United Nations

FCCC/ARR/2022/PRT

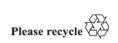Framework Convention on
Climate Change

Distr.: General
3 April 2023

English only

Report on the individual review of the annual submission of Portugal submitted in 2022*

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 2022 annual submission of Portugal, conducted by an expert review team in accordance with the "Guidelines for review under Article 8 of the Kyoto Protocol". The review took place from 26 September to 1 October 2022 in Bonn.

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* In the symbol for this document, 2022 refers to the year in which the inventory was submitted, not to the year of publication.

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Contents

Abbreviations and acronyms

2006 IPCC Guidelines	*2006 IPCC Guidelines for National Greenhouse Gas Inventories*
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"
BCEF	biomass conversion and expansion factor
CER	certified emission reduction
CH_4	methane
CM	cropland management
CO_2	carbon dioxide
CO_2 eq	carbon dioxide equivalent
Convention reporting adherence	adherence to the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual greenhouse gas inventories"
CPR	commitment period reserve
CRF	common reporting format
DE%	digestible energy expressed as a percentage of gross energy
EEA	European Environment Agency
EF	emission factor
EMEP	Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe
EMEP/EEA guidebook	*EMEP/EEA air pollutant emission inventory guidebook*
ERT	expert review team
ERU	emission reduction unit
EU	European Union
EU ETS	European Union Emissions Trading System
F-gas	fluorinated gas
FM	forest management
FMRL	forest management reference level
$Frac_{GASM}$	fraction of applied organic nitrogen fertilizer materials and of urine and dung nitrogen deposited by grazing animals that volatilizes as ammonia and nitrogen oxides
$Frac_{LEACH-(H)}$	fraction of all nitrogen added to/mineralized in managed soils in regions where leaching/run-off occurs that is lost through leaching and run-off
GHG	greenhouse gas
GM	grazing land management
HFC	hydrofluorocarbon
HWP	harvested wood products
IE	included elsewhere
IEF	implied emission factor
IPCC	Intergovernmental Panel on Climate Change
IPPU	industrial processes and product use
KP reporting adherence	adherence to the reporting guidelines under Article 7, paragraph 1, of the Kyoto Protocol
KP-LULUCF	activities under Article 3, paragraphs 3–4, of the Kyoto Protocol
Kyoto Protocol Supplement	*2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol*
LPG	liquefied petroleum gas

LULUCF	land use, land-use change and forestry
MAI	mean annual increment
MMS	manure management system(s)
N	nitrogen
N_2O	nitrous oxide
NA	not applicable
NE	not estimated
NF_3	nitrogen trifluoride
NFI	national forest inventory
NIR	national inventory report
NMVOC	non-methane volatile organic compound
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
SOC	soil organic carbon
SOM	soil organic matter
UNFCCC Annex I inventory reporting guidelines	"Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual greenhouse gas inventories"
UNFCCC review guidelines	"Guidelines for the technical review of information reported under the Convention related to greenhouse gas inventories, biennial reports and national communications by Parties included in Annex I to the Convention"
WDR	wetland drainage and rewetting
Wetlands Supplement	*2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands*

I. Introduction

1.   This report covers the review of the 2022 annual submission of Portugal, organized by the secretariat in accordance with the Article 8 review guidelines (adopted by decision 22/CMP.1 and revised by decision 4/CMP.11). In accordance with the Article 8 review guidelines, this review process also encompasses the review under the Convention as described in the UNFCCC review guidelines, particularly in part III thereof, namely the "UNFCCC guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention" (annex to decision 13/CP.20). The review took place from 26 September to 1 October 2022 in Bonn and was coordinated by Jongikhaya Witi and Tomoyuki Aizawa (secretariat). Table 1 provides information on the composition of the ERT that conducted the review for Portugal.

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

Area of expertise	Name	Party
Generalist	Hlobsile Patricia Sikhosana	Eswatini
	Sorin Deaconu	Romania
Energy	Ana Carolina Avzaradel Szklo	Brazil
	Lawrence Kotoe	Ghana
	John David Watterson	United Kingdom
	Songli Zhu	China
IPPU	Jet Chong	Australia
	Kristina Gonchar	Belarus
	Ingrid Person Rocha e Pinho	Brazil
Agriculture	Kingsley Kwako Amoako	Ghana
	Hongmin Dong	China
LULUCF and KP-LULUCF	Thiago de Araújo Mendes	Brazil
	Helen Karu	Estonia
	Admore Mureva	Zimbabwe
	Atsushi Sato	Japan
Waste	Richard Claxton	United Kingdom
	Igor Ristovski	North Macedonia
Lead reviewers	Thiago de Araújo Mendes	
	John David Watterson	

2.   The basis of the findings in this report is the assessment by the ERT of the Party's 2022 annual submission in accordance with the UNFCCC review guidelines and the Article 8 review guidelines.

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

4.   A draft version of this report was communicated to the Government of Portugal, which provided no comments.

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[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.

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

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

II.   Summary and general assessment of the Party's 2022 annual submission

7.   Table 2 provides the assessment by the ERT of the Party's 2022 annual submission with respect to the tasks undertaken during the review. Further information on the issues identified, as well as additional findings, may be found in tables 3 and 5.

Table 2
Summary of review results and general assessment of the 2022 annual submission of Portugal

Assessment		*Issue/problem ID#(s) in table 3 or 5[a]*
Date(s) of submission	Original submission: NIR, 7 April 2022; CRF tables (version 1), 7 April 2022; SEF tables, 8 April 2022.	
	Revised submissions: NIR, 6 July 2022; CRF tables (version 2), 6 July 2022; CRF tables (version 3), 24 October 2022.	
	Unless otherwise specified, values from the most recent submission are included in this report.	
Review format	Centralized	
Application of the requirements of the UNFCCC Annex I inventory reporting guidelines and the Wetlands Supplement (if applicable)	Have any issues been identified in the following areas:	
	(a) Identification of key categories?	No
	(b) Selection and use of methodologies and assumptions?	No
	(c) Development and selection of EFs?	Yes E.5, E.12, E.17
	(d) Collection and selection of AD?	Yes E.16, I.11, A.11, L.7, L.8, L.10, L.13, L.14, L.20, W.1, KL.2
	(e) Reporting of recalculations?	No
	(f) Reporting of a consistent time series?	Yes E.6
	(g) Reporting of uncertainties, including methodologies?	Yes G.4, G.5
	(h) QA/QC?	QA/QC procedures were assessed in the context of the national system (see supplementary information under the Kyoto Protocol below)
	(i) Missing categories, or completeness?[b]	Yes I.5, I.15, I.18, KL.10, KL.13
	(j) Application of corrections to the inventory?	No
Significance threshold	For categories reported as insignificant, has the Party provided sufficient information showing that the likely level of emissions meets the criteria in paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines?	Yes
Description of trends	Did the ERT conclude that the description in the NIR of the trends for the different gases and sectors is reasonable?	Yes
Supplementary information under the Kyoto Protocol	Have any issues been identified related to the following aspects of the national system:	
	(a) Overall organization of the national system, including the effectiveness and reliability of the	No

Assessment			Issue/problem ID#(s) in table 3 or 5[a]
	institutional, procedural and legal arrangements?		
	(b) Performance of the national system functions?	No	
	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?	No	
	(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	Portugal does not have a previously applied adjustment
Response from the Party during the review	Has the Party provided the ERT with responses to the questions raised, including the data and information necessary for assessing conformity with the UNFCCC Annex I inventory reporting guidelines and any further guidance adopted by the Conference of the Parties?	Yes	
Recommendation for an exceptional in-country review	On the basis of the issues identified, does the ERT recommend that the next review be conducted as an in-country review?	No	
Questions of implementation	Did the ERT list any questions of implementation?	No	

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

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

8.   Table 3 compiles the recommendations from previous review reports that were included in the most recent previous review report, published on 5 May 2021,[3] and had not been resolved by the time of publication of the report on the review of the Party's 2020 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 Portugal

ID#	Issue/problem classification[a, b]	Recommendation from previous review report	ERT assessment and rationale
General			
G.1	Article 3.14 (G.1, 2020) (G.1, 2018) (G.7, 2016) (G.7, 2015) (134, 2014) Transparency	Report any change(s) in the information provided under Article 3, paragraph 14, of the Kyoto Protocol in accordance with decision 15/CMP.1, annex, chapter I.H, and/or further relevant decisions of the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol.	Resolved. The ERT has reviewed the changes in Portugal's NIR against the information reported in the country's 2021 submission and judged the current reporting against the requirements of decision 15/CMP.1, annex, chapter I.H, paragraph 25. The ERT concluded that the information Portugal included in NIR section 15 (p.15-1) is in accordance with the requirements of the decision.
G.2	CPR (G.9, 2020) KP reporting adherence	Include a description of the full calculation process for the CPR in the NIR.	Resolved. Portugal has included a full description of the calculation process for the CPR in its NIR (section 12.5, p.12-1). The ERT agrees with the CPR calculation process as explained by Portugal in the NIR.
G.3	QA/QC and verification (G.5, 2020) (G.6, 2018) (G.2, 2016) (G.2, 2015) (12, 2014) Transparency	Provide information on QC activities and their results.	Resolved. The ERT concluded that Portugal has enhanced the clarity and the level of detail of reporting on QC activities in the NIR. In particular, the ERT noted improvements in the detail of reporting in the energy sector, for example for road transportation (p.3-90) and other sectors (pp.3-114–3-117), and in the IPPU sector, for example, for cement production (pp.4-20–4-21) and lime production (pp.4-26–4-27).
G.4	Uncertainty analysis (G.8, 2020) (G.13, 2018) Convention reporting adherence	Avoid reporting the uncertainty of the AD or EFs as 0.0 per cent, ensure that the uncertainty analysis incorporates and reports the intended information by checking for and correcting coding and compilation errors and document the results of this QA/QC procedure in the NIR.	Addressing. The Party continued to report 0.0 per cent for the uncertainty of some AD and EFs in table F-1. Responding to a question from the ERT during the review, Portugal justified several cases of the use of 0.0 per cent in conjunction with EFs, for example in respect to the N_2O emissions for category 2.G (other product manufacture and use) and the CO_2 emissions for category 3.G (liming). Specific explanations are included in the NIR for these examples and the ERT agrees with the explanations provided. However, the 0.0 per cent value has also been reported in conjunction with the CO_2 emissions associated with category 4.G (HWP), in respect to both AD and EFs. The

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[3] FCCC/ARR/2020/PRT. The ERT notes that the report on the review of Portugal's 2021 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 2020 annual submission.

ID#	Issue/problem classification[a, b]	Recommendation from previous review report	ERT assessment and rationale
			Party stated in the NIR that it was not yet possible to include HWP in the uncertainty analysis.
			The ERT considers that the recommendation has not been fully addressed because the Party has not yet included values in the uncertainty analysis that characterize the uncertainties associated with AD and EFs for category 4.G (HWP).
G.5	Uncertainty analysis (G.13, 2020) Transparency	Report thorough work to quantify the assumptions used when defining the uncertainty of parameters for the LULUCF sector, including the key assumptions, choice of methods and detailed results, in accordance with the 2006 IPCC Guidelines (vol. 1, chap. 3.5).	Not resolved. Portugal has not yet reported in its NIR on thorough work to quantify the assumptions used when defining the uncertainty of parameters for the LULUCF sector. During the review, Portugal stated that the review of data and methodologies presented in its submission was significant and that, unfortunately, the corresponding review of the uncertainty assessment was not possible owing to time and human resource constraints. The Party also stated that the review of the uncertainty assessment will be carried out in future submissions.

