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Report on the individual review of the annual submission of Spain 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 Spain, conducted by an expert review team in accordance with the “Guidelines for review under Article 8 of the Kyoto Protocol”. The review took place from 27 September to 2 October 2021.

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



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Abbreviations and acronyms

2006 IPCC Guidelines	<i>2006 IPCC Guidelines for National Greenhouse Gas Inventories</i>
2019 Refinement to the 2006 IPCC Guidelines	<i>2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories</i>
AAU	assigned amount unit
AD	activity data
Annex A source	source category included in Annex A to the Kyoto Protocol
AR	afforestation and reforestation
Article 8 review guidelines	“Guidelines for review under Article 8 of the Kyoto Protocol”
C	carbon
C ₂ F ₆	hexafluoroethane
CER	certified emission reduction
CF ₄	tetrafluoromethane
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”
COPERT	software tool for calculating road transport emissions
CORINE	Coordination of Information on the Environment (programme)
CPR	commitment period reserve
CRF	common reporting format
CSC	carbon stock change
DOC	degradable organic carbon
EEA	European Environment Agency
EF	emission factor
EMEP	Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe
ERT	expert review team
ERU	emission reduction unit
F-gas	fluorinated gas
F _{IND-COM}	fraction of industrial and commercial co-discharged protein into the sewer system
FM	forest management
FMRL	forest management reference level
Frac _{GASF}	fraction of synthetic nitrogen fertilizer that volatilizes as ammonia and nitrogen oxides
Frac _{GASM}	fraction of applied organic nitrogen fertilizer materials and urine and dung nitrogen deposited by grazing animals that volatilizes as ammonia and nitrogen oxides
GE	gross energy intake
GHG	greenhouse gas
GM	grazing land management
HFC	hydrofluorocarbon
IE	included elsewhere
IEA	International Energy Agency
IEF	implied emission factor
IPCC	Intergovernmental Panel on Climate Change

IPPU	industrial processes and product use
KP-LULUCF	activities under Article 3, paragraphs 3–4, of the Kyoto Protocol
Kyoto Protocol Supplement	<i>2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol</i>
LULUCF	land use, land-use change and forestry
MCF	methane correction factor
N	nitrogen
N ₂ O	nitrous oxide
NA	not applicable
NE	not estimated
NF ₃	nitrogen trifluoride
NFI	national forest inventory
NIR	national inventory report
NO	not occurring
PFC	perfluorocarbon
QA/QC	quality assurance/quality control
RMU	removal unit
RV	revegetation
SEF	standard electronic format
SF ₆	sulfur hexafluoride
SIAR	standard independent assessment report
UNFCCC Annex I inventory reporting guidelines	“Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual greenhouse gas inventories”
UNFCCC review guidelines	“Guidelines for the technical review of information reported under the Convention related to greenhouse gas inventories, biennial reports and national communications by Parties included in Annex I to the Convention”
WDR	wetland drainage and rewetting
Wetlands Supplement	<i>2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands</i>
Ym	methane conversion rate

I. Introduction

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

Table 1

Composition of the expert review team that conducted the review for Spain

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

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

3. The ERT has made recommendations that Spain resolve identified findings, including issues¹ designated as problems.² Other findings, and, if applicable, the encouragements of the ERT to Spain to resolve related issues, are also included in this report.

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

5. Annex I presents the annual GHG emissions of Spain, including totals excluding and including LULUCF, indirect CO₂ emissions, and emissions by gas and by sector, and contains background data on emissions and removals from KP-LULUCF, if elected by the Party, by gas, sector and activity.

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

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

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

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

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

Table 2

Summary of review results and general assessment of the 2021 annual submission of Spain

Assessment		Issue/problem ID#(s) in table 3, 5 or 6 ^a
Dates of submission	Original submission: NIR, 15 March 2021; CRF tables (version 1), 15 March 2021; SEF tables, 15 March 2021 Revised submissions: NIR, 7 May 2021; addendum to the NIR, 30 September 2021; CRF tables (version 3), 30 September 2021; SEF tables, 7 May 2021 Unless otherwise specified, values from the most recent submission are included in this report	
Review format	Desk review	
Application of the requirements of the UNFCCC	Have any issues been identified in the following areas:	
Annex I inventory reporting guidelines and the Wetlands Supplement (if applicable)	(a) Identification of key categories?	No
	(b) Selection and use of methodologies and assumptions?	No
	(c) Development and selection of EFs?	Yes E.10, A.5, A.8
	(d) Collection and selection of AD?	Yes L.7, L.10, KL.2
	(e) Reporting of recalculations?	Yes I.7, I.8, I.9, I.10, W.7
	(f) Reporting of a consistent time series?	Yes L.11
	(g) Reporting of uncertainties, including methodologies?	Yes A.4, W.2
	(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 L.6, L.9
	(j) Application of corrections to the inventory?	No
Significance threshold	For categories reported as insignificant, has the Party provided sufficient information showing that the likely level of emissions meets the criteria in paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines?	NA The Party did not report any insignificant categories as "NE"
Description of trends	Did the ERT conclude that the description in the NIR of the trends for the different gases and sectors is reasonable?	Yes
Supplementary information under the Kyoto Protocol	Have any issues been identified related to the following aspects of the national system:	
	(a) Overall organization of the national system, including the effectiveness and reliability of the institutional, procedural and legal arrangements?	No
	(b) Performance of the national system functions?	No

Assessment	Issue/problem ID#(s) in table 3, 5 or 6 ^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?	No
	Have any issues been identified related to the following reporting requirements for KP-LULUCF:	
	(a) Reporting requirements of decision 2/CMP.8, annex II, paragraphs 1–5?	Yes KL.1, KL.6
	(b) Demonstration of methodological consistency between the reference level and reporting on FM in accordance with decision 2/CMP.7, annex, paragraph 14?	No
	(c) Reporting requirements of decision 6/CMP.9?	No
	(d) Country-specific information to support provisions for natural disturbances in accordance with decision 2/CMP.7, annex, paragraphs 33–34?	No
CPR	Was the CPR reported in accordance with decision 18/CP.7, annex; decision 11/CMP.1, annex; and decision 1/CMP.8, paragraph 18?	Yes
Adjustments	Has the ERT applied any adjustments under Article 5, paragraph 2, of the Kyoto Protocol?	No
	Has the Party submitted a revised estimate to replace a previously applied adjustment?	NA Spain does not have a previously applied adjustment
Response from the Party during the review	Has the Party provided the ERT with responses to the questions raised, including the data and information necessary for assessing conformity with the UNFCCC Annex I inventory reporting guidelines and any further guidance adopted by the Conference of the Parties?	Yes
Recommendation for an exceptional in-country review	On the basis of the issues identified, does the ERT recommend that the next review be conducted as an in-country review?	No
Questions of implementation	Did the ERT list any questions of implementation?	No

^a Further information on the issues identified, as well as additional findings, may be found in tables 3, 5 and 6.

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

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

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

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

ID#	Issue/problem classification ^{a, b}	Recommendation made in previous review report	ERT assessment and rationale
General			
G.1	Follow-up to previous reviews (G.1, 2019) (G.1, 2017) (G.4, 2016) (G.4, 2015) Transparency	Continue to address the transparency issues identified in the previous and current annual review reports and provide information on the implementation of the recommendations on transparency in the NIR.	Resolved. The Party reported in its NIR (chap. 10, table 10.A.2.1, p.605) that all outstanding transparency issues identified in the previous review report (2019) have been resolved. Spain included descriptions of steps taken to address these issues in the relevant sectoral chapters of the NIR. The ERT confirmed that most of the outstanding transparency issues identified in the 2019 annual review report (see document FCCC/ARR/2019/ESP, ID#s E.2, I.9, A.1, A.5, L.18, L.19, L.22 and KL.4) have been resolved (see ID#s E.2, I.2, A.1, A.2, L.2, L.3, L.5 and KL.3 below).
G.2	Uncertainty analysis (G.6, 2019) Convention reporting adherence	Report an uncertainty analysis in accordance with paragraphs 15 and 42 of the UNFCCC Annex I inventory reporting guidelines, including uncertainties for at least the base year and the latest inventory year and the trend uncertainty between these two years.	Resolved. The Party reported in its NIR (chap. 1, pp.80–81, and annex 6, pp.913–921) the required uncertainty analysis and corresponding tables.
Energy			
E.1	1. General (energy sector) – liquid fuels – CO ₂ (E.13, 2019) Transparency	Provide more detail in the NIR for category 1.B.2 petroleum refining, describing changes in the sector and how they effect changes in emissions over time for this category. Furthermore, provide data for category 1.A.1.b explaining that the refinery gas increase for this category comes from changes in the refining sector and that there is no double counting of emissions between refinery gas	Resolved. The Party provided more detail in the NIR (chap. 3.15.1, p.258) for category 1.B.2 petroleum refining, describing the changes in the oil sector over the last decade and noting that although the amount of crude oil processed has increased only slightly over the years, remarkable developments in refining processes and changes in the fuel mix have led to an increase in emissions (see NIR figure 3.15.1, p.258). Spain explained how emissions have changed as a result of energy efficiency improvements and the commissioning of new facilities or conversion units that use fuels from the refineries themselves, such as refinery gas,

³ FCCC/ARR/2019/ESP. The ERT notes that the report on the individual inventory review of Spain'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.

<i>ID#</i>	<i>Issue/problem classification^{a, b}</i>	<i>Recommendation made in previous review report</i>	<i>ERT assessment and rationale</i>
		reported in category 1.A.1.b and fugitive emissions from refineries reported in category 1.B.2.	which is composed of off-gases from distillation. The Party also provided in the NIR (chap. 3.3.2.1, p.160) data for subcategory 1.A.1.b to clarify trends and fluctuations in relation to emissions from refinery gas, natural gas and fuel oil. The Party reported that increased efficiency in refineries has led to changes in the fuel mix, decreasing the use of fuel oil and increasing the use of other fuels, and indicated that there was no double counting between the emissions from refinery gas reported under subcategory 1.A.1.b and fugitive emissions from refineries reported under subcategory 1.B.2.a.4 (NIR chap. 3.3.2.1, p.160).
E.2	1.A Fuel combustion – sectoral approach – all fuels – CO ₂ , CH ₄ and N ₂ O (E.2, 2019) (E.12, 2017) Transparency	<p>Improve transparency regarding the use of the national energy balance in the inventory by:</p> <p>(a) Explaining the application of the full consistency principle for energy use and how consistency is ensured for non-energy use;</p> <p>(b) Describing, at a detailed activity level, the automatic checks carried out by the queries in the database and the procedures to rebalance excessive or missing fuel consumption;</p> <p>(c) Providing a reference in section 3.1.1 of the NIR to the detailed data in annex 2.</p>	Resolved. The ERT noted that Spain already implemented parts (a) and (c) of the recommendation for the 2019 annual submission (see document FCCC/ARR/2019/ESP, ID# E.2). With regard to part (b), the Party corrected the inaccurate information previously reported on non-energy use of liquefied petroleum gas (NIR chap. A2, table A2.2, p.773) and included information on its balancing approach, indicating the steps taken to rebalance energy use across fuel types and sectors (NIR chap. A2.1.2, p.772).
E.3	1.A Fuel combustion – sectoral approach – all fuels – CO ₂ , CH ₄ and N ₂ O (E.3, 2019) (E.13, 2017) Consistency	Develop a method whereby all methodological improvements (methodological refinements for recent years) are applied in the energy balance for previous years of the time series so that a consistent data set is produced. If this is not possible, consider revising the principle of full consistency with the national energy balance at the subcategory level and develop an internally consistent energy balance for previous years of the time series.	Resolved. The Party reported in its NIR (chap. A.2.1.1, p.769) its method for producing a consistent data set for inventory use. According to the Party, the information for the inventory was taken directly from questionnaires as part of a bottom-up approach. In some cases, when the available consumption data are not sufficiently complete to produce estimates for a whole sector, they must be supplemented with information from energy statistics produced by the Ministry for the Ecological Transition and the Demographic Challenge. These statistics, which are those referenced by IEA and the statistical office of the European Union, represent a top-down approach. Over the years, the Ministry has updated its methodologies and changed the information provided for certain years, which have occasionally caused inconsistencies in the time series after they have been incorporated into the inventory. The Party also reported on efforts to ensure that the data reported for different activities over the years are as consistent as possible with the data provided by the Ministry, and on the regular meetings held with the Ministry to consider including the observations and requests of the inventory team in the possible improvements of the energy statistics for the future. The Party detailed its methodology for balancing the fuel consumption figures used for the inventory with energy statistics by activity and fuel type (NIR chap. A.2.1.2, p.772). It stated that a principle of coherence is assumed for the national GHG inventory, with official energy statistics prepared by the Ministry. Consequently, when the information on fuel consumption in the inventory differs from that in the official

