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Report on the individual review of the annual submission of Italy 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 Italy, 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 20 to 25 September 2021 remotely.

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

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Contents

Abbreviations and acronyms

2006 IPCC Guidelines	*2006 IPCC Guidelines for National Greenhouse Gas Inventories*
2019 Refinement to the 2006 IPCC Guidelines	*2019 Refinement to the 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
CDM	clean development mechanism
CER	certified emission reduction
CH_4	methane
CM	cropland management
CO_2	carbon dioxide
CO_2 eq	carbon dioxide equivalent
Convention reporting adherence	adherence to the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual greenhouse gas inventories"
CPR	commitment period reserve
CRF	common reporting format
CSC	carbon stock change
DE%	feed digestibility
dm	dry matter
EF	emission factor
ERT	expert review team
ERU	emission reduction unit
EU ETS	European Union Emissions Trading System
Eurostat	statistical office of the European Union
FM	forest management
FMRL	forest management reference level
$FMRL_{corr}$	forest management reference level technical correction
GE	gross energy intake
GHG	greenhouse gas
GM	grazing land management
HFC	hydrofluorocarbon
HWP	harvested wood products
IE	included elsewhere
IEA	International Energy Agency
IEF	implied emission factor
IPCC	Intergovernmental Panel on Climate Change
IPCC good practice guidance	*Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*
IPPU	industrial processes and product use
IUTI	Italian Land-Use Inventory
k	methane generation rate
KP-LULUCF	activities under Article 3, paragraphs 3–4, of the Kyoto Protocol

KP reporting adherence	adherence to the reporting guidelines under Article 7, paragraph 1, of the Kyoto Protocol
Kyoto Protocol Supplement	*2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol*
LULUCF	land use, land-use change and forestry
MCF	methane conversion factor (agriculture)
MMS	manure management system(s)
N	nitrogen
N_2O	nitrous oxide
NA	not applicable
NE	not estimated
Nex	nitrogen excretion
NF_3	nitrogen trifluoride
NFI	national forest inventory
NIR	national inventory report
NO	not occurring
NO_X	nitrogen oxides
PFC	perfluorocarbon
QA/QC	quality assurance/quality control
Revised 1996 IPCC Guidelines	*Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*
RMU	removal unit
RV	revegetation
SEF	standard electronic format
SF_6	sulfur hexafluoride
SIAR	standard independent assessment report
SWDS	solid waste disposal site(s)
TOW	total organic load in wastewater
UNFCCC Annex I inventory reporting guidelines	“Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual greenhouse gas inventories”
UNFCCC review guidelines	“Guidelines for the technical review of information reported under the Convention related to greenhouse gas inventories, biennial reports and national communications by Parties included in Annex I to the Convention”
VS	volatile solid(s)
WDR	wetland drainage and rewetting
Wetlands Supplement	*2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands*
Y_m	methane conversion rate

I. Introduction

1. This report covers the review of the 2021 annual submission of Italy, 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 20 to 25 September 2021 remotely[1] and was coordinated by Pedro Torres, Veronica Colerio and Sabin Guendehou (secretariat). Table 1 provides information on the composition of the ERT that conducted the review for Italy.

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

Area of expertise	*Name*	*Party*
Generalist	Newton Paciornik	Brazil
	Detelina Petrova	Bulgaria
Energy	Branca Americano	Brazil
	Melanie Hobson	United Kingdom
	Katrina Young	United Kingdom
IPPU	Kendal Blanco-Salas	Costa Rica
	Clemencio Nhantumbo	Mozambique
	Koen E.L. Smekens	Belgium
Agriculture	Baasansuren Jamsranjav	Mongolia
	Miguel Angel Taboada	Argentina
LULUCF and KP-LULUCF	Markus Didion	Switzerland
	Inge G.C. Jonckheere	Belgium
	Timothy Paul Liersch	Australia
Waste	Gabor Kis-Kovacs	Hungary
	Inês Sousa Mourão	Cabo Verde
	Hans Oonk	Netherlands
Lead reviewers	Newton Paciornik	
	Koen E.L. Smekens	

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 Italy resolve identified findings, including issues[2] designated as problems.[3] Other findings, and, if applicable, the encouragements of the ERT to Italy to resolve related issues, are also included in this report.

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

[1] Owing to the circumstances related to the coronavirus disease 2019, the review had to be conducted remotely.

[2] Issues are defined in decision 13/CP.20, annex, para. 81.

[3] Problems are defined in decision 22/CMP.1, annex, paras. 68–69, as revised by decision 4/CMP.11.

5. Annex I presents the annual GHG emissions of Italy, 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.

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

7. Table 2 provides the assessment by the ERT of the Party's 2021 annual submission with respect to the tasks undertaken during the review. Further information on the issues identified, as well as additional findings, may be found in tables 3 and 5.

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

Assessment			*Issue/problem ID#(s) in table 3 or 5*[a]
Dates of submission	Original submission: NIR, 12 April 2021; CRF tables (version 1), 12 April 2021; SEF tables, 13 April 2021 Revised submission: SEF tables, 12 May 2021 Unless otherwise specified, values from the most recent submission are included in this report		
Review format	Centralized review conducted remotely		
Application of the requirements of the UNFCCC Annex I inventory reporting guidelines and the Wetlands Supplement (if applicable)	Have any issues been identified in the following areas:		
	(a) Identification of key categories?	No	
	(b) Selection and use of methodologies and assumptions?	Yes	I.5, I.6, L.20, W.11
	(c) Development and selection of EFs?	Yes	A.18, W.10
	(d) Collection and selection of AD?	Yes	W.1, E.4
	(e) Reporting of recalculations?	No	
	(f) Reporting of a consistent time series?	Yes	KL.8
	(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.5, KL.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?	No	
	(b) Performance of the national system functions?	No	

Assessment			*Issue/problem ID#(s) in table 3 or 5[a]*
	Have any issues been identified related to the national registry:		
	(a) Overall functioning of the national registry?	No	
	(b) Performance of the functions of the national registry and the adherence to technical standards for data exchange?	No	
	Have any issues been identified related to the reporting of information on AAUs, CERs, ERUs and RMUs and on discrepancies in accordance with decision 15/CMP.1, annex, chapter I.E, in conjunction with decision 3/CMP.11, taking into consideration any findings or recommendations contained in the SIAR?	No	
	Have any issues been identified in matters related to Article 3, paragraph 14, of the Kyoto Protocol, specifically problems related to the transparency, completeness or timeliness of the reporting on the Party's activities related to the priority actions listed in decision 15/CMP.1, annex, paragraph 24, in conjunction with decision 3/CMP.11, including any changes since the previous annual submission?	Yes	G.1
	Have any issues been identified related to the following reporting requirements for KP-LULUCF:		
	(a) Reporting requirements of decision 2/CMP.8, annex II, paragraphs 1–5?	Yes	KL.8
	(b) Demonstration of methodological consistency between the reference level and reporting on FM in accordance with decision 2/CMP.7, annex, paragraph 14?	Yes	KL.13
	(c) Reporting requirements of decision 6/CMP.9?	No	
	(d) Country-specific information to support provisions for natural disturbances in accordance with decision 2/CMP.7, annex, paragraphs 33–34?	Yes	KL.9, KL.11, KL.12
CPR	Was the CPR reported in accordance with decision 18/CP.7, annex; decision 11/CMP.1, annex; and decision 1/CMP.8, paragraph 18?	Yes	
Adjustments	Has the ERT applied any adjustments under Article 5, paragraph 2, of the Kyoto Protocol?	No	
	Has the Party submitted a revised estimate to replace a previously applied adjustment?	NA	Italy 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 and 5.
[b] Missing categories for which methods are provided in the 2006 IPCC Guidelines may affect completeness and are listed in annex III.

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

8. Table 3 compiles the recommendations from previous review reports that were included in the most recent previous review report, published on 29 May 2020,[4] 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 Italy

ID#	*Issue/problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
General			
G.1	Article 3.14 (G.12, 2019) KP reporting adherence	Report any changes in the information provided under Article 3, paragraph 14, of the Kyoto Protocol in accordance with decision 15/CMP.1 in conjunction with decision 3/CMP.11. If there have been no changes, highlight this in the NIR.	Not resolved. The Party did not report in its NIR the changes in the information provided under Article 3, paragraph 14, of the Kyoto Protocol. During the review, the Party clarified that this was due to a mistake in the NIR, noting that this recommendation was implemented in its 2020 NIR. Italy also clarified that, compared with the 2020 NIR, it has updated its breakdown of global CDM projects by host country and scope (NIR section 13.3, figure 14.1 and tables 14.2–14.3, p.361) and the information on its provision of financial resources to developing countries (NIR section 13.4, pp.365–366). It further clarified that annex 8 to the NIR includes updated information on registered CDM projects in which Italy is involved. The ERT considers that the recommendation has not yet been fully addressed because the changes in the information provided under Article 3, paragraph 14, of the Kyoto Protocol were not reported in the NIR.
G.2	Article 3.14 (G.13, 2019) KP reporting adherence	Provide accurate information on CDM projects hosted exclusively by the Party in the NIR.	Resolved. The Party reported in its NIR (section 13.3, p.361) accurate information on projects hosted exclusively by it.
G.3	Inventory planning (G.2, 2019) Transparency	Improve the transparency of the description of the national system by including an explanation of the involvement of external organizations that contribute to inventory development.	Resolved. The Party revised its description of the involvement of external organizations that contribute to inventory development in the NIR (section 1.2, pp.26–28).

[4] FCCC/ARR/2019/ITA. The ERT notes that the report on the individual inventory review of Italy'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*
G.4	Key category analysis (G.4, 2019) Transparency	Include the detailed key category analysis results for the base year using approach 1, including and excluding LULUCF, in annex 1 to the NIR of the next annual submission.	Resolved. The Party included in annex 1 to the NIR (tables A1.5–A1.6, pp.415–416) the results of its key category analysis for the base year using approach 1, including and excluding emissions from LULUCF.
G.5	QA/QC and verification (G.9, 2019) Transparency	Streamline the description of QA/QC and verification by updating information on procedures to accurately reflect whether they are annual or new activities.	Resolved. The Party updated the information on QA/QC activities in its NIR (section 1.6), including a better description of the procedures in place.
G.6	Uncertainty analysis (G.6, 2019) Transparency	Streamline the description of the use of approach 2 in the uncertainty analysis by explicitly explaining the scope of its application so far, and delete the hyperlink if the website it leads to is no longer accessible.	Resolved. The Party adequately modified the description of the use of approach 2 in its NIR (section 1.7, p.44–45) and deleted the hyperlink to the website that is no longer accessible. Italy described the categories to which approach 2 of the uncertainty analysis was applied and reported the reference years in annex 1 to the NIR (table A1.15, p.424).
Energy			
E.1	1.A.2.d Pulp, paper and print – biomass – CO_2 (E.4, 2019) (E.2, 2018) (E.3, 2016) (E.3, 2015) Accuracy	Further analyse the EU ETS data for the time series available, taking into consideration biomass fuel mix in the relevant year, and document the relevant information in the NIR.	Resolved. The Party reported in its NIR (section 3.4.3, pp.81–82) that emissions from biomass fuel consumption are reported by the paper, cardboard and pulp industrial association (Assocarta) and have been reported under the EU ETS since 2008. In addition, the Party provided an explanation for the varying annual trend in these emissions. In particular, it explained that the prevalence of black liquor and industrial waste led to a high IEF (112.57 t/TJ) prior to 2008, with the gradual shift to biogas leading to lower IEFs (e.g. 55.47 t/TJ in 2019).
E.2	1.B.2 Oil, natural gas and other emissions from energy production – liquid and gaseous fuels – CH_4 (E.10, 2019) Transparency	Include in the NIR specific information on why using the IPCC good practice guidance rather than the more recent guidelines (2006 IPCC Guidelines) better reflects national circumstances (oil and gas exploration).	Resolved. The Party reported in its NIR (section 3.9.2, p.115) that, for oil and gas exploration, fugitive emissions were estimated on the basis of the number of exploration wells and EFs from the IPCC good practice guidance (chap. 2, section 2.7). This is because there are no EFs in the 2006 IPCC Guidelines, which only provide AD on the number of wells. Italy also explained that the methodology for estimating fugitive emissions provided in the 2006 IPCC Guidelines is based on the amount of oil produced and that using it would result in emissions being overestimated because most of Italy's oil and gas production takes place onshore and exploration offshore, so in different locations, whereas the 2006 IPCC Guidelines assume that oil production and exploration are performed in the same location.
E.3	1.B.2.b Natural gas – gaseous fuels – CH_4 (E.11, 2019) Transparency	Include an explanation of the AD gap between gas transmission and distribution and highlight the difference between the CH_4 IEF for natural gas distribution and the default EF in the 2006 IPCC Guidelines in the next annual submission.	Resolved. The Party reported in its NIR (section 3.9.2, pp.116–118) that a significant proportion of natural gas does not go through the distribution network, but is instead transported directly to industrial sites, explaining why the amount of natural gas distributed is less than 50 per cent of the natural gas transmitted across the entire time series. The Party also provided graphs in the NIR (section 3.9.2, p.118) comparing the national CH_4 IEF with the default value from the 2006 IPCC Guidelines taking into