Energy

ID#	Issue/problem classification[a, b]	Recommendation from previous review report	ERT assessment and rationale
E.1	Fuel combustion – reference approach – all fuels – CO_2 (E.1, 2020) (E.1, 2018) (E.1, 2016) (E.1, 2015) (25, 2014) Convention reporting adherence	Improve the consistency between the energy balance and the data available for large point sources in order to reduce the differences between the reference and sectoral approaches.	Addressing. The ERT welcomed Portugal's efforts to improve consistency between data from the energy balance and large point sources. In the NIR (p.1-24), differences are noted as less than ±2 per cent for several years in the time series, but as exceeding ±2 per cent for 1996, 1997, 1998 and 2013. The Party states in its NIR that these differences are due to missing information and other possible factors which require further development (p.1-24). The difference between sectoral and reference approaches is 0.36 per cent for 2020.
			The ERT considers that the recommendation has not been fully addressed because the Party has not yet investigated the reasons for the differences between the two approaches and has not improved consistency between the data from the energy balance and large point sources. Further findings and insight have not been summarized in the NIR. It may not be possible to reduce the difference between the reference and sectoral approaches to 2 per cent or less in all years across the full inventory time series, but, explaining in the NIR the large difference in 1997, in particular, would help resolve this issue.
E.2	Feedstocks, reductants and other non-energy use of fuels – gaseous, liquid and solid fuels – CO_2 (E.4, 2020) (E.5, 2018) (E.22, 2016) (E.22, 2015) Convention reporting adherence	Carry out QC checks for non-energy use of fuels, as prescribed in the 2006 IPCC Guidelines (vol. 3, chap. 1.4).	Not resolved. The Party refers in its NIR to emissions from the non-energy use of fuels in sections 2.3 (p.2-9), 3.11.5 (p.3-156) and 4.5 (p.4-87). NIR section 4.5.2.6 on category-specific QA/QC and verification (p.4-89) presents no evidence of additional QC checks, with respect to non-energy use of fuels. During the review, the Party clarified that it did not carry out any QC checks for non-energy use of fuels in its 2022 submission.
E.3	Feedstocks, reductants and other non-energy use	Provide information on non-energy use of LPG, naphtha and natural gas and indicate	Addressing. The Party addressed the issue of LPG and naphtha in its 2020 submission and reported the AD and CO_2 emissions associated with non-energy use of LPG and

ID#	Issue/problem classification[a, b]	Recommendation from previous review report	ERT assessment and rationale
	of fuels – gaseous, liquid and solid fuels – CO_2 (E.5, 2020) (E.6, 2018) (E.22, 2016) (E.22, 2015) Transparency	the categories under which the related emissions, if any, have been included.	naphtha in CRF table 1.A(d), together with information on the categories under which those emissions were included. The Party has not addressed the issue of natural gas, although it stated during the review that it has implemented the recommendation. The ERT further stated that CO_2 emissions from the non-energy use of natural gas were not reported in CRF table 1.A(d). In response to a question from the ERT as to how it had implemented the recommendation, Portugal stated that the values of natural gas excluded from the reference approach analysis in CRF table 1.A.(d) refer to non-energy consumption of natural gas that occurs in oil refineries and that is considered under the fugitive emissions. Furthermore, the Party stated that, as this category is not an option in the drop-down list for CRF table 1.A(d), it was not possible to report this information transparently. The values reported in cell I39 of CRF table 1.A(d) are considered under the sectoral approach in cell H13 of table 1.B.2, which includes other emission sources, including hydrogen production.
			Portugal considers that it is not technically possible to include correct information for CO_2 emissions related to the non-energy use of natural gas since there is no option to choose category 1.B.2.a.4 and intends to include this justification in its next NIR.
			To fully address this issue, Portugal should include a transparent and complete justification of its reporting of CO_2 emissions related to the non-energy use of natural gas in its NIR.
E.4	1.A Fuel combustion – sectoral approach – all fuels – CO_2 (E.7, 2020) (E.9, 2018) (E.24, 2016) (E.24, 2015) Transparency	Explain the use of oxidation factors when country-specific or plant-specific oxidation factors are used.	Resolved. The oxidation factors reported in Portugal's NIR table 3-5 (p.3-21) are now all reported as equal to 1. The ERT notes that the use of a unified oxidation factor ensures that emissions are not underestimated, as the Party is following a conservative approach.
E.5	1.A.1 Energy industries – all fuels – CO_2 (E.8, 2020) (E.10, 2018) (E.26, 2016) (E.26, 2015) Accuracy	Develop a country-specific CO_2 EF for natural gas and provide further information on the reasons for not deriving country-specific CO_2 EFs for other fuels (hard coal and fuel oil) that are identified as key.	Addressing. For natural gas, Portugal uses a tier 2 methodology to estimate GHG emissions for the key category 1.A.1 (energy industries – gaseous fuels) (see NIR table 3-2, p.3-11). The CO_2 EF is country-specific and is obtained from EU ETS reports (for example, see NIR table 3-6, p.3-21).
			For hard coal, Portugal states that it uses a tier 3 methodology to estimate GHG emissions for the key category 1.A.1 (energy industries – solid fuels (coal included)) (see NIR table 3-2, p.3-11). The CO_2 EFs are a mixture of IPCC default factors from the 2006 IPCC Guidelines (see NIR table 3-5, p.3-21) and plant-specific factors derived from the EU ETS (see NIR table 3-6, p.3-21).
			Regarding fuel oil, Portugal clarified during the review week that the inventory team contacted one of the main refineries in the country and was able to obtain results from laboratory analysis of some of the main liquid fuels produced. The Party plans to use these results in future submissions. The ERT considered that as Portugal is currently using IPCC default EFs for hard coal and fuel oil (in some instances), emissions are not

ID#	Issue/problem classification[a, b]	Recommendation from previous review report	ERT assessment and rationale
			likely to be underestimated.
			Portugal can fully resolve this issue by (1) providing transparent reasons for why it has chosen not to derive country-specific CO_2 EFs for hard coal and fuel oil, clearly explaining why the current EFs used do not underestimate emissions; or, (2) developing country-specific EFs for hard coal and fuel oil.
E.6	1.A.2 Manufacturing industries and construction – biomass – CO_2, CH_4 and N_2O (E.30, 2020) Consistency	Analyse the differences between the previous methodology and the new methodology introduced in 2011 to enhance consistency and recalculate biomass consumption for before 2011, if necessary.	Not resolved. No further information was provided in the NIR, and the time series of biomass prior to 2011 was not revised in these categories to respond to this issue. During the review, the Party clarified that revision to the time series of biomass fuel consumption in category 1.A.2 (manufacturing industries and construction) needs to be coordinated with the energy statistics and industrial operator reporting entities. Although this coordination was included in the Party's methodological development plan for the inventory, it has not yet been implemented owing to the need to implement several other higher priority improvements and the limited resources related not only to the inventory but also to other entities.
E.7	1.A.2.b Non-ferrous metals – all fuels – CO_2, CH_4 and N_2O (E.31, 2020) Comparability	Make efforts to report emissions for subcategory 1.A.2.b (non-ferrous metals) separately or include in the NIR the reasons for reporting the industrial subcategory non-ferrous metals as "IE" and including the associated emissions in subcategory 1.A.2.g.i (manufacturing of machinery).	Resolved. The Party has added a new section in its NIR (section 3.4.2.3.2, p.3-51) in which it explains that the national energy balance does not have disaggregated information for the industrial subcategory for non-ferrous metals. As it is currently impossible to determine the fuel consumption for non-ferrous metals, emissions for subcategory 1.A.2.b (non-ferrous metals) are allocated under subcategory 1.A.2.g.i (manufacturing of machinery). Emissions for subcategory 1.A.2.b are reported as "IE" and an explanation included in CRF table 9.
E.8	1.A.2.c Chemicals – other fossil fuels – CO_2, CH_4 and N_2O (E.14, 2020) (E.23, 2018) (E.36, 2016) (E.36, 2015) Transparency	Clarify in the NIR that other fossil fuels in CRF table 1.A(a) correspond to residual gas (NIR tables 3.22 and 3.24) and where the flared amounts of residual gas and emissions are reported.	Resolved. The Party provided a short explanation of the allocation in its NIR (section 3.4.2.3.3, p.3-52). During the review, the Portugal clarified that it has implemented this recommendation and all emissions related to fuel combustion in the petrochemical sector were reported under subcategory 1.A.2.c (chemicals – other fossil fuels). In response to a question from the ERT, Portugal stated that in 2015, when this issue was first identified, it reported emissions of residual gases from the chemical industry under two subcategories, namely 1.A.2.c (chemicals – other fossil fuels) and 1.B.2.c (venting and flaring). In its 2021 submission, Portugal allocated residual gas emissions for subcategory 1.B.2.c to subcategory 1.A.2.c and documented this change in its 2021 NIR (section 3.4.6, pp.3-67–3-68).
E.9	1.A.2.f Non-metallic minerals – all fuels – CO_2, CH_4 and N_2O (E.16, 2020) (E.25, 2018) (E.37, 2016) (E.37, 2015) Transparency	Include explanations for the introduction of industrial waste and the rate of biogenic and fossil fuel use in the NIR.	Addressing. In its NIR (section 3.4.2.3.6, p.3-54), Portugal provides a limited explanation for energy consumption trends (fossil, biogenic and electric) in subcategory 1.A.2.f (non-metallic minerals). It also provides some information regarding the start of consumption of industrial waste in cement plants. The ERT considers that the explanation is not complete or transparent and does not fully explain the changes in fuel consumption over time. No mention is made of the brick and tile industries in terms of energy consumption trends. During the review, Portugal recognized that the paragraph could be more comprehensive and include references to the start of the incineration

ID#	Issue/problem classification[a, b]	Recommendation from previous review report	ERT assessment and rationale
			process in some of the installations that produce cement.
			The ERT considers that the recommendation has not been fully addressed because the Party has not yet provided sufficient detail on the reasons for the changes in fuel consumption over time. The ERT suggests that adding a brief commentary on the fuel consumption changes and the likely reasons for any variability in their time series, in each industry in the subcategory, would help resolve this issue.
E.10	1.A.2.f Non-metallic minerals – gaseous fuels – CO_2, CH_4 and N_2O (E.32, 2020) Transparency	Explain in the NIR why the glass industry was the first to adopt natural gas, and why adoption was slower for the cement industry subcategory.	Addressing. The Party added figure 3-27 to its NIR (section 3.4.2.3.6, pp.3-55–3-56) to show the change in the use of liquid fuels and natural gas in the ceramic, lime, glass and cement production industries for 1990–2020.
			During the review, the Party noted that its explanation of the cement industry's fuel transition has not been updated in the NIR and is therefore incorrect, as it includes the lime production industry. To address this issue, Portugal will update the text in its next annual submission.
E.11	1.A.2.g Other (manufacturing industries and construction) – liquid fuels – CO_2, CH_4 and N_2O (E.33, 2020) Transparency	Include information on the methodology used for estimating emissions from off-road vehicles and other machinery in the NIR.	Resolved. The Party has added details to the NIR (section 3.4.1.7, p.3-45) explaining how it obtains data on the energy consumption of mobile sources operating in the iron and steel industry and uses this information to separate the energy consumption data between stationary and mobile sources. The EFs and sources of these EFs are presented in NIR table 3-38 (section 3.4.3, p.3-67).
E.12	1.A.3.b Road transportation – liquid fuels – CO_2 (E.17, 2020) (E.27, 2018) (E.16, 2016) (E.16, 2015) (44, 2014) Accuracy	Continue with the efforts to develop country-specific CO_2 EFs for gasoline and diesel oil, and investigate the possibility of obtaining a country-specific CO_2 EF for gasoline and diesel oil reported under the EU ETS.	Addressing. NIR section 3.5.2.2 (p.138) states that CO_2 emissions for road transport are calculated using a tier 1 method. During the review, the Party clarified that, although it has not yet been possible to develop national CO_2 EFs, it has contacted national refineries to obtain the carbon content of fuels. Portugal is also investigating whether it can analyse the carbon content of fuel samples collected under the EU directive on fuel quality. The ERT considers that since Portugal is currently using IPCC default EFs for gasoline and diesel oil from the 2006 IPCC Guidelines, emissions are not likely to be underestimated.
E.13	1.A.3.b Road transportation – liquid fuels – CO_2 (E.18, 2020) (E.42, 2018) Transparency	Transparently document in the NIR the methodology used to fill data gaps for the estimates of the vehicle fleet and distance travelled for 1990–2002 and ensure that the results of the methodology are compared with the standard splicing techniques contained in the 2006 IPCC Guidelines.	Resolved. The Party has added clarifications in its NIR, in section 3.5.2 (p.3-79), and sections 3.5.2.4.5 (p.3-83) and 3.5.2.4.6 (p.3-87). In the NIR, Portugal describes how backcasting was based on data related to inspections, which are available for 2003 onward, and how the country-specific approach determines how many kilometres are covered each year for each class of vehicle depending on the vehicle's age. NIR figure 3-41 (p.3-88) shows the change in road traffic activity according to vehicle class, and annex B to the NIR presents detailed information on total activity for 1990–2020 by vehicle category, fuel type, trip segment and EU standard.
E.14	1.A.3.c Railways – CO_2, CH_4 and N_2O	Clarify the issue of the use of biodiesel in rail transport and explain any recalculation in	Resolved. The Party incorporated biodiesel into the diesel consumed in rail transport, recalculating GHG emissions for 2006–2020. NIR section 3.5.3 (p.3-91) contains a short