ID#	Issue/problem classification ^{a, b}	Recommendation made in previous review report	ERT assessment and rationale
E.4	Feedstocks, reductants and other non-energy use of fuels – gaseous fuels – CO ₂ (E.14, 2019) Transparency	Include information on the disposition of non-energy uses of fuels in the energy balance discussion in annex 2 to the NIR to clarify that the non-energy use of fuels is accounted for and there is no underestimation of emissions from fuel combustion. Include the use of natural gas for hydrogen production in CRF table 1.A(d), as appropriate, and ensure consistency between the information in CRF tables 1.A(b) and 1.A(d) and the information in the NIR.	<p>energy statistics, in particular when the figures in the inventory are lower, the identified gaps are filled using existing surpluses from other activities, so that the adjusted total for each fuel is consistent with the energy statistics, although complete consistency is not maintained for every activity of the balance sheet. Therefore, the total national consumption from Spain's official energy statistics constitutes the upper limit for the corresponding data used in the inventory. Moreover, to ensure internal consistency and address the recommendation, the Party demonstrated in the NIR as an example (figure A.2.2, p.773) how time-series consistency was achieved for natural gas, reporting the energy statistics used and the adjustments made in order to obtain the consumption values for the fuel balance at the level of the entire energy sector.</p> <p>Addressing. The Party reported in annex 2 to its NIR (chap. A.2.1.2, p.776) information on non-energy uses of natural gas, indicating that part of the emission estimates was reported in CRF table 1.A(d) and part was reported as fugitive emissions under subcategory 1.B.2.a.4 refining/storage, and that there was no underestimation of emissions from fuel combustion. In addition, in NIR table A2.5 (p.776) Spain included examples of the allocation and amounts of natural gas for non-energy use for 2017–2019. In response to the recommendation on reporting the use of natural gas as feedstock for hydrogen production in CRF table 1.A(d), Spain explained that since the 2006 IPCC Guidelines (vol. 2, chap. 6, figure 6.1, p.6.12) indicate that fugitive emissions should not be included in the reference approach, the amount of natural gas used for hydrogen production should not be excluded from the reference approach (NIR, p.776). However, the ERT considers that in accordance with the 2006 IPCC Guidelines (vol. 2, chap. 6, section 6.6.1, p.6.8) the amount of natural gas used as feedstock for hydrogen production (total carbon content in the fuel) should be excluded from the CO₂ calculations under the reference approach in line with its principles of estimation, given that the reference approach is aimed at simplicity in calculations and that it should be ensured that all CO₂ emissions from the use of natural gas as feedstock are reported under the corresponding category in the IPPU sector. The NIR did not contain a satisfactory explanation of the Party's approach to estimating emissions while avoiding the underestimation or double counting of emissions between the energy and IPPU sectors. During the review, the Party clarified that hydrogen production was reported under two separate categories to differentiate between the hydrogen produced in refineries (under the energy sector) and that produced in hydrogen facilities (under the IPPU sector), considering that the former is a by-product of refineries, while the latter is the main product of stand-alone facilities. The Party stated that different data sources and methodologies were used for each sector; information about hydrogen production in refineries was collected through individual questionnaires completed by each facility, including on consumption of natural gas as feedstock and measured CO₂ emissions, while information from hydrogen production facilities was collected by the Business Federation of the</p>

<i>ID#</i>	<i>Issue/problem classification^{a, b}</i>	<i>Recommendation made in previous review report</i>	<i>ERT assessment and rationale</i>
			Spanish Chemical Industry, which provided detailed information on the consumption of natural gas as feedstock and its characteristics (carbon content) for each plant; therefore, for these facilities CO ₂ emissions were estimated using a mass balance. The ERT considers that the recommendation has not yet been fully addressed because the Party did not clarify in the NIR how the non-energy use of fuels in hydrogen production was accounted for while avoiding the underestimation or double counting of emissions, nor did it include the use of natural gas for hydrogen production in CRF table 1.A(d), as appropriate, or ensure consistency between CRF tables 1.A(b) and 1.A(d) and the NIR in terms of the information reported.
E.5	1.A.1.b Petroleum refining – all fuels – CO ₂ (E.15, 2019) Transparency	Revise the NIR to clarify that the EFs being used for subcategory 1.A.1.b reflect the latest information from planned updates and remove the reference to the planned publication of data in 2019.	Resolved. The Party clarified that the EFs used for subcategory 1.A.1.b petroleum refining reflect the latest information from planned updates and removed the reference to the planned publication of data in 2019 (NIR chap. 3.3.2.2, p.162).
E.6	1.A.2 Manufacturing industries and construction – all fuels – CH ₄ and N ₂ O (E.16, 2019) Transparency	Include in the NIR the information on the approaches used to calculate CH ₄ and N ₂ O emissions that the Party provided during the review.	Resolved. The Party reported in NIR table 3.6.4 (chap. 3.6.2.2, p.192) its approach to calculating CH ₄ and N ₂ O emission estimates (tiers 1, 2 and 3) for the subcategories under category 1.A.2 manufacturing industries and construction.
E.7	1.A.3.a Domestic aviation – liquid fuels – CO ₂ (E.17, 2019) Transparency	Report in section 3.7.2.1 of the NIR the information provided by the Party during the review on the similarity between data on kerosene consumption obtained from the European Organisation for the Safety of Air Navigation for 2005–2017 and those provided in the national statistics for the aviation sector for those years; and on the adjustment based on the average of the difference between those data that is established for each airport per year, zone and phase in IPCC accounting and applied to the national statistics data for 1990–2004 to develop estimates of kerosene fuel use for those years.	Resolved. The Party included in the NIR (chap. 3.7.2.1, p.201) the required information on the similarity between the kerosene consumption data from the European Organisation for the Safety of Air Navigation and the national statistics for 2005–2017, and explained the adjustment applied for estimates for 1990–2004.
E.8	1.A.3.b Road transportation – liquid fuels – N ₂ O (E.18, 2019) Transparency	Clarify the text in section 3.8.2.2.4 of the NIR to describe the impact of sulfur content on EFs for different vehicle control technologies.	Resolved. The Party clarified the information on the impact of sulfur content on EFs for different vehicle control technologies in the NIR (chap.3.8.2.2.4, p.223); in addition, it included the sulfur content of fuels (for gasoline, weighted by the amount of leaded and non-leaded fuel used) in NIR figure 3.8.12 (p.223), plotted on a second axis.

ID#	Issue/problem classification ^{a, b}	Recommendation made in previous review report	ERT assessment and rationale
E.9	1.A.3.b Road transportation – gaseous fuels – CO ₂ (E.19, 2019) Transparency	Clarify the description in the NIR as to how EFs for natural gas for category 1.A.3.b were determined, making it similar to that used to report the country-specific natural gas CO ₂ EF for other sectors (e.g. as described in section 3.11.2.2).	Resolved. The Party reported in its NIR (chap. 3.8.2.2.1, p.220) that it determined the CO ₂ EFs using annual data on the characteristics and composition of natural gas (carbon content, density and net calorific value) provided by Enagás. The ERT noted that information on specific CO ₂ EFs for natural gas was reported consistently throughout the NIR and that these CO ₂ EFs were applied for all subcategories under category 1.A fuel combustion.
E.10	1.A.3.b Road transportation – diesel oil – CO ₂ (E.20, 2019) Accuracy	Use the decision tree in the 2006 IPCC Guidelines (vol. 2, chap. 3, p.3.11) for determining EFs or either evaluate the applicability of the CO ₂ EF used for road transportation – diesel oil and update the EF based on the results of the evaluation, or provide a justification as to how the CO ₂ EF applied for diesel oil is appropriate to the national circumstances, including comparisons (e.g. with the COPERT model) to the values from the 2014 Joint Research Centre report and values used by other European countries.	Addressing. The Party included in its NIR (chap. 3.8.2.2, p.218) an evaluation of the diesel oil CO ₂ EF used and reported on the update made by using the CO ₂ EF value for diesel oil from appendix 1 to version 4a (2014) of the <i>Well-to-Tank Report</i> by the Joint Research Centre. Spain stated that it used the most representative value for its national circumstances. A comparison provided in NIR table 3.8.9 (p.220) indicates that the CO ₂ EF used (73.20 t CO ₂ /TJ) falls within the range of the CO ₂ EFs used by other European countries and the range provided in the 2006 IPCC Guidelines and is below the value (74.23 t CO ₂ /TJ) from the <i>EMEP/EEA air pollutant emission inventory guidebook 2019</i> . During the review, the Party clarified that, effectively, there is still no country-specific CO ₂ EF value available for diesel oil. However, new country-specific information about calorific values and the carbon content of diesel oil, representative at the country level, has been made available by Spain's main operator, Exolum. Therefore, for its next annual submission, Spain will use a country-specific CO ₂ EF for diesel oil to report CO ₂ emissions. The ERT considers that the recommendation has not yet been fully addressed because, although the Party re-evaluated and recalculated its CO ₂ emission estimates using a CO ₂ EF within the range of values provided by other information sources and used by other Parties, it did not follow the recommendation of the decision tree from the 2006 IPCC Guidelines (vol. 2, chap. 3, p.3.11) for this key category by using country-specific carbon contents to determine a country-specific CO ₂ EF for diesel oil to estimate CO ₂ emissions from road transportation. The ERT also considers that CO ₂ emissions were not underestimated since the CO ₂ EF used for diesel oil falls within the range of the default values from the 2006 IPCC Guidelines.
E.11	1.A.3.b.iv Motorcycles – gasoline – CO ₂ (E.7, 2019) (E.16, 2017) Transparency	Correct the lubricant/gasoline ratio in the calculation formula for lubricants in two-stroke engines and explain in the NIR the variations over the time series.	Resolved. The ERT noted that Spain already corrected the lubricant/gasoline ratio in the calculation formula in its 2019 annual submission. The Party explained in the NIR (chap. 3.8.2.2.2, p.222) the reasons for the variations in the lubricant/gasoline use ratio, in particular the decrease in lubricant use in recent years.
E.12	1.A.3.d Domestic navigation – liquid fuels – CO ₂ (E.21, 2019) Transparency	Explain the dramatic increase in residual fuel oil consumption in recent years by including in the next NIR the information the Party provided during the review on the combination of factors responsible.	Resolved. The Party included in the NIR (chap. 3.10.2.1, p.231) the required information explaining the dramatic increase in residual fuel consumption for domestic navigation.

<i>ID#</i>	<i>Issue/problem classification^{a, b}</i>	<i>Recommendation made in previous review report</i>	<i>ERT assessment and rationale</i>
IPPU			
I.1	2.A.2 Lime production – CO ₂ (I.16, 2019) Transparency	Include in the NIR an explanation of the estimation of emissions from the production of lime, including the years when the Spanish National Association of Lime and Lime Derivatives Manufacturers provided data or estimations and the years when data were gathered directly from installations.	Resolved. The Party reported in its NIR (p.285) information on how emissions from lime production were estimated, indicating the years when data were collected through the Spanish National Association of Lime and Lime Derivatives Manufacturers and the period when data were provided directly by plant operators.
I.2	2.C.2 Ferroalloys production – CO ₂ (I.9, 2019) (I.18, 2017) (I.19, 2016) (I.19, 2015) Transparency	Include in the NIR a detailed description of and justification for the emission trends.	Resolved. The Party reported in its NIR (p.321) a detailed description of the emission trends for ferroalloys production, including a justification explaining the emission trends.
I.3	2.C.3 Aluminium production – CF ₄ and C ₂ F ₆ (I.17, 2019) Transparency	Include in the NIR information on the reasons for the decreasing trends in CF ₄ and C ₂ F ₆ emissions despite the stable production of aluminium over the time series.	Resolved. The Party explained in its NIR (p.326) that improvements in abatement technology were the primary cause of the decreasing trends in CF ₄ and C ₂ F ₆ emissions despite production of aluminium remaining stable over time.
I.4	2.C.7 Other (metal industry) – CO ₂ (I.18, 2019) Transparency	Include in the NIR an explanation of the trend of the CO ₂ IEF of silicon production after 2010, such as the replacement of coal with wood and improvements in energy efficiency in the process.	Resolved. The Party reported in its NIR (pp.329–332) that the reasons for the trend in the CO ₂ IEF for silicon production after 2010 are related to the carbon content of the fossil and biogenic reducing agents used (where wood replaced coal), which varied over time (see NIR figure 4.20.3, p.330, for the carbon content of the fossil reducing agent). Spain explained that the fluctuating CO ₂ IEF trend is also linked to fluctuations in the rate of silicon production among other products resulting from the production process, such as silica fume, at the country's only plant.
I.5	2.F.1 Refrigeration and air conditioning – HFCs and PFCs (I.12, 2019) (I.28, 2017) Transparency	Use information provided under the framework of Law 16/2013 to calculate emissions from end-of-life equipment and small sealed units used for domestic air conditioning or report the emissions as “NE”, and clearly demonstrate in the NIR that emissions associated with this category can be considered insignificant in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.	Resolved. The Party reported in its NIR (pp.338–339) that end-of-life emissions were estimated for subcategories 2.F.1.a, 2.F.1.b, 2.F.1.c, 2.F.1.d and 2.F.1.f, including for small sealed units, and were no longer reported as “NE”. Recalculations were performed for subcategory 2.F.1.e mobile air conditioning (see ID# I.8 in table 5). Spain estimated emissions from the end of life of equipment and subsequently performed recalculations for 1995–2018, resulting in total HFC and PFC emissions expressed in CO ₂ eq increasing for all subcategories under category 2.F.1 refrigeration and air conditioning, except subcategory 2.F.1.e, by 2.75, 3.52 and 4.75 per cent for 2016, 2017 and 2018, respectively. Spain carried out the recalculations after improving its estimation of emissions from end-of-life equipment in the light of the recommendations from the previous ERT by applying the EF of 11 per cent to the total amount of F-gas aggregated at the end of life of equipment for all subcategories (NIR, p.339). Spain collected data on recovered gas from the European registry of F-gases and on residual gas exported and internally recycled gas for 2016–2019, as data were available for those years. As data were