ID#	*Issue/problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
			account uncertainty for the transmission and distribution of natural gas (vol. 2, chap. 4, table 4.2.4), including an explanation of the differences (figure 3.1 of the NIR).
IPPU			
I.1	2. General (IPPU) – CO_2, CH_4 and N_2O (I.5, 2019) Convention reporting adherence	Address issues (a)–(j) identified in ID# I.5 of the 2019 review report and reinforce and implement QA/QC procedures for the IPPU sector, including, as a minimum, the following measures: (a) verifying the references and weblinks to AD, ensuring that they are functional and correct, and considering the inclusion of a table containing the information shown in the NIR; (b) verifying systematically the processing of AD; (c) checking the description of recalculations in the NIR against the CRF tables and ensuring that any recalculations performed are correctly described in the NIR in both the category sections and the chapter summarizing the recalculations; (d) ensuring proper use of the notation keys; (e) performing QA of the NIR and the CRF tables and correcting the errors annually before each submission.	Resolved. During the review, the Party clarified that the relevant parts of the NIR and the notation keys were updated accordingly, with QA/QC procedures implemented and reinforced. The ERT noted that the references to the 2006 IPCC Guidelines were corrected and the non-functioning hyperlink to the web page of the Ministry of Economic Development containing information on clinker production was deleted. Further, the recalculations performed for categories 2.A.3, 2.B.2, 2.B.3, 2.B.5, 2.C.5, 2.C.6, 2.D.1, 2.E and 2.F were reported in the NIR. The ERT also noted that SF_6 emissions for category 2.B, PFC emissions for categories 2.C and 2.E and CO_2 emissions for category 2.D reported in the NIR are consistent with those reported in CRF tables 2(II)B-Hs1, 2(II)B-Hs1 and 2(I).A-Hs2. Finally, the ERT noted that the description of recalculations performed for category 2.B.9 was not included and that emissions from disposal under category 2.F.1 were reported as "IE" and included under operating system emissions.
I.2	2. General (IPPU) – CO_2, CH_4 and N_2O (I.6, 2019) Transparency	Include focused information under each heading in the NIR (i.e. "Source category description", "Methodological issues" and "Source-specific QA/QC and verification") to support understanding and provide detailed information on the AD selection and the methodologies used for estimating emissions under the "Methodological issues" heading in each subcategory of the IPPU sector.	Resolved. The Party reported focused information under each heading in the NIR and provided detailed information on the AD, EFs and methodologies used for each IPPU category. During the review, Italy clarified that such information was provided to the extent possible at the category level, noting that, under refrigeration and air conditioning (category 2.F.1), emissions from stationary air conditioning were described separately to better reflect the method used for estimating emissions and the type of AD available.
I.3	2.B Chemical industry – N_2O (I.7, 2019) Transparency	Select a tier methodology in accordance with the 2006 IPCC Guidelines and provide updated information on the tiers used across the time series in the NIR.	Resolved. The Party reported in its NIR (section 4.3.2, pp.135–136) that N_2O emissions from nitric acid production and adipic acid production were estimated following a tier 2 approach for years up to 2012 and a tier 3 approach for 2013 onward in accordance with the 2006 IPCC Guidelines (vol. 3, chap. 3). Italy explained that a tier 3 approach cannot be implemented for the entire time series, but that this does not affect the consistency of the time series because there is only one producer of adipic acid and two producers of nitric acid at the national level, all of which report the same AD under the European

ID#	Issue/problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
			Pollutant Release and Transfer Register and the EU ETS. During the review, the ERT compared the emissions estimated using a tier 2 method for 2013–2017 reported in the 2019 NIR with the equivalent emissions estimated using a tier 3 method in the current NIR and concluded that the time series is consistent.
I.4	2.B.1 Ammonia production – CO_2 (I.8, 2019) Transparency	Investigate the reasons for the difference between apparent consumption and the amount of urea used in the inventory and include the results of this investigation in the NIR.	Addressing. The Party reported in its NIR (section 4.3.2, p.136) and confirmed during the review that it has started to investigate the differences between apparent consumption (estimated using production data from producers and trade data from the National Institute of Statistics) and the final use of urea at the national level. It reported that in 2017 urea was used for selective catalytic reduction engines (7.6 per cent of total urea use), NO_X abatement systems (2.8 per cent), industry (15.1 per cent) and fertilizers (74.5 per cent). Italy also reported that the final use of urea can be divided into emissive sources (selective catalytic reduction engines, NO_X abatement systems and fertilizers) and non-emissive sources (industry), noting that the emissive sources already included in the NIR are the same as those indicated by the producers and that the completeness of the inventory has been verified.
I.5	2.D.3 Other (non-energy products from fuels and solvent use) – CO_2 (I.10, 2019) Convention reporting adherence	Present national totals with and without indirect CO_2 emissions in CRF table summary 2.	Not resolved. The Party continued to report total national emissions including indirect CO_2 in the CRF tables (e.g. CRF table summary 2 and CRF table 10) in the row intended for total national emissions excluding indirect CO_2, while reporting "NA" for the national emission totals including indirect CO_2 rather than providing numerical values to reflect the reporting of indirect CO_2 emissions from solvents. The Party explained in the NIR (p.580) and during the review that CRF table summary 2 is populated automatically and the reporting of "NA" therein is the result of using a notation key under "indirect CO_2 emissions" in background tables for the IPPU sector. It also stated that reporting indirect CO_2 emissions in the totals would reduce transparency because emissions would be reported at an aggregated level and not at the level at which they occur, and that implementing the recommendation would alter the national total, with implications for other relevant assessments (e.g. trend and key category assessments). Italy referred to the conclusions from the 17th meeting of GHG inventory lead reviewers (available at https://unfccc.int/sites/default/files/resource/conclusions-GHG_LRs-2020.pdf) to support its assessment further. The ERT considers that this approach is not in accordance with paragraph 29 of the UNFCCC Annex I inventory reporting guidelines, according to which, for Parties that decide to report indirect CO_2, the national totals shall be presented with and without indirect CO_2.
I.6	2.D.3 Other (non-energy products from fuels and solvent use) – CO_2 (I.10, 2019) Convention reporting adherence	Report indirect CO_2 emissions in CRF table 6 as "IE" instead of "NO".	Not resolved. The Party continued to report indirect emissions from the IPPU sector as "NO" in CRF table 6 despite reporting indirect emissions for this sector under category 2.D.3 (NIR, p.153). During the review, the Party explained that it did not seem appropriate to report "IE" in CRF table 6 as the notation key would only apply to indirect CO_2 emissions associated with category 2.D.3 and it would not be clear where such emissions occur (see ID# I.5 above).

ID#	*Issue/problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
I.7	2.F Product uses as substitutes for ozone-depleting substances – HFCs (I.9, 2019) Transparency	Describe in the NIR the approach followed and the equations used for calculating the AD and EFs, as well as the emissions at each stage of the useful life cycle of the equipment (manufacturing, stock and disposal) for each subcategory in accordance with the information provided in CRF table 2(II).B-Hs2.	Resolved. The Party reported in its NIR (sections 4.7.3–4.7.5, pp.160–184) a detailed description of the approach followed and the equations used for calculating its AD and EFs, as well as the emissions at each stage of the useful life cycle of the equipment for subcategories 2.F.1.a, 2.F.1.b, 2.F.1.c, 2.F.1.e and 2.F.1.f and categories 2.F.2, 2.F.3 and 2.F.4. During the review, the Party clarified that the more detailed descriptions provided for subcategories 2.F.1.a, 2.F.1.b, 2.F.1.c and 2.F.1.f compared with those provided for 2.F.1.e, 2.F.2, 2.F.3 and 2.F.4 are the result of more data and information from experts and statisticians being available for the former subcategories.
Agriculture			
A.1	3.A.2 Sheep – CH_4 (A.4, 2019) Transparency	Improve the transparency of reporting on the enteric fermentation of sheep by providing information on the assumptions used to adjust the DE% values for mature ewes and other mature sheep.	Addressing. The Party applied adjusted DE% values of 65 for mature ewes and other mature sheep (NIR section 5.2.2, table 5.13, p.204) and stated (NIR section 5.2.2, p.204) that it uses the average from the default range given for ruminant categories relating to pasture-fed animals in the 2006 IPCC Guidelines (vol. 4, chap. 10, table 10.2). However, no information was provided on the assumptions used to adjust the DE% values for mature ewes and other mature sheep. Italy reported in its NIR (section 5.2.6, pp.206–207) that additional data and information will be collected to improve the estimation of CH_4 emissions from sheep and thus the DE% for mature ewes and other mature sheep in particular. Regarding the value of 60 per cent proposed in table 10A-9 of the 2006 IPCC Guidelines (vol. 4, chap. 10) for sheep in developed countries, Italy argues that table 10A-9 does not include a description of data on the type of diet considered in its calculations and does not match the data in table 10.2, probably owing to a typographical error (digestibility rate given as 0.6 per cent instead of 60 per cent). The Party also noted in the NIR that table 10A-9 has been removed from the 2019 Refinement to the 2006 IPCC Guidelines. The ERT noted the Party's explanations on the selection of the DE% value, but considers that the recommendation has not yet been fully resolved as it is still not clear in the NIR which assumptions were used to adjust the DE% values for mature ewes and other mature sheep.
A.2	3.B Manure management – CH_4 (A.5, 2019) Accuracy	Justify in the NIR the applicability of the current VS content values used, which were developed by a researcher from a Danish university in 1992, to the national circumstances of Italy for the entire reporting period and, if a justification is not possible, consider using equation 10.24 of the 2006 IPCC Guidelines (vol. 4) to calculate VS excretion per day on a dry organic matter basis (kg/VS day). Furthermore, correct the values for VS content to match the reference currently in use; that is, that the Party does not round fractional parts.	Resolved. The Party explained in its NIR (section 5.3.2, p.209) that the VS values used (47.5 g VS/kg slurry and 142.7 g VS/kg solid manure) are very close to the values obtained from a survey carried out by the Research Centre on Animal Production, which collected national data related to the solid and liquid manure of dairy cows in various types of housing. During the review, the Party clarified that the survey values are 48.21 g VS/kg slurry and 128.31 g VS/kg solid manure. As explained in the NIR (section 5.3.5, p.220), a verification of the VS values used was carried out and Italy reported that the verification supports the estimates made on the basis of the factors from Husted (1994) and the Research Centre on Animal Production (2006), but further investigations will be carried out. The ERT noted that the VS values had been correctly rounded to 47.5 g VS/kg slurry and 142.7 g VS/kg solid manure (NIR, p.209). During the review, Italy confirmed that the corrected VS values were used for estimating specific conversion factors for slurry (17.25 and 18.12 g CH_4/kg VS for 1990–2000 and

ID#	Issue/problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
			2001 onward, respectively) and solid manure (8.11 and 9.28 g CH_4/kg VS for 1990–2000 and 2001 onward, respectively), which were used for estimating EFs for CH_4 emissions from manure management.
A.3	3.B Manure management – CH_4 (A.6, 2019) Transparency	Report information on the amount of manure generated by each subcategory of cattle and buffalo (e.g. in kg VS_{manure}/head/day or in kg manure/head/day) and include information on the quantity of bedding material used in solid MMS (e.g. in kg $VS_{bedding}$/head/day or in kg/head/day). Moreover, cross-check the country-specific values of VS for cattle and buffalo against the values calculated on the basis of GE for each subcategory of cattle and buffalo (using equation 10.24 of the 2006 IPCC Guidelines, vol. 4) and report the results of this verification in the next NIR.	Resolved. The Party reported the amount of manure generated by each subcategory of cattle and buffalo (m^3/head/day) and the content of VS in manure (g VS/head/day) produced by subcategory of cattle and buffalo for solid MMS (NIR section A7.2, table A.7.14, p.495) and slurry MMS (NIR section A7.2, table A.7.15, p.496). Data on the quantity of bedding material (kg dm straw/head/day) used were provided for dairy cattle, fattening cattle, replacement cows, other non-dairy cattle and buffalo (NIR section A7.3, p.499), and information on the cross-check and verification, including the results, were reported in the NIR (table 5.20 and section 5.3.5, p.220) and found to support the estimates used, which were based on the factors reported by Husted (1994).
A.4	3.B Manure management – CH_4 (A.7, 2019) Accuracy	Improve the accuracy of the CH_4 emission estimates for cattle and buffalo manure management by using data on the allocation of MMS for both cool and temperate climate zones, as reported in CRF table 3.B(a)s2, and applying average monthly temperatures from each year in calculating CH_4 emissions from manure management across the entire reporting period for both zones.	Resolved. The Party applied a country-specific approach to estimating CH_4 emissions from manure management, based on average monthly temperature data, the content of VS in manure and the storage time of manure in MMS (NIR section 5.3.2, pp.207–209). Italy reported in its NIR (section 5.3.2, p.208) that its average monthly temperature data were updated using the national system to collect, process and disseminate climate data, which are available for 30-year climatological periods (1961–1990, 1971–2000 and 1981–2010). During the review, the Party clarified that it used temperature data for 1971–2000 and 1981–2010 to estimate CH_4 emissions for 1990–2000 and 2001 onward, respectively. It reported that the allocation of MMS for both cool and temperate climate zones will be updated using data on livestock numbers at the municipal level from its 7th General Census of Agriculture (to be released in June 2022), as well as municipal-level temperature data.
A.5	3.B Manure management – CH_4 (A.7, 2019) Transparency	Provide information on the average monthly temperatures used in the estimations of CH_4 emissions, the specific CH_4 emission rate (g CH_4/kg VS) calculated using the equations reported in the NIR, and the total amount of VS handled in slurry/liquid and solid MMS for the entire reporting period (e.g. in an annex table).	Resolved. Data on the average monthly temperature, specific conversion factor (g CH_4/kg VS) and VS production (g VS/head/day) used to estimate CH_4 emissions from solid manure and slurry manure were reported in NIR tables A.7.14 (section A7.2, p.495) and A.7.15 (section A7.2, p.496), respectively.
A.6	3.B Manure management – CH_4 (A.11, 2019) Completeness	Complete the estimation of CH_4 emissions from pasture management practices of sheep, goats, horses, mules and asses for the entire reporting period and report the emissions, or	Resolved. The Party reported (NIR section 5.3.2, p.214, and section A12.1, pp.581–582) CH_4 emissions from pasture, range and paddock for other livestock categories (i.e. sheep, goats, horses, mules and asses), which were calculated using tier 1 default EFs