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	(E.35, 2020) Accuracy	the NIR.	description of the use of biodiesel in rail transport, figure 3-42 shows the consumption of fuels in the railway transport sector by fuel, and section 3.5.3.7 (p.3-93) refers to the recalculations.
E.15	1.A.3.d Domestic navigation – liquid fuels – CO_2, CH_4 and N_2O (E.20, 2020) (E.43, 2018) Transparency	Describe the results of efforts to disaggregate fuel consumption for small boats in the bottom-up emission quantification methodology for reporting.	Resolved. The Party has included a clarification of this issue in its NIR (section 3.5.4, p.3-94), stating that, since it is not possible to separate consumption in the energy balance for recreational craft, emissions may also be included in categories 1.A.3.b (road transportation) and 1.A.4.c.iii (fishing).
E.16	1.A.3.e.ii Other (other transportation) – gaseous, liquid and solid fuels – CO_2, CH_4 and N_2O (E.21, 2020) (E.31, 2018) (E.21, 2016) (E.21, 2015) (49, 2014) Comparability	Report the AD and emissions from ground activities at airports under the other transportation category, explain what type of consumption is included under the item "Serviços" in the energy balance and report the fuel consumption and the associated emission estimates under the appropriate category.	Addressing. The ERT notes that the Party has included an explanation of the scope of fuel consumption for the item "Serviços" in its NIR (section 3.5.5, p.3-100). However, the fuel consumption and emissions from ground activities at airports are still reported under category 1.A.4 (other sectors). The ERT considers that the recommendation has not been fully addressed because the Party continues to report emissions from ground activities at airports under category 1.A.4 (other sectors).
E.17	1.B.2.a Oil – liquid fuels – CH_4 (E.24, 2020) (E.45, 2018) Transparency	For CH_4 emissions from oil transport (category 1.B.2.a.iii.3), correct the EF units and revise the emission estimates.	Not resolved. The AD in CRF table 1.B.2 for category 1.B.2.a.3 (oil – transport) are reported as Mt but should be reported as m^3. During the review, the Party clarified that this issue was resolved and referred to table 3-91 (NIR section 3.8.3.4, p.3-128). The EF for CH_4 in this table is given as 5.4×10^{-3} kg/1,000 m^3 crude.
			The ERT concludes that the same compilation error that was noted in ARR 2020 has occurred again. The AD in CRF table 1.B.2 for category 1.B.2.a.3 (transport – crude consumption) should have been reported in m^3; however, Portugal used Mt as the unit by mistake. The ERT noted that the error did not impact the emission estimates, which are reported correctly.
			To resolve this issue, the Party must use the correct units for the EF and conduct a specific QC check during the compilation of the inventory to ensure that the units of EF associated with CH_4 emissions from oil transport have been reported correctly.
E.18	1.B.2.a Oil – gaseous fuels – CO_2 (E.36, 2020) Transparency	Include in the NIR an explanation of the effect of hydrogen production units from Sines refinery on the reported emissions for the entire time series.	Resolved. The Party explained in its NIR (section 3.8.3.5.4.3, p.3-134) the time-series change from 2013 onward, namely that fuel consumption increases significantly owing to the entry into full operation of the new hydrocracking unit in 2013. This explains the effect of hydrogen production units from Sines refinery on the reported emissions for the entire time series.
E.19	1.B.2.c Venting and flaring – gaseous and liquid fuels – CO_2 and CH_4 (E.37, 2020)	Clarify in the NIR that venting activities do not occur in the country.	Resolved. Portugal added a statement to its NIR (section 3.8.5.1, p.3-142) saying that venting activities do not occur in Portugal and changed the title of section 3.8.5 to state explicitly that it covers venting in the NIR.

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	Transparency		
E.20	1.B.2.c Venting and flaring – gaseous and liquid fuels – N_2O (E.38, 2020) Transparency	Explain in the NIR the methodology used to estimate N_2O emissions from flaring for category 1.B.2.c.2.i (flaring – oil).	Resolved. The methodology used to estimate N_2O emissions from flaring for category 1.B.2.c.2.i (flaring – oil) is described in the NIR (section 3.8.5.2, p.3-142).
E.21	1.B.2.c Venting and flaring – gaseous and liquid fuels – CO_2, CH_4 and N_2O (E.39, 2020) Comparability	Reallocate the emissions from combustion of waste gases from the petrochemical industry from category 1.B.2.c flaring (gas) to category 1.A.2.c (chemicals).	Resolved. In CRF table1.B.2, the Party reported "NO" for all GHGs in category 1.B.2.c (flaring – gas). The ERT notes the emissions in subcategory 1.A.2.c (chemicals) have increased with respect to the emissions reported in 2020, and now include the reallocated emissions for category 1.B.2.c flaring (gas).
E.22	1.B.2.d Other (oil, natural gas and other emissions from energy production) – CO_2 (E.27, 2020) (E.38, 2018) (E.46, 2016) (E.46, 2015) Transparency	Provide detailed information on the flows and operating regimes for geothermal energy production, and on how the CO_2 EFs are derived.	Not resolved. The Party has not provided the detailed information requested by the previous ERTs in section 3.8.6 of its NIR (p.3-145). During the review, the Party clarified that this issue has not been resolved. In response to a question from the ERT, Portugal reported that information received from the relevant facilities did not correspond exactly to the information requested by the Party on the flows and operating regimes for geothermal energy production, and on how the CO_2 EFs were derived. Portugal intends to contact the facilities again in order to obtain the necessary information.
E.23	1.B.2.d Other (oil, natural gas and other emissions from energy production) – gaseous and liquid fuels – CO_2, CH_4 and N_2O (E.40, 2020) Transparency	Include in the NIR additional information on the geothermal plants, including the sources of the AD, the AD used for the emission estimates and the trend in emissions since 1990.	Resolved. The Party included additional information in its NIR (section 3.8.6, pp.3-145–3-147) on the geothermal plants, including the sources of the AD, the AD used for the emission estimates and the trend in emissions since 1990.
IPPU			
I.1	2. General (IPPU) – (I.1, 2020) (I.1, 2018) (I.1, 2016) (I.1, 2015) (53, 2014) Transparency	Improve the transparency of the information on how the consistency of the time series is ensured for subcategories for which EU ETS data are used only for some years in 1990–2012.	Resolved. The Party reported in its NIR on the improvements to ensure time-series consistency and the detailed information on QA/QC process relating to time-series consistency in sections 4.2.2.2 (p.4-16), 4.2.3.4 (p.4-23), 4.2.7.4 (p.4-36), 4.2.13.4 (p.4-54) and 4.3.3.3 (p.4-60).
I.2	2. General (IPPU) – (I.2, 2020) (I.2, 2018) (I.2, 2016) (I.2, 2015) (54, 2014) (39, 2013) Transparency	Include information in the NIR on specific QA/QC activities for industrial processes, for example for limestone and dolomite use and for glass production (reported under other mineral products), for which this information	Addressing. The Party reported in its NIR (table 10-1, p.10-11) that it included the description of the specific QA/QC activities for some categories, namely cement, iron and steel, lime in dedicated plants, and ethylene production. During the review, Portugal confirmed that this issue has not been fully addressed and stated that it will continue to improve the reporting on QA/QC activities.

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		is not currently included.	The ERT considers that the recommendation has not yet been fully addressed because the Party has not included information on QA/QC activities for all categories. For some categories such as category 2.B.1 (chemical industry – ammonia production) only a generic phrase stating that QA/QC procedures included a series of checks was provided.
I.3	2. General (IPPU) – (I.4, 2020) (I.37, 2018) Transparency	Include explanations of the checks performed to ensure time-series consistency for cement production, lime production from dedicated plants, other process uses of carbonates and lead production, where two data sources are used throughout the time series. These explanations can be included in the category-specific QC section.	Addressing. The Party reported in its NIR (sections 4.2.2.6 and 4.2.3.6) on the checks performed to ensure time-series consistency for cement and lime production only. The ERT considers that the recommendation has not yet been fully addressed because the Party continues to estimate emissions for category 2.C.5 (lead production) using several sources of AD but does not explain how time-series consistency is ensured. The ERT also noted that Portugal has not addressed ID# I.11 below and continues to report total national consumption of raw materials using extrapolation on the basis of energy consumption in ceramics reported both under the EU ETS and in the national energy balance. During the review, the Party clarified that it has begun contacting sectoral associations but has not yet collected all the data required on lead and ceramics production. The Party will report on its progress in this regard in its next annual submission.
I.4	2. General (IPPU) – all gases (I.31, 2020) Comparability	Use "NA" to report in the CRF tables the following activities that occur within the country but do not result in emissions of a specific gas: 2.D.1 lubricant use (CH_4, N_2O, nitrogen oxides, carbon monoxide, NMVOCs, sulfur dioxide); 2.D.2 paraffin wax use (CH_4, N_2O, nitrogen oxides, carbon monoxide, NMVOCs, sulfur dioxide); and 2.E electronics industry (NF_3).	Resolved. The Party reported in CRF tables 2(I)s2, 2(I).A-Hs2 and 2(II)B-Hs1 "NA" for the activities that occur within the country but do not lead to emissions of a specific gas. Changes were made in the following categories: 2.D.1 (lubricant use) and 2.D.2 (paraffin wax use) for CH_4, N_2O, nitrogen oxides, carbon monoxide, NMVOCs and sulfur dioxide, and 2.E (electronics industry) for NF_3.
I.5	2.A.2 Lime production – CO_2 (I.6, 2020) (I.7, 2018) (I.14, 2016) (I.14, 2015) Completeness	Investigate whether lime production in sugar mills and artisanal production of lime for sanitation purposes or for whitewash are potential activities and, in cases where such activities are present, provide estimates of CO_2 emissions.	Addressing. The Party reported in its NIR (section 4.2.6) information regarding lime production in sugar mills in Portugal. There are two operating units that use milk lime in their production process and only one of these produced lime from 1997 to 2008. Portugal collected data directly from this facility and included in the NIR the methodology and EFs used to estimate CO_2 emissions from lime produced at sugar mills. Regarding the artisanal production of lime, the Party noted that in 1997 there were still six or seven traditional kilns in operation in the south of the country. In 2007, only two remained and those have both now ceased work. During the review, the Party clarified that there are no available data on this production, as it referred to artisanal and traditional small kilns. For this reason, these sources are considered by the Party as negligible. Regarding lime production in sugar mills, the Party obtained data on lime production from one operating facility for 1997–2008 (when the lime kiln was operational) and made conservative CO_2 emission estimates, which were far below (max. 0.013 per cent of total national emissions for 1997–2008) the significance threshold for application of an adjustment in accordance with decision 22/CMP.1,

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			annex, paragraph 80(b), in conjunction with decision 4/CMP and therefore did not include this issue in the list of potential problems and further questions raised.
			The ERT considers that the recommendation has not yet been fully addressed because the Party has not estimated artisanal lime production using the techniques in the 2006 IPCC Guidelines (vol. 1, chap. 5.3).
I.6	2.A.2 Lime production – CO_2 (I.10, 2020) (I.38, 2018) Transparency	Check whether there are data transcription errors and confirm the correctness of the data with the facilities when large inter-annual changes in the IEFs are observed, in particular for 2009–2015.	Addressing. The Party stated in its NIR (p.4-23) that, after consultation with one of the facilities, it corrected the reporting error in the consumption of carbonates for 2010–2013. The emissions for 2010–2013 for this facility were correct and the error only affected the AD. During the review, the Party clarified that improving time-series consistency is a continuing and time-consuming process.
			The ERT considers that the recommendation has not yet been fully addressed because despite the Party having checked and corrected the information for one facility, the information on IEF variability and how the IEF was validated with the four other facilities was still missing from the NIR.
I.7	2.A.2 Lime production – CO_2 (I.32, 2020) Consistency	Clarify the CO_2 EF for lime production with the facility for which the IEF increased from 0.31 t CO_2/t carbonate in 2009 to more than 1 t CO_2/t carbonate for 2010–2013 (1.09, 1.14, 1.07 and 1.06 t CO_2/t carbonate respectively). If additional information is not obtained from the facility, ensure the time-series consistency of CO_2 emissions by using one of the splicing techniques described in the 2006 IPCC Guidelines (vol. 1, chap. 5.3.3).	Resolved. The Party reported in its NIR (p.4-23) that, after consultation with the facility, a reporting error of the consumption of carbonates for 2010–2013 was identified. The emissions for 2010–2013 for this facility are correct and the error affected only the AD. The carbonates consumption values for 2010–2013 were corrected using new information obtained from the facility, in order to improve time-series consistency for that period.
I.8	2.A.2 Lime production – CO_2 (I.33, 2020) Transparency	Include in the NIR information on the recirculation factor applied in the calculations to estimate CO_2 emissions from lime production.	Resolved. The Party reported in its NIR (p.4-22) that the recirculation factor of approximately 0.2 per cent was applied to the actual amount of carbonate-bearing materials entering lime kilns.
I.9	2.A.3 Glass production – CO_2 (I.12, 2020) (I.12, 2018) (I.11, 2016) (I.11, 2015) Transparency	Include the emission estimates for CO_2 emissions from rock wool production (under category 2.A.3 – glass production). If emissions do not occur, use the appropriate notation key ("NO") in the CRF tables and provide an explanation in the NIR for this assessment. If the emissions for any of these categories are judged as insignificant in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting	Resolved. The Party reported in its NIR (section 4.2.13, pp.4-53 and 4-55) the emission estimates for CO_2 emissions from rock wool production. Portugal clarified that there are two rock wool production plants in operation in the country, both of which have been included in EU ETS system since 2008. Rock wool from these facilities was produced solely from basalt for 1990–1996. From 1997 onward, limestone was added to the process. As the composition of basalt does not include carbonates, CO_2 process emissions from rock wool production originate only where limestone is used as a raw material. The ERT agreed with the Party's allocation of emissions from rock wool production under category 2.A.4.d (mineral industry – other process uses of carbonates – other). Portugal referred to the 2006 IPCC Guidelines (vol. 3, chap. 2.4.1, p.2.27), where