ID#	Issue/problem classification ^{a, b}	Recommendation made in previous review report	ERT assessment and rationale
			not available for 1995–2015, the Party applied the ratio between emissions during the operation phase and those at the end-of-life phase for 2016 to the operation phase for each year. The aggregate annual end-of-life emissions were distributed across all subcategories according to the percentage of emissions in the operating phase for each subcategory per year.
I.6	2.G.3 N ₂ O from product uses – N ₂ O (I.19, 2019) Transparency	Clarify in the NIR that the AD used in the estimation of N ₂ O emissions from the food industry include national production and imports but exclude exports.	Resolved. The Party clarified in its NIR (p.346) that the AD used for estimating N ₂ O emissions from the food industry (reported under subcategory 2.G.3.b other) include national production and imports of N ₂ O used as propellant but exclude exports, in addition to specifying the data source. Spain indicated that recalculations were performed for this category but did not provide further information (see ID# I.10 in table 5).
Agriculture			
A.1	3. General (agriculture) – (A.1, 2019) (A.1, 2017) (A.1, 2016) (A.1, 2015) (51, 2014) (50, 2013) Transparency	Develop a summary table providing details of the references used in developing the country-specific methodologies and parameters used for the tier 2 approaches, and also provide a table detailing the main parameters used in the tier 2 methodologies.	Resolved. The Party reported in NIR tables 5.2.4, 5.3.3, 5.4.5, 5.5.3 and 5.6.5 (pp.362–363, p.371, p.381, p.394 and p.400, respectively) all the references used in developing the country-specific methodologies and parameters used for tier 2 approaches, either in the tables or as footnotes. Most of the references include links to external sources where the methods and parameters are described in detail. The ERT noted that two references for two recently developed methodologies on enteric fermentation are missing a link to an external source, since the sources in question are not yet publicly available (NIR table 5.2.4, p.363). During the review, Spain provided the ERT with the reference documents and indicated that it will include links to the documents in the NIR as soon as they are available.
A.2	3.A Enteric fermentation – CH ₄ (A.5, 2019) (A.3, 2017) (A.2, 2016) (A.2, 2015) (53, 2014) (53, 2013) Transparency	Incorporate in the NIR detailed explanations of the AD, assumptions, parameters and EFs used for the country-specific emission estimates in order to improve transparency.	Resolved. The Party reported in its NIR (table 5.2.4, pp.362–363), and in the information provided in multiple references to external sources included in the NIR, detailed descriptions for AD, assumptions, parameters and EFs. Most of the references in the NIR to external sources contain links. These external sources are comprehensive and transparent, enabling easy access to information. The ERT commends Spain for the high level of transparency in the NIR and for following a standard model for external references, making it easier for the reader to find information.
A.3	3.F Field burning of agricultural residues – CH ₄ and N ₂ O (A.13, 2019) Transparency	Specify in CRF table 3.F which crops the Party includes in the category other.	Resolved. The Party reported in its NIR (p.621) that CRF table 3.F was modified in the light of the recommendation. The ERT noted that in the documentation box of CRF table 3.F Spain indicated that the only crop that has residues burned is cotton and that the related emissions were reported under subcategory 3.F.5 other. The ERT considers that the recommendation was fully addressed.
LULUCF			
L.1	4. General (LULUCF) – (L.1, 2019) (L.1, 2017)	Explore the methods provided in chapter 5 of the IPCC <i>Good Practice Guidance for Land Use</i> ,	Resolved. The NIR (chap. 6.1.3, pp.430–434) contains detailed information on how this recommendation has been addressed by the Party. During the review, Spain

ID#	Issue/problem classification ^{a, b}	Recommendation made in previous review report	ERT assessment and rationale
	(L.1, 2016) (L.1, 2015) (67, 2014) (68, 2013) (102, 2012) Accuracy	<i>Land-Use Change and Forestry</i> in order to consider pre-1990 land uses and land-use changes in the reporting of GHG emissions/removals to improve the accuracy of the LULUCF sector inventory.	clarified that pre-1990 land use and land-use changes were estimated and considered in the current GHG emission or removal estimates in the LULUCF sector and will be included as part of the planned improvements for when the updated LULUCF cartography will be implemented (see ID# L.4 below). The ERT considers that the information provided in the NIR (chap. 6.1.3, pp.430–434), the information and data provided in NIR tables 6.2.2 (p.447), 6.3.2 (p.457), 6.4.2 (p.467), 6.5.2 (p.475) and 6.6.2 (p.481) and the results reported in CRF tables 4.A–4.F are sufficient to demonstrate the Party's efforts to address the recommendation, and that the improvements to both the NIR and CRF tables ensure that the recommendation to consider pre-1990 land uses and land-use changes in the reporting of GHG emissions/removals with a view to improving the accuracy of the LULUCF sector inventory has been fully addressed.
L.2	Land representation – (L.18, 2019) Transparency	Report in the NIR the additional information provided during the review (i.e. hierarchy among land-use categories, summary table with the result of the comparative analysis of cartography data sources) and a table listing the different map sources and their related spatial resolution, including minimum mapping units.	Resolved. The Party reported in NIR chapters 6.1.3 and 6.1.6 (pp.432 and 441–442, respectively) the additional information that was provided during the previous review. NIR table 6.1.5 (p.432) lists the different map sources and provides information on the maps' related spatial resolution, including minimum mapping units.
L.3	Land representation – (L.19, 2019) Transparency	Include the additional information regarding the sources for land classification and the justification for their use in the NIR.	Resolved. The Party provided the additional information requested in the recommendation and justified the use of the sources for land classification in the NIR (chap. 6.1.3, pp.430–431, and tables 6.1.4, p.431, and 6.1.5, p.432).
L.4	Land representation – (L.20, 2019) Transparency	Include in the NIR a detailed explanation of the project for the improvement of LULUCF cartography (i.e. the spatial data sources used, the procedure implemented for the remote sensing and cartographical data, elaboration of methods and the hierarchy established among land-use categories) and use its results. Provide information on how time-series consistency is ensured and harmonization of the various data sources is achieved.	Addressing. The ERT noted that Spain continued working on updating and improving the LULUCF cartography and provided information in the NIR (chap. 6.1.3, pp.431–432) on the project for improving cartographic data and the project's progress. During the review, the Party clarified that the project is comprehensive and requires significant time and effort. Spain is currently at a key stage of the project, working to ensure the consistency and quality of the data before the new LULUCF cartography results are included as a data source for the GHG estimates. As soon as the results of the project are implemented, a detailed description of the methodology and parameters used will be provided in the NIR, along with other relevant information (see ID# KL.2 below).
L.5	4.A.1 Forest land remaining forest land – CO ₂ (L.22, 2019) Transparency	Enhance the transparency of the description of the estimation method used for forest land remaining forest land by including in the next NIR a table reporting the annual area classified as forest land remaining forest land and the related biomass carbon stock per ha values used to estimate the annual CSC. Noting that the stock difference method needs to be applied to a constant area,	Resolved. NIR table A3.4 (p.818) provides a summary of the annual areas classified as forest land remaining forest land and includes the corresponding values of biomass carbon stock per ha used to estimate annual CSCs. The NIR (chap. 6.2.2.1.1, pp.449–450) also contains information on the procedure adopted for using data from the three complete NFIs in CSC estimates, taking into account the NFI periods and the need to consider a constant area when applying equation 2.8 from the 2006 IPCC Guidelines (vol. 4, chap. 2, p.2.12).

ID#	Issue/problem classification ^{a, b}	Recommendation made in previous review report	ERT assessment and rationale
		document the procedure adopted to implement data from the complete three NFIs in CSC estimates, taking into account the timespan of the NFIs and the need for considering a constant area in the application of equation 2.8 of the 2006 IPCC Guidelines (vol. 4, chap. 2).	
L.6	4.C.1 Grassland remaining grassland – CO ₂ (L.11, 2019) (L.11, 2017) Completeness	Implement and/or report on progress in the implementation of the reporting of CSC in the soil pool in grassland remaining grassland.	Addressing. The ERT noted that the Party reported the CSC in mineral soils in grassland remaining grassland as “NE”. The ERT also noted that the Party continued working to improve its estimation and reporting of CSC in the soil pool under category 4.C.1 grassland remaining grassland, documenting its progress in the NIR (chap. 6.4.5, p.473). During the review, the Party clarified that it will provide information on the implementation and/or its progress in reporting of CSCs in the soil pool under category 4.C.1 in the 2022 annual submission.
L.7	4.C.1 Grassland remaining grassland – CO ₂ (L.12, 2019) (L.3, 2017) (L.8, 2016) (L.8, 2015) Accuracy	Develop an approach to collect sufficient information on this category so as to be able to determine if it is a key category and therefore whether applying tier 1 methodologies to the dead organic matter and living biomass pools is appropriate.	Addressing. The ERT noted that the Party reported CSCs in living biomass and dead organic matter pools under grassland remaining grassland as “NE” and “NA”, respectively. The ERT also noted that the Party continued searching for sources of AD that would enable it to identify any CSC leading to emissions under category 4.C.1 grassland remaining grassland, reporting in the NIR (chap. 6.4.5, p.473) on its progress in relation to this improvement. During the review, however, the Party clarified that most grassland areas in the country are long-standing grasslands that have not been affected by changes in their management. Therefore, Spain expects that these grassland areas will continue to achieve the current (historical) equilibrium level, leading to a neutral balance in CSCs and justifying the application of tier 1 methodologies for the dead organic matter and living biomass pools.
L.8	4.D.1 Wetlands remaining wetlands – CO ₂ (L.24, 2019) Convention reporting adherence	Enhance QC checks and ensure consistency between the information reported in CRF table 4.D and that reported in the NIR.	Resolved. The Party corrected the identified inconsistency in the information on the allocation of emissions from wetlands remaining wetlands between CRF table 4.D and the NIR (chap. 6.5.1.2, p.475) in the 2021 annual submission, indicating that its QC checks have been enhanced.
L.9	4(V) Biomass burning – CO ₂ (L.14, 2019) (L.13, 2017) Completeness	Estimate and report the CO ₂ emissions from biomass burning on cropland remaining cropland and grassland remaining grassland if suitable data become available, or either use the notation key “NA” if the emissions released can be assumed to be absorbed in the next growing season in accordance with the 2006 IPCC Guidelines, or use the notation key “IE” to indicate that they are included elsewhere if Spain can demonstrate that	Addressing. The Party reported CO ₂ emissions from biomass burning on cropland remaining cropland and grassland remaining grassland as “NA” in CRF table 4(V) in accordance with the 2006 IPCC Guidelines (vol. 4, chap. 5.2.4, p.5.24, and chap. 6.2.4, p.6.22) and justified the assumptions made in the NIR (chap. 6.13.1, pp.499–500). During the review, the Party clarified that, in the light of the assessment in the previous annual review report for this recommendation (see document FCCC/ARR/2019/ESP, ID# L.14), it considers that it may be more appropriate to report CO ₂ emissions from biomass burning on woody crops as “IE”, since CO ₂ emissions associated with CSC in living biomass are estimated and reported in CRF

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		these emissions are already covered in CRF tables 4.B and 4.C.	table 4.B. The Party also clarified that the consequences of fires vary: if there is a land-use change following a fire, the CSCs (and the corresponding CO ₂ emissions/removals) are reported under the land-use change category (i.e. cropland converted to a new land-use category); if there is a change in the crop type (i.e. woody crop converted to herbaceous crop), the biomass carbon losses (and the corresponding CO ₂ emissions) are reported in cropland remaining cropland; if there is no change in crop type and the crop was only slightly affected by a fire, the CSCs in living biomass are also reported in cropland remaining cropland, as the estimation methodology considers the biomass increase in the ultimate crop type over its maturity period; and if the crop is severely affected by fire and must be replaced by a new crop (of the same type), the CO ₂ emissions from biomass burning are not reported, but nor are the CO ₂ removals resulting from the biomass carbon gains. Therefore, Spain considers that the reporting of “IE” for CO ₂ emissions from biomass burning on cropland remaining cropland may be justified as it avoids double counting. The ERT considers that the guidance provided in the 2006 IPCC Guidelines applies to the reporting of biomass burning in non-woody cropland remaining cropland and grassland remaining grassland and that the justification provided in the NIR (chap. 6.13.1, pp.499–500) is appropriate. The ERT considers that Spain could report CO ₂ emissions from biomass burning on woody crops as “IE” if this is considered more appropriate, providing the required explanation in CRF table 9 and a reference to the chapter of the NIR where the Party demonstrates that the corresponding emissions are reported in CRF table 4.B.

Waste

W.1	5.A Solid waste disposal – CH ₄ (W.1, 2019) (W.1, 2017) (W.1, 2016) (W.1, 2015) (84, 2014) (91, 2013) Accuracy	Improve the accuracy of the emission estimates by using more country-specific parameters for DOC, MCF and the methane generation rate constant.	Resolved. The decision tree from the 2006 IPCC Guidelines (vol. 5, chap. 3, figure 3.1, p.3.7) indicates that if solid waste disposal is a key category, in the absence of country-specific models or key parameters (i.e. degradable organic carbon/methane generation potential (known as DOC/L ₀), fraction of degradable organic carbon that decomposes (known as DOC _f), and half-life time), the tier 2 method should be applied, using the IPCC first-order decay method with default parameters and good-quality country-specific AD. The ERT noted that Spain used the tier 2 first-order decay method with good-quality country-specific AD (NIR, pp.516–523; methodological fact sheets on disposal of solid waste in managed disposal sites and disposal of solid waste in unmanaged disposal sites, referenced in the NIR and available in Spanish only at www.miteco.gob.es/es/calidad-y-evaluacion-ambiental/temas/sistema-espanol-de-inventario-sei-/090401_vertederos_gestionados_tcm30-446897.pdf and www.miteco.gob.es/es/calidad-y-evaluacion-ambiental/temas/sistema-espanol-de-inventario-sei-/090402_vertederosnogestionados_tcm30-456069.pdf , respectively). During the review, Spain confirmed that it applied the tier 2 method and used default parameters from the 2006 IPCC Guidelines. The ERT verified that the Party
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ID#	Issue/problem classification ^{a, b}	Recommendation made in previous review report	ERT assessment and rationale
W.2	5.A Solid waste disposal – CH ₄ (W.2, 2019) (W.2, 2017) (W.3, 2016) (W.3, 2015) (87, 2014) (96, 2013) Accuracy	Continue the efforts to reduce the uncertainties of the AD and EFs.	adequately applied default parameters and used good-quality country-specific AD for the estimates, and therefore considers this issue to be resolved. Not resolved. The ERT noted that the uncertainty of the AD used by Spain (NIR, p.523) in its uncertainty analysis for this category is 30 per cent in accordance with the default value in table 3.5 of the 2006 IPCC Guidelines (vol. 5, chap. 3, p.3.27). During the review, Spain provided additional information on the uncertainty values for parameters used in the CH ₄ emission estimates and indicated that the reference to the CH ₄ EF uncertainty value (36 per cent) in the NIR (table 7.2.8, chap. 7.2.3, p.523) is incorrect as it was calculated using equation 6.4 from the IPCC <i>Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories</i> (chap. 6, p.6.12). The Party also indicated that the CH ₄ EF uncertainty reported in table NIR 7.2.8 should be 37.7 rather than 36 per cent and informed the ERT that this will be corrected for the next annual submission. The ERT also noted that Parties shall estimate uncertainties of the data and parameters used for their emission estimates in accordance with the 2006 IPCC Guidelines (vol. 5, chap. 3.7.2, pp.3.25–3.27). Spain confirmed that the AD uncertainty of 30 per cent reported in NIR table 7.2.8 is “a typical value for countries that collect waste generation data on regular basis”. Although NIR table 7.2.4 (p.517) indicates improvements in the collection of information for this category, Spain did not explain in the NIR how these improvements were reflected in the uncertainty of AD and EFs. In addition, the Party did not explain in the NIR how improvement plans for the electronic processing of AD will reduce uncertainties associated with the AD. The ERT considers that the recommendation has not yet been addressed.
W.3	5.A Solid waste disposal – CH ₄ (W.4, 2019) (W.6, 2017) (W.8, 2016) (W.8, 2015) Accuracy	Continue efforts to develop country-specific parameters.	Resolved. The ERT noted that Spain applied a tier 2 method to estimate CH ₄ emissions for this category and used default parameters in accordance with the methodological guidance provided in the decision tree from the 2006 IPCC Guidelines (vol. 5, chap. 3, figure 3.1, p.3.7). Acknowledging that a continued effort to develop country-specific parameters is a general recommendation for key categories, the ERT also noted that CH ₄ emissions from solid waste disposal are a key category in terms of both level and trend for Spain. The ERT further noted that Spain did not provide information in the NIR on how it plans to continue efforts to develop country-specific parameters for DOC, even though the information reported on elements of the solid waste disposal process (NIR table 7.2.4, p.517) and changes in regional legislation suggests that the DOC of specific components of domestic waste may have changed over time. During the review, the Party clarified that the 2020 review of its inventory under the European Union effort-sharing decision recommended that Spain not make efforts to develop country-specific values for DOC in organics, paper and waste and for other model parameters. However, in its comments on the draft annual review report, Spain confirmed that national data provided by the Sub-Directorate General for Waste of the Ministry for the Ecological Transition and the Demographic Challenge categorizing quantity and