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		if this is not possible, provide in the NIR a justification for the exclusion of these estimates in terms of the likely level of emissions in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.	(which cover all manure management practices including grazing) from the 2006 IPCC Guidelines. These CH_4 emissions are reported in CRF table 3.B(a)s1.
A.7	3.B.1 Cattle – CH_4 (A.8, 2019) Accuracy	Use a country-specific B_o value obtained from measurements developed to obtain the B_o value for dairy cattle or apply the default value provided in table 10.A-4 of the 2006 IPCC Guidelines (vol. 4).	Resolved. The Party applied a country-specific methodology based on an approach by Husted (1994) and explained that this does not require a B_o value (NIR section 5.3.2, p.211). The value reported in CRF table 3.B(a)s1 was estimated in line with equation 10.23 from the 2006 IPCC Guidelines (vol. 4, chap. 10), using country-specific EFs and VS values by livestock category and an average MCF by livestock category. Details on the country-specific methodology were provided in the NIR (section 5.3.2, pp.207–209).
A.8	3.B.1 Cattle – CH_4 (A.9, 2019) Accuracy	Cross-check the amounts of bedding material used for estimating CH_4 emissions from manure management and N_2O emissions from animal manure applied to agricultural soils, ensuring that the amounts are consistent between the two reporting categories.	Resolved. The Party revised its estimates for the amount of bedding and reported in its NIR that the amounts of bedding material used for estimating CH_4 emissions from manure management and N_2O emissions from animal manure applied to agricultural soils have been cross-checked and provided relevant information and data (section 5.3.2, p.212, and section A7.3, table A7.18, p.499). The amount of straw used as bedding material was estimated on the basis of the amount of straw used per day (per t live weight and per type of housing) and manure production coefficients used for estimating CH_4 emissions from solid manure storage contained in the ministerial decree of 25 February 2016 on the use of zootechnical effluents. The N content in the bedding material was estimated and N from bedding material was added to the N input from animal manure applied to soil for estimating N_2O emissions from soil (NIR section 5.3.2, p.212).
A.9	3.B.1 Cattle – CH_4 (A.10, 2019) Completeness	Complete the estimation of CH_4 emissions from pasture, range and paddock manure management of cattle (dairy and non-dairy) and buffalo for the entire reporting period and report the emissions, or if this is not possible, provide in the NIR a justification for the exclusion of these estimates in terms of the likely level of emissions in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.	Resolved. The Party reported in its NIR (sections 5.3.2, p.212, and A12.1, p.581) that CH_4 emissions from pasture, paddock and range for cattle (dairy and non-dairy) and buffalo were estimated for the entire time series using equation 10.23 from the 2006 IPCC Guidelines (vol. 4, chap. 10). The NIR provides CH_4 EFs disaggregated by subcategory of cattle and buffalo (section 5.3.2, table 5.12, p.212). The ERT considers that, while the completeness issue has been resolved thereby, the CH_4 EFs were not estimated in line with equation 10.23 from the 2006 IPCC Guidelines. See ID# A.18 in table 5.

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A.10	3.B.1 Cattle – N_2O (A.13, 2019) Accuracy	Improve the consistency of data on the performance parameters and feed rations used to estimate GE of dairy cattle under enteric fermentation of dairy cattle and the Nex rates for dairy cattle for the entire reporting period.	Resolved. The Party recalculated the Nex rate (kg N/head/year) for dairy cattle for the entire time series using equations 10.31–10.33 from the 2006 IPCC Guidelines (vol. 4, chap. 10) and reported the information in its NIR (section 5.3.2, table 5.26, pp.216–217) and CRF table 3.B(b). The Nex rate amounted to 104.85 kg N/head/year in 1990 and 106.44 kg N/head/year in 2019. The ERT noted that, during the reporting period (1990–2019), GE (MJ/head/day) and the milk yield (kg/day) of dairy cattle increased from 260.66 to 335.36 MJ/head/day (NIR section A7.1, table A.7.1, p.480, and CRF table 3.As2) and from 11.53 to 22.88 kg/day (CRF table 3.As2), respectively. During the review, the Party confirmed that the Nex values were recalculated using the parameters (e.g. GE, milk production, weight gained and net energy for growth) applied for estimating CH_4 emissions from enteric fermentation, thus ensuring consistency between emissions from enteric fermentation and those from manure management. Italy also explained in the NIR (p.212) that updates to the values for GE and crude protein in diet resulted in lower Nex rates compared with the previous annual submission.
A.11	3.B.1 Cattle – N_2O (A.14, 2019) Transparency	Revise the "other dairy cattle" subcategory title to "other non-dairy cattle", provide a definition for the subcategory "cows in late career" and justify why milk produced by cows in late career is not used for human consumption in commercial quantities.	Resolved. The Party revised the subcategory title from "other dairy cattle" to "other non-dairy cattle" in NIR table 5.17 (section 5.3.2, p.209), explaining that the subcategory "other non-dairy cattle" includes suckling cows (cows farmed for feeding calves whose milk is not normally intended for human consumption) and cows in late career (cows that have had their last lactation and are thus no longer productive and will be slaughtered) (NIR section 5.3.2, p.209).
A.12	3.B.4 Other livestock – CH_4 (A.12, 2019) Completeness	Provide in the NIR the calculation for CH_4 emissions from ostrich manure management as provided to the ERT during the review (i.e. using the AD for 2010, 2013 and 2016 and the default EF from the 2006 IPCC Guidelines, vol. 4, table 10.A-9) to justify the exclusion of these emissions as an insignificant source in line with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.	Resolved. The Party estimated CH_4 emissions from ostrich manure management for the entire time series and reported the information in the NIR (section 5.3.2, p.214) and CRF table 3.B(a). The ERT considers that the emissions are correctly calculated.
A.13	3.D Direct and indirect N_2O emissions from agricultural soils – N_2O and CH_4 (A.16, 2019) Transparency	Enhance the transparency of the reporting on crop residues in the NIR by providing information on the total amount of crop residues generated and on the shares of crop residues used for different purposes (e.g. in tabular format or in a flow chart).	Resolved. The Party provided in a flow chart (NIR section A7.3, figure A.7.1, p.508) information on the total amount of crop residues generated and the shares of crop residues used for different purposes.
A.14	3.D Direct and indirect N_2O emissions from agricultural soils – N_2O	Improve the transparency of the NIR by including information on how the N content	Resolved. Information on how the N content (%) values reported in NIR table 5.38 (equivalent to table 5.26 of the 2019 submission) are estimated is now provided in the NIR (section 5.5.2, p.228), with the explanation that the values are calculated on the

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	(A.17, 2019) Transparency	(%) values reported in NIR table 5.26 are calculated (e.g. in a footnote to the table).	basis of data on the amount of fertilizer distributed (t/year) and N contained in fertilizer (t N/year) collected by the National Institute of Statistics using annual questionnaires sent to Italian companies that distribute fertilizers, including to wholesalers and retailers, commercial structures, and farmers and cooperatives.
A.15	3.D.a Direct N_2O emissions from managed soils – N_2O (A.15, 2019) Transparency	Investigate the drivers of the significant inter-annual changes in AD on the amounts of sewage sludge (between 2000 and 2001) and other organic fertilizers (between 2010 and 2011 and between 2011 and 2012) applied to agricultural soils and report this information in the next annual submission.	Resolved. The Party reported in its NIR (section 5.5.4, p.235) that the amount of compost applied in 2011, which caused the anomalous trend between 2010 and 2011 in the amount of other organic fertilizers, was confirmed by the data providers. Regarding the sewage sludge applied, the values used are official data provided by the Ministry of the Environment, collected at the regional level under the European Union sewage sludge directive. The annual variations are attributable to the fact that some regions prohibit the practice of spreading sewage sludge in certain years depending on weather, climatic, soil and water conditions and that over the years other types of sludge treatment (e.g. anaerobic digestion), which also affect the amount of sewage sludge applied to soil, have been implemented. In the NIR (section A12.1, p.582) and during the review, Italy reported that it is collecting additional information to include in the NIR.
LULUCF			
L.1	4. General (LULUCF) (L.1, 2019) (L.8, 2018) Transparency	Report more detailed explanatory information and a justification for recalculations in the NIR in line with paragraph 44 of the UNFCCC Annex I inventory reporting guidelines (e.g. providing information on the updated AD and/or on errors corrected in the models used).	Addressing. The Party reported additional information on recalculations but the ERT considers that explanatory information and justification for the recalculations is still lacking and information on the nature of the changes in the calculation methods, EFs and AD is limited, in particular in sections 6.2.7 (p.259), 6.3.7 (pp.265–266), 6.6.7 (p.279), 6.10.3 (p.281) and 6.11.3 (p.282) of the NIR. To further improve transparency, Italy could include in each subsection on category-specific recalculations a table showing the time series of emission estimates from the previous inventory, such as those included for grasslands and biomass burning in tables 6.29 (section 6.4.7, pp.272–273) and 6.42 (section 6.12.5, pp.285–286) of the NIR, respectively, and a breakdown of the recalculation quantity between each reason for recalculation. The ERT considers section 9.3.1.3 (pp.340–342) on KP-LULUCF a good example of transparent reporting on recalculations applied.
L.2	4. General (LULUCF) (L.2, 2019) (L.8, 2018) Transparency	Ensure that the NIR contains up-to-date and consistent information on recalculations applied in the sector.	Resolved. The NIR contains information relevant to the current annual submission. While the ERT has concerns regarding the level of detail provided, these are considered under ID# L.1 above.
L.3	Land representation (L.10, 2019) Convention reporting adherence	Correct the error in the reporting of the total national land area in the land transition matrix reported in CRF table 4.1, which is the result of an error made when updating the areas of forest land remaining forest land for 2005, 2006 and 2007.	Resolved. A consistent total for the national land area (30,133.60 kha) is reported across the time series, including for 2005, 2006 and 2007, in the land transition matrix in CRF table 4.1.

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L.4	4.A Forest land – CO_2 (L.3, 2019) (L.2, 2018) (L.5, 2016) (L.5, 2015) (56, 2014) Transparency	Document the For-est Model validations in the NIR.	Addressing. In previous review reports, it was noted that fully resolving this recommendation will require data from the third NFI to validate the For-est Model. During the review, the Party confirmed that the release of the NFI data has been delayed and is preventing the validation work from being carried out, as noted in section 6.2.8 (p.259) of the NIR.
L.5	4.A Forest land – CO_2 (L.4, 2019) (L.5, 2018) (L.7, 2016) (L.7, 2015) (58, 2014) Transparency	Provide definitions and thresholds for carbon pools in a table in the NIR.	Resolved. Table 6.5 (section 6.2.4, p.252) of the NIR provides information on carbon pools and ecosystem components of the NFI surveys and information on different pools and relative thresholds. Specific documentation and information on the definitions of the NFI is referenced in footnotes to the table.
L.6	4.A Forest land – CO_2 (L.11, 2019) Transparency	Include in annex 14 to the NIR a summary of the process used to determine the correction factors introduced to ensure that the informal harvest is accounted for in the CSC estimates for forest land, and a table or a graph similar to the ones presented to the ERT during the review showing how the correction factors are calculated by region.	Resolved. Annex 14 (pp.594–601) to the NIR contains the required information as to how the correction factors for "informal" harvest were calculated and a table showing the factors for each region.
L.7	4.A Forest land – CO_2 (L.12, 2019) Transparency	Correct the threshold values for below-ground biomass and for all other non-living biomass in litter contained in the table on carbon pools (NIR 2019, section 6.2.4, p.241).	Resolved. The table in the NIR (section 6.2.4, p.252) has been numbered table 6.5 and the parameters have been corrected to show the threshold for below-ground biomass as a diameter of >2 mm and other non-living biomass in litter as a diameter of <2 mm.
L.8	4.B.1 Cropland remaining cropland – CO_2 (L.6, 2019) (L.11, 2018) Transparency	Provide information on the smoothing process applied for the estimates and provide a table with the calculations with and without the smoothing in the NIR.	Resolved. Tables reporting land-use data with and without smoothing over a five-year period were included in the NIR (tables 6.3a and 6.3b, respectively, p.246). Smoothing of the areas is clearly noted. There appears to be no artificial change in the trend, and remarks about smoothing being conducted at the most disaggregated level with particular treatments for the end points in the time series have been included. The ERT suggests the Party state in the text of future annual submissions that the smoothing process is not relevant to forest land, which the Party clarified during the review as being due to the interpolation of NFI data.
L.9	4.B.1 Cropland remaining cropland – CO_2 (L.13, 2019) Completeness	Report estimates of CSC in mineral soils in cropland remaining cropland and in CM under KP-LULUCF made using the country-specific methodology that has recently been developed.	Resolved. The Party has estimated and reported CSCs for the soil pool in cropland remaining cropland (in CRF table 4.B) and in CM (in CRF table 4(KP-I)B.2), and has outlined its methodology in section 6.3.4 (pp.259–265) of the NIR.
L.10	4.C.1 Grassland remaining grassland –	Include the subset of "improved grazing" land in the CRF tables and the NIR under the	Resolved. The Party has implemented improved methodologies for the identification of grazing lands and other wooded lands and estimated emissions associated with changes