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	guidelines, use the appropriate notation key ("NE") in the CRF tables, providing a qualitative and quantitative justification in the NIR.		it is reported that if the production of rock wool is emissive, these emissions should be reported under category 2.A.5. However, since CRF tables do not include category 2.A.5 (other), the Party has reported CO_2 emissions from rock wool production under category 2.A.4.d. The ERT agrees with the allocation because the 2006 IPCC Guidelines (vol. 3, chap. 2.5.1.4, table 2.7, p.2.37) allow for the reporting of emissions from this process under category 2.A.4.d when a description of the production process is also provided. The Party provided an explanation of the allocation in its NIR in section 4.2.13.1 (p.4-53).
I.10	2.A.3 Glass production – CO_2 (I.13, 2020) (I.13, 2018) (I.19, 2016) (I.19, 2015) Transparency	Describe in the NIR the detailed methodology and assumption considered in the CO_2 emission estimates of glass production.	Resolved. The Party reported in its NIR (section 4.2.7.2) the detailed methodology of, and assumptions considered in, the CO_2 emission estimates for category 2.A.3 (glass production), noting that the splicing technique was used to estimate carbon consumption for 1990–2004. The Party no longer uses only 2005 as a reference year for backcasting, applying a ratio between the average carbonate consumption for 2005–2009 and the average glass production for 2005–2009 to the glass production for 1990–2004. In section 4.2.7.7 of its NIR, Portugal states that using the splicing technique led to a decrease of 14–20 per cent in annual CO_2 emissions.
I.11	2.A.4 Other process uses of carbonates – CO_2 (I.14, 2020) (I.40, 2018) Accuracy	Work with the data provider (the EU ETS) to improve the quality of raw material data (e.g. by contacting facilities to check for reporting errors) and use raw material data for the years for which data from the ceramics industry were collected under the EU ETS as the AD for backcasting, instead of using estimated fuel consumption data collected directly from facilities.	Not resolved. The Party continues to estimate the consumption of carbonates for 1990–2014 on the basis of energy consumption for ceramics production (NIR section 4.2.9.2, p.4-43). This energy consumption is reported both under the EU ETS and in the national energy balance.
			During the review, the Party clarified that the improvement in the quality of raw material data requires significant amounts of time and human resources. Portugal also explained that activity in the ceramics sector has been included in the EU ETS since 2012. Currently, the EU ETS coverage of the ceramics sector is limited, and approximately 38 per cent of ceramics facilities are not included. The ERT noted that the research of the European Ceramic Industry Association (Cerame-Unie) estimated the share of production of ceramics in Portugal for 2020 to be less than 2.5 per cent of all production in EU countries. Based on CO_2 emissions in category 2.A.4.a of EU countries, the total CO_2 emissions for ceramic production in Portugal is 75.44 kt CO_2 eq instead of 73.33 kt CO_2 eq reported by the country, which is an underestimation by 0.004 per cent of the national total and therefore below the significance threshold established in paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.
I.12	2.B.1 Ammonia production – CO_2 (I.16, 2020) (I.18, 2018) (I.24, 2016) (I.24, 2015) Accuracy	Review the methodology used, given that estimating CO_2 emissions based only on feedstock consumption is not in line with the 2006 IPCC Guidelines.	Resolved. The Party reported in its NIR (pp.4-56–4-60) that category 2.B.1 (ammonia production) was estimated using a tier 1 approach and default EFs from the 2006 IPCC Guidelines. Furthermore, in section 4.3.2.3 of its NIR, Portugal noted that according to the 2006 IPCC Guidelines, it is good practice to use the average EF for partial oxidation (the production process used in Portugal) when no information is available on the fuel type used in the process. Portugal has followed this guidance and as result used the total fuel requirement of 42.5 GJ/t NH_3 and CO_2 EF of 3.273 t CO_2/t NH_3 sourced from the 2006 IPCC Guidelines (vol. 3, chap. 3.2.2.2, table 3.1).

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			The ERT concluded that this accuracy issue has been resolved; however, it identified a new accuracy issue with the application of a tier 1 approach for estimation of CO_2 emissions from vinyl chloride monomer production (see ID# I.25 in table 5).
I.13	2.B.2 Nitric acid production – N_2O (I.34, 2020) Consistency	Clarify the N_2O IEF for nitric acid production with the facility for which the N_2O IEF increased sharply in 2013, noting that the actual data are confidential and cannot be reported in the NIR. If additional information from the facility is not obtained, ensure the time-series consistency of N_2O emissions by using one of the splicing techniques described in the 2006 IPCC Guidelines (vol. 1, chap. 5.3.3).	Resolved. The Party reported in its NIR (section 4.3.3.3) additional information obtained directly from four facilities. Portugal noted that the variation in emissions is a result of the variation in nitric acid production and depends on operating conditions. The sharp decrease in N_2O emissions in 2009–2010 corresponds with the introduction of N_2O abatement at two of the facilities (facilities 3 and 4).
			During the review, the Party provided the ERT with the calculation sheet for estimating emissions for category 2.B.2 (nitric acid production). The Party also clarified that, after consultation with the facility (facility 2) where two different sources of information for the EF were used, namely pollution release and transfer register monitoring data for 2010–2012 and the EU ETS for 2013 onward, it revised EFs for 2010–2012 for this facility on the basis of the average EU ETS N_2O EFs for 2013–2017. Following further QA/QC procedures for the sector, and owing to a lack of data, Portugal revised the N_2O EFs for another facility (facility 1) and used a default tier 1 EF from table 3.7 of the best available reference documents for the Production of Large Volume Organic Chemicals (Brinkman et al., 2018) for medium/high pressure nitric acid facilities.
			The ERT has studied the calculations used by the Party to estimate emissions category 2.B.2 (nitric acid production) and has concluded that the recommendation has been fully addressed.
I.14	2.C.1 Iron and steel production – CO_2 (I.23, 2020) (I.31, 2018) (I.34, 2016) (I.34, 2015) Transparency	Include information on the types of fuel used for the CO_2 emission estimates and how CO_2 emissions are allocated (for 2002 onward) between categories 2.C.1 and 1.A.2.a.	Resolved. The Party reported in NIR table 4-39 information on the allocation of emissions by process in the iron and steel industry for all years of the time series. Detailed descriptions of the types of fuel used for the CO_2 emission estimates and how CO_2 emissions are allocated between categories 2.C.1 (metal industry – iron and steel production) and 1.A.2.a (manufacturing industries and construction – iron and steel) are reported in NIR sections 4.4.2.1–4.4.2.2. The ERT concluded that this issue has been fully addressed.
I.15	2.C.1 Iron and steel production – CO_2 (I.24, 2020) (I.32, 2018) (I.35, 2016) (I.35, 2015) Completeness	Estimate emissions from the use of limestone and dolomite and report these estimates under category 2.C.1.	Not resolved. The Party reported in its NIR (p.4-28) that all limestone and dolomite were used for lime production and that there were no other uses for limestone or dolomite in the iron and steel facility. Portugal continues to report CO_2 emissions only from lime production in iron and steel. During the review, the Party clarified that the iron and steel facility producing lime from limestone and dolomite has informed the Party that it does not possess the information needed by the inventory team, as another company owned the facility for 1990–2001 and that company no longer exists.
			The ERT considers that the recommendation has not yet been addressed because the Party has not collected sufficient AD or estimated CO_2 emissions from the use of limestone and dolomite for purposes other than lime production, for example, limestone consumed as a flux. The ERT also noted that if half of the limestone/dolomite used for

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			lime production were to be used as flux in steel production, the difference in emissions from limestone and dolomite would equate to 0.01 per cent of the national total emissions in 2020, which is below the significance threshold established in paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.
I.16	2.D.3 Other (non-energy products from fuels and solvent use) – CO_2 (I.35, 2020) Comparability	Report all indirect CO_2 emissions from solvent use as indirect CO_2 emissions in CRF table 6 only, without reporting those emissions in CRF tables 2(I)s2 and 2(I).A-Hs2. In addition, specify and explain in the NIR the activities leading to the indirect CO_2 emissions reported in CRF table 6.	Addressing. The Party reported in its NIR (pp.4-91, 4-92, 9-1 and 9-2) that it continues to report indirect CO_2 emissions for categories 2.D.3.a (solvent use) and 2.D.3.b (road paving with asphalt) as direct emissions in CRF table2(I).A-Hs2. The Party clarified in the NIR that such reporting was agreed among EU countries to ensure consistency between Kyoto Protocol commitment periods. EU member States, including Portugal, reported indirect CO_2 emissions for this category in inventory submissions before 2015 (first commitment period) previously reported in CRF table 3 (sectoral report for solvents and other products use). For the second commitment period and in order to ensure consistency with 2006 IPCC Guidelines and with previous submissions, countries should continue reporting these emissions in the same manner. During the review, the Party confirmed that this reporting is not in line with the 2006 IPCC Guidelines. Nevertheless, the inventory team has attempted to improve the transparency of the reporting of the indirect emissions by further clarifying the situation in the following NIR sections: 4.2.3.1, 4.2.8.1, 4.3.1, 4.3.7.1, 4.3.10.1, 4.3.11.1, 4.3.14.1, 4.3.15, 4.3.19, 4.4.2.1, 4.5.1, 4.5.4, 4.5.5.1, 4.9.1, 4.9.3–4.9.5 and 9.

The ERT considers that the recommendation has not yet been fully addressed because the Party has not included all indirect CO_2 emissions in CRF table 6 only, without reporting those emissions in CRF tables 2(I)s2 and 2(I).A-Hs2. |
| I.17 | 2.E.1 Integrated circuit or semiconductor – HFCs, PFCs, SF_6 and NF_3 (I.27, 2020) (I.34, 2018) (I.11, 2016) (I.11, 2015) Transparency | Include the estimates for HFCs, PFCs, SF_6 and NF_3 emissions from integrated circuits or semiconductors (category 2.E.1). If emissions do not occur, use the appropriate notation key ("NO") in the CRF tables and provide an explanation in the NIR for this assessment. If the emissions for any of these categories are judged as insignificant in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines, use the appropriate notation key ("NE") in the CRF tables, providing a qualitative and quantitative justification in the NIR. | Addressing. The Party reported emissions for category 2.E.1 (integrated circuit or semiconductor) as "NE". In NIR section 4.6.2, Portugal provided information about the national company that provides wafer-level fan-out semiconductor packaging solutions. During the review, the Party clarified that this company is only a packaging and assembling facility for semiconductor encapsulation and its production activity does not lead to emissions of F-gases.

The ERT considers that the recommendation has not yet been fully addressed because the Party has not included in NIR section 4.6.2 the information provided during the review and change the notation key "NE" to "NO" in the corresponding CRF tables. |
| I.18 | 2.E.2 Thin-film transistor flat panel display – PFCs, SF_6 and NF_3 (I.28, 2020) (I.35, 2018) | Include the estimates for PFCs, SF_6 and NF_3 emissions from thin-film transistor flat-panel displays (category 2.E.2). If emissions do not occur, use the appropriate notation key | Not resolved. The Party reported in CRF tables 2(I)s2, 2(II) and 2(II)b-Hs1 emissions for category 2.E.2 (thin-film transistor flat-panel display) as "NE". The Party did not justify that the emissions for this category do not occur in the country or present a calculation demonstrating that these emissions are insignificant. During the review, |

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	(I.11, 2016) (I.11, 2015) Completeness	("NO") in the CRF tables and provide an explanation in the NIR for this assessment. If the emissions for any of these categories are judged as insignificant in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines, use the appropriate notation key ("NE") in the CRF tables, providing a qualitative and quantitative justification in the NIR.	Portugal informed the ERT that regardless of the efforts made, no evidence of the occurrence of activities under the category 2.E.2 (thin-film transistor flat-panel display) was found. The Party is unaware of any thin-film transistor flat-panel display production in Portugal but will investigate this issue further and report on its progress in its next annual submission. The ERT concluded that the recommendation has not yet been addressed because the Party has not included in NIR section 4.6.3 the information provided during the review and change the notation key "NE" to "NO" in the corresponding CRF tables.
I.19	2.E.3 Photovoltaics 2.E.4 Heat transfer fluid – HFCs, PFCs and SF_6 (I.36, 2020) Transparency	Complete research on the occurrence of activities under categories 2.E.3 and 2.E.4 in the country since 1990 and report AD and emissions as "NO" if an activity has not occurred, or, if corresponding activities occur in the country, either estimate and report AD or emissions, or, if considered insignificant, report them as "NE" and demonstrate that the likely level of emissions is below the significance threshold established in paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.	Addressing. The Party reported emissions for categories 2.E.3 (photovoltaics) and 2.E.4 (heat transfer fluid) as "NE". In its NIR (section 4.6.4, p.4-93) the Party clarified that a joint-venture facility for photovoltaic cell production and distribution had been due to open but became insolvent before it was fully developed. Portugal also reported that a solar panel facility was in operation in the country for 2008–2018. During the review, Portugal clarified that the annual capacity production of that facility was around 90,000 mono- and polycrystalline silicon photovoltaic modules each year (Fischer, /2009), which corresponds to an area of 270,000 m^2 of cells, assuming average dimensions of large photovoltaic modules. Adopting a conservative approach and on the basis of default data from the 2006 IPCC Guidelines using the EFs for photovoltaic cells from (vol. 3, chap. 6.2.2.1, table 6.2), the total emissions for each operating year were estimated as 10.6 kt CO_2 eq. The level of emissions is below 0.05 per cent of national total emissions (28.83 kt CO_2 eq in 2020), so these emissions can be considered as insignificant. Concerning heat transfer fluid, the Party continued to report in the NIR (section 4.6.5) that it is unaware of any heat transfer fluid consumption in Portugal. During the review, Portugal contacted its focal point for management of F-gases which further confirmed that there is no heat transfer fluid consumption in Portugal. The ERT considers that the recommendation can be fully addressed if the Party includes the information provided during the review in NIR section 4.6.4 and report AD and emissions as "NO" for category 2.E.4.
I.20	2.F Product uses as substitutes for ozone-depleting substances – HFCs, PFCs and SF_6 (I.29, 2020) (I.36, 2018) (I.37, 2016) (I.37, 2015) Transparency	Explain how the estimates for categories 2.F.1–2.F.4 are calculated, including detailed information on the AD and EFs used and their sources.	Resolved. The Party provided in its NIR an explanation for the estimates for categories 2.F.1–2.F.4, including detailed information on the AD and EFs used. The Party also included in its NIR (sections 4.7.2–4.7.7) detailed information on the sources of the EFs used for categories 2.F.1–2.F.4.
I.21	2.F.1 Refrigeration and air conditioning – HFCs and PFCs (I.37, 2020)	Explain in the NIR the HFC and PFC composition of the blends used in refrigeration and air-conditioning equipment in the country.	Addressing. The Party reported in its NIR (pp.4-100, 4-122 and 4-125) that the composition of the blends used for estimating emissions from all refrigeration and air-conditioning subapplications are those provided in the 2006 IPCC Guidelines (vol. 3, chap. 7, table 7.8). However, the ERT noted that some blends that the Party uses in