<i>ID#</i>	<i>Issue/problem classification^{a, b}</i>	<i>Recommendation made in previous review report</i>	<i>ERT assessment and rationale</i>
			percentage of waste by type are used in estimating CH ₄ emissions from solid waste disposal. Spain also confirmed that it will continue its efforts to improve national information on deposited waste, according to methodology and type of waste, and to develop an improvement plan for updating and improving the collection of information on the waste mix, which might eventually enable the development of country-specific parameters for DOC. Taking into account the information provided by the Party and the use of a tier 2 method to estimate CH ₄ emissions for this category in accordance with the 2006 IPCC Guidelines, the ERT considers that the recommendation has been addressed.
W.4	5.A.1 Managed waste disposal sites – CH ₄ (W.7, 2019) Transparency	Provide more detailed information in the NIR regarding the data sources of CH ₄ recovered and flared for the entire time series, as well as data and explanatory information on the amount of recovered CH ₄ that is estimated, calculated or measured.	Resolved. Spain provided in the NIR (chap. 7.2.2.2, p.521) detailed information on its national strategy for assessing emissions from controlled landfills with biogas capture. For landfills that have a biogas capture process but no system for registering the amount of CH ₄ captured, the Party applied a default estimate of recovery efficiency of 20 per cent in accordance with the 2006 IPCC Guidelines (vol. 5, chap. 3, p.3.19). For other solid waste disposal sites with landfill gas recovery that have adequate registry systems for CH ₄ capture, it applied a 70 per cent cap for recovery process efficiency in cases where the level of efficiency exceeded that value, which is in line with the recovered amount of CH ₄ in terms of the percentage of capacity rate indicated in the 2006 IPCC Guidelines (vol. 5, chap. 3, p.3.19). The Party detailed in the NIR (chap. 7.1, p.512) its efforts to improve the process of obtaining digital information through annual surveys completed by the autonomous administrations of Spain, and indicated that this information is used to verify CH ₄ generation data obtained from landfills (NIR chap. 7.2.2.2, p.521). The NIR contains detailed information on the amount of recovered CH ₄ (table 7.2.6, chap. 7.2.2.2, p.522). The ERT confirmed that Spain provided adequate information in the NIR in line with the recommendation and considers this issue resolved.
W.5	5.B.1 Composting – CH ₄ and N ₂ O (W.5, 2019) (W.8, 2017) (W.11, 2016) (W.11, 2015) Consistency	Investigate options to establish time-series consistency and recalculate historical emissions from composting accordingly, and check the values of the AD in 2013 and 2014.	Resolved. Spain provided in the 2020 NIR (chap. 7.3.2.1, p.522) information on measures for improving the time-series consistency of its CH ₄ and N ₂ O emission estimates. During the review, the Party indicated that it performed recalculations for the entire time series in the 2020 annual submission. The ERT noted that according to the NIR (chap. 7.3.5, p.524), changes in the methods for estimating CH ₄ and N ₂ O emissions since the previous submission were due to adjustments to national methods for disaggregating AD in relation to the percentage of waste that is composted compared with the fraction that undergoes triage for 2009–2013. The calculations for 1990–2008 were based on average figures for 2009–2013. The ERT confirmed that Spain has checked the values for AD related to biological treatment of solid waste and considers this issue resolved.
W.6	5.D.1 Domestic wastewater – N ₂ O (W.8, 2019)	Ensure consistency between the value for F _{IND-COM} provided in CRF table 5.D and in the NIR, and correct errors where necessary.	Resolved. The ERT noted that Spain corrected the value for F _{IND-COM} (1.25) reported in CRF table 5.D, ensuring consistency with the information provided in the NIR (p.535).

ID#	Issue/problem classification ^{a, b}	Recommendation made in previous review report	ERT assessment and rationale
	Convention reporting adherence		
KP-LULUCF			
KL.1	General (KP-LULUCF) – (KL.8, 2019) Transparency	Include a technical annex to or reference in the NIR where the full documentation on land classification assessment and the identification of areas subject to KP-LULUCF are clearly reported. Include in the technical annex the correspondence matrices between CORINE land cover, the national forestry map of Spain at 1:50,000 and the map of crops and land-use categories and UNFCCC land-use categories.	Addressing. The Party stated in the NIR (chap. 6.1.3, p.431) that all information regarding its most recent land-use surface area estimation can be found in the 2018 NIR (chap. 6.1.2, pp.6.4–6.12), and the supplementary information required under the Kyoto Protocol can be found in chapter 11 of the 2021 NIR. During the review, Spain clarified that, therefore, it considers that it is not necessary to provide more information. The ERT considers that the above-mentioned information reported in the 2018 NIR and referenced in the 2021 NIR (chap. 6.1.3, p.431) is sufficient. However, although the correspondence matrices between CORINE land cover, the national forestry map of Spain at 1:50,000 and the map of crops and land-use categories and UNFCCC land-use categories were provided in appendix 6.1 to the 2018 NIR (pp.6.117–6.118), the Party did not include a full reference to this appendix in its most recent NIR.
KL.2	General (KP-LULUCF) – (KL.8, 2019) Accuracy	Update and improve cartographic data to implement IPCC approach 3 on the basis of the ongoing project.	Addressing. The ERT noted that Spain continued working on updating and improving the LULUCF cartography and provided information in the NIR (chap. 6.1.3, pp.431–432) on the progress of the project aimed at improving cartographic data. Spain plans to implement the results of the project for the next annual submission. During the review, the Party clarified that this is a comprehensive project which requires significant time and effort. Spain is currently at a key stage of the project, working to ensure the consistency and quality of the data before the new cartographic data are included as a data source for the GHG estimates. The Party noted that as soon as the results of the project are implemented, a detailed description of the methodology and parameters used will be provided in the NIR, along with other relevant information (see ID# L.4 above).
KL.3	CM – CO ₂ (KL.4, 2019) (KL.8, 2017) (KL.10, 2016) (KL.10, 2015) Transparency	Include in the NIR information on the trends of CSCs in mineral soils in CM.	Resolved. The Party reported in its NIR (chap. 11.3.1.1, p.652) information explaining the trends of CSCs in mineral soils in CM. The ERT considers that the information provided on trends is adequate; therefore it considers the issue of transparency resolved.
KL.4	CM – CO ₂ (KL.12, 2019) Transparency	In order to support the use of “NO” in CRF table 4(KP-I)B.2, explain in the NIR that, according to National Geographic Institute data, total organic soils in Spain amount to 6,247 ha, representing 0.01 per cent of the national land surface, that the natural vegetation of these histosols is heathland and that they are not cultivated in Spain.	Resolved. The Party reported in its NIR (chap. 11.3, pp.649–650) the required information in order to support the use of “NO” in CRF table 4(KP-I)B.2.

^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 Spain 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 and 2018 are excluded from the list of review years in which issues could have been identified.

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

9. In accordance with paragraph 83 of the UNFCCC review guidelines, the ERT noted that the issues and/or problems included in table 4 have been identified in three or more successive reviews, including the review of the 2021 annual submission of Spain, 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 Spain

<i>ID#</i>	<i>Previous recommendation for issue</i>	<i>Number of successive reviews issue not addressed^a</i>
General	No issues identified.	
Energy	No issues identified.	
IPPU	No issues identified.	
Agriculture	No issues identified.	
LULUCF		
L.6	Implement and/or report on progress in the implementation of the reporting of CSC in the soil pool in grassland remaining grassland.	3 (2017–2021)
L.7	Develop an approach to collect sufficient information on this category so as to be able to determine if it is a key category and therefore whether applying tier 1 methodologies to the dead organic matter and living biomass pools is appropriate.	4 (2015/2016–2021)
L.9	Estimate and report the CO ₂ emissions from biomass burning on cropland remaining cropland and grassland remaining grassland if suitable data become available, or either use the notation key “NA” if the emissions released can be assumed to be absorbed in the next growing season in accordance with the 2006 IPCC Guidelines, or use the notation key “IE” to indicate that they are included elsewhere if Spain can demonstrate that these emissions are already covered in CRF tables 4.B and 4.C.	3 (2017–2021)
Waste		
W.2	Continue the efforts to reduce the uncertainties of the AD and EFs.	6 (2013–2021)
KP-LULUCF	No issues identified.	

^a Reports on the reviews of the 2018 and 2020 annual submissions of Spain have not yet been published. Therefore, 2018 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. Tables 5–6 present findings made by the ERT during the individual review of the 2021 annual submission of Spain that are additional to those identified in table 3. In accordance with paragraph 76(b) of the UNFCCC review guidelines, the ERT has prioritized in table 5 recalculations that changed the estimated total emissions or removals for a category by more than 2 per cent and/or national total emissions by more than 0.5 per cent for any of the recalculated years.

Table 5

Additional findings made during the individual review of the 2021 annual submission of Spain related to recalculations

<i>ID#</i>	<i>Finding classification</i>	<i>Description of finding with recommendation or encouragement</i>	<i>Is finding an issue/problem?^a</i>
Energy			
		Recalculations made for the energy sector changed the estimated emissions for a category by more than 2 per cent and/or national total emissions by more than 0.5 per cent; however, the ERT did not identify any issues or problems with these recalculations.	
IPPU			
I.7	2.B.7 Soda ash production – CO ₂	<p>The ERT noted that recalculations for this category decreased the Party's CO₂ emission estimates for 2018 by 12.18 per cent compared with the value reported in the previous annual submission. The Party reported in its NIR (p.301) the reason for carrying out a recalculation for 2018, but the explanation referred only to the correction of the CO₂ IEF. Spain reported AD for this category as confidential and stated in its NIR (p.301) that it applied the tier 3 methodology from the 2006 IPCC Guidelines to estimate CO₂ emissions. However, the ERT noted that the tier 3 method from the 2006 IPCC Guidelines (vol. 3, chap. 3, figure 3.7, p.3.53) is based on plant-level CO₂ emission data obtained from direct measurements and that the use of a CO₂ EF is in line with a tier 2 method rather than a tier 3 method. The ERT also noted that Spain's explanation related to the correction of the CO₂ IEF is unclear and may not justify the recalculation of the CO₂ estimates for 2018, which should have been obtained through plant-specific measurements. As the AD for this category are confidential, the ERT was unable to check the CO₂ IEF or the production AD. During the review, Spain clarified that the sentence in the NIR related to the CO₂ IEF under the rationale for the recalculations contained an error. Spain stated that it calculated the EF using information on both production and emissions provided directly by the relevant plant through an individual questionnaire. The recalculation for 2018 was based on the AD provided directly by the plant and, as part of the QA/QC system, the values were checked against data from the European Union Emissions Trading System.</p> <p>The ERT recommends that Spain provide accurate explanations on the rationale for any recalculations for category 2.B.7 soda ash production, where they occur, and correct the information reported on the use of a CO₂ EF as part of the tier 3 methodology for its next annual submission.</p>	Yes. Transparency