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	CO_2 (L.7, 2019) (L.6, 2018) (L.13, 2016) (L.13, 2015) Accuracy	Convention while the new information is becoming available.	in management practices for the entire time series and detailed these in section 6.4.4 of the NIR (pp.266–272). See also ID# L.11 below.
L.11	4.C.1 Grassland remaining grassland – CO_2 (L.14, 2019) Completeness	Report the new estimates of CSC in mineral soils in grassland or report this carbon pool as "NA" if the assumption of steady state for the carbon stock provided for the tier 1 method in the 2006 IPCC Guidelines (vol. 4, chap. 6.2.3.1) can be justified.	Resolved. The Party has estimated and reported CSCs for the soil pool in grassland remaining grassland and in GM, and has outlined its methodology in section 6.4.4 (pp.266–272) of the NIR. The ERT commends Italy for its implementation of this improvement. For other wooded land, the Party reported "NA", consistent with the application of a tier 1 steady state assumption, and provided a justification in section 6.4.4 of the NIR, explaining that there were no changes in management practices on these lands.
L.12	4.G HWP – CO_2 (L.16, 2019) Transparency	Document in the NIR the methodology used for estimating CO_2 emissions from SWDS reported in CRF table 4.Gs1 and the rationale for the reported half-life value of 3.89 years.	Not resolved. In the NIR (p.584) and during the review, the Party stated that additional information on the issue is contained in section 6.13 of the NIR. However, the ERT could not identify any documentation or references in the NIR describing the methodology for estimating CO_2 emissions from HWP in SWDS or the rationale for the reported half-life. See also ID# L.20 in table 5.
L.13	4(V) Biomass burning – CO_2, CH_4 and N_2O (L.8, 2019) (L.12, 2018) Completeness	Revise the use of the notation key from "NO" to "NE" for CO_2, CH_4 and N_2O emissions for settlements together with the relevant justification for excluding the emissions in line with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines (regarding biomass burning for settlements).	Resolved. The Party reported the correct notation keys for CO_2, CH_4 and N_2O emissions from settlements and explained their use in CRF table 9. Section 6.12.1 of the NIR (p.283) provides the required justification for the use of "NE" for biomass burning on settlements, namely that such emissions are considered insignificant.
L.14	4(V) Biomass burning – CO_2, CH_4 and N_2O (L.15, 2019) Accuracy	Revise the methodology used for estimating emissions from biomass burning by using the mean instead of the maximum average values calculated for 2008–2016 to estimate emissions for 1990–2007.	Resolved. Annex 15 to the NIR (pp.602–606) identifies that the average values for 2008–2016 are being used and this change is the reason for the recalculations of biomass burning. While it is not clear whether the mean was used as the average, the ERT does not consider this material to the resolution of the recommendation because the time series no longer contains the risk of an artificial declining trend.
Waste			
W.1	5. General (waste) – CO_2 (W.11, 2019) Convention reporting adherence	Ensure that the information on the annual change in total long-term carbon storage in HWP waste presented in CRF table 5 is consistent with the information reported under LULUCF in CRF table 4.Gs1.	Resolved. The Party has changed its reporting of annual change in total long-term carbon storage in HWP waste in CRF table 5 from "NO" to the same value as that contained in CRF table 4.Gs1.
W.2	5.A Solid waste disposal on land – CH_4	Provide in the NIR further explanation on how time-series consistency and completeness is ensured. (This could be done	Resolved. The Party included in the NIR (section 7.2.2, p.293) a brief explanation as to how AD were estimated, gaps filled, and consistency ensured across different waste classifications.

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	(W.2, 2019) (W.7, 2018) Transparency	by including a description on how the historical and more recent waste categorizations are combined (e.g. textiles, leather and wood in historical data are included in other waste type).)	
W.3	5.A Solid waste disposal on land – CH_4 (W.3, 2019) (W.7, 2018) Transparency	Provide in the NIR a reason for applying the current waste composition in the calculation for the weighted average k values for the entire time series (for slowly degraded waste (paper, nappies, textiles, leather, wood), which varies in composition and is inconsistently categorized throughout the time series).	Resolved. The NIR (section 7.2.3, p.293 and pp.296–297) contains additional background information on the role of the k values used to ensure consistency. In addition, the ERT noted that the Party carried out a comparison between its national model and the IPCC Waste Model using the same AD and parameters (including the six different k values) and there was sufficient parity between the results (NIR section 7.2.4, p.301). During the review, Italy provided the ERT with the results achieved using the IPCC Waste Model.
W.4	5.A Solid waste disposal on land – CH_4 (W.4, 2019) (W.8, 2018) Transparency	Provide in the NIR summary information on waste disposal amounts for each climate zone.	Resolved. Information on shares of solid waste disposed of in dry and wet zones was included in the NIR (section 7.2.3, p.297).
W.5	5.A.2 Unmanaged waste disposal sites – CH_4 (W.6, 2019) (W.10, 2018) Transparency	Include in the NIR information to justify why disposal amounts from unmanaged disposal sites related to the Naples waste management issue are not included in the inventory estimates.	Resolved. Justification was provided in the NIR (section 7.2.4, p.302) as to why disposal amounts in connection with certain episodes of illegal dumping were not included in the inventory, with the situation in the Naples region given as an example.
W.6	5.B Biological treatment of solid waste – CH_4 and N_2O (W.7, 2019) (W.11, 2018) Transparency	Include in the NIR the information of dry basis AD and the assumption of moisture content.	Resolved. Table 7.16 (section 7.3.2, p.304) of the NIR was supplemented with dry weight AD consistent with the information provided in CRF table 5.B.
W.7	5.C.1 Waste incineration – CO_2 (W.12, 2019) Transparency	Improve the transparency of reporting on waste incineration by including the values of carbon content for the whole time series and the reason for the changes in carbon content, fossil carbon fraction and oxidation factor in order to facilitate the replication of the estimation.	Addressing. Table 7.23 (section 7.4.2, p.308) of the NIR was supplemented with information on carbon content of different incinerated waste types. However, no information could be found in the NIR on the oxidation factor used. During the review, the Party clarified that the oxidation factor used is 100 per cent.
W.8	5.D.2 Industrial wastewater – N_2O (W.9, 2019) (W.12,	Improve the transparency of the NIR and of CRF table 5.D by using the appropriate AD in the CRF table or by including an explanation that the AD reported in CRF	Resolved. The Party reported in CRF table 5.D the appropriate AD and the estimated value of N in the effluent, resulting in comparable N_2O IEFs. Furthermore, the Party provided additional background information in its NIR (section 7.5.2, p.317) as to how

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	2018) Transparency	table 5.D are in fact the N-N_2O in the effluent.	these AD were derived, namely from N_2O emission estimates that are based on various AD, volume of wastewater and an EF of 0.25 g N_2O/m^3.
KP-LULUCF			
KL.1	General (KP-LULUCF) – CO_2, CH_4 and N_2O (KL.5, 2019) Transparency	Describe in the NIR the drivers of recalculations applied to KP-LULUCF.	Resolved. Section 9.3.1.3 (pp.340–342) of the NIR includes information regarding changes in data and methods since the previous annual submission, mainly relating to AD updates, but also including a number of other subsector-specific improvements.
KL.2	Article 3.4 activities – CO_2 (KL.1, 2019) (KL.1, 2018) (KL.2, 2016) (KL.2, 2015) Accuracy	Include transparent and verifiable information that demonstrates that the litter pool and deadwood pool for CM and above-ground biomass, below-ground biomass, litter, deadwood pools for GM are not net sources, as stated in the annex to decision 2/CMP.7, and change the notation key from "NO" to "NE".	Resolved. In section 9.3.1.1 (pp.334–336) of the NIR, references to the use of the same methodologies as those applied under the Convention satisfy the ERT that the application of tier 1 assumptions is justified, and this is further supported by the justifications explicitly outlined in section 9.3.1.2 (pp.336–340) of the NIR. The use of notation keys is considered under ID# KL.15 in table 5 owing to a change in assumptions.
KL.3	FM – CO_2 (KL.3, 2019) (KL.6, 2018) Accuracy	Correct the reporting of the FM cap in the CRF accounting table.	Resolved. The CRF accounting table reports the correct FM cap of 146,137.77 kt CO_2 eq.
KL.4	CM – CO_2 (KL.4, 2019) (KL.7, 2018) Transparency	Provide detailed information in the NIR on how the IUTI is updated and how it impacts the further refinement of AD classes in woody crops and non-woody crops, together with detailed information on the typologies of perennial woody crops and biomass estimates that are affected by the IUTI updates, which may affect the IEF changes.	Resolved. Section 6.1 (pp.243–250) of the NIR summarizes the updating process for the IUTI and annex 10 (pp.562–573) to the NIR provides additional information as to how plots are assessed, including through the use of visual interpretation.
KL.5	CM – CO_2, CH_4 and N_2O (KL.6, 2019) Transparency	Document in the NIR any significant inter-annual changes in the area data and explain other drivers of significant changes in emission/removal trends in CM.	Resolved. The ERT notes that the methodologies for cropland and CM emissions have been updated since the previous review and the previously detected significant inter-annual changes in the area of perennial woody crops between 2015 and 2016 are no longer present. The ERT is satisfied with the explanations for time-series changes in croplands and CM provided in section 6.3 (pp.259–266) of the NIR.
KL.6	Biomass burning – CO_2, CH_4 and N_2O (KL.7, 2019) KP reporting adherence	Revise the methodology used for estimating emissions from biomass burning by using the mean instead of the maximum average values calculated for 2008–2016 for estimating emissions for 1990–2007.	Resolved. The use of average values has been resolved in accordance with ID# L.14 above.

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KL.7	Biomass burning – CO_2, CH_4 and N_2O (KL.7, 2019) KP reporting adherence	Report in the NIR revised information on the calculation of the background level and the margin, including any recalculations made to them, to maintain methodological consistency with the reported emissions and the FMRL and revise accordingly the values reported in CRF tables 4(KP-I)A.1.1 and 4(KP-I)B.1.3, where applicable.	No longer relevant. During the review, the ERT identified separate issues in the calculation and reporting of the emissions, background level and margin for AR, which supersede this issue and are considered in ID# KL.9 and ID# KL.11 in table 5.

[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 Italy 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 is 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 Italy, and had not been addressed by the Party at the time of publication of this review report.

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

ID#	*Previous recommendation for issue*	*Number of successive reviews issue not addressed*[a]
General	No issues identified.	
Energy	No issues identified.	
IPPU	No issues identified.	
Agriculture	No issues identified.	
LULUCF		
L.1	Report more detailed explanatory information and a justification for recalculations in the NIR in line with paragraph 44 of the UNFCCC Annex I inventory reporting guidelines (e.g. providing information on the updated AD and/or on errors corrected in the models used).	3 (2018–2021)
L.4	Document the For-est Model validations in the NIR.	5 (2014–2021)
Waste	No issues identified.	

ID#	*Previous recommendation for issue*	*Number of successive reviews issue not addressed*[a]
KP-LULUCF	No issues identified.	

[a] Reports on the reviews of the 2017 and 2020 annual submissions of Italy have not yet been published. Therefore, 2017 and 2020 were not included when counting the number of successive years for this table. In addition, as the reviews of the Party's 2015 and 2016 annual submissions were conducted together, they are not considered successive reviews and 2015/2016 is counted as one year.

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

10. Table 5 presents findings made by the ERT during the individual review of the 2021 annual submission of Italy that are additional to those identified in table 3.