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	Transparency		commercial and domestic refrigeration equipment are not included in the table 7.8, namely R-422D, R-427A, R-434A and R-437A. During the review, the Party clarified that the composition and the global warming potential of the blends used were obtained from the Portuguese Environment Agency and shared with the ERT. Portugal plans to include this information in its next submission.
			The ERT considers that the recommendation can be fully addressed if the Party includes the information provided during the review in its NIR.
I.22	2.F.1 Refrigeration and air conditioning – HFCs and PFCs (I.38, 2020) Transparency	Include the equation used to calculate the bank of gases in use by gas and application, specifying the assumptions made regarding the gas composition of the bank and the Party's source of information.	Resolved. The Party included in its NIR (sections 4.7.2.2, 4.7.3.2, 4.7.4.2 and 4.7.5.2) the equation used to calculate the bank of gases in use by gas and application as well as information on gas composition of the bank and the source of that information.
I.23	2.F.3 Fire protection – HFCs (I.39, 2020) Transparency	Replace equation 4-69 of the NIR with the equations used when estimating the bank of gases in use, operating emissions and disposal emissions, in line with the tier 2a approach provided in the 2006 IPCC Guidelines (vol. 3, chap. 7, equation 7.4) for estimating emissions from fire protection.	Resolved. The Party has replaced in its NIR (pp.4-131–4-132) a single equation, equation 4-69, with multiple equations, equations 4-69–4-72. These equations are used to estimate the bank of F-gases in each year (equation 4-70), emissions during their lifetime (equation 4–69), emissions from disposal (equation 4-71) and amount of F-gas in equipment at disposal (equation 4-72).
			The ERT considers that the recommendation has been addressed and the methodology provided is in line with the tier 2a approach of the 2006 IPCC Guidelines (vol. 3, chap. 7, equation 7.4).
Agriculture			
A.1	3.A Enteric fermentation – CH_4 (A.2, 2020) (A.8, 2018) Convention reporting adherence	Make efforts to provide and improve the uncertainty of the DE% estimates for dairy cattle and report the results of those efforts in the NIR.	Resolved. The Party provided clarification on the uncertainty assessment of DE% estimated for dairy and non-dairy cattle in NIR section 5.2.5, stating that the calculation was based on the results of a chemical and nutritional analysis of each food component of the diet of cattle carried out by experts from the National Institute for Agricultural and Veterinary Research specializing in chemical and nutritive evaluation of animal feed, and on the expert judgment on nutrition and animal production provided by experts from the National Institute for Agricultural and Veterinary Research and the University of Évora, which covered the food components of diets of dairy and non-dairy cattle. Portugal calculated the uncertainties using the error propagation approach from the 2006 IPCC Guidelines (vol. 1, chap. 3.2.3.1) and used equations 3.1–3.2 to combine the uncertainties of food components with their proportion in each diet.
A.2	3.A Enteric fermentation – CH_4 (A.5, 2020) Convention reporting adherence	Correct the ratio of net energy available in diet for maintenance to digestible energy consumed value for 2017 in NIR table 5.5 from 0.53 to 0.54.	Resolved. The Party reported the correct value of 0.54 in NIR table 5-5 (p.5-17).
A.3	3.A.1 Cattle – CH_4	Justify in the NIR the CH_4 EF used for dairy	Resolved. The Party included a justification for the use of 134.93 kg CH_4/head/year in

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	(A.6, 2020) Transparency	cows (130.5 kg CH$_4$/head/year) by comparing milk production per cow in the country with the milk production and default CH$_4$ EFs for different regions included in the 2006 IPCC Guidelines (vol. 4, chap. 10, table 10.11).	its NIR (p.5-18) and indicated in footnote 11 (p.5-18) that average dairy milk production in Portugal is 8,600 kg/head/year, which is closer to average milk production in North America (8,400 kg/head/year) and higher than the average milk production in Western Europe (6,000 kg/head/year). This informed the use of the EF of 130.5 kg CH$_4$/head/year, which was closer to the default EF of 128 kg CH$_4$/head/year for North America.
A.4	3.B Manure management – CH$_4$ (A.3, 2020) (A.9, 2018) Transparency	Revise NIR table 5.25 and explain in the NIR that the country-specific manure management lagoon systems and tanks/earthen ponds correspond to the categories liquid/slurry with and without natural crust cover in the 2006 IPCC Guidelines respectively.	Addressing. In NIR table 5-24, the Party provided the 2006 IPCC Guidelines equivalent to the national MMS classification. However, there was no additional information or description of the lagoon system or tanks/earthen ponds that could establish their correspondence with the categories liquid/slurry with and without natural crust cover as described in the 2006 IPCC Guidelines. During the review, the Party clarified that the definition it uses for lagoon systems is taken from table 3.13 of volume 3.B (manure management) of the EMEP/EEA guidebook 2019: storage with a large surface area to depth ratio; normally shallow excavations in the soil. The terms 'lagoon' and 'tank/earth ponds' are commonly used in Portugal for liquid/slurry manure storage, namely manure that is stored as excreta or with a minimal addition of water outside the animal housing, usually for periods of less than one year (2006 IPCC Guidelines definition). There are no country-specific MMS, but only national classifications aligned with the terms and definitions of both the 2006 IPCC Guidelines and the EMEP/EEA guidebook 2019, in order to ensure coherence, accuracy and completeness of national emission estimates in both inventories. The ERT considers that the recommendation has not yet been fully addressed because the Party has not provided references to the sources that informed its description of the MMS and their alignment to the 2006 IPCC Guidelines categories.
A.5	3.B.5 Indirect N$_2$O emissions – N$_2$O (A.8, 2020) Accuracy	Estimate indirect N$_2$O emissions from MMS due to leaching and run-off by using a tier 2 approach, in accordance with the 2006 IPCC Guidelines (vol. 4, chap. 10, figure 10.4), and by developing a value for the fraction of managed manure N losses due to leaching and run-off on the basis of country-specific data on N run-off and leaching from MMS.	Resolved. The Party reported in its NIR (section 5.5.2.4, p.5-57) that the country has no specific value for N fraction leached into soil from liquid/slurry and solid storage manure. The national legislation requires that liquid/slurry manure is stored in containers with a waterproof bottom, of concrete or a similar material, and uses a leachate collection system. Manure heaps near fields that are intended for spreading are, however, permitted for a limited time after storage. Leaching of N during manure management is thus restricted to those manure heaps after storage. On the basis of this information, the fraction leached is assumed to be 1 per cent, the lower boundary of the typical range in the 2006 IPCC Guidelines. During the review, the Party provided documentation containing the equation used and calculations for N leached from solid storage.
A.6	3.D.a Direct N2O emissions from managed soils – N$_2$O (A.7, 2020)	Correct the value for direct N$_2$O emissions from managed soils for 2018 in NIR table 5-38 to match the values reported in CRF table 3.D.	Not resolved. The Party did not correct the value for direct N$_2$O emissions from managed soils for 2018 in NIR table 5-37 (table 5-38 in the 2020 NIR). During the review, the Party clarified that the typographical error in the value for 2018 had not been corrected. The Party provided the correct value as 5.84 in a calculation file; this value

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	Convention reporting adherence		corresponds to the value in CRF table 3.D while the value in NIR table 5-37 was 5.
A.7	3.D.b.1 Atmospheric deposition – N_2O (A.9, 2020) Accuracy	Revise the estimates of indirect N_2O emissions due to volatilization/ atmospheric deposition of N added to soils reported in the CRF tables and explain the recalculation in the NIR.	Resolved. The ERT checked the 2021 NIR and confirmed that the Party has revised the estimates of indirect emissions owing to volatilization/ atmospheric deposition of N added to soils and reported the recalculation in the NIR. During the review, the Party confirmed that the recommendation was implemented and reported in its 2021 NIR. The Party indicated that the formula error in the calculation file was corrected following the last annual review.
A.8	3.D.b.1 Atmospheric deposition – N_2O (A.10. 2020) Accuracy	Report the correct value of $Frac_{GASM}$ (0.1027) for 2018 in NIR table 5-47 and CRF table 3.D, revise the associated N_2O emissions and explain the recalculation in the NIR.	Resolved. There is consistency in the time series between the NIR and CRF table 3.D, as the Party reported a value of $Frac_{GASM}$ for 2018 in NIR table 5-47 (0.132) and in CRF table 3.D. During the review, the Party clarified that the recommendation was implemented in its 2021 submission. The value of $Frac_{GASM}$ provided in NIR table 5-24 and in CRF table 3.D are now consistent. Information on recalculations was provided in section 5.6.4 of the 2021 NIR. The ERT checked table 5-46 (p.5-67) and section 5.6.4 (p.5-70) of the 2021 NIR submission and corroborates the response from the Party.
A.9	3.D.b.2 N leaching and run-off – N_2O (A.11, 2020) Transparency	Revise the indirect N_2O emissions and the fraction leached from N sewage sludge applied to soils reported for 2018 for this category in the NIR and CRF table 3.D and explain the recalculation in the NIR.	Not resolved. In the current submission, indirect N_2O emissions due to N leaching and run-off for 2018 were overestimated by about 0.295 kt CO_2 eq (0.0004 per cent of total emissions excluding LULUCF), as there was an error in calculating the fraction leached from N sewage sludge applied to soils in that year. During the review, the Party clarified that the recommendation was implemented in the 2021 NIR, along with other recalculations that occurred in this source category (2021 NIR, section 5.6.4) and that it was stated in the 2021 NIR (p.5) that the differences between the 2020 and 2021 submissions are mainly due to the change in the N_2O emission factor for N fertilizer applications in rice fields, following AD for 2020 from the EU Effort Sharing Decision review; to the change of the N fraction leached from manure management systems, which lead to more available manure for application; to the update of the NH_3 emission factors, manure application and grazing, included in the EMEP/EEA guidebook 2019.

LULUCF

ID#	Issue/problem classification[a, b]	Recommendation from previous review report	ERT assessment and rationale
L.1	4. General (LULUCF) – CO_2, N_2O and CH_4 (L.1, 2020) (L.2, 2018) (L.15, 2016) (L.15, 2015) Transparency	Revise the MAI and other relevant AD (e.g. the country-specific definition of important variables such as MAI and wood volume, the methodology on how the MAI is defined) and provide all methodological updates as soon as the NFI6 is officially published, in accordance with the 2006 IPCC Guidelines.	Addressing. The Party reported in its NIR section 6.1.3.1.1 (p.6-22) revised carbon stocks from the NFI6 and updated annual increments by forest type. Average growth rates were obtained by expert judgment and were assumed to be constant throughout the reporting period. The ERT considers that the recommendation has not yet been fully addressed, since the parameter MAI (on NIR p.6-31) is not clearly defined in the NIR. The description of the methodology for estimating biomass gains in forest land remaining forest land (p.6-31) does not make it clear whether or not equations 6-14 and 6-15 (both on p.6-31) were applied at the level of forest type or individual species (in mixed forests), and for equation 6-15, which parameter values were used.