<i>ID#</i>	<i>Finding classification</i>	<i>Description of finding with recommendation or encouragement</i>	<i>Is finding an issue/problem?^a</i>
I.8	2.F.1 Refrigeration and air conditioning – HFC-134a	<p>The ERT noted that Spain made recalculations for the whole time series for category 2.F.1 refrigeration and air conditioning, which is a key category, following the recommendation in the 2019 annual review report to estimate emissions from end-of-life equipment for subcategories 2.F.1.a, 2.F.1.b, 2.F.1.c, 2.F.1.d and 2.F.1.f by applying an EF of 11 per cent to the total amount of F-gas aggregated at the end-of-life phase for all subcategories (NIR, p.339), rather than reporting them as “NE” as in the previous annual submission (see ID# I.5 in table 3). The recalculations for category 2.F.1 resulted in an increase of HFC-134a emission estimates by 4.75 per cent for 2018 compared with the previous submission. Spain provided in its NIR (pp.337–339) detailed information on the rationale, the methodology used, the results obtained and the impacts of the recalculations on the estimated emissions for this category. The ERT also noted that Spain for the first time reported estimates of HFC-134a recovery for subcategory 2.F.1.e mobile air conditioning in its 2020 annual submission, having reported “NA” in all previous annual submissions. For its 2021 annual submission, Spain carried out recalculations to estimate emissions from recovery of HFC-134a for subcategory 2.F.1.e mobile air conditioning (the only subcategory under 2.F.1 for which recovery emissions were estimated), which resulted in a decrease in the estimated emission from recovery for the subcategory by 85 per cent on average for all reported years in the time series (1996–2018) compared with the corresponding values in the previous annual submission. The NIR does not contain any information on the rationale or an explanation for the recalculation for subcategory 2.F.1.e mobile air conditioning. During the review, Spain stated that it changed its reporting on the recovery of HFC-134a emissions under this subcategory but did not consider this to be a recalculation since the level of emissions was not affected. When reporting on recovery for the first time in its 2020 annual submission, Spain used the total amount of HFC-134a contained in decommissioned vehicles (considering the amount at the time that they entered the market) as the amount of HFC-134a remaining in products at decommissioning. In the 2021 annual submission, Spain first reported the actual amount of HFC-134a remaining in vehicles at the end of life and calculated recovery as the difference between the amount of HFC-134a remaining at the end of life and the reported emissions in operating systems, which led to the above-mentioned 85 per cent decrease in recovery emissions for all reported years in the time series. However, Spain did not report on the changes in the methodology for estimating recovery amounts or on the resulting recalculations, considering that recovery amounts were not emissions. The ERT further noted that Spain reported in its NIR (p.338) that the amount of HFC-134a in vehicles at the end of life was obtained from the percentage of vehicles decommissioned, which was applied to the stock of HFC-134a in the Spanish vehicle fleet. The ERT considers the methodology used by Spain to estimate HFC-134a emissions from recovery at the end of life of the vehicles to be unclear. It also considers the change made to the approach for estimating recovery to fall under the methodology for estimating HFC-134a emissions from mobile air conditioning and therefore any related revision of estimates constitutes a recalculation and should be reported as such in future annual submissions.</p> <p>The ERT recommends that the Party provide detailed and clear information in the NIR on the methodology used to estimate recovery of HFC-134a and related emissions for subcategory 2.F.1.e mobile air conditioning and information on the existing regulations on recovery of refrigerants from mobile air conditioning implemented in Spain, in addition to explaining the reasons for any recalculations for category 2.F.1 refrigeration and air conditioning or its subcategories, where they occur.</p>	Yes. Transparency
I.9	2.F.4 Aerosols – HFC-134a and HFC-152a	The ERT noted that recalculations made to subcategory 2.F.4.b aerosols – domestic and industrial applications for 2018 decreased the Party’s HFC-152a estimated emissions by 28.66 per cent compared with the values in the previous annual submission. Spain stated in its NIR (p.341) that data on propellant in pharmaceutical aerosols	Yes. Transparency

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem? ^a
I.10	2.G.3 N ₂ O from product uses – N ₂ O	<p>(metered dose inhalers) were provided directly by pharmaceutical manufacturing and distribution companies for 1997–2019, including information on the manufacturing phase and sales on the Spanish market. Spain explained in the NIR (p.342) that it made recalculations owing to updated AD for 2018 but did not provide any further information on the subcategory affected or the nature of the AD update or the source of the updated data, such as professional associations or the European registry of F-gases. In addition, the NIR body text and figures 4.22.7–4.22.8 (p.344), which compare the emission estimates of the 2020 and 2021 annual submissions for category 2.F.4, do not provide any further information on the reasons for the recalculations or the subcategories under 2.F.4 affected by the recalculations. During the review, Spain clarified that the recalculation for 2018 was made for only subcategory 2.F.4.b aerosols – domestic and industrial applications owing to a correction of HFC-152a data by the European registry of F-gases (reported by Spanish companies under the European Union regulation on fluorinated greenhouse gases (regulation 517/2014)). In addition, it clarified that for subcategory 2.F.4.a aerosols – metered dose inhalers, data are collected from two pharmaceutical companies through questionnaires; both provide sales data, and one provides information on losses in the manufacturing phase, and the other on the amounts of propellant incorporated into products during the manufacturing process.</p> <p>The ERT commends Spain for the clarifications provided and recommends that the Party explain in the NIR that for subcategory 2.F.4.a aerosols – metered dose inhalers, data are collected from two pharmaceutical companies through questionnaires, where one provides information on losses in the manufacturing phase, the other provides information on amounts of propellant incorporated into products during the manufacturing process, and both provide sales data, and explain the reasons for any recalculations for category 2.F.4 aerosols and its subcategories, in particular subcategory 2.F.4.b aerosols – domestic and industrial applications, where they occur.</p> <p>Recalculations made to subcategory 2.G.3.b other – propellant for pressure and aerosol products for 2018 caused the estimated N₂O emissions for this subcategory to increase by 96.65 per cent compared with the previous annual submission. The Party did not report the rationale for the recalculation in the NIR. During the review, the Party clarified that the recalculation was made following a correction to the AD for N₂O used as a propellant for 2018 provided by the Business Federation of the Spanish Chemical Industry.</p> <p>The ERT recommends that the Party explain in the NIR the reasons for any recalculations for category 2.G.3.b other – propellant for pressure and aerosol products, where they occur, such as a correction to the AD for N₂O used as a propellant.</p>	Yes. Transparency
Agriculture		Recalculations made for the agriculture sector changed the estimated emissions for a category by more than 2 per cent and/or national total emissions by more than 0.5 per cent; however, the ERT did not identify any issues or problems with these recalculations. The NIR contains information on all recalculations, including transparent explanations and figures illustrating the variations and their significance.	
LULUCF		Recalculations made for the LULUCF sector changed the estimated emissions or removals for a category by more than 2 per cent and/or national total emissions by more than 0.5 per cent; however, the ERT did not identify any	

<i>ID#</i>	<i>Finding classification</i>	<i>Description of finding with recommendation or encouragement</i>	<i>Is finding an issue/problem?^a</i>
		issues or problems with these recalculations. All recalculations applied are clearly explained in chapters 6.2.4 (pp.453–454), 6.3.4 (pp.464–465), 6.4.4 (p.472), 6.5.4 (p.479) and 6.8.4 (p.493) of the NIR.	
Waste			
W.7	5.E Other (waste) – CH ₄	<p>The ERT identified that Spain did not provide in its NIR (chap. 7.6.2.4, p.558) an analysis of the impact of recalculations of CH₄ emissions from sludge spreading under category 5.E other. The ERT noted that recalculations for 2013–2018 resulted in a decrease in estimated CH₄ emissions for this category; for example, estimated CH₄ emissions for 2018 in the 2021 annual submission were 41.7 per cent lower than those in the 2020 annual submission. During the review, Spain acknowledged this issue and indicated that an impact analysis will be included in the NIR of its next annual submission.</p> <p>The ERT recommends that Spain provide in the NIR of its next annual submission an analysis of the impact of recalculations of CH₄ emissions from sludge spreading and explain the reasons for any recalculations, where they occur.</p>	Yes. Transparency
KP-LULUCF			
		Recalculations made for KP-LULUCF changed the estimated emissions or removals for a category by more than 2 per cent and/or national total emissions by more than 0.5 per cent; however, the ERT did not identify any issues or problems with these recalculations. All recalculations applied are clearly explained in NIR chapter 11.3.1.4 (pp.657–658).	

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

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

Table 6

Additional findings made during the individual review of the 2021 annual submission of Spain

<i>ID#</i>	<i>Finding classification</i>	<i>Description of finding with recommendation or encouragement</i>	<i>Is finding an issue/problem?^a</i>
General			
G.3	Key category analysis	The ERT noted that in the key category analysis, carried out using approach 2, level assessment, from the 2006 IPCC Guidelines, the uncertainty value used by the Party for the N ₂ O EF (1,400 per cent) for the aggregated category 5.D wastewater treatment and discharge (NIR, annex 6, tables A6.1–A6.3, pp.915–917) changed compared with the value used in the previous annual submission, owing to the fact that Spain applied the information available in the 2019 Refinement to the 2006 IPCC Guidelines in its 2021 submission. During the review, Spain stated that it followed the encouragement included in the previous review report, referring to the use of the uncertainty value proposed in the 2019 Refinement to the 2006 IPCC Guidelines. Although this change improves the key category analysis, the high uncertainty value attributed to this category will continue to affect the analysis,	Not an issue/problem

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem? ^a
		<p>excluding other potential key categories and resulting in a selected uncertainty value that is seven times greater than the next highest one.</p> <p>The ERT reiterates the encouragement to the Party to consider revising the uncertainty for the N₂O emissions for the aggregated category 5.D wastewater treatment and discharge, for example, by selecting a more appropriate value from the range of uncertainty values for the EF from the 2006 IPCC Guidelines, in line with Spain's national circumstances.</p>	
Energy			
E.13	Fuel combustion – reference approach – other non-fossil fuels – CO ₂	<p>The Party reported in CRF table 1.A(b) CO₂ emissions and relevant parameters for other non-fossil fuels (biogenic waste) as “NO” and “NA”. According to the NIR (p.153), for the sectoral approach the Party obtained the estimate of biogenic CO₂ emissions from municipal waste incineration using data provided by facilities and reported these emissions under subcategory 1.A.1.a public electricity and heat production. The ERT noted that Spain's biogenic waste production and use for energy recovery is reported by IEA. During the review, the Party clarified that data on production of biogenic waste (other non-fossil fuels) from IEA that would correspond to “municipal waste (renewable)” were not reported in CRF table 1.A(b) because their reliability is highly uncertain. The Party also explained that data entry referring to production of “municipal waste (non-renewable)” in IEA questionnaires, which would correspond to data for waste (non-biomass fraction) in CRF table 1.A.(b), contains the same values as “municipal waste (renewable)”, which suggests that one or both data entries may be incorrect. The Party explained that it is seeking to clarify this and other discrepancies with the Ministry for the Ecological Transition and the Demographic Challenge, which prepares the questionnaires for submission to IEA.</p> <p>The ERT recommends that the Party analyse the discrepancies related to values for biogenic and non-biogenic fractions of waste available from different sources in the country, report on the results in the NIR and report data for other non-fossil fuels (biogenic waste) in CRF table 1.A(b), ensuring consistency with the data reported under the sectoral approach.</p>	Yes. Transparency
E.14	1.A Fuel combustion – sectoral approach – other fossil fuels – CO ₂ , CH ₄ and N ₂ O	<p>The Party reported in CRF table 1.A(a) (sheet 4) under “information item” AD for and CO₂ emissions from waste incineration with energy recovery (biomass and fossil fuels); however, it reported CH₄ and N₂O emissions and the amount of CO₂ captured for 1990–2019 as “NE”. The ERT noted that for 2019 the AD value reported for biomass (24,947.89 TJ) is the same as the AD value reported for fossil fuels. According to the NIR (chap. 3.2.2.2, p.141), CH₄ and N₂O emissions from waste combustion with energy recovery were estimated and included in the sectoral approach. During the review, the Party clarified that CO₂ capture from waste incineration does not occur in Spain and confirmed that CH₄ and N₂O emissions were accounted for, regardless of their origin (biogenic or fossil), so the biogenic component is not separated from the fossil component for the Spanish GHG inventory.</p> <p>The ERT recommends that the Party revise the use of the notation key “NE” in CRF table 1.A(a) (sheet 4) under the information item “waste incineration with energy recovery” and report “NO” for CO₂ captured from waste incineration, ensuring that AD for biomass and fossil fuels are accurately reported. In addition, the ERT recommends that the Party report the total estimated values of CH₄ and N₂O emissions under fossil fuels and report “IE” under biomass, providing information in CRF table 9 and the documentation box of CRF table 1.A(a) to clarify that such emissions were estimated and reported as aggregated under fossil fuels under the information item “waste incineration with energy recovery”.</p>	Yes. Comparability