Table 5
Additional findings made during the individual review of the 2021 annual submission of Italy

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 table 3 were made by the ERT during the review.	
Energy			
E.4	Comparison with international data – refinery feedstocks	The Party reported in CRF table 1.A(b) a figure for the stock change of refinery feedstocks (–75,646.85 TJ in 2019) which differed substantially from that provided to IEA (18 kt in 2019, which is approximately 765 TJ). During the review, Italy clarified that there is a difference in the modalities of reporting the national energy balance compared with the format of the joint questionnaire submitted to IEA. The Party also stated that it plans to conduct further analysis by involving experts responsible for the compilation of the national energy balance in order to harmonize the submissions. The ERT recommends that the Party check the value reported in CRF table 1.A(b) for the stock change of refinery feedstock and report in the NIR on any further analysis comparing the data reported in the CRF table and those reported to IEA.	Yes. Accuracy
E.5	1.A.1.a Public electricity and heat production – waste – CO_2, CH_4, N_2O	The Party reported in CRF table 1.A(b) the amount of waste (non-biomass fraction) production for 2019. The ERT noted that this figure was 53 per cent lower than that reported to IEA. During the review, Italy clarified that the value provided related only to waste for electricity production and did not include waste for heat production and that for 2019 the value would be approximately 17 per cent higher if the latter were included.	Yes. Accuracy

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
		The ERT recommends that the Party undertake a review of the amount of waste used in the energy sector and account for waste used not only for electricity production but also for heat production and make any appropriate amendments to the CRF tables.	
E.6	1.A.3.b Road transportation – biomass – CO_2, CH_4, N_2O	The Party reported in its NIR (section 3.5.3.2.1.1, p.92) that biogasoline accounts for 0.4 per cent of total road gasoline consumption. When describing the assessment of CO_2 emissions from biofuels (NIR p.93), the Party referred to fossil fuel fraction of biodiesel; it was unclear from the text whether emission estimates had been compiled only for biodiesel or also for biogasoline. During the review, Italy clarified that emissions had also been estimated for biogasoline consumption. The ERT recommends that the Party specify in the NIR that emission estimates have also been compiled for biogasoline consumption.	Yes. Transparency
IPPU			
		No findings for the IPPU sector additional to those included in table 3 were made by the ERT during the review.	
Agriculture			
A.16	3.A.1 Cattle – CH_4	The Party reported in its NIR (section A7.1, pp.482–483) that the Y_m values for the non-dairy cattle category have been chosen on the basis of average characteristics in terms of dm intake, weight and typical diet according to the default values range provided in the Revised 1996 IPCC Guidelines (4 per cent ± 0.5 per cent for good diet and 6 per cent ± 0.5 per cent for poor diet). Furthermore, the NIR (section A7.1, p.483) states that the 2006 IPCC Guidelines provide two values for Y_m, namely 3.0 per cent ± 1.0 per cent for cattle (when fed diets containing 90 per cent or more concentrates) and 6.5 per cent ± 1.0 per cent for other cattle and buffalo primarily fed low-quality crop residues and by-products, but do not provide any values for intermediate feed quality. Table A.7.7 of the NIR (section A7.1, pp.484–485) presents the results of the Party's estimation of country-specific Y_m values, with Y_m values calculated using the formula proposed by Ellis et al. (2007), which is based on dm intake and the proportion of forage in the diet, using national values for animal weight and dm intake and assuming forage percentages of between 30 and 50 per cent. The results of the verification showed that the country-specific Y_m values are close to those calculated on the basis of the formula proposed by Ellis et al. (2007). The ERT noted that the NIR does not provide a transparent justification as to why Y_m values based on the default values from the Revised 1996 IPCC Guidelines better represent Italy's national circumstances compared with the default values from the 2006 IPCC Guidelines. During the review, Italy clarified that Y_m values have been estimated by the Research Centre on Animal Production on the basis of its knowledge of the sector and information collected at farm level on intensive farms where more than 90 per cent of livestock are reared. On the basis of the data collected at farm level, intermediate-quality feed diets, where concentrates are less than 90 per cent but can exceed 70 per cent, depending on the breed, were found. The Party noted that Ellis et al. (2007) is cited in the 2019 Refinement to the 2006 IPCC Guidelines. Italy informed the ERT that a verification of Y_m values for the non-dairy cattle category will be carried out together with experts from the Research Centre on Animal Production for the next annual submission on the basis of the new information and data available in the 2019 Refinement to the 2006 IPCC Guidelines.	Yes. Transparency

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
		The ERT recommends that the Party conduct further verification of country-specific Y_m values, as indicated by Italy during the review, and include in the NIR the results of the verification to demonstrate that country-specific values better represent Italy's national circumstances, in addition to a justification.	
A.17	3.B Manure management – CH_4	The Party applied a country-specific method to estimate CH_4 emissions from cattle and buffalo manure management. The NIR (section 5.3.2, p.209) states that the value for VS production (kg VS/head/day) used in the estimation was obtained by multiplying the average production of slurry and solid manure (converted to mass unit) by the factors 47.5 g VS/kg slurry and 142.7 g VS/kg solid manure proposed by Husted (1994). During the review, Italy clarified that slurry and solid manure values expressed in volume were multiplied by 1 t/m^3 and 0.75 t/m^3, respectively, to obtain the values in mass unit. The ERT recommends that the Party provide in the NIR the values used for conversions from volume to mass unit for slurry and solid manure when estimating CH_4 emissions from cattle and buffalo manure management.	Yes. Transparency
A.18	3.B Manure management – CH_4	Following the recommendation in the previous review report (see ID# A.9 in table 3), the Party estimated and reported in its NIR (section 5.3.2, p.212, and annex 12, p.581) that CH_4 emissions from pasture, paddock and range for cattle (dairy and non-dairy) and buffalo have been estimated for the entire time series using equation 10.23 from the 2006 IPCC Guidelines (vol. 4, chap. 10). Table 5.21 of the NIR (section 5.3.2, p.212) provides the EFs, disaggregated by subcategory of cattle and buffalo, used to estimate CH_4 emissions from pasture, paddock and range. During the review, Italy provided a spreadsheet with the calculation of CH_4 EFs presented in table 5.21 of the NIR (section 5.3.2, p.212). The ERT noted that the allocation of MCF and manure handled by climate zone used to estimate EFs was not in line with equation 10.23 of the 2006 IPCC Guidelines (vol. 4, chap. 10). Moreover, only the MCF value for temperate climate conditions was considered in the estimate, whereas the MCF values for both cool and temperate climate conditions should have been considered. The Party acknowledged the findings and stated that it will provide recalculated EFs in its next annual submission. The ERT noted that the recalculated CH_4 emissions from pasture, paddock and range for cattle (dairy and non-dairy) and buffalo provided by the Party during the review amount to 15 kt CO_2 eq in 1990 and 11 kt CO_2 eq in 2019, which is below the threshold of significance for Italy (209.1 kt CO_2 eq for 2019). The ERT believes that future ERTs should consider this issue further to ensure that the data on allocation of manure handled, MCF and average monthly temperature are updated to prevent underestimation of CH_4 emissions from manure management for any subcategory of cattle or buffalo. The ERT recommends that the Party revise the CH_4 EFs used to estimate emissions from pasture, paddock and range for cattle (dairy and non-dairy) and buffalo by correcting the allocation of MCF and manure handled by climate zone, in line with equation 10.23 of the 2006 IPCC Guidelines (vol. 4, chap. 10), and recalculate CH_4 emissions for this subcategory.	Yes. Accuracy
A.19	3.C Rice cultivation – CH_4	The ERT noted that CH_4 emissions from rice cultivation amounted to 63.33 kt in 2019 and decreased by 15.6 per cent compared with 1990 (75.06 kt). However, the NIR provides no explanation on the trend. CH_4 emissions from rice cultivation is a key category by level assessment (including and excluding LULUCF). The Party explained in its NIR (section 5.4.3, p.225) that CH_4 emissions from rice cultivation depend on the harvest area and percentage of	Yes. Transparency

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem?[a]
		harvest area with single aeration. The harvest area has increased by 2.3 per cent between 1990 and 2019, whereas the share of single aerated area has increased from 0.9 per cent in 1990 to 52.3 per cent in 2019 (CRF table 3.C). During the review, the Party clarified that dry seeded sowing (single aeration) has been widespread since the beginning of the 1990s owing to the simplification of cultivation operations and water management in particular. Moreover, dry seeded sowing allows better production performance than sowing in water in areas with very loose soils. Data on rice cultivation including harvest area with single aeration are provided by the National Rice Institute. The ERT recommends that the Party provide an explanation in the NIR of the increase in the share of rice cultivation area with single aeration, which is one of the key drivers for the decrease in CH_4 emissions from rice cultivation.	
A.20	3.B.4 Other livestock – N_2O	Following the recommendation from the previous review (see ID# A.12 in table 3), the Party estimated CH_4 emissions from ostrich manure management for the entire time series and reported them in CRF table 3.B(a) and in the NIR (section 5.3.2, p.214). The ERT considers that N_2O emissions from ostrich manure management would also be expected to occur. However, the ERT noted that no information was reported regarding N_2O emissions from ostrich manure management in the NIR or in the CRF tables. During the review, Italy explained that N_2O emissions from ostrich manure management have been assessed as being insignificant and provided the calculation spreadsheet. N_2O emissions amounted to 1.27 kt CO_2 eq in 2019, which is 0.000304 per cent of the national total emissions without LULUCF and therefore below the threshold referred to in paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines. The Party also explained that the common rearing system for ostriches is free-range outdoor housing and the MMS for ostriches reported in CRF table 3.B(a)s2 will be corrected from solid storage and dry lot to pasture, range and paddock. The ERT recommends that the Party ensure that emissions from ostrich manure management are consistently reported between CRF tables 3.B(a) and 3.B(b), including the reporting of estimates or the appropriate notation key, together with a justification for excluding N_2O emissions from ostrich manure management as an insignificant source in line with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines. The ERT also recommends that Italy correct the MMS reported for ostriches in CRF table 3.B(a)s2.	Yes. Consistency
A.21	3.D.a.1 Inorganic N fertilizers – N_2O	Table 5.38 of the NIR (section 5.5.2, p.228) presents the amount of synthetic fertilizer distributed (t/year) in 2019 by fertilizer type, N content (%) and content of N (t N/year). The Party explained in the NIR (section 5.5.2, p.228) that the N content (%) in the fertilizers is calculated on the basis of the amount of fertilizer distributed (t/year) and amount of N (t N/year) in the fertilizer. However, the N content for other nitric N fertilizer presented in table 5.38 (27.7 per cent) does not correspond to the value calculated by the ERT on the basis of the amount of other nitric N fertilizer distributed (120,880 t/year) and amount of N in the fertilizer (1,784 t N/year) presented in table 5.38. During the review, Italy clarified that the amount of fertilizer distributed (120,880 t/year) refers to the total of other nitrogenous fertilizers, which includes other nitric, ammoniacal and amidic N fertilizers distributed. The Party also clarified that the total amount of N in these fertilizers is 33,450 t N/year and the N content is 27.7 per cent. The ERT recommends that the Party provide an explanation in the NIR (e.g. as a footnote to table 5.38) of the amount of fertilizer distributed (t/year), N content (%) and amount of N (t N/year) in the fertilizer for other nitrogenous fertilizers.	Yes. Transparency

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
LULUCF			
L.15	4. General (LULUCF)	The ERT observed that table 6.2 of the NIR (section 6.1, p.245) did not include the identification of HWP as a key category for LULUCF and was therefore inconsistent with table 1.6 of the NIR (section 1.5, p.39). During the review, the Party confirmed that HWP should have been identified as a key category for LULUCF in table 6.2 and that the exclusion of this information was an oversight, thereby confirming that the key category analysis in table 1.6 was correct. The ERT recommends that the Party ensure that the key category analysis is reported in a consistent manner in chapter 6 and in the rest of the NIR.	Yes. Convention reporting adherence
L.16	4. General (LULUCF) – CO_2	A number of categories were identified where the Party was using the notation key "NO" when applying a tier 1 assumption of carbon stocks in equilibrium. These include CSCs for living biomass (excluding for perennial woody crops) and dead organic matter in cropland, and all CSCs in settlements remaining settlements. During the review, the Party confirmed that it was applying this assumption and that it considered the use of "NO" appropriate, as the assumption meant that no net CSC was occurring, consistent with a previous ERT recommendation from 2018. The ERT notes that the conclusions and recommendations of the 16th meeting of GHG inventory lead reviewers (available at https://unfccc.int/sites/default/files/resource/04_GHG-LRs-2019-conclusions.pdf) state that the correct notation key to use for a tier 1 assumption of carbon stocks in equilibrium (i.e. gains equal losses) is "NA". The ERT also acknowledges that previous recommendations to the Party may have given alternative advice on this matter, but that such advice has been superseded by the outcomes of the 16th meeting of GHG inventory lead reviewers. The ERT recommends, with specific reference to cropland and settlements remaining settlements, that the Party use the notation key "NA" in all circumstances where a tier 1 assumption of carbon stocks being in equilibrium (i.e. gains equal losses) is used (see also ID# KL.15 below).	Yes. Comparability
L.17	4.D Wetlands – CO_2, CH_4, N_2O	Section 6.5.3 of the NIR (p.273) identified that reservoirs or water bodies regulated by human activities have not been considered in the land-use definitions of wetlands (flooded land) in the NIR. The ERT was therefore concerned that the area of wetlands may have been underestimated. During the review, the Party clarified that these reservoirs and water bodies are included in wetlands, but that no estimation of their area was provided owing to insufficient data. The ERT notes that emissions for these flooded lands were not estimated for reasons justifiable under the 2006 IPCC Guidelines, including the lack of tier 1 methodologies and EF (vol. 4, chap. 7). As a result, any underrepresentation of the area owing to the exclusion of reservoirs and other constructed water bodies would not affect emissions unless these were voluntarily estimated using the Wetlands Supplement or other guidance relevant to the Party's national circumstances. The ERT encourages the Party to extend its land-monitoring systems to identify and estimate areas of reservoirs and other constructed water bodies, and to consider how it might estimate emissions for these lands using the methods outlined in the Wetlands Supplement or other guidance material relevant to its national circumstances.	Not an issue/problem