ID#	Issue/problem classification[a, b]	Recommendation from previous review report	ERT assessment and rationale
L.2	4. General (LULUCF) – CO_2, N_2O and CH_4 (L.2, 2020) (L.11, 2018) Transparency	Analyse and transparently report the reasons which led to the significant inter-annual fluctuations in net emissions in the LULUCF sector, including for forest land and settlements.	Resolved. The Party reported in its NIR (section 6.1.1, p.6-6) that the main contributors to the observed inter-annual variations in the LULUCF sector are wildfires and this is supported by the estimates for annual burned areas (figure 6-36, p.6-53). During the review, the Party also clarified that all emission and removal estimates have been revised and that the main inter-annual variations are linked to differences in land-use change over time and differences in annual burned area for each land-use type.
L.3	4. General (LULUCF) – (L.3, 2020) (L.12, 2018) Comparability	Complete CRF table summary 3s2 for all LULUCF categories and provide transparent information in the NIR on the descriptions, references and sources of information for the methodologies and EFs, as well as an indication of the level of complexity (i.e. tier) applied at the land-use subcategory and pool level.	Addressing. There are still categories in CRF table summary3s2 for which the Party has not included information on the methods and EFs used (settlements and other land). During the review, the Party provided a revised CRF table summary3s2 containing information on tier levels for methods and EFs used in LULUCF. The Party stated that this will be included in its next annual submission.
L.4	4. General (LULUCF) – (L.4, 2020) (L.13, 2018) Convention reporting adherence	Carry out a significance analysis to determine which carbon pools and subcategories are significant in each key category on the basis of the 2006 IPCC Guidelines (vol. 1, chap. 4.2, and vol. 4, chap. 1.3), and provide in the NIR detailed information on the results of this analysis.	Not resolved. The Party reported in its NIR table 10-1 (p.10-24) that the recommendation has not yet been implemented. During the review, the Party clarified that it intends to implement a significance analysis to determine which carbon pools and subcategories are significant in each key category and report the results in its next annual submission.
L.5	4. General (LULUCF) – (L.5, 2020) (L.15, 2018) Transparency	(a) Revise the land-use classification scheme so that the land category other land includes only land without significant carbon stocks and land areas that do not fall within any other land-use category; (b) Reallocate shrubland to the appropriate land-use category in line with national land-use definitions (e.g. under forest land, grassland or cropland), reconstruct the land-use matrix accordingly and report the associated GHG emissions and removals from shrubland in the respective land-use category; (c) Report on the impact of this reallocation on the associated emissions and removals in the land-use categories affected, namely grassland and, if necessary, forest land and cropland.	Addressing. The category other land includes land areas that do not fall within any other land-use category, and also natural or man-made land-use change transitions to or from oceans. The areas identified in NIR table 6-1 (p.6-8) include only those without significant carbon stocks. The Party reported in its NIR table 6-1 (p.6-8), and the ERT confirmed, that shrubland has been allocated to the grassland category and the land-use change matrix has been revised accordingly. The Party states in its NIR (p.6-57) that one of the reasons for recalculations was reallocation of shrublands from other land to the grasslands category. The ERT noted that quantitative information on the impact of this reallocation is documented in the NIR.

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L.6	4. General (LULUCF) – CO_2 (L.7, 2020) (L.17, 2018) Completeness	Estimate and report the carbon stock changes in the SOM pool by applying, as a minimum, the tier 1 methodology from the 2006 IPCC Guidelines (vol. 4, chaps. 2.3.3, 4.3.3, 5.3.3, 6.2.3 and 6.3.3) for settlements converted to forest land, grassland and settlements converted to cropland, grassland remaining grassland before 2008, and cropland and settlements converted to grassland.	Resolved. The Party reported in CRF tables 4.A–4.E soil carbon changes for areas undergoing transition periods in all land-use categories, including those involving settlements. However, during the review, the Party stated that data on soils will need to be further examined based on the Land Use/Cover Area frame Surveys for 2015 and 2018 and it plans to conclude this exercise for its next annual submission.
L.7	Land representation – (L.8, 2020) (L.18, 2018) Accuracy	Provide detailed information on the technical specifications of the maps used for land representation, the classification protocol followed to ensure consistency over time, the QC protocol, the response design and the results of the accuracy assessment.	Addressing. The Party reported in its NIR section 6.1.2.3.1 (pp.6-9–6-12) new and revised land-use information that had been used in the calculations. The ERT considers that the recommendation has not yet been fully addressed because the Party has not yet provided the additional information stipulated in the recommendation in the NIR.
L.8	Land representation – (L.9, 2020) (L.19, 2018) Accuracy	Revise the assumption of constant areas for wetlands, settlements and other land between 1970 and 1994, taking into account any updated information from the new land-use map of the Portuguese Directorate-General for Territory (for 1990, 1995, 2007, 2010 and 2015).	Addressing. The Party reported in its NIR section 6.1.2.3.2 (pp.6-12–6-15) that the areas for settlements and flooded areas in 1970 have been estimated on the basis of the trend for 1995–2018 period. However, for other land and natural wetlands (excluding flooded areas) the area was assumed to have remained constant for 1970–1995.
L.9	Land representation – (L.10, 2020) (L.19, 2018) Accuracy	Use the available updated land cover information for Madeira from the Coordination of Information on the Environment programme and use the same data sources for the Azores to enhance consistency in the land representation between the two archipelagos' units.	Resolved. The ERT considers that the recommendation has been addressed because the Party reported in its NIR section 6.1.2.4 (pp.6-15–6-17), and the ERT confirmed, that updated land cover information and the same data sources have been used for the autonomous regions of the Azores and Madeira.
L.10	Land representation – (L.11, 2020) (L.20, 2018) Accuracy	Correct the inconsistencies with regard to the areas of the different categories of land use and land-use change and revise the GHG emissions and removals by: (a) Ensuring that, for all years and all land-use categories, the values reported in CRF table 4.1 in the "Final area" row in year X-1 equal the values in the "Initial area" column in year X; (b) Ensuring that, for all years and all land-	Addressing. The Party reported in its NIR (p.10-26) and also stated during the review that all area values for land-use and land-use changes have been revised and inconsistencies no longer occur. The ERT confirmed that the Party has resolved most of the inconsistencies with regard to the areas of the different categories of land use and land-use change: (a) Resolved. The Party corrected inconsistencies in the values reported in CRF table 4.1, ensuring that the values reported in the "Final area" row in year X-1 equal the values in the "Initial area" column in year X; (b) Not resolved. The ERT noted that the values reported in CRF table 4.1 in the "Final area" row in year X for wetlands do not equal the total wetlands area in the CRF table

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		use categories, the values reported in CRF table 4.1 in the "Final area" row in year X for each land-use category equal the values in the background CRF tables 4.A–4.F for the total area of the respective land-use category for the same year X;	4.D for the same year X;
			(c) Resolved. The Party correctly calculated the cumulative area reported for land remaining under the same land use;
			(d) Resolved. The Party explained in its NIR (p.6-56) that the recalculations were a result of the revision of land-use and land-use change data.
		(c) Ensuring that, for all years and all land remaining under the same land-use category, the cumulative area reported and taken into account in the estimation of the carbon stock changes and associated emissions and removals also appropriately takes into account the annual land-use conversions from a land-use category and the annual areas converted to that land-use category 20 or more years before;	
		(d) Explaining in the NIR the reasons for recalculating the associated GHG emissions and/or removals as a result of the revision of the land transition matrix.	
L.11	4.A Forest land – AD (L.12, 2020) (L.3, 2018) (L.16, 2016) (L.16, 2015) Transparency	Provide more transparent information on the reasons for the large differences in NIR tables 6.11 and 6.12 (information on volumes per hectare) and on the relationship between the biomass volume and the MAI calculation.	Resolved. The Party included the latest national forest inventory (NFI6, representative year is 2015) and provided update information on MAI and total forest carbon stock in the NIR (table 6-3, p.6-22) in the 2022 submission. According to the NIR (p.6-22), the growth rates were obtained using expert opinion, which was considered to reflect the current and past forest situation of the Party. However, the past GHG inventory only provided the biomass volumes up to NFI5, representative year is 2005, and so a significant difference was observed. The ERT notes that the inclusion of NFI6 improved the consistency between the biomass volume and MAI calculation and so it considers that the recommendation has been fully addressed.
L.12	4.A Forest land – CO_2 (L.13, 2020) (L.21, 2018) Transparency	Include detailed information on the differences between the NFIs and the land-use map of the Portuguese Directorate-General for Territory for the forest land area, along with a justification for these differences and the reasons that led to the choice of the data source for the forest land area.	Not resolved. The Party reported in its NIR table 10-1 (p.10-26) that it has not yet implemented the recommendation.
L.13	4.A Forest land – CO_2 (L.14, 2020) (L.22, 2018)	Establish a system for data collection on fuelwood gathering in order to collect the necessary information for estimating losses	Not resolved. The Party reported in its NIR section 6.2.1.2.2 (p.6-33) that there are no statistics available for harvesting for other wood use (domestic use of biomass for energy and thinning with no industrial use). The volumes associated with this harvesting

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	Accuracy	from living biomass and report on any updates on this matter in the NIR.	are adjusted so that changes in total stocks in the NFI match the sum of gains and losses in the equivalent period.
			The ERT considers that the recommendation has not been fully addressed because the Party has not established a system to collect data from fuelwood gathering.
L.14	4.A Forest land – CO_2 (L.15, 2020) (L.23, 2018) Accuracy	Provide detailed information on the scope and phases of the NFI6 in the NIR, including any updates with regard to the module/phase on the evaluation of SOC.	Addressing. The Party reported in its NIR table 10-1 (p.10-26) that NFI6 has been completed but the soil module was not implemented.
L.15	4.A.1 Forest land remaining forest land – CO_2 (L.16, 2020) (L.4, 2018) (L.6, 2016) (L.6, 2015) (80, 2014) Accuracy	Complete the NFI6 to report updated estimates based on the new inventory information, for example for changes in forest areas caused by site fertility, the average volume per hectare and average MAI data.	Resolved. The Party reported in its NIR table 10-1 (p.10-26), and the ERT confirmed, that NFI6 was implemented and provided updated estimations of carbon stock changes in forest land (except for soil, see ID# I.14 above) using NFI6 information in NIR table 6-3 (p.6-22) and CRF table 4.A.
L.16	4.A.1 Forest land remaining forest land – CO_2 (L.17, 2020) (L.5, 2018) (L.8, 2016) (L.8, 2015) (87, 2014) Transparency	For losses from living biomass that now include loss types as well as the estimation of natural mortality, include an explanation of the expert judgments used for the methodology and validate the expert judgments or replace them with specific measurements.	Resolved. The Party reported in its NIR table 10-1 (p.10-26) that a new methodology was introduced that avoids the use of expert judgment and reported recalculated carbon loss estimation in living biomass pool in CRF table 4.A.
			The ERT notes that the original issue raised in the annual review report for 2014 concerned the appropriateness of the expert judgment that used NFI5 data. As the NFI6 was reflected in the carbon loss estimation in living biomass pool, the ERT considers the issue to be no longer relevant as expert judgment is no longer used.
L.17	4.A.1 Forest land remaining forest land – CO_2 (L.18, 2020) (L.6, 2018) (L.10, 2016) (L.10, 2015) (88, 2014) Transparency	For the loss type other wood use, explain the respective expert judgment used for the assumption and validate the expert judgment, or replace it with specific measurements.	Resolved. The Party reported in its NIR (p.10-26) that a new methodology was introduced that resolves this issue and reported recalculated carbon loss estimation in living biomass pool in CRF table 4.A which no longer requires expert judgment.
L.18	4.A.1 Forest land remaining forest land – CO_2 (L.19, 2020) (L.24, 2018) Transparency	Include in the NIR information on the justification of the expert judgment applied to estimate the MAI values reported in NIR table 6.10 and an explanation stating that these MAI values do not include loss due to mortality.	Addressing. The Party explained in its NIR (p.10-27) that the recommendation was implemented and that the GHG inventory and NFI are now consistent. In its NIR, Portugal provided the growth rate, which is also applicable as MAI, in table 6-3 and explained (p.6-22) that growth rates were obtained by expert opinion, involving a number of experts from forest authorities, forest owner organizations and forest companies, and were assumed to be constant throughout the reporting period.
			The ERT considers that the recommendation has not yet been fully addressed because the Party has not included in its NIR information on the justification of the expert judgment applied to estimate the MAI values and an explanation that these MAI values