<i>ID#</i>	<i>Finding classification</i>	<i>Description of finding with recommendation or encouragement</i>	<i>Is finding an issue/problem?^a</i>
E.15	1.A.1.a Public electricity and heat production – other fossil fuels – CO ₂	<p>The Party reported in its NIR (chap. 3.2.2.2, p.151) information on the approach used to calculate CO₂ emissions from municipal waste incineration. In the calculations, the Party used available data on carbon content for facilities with information on waste characteristics; for facilities that did not have such data, the Party assessed available information and estimated values of 344 kg CO₂ fossil/t waste for 1990–1999 and 481 kg CO₂ fossil/t waste for 2006 onward. However, in the NIR (table 7.6.12, p.550) Spain reported a CO₂ EF of 297 kg CO₂/t waste. Annex 2 (p.9) to the fact sheet referenced in the NIR (chap. 3.2.2.2, p.151; available in Spanish only at www.miteco.gob.es/es/calidad-y-evaluacion-ambiental/temas/sistema-espanol-de-inventario-sei-/090201-incinerarsuvaloriz_tcm30-456067.pdf) indicates that a CO₂ EF of 297 kg/Mg incinerated waste was used for 1990–2005, while the EFs for 2006–2017 were calculated annually by facilities. During the review, the Party clarified that it applied EFs of 344 kg CO₂/t waste for 1990–1999 and 481 CO₂/t waste for 2006 onward, and a linear interpolation of these values for 2000–2005, resulting in EFs of 364 kg CO₂/t waste (2000), 383 kg CO₂/t waste (2001), 403 kg CO₂/t waste (2002), 422 kg CO₂/t waste (2003), 442 kg CO₂/t waste (2004) and 461 kg CO₂/t waste (2005). The Party indicated that the referenced fact sheet has yet to be updated and, although most of the methodological considerations are still applicable, the default EF for fossil CO₂ needs to be updated.</p> <p>The ERT recommends that the Party correct the CO₂ EF values for municipal waste incineration provided in the NIR and the fact sheet referenced therein, report explicitly the CO₂ EF values for 2000–2005 calculated using linear interpolation, and ensure full consistency and transparency of the information provided in the NIR, the referenced fact sheet and annex 2 thereto.</p>	Yes. Transparency
IPPU			
I.11	2.F.1 Refrigeration and air conditioning – HFC-134a	<p>The ERT noted that emissions from the recovery of HFC-134a reported under subcategory 2.F.1.e mobile air conditioning fluctuate between 2016 and 2018 (decreasing from 31.43 t for 2016 to 30.94 t for 2017, and increasing to 34.49 t for 2018), and that this is not explained in the NIR. During the review, the Party clarified that these fluctuations are linked to fluctuations in the number of vehicles removed from the vehicle fleet each year, which is reported by the Directorate General for Traffic. The percentage of vehicles removed increased between 2016 and 2018 owing to an increase in the renewal rate of vehicles as a consequence of the economic growth experienced in Spain in those years.</p> <p>The ERT recommends that the Party explain in the NIR that the fluctuations of emissions from the recovery of HFC-134a observed between 2016 and 2018 are linked to annual fluctuations in the percentage of vehicles removed from the vehicle fleet.</p>	Yes. Transparency
I.12	2.D.3 Other (non-energy products from fuels and solvent use) – CO ₂	<p>The ERT noted that Spain reported indirect CO₂ emissions in the IPPU sector as “IE” in CRF table 6, noting in a comment note that these indirect CO₂ emissions are included in CRF table 2(I).A-H (sheet 2) under category 2.D.3 other. The ERT considers that this reporting affects the required reporting of total national emissions including indirect CO₂ emissions with and without LULUCF in the CRF tables (e.g. CRF table summary 2 or CRF table 10 on emission trends), where “NA” was reported for those emissions instead of numerical values. During the review, Spain indicated that it reported CO₂ emissions from the atmospheric oxidation of non-methane volatile organic compounds under non-energy products from fuels and solvent use in line with previous reporting and that this issue was not raised in previous reviews. The ERT considers that indirect CO₂ emissions were reported in CRF table 2(I).A-H (sheet 2) under category 2.D.3 other – solvent use as direct CO₂ emissions and were therefore included as such in the national emissions total, which is not in accordance with paragraph 29 of the UNFCCC Annex I</p>	Yes. Comparability

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem? ^a
<p>inventory reporting guidelines. For 2019, indirect CO₂ emissions for category 2.D.3 other – solvent use amounted to 445.91 kt CO₂, or 0.14 per cent of the national total without LULUCF. In its comments on the provisional main findings, Spain stated that it was following the recommendation of a European Union working group to report these emissions under category 2.D.3 other – solvent use, as this is considered more transparent. The ERT considers that reporting under the Convention should follow the UNFCCC Annex I inventory reporting guidelines.</p> <p>The ERT recommends that the Party report the national totals in the relevant CRF tables including and excluding indirect CO₂, as required by paragraph 29 of the UNFCCC Annex I inventory reporting guidelines, ensuring that indirect CO₂ emissions for category 2.D.3 other – solvent use are not included in national totals of direct emissions.</p>			
Agriculture			
A.4	3. General (agriculture) – CH ₄ and N ₂ O	<p>The Party reported in its NIR (chaps. 5.2.3–5.4.3, pp.364–386) that it calculated EFs for enteric fermentation and manure management on the basis of national data (except for the Y_m in enteric fermentation for one specific subcategory in the 2021 annual submission (see ID# A.5 below)). However, Spain used the default value of 20 per cent for the uncertainties of EFs taken from the 2006 IPCC Guidelines (vol. 4, chap. 10.3.4, p.10.33). During the review, the Party clarified that it is considering the possibility of using national data to perform the uncertainty estimation for future annual submissions after the implementation in the country of the ECOGAN tool (a digital tool for environmental data storage and management being developed by the Ministry of Agriculture, Fisheries and Food).</p> <p>The ERT recommends that the Party calculate the uncertainties of the EFs for enteric fermentation and manure management on the basis of existing local data, given that the uncertainty values provided in the 2006 IPCC Guidelines are extremely conservative and are not aligned with Spain's efforts to gather local information on EFs, and report the results of the uncertainty analysis using such values in its next annual submission. If Spain intends to continue using default uncertainty values from the 2006 IPCC Guidelines, while using country-specific EFs, the ERT recommends that it provide arguments in the NIR demonstrating that the default uncertainty values from the 2006 IPCC Guidelines used by Spain in its uncertainty analysis are valid for those country-specific EFs used in its emission estimates for the relevant categories.</p>	Yes. Convention reporting adherence
A.5	3.A Enteric fermentation – CH ₄	<p>The Party reported in its NIR (pp.361–362) that for the 2021 annual submission, as a result of a technical correction made as a consequence of the 2020 review under the European Union effort-sharing decision, it adopted the default Y_m value of 6.5 per cent from the 2006 IPCC Guidelines (vol. 4, chap. 10, table 10.12, p.10.30) for dairy and non-dairy cattle to replace its previously used country-specific values (7.3–7.7 per cent) based on a national study (Jaurena et al., 2015). The ERT noted that the previous country-specific Y_m values led to higher emission estimates than those calculated using the default value from the 2006 IPCC Guidelines. During the review, the Party clarified that the 2020 review of its inventory under the European Union effort-sharing decision found that, with regard to CH₄ emissions for category 3.A enteric fermentation for 2005 and 2016–2018, there was a significant decrease in the Y_m for dairy cattle, from 6.42 to 5.65 per cent, and that the Y_m values used for non-dairy cattle (decreasing from 7.77 to 7.29 per cent) were in most cases above the range of the default values (6.5 +/- 1 per cent) provided in the 2006 IPCC Guidelines (vol. 4, chap. 10, table 10.12, p.10.30). The Party gave a comprehensive description of its views on this issue in the NIR (appendix 10.3, pp.629–630). As a result of the findings of the 2020 review under the European Union effort-sharing decision, the technical correction based on the default Y_m value from the 2006 IPCC Guidelines applied by the reviewers was accepted by Spain for 2005 and 2016–2018. Therefore, Spain</p>	Yes. Accuracy

<i>ID#</i>	<i>Finding classification</i>	<i>Description of finding with recommendation or encouragement</i>	<i>Is finding an issue/problem?^a</i>
		<p>decided to use the Ym default value of 6.5 per cent until the use of the guidance contained in the 2019 Refinement to the 2006 IPCC Guidelines is established. Nevertheless, the ERT considers that robust country-specific values generally are more representative and applicable to national circumstances than default IPCC values.</p> <p>The ERT recommends that the Party further examine the issue related to the use of the previously used country-specific Ym values based on a national study (Jaurena et al., 2015) and explain in the NIR why the Ym values from that study led to a misrepresentation of national circumstances and data resulting in an overestimation of the Ym values. Furthermore, the ERT recommends that, as a conservative and temporary approach, while awaiting verification and revision of national Ym values, Spain use the default Ym value from the 2006 IPCC Guidelines (i.e. 6.5 per cent) until this can be replaced by newly validated country-specific Ym values, applying either a constant value for the whole time series or a series of decreasing values, as suggested by the Party during the review.</p>	
A.6	3.A.4 Other livestock – CH ₄	<p>The Party reported in its NIR (table 5.2.4, pp.362–363) that it adopted nationally determined values for the Ym and GE for goats, replacing the previously used default values from the 2006 IPCC Guidelines (vol. 4, chap. 10, table 10.13, p.10.31), which led to reductions of up to 22 per cent in the estimated CH₄ emissions from enteric fermentation of goats. Spain stated in the NIR that these values were taken from documents that are finalized but not yet published. During the review, the Party provided the ERT with an unpublished document (“Caprine – Zootechnical basis for the calculation of the nitrogen and phosphorus food balance”) that provides the Ym and GE values used for calculating the EF for enteric fermentation of goats. The Party explained that precise zootechnical coefficients were obtained by production category and by region or province and by year. The resulting values were allocated to census categories on the basis of the relationships established in the above-mentioned document. Spain provided specific references to explanations in the document for different categories and their relationships, Ym values and the enteric fermentation EF, including disaggregated values for all years and regions and zootechnical coefficients. The ERT considers that the country-specific values used in the inventory should be well documented in the NIR and in line with the good practice provided in the 2006 IPCC Guidelines (vol. 1, chap. 2, p.2.12).</p> <p>The ERT recommends that the Party include in the NIR transparent and well-documented information supporting the country-specific values for the Ym and GE for goats, including an accurate reference to the zootechnical document on goats provided to the ERT during the review (“Caprine – Zootechnical basis for the calculation of the nitrogen and phosphorus food balance”).</p>	Yes. Transparency
A.7	3.B.3 Swine – CH ₄ and N ₂ O	<p>The Party reported in its NIR (pp.370–371) that it used the suggested distribution of manure management systems for swine for 1990 from the 2006 IPCC Guidelines (vol. 4, chap. 10, tables 10A-7–10A-8, pp.10.80–10.81) as a starting point and used linear interpolation for 1991–2014, adopting the results of a 2015 survey on the use of different management systems for 2015. For 2016–2019, the distribution shares were considered constant (same proportion of management systems) as in 2015. During the review, the Party clarified that no new surveys are planned, although the ECOGAN tool, which will help farmers and the relevant authorities to share information on environmental and farm management data, is expected to be operational by 2023. The year 2023 will therefore be set as the third point after 1990 and 2015, with linear interpolation used for 2016–2022. The Party indicated that it plans to incorporate new ECOGAN manure management data with an estimated periodicity of two to five years depending on the animal category. In this regard, the ERT considers that it would be appropriate for Spain to consider, for example, the approach taken by some other European countries to adopt a trend for specific</p>	Yes. Transparency

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem? ^a
A.8	3.D.b.1 Atmospheric deposition – N ₂ O	<p>management systems that led to progressive changes over time, rather than considering the distribution shares as constant in the absence of data.</p> <p>The ERT recommends that the Party explain in the NIR why adopting a constant value for the share of different manure management systems for swine for 2015 onward is a better approach than maintaining the linear trend adopted for 1990–2015.</p> <p>The Party reported in its NIR (p.399) that it adopted the N mass balance methodology from the <i>EMEP/EEA air pollutant emission inventory guidebook 2019</i> to estimate the amount of N present in manure and applied the default $\text{Frac}_{\text{GASF}}$ value of 0.1 from the 2006 IPCC Guidelines (vol. 4, chap. 11.2.2.3, table 11.3, p.11.24) (NIR chap. 5.6.2.2 and table 5.6.5, p.400), which may result in inaccurate emission estimates. During the review, the Party indicated that it is preparing to implement the guidance from the 2019 Refinement to the 2006 IPCC Guidelines for future annual submissions. Spain will consider calculating indirect N₂O emissions using the methodology from the <i>EMEP/EEA air pollutant emission inventory guidebook 2019</i> to replace parameters related to the vaporization and deposition of ammonia and nitrates associated with N₂O emissions from agricultural soils, such as $\text{Frac}_{\text{GASF}}$ or $\text{Frac}_{\text{GASM}}$, rather than using the default values from the 2006 IPCC Guidelines.</p> <p>The ERT recommends that the Party ensure full consistency with the 2006 IPCC Guidelines when adopting the methodology from the <i>EMEP/EEA air pollutant emission inventory guidebook 2019</i> for calculating indirect N₂O emissions and replacing the parameters related to the vaporization of ammonia and nitrates, such as $\text{Frac}_{\text{GASF}}$ or $\text{Frac}_{\text{GASM}}$, with a view to enhancing the accuracy of its estimates for indirect N₂O emissions from agricultural soils, and provide the relevant documentation and justifications in the NIR.</p>	Yes. Accuracy
LULUCF			
L.10	Land representation	<p>The ERT identified small discrepancies for all years between the total national land areas reported in CRF table 4.1 and the total sum of the areas reported in CRF tables 4.A–4.F. For example, CRF tables 4.1 and 4.A–4.F report areas of 50,651.030 and 50,651.032 kha, respectively, for 1990, and 50,651.030 and 50,651.033 kha, respectively, for 2019. After further examining the areas reported under each land use and land-use change category in CRF tables 4.A–4.F, the ERT found that the discrepancies in the total national land areas correspond to the areas reported in CRF table 4.D under subcategory 4.D.1.1 peat extraction remaining peat extraction. During the review, the Party clarified that peat extraction areas were not included in the national land area reported in CRF table 4.1 and that the small discrepancies identified will be amended in the next annual submission.</p> <p>The ERT recommends that the Party correct the inconsistencies in the total national land areas reported in CRF tables 4.1 and 4.A–4.F, giving consideration to areas affected by peat extraction within the areas reported in all relevant tables.</p>	Yes. Accuracy
L.11	4.B.1 Cropland remaining cropland – CO ₂	<p>The ERT noted that the trend in net CSCs in the living biomass pool reported in CRF table 4.B under cropland remaining cropland is highly inconsistent between 1990–2004 and 2005–2019. For example, while net CSCs in living biomass remain stable at around 55 kt C/year for 1990–2004, the trend shows high inter-annual variability from 2005 onward, with values ranging between –435.06 kt C (2013) and 677.14 kt C (2017). Spain explained the reasons for this trend in the NIR (chap. 6.3.1.1, p.456), noting that the AD related to crop transitions from and to woody biomass for 1990–2004 were calculated as an average of these AD for 2005–2014. According to the NIR (footnote 36, p.456), this extrapolation technique was applied as an option to address a time-series inconsistency</p>	Yes. Consistency