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
L.18	4.D.2 Land converted to wetlands	Table 6.31 (section 6.5.4, pp.274–275) of the NIR identifies a change in carbon stocks and an increasing area in the column "20 years change" for 1991–1995, but no annual change in the area. This raised concerns about time-series consistency issues in the underlying data. During the review, the Party confirmed that there was an error in the formatting of the table and provided information confirming that the correct values were used in the estimation of emissions and that the time series was consistent. The ERT encourages the Party to ensure that the tables in the NIR are formatted correctly, with sufficient decimal places to ensure that the information presented is logical and consistent.	Not an issue/problem
L.19	4.G HWP – AD	The ERT observed that CRF table 4.Gs2 only includes AD for HWP from 1990 onward, rather than for the full series of estimates used in the calculation of emissions. During the review, the Party confirmed that AD were sourced from the Food and Agriculture Organization of the United Nations and that data from 1961 onward were used. The ERT notes that the CRF Reporter software allows users to amend the span of reported years for HWP reporting on the HWP data entry screen, which allows for additional AD reporting in CRF table 4.Gs2 without further impacting the range of CRF tables produced. Instructions for this, including an example for HWP reporting, are available in section 5.3.6 of the CRF Reporter User Manual. The ERT recommends that the Party include in CRF table 4.Gs2 the full series of HWP AD from 1961 onward used for the estimation of emissions.	Yes. Transparency
L.20	4.G HWP – CO_2	The ERT notes ID# L.12 in table 3 concerning transparency of the reporting of methods used to estimate HWP in SWDS for the information item in CRF table 4.Gs1. The ERT also has concerns regarding the accuracy of this estimate. In CRF tables 4.Gs1 and 5 (memo item), the CO_2 emissions from HWP in SWDS are reported as –3,971.84 kt CO_2 in 2019 (negative emissions; a net sink) (see ID# W.1 in table 3). However, CRF table 4.Gs1 also identifies gains in SWDS as "NO" (implying that the disposal of wood products is prohibited in Italy) and losses as a negative value (a carbon stock gain). It was clear to the ERT that this was not reflective of the Party's national circumstances. The ERT had concerns that the Party was attempting to report the quantity of carbon disposed of to SWDS using the processes of instant oxidation outlined in the Kyoto Protocol Supplement (chap. 2.8.1, step 1.4) in accordance with decision 2/CMP.7. The 2006 IPCC Guidelines (vol. 4, chap. 12, pp.12.8–12.10) state that this information item should be calculated using the methods outlined in the waste chapter, rather than those in the Kyoto Protocol Supplement. Until this recalculation is completed, the ERT is unable to assess whether the emissions from HWP in SWDS are significant or can be excluded from being reported as an HWP pool. During the review, Italy confirmed that the data used to estimate HWP in SWDS originated from the waste sector, but that the estimates reported in CRF table 4.Gs1 took into account only wood, paper and paperboard and used the Kyoto Protocol Supplement methods and parameters. The Party explained that the teams responsible for the LULUCF and waste sectors are discussing potential improvements and have presented an initial estimate of an annual change of 571 Gg carbon for HWP in SWDS.	Yes. Accuracy

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
		The ERT recommends that the Party estimate HWP in SWDS using methods consistent with the 2006 IPCC Guidelines for the waste sector and report the estimates under the information item in CRF table 4.Gs1 and under the memo item in CRF table 5, and also include HWP in SWDS in the HWP estimates if they meet the significance criteria of a key category, in accordance with guidance provided in the 2006 IPCC Guidelines (vol. 4, chap. 12, pp.12.8–12.9, and figure 12.1).	
L.21	4.G HWP – CO_2	The ERT observed that the Party applied the same methods for estimating HWP under the Convention as under the Kyoto Protocol. This would imply, on the basis of information in the NIR (chap. 6.13.1, p.286), that HWP from deforested sources are accounted for on the basis of instant oxidation, which is contrary to the 2006 IPCC Guidelines (vol. 4, chap. 12, pp.12.8–12.10) for reporting under the Convention. During the review, Italy explained that the amount of HWP sourced from deforestation was judged by national experts to be negligible, and therefore the method used was of no material consequence to emissions for this category. In its comments in response to the draft review report, Italy indicated that it used the 2019 Refinement to the 2006 IPCC Guidelines to estimate HWP under the Convention and that the methods therein are inherently consistent with the 2006 IPCC Guidelines and, more importantly, with the transparency, accuracy, consistency, comparability and completeness principles. Italy also noted that instantaneous oxidation of a carbon stock input to an HWP subpool corresponds to assuming that the subpool is in a steady state, which makes the reported calculated HWP contribution under the Kyoto Protocol fully consistent with that calculated under the Convention. The Party noted that all wood sourced from deforestation in the country is used as fuelwood (NIR, p.346), and fuelwood does not build any carbon stock in the calculation of the HWP contribution. In accordance with the 2006 IPCC Guidelines, fuelwood is reported as used in the year of harvest and is thus not part of the calculation of carbon stock of HWP in use. Italy further commented that using the most up-to-date science promotes accuracy of inventories as required by UNFCCC reporting guidelines. The ERT notes that the 2006 IPCC Guidelines and the 2019 Refinement to the 2006 IPCC Guidelines require Parties to use the most accurate methods for calculating emissions from HWP. The guidelines do not allow for the assumption of instantaneous oxidation to be applied if there is information enabling the calculation of a more accurate result unless the Party can explain why the assumption of instantaneous oxidation for deforestation-sourced HWP is a valid choice for the estimation under its national circumstances. In the light of the Party's comments in response to the draft review report, the ERT appreciates that Italy can justify that such circumstances exist in the country, which is why the issue is classed as a transparency issue and not as an accuracy issue. The ERT recommends that the Party report in the NIR information which identifies deforestation-sourced HWP as negligible in Italy as justification for not estimating additional deforestation-sourced HWP emissions or sequestrations under the Convention compared with those estimated under the Kyoto Protocol, and explain why using the assumption of instantaneous oxidation for deforestation-sourced HWP is a valid choice for producing its estimates given its national circumstances, consistent with the 2006 IPCC Guidelines.	Yes. Transparency
Waste			
W.9	5. General (waste) – CO_2	Italy reported negative values in CRF table 5 whereas annual change in total long-term carbon storage in SWDS should be greater than, or equal to, zero. Moreover, the ERT noted that the estimates provided by the IPCC Waste	Yes. Accuracy

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
		Model, which the Party uses for verification, are significantly lower than the figures reported in the CRF tables (e.g. for 2019, the IPCC Waste Model calculated 571 kt C, whereas 1,083 kt C is included in CRF table 4.Gs1). During the review, the Party stated that it will assess the results produced by the IPCC Waste Model and consider importing this calculation into its national model for the next annual submission. See also ID# L.20 above. The ERT recommends that Italy revise its estimates of the annual change in total long-term carbon storage in HWP waste in CRF table 5, ensuring that the corresponding CO_2 emissions are greater than, or equal to, zero.	
W.10	5.D.1 Domestic wastewater – CH_4	The Party reported in its NIR (section 7.5.2, p.314) that it used the value 1.25 as the correction factor for additional industrial BOD discharged into sewers for the calculation of total amount of organically degradable material in the wastewater. The ERT noted that this parameter was applied to all wastewater, whereas the 2006 IPCC Guidelines (vol. 5, chap. 6, p.6.14) provide different default values for collected and uncollected wastewater, namely 1.25 and 1.00, respectively. During the review, the Party confirmed that it had used the value 1.25 for uncollected wastewater, as industries and establishments (e.g. restaurants, butchers and grocery stores) might discharge additional BOD into domestic wastewater. The ERT recommends that the Party provide a justification in the NIR for using the value 1.25 as the correction factor for all additional industrial BOD discharged into sewers or revise its current practice and apply the default value of 1.00 for uncollected wastewater, especially in the case of rural populations using latrines.	Yes. Accuracy
W.11	5.D.1 Domestic wastewater – CH_4	Although anaerobic processes are used in sludge treatment of wastewater (NIR pp.312–313), the NIR does not specify whether the Party estimated CH_4 emissions from leakage from anaerobic digestion of sewage sludge in wastewater treatment plants. During the review, the Party confirmed that such emissions were not estimated. The ERT noted that, considering the level of biogas production in 2019 reported by Eurostat (2,137 TJ) and the default leakage rate of 5 per cent from the 2006 IPCC Guidelines (vol. 5, chap. 4, p.4.4), the potential underestimation of CH_4 emissions would be below the threshold of significance for Italy. The ERT recommends that the Party estimate CH_4 emissions from leakage from anaerobic digestion of sewage sludge by using either country-specific information on the leakage rate or, if no country-specific information is available, the default value of 5 per cent from the 2006 IPCC Guidelines (vol. 5, chap. 4, p.4.4).	Yes. Accuracy
W.12	5.D.1 Domestic wastewater – CH_4	The ERT compared the indigenous sewage sludge gas production reported by the Party to Eurostat (2,137 TJ in 2019) with the amounts of CH_4 for energy recovery reported in CRF table 5.D (21.56 kt in 2019, which is approximately 1,087 TJ) and found a difference of about 50 per cent. During the review, the Party explained that its estimation was based on the volume of biogas with an assumption of 50 per cent fraction of CH_4 in the biogas. Italy also explained that the volume of biogas was provided by Terna (the national independent system operator that provides data used in submissions to Eurostat), including details on amounts used for the production of electricity and heat which, in 2019, amounted to 63.7 Mm^3 and 1,415 TJ. The ERT noted that, on the basis of the data provided by the Party, the fraction of CH_4 would be about 65 per cent. The ERT encourages the Party to reconsider its assumption of a 50 per cent share of CH_4 in the biogas. The ERT also encourages Italy to investigate possible reasons for the remaining difference between the amount reported to	Not an issue/problem

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
		Eurostat (2,137 TJ in 2019) and the amount it estimated on the basis of the volume of biogas provided by Terna (1,415 TJ in 2019), which may include other uses of biogas (e.g. blending with natural gas, own use in wastewater treatment plants) in addition to use of biogas for the production of electricity and heat, or consider estimating CH_4 recovery for energy on the basis of total indigenous biogas production.	
W.13	5.D.1 Domestic wastewater – CH_4	The Party reported estimates of TOW of generated sludge in table 7.34 of the NIR. The ERT noted that these TOW values are exactly half of the total TOW values in wastewater treatment plants but found no explanation for this in the NIR. During the review, the Party confirmed that TOW in sludge was indeed estimated as half of TOW in accordance with international literature such as Metcalf and Eddy (1991), which proposes that the typical reduction in VS achieved in anaerobic digestion for mixed sludge (primary plus secondary) varies from 45 to 60 per cent. The ERT recommends that the Party include information on the approach used to estimate TOW in sludge in the NIR.	Yes. Transparency
W.14	5.D.1 Domestic wastewater – CH_4	The ERT noted that the Party reports by far the highest amount of CH_4 flared among reporting Parties, with most developed country Parties reporting "NO" or "NE" for amount of CH_4 flared. In its calculations, Italy assumed that all TOW of sludge in wastewater treatment plants undergoes anaerobic treatment. During the review, Italy explained that it assumed that the biogas which is not recovered for energy is automatically flared for safety reasons and noted that flaring is mandatory in wastewater treatment plants. The Party also explained that anaerobic digestion of sludge is common practice in wastewater treatment plants. Moreover, Italy informed the ERT that it is investigating a different methodology for estimating the production of biogas in wastewater treatment plants. The ERT encourages the Party to pursue its investigation into a different methodology for estimating total biogas production and revise the amount of CH_4 flared accordingly.	Not an issue/problem
KP-LULUCF			
KL.8	General (KP-LULUCF)	The ERT identified the following issues with CRF table NIR-2: (a) For deforestation, the total area at the end of the previous year was not consistent to two decimal places with the previous year's total area at the end of the current year for 2015, 2017 and 2019; (b) For FM, the total area at the end of the previous year was not consistent to two decimal places with the previous year's total area at the end of the current year for 2014, 2017 and 2019; (c) For CM, the total area at the end of the previous year was not consistent to two decimal places with the previous year's total area at the end of the current year for 2018; (d) For GM, the total area at the end of the previous year matched that year's total area at the end of the current year but was not consistent with the previous year's total area at the end of the current year for all commitment period years with differences of 28–295 kha; (e) For other land (not in the scope of the Kyoto Protocol), the total area at the end of the previous year was not consistent with the previous year's total area at the end of the current year and did not reconcile with conversions from other land to accounting categories for all commitment period years with differences of 28–295 kha;	Yes. KP reporting adherence