ID#	Issue/problem classification[a, b]	Recommendation from previous review report	ERT assessment and rationale
			do not include loss due to mortality.
L.19	4.A.1 Forest land remaining forest land – CO_2 (L.20, 2020) (L.25, 2018) Accuracy	(a) Include detailed information on how the country-specific BCEF values were derived; (b) Demonstrate that applying the same country-specific average BCEF values to growing stock, net annual increment and wood removals ensures that CO_2 removals and emissions are neither over- nor underestimated, using NFI information. Alternatively, apply the country-specific BCEF values to the growing stock and apply IPCC default BCEF values to net annual increment and wood removals.	Resolved. The Party reported in its NIR (pp.6-22 and 10-27), and the ERT confirmed, that the Party used the default BCEFs from the 2006 IPCC Guidelines to derive above- and below-ground carbon stocks, gains and losses in living biomass. The Party specified the values used, by forest type and by standing volume for the stock, and gains and losses calculation (figures 6.13 and 6-14, pp.6-22–6-23).
L.20	4.A.2 Land converted to forest land – CO_2 (L.21, 2020) (L.8, 2018) (L.12, 2016) (L.12, 2015) (95, 2014) Accuracy	Develop further the sampling and estimation system and the application of the sampling system when developing carbon stock change estimates for mineral soils.	Not resolved. The Party reported in its NIR (p.10-27) that the recommendation has not been implemented. During the review, Portugal clarified that it was unable to include revisions of soil data or to develop a national soil information system. The Party has included a revision of the soil emission and sequestration factors, taking into account the new data released by the Land Use/Cover Area frame Survey, under its planned improvements (p.6-57).
L.21	4.B.1 Cropland remaining cropland – CO_2 (L.22, 2020) (L.26, 2018) Transparency	Estimate and report all carbon stock changes in living biomass for perennial cropland types remaining under the same type in accordance with the 2006 IPCC Guidelines (vol. 4, chap. 5.2.1), taking into account the biomass growth and biomass losses associated with harvest, gathering or disturbance.	Not resolved. The Party reported in its NIR table 10-1 (p.10-27) that the recommendation has been implemented. However, according to the description provided in the NIR section 6.3.1.2.2 (p.6-37) gains and losses in living biomass in cropland remaining cropland occur only from the conversion between cropland types and the post-fire recovery of burned permanent crop areas. The ERT considers that the recommendation has not yet been addressed because the Party has not included additional information in the NIR on how exactly it has resolved the recommendation, which could include the reason for the assumption of no net change in living biomass being applied not only for annual cropland but also for perennial cropland and information on why the biomass growth and biomass losses for perennial cropland types were considered to remain under the same type.
L.22	4.B.1 Cropland remaining cropland – CO_2 (L.23, 2020) (L.27, 2018) Transparency	Do not consider below-ground biomass in annual crops, in line with the IPCC default assumption (2006 IPCC Guidelines, vol. 4, chap. 5, p.5.10).	Addressing. The Party reported in its NIR (p.10-27) that annual gains and losses in both above-ground and below-ground biomass are considered for all annual crops. Portugal has revised root–shoot ratios for annual crops since its previous submission. In the NIR (p.6-25), the Party states that the default root–shoot values from the 2006 IPCC Guidelines (vol. 4, chap. 11, table 11.2) are applied for annual crops, pastures and wetlands. The ERT considers that the recommendation has not yet been fully addressed because the Party needs to explain fully in the NIR how the approach adopted is in line with the

ID#	Issue/problem classification[a, b]	Recommendation from previous review report	ERT assessment and rationale
			2006 IPCC Guidelines.
L.23	4.B.1 Cropland remaining cropland – CO_2 (L.24, 2020) (L.27, 2018) Accuracy	Correct the root–shoot values used, revise the carbon stock change estimates and explain in the NIR the reason for the recalculations.	Resolved. The Party reported in its NIR table 10-1 (p.10-27) that root–shoot ratios have been revised for permanent crops and explains in its NIR section 6.16 (p.6-56) that carbon stock estimates have been recalculated after the introduction of new EFs and sequestration factors for permanent crops, using data from the Mediterranean Network for Reporting Emissions and Removals in Cropland and Grassland project.

Waste

W.1	5.A Solid waste disposal on land – CH_4 (W.4, 2020) (W.9, 2018) Accuracy	Make efforts to obtain information on the industrial waste growth rate from other experts in line with the 2006 IPCC Guidelines (vol. 1, annex 2A.1, p.2.20) and transparently report the expert judgment in the NIR, demonstrating compliance with the 2006 IPCC Guidelines.	Not resolved. The Party reported in CRF table 5A and its NIR (section 7.2.5, p.7-25) a recalculated time series for CH_4 from category 5.A (solid waste disposal).
			During the review, the Party explained that it was not possible to identify additional expertise to support previous assumptions used to estimate the industrial waste time series for 1960–1998. A new approach was therefore developed using the value of gross domestic product for the country as surrogate data for industrial waste generation and a recalculation was submitted.
			The ERT noted that the recalculation is not in accordance with the 2006 IPCC Guidelines (vol. 1, chap. 5.3.3.6, table 5.1), which highlight that the use of surrogate data as a technique for resolving data gaps is not appropriate unless there is strong correlation between data sets and also state that using surrogate data as a splicing technique should not cover long periods. The ERT therefore considers that the application of gross domestic product as surrogate data for the determination of AD on industrial waste generation for 1960–1998 is not appropriate.
			The ERT considers that the recommendation has not yet been addressed and there was a potential underestimation of emissions from the disposal of industrial waste for 2013–2020. Therefore, the ERT included this issue in the list of potential problems and further questions raised.
			In response to the potential problem, Portugal reverted to using its previous methodology to estimate its historical time series (1960–1998) on industrial waste quantities deposited to solid waste disposal site and submitted revised estimates on 24 October 2022. The Party indicated in its response that it also intends to reassess the time-series consistency by seeking additional expert input to establish a more robust time-series estimation in future submissions. This resolution is in line with the recommendation of the ERT and is acceptable to the ERT. The impact of the recalculation is an increase to 2020 emissions (+ 68 kt CO_2 eq) for category 5A. Minor recalculations have also been submitted by Portugal under category 5C (incineration and open burning of waste) owing to the knock-on effect of the AD changes to the proportion of industrial waste that is incinerated; however this only affects the emission time series for 1990–1998 under category 5C.

ID#	Issue/problem classification[a, b]	Recommendation from previous review report	ERT assessment and rationale
KP-LULUCF			
KL.1	General (KP-LULUCF) – CO_2 (KL.1, 2020) (KL.1, 2018) (KL.1, 2016) (KL.1, 2015) (111, 2014) Accuracy	Continue to develop the land area identification system for Madeira to ensure that the land-use and land-use change identification system meets the indicated area requirements.	Resolved. The Party reported in its NIR table 10-1 (p.10-28) that there are no new information sources for Madeira. However, the land cover information from the Coordination of Information on the Environment (programme) was reprocessed to include the whole available time series.
KL.2	General (KP-LULUCF) – CO_2 (KL.2, 2020) (KL.2, 2018) (KL.2, 2016) (KL.2, 2015) (112, 2014) Accuracy	Develop the estimation system for carbon stock changes in mineral soils, as indicated in paragraph 95 of the 2014 ARR.	Not resolved. The ERT considers that the recommendation has not yet been addressed because the Party has not implemented the development of the estimation system for carbon stock changes in mineral soils (NIR, p.10-28) (see ID# L.20 above). During the review, the Party explained that, despite its efforts, it had not proved possible to develop a soil information system or to revise the existing data owing to limited time. The ERT notes that the approach to calculating carbon stock change in mineral soils due to land conversion from the difference between mean carbon stocks of land uses before and after, may have risked not calculating the carbon stock change that actually occurred associated with land-use conversion as noted in paragraphs 91–95 of ARR 2014. On the other hand, it is not possible to provide evidence as to whether this approach led to overestimation or underestimation of removals. The ERT concludes that this potential problem of a mandatory nature does not influence the Party's ability to fulfil its commitments for the second commitment period of the Kyoto Protocol and therefore this issue was not included in the list of potential problems and further questions raised.
KL.3	General (KP-LULUCF) – (KL.3, 2020) (KL.10, 2018) Accuracy	Use the available updated land cover information from the Coordination of Information on the Environment programme for Madeira and incorporate the same data sources for the Azores when developing the land transition matrix for KP-LULUCF.	Resolved. The ERT considers that the recommendation has been addressed because the Party reported in its NIR section 6.1.2.4 (p.6-15), and the ERT confirmed, that the updated land cover information and the same data sources have been used for the autonomous regions of the Azores and Madeira.
KL.4	General (KP-LULUCF) – CO_2, CH_4 and N_2O (KL.4, 2020) (KL.11, 2018) Accuracy	(a) Reallocate shrubland to the appropriate land-use category in line with the national land-use definitions (e.g. under forest land, grassland and cropland) under KP-LULUCF; (b) Revise the land transition matrix accordingly; (c) Report the associated GHG emissions and removals from shrubland under KP-LULUCF; (d) Explain in the NIR the reasons for recalculating the associated GHG emissions	Resolved. (a) The Party reported in its NIR table 6-1 (p.6-8) that shrubland has been allocated to the grassland category and therefore is also included under GM (p.11-5); (b) The land transition matrix (CRF table NIR-2) has been revised accordingly; (c) GHG emissions and removals from shrubland have been reported under GM activity (CRF table 4(KP-I)B.3); (d) The Party states in its NIR section 6.16 (p.6-57) that one of the reasons for the recalculations was the reallocation of shrubland from other land to the grassland category.

		and/or removals as a result of the reallocation of shrubland.	
KL.5	General (KP-LULUCF) – (KL.5, 2020) (KL.12, 2018) Accuracy	(a) Correct the inconsistencies in CRF table NIR-2 with regard to the land transition matrix by ensuring that for all reported years and for the activities FM, CM and GM and the category other, the values reported in the "Total area at the end of the current inventory year" row in year X-1 equal the values in the "Total area at the end of the previous inventory year" column in year X, and revise the associated GHG emissions and/or removals for these activities;	Resolved. The ERT considers that the recommendation has been addressed because the Party has ensured that CRF tables NIR-2 are consistent and explained in the NIR section 6.15 (p.6-56) that recalculations have been made owing to the revision of land-use and land-use change data.
		(b) Explain in the NIR the reasons for recalculating the associated GHG emissions and/or removals as a result of the revision of the land transition matrix.	
KL.6	General (KP-LULUCF) – CO_2 (KL.6, 2020) (KL.13, 2018) Completeness	In cases where the Party chooses not to report the carbon stock changes from a pool, provide transparent and verifiable information demonstrating that the pool is not a source, in accordance with decision 2/CMP.7, annex, paragraph 26.	Not resolved. The Party stated in its NIR table 10-1 (p.10-29) that it has not implemented the recommendation, but did not provide any additional information on the matter. However, the ERT notes that carbon stock changes in minerals soils associated with land-use changes among six land-use categories were calculated and reported in CRF tables 4.A to 4.F for all land-use changes, including those reported as "NO" for land-use changes that were not observed. The ERT found that the Party had estimated carbon stock changes in mineral soils for categories: (i) settlements converted to forest land (AR); (ii) grassland and settlements converted to cropland (CM); and (iii) cropland and settlements converted to grassland (GM), which were reported as "NE" and not included in KP-LULUCF reporting. Therefore, the ERT did not include this issue in the list of potential problems and further questions raised.
KL.7	General (KP-LULUCF) – CO_2 (KL.7, 2020) (KL.13, 2018) Completeness	Estimate the carbon stock changes in the SOM pool for KP-LULUCF where the following land uses and land-use conversions correspond: settlements converted to forest land (AR); grassland and settlements converted to cropland (CM); grassland remaining grassland before 2008 (GM); and cropland and settlements converted to grassland (GM).	Resolved. The Party has reported SOC changes for settlements converted to forest land in CRF table 4.A, grassland and settlements converted to cropland in CRF table 4.B, grassland remaining grassland before 2008, and cropland and settlements converted to grassland, in CRF table 4.C. According to information provided in NIR section 11.1.1 (pp.11-3–11-5), these carbon stock changes have also been considered under the relevant KP-LULUCF activities.
KL.8	Deforestation – CO_2, CH_4 and N_2O	Include in the NIR information clarifying how the five-year rule is implemented when	Resolved. The ERT considers that the recommendation has been addressed because the Party presented in NIR section 6.1.2.3.1 (pp.6-9–6-12) the result of the consistency