<i>ID#</i>	<i>Finding classification</i>	<i>Description of finding with recommendation or encouragement</i>	<i>Is finding an issue/problem?^a</i>
		<p>issue identified in the 2017 annual review report. The Party clarified that following a recommendation from the 2017 annual review report, as stated in NIR chapters 6.1.5.2 (pp.440–441), 6.3.1.1 (pp.454–457) and 6.3.2.1 (pp.458–462), it carried out an analysis of time-series consistency and decided to use the average data from the change matrices for the first available decade of data (i.e. 2004–2015) from the Spanish crop surface area and yield survey (known as ESYRCE) instead of national data from the Yearbook of Forest Statistics as of the 2019 annual submission, and noted that this issue was considered to be resolved in the previous annual review report (see document FCCC/ARR/2019/ESP, ID# L.10). The ERT considers that the extrapolation techniques used by Spain to calculate CSCs in the living biomass carbon pool for 1990–2004, which cover a long period of time and the base year, are not in line with the good practice for time series and trends provided in the Kyoto Protocol Supplement (chap. 2.4.3.2, p.2.59) or the 2006 IPCC Guidelines (vol. 1, chap. 5.3.3.4, p.5.12) and may result in highly uncertain estimates for the first 15 years of the reported time series.</p> <p>The ERT recommends that the Party consider other, more appropriate, splicing techniques, as set out in the 2006 IPCC Guidelines (vol. 1, chap. 5.3.3, pp.5.8–5.14), including the use of surrogate data such as crop production or harvested crop area by crop type (e.g. almonds, apples, etc.), by year and by source of information type (e.g. official data, FAO estimate) available from the statistics published by the Food and Agriculture Organization of the United Nations for 1961 onward, to improve time-series consistency, in particular for 1990–2004 for CSCs in the living biomass carbon pool for category 4.B.1 cropland remaining cropland. If the Party finds that no other splicing techniques as set out in the 2006 IPCC Guidelines can be applied to improve the consistency and accuracy of its CSCs in living biomass estimates for cropland remaining cropland, the ERT recommends that it document this in the NIR with a clear explanation demonstrating why other splicing techniques, less uncertain than the trend extrapolation currently used, cannot be applied.</p>	
Waste			
W.8	5.A.1 Managed waste disposal sites – CH ₄	<p>The NIR does not provide information on the significant inter-annual changes in the CH₄ IEFs for subcategory 5.A.1.a anaerobic, namely for 2003–2004 (–12.72 per cent), 2008–2009 (32.65 per cent), 2010–2011 (10.24 per cent) and 2012–2013 (8.94 per cent). During the review, the Party clarified that the observed inter-annual variations stem from the dynamic of AD for municipal waste disposal sites associated with fluctuations in the amount of CH₄ captured and used for energy recovery over the years.</p> <p>The ERT recommends that Spain explain in the NIR that the inter-annual changes in the CH₄ IEFs for subcategory 5.A.1.a anaerobic result from the dynamic of AD for municipal waste disposal sites associated with fluctuations in the amount of CH₄ captured and used for energy recovery over the years, as explained to the ERT during the review.</p>	Yes. Transparency
W.9	5.B Biological treatment of solid waste – CH ₄ and N ₂ O	<p>The ERT noted inconsistent information reported on the AD used to estimate emissions for this category. For example, the NIR (p.526) states that the most recent data for composting relate to 2018, but NIR tables 7.3.5 and 7.3.6 (p.527) include AD for generated and flared biogas and treated urban residues for 2019. During the review, Spain clarified that, as part of its national practices, AD are compiled one year after the NIR is produced owing to a one-year delay in the communication process with the focal point responsible for annualizing AD related to solid waste treatment. It indicated that it is a common practice to recalculate emission estimates for the subsequent annual submission for this reason. During the review, in response to a question from the ERT on the relationship between the 2019 AD values presented in NIR tables 7.3.5 and 7.3.6 (chap. 7.3.2.1, p.527) and the values presented in NIR</p>	Not an issue/problem

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem? ^a
W.10	5.D.2 Industrial wastewater – CH ₄	<p>figure 7.3.3 (chap. 7.3.5, p.529), which shows N₂O emissions for this category and the recalculation performed for 2018, the Party again referred to the national practice of compiling emission data in the inventory with a one-year delay, but did not provide details on the relationship between the data in tables 7.3.5 and 7.3.6 and figure 7.3.3. The ERT acknowledges the Party's procedures for collecting data and compiling inventories but notes that systematically delaying data compilation by one year with respect to the submission date of the annual GHG inventory and then revising and recalculating emission estimates for the subsequent annual submission does not contribute to ensuring comparability of reporting across Parties and may lead to inconsistencies in the data reported between the CRF tables and the NIR within an annual submission and inaccuracy of the estimates reported for the latest year.</p> <p>The ERT encourages Spain to cooperate with the relevant institutions responsible for handling AD for the emission estimates for category 5.B biological treatment of solid waste to avoid systematic delays in the availability of data for compiling the annual GHG inventory, ensuring the accuracy of the estimates reported for the latest year, and to strive to meet the deadlines for the annual submission.</p> <p>The ERT noted a significant inter-annual change in the CH₄ IEF for 2006–2007 for this category (5.3 per cent) and that Spain did not provide an explanation for this in the NIR. During the review, Spain indicated that the use of measures for CH₄ capture has increased in the country, resulting in a reduction in CH₄ emissions and therefore affecting the CH₄ IEFs, but did not specify when these measures were first introduced. Spain explained that three MCF values for industrial area sources with aerobic treatment are available in the country, each corresponding to one of the three periods of the time series, which are linked to the entry into force of the European Union directive on integrated pollution prevention and control (directive 96/61/EC) and law 27/2006. In addition, Spain explained that in order to avoid abrupt inter-annual changes in the MCF values between these periods, the MCF values underwent progressive attenuation. However, the 2005 MCF value was also mistakenly used for 2006, which led to the identified significant inter-annual variation in the CH₄ EF values and resulting IEFs for 2006 and 2007, but did not affect the emission estimates. Spain also provided the ERT with an Excel spreadsheet detailing the progressive attenuation applied to the MCF values and the IEF values for industrial area sources and informed the ERT that it will update the methodological fact sheet on the treatment of industrial wastewater referenced in the NIR (available in Spanish only at www.miteco.gob.es/es/calidad-y-evaluacion-ambiental/temas/sistema-espanol-de-inventario-sei-091001-trat-ag-res-industr_tcm30-429867.pdf), which describes the methodology for the estimations in detail.</p> <p>The ERT recommends that Spain report in the NIR the correct MCF value for 2006, ensuring accurate reporting of CH₄ IEFs, and update the methodological fact sheet accordingly. The ERT also recommends that Spain clarify in the NIR the nature of the CH₄ capture measures in place in the country and when they were introduced.</p>	Yes. Transparency
W.11	5.D.2 Industrial wastewater – N ₂ O	<p>The ERT noted that N₂O emissions (and N in effluent) were reported as “NE” for 1990–2019. The ERT also noted that CRF table 9 indicates that the N₂O emissions from industrial sources are included under 5.D.1 domestic wastewater and that the NIR (p.530) indicates that estimates of N₂O emissions from domestic wastewater treatment include those from industrial wastewater treatment, as Spain applied the F_{IND-COM} parameter. During the review, Spain explained that it only has data on the volume of wastewater treated and relies on default values from the 2006 IPCC Guidelines for the industrial wastewater sector (for estimating CH₄ emissions). The ERT recognizes that the 2006 IPCC Guidelines lack default EFs for estimating N₂O emissions from industrial wastewater.</p>	Yes. Comparability

<i>ID#</i>	<i>Finding classification</i>	<i>Description of finding with recommendation or encouragement</i>	<i>Is finding an issue/problem?^a</i>
		<p>The ERT recommends that Spain report “IE” instead of “NE” for N₂O emissions for category 5.D.2 industrial wastewater. In addition, the ERT encourages Spain to explore the possibility of using other available international methodological guidance to estimate N₂O emissions from industrial wastewater activities and to examine the feasibility of developing an improvement plan with a view to producing a country-specific EF for the relevant industrial wastewater treatment/discharge pathway in the wastewater system and collecting AD that reflect Spain’s country-specific circumstances with regard to the types of industrial activity that contribute to N₂O emissions.</p>	
KP-LULUCF			
KL.5	FM – CO ₂ , CH ₄ and N ₂ O	<p>The ERT noted that Spain did not provide an FMRL technical correction and the related information required in any of its annual submissions during the second commitment period of the Kyoto Protocol, including the 2021 annual submission. Spain acknowledged in the NIR (chap. 11.5.2.5, p.672) that a technical correction to its FMRL is necessary owing to updates applied to historical FM AD and associated estimates in recent annual submissions and the integration of estimates associated with harvested wood products. The Party indicated that it will provide an FMRL technical correction in the 2022 annual submission, taking into account the methodological guidance provided in the Kyoto Protocol Supplement (chap. 2.7.6, pp.2.98–2.103) and the recommendations of the ERTs and the Joint Research Centre team, in addition to a detailed description in the NIR of the 2022 annual submission, including in relation to the elements that have changed in the GHG reporting following the adoption of the FMRL. The ERT also noted that in accordance with decision 2/CMP.8 (annex II, para. 5(e–f)), decision 2/CMP.7 (annex, para. 14) and the methodological guidance provided in the Kyoto Protocol Supplement, information on technical corrections and information that demonstrates methodological consistency between the FMRL and reporting for FM shall be reported as part of the annual GHG inventories and inventory reports. During the review, the Party formally submitted an addendum to NIR chapter 11 containing the calculations of the FMRL technical correction and relevant information, along with a revised version of CRF table 4(KP-I)B.1.1 and the information tables on accounting, which included the required technical correction value. The ERT agreed with the information submitted by Spain on the FMRL technical correction.</p> <p>The ERT recommends that the Party include in NIR chapter 11 transparent information on the technical correction and information demonstrating methodological consistency between the FMRL and reporting for FM in accordance with decision 2/CMP.8 (annex II, para. 5(e–f)), decision 2/CMP.7 (annex, para. 14) and the methodological guidance provided in the Kyoto Protocol Supplement (chap. 2.7.6, pp.2.98–2.103), similar to the information provided in the addendum to NIR chapter 11 of the 2021 annual submission.</p>	Yes. Transparency
KL.6	CM – CO ₂ , CH ₄ and N ₂ O	<p>The ERT noted that the area reported under CM is 20,998.72 kha for the base year and 20,157.63 kha for 2013, resulting in a net decrease of 841.09 kha between the base year and the first year of the second commitment period of the Kyoto Protocol. Furthermore, the only transitions reported regarding CM are from CM to AR and from “other activity” (i.e. from land units not subject to KP-LULUCF, such as grassland and other land as reported under the Convention) to CM. In all years of the second commitment period, the area reported for the CM to AR transition (when transition occurs) is smaller than for the “other activity” to CM transition, which has a constant value of 6.40 kha/year (NIR table 6.3.2, p.457). This indicates that it is very likely that land reported under CM in the base year only was not reported under any other KP-LULUCF during the second commitment period. Spain referenced this situation in the NIR (chap. 11.1.5, p.644) for cases of transitions from cropland to grassland, wetlands, settlements and other land, for which the Party ‘zeroed’ the accounting (footnote 4 to NIR table 11.2.2, p.648) in line with the</p>	Yes. Transparency

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem? ^a
		<p>guidance provided in the Kyoto Protocol Supplement (chap. 2.9.2, p.2.136); however, it did not describe in the NIR the consequences of this exclusion affecting reported emissions and removals. During the review, the Party acknowledged that there are emissions and removals associated with transitions from cropland to grassland, wetlands, settlements and other land that occurred between the base year and the commitment period years that have been reported under the Convention since 2013. In particular, there are emissions and removals associated with CSCs with a 20-year conversion period for the conversion areas in the following pools: living biomass and litter for cropland converted to grassland, and soil organic carbon for cropland converted to grassland, cropland converted to flooded land and cropland converted to settlements. There are also emissions associated with grassland biomass burning and direct and indirect N₂O emissions from N mineralization associated with loss of soil organic matter resulting from land-use change for cropland converted to settlements. The Party noted that it will include the required information in the NIR of its next annual submission.</p> <p>The ERT recommends that the Party clearly describe in the NIR how the exclusion of transitions from cropland to grassland, wetlands, settlements and other land that occurred between the base year and the commitment period affects emissions and removals accounted for under CM during the second commitment period of the Kyoto Protocol and provide any additional information that enhances transparency with regard to the application of the exclusion of the above-mentioned transitions, as required by the Kyoto Protocol Supplement (chap. 2.9.2, p.2.136).</p>	

^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

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

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

13. Spain 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

14. 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 Spain in its 2021 annual submission

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

Table I.1

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

(kt CO₂ 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								–23 100.00
Base year ^d	256 758.94	292 755.84	NA	NA	NA		–144.01	
1990	254 004.57	290 001.47	NA	NA				
1995	294 739.28	329 350.69	NA	NA				
2000	348 655.13	388 211.54	NA	NA				
2010	320 403.48	357 876.02	NA	NA				
2011	320 169.36	357 588.45	NA	NA				
2012	314 877.20	350 317.74	NA	NA				
2013	289 185.91	323 525.94	NA	NA		–7 571.39	1 595.87	–28 050.35
2014	289 302.39	325 609.36	NA	NA		–7 271.49	66.10	–28 890.58
2015	298 248.54	336 994.88	NA	NA		–6 655.17	–2 315.29	–29 678.00
2016	286 860.79	325 465.70	NA	NA		–6 160.99	–2 779.03	–29 682.94
2017	299 904.47	338 738.17	NA	NA		–5 462.79	–3 202.28	–30 286.18
2018	294 368.08	333 250.41	NA	NA		–5 007.82	–3 300.30	–30 794.51
2019	276 951.59	314 528.51	NA	NA		–4 531.88	–3 350.12	–30 033.38