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem?[a]
		(f) The total national land area was different in 2016 and the base year to all other commitment period years at the second decimal place. These issues suggest that rounding to too few decimal places may be occurring in the preparation of estimates and that the area of land converted from other land to GM was being misreported by using the notation key "NO" rather than a value. During the review, Italy confirmed that it would correct these errors in its next annual submission. The ERT recommends that the Party ensure that time-series consistency is maintained in the publishing of CRF table NIR-2 by ensuring that, for all categories in all reported years, the area total at the end of the previous year aligns with the previous year's total at the end of the current year and that a consistent total national area is reported in all years.	
KL.9	General (KP-LULUCF) – CO_2, CH_4, N_2O	Paragraph 1(k)(ii) of annex I to decision 2/CMP.8 requires that Parties provide information on how net credits and debits are to be avoided during the commitment period arising from a Party's decision to apply the natural disturbances provision. It is stated in section 9.4.4 (pp.345–346) of the NIR that the expectation of net credits has been avoided by comparing the emissions resulting from the application of step 3 in the calculations (checking whether any emission estimate is greater than the arithmetic mean plus twice the standard deviation and such emissions should be iteratively removed from the data set until there are no outliers remaining to be removed (Kyoto Protocol Supplement, pp.2.48–2.49)) with the mean minus twice the standard deviation without removing emissions from the data set. The ERT noted that this check is insufficient. Box 2.3.6 of the Kyoto Protocol Supplement provides advice on how to ensure the avoidance of an expectation of net debits and credits, and criterion 1 is that there should not be a trend in the calibration period, so that an expectation of net debits and net credits is always avoided. Trend analysis on the series used for the calibration periods was not apparent in the NIR. During the review, the Party indicated that it will provide additional information in its next annual submission. The ERT recommends that the Party report transparent and detailed information in the NIR on how its method for applying the natural disturbances provision in FM and AR avoids the expectation of net credits and net debits (see ID# KL.11 below). The ERT encourages the Party to conduct QA on its approach for the next annual submission by personnel not directly involved in the inventory compilation/development process, to support its conclusions.	Yes. Transparency
KL.10	General (KP-LULUCF) – CO_2, CH_4, N_2O	The ERT noted a lack of information in the CRF accounting table regarding application of the natural disturbances provision, despite the Party's indication in the NIR that it intended to apply the natural disturbances provision. Further examination indicated that Italy did not provide all necessary information for the natural disturbances provision in the CRF tables, because CRF table 4(KP-I)A.1.1 contains only information on the background level and margin, and CRF table 4(KP-I)B.1.3 contains the same, as well as limited additional information on emissions in 2017. During the review, the Party noted that it had not yet reached a final decision as to whether it would apply the natural disturbances provision, and that intended that the CRF table 4(KP-I)B.1.3 would not be used to exclude emissions from accounting until the end of the commitment period.	Yes. KP reporting adherence

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
		The ERT notes that the design of the CRF tables aims to ensure that all emissions are included in reporting, including from natural disturbances events, and that CRF tables 4(KP-I)A.1.1 and 4(KP-I)B.1.3 are subsequently used to identify the component of reported emissions that could be excluded in the inventory year if the test for exclusion is met. The ERT must also act on the assumption that the Party will apply the provision, as it had indicated in the NIR its intention to do so, and assess the completeness of the CRF tables accordingly. Noting that the 2022 submission will be the final annual submission under the second commitment period of the Kyoto Protocol, the ERT recommends that the Party clearly report its final decision with regard to applying the natural disturbances provision. If Italy decides to apply the provision, the ERT recommends that it include all information on areas and emissions from activities relevant to natural disturbances in CRF tables 4(KP-I)A.1.1 and 4(KP-I)B.1.3, enabling the accounting of emissions and removals and the effect of natural disturbances for FM, and also make proper use of these tables to subsequently exclude emissions from accounting in the CRF accounting table.	
KL.11	AR – CO_2, CH_4, N_2O	Paragraph 33(b) of the annex to decision 2/CMP.7 requires that Parties provide information on how the method to estimate the background level and margin for natural disturbances avoids the expectation of net credits and net debits. Footnote 9 in the annex to decision 2/CMP.7 also requires that the AR background level and margin be calculated using a methodology that is consistent with that used to calculate the FM background level. In considering the matters discussed under ID# KL.9 above, the ERT identified a declining trend in the area-specific wildfire emissions (that is, the emissions from AR wildfire divided by the area under AR in each year) which is used to estimate the background level and margin for AR. This suggests that the severity of wildfire in AR lands has been decreasing over time, which could in turn create an expectation of net debits where this series of area-specific emissions is used as a calibration series. This concern is confirmed when observing that 1990–1993 are identified as years for exclusion in AR, while significant emissions in 2017 (a year with significant wildfire activity in Italy, which would therefore be expected to be excluded under the natural disturbances provision) did not meet the trigger test for exclusion from accounting. The ERT noted that this trend of declining wildfire severity may in fact arise from accuracy issues in the estimation of emissions from AR wildfire for the purposes of estimating the background level and margin. This matter is considered in ID# KL.12 below. The ERT also observed that the method for estimating the natural disturbances background level and margin for AR used area-specific emissions, whereas for FM emission levels were used that were not adjusted for area. During the review, the Party confirmed that different methods are used for AR and FM. The ERT notes that these methods are not consistent or in accordance with decision 2/CMP.7, so the FM background level should also be estimated using area-specific emissions (recalculations in FM would likely have a negligible impact on accounting and therefore present a less significant issue). In its comments in response to the draft review report, Italy confirmed that it applied the Kyoto Protocol Supplement to estimate background and margin for AR and FM (chap. 2.3.9.6, tables 2.3.1–2.3.2). Italy noted that the Kyoto Protocol Supplement was developed to ensure full consistency with the elements set out in decision 2/CMP.7 and is the mandatory guidance to be used for estimating and reporting Kyoto Protocol activities.	Yes. Accuracy

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem?[a]
		In its assessment, the ERT outlined how the estimation methods may not be fully consistent with the Kyoto Protocol Supplement and decision 2/CMP.7. However, the Party did not provide further clarification on the substance of the issue showing elements of this consistency during the review. The ERT recommends that the Party use methods for estimating the natural disturbance background level and margin that ensure that there is no expectation of net credits or debits, in addition to ensuring that its methods for estimating natural disturbances are consistent between AR and FM in accordance with decision 2/CMP.7, annex, paragraph 33(b) and footnote 9.	
KL.12	AR – CO_2, CH_4, N_2O	As discussed in ID# KL.11 above, the ERT observed a declining trend in the severity of wildfires in AR. The ERT is concerned that this may not be accurate because the nature of AR, which is similar to land converted to forest land, means that it should contain growing forests with increasing carbon stocks, which would allow for more severe wildfire impacts over time. The ERT is also concerned that the Party may have estimated fire emissions for this activity without applying age adjustments to trees, using emissions from the Convention category land converted to forest land, which has a broader land scope than AR prior to 2009, or including subsequent recoveries in a manner which is not appropriate for the estimation of the background level and margin (subsequent recoveries would increase over time, reducing the apparent severity). During the review, Italy provided the ERT with material showing some of the calculations for natural disturbances in AR, but the ERT was unable to verify how the emission levels for AR wildfires (the preliminary step in calculating area-specific emissions) were calculated. The ERT recommends that the Party provide transparent information in the NIR regarding the areas of wildfire in AR from 1990 onward and justify its methods for the estimation of emissions from biomass burning in AR. The ERT also recommends that the Party explain in detail in the NIR how the estimates for biomass burning are used in the construction of the natural disturbances background level and margin.	Yes. Transparency
KL.13	FM – CO_2, CH_4, N_2O	For the $FMRL_{corr}$ no information was given as to whether the projected harvesting rate applied in the calculation of the $FMRL_{corr}$ was the same as that for the FMRL and if or how the background level for FM natural disturbances was included in the $FMRL_{corr}$ to replace the GHG emissions included in the FMRL. In its response to preliminary findings on KP-LULUCF, the Party noted that the actual values of harvest had been used for the $FMRL_{corr}$, whereas a projected harvesting rate was used to run the model assessing the FMRL. In addition, the actual values of burned areas and related GHG emissions had been used for the $FMRL_{corr}$. During the review, the ERT sought further clarification on Italy's response, as there was a concern that the Party might not be applying the same policy assumptions for the $FMRL_{corr}$ as those used at the time the FMRL was constructed, and was instead using FM calculation data. Italy confirmed that the same 'business as usual' policy assumptions were used to construct both the FMRL and the $FMRL_{corr}$. The ERT recommends that the Party provide comprehensive and transparent information in the NIR as to how the $FMRL_{corr}$ is calculated, demonstrating that the policy assumptions used in the construction of the $FMRL_{corr}$ are the same as for the FMRL, including how the harvesting rate assumptions used for FMRL are maintained in the $FMRL_{corr}$ and how wildfire emissions have been updated in the $FMRL_{corr}$ in a manner consistent with the calculation of the natural disturbance background level for FM.	Yes. Transparency

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
KL.14	CM	For CM and GM, the Party is 'zeroing' the accounting of 1,730 kha of land, which is reported under CM only in the base year and not in any of the commitment period years, but it has not described in its NIR the consequences of this exclusion for reported emissions and removals, as required by the Kyoto Protocol Supplement (chap. 2.9.2, p.2.136). The preliminary findings on KP-LULUCF also identified that the area of GM reported in 1990 was smaller than in the commitment period without commensurate conversions to AR, and that the 'zeroing' practice may therefore also be applied to GM. During the review, Italy indicated that it will provide additional information on CM in its next annual submission and confirmed that it was also 'zeroing' 172 kha of land in GM. The ERT recommends that the Party provide additional information in the NIR regarding the consequences of excluding land areas which are reported under CM and GM only in the base year.	Yes. Transparency
KL.15	CM – CO_2	In a previous review, it was recommended that the Party provide justification for tier 1 assumptions on the basis of pools not being a net source and update notation keys in CM and GM to "NE" (see ID# KL.2 in table 3). While that issue has now been resolved, Italy used an alternative justification of carbon pools being in equilibrium and stated in the NIR (chap. 9.3.1.1, pp.334–335) that it uses the same methods for estimating the relevant pools under the Kyoto Protocol and under the Convention. It is noted in the conclusions and recommendations of the 16th meeting of GHG inventory lead reviewers that the correct notation key for this tier 1 assumption is "NA", and therefore the use of "NE" is no longer correct. The Party also continued to apply the notation key "NO" for changes in above-ground and below-ground biomass, which is similarly reliant upon an assumption of carbon stocks being in equilibrium. See also ID# L.16 above. The ERT recommends, with specific reference to CM and GM, that the Party use the notation key "NA" in all circumstances where a tier 1 assumption of carbon stocks being in equilibrium (i.e. gains equal losses) is applied.	Yes. Comparability
KL.16	GM – N_2O	Following the implementation of an updated model for CSCs in mineral soils reflecting changes in land management practices (NIR chap. 6.4.4), the ERT checked for consistency of reporting with N_2O emissions from N mineralization or immobilization. It was identified that for GM and for grassland remaining grassland, this activity was reported as "NO" for the entire time series. During the review, the Party pointed out to the ERT that emissions should be reported as "NO" in circumstances where carbon stocks in mineral soils are increasing. Although this assisted the ERT by clarifying Italy's national circumstances, the ERT notes that CSCs reported in CRF table 4(KP-I)B.3 for mineral soils on managed grazing land are negative in the base year of 1990 and that the AD and CSCs were still not included in CRF table 4(KP-II)3. The Party acknowledged this and indicated that it will correct this in its next annual submission. The ERT recommends that the Party estimate and report N_2O emissions from N mineralization or immobilization where CSCs are negative and report the areas and CSCs in mineral soils (including where N_2O emissions are not occurring owing to increasing carbon stocks and negative mineralized N from loss of soil organic carbon stocks in mineral soils) in CRF table 4(KP-II)3, and ensure that the reporting under the Convention is consistent with this.	Yes. Completeness

[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 Italy.

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

12. Italy elected commitment period accounting and therefore the issuance and cancellation of units for KP-LULUCF is not applicable to the 2021 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 Italy in its 2021 annual submission

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

Table I.1
Total greenhouse gas emissions and removals for Italy, 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								–22 166.00
Base year[d]	515 305.92	518 797.02	NA	NA	NA		979.53	
1990	515 229.35	518 720.44	NA	NA				
1995	508 331.28	532 004.11	NA	NA				
2000	534 550.28	555 466.29	NA	NA				
2010	474 551.18	516 473.73	NA	NA				
2011	469 691.95	503 645.26	NA	NA				
2012	459 318.42	484 218.02	NA	NA				
2013	409 108.69	449 178.93	NA	NA		–6 047.02	–3 052.50	–30 321.65
2014	386 901.01	427 930.41	NA	NA		–6 448.86	–3 761.83	–31 346.82
2015	396 754.37	440 436.70	NA	NA		–6 898.69	–4 348.63	–32 564.96
2016	397 035.15	437 696.09	NA	NA		–6 447.60	–6 300.21	–29 527.89
2017	412 374.40	432 713.74	NA	NA		–3 237.13	–5 669.17	–13 759.68
2018	392 546.60	428 549.35	NA	NA		–5 892.25	–5 453.03	–24 878.84
2019	376 719.37	418 280.60	NA	NA		–7 023.78	–5 649.48	–31 081.26

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 all gases except NF_3, for which the base year is 1995. The base year for CM and GM under Article 3, para. 4, of the Kyoto Protocol is 1990. 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 Italy, 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	439 549.77	49 331.22	26 080.24	444.00	2 906.86	NO, NA	408.35	NA, NO
1995	449 826.01	51 346.99	27 630.89	926.65	1 492.31	24.97	679.72	76.57
2000	470 493.15	51 847.83	28 505.32	2 488.95	1 488.50	24.97	604.31	13.26
2010	436 153.68	47 339.06	18 967.73	12 053.95	1 520.39	24.97	393.79	20.17
2011	424 277.53	45 862.16	18 380.10	12 970.08	1 661.28	24.97	441.36	27.78
2012	403 447.21	46 421.80	18 757.64	13 596.65	1 499.21	24.97	445.61	24.93
2013	369 834.34	44 965.31	17 932.11	14 269.22	1 705.41	24.97	421.88	25.70
2014	349 581.75	43 995.34	17 458.58	14 918.10	1 564.34	24.97	359.16	28.17
2015	361 302.48	44 059.30	17 473.72	15 387.24	1 688.33	24.97	472.25	28.42
2016	358 060.74	43 793.80	17 828.29	15 941.17	1 613.73	24.97	399.42	33.98
2017	352 849.91	44 023.72	17 739.64	16 320.83	1 313.68	24.97	417.49	23.50
2018	349 020.45	43 472.15	17 462.31	16 445.46	1 657.27	23.15	446.43	22.13
2019	339 772.17	42 967.29	17 227.38	16 800.52	1 027.55	23.54	444.31	17.84
Percentage change 1990–2019	**22.7**	**–12.9**	**–33.9**	**3 683.9**	**–64.7**	**NA**	**8.8**	**NA**

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

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

	Energy	*IPPU*	*Agriculture*	*LULUCF*	*Waste*	*Other*
1990	425 321.96	40 421.81	35 672.25	–3 491.09	17 304.42	NO
1995	437 941.49	38 315.54	35 751.01	–23 672.83	19 996.08	NO
2000	459 623.81	39 123.40	34 828.88	–20 916.01	21 890.21	NO
2010	429 048.91	37 000.49	30 020.15	–41 922.56	20 404.19	NO
2011	416 145.03	37 319.84	30 419.00	–33 953.32	19 761.39	NO
2012	398 957.09	34 573.45	30 822.89	–24 899.60	19 864.59	NO
2013	366 954.34	33 600.30	29 979.73	–40 070.25	18 644.57	NO
2014	346 735.46	33 209.58	29 486.93	–41 029.40	18 498.44	NO

	Energy	*IPPU*	*Agriculture*	*LULUCF*	*Waste*	*Other*
2015	359 024.93	33 232.31	29 562.75	–43 682.33	18 616.71	NO
2016	355 572.78	33 426.77	30 360.33	–40 660.94	18 336.21	NO
2017	350 478.14	33 817.48	30 108.67	–20 339.33	18 309.45	NO
2018	345 962.37	34 569.82	29 685.57	–36 002.75	18 331.59	NO
2019	336 642.21	33 937.08	29 517.32	–41 561.22	18 183.99	NO
Percentage change 1990–2019	**–20.9**	**–16.0**	**–17.3**	**1 090.5**	**5.1**	**NA**

Notes: (1) Italy did not report emissions or removals in the sector other (sector 6); the corresponding cells in the CRF tables were left blank; (2) Italy 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 Italy

(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				–22 166.00				
Technical correction				–1 680.06				
Base year[b]	NA				863.76	115.77	NA	NA
2013		–7 989.34	1 942.32	–30 321.65	–2 283.25	–769.26	NA	NA
2014		–8 402.02	1 953.16	–31 346.82	–2 578.34	–1 183.49	NA	NA
2015		–8 862.63	1 963.94	–32 564.96	–3 503.61	–845.01	NA	NA
2016		–8 421.57	1 973.97	–29 527.89	–5 367.09	–933.11	NA	NA
2017		–5 213.09	1 975.96	–13 759.68	–5 126.76	–542.41	NA	NA
2018		–7 876.56	1 984.30	–24 878.84	–4 879.14	–573.89	NA	NA
2019		–9 018.10	1 994.32	–31 081.26	–5 009.57	–639.91	NA	NA
Percentage change base year–2019					**–680.0**	**–652.8**	**NA**	**NA**

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

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

[b] The base year for CM and GM under Article 3, para. 4, of the Kyoto Protocol is 1990. For activities under Article 3, para. 3, of the Kyoto Protocol and FM under Article 3, para. 4, only the inventory years of the commitment period must be reported.

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

Table I.5
Key relevant data for Italy 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: commitment period accounting (e) GM: commitment period accounting (f) RV: not elected (g) WDR: not elected
Elected activities under Article 3, paragraph 4, of the Kyoto Protocol	CM, GM
Election of application of provisions for natural disturbances	Yes, for AR and FM (see ID# KL.10 in table 5)
3.5% of total base-year GHG emissions, excluding LULUCF	18 267.221 kt CO_2 eq (146 137.768 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
4. CM	NA
5. GM	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 Italy. 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 Italy
(t CO_2 eq)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
CPR	2 169 262 279	–	–	2 169 262 279
Annex A emissions				
CO_2	339 772 171	–	–	339 772 171
CH_4	42 967 285	–	–	42 967 285
N_2O	17 227 377	–	–	17 227 377
HFCs	16 800 524	–	–	16 800 524
PFCs	1 027 554	–	–	1 027 554
Unspecified mix of HFCs and PFCs	23 540	–	–	23 540
SF_6	444 306	–	–	444 306
NF_3	17 838	–	–	17 838
Total Annex A sources	**418 280 596**	–	–	**418 280 596**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–9 018 099	–	–	–9 018 099
Deforestation	1 994 316	–	–	1 994 316
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–31 081 265	–	–	–31 081 265
CM	–5 009 569	–	–	–5 009 569
CM for the base year	863 759	–	–	863 759
GM	–639 907	–	–	–639 907
GM for the base year	115 768	–	–	115 768

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

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Annex A emissions				
CO_2	349 020 446	–	–	349 020 446
CH_4	43 472 154	–	–	43 472 154
N_2O	17 462 309	–	–	17 462 309
HFCs	16 445 459	–	–	16 445 459
PFCs	1 657 269	–	–	1 657 269
Unspecified mix of HFCs and PFCs	23 151	–	–	23 151
SF_6	446 426	–	–	446 426
NF_3	22 132	–	–	22 132
Total Annex A sources	**428 549 346**	–	–	**428 549 346**

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–7 876 559	–	–	–7 876 559
Deforestation	1 984 305	–	–	1 984 305
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–24 878 835	–	–	–24 878 835
CM	–4 879 137	–	–	–4 879 137
CM for the base year	863 759	–	–	863 759
GM	–573 891	–	–	–573 891
GM for the base year	115 768	–	–	115 768

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

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Annex A emissions				
CO_2	352 849 912	–	–	352 849 912
CH_4	44 023 715	–	–	44 023 715
N_2O	17 739 637	–	–	17 739 637
HFCs	16 320 833	–	–	16 320 833
PFCs	1 313 677	–	–	1 313 677
Unspecified mix of HFCs and PFCs	24 968	–	–	24 968
SF_6	417 494	–	–	417 494
NF_3	23 500	–	–	23 500
Total Annex A sources	**432 713 736**	**–**	**–**	**432 713 736**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–5 213 088	–	–	–5 213 088
Deforestation	1 975 961	–	–	1 975 961
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–13 759 683	–	–	–13 759 683
CM	–5 126 760	–	–	–5 126 760
CM for the base year	863 759	–	–	863 759
GM	–542 412	–	–	–542 412
GM for the base year	115 768	–	–	115 768

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

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Annex A emissions				
CO_2	358 060 743	–	–	358 060 743
CH_4	43 793 802	–	–	43 793 802
N_2O	17 828 288	–	–	17 828 288
HFCs	15 941 170	–	–	15 941 170
PFCs	1 613 725	–	–	1 613 725
Unspecified mix of HFCs and PFCs	24 968	–	–	24 968
SF_6	399 415	–	–	399 415
NF_3	33 979	–	–	33 979
Total Annex A sources	**437 696 091**	**–**	**–**	**437 696 091**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–8 421 566	–	–	–8 421 566

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Deforestation	1 973 966	–	–	1 973 966
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–29 527 893	–	–	–29 527 893
CM	–5 367 093	–	–	–5 367 093
CM for the base year	863 759	–	–	863 759
GM	–933 114	–	–	–933 114
GM for the base year	115 768	–	–	115 768

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

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Annex A emissions				
CO_2	361 302 482	–	–	361 302 482
CH_4	44 059 300	–	–	44 059 300
N_2O	17 473 723	–	–	17 473 723
HFCs	15 387 241	–	–	15 387 241
PFCs	1 688 326	–	–	1 688 326
Unspecified mix of HFCs and PFCs	24 968	–	–	24 968
SF_6	472 245	–	–	472 245
NF_3	28 417	–	–	28 417
Total Annex A sources	**440 436 701**	**–**	**–**	**440 436 701**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–8 862 630	–	–	–8 862 630
Deforestation	1 963 938	–	–	1 963 938
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–32 564 956	–	–	–32 564 956
CM	–3 503 613	–	–	–3 503 613
CM for the base year	863 759	–	–	863 759
GM	–845 013	–	–	–845 013
GM for the base year	115 768	–	–	115 768

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

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Annex A emissions				
CO_2	349 581 755	–	–	349 581 755
CH_4	43 995 337	–	–	43 995 337
N_2O	17 458 575	–	–	17 458 575
HFCs	14 918 101	–	–	14 918 101
PFCs	1 564 344	–	–	1 564 344
Unspecified mix of HFCs and PFCs	24 968	–	–	24 968
SF_6	359 158	–	–	359 158
NF_3	28 175	–	–	28 175
Total Annex A sources	**427 930 412**	**–**	**–**	**427 930 412**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–8 402 025	–	–	–8 402 025
Deforestation	1 953 164	–	–	1 953 164
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				

	Original submission	*Revised submission*	*Adjustment*	*Final value*
FM	–31 346 824	–	–	–31 346 824
CM	–2 578 339	–	–	–2 578 339
CM for the base year	863 759	–	–	863 759
GM	–1 183 494	–	–	–1 183 494
GM for the base year	115 768	–	–	115 768

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

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Annex A emissions				
CO_2	369 834 337	–	–	369 834 337
CH_4	44 965 313	–	–	44 965 313
N_2O	17 932 107	–	–	17 932 107
HFCs	14 269 217	–	–	14 269 217
PFCs	1 705 414	–	–	1 705 414
Unspecified mix of HFCs and PFCs	24 968	–	–	24 968
SF_6	421 884	–	–	421 884
NF_3	25 696	–	–	25 696
Total Annex A sources	**449 178 935**	**–**	**–**	**449 178 935**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–7 989 338	–	–	–7 989 338
Deforestation	1 942 320	–	–	1 942 320
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–30 321 652	–	–	–30 321 652
CM	–2 283 245	–	–	–2 283 245
CM for the base year	863 759	–	–	863 759
GM	–769 256	–	–	–769 256
GM for the base year	115 768	–	–	115 768

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 GM (N_2O) (see ID# KL.16 in table 5).

Annex IV

Reference documents

A. Reports of the Intergovernmental Panel on Climate Change

IPCC. 1997. *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*. JL Houghton, LG Meira Filho, B Lim, et al. (eds.). Paris: IPCC/Organisation for Economic Co-operation and Development/International Energy Agency. Available at https://www.ipcc-nggip.iges.or.jp/public/gl/invs1.html.

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

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

IPCC. 2019. *2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories*. E Calvo Buendia, K Tanabe, A Kranjc, et al. (eds.). Geneva: IPCC. Available at https://www.ipcc.ch/report/2019-refinement-to-the-2006-ipcc-guidelines-for-national-greenhouse-gas-inventories/.

B. UNFCCC documents

Annual review reports

Reports on the individual reviews of the 2014, 2015, 2016, 2018 and 2019 annual submissions of Italy, contained in documents FCCC/ARR/2014/ITA, FCCC/ARR/2015/ITA, FCCC/ARR/2016/ITA, FCCC/ARR/2018/ITA and FCCC/ARR/2019/ITA, 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 Italy for 2021. Available at https://unfccc.int/sites/default/files/resource/asr2021_ITA.pdf.

C. Other documents used during the review

Responses to questions during the review were received from Daniela Romano and Riccardo de Lauretis (Italian Institute for Environmental Protection and Research), including

additional material on the methodology and assumptions used. The following references may not conform to UNFCCC editorial style as some have been reproduced as received:

CRPA, 2016. *Personal communication - experts Nicola Labartino and Laura Valli from the Research Centre on Animal Production (expert consultation on N excretion and national production systems)*. Reggio Emilia, Italy.

Ellis J. L., Kebreab E., Odongo N. E., McBride B. W., Okine E. K., France J., 2007. *Prediction of Methane Production from Dairy and Beef Cattle*. Article in Journal of Dairy Science - August 2007

Husted S., 1994. *Seasonal variation in methane emissions from stored slurry and solid manures*, J. Env. Qual. 23, pp. 585-592.

Metcalf and Eddy,1991. *Wastewater engineering: treatment, disposal and reuse*. Mc Graw Hill.