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 CO₂ 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 CO₂, CH₄ and N₂O and 1995 for HFCs, PFCs, SF₆ and NF₃. The base year for CM 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 Spain, excluding land use, land-use change and forestry, 1990–2019(kt CO₂ eq)

	CO ₂ ^a	CH ₄	N ₂ O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF ₆	NF ₃
1990	231 194.16	36 646.73	17 892.29	3 039.92	1 164.38	NO, NA	63.99	NO, NA
1995	267 458.29	37 623.74	17 246.00	5 867.64	1 055.21	NO, NA	99.81	NO, NA
2000	311 384.59	42 253.66	21 549.00	12 343.25	494.73	NO, NA	186.33	NO, NA
2010	283 872.71	39 462.24	17 766.12	16 434.93	105.12	NO, NA	234.89	NO, NE, NA
2011	284 729.53	39 822.27	16 820.73	15 759.43	89.97	127.36	239.15	NO, NE, NA
2012	278 963.93	38 687.12	16 157.68	15 735.22	54.36	499.44	220.00	NO, NE, NA
2013	252 726.12	37 475.84	16 786.76	15 585.22	67.17	670.97	213.86	NO, NA
2014	255 067.90	36 821.33	17 457.69	15 465.36	63.42	523.68	209.99	NO, NA
2015	271 694.20	38 177.10	17 692.20	8 621.72	93.04	495.26	221.35	NO, NA
2016	260 757.96	38 010.71	17 426.82	8 377.79	90.80	572.00	229.62	NO, NA
2017	274 641.96	38 337.43	18 060.73	6 464.70	128.05	879.90	225.40	NO, NA
2018	269 713.44	38 565.96	18 314.11	4 677.91	130.74	1 621.37	226.88	NO, NA
2019	251 498.50	38 492.66	18 321.85	4 492.62	52.88	1 442.02	227.97	NO, NA
Percentage change 1990– 2019	8.8	5.0	2.4	47.8	–95.5	NA	256.3	NA

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

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

Table I.3

Greenhouse gas emissions and removals by sector for Spain, 1990–2019(kt CO₂ eq)

	Energy	IPPU	Agriculture	LULUCF	Waste	Other
1990	213 000.05	29 647.92	34 990.75	–35 996.89	12 362.75	NA
1995	249 975.77	31 897.17	34 296.78	–34 611.41	13 180.97	NA
2000	290 221.61	41 978.34	41 773.52	–39 556.41	14 238.08	NA
2010	265 986.98	40 545.54	36 186.96	–37 472.54	15 156.53	NA
2011	268 661.51	37 659.79	35 457.26	–37 419.09	15 809.90	NA
2012	264 650.51	36 015.27	34 290.96	–35 440.54	15 361.00	NA
2013	239 305.30	34 830.24	34 343.48	–34 340.03	15 046.92	NA
2014	239 188.05	36 661.93	35 939.59	–36 306.97	13 819.78	NA

	<i>Energy</i>	<i>IPPU</i>	<i>Agriculture</i>	<i>LULUCF</i>	<i>Waste</i>	<i>Other</i>
2015	254 552.01	31 056.08	36 665.62	–38 746.34	14 721.17	NA
2016	243 831.84	30 577.08	36 725.43	–38 604.91	14 331.35	NA
2017	258 678.13	28 311.19	37 747.70	–38 833.70	14 001.15	NA
2018	253 528.24	27 860.35	37 794.58	–38 882.33	14 067.25	NA
2019	236 737.81	26 109.64	37 794.46	–37 576.92	13 886.59	NA
Percentage change 1990–2019	11.1	–11.9	8.0	4.4	12.3	NA

Note: Spain did not report indirect CO₂ 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 Spain
(kt CO₂ eq)

	<i>Article 3.7 bis as contained in the Doha Amendment^a</i>	<i>Activities under Article 3.3 of the Kyoto Protocol</i>		<i>FM and elected activities under Article 3.4 of the Kyoto Protocol</i>				
	<i>Land-use change</i>	<i>AR</i>	<i>Deforestation</i>	<i>FM</i>	<i>CM</i>	<i>GM</i>	<i>RV</i>	<i>WDR</i>
FMRL				–23 100.00				
Technical correction				–8 145.00				
Base year ^b	NA				–144.01	NA	NA	NA
2013		–8 211.82	640.43	–28 050.35	1 595.87	NA	NA	NA
2014		–7 909.25	637.77	–28 890.58	66.10	NA	NA	NA
2015		–7 289.35	634.17	–29 678.00	–2 315.29	NA	NA	NA
2016		–6 793.93	632.95	–29 682.94	–2 779.03	NA	NA	NA
2017		–6 095.10	632.31	–30 286.18	–3 202.28	NA	NA	NA
2018		–5 639.39	631.57	–30 794.51	–3 300.30	NA	NA	NA
2019		–5 163.58	631.70	–30 033.38	–3 350.12	NA	NA	NA
Percentage change base year–2019					2 226.4	NA	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 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 Spain's reporting under Article 3, paragraphs 3–4, of the Kyoto Protocol.

Table I.5

Key relevant data for Spain under Article 3, paragraphs 3–4, of the Kyoto Protocol from its 2021 annual submission

<i>Parameter</i>	<i>Data values</i>
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: not elected (f) RV: not elected (g) WDR: not elected
Elected activities under Article 3, paragraph 4, of the Kyoto Protocol	CM
Election of application of provisions for natural disturbances	Yes, for AR and FM
3.5% of total base-year GHG emissions, excluding LULUCF	9 917.659 kt CO ₂ eq (79 341.275 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

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 Spain. 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 Spain

(t CO₂ eq)

	<i>Original submission</i>	<i>Revised submission</i>	<i>Adjustment</i>	<i>Final value</i>
CPR	1 590 189 509	–	–	1 590 189 509
Annex A emissions				
CO ₂	251 498 499	–	–	251 498 499
CH ₄	38 492 662	–	–	38 492 662
N ₂ O	18 321 855	–	–	18 321 855
HFCs	4 492 620	–	–	4 492 620
PFCs	52 885	–	–	52 885
Unspecified mix of HFCs and PFCs	1 442 019	–	–	1 442 019
SF ₆	227 972	–	–	227 972
NF ₃	NO, NA	–	–	NO, NA
Total Annex A sources	314 528 511	–	–	314 528 511
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–5 163 578	–	–	–5 163 578
Deforestation	631 701	–	–	631 701
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–30 033 384	–	–	–30 033 384
CM	–3 350 116	–	–	–3 350 116
CM for the base year	–144 007	–	–	–144 007

Table II.2

Information to be included in the compilation and accounting database for 2018 for Spain

(t CO₂ eq)

	<i>Original submission</i>	<i>Revised submission</i>	<i>Adjustment</i>	<i>Final value</i>
Annex A emissions				
CO ₂	269 713 437	–	–	269 713 437
CH ₄	38 565 961	–	–	38 565 961
N ₂ O	18 314 112	–	–	18 314 112
HFCs	4 677 909	–	–	4 677 909
PFCs	130 740	–	–	130 740
Unspecified mix of HFCs and PFCs	1 621 374	–	–	1 621 374
SF ₆	226 875	–	–	226 875
NF ₃	NO, NA	–	–	NO, NA
Total Annex A sources	333 250 407	–	–	333 250 407
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–5 639 386	–	–	–5 639 386
Deforestation	631 568	–	–	631 568

	<i>Original submission</i>	<i>Revised submission</i>	<i>Adjustment</i>	<i>Final value</i>
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	-30 794 510	—	—	-30 794 510
CM	-3 300 302	—	—	-3 300 302
CM for the base year	-144 007	—	—	-144 007

Table II.3

Information to be included in the compilation and accounting database for 2017 for Spain(t CO₂ eq)

	<i>Original submission</i>	<i>Revised submission</i>	<i>Adjustment</i>	<i>Final value</i>
Annex A emissions				
CO ₂	274 641 963	—	—	274 641 963
CH ₄	38 337 429	—	—	38 337 429
N ₂ O	18 060 731	—	—	18 060 731
HFCs	6 464 699	—	—	6 464 699
PFCs	128 052	—	—	128 052
Unspecified mix of HFCs and PFCs	879 897	—	—	879 897
SF ₆	225 399	—	—	225 399
NF ₃	NO, NA	—	—	NO, NA
Total Annex A sources	338 738 171	—	—	338 738 171
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	-6 095 096	—	—	-6 095 096
Deforestation	632 308	—	—	632 308
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	-30 286 183	—	—	-30 286 183
CM	-3 202 276	—	—	-3 202 276
CM for the base year	-144 007	—	—	-144 007

Table II.4

Information to be included in the compilation and accounting database for 2016 for Spain(t CO₂ eq)

	<i>Original submission</i>	<i>Revised submission</i>	<i>Adjustment</i>	<i>Final value</i>
Annex A emissions				
CO ₂	260 757 956	—	—	260 757 956
CH ₄	38 010 713	—	—	38 010 713
N ₂ O	17 426 817	—	—	17 426 817
HFCs	8 377 793	—	—	8 377 793
PFCs	90 802	—	—	90 802
Unspecified mix of HFCs and PFCs	571 999	—	—	571 999
SF ₆	229 620	—	—	229 620
NF ₃	NO, NA	—	—	NO, NA
Total Annex A sources	325 465 701	—	—	325 465 701
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	-6 793 934	—	—	-6 793 934
Deforestation	632 947	—	—	632 947
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	-29 682 939	—	—	-29 682 939
CM	-2 779 035	—	—	-2 779 035
CM for the base year	-144 007	—	—	-144 007

Table II.5

Information to be included in the compilation and accounting database for 2015 for Spain(t CO₂ eq)

	<i>Original submission</i>	<i>Revised submission</i>	<i>Adjustment</i>	<i>Final value</i>
Annex A emissions				
CO ₂	271 694 203	–	–	271 694 203
CH ₄	38 177 103	–	–	38 177 103
N ₂ O	17 692 201	–	–	17 692 201
HFCs	8 621 724	–	–	8 621 724
PFCs	93 037	–	–	93 037
Unspecified mix of HFCs and PFCs	495 263	–	–	495 263
SF ₆	221 352	–	–	221 352
NF ₃	NO, NA	–	–	NO, NA
Total Annex A sources	336 994 883	–	–	336 994 883
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–7 289 346	–	–	–7 289 346
Deforestation	634 172	–	–	634 172
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–29 677 998	–	–	–29 677 998
CM	–2 315 293	–	–	–2 315 293
CM for the base year	–144 007	–	–	–144 007

Table II.6

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

	<i>Original submission</i>	<i>Revised submission</i>	<i>Adjustment</i>	<i>Final value</i>
Annex A emissions				
CO ₂	255 067 902	–	–	255 067 902
CH ₄	36 821 332	–	–	36 821 332
N ₂ O	17 457 686	–	–	17 457 686
HFCs	15 465 355	–	–	15 465 355
PFCs	63 420	–	–	63 420
Unspecified mix of HFCs and PFCs	523 676	–	–	523 676
SF ₆	209 988	–	–	209 988
NF ₃	NO, NA	–	–	NO, NA
Total Annex A sources	325 609 359	–	–	325 609 359
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–7 909 254	–	–	–7 909 254
Deforestation	637 765	–	–	637 765
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–28 890 579	–	–	–28 890 579
CM	66 104	–	–	66 104
CM for the base year	–144 007	–	–	–144 007

Table II.7

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

	<i>Original submission</i>	<i>Revised submission</i>	<i>Adjustment</i>	<i>Final value</i>
Annex A emissions				
CO ₂	252 726 123	–	–	252 726 123
CH ₄	37 475 843	–	–	37 475 843

	<i>Original submission</i>	<i>Revised submission</i>	<i>Adjustment</i>	<i>Final value</i>
N ₂ O	16 786 755	–	–	16 786 755
HFCs	15 585 225	–	–	15 585 225
PFCs	67 168	–	–	67 168
Unspecified mix of HFCs and PFCs	670 971	–	–	670 971
SF ₆	213 858	–	–	213 858
NF ₃	NO, NA	–	–	NO, NA
Total Annex A sources	323 525 943	–	–	323 525 943
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–8 211 821	–	–	–8 211 821
Deforestation	640 431	–	–	640 431
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–28 050 345	–	–	–28 050 345
CM	1 595 872	–	–	1 595 872
CM for the base year	–144 007	–	–	–144 007

Annex III

Additional information to support findings in table 2

Missing categories that may affect completeness

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

- (a) 4.C.1 grassland remaining grassland – soil pool (CO₂) (see ID# L.6 in table 3);
- (b) 4.V biomass burning – cropland remaining cropland and grassland remaining grassland (CO₂) (see ID# L.9 in table 3).

Annex IV

Reference documents

A. Reports of the Intergovernmental Panel on Climate Change

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

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

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

IPCC. 2019. *2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories*. E Calvo Buendia, S Guendehou, B Limmeechokchai, 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 2012, 2013, 2014, 2015, 2016, 2017 and 2019 annual submissions of Spain, contained in documents FCCC/ARR/2012/ESP, FCCC/ARR/2013/ESP, FCCC/ARR/2014/ESP, FCCC/ARR/2015/ESP, FCCC/ARR/2016/ESP, FCCC/ARR/2017/ESP and FCCC/ARR/2019/ESP, 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 Spain for 2021. Available at https://unfccc.int/sites/default/files/resource/asr2021_ESP.pdf.

C. Other documents used during the review

Responses to questions during the review were received from María José Alonso Moya (Ministry for the Ecological Transition and the Demographic Challenge of Spain), 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:

EEA. 2019. *EMEP/EEA air pollutant emission inventory guidebook 2019: Technical guidance to prepare national emission inventories*. Luxembourg: Publications Office of the European Union. Available at <https://www.eea.europa.eu/publications/emep-eea-guidebook-2019>.

G. Jaurena, J.M.Cantet, J.I.Arroquy, R.A.Palladino, M.Wawrzekiewicz and D. Colombatto 2015. Prediction of the Ym factor for livestock from on-farm accessible data. *Livestock Science*, 177, 52–62.