ID#	Issue/problem classification[a, b]	Recommendation from previous review report	ERT assessment and rationale
	(KL.8, 2020) (KL.6, 2018) (KL.7, 2016) (KL.7, 2015) Transparency	the time between land-use maps is longer than five years.	check of land-use histories, which included all maps for 1995, 2007, 2010, 2015 and 2018. Portugal explained that the production of the land-use maps includes a definition of 'temporarily unstocked' land. Following a harvest or fire, land is designated as forest until the following map allows confirmation that the land remains forest land or that there has been a land-use change. This also applies to the maps for 1995–2007, with 12-year intervals. In cases where the forest type in 1995 and 2010 is the same but the land use is different in 2007, it is assumed that there is no land-use change (i.e. 2007 was 'temporarily unstocked'). Where the land use in 1995 and 2007 is different and that of 2010 is different from 1995, a land-use change is assumed to have happened between 1995 and 2007.
KL.9	Deforestation – N_2O (KL.9, 2020) (KL.14, 2018) Completeness	Report direct N_2O emissions from N mineralization/ immobilization due to loss/gain associated with all deforestation activities and transparently clarify in the NIR the reasons for any difference in the area reported for deforestation in CRF tables NIR-2 and 4(KP-II)3.	Resolved. The ERT considers that the recommendation has been addressed because the Party has reported in CRF table 4(KP-II)3 direct N_2O emissions from N mineralization due to losses in mineral soil SOC stocks, and the areas where mineralization is taking place. Portugal explains in its NIR (p.6-49) that these include only land-use changes that lead to SOC losses. The Party further explained that the areas may be smaller than those reported in CRF table NIR-2, owing to the consideration of a 20-year transition period for mineralization of SOM. The areas in CRF table 4(KP-II)3 refer to areas where an activity has occurred over the last 20 years, while those in CRF table NIR-2 refer to all areas for that activity since 1990 (NIR, p.11-3). This approach was followed for all KP-LULUCF activities, not just deforestation.
KL.10	Deforestation – N_2O (KL.10, 2020) (KL.14, 2018) Completeness	Include indirect N_2O emission estimates in CRF table 4(KP-II)3.	Not resolved. The ERT considers that the recommendation has not yet been addressed because during the review the Party clarified that CRF table 4(KP-II)3 does not include indirect N_2O emissions.
			The ERT found that the Party had likely underestimated emissions by approximately 15 kt CO_2 eq as an average for 2013 to 2020 (calculated by using the reported carbon losses amount in CRF table 4(KP-II)3 and the default parameters of the carbon–nitrogen ratio, EF_5 and $Frac_{LEACH-(H)}$ provided in the 2006 IPCC Guidelines (vol. 4, chap. 11, pp.11.16 and 11.24), which is below the significance threshold for application of an adjustment in accordance with decision 22/CMP.1, annex, paragraph 80(b), in conjunction with decision 4/CMP.11 and therefore not included in the list of potential problems and further questions raised.
KL.11	FM – CO_2 (KL.11, 2020) (KL.9, 2018) (KL.11, 2016) (KL.11, 2015) Transparency	Review the question of identifying the drivers of or reasons for the high losses in above-ground biomass and provide more transparent information in the NIR.	Resolved. The ERT considers that the recommendation has been addressed because the Party revised the gains and losses of above-ground biomass and an explanation was included in NIR sections 11.1.1.3 and 11.4.5.
KL.12	FM – CO_2, N_2O and CH_4 (KL.12, 2020) (KL.15, 2018)	(a) Include quantitative information on how the background level and the margin were estimated in accordance with decision 2/CMP.7, annex, paragraph 33(a), and the	Resolved. The Party reported quantitative information on the method for estimating the background level and margin in NIR section 11.1.7 (p.11-7), including an explanation on how forest fires were included in the FMRL.

ID#	Issue/problem classification[a, b]	Recommendation from previous review report	ERT assessment and rationale
	Transparency	Kyoto Protocol Supplement, including the time series of emissions used to estimate the background level and the margin;	
		(c) Report how emissions from forest fires were included in the FMRL	
KL.13	CM – CO_2 (KL.14, 2020) (KL.17, 2018) Completeness	Estimate and report all carbon stock changes in living biomass for perennial cropland types remaining under the same land type in accordance with the 2006 IPCC Guidelines, taking into account the accumulation from growth and losses associated with harvest, gathering or disturbances.	Addressing. The ERT notes that the Party assumes that carbon stock changes in living biomass result only from the conversions between cropland types for cropland remaining cropland, and also assumes living biomass is not changed under the same cropland type (NIR p.6-37). The ERT therefore considers that the recommendation has yet not been addressed because the Party has not taken into account the growth and losses which have occurred in the estimation of carbon stock changes in living biomass for perennial cropland types that remain under the same land type (see ID# L.21 above). The ERT notes that the inclusion of growth and losses with a constant harvesting cycle provide no net change of carbon stocks over time and so it is difficult to provide evidence on whether this approach led to overestimation or underestimation of removals. The ERT concludes that this potential problem of a mandatory nature does not influence the Party's ability to fulfil its commitments for the second commitment period of the Kyoto Protocol and therefore this issue was not included in the list of potential problems and further questions raised.
KL.14	CM and GM – CO_2, CH_4 and N_2O (KL.15, 2020) (KL.18, 2018) Transparency	Describe and report, in accordance with the Kyoto Protocol Supplement, the consequences of excluding emissions and removals from lands that were subject to CM and GM in the base year (1990) only, are no longer reported under the respective activity and were not transferred to another reported activity in any year of the second commitment period of the Kyoto Protocol.	Not resolved. The Party reported in its NIR table 10-1 (p.10-30) that the recommendation has not been implemented. During the review, the Party clarified that the calculation files are designed to provide estimates for the LULUCF definition (conversions over the previous 20 years) and the KP-LULUCF definitions with respect to conversions from cropland to wetlands, settlements and other land are only considered since 2008. The ERT identified that the Party elected CM already in the first commitment period of the Kyoto Protocol and understands the difficulties in separating out emission estimates for conversions since 1990. However, the Party provided an additional spreadsheet which allows for the comparison of conversions from cropland to wetlands, settlements or other land on the basis of LULUCF and KP-LULUCF definitions. The ERT concludes that this potential problem of a mandatory nature does not influence the Party's ability to fulfil its commitments for the second commitment period of the Kyoto Protocol because this reporting issue was only related to areas and associated carbon stock changes that were not included in the emissions and removals from CM and GM. Therefore this issue was not included in the list of potential problems and further questions raised.
KL.15	GM – CO_2, N_2O and CH_4 (KL.16, 2020) (KL.19, 2018)	Provide transparent information on how the GM area is estimated in NIR section 6.1.2.8, including the equations used in the	Resolved. As part of the methodological approach adopted by the Party that affected the recalculations, it was possible to identify the various GM subcategories, separating off-pasture and shrubland that were previously reported under "other land" (NIR section

ID#	Issue/problem classification[a, b]	Recommendation from previous review report	ERT assessment and rationale
	Transparency	estimations.	6.1.2.7, p.6-20).
KL.16	Biomass burning – CO_2 (KL.17, 2020) (KL.20, 2018) Completeness	(a) Report CO_2 emissions from woody biomass burning for the deforestation, CM and GM activities;	(a) Resolved. The ERT considers that the recommendation has been addressed because the Party reported in CRF table 4(KP-II)4 CO_2 emissions from woody biomass burning for all KP-LULUCF activities;
		(b) For activities for which CO_2 emissions from biomass burning are not estimated but burning does occur, correct the notation key to "NE" in CRF table NIR-1.	(b) Resolved. The Party reported in its NIR table 10-1 (p.10-30) that it has implemented the recommendation. Portugal now correctly uses the notation key "R" (reported) in CRF table NIR-1 for the deforestation, CM and GM activities for CO_2 emissions from biomass burning. Emissions of CO_2 from biomass burning as a result of wildfires have also been reported in CRF table 4(KP-II) 4 for these activities.

[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 2021 annual submission of Portugal was not available at the time of this review. Therefore, the recommendations reflected in this table are taken from the 2020 annual review report. For the same reason, 2021, 2019 and 2017 are excluded from the list of review years in which issues could have been identified.

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

9. In accordance with paragraph 83 of the UNFCCC review guidelines, the ERT noted that the issues and/or problems included in table 4 have been identified in three or more successive reviews, including the review of the 2022 annual submission of Portugal, and had not been addressed by the Party by 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 Portugal

ID#	Previous recommendation for issue	Number of successive reviews issue not addressed[a]
General		
G.4	Avoid reporting the uncertainty of the AD or EFs as 0.0 per cent, ensure that the uncertainty analysis incorporates and reports the intended information by checking for and correcting coding and compilation errors and document the results of this QA/QC procedure in the NIR.	3 (2018–2022)
Energy		
E.1	Improve the consistency between the energy balance and the data available for large point sources in order to reduce the differences between the reference and sectoral approaches.	5 (2014–2022)
E.2	Carry out QC checks for non-energy use of fuels, as prescribed in the 2006 IPCC Guidelines (vol. 3, chap. 1.4).	4 (2015/2016–2022)
E.3	Provide information on non-energy use of LPG, naphtha and natural gas and indicate the categories under which the	4 (2015/2016–2022)

ID#	Previous recommendation for issue	Number of successive reviews issue not addressed[a]
	related emissions, if any, have been included.	
E.5	Develop a country-specific CO_2 EF for natural gas and provide further information on the reasons for not deriving country-specific CO_2 EFs for other fuels (hard coal and fuel oil) that are identified as key.	4 (2015/2016–2022)
E.9	Include explanations for the introduction of industrial waste and the rate of biogenic and fossil fuel use in the NIR.	4 (2015/2016–2022)
E.12	Continue with the efforts to develop country-specific CO_2 EFs for gasoline and diesel oil, and investigate the possibility of obtaining a country-specific CO_2 EF for gasoline and diesel oil reported under the EU ETS.	5 (2014–2022)
E.16	Report the AD and emissions from ground activities at airports under the other transportation category, explain what type of consumption is included under the item "Serviços" in the energy balance and report the fuel consumption and the associated emission estimates under the appropriate category.	5 (2014–2022)
E.17	For CH_4 emissions from oil transport (category 1.B.2.a.iii.3), correct the EF units and revise the emission estimates.	3 (2018–2022)
E.22	Provide detailed information on the flows and operating regimes for geothermal energy production, and on how the CO_2 EFs are derived.	4 (2015/2016–2022)
IPPU		
I.2	Include information in the NIR on specific QA/QC activities for industrial processes, for example for limestone and dolomite use and for glass production (reported under other mineral products), for which this information is not currently included.	5 (2014–2022)
I.3	Include explanations of the checks performed to ensure time-series consistency for cement production, lime production from dedicated plants, other process uses of carbonates and lead production, where two data sources are used throughout the time series. These explanations can be included in the category-specific QC section.	3 (2018–2022)
I.5	Investigate whether lime production in sugar mills and artisanal production of lime for sanitation purposes or for whitewash are potential activities and, in cases where such activities are present, provide estimates of CO_2 emissions.	4 (2015/2016–2022)
I.6	Check whether there are data transcription errors and confirm the correctness of the data with the facilities when large inter-annual changes in the IEFs are observed, in particular for 2009–2015.	3 (2018–2022)
I.11	Work with the data provider (the EU ETS) to improve the quality of raw material data (e.g. by contacting facilities to check for reporting errors) and use raw material data for the years for which data from the ceramics industry were collected under the EU ETS as the AD for backcasting, instead of using estimated fuel consumption data collected directly from facilities.	3 (2018–2022)
I.15	Estimate emissions from the use of limestone and dolomite and report these estimates under category 2.C.1.	4 (2015/2016–2022)
I.17	Include the estimates for HFCs, PFCs, SF_6 and NF_3 emissions from integrated circuits or semiconductors (category 2.E.1). If emissions do not occur, use the appropriate notation key ("NO") in the CRF tables and provide an explanation in the NIR for this assessment. If the emissions for any of these categories are judged as insignificant in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines, use the appropriate notation key ("NE") in the	4 (2015/2016–2022)

ID#	Previous recommendation for issue	*Number of successive reviews issue not addressed[a]*
	CRF tables, providing a qualitative and quantitative justification in the NIR.	
I.18	Include the estimates for PFCs, SF_6 and NF_3 emissions from thin-film transistor flat-panel displays (category 2.E.2). If emissions do not occur, use the appropriate notation key ("NO") in the CRF tables and provide an explanation in the NIR for this assessment. If the emissions for any of these categories are judged as insignificant in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines, use the appropriate notation key ("NE") in the CRF tables, providing a qualitative and quantitative justification in the NIR.	4 (2015/2016–2022)
Agriculture		
A.4	Revise NIR table 5.25 and explain in the NIR that the country-specific manure management lagoon systems and tanks/earthen ponds correspond to the categories liquid/slurry with and without natural crust cover in the 2006 IPCC Guidelines respectively.	3 (2018–2022)
LULUCF		
L.1	Revise the MAI and other relevant AD (e.g. the country-specific definition of important variables such as MAI and wood volume, the methodology on how the MAI is defined) and provide all methodological updates as soon as the NFI6 is officially published, in accordance with the 2006 IPCC Guidelines.	4 (2015/2016–2022)
L.3	Complete CRF table summary 3s2 for all LULUCF categories and provide transparent information in the NIR on the descriptions, references and sources of information for the methodologies and EFs, as well as an indication of the level of complexity (i.e. tier) applied at the land-use subcategory and pool level.	3 (2018–2022)
L.4	Carry out a significance analysis to determine which carbon pools and subcategories are significant in each key category on the basis of the 2006 IPCC Guidelines (vol. 1, chap. 4.2, and vol. 4, chap. 1.3), and provide in the NIR detailed information on the results of this analysis.	3 (2018–2022)
L.5	Report on the impact of this reallocation on the associated emissions and removals in the land-use categories affected, namely grassland and, if necessary, forest land and cropland.	3 (2018–2022)
L.7	Provide detailed information on the technical specifications of the maps used for land representation, the classification protocol followed to ensure consistency over time, the QC protocol, the response design and the results of the accuracy assessment.	3 (2018–2022)
L.8	Revise the assumption of constant areas for wetlands, settlements and other land between 1970 and 1994, taking into account any updated information from the new land-use map of the Portuguese Directorate-General for Territory (for 1990, 1995, 2007, 2010 and 2015).	3 (2018–2022)
L.10	Correct the inconsistencies with regard to the areas of the different categories of land use and land-use change and revise the GHG emissions and removals by: (b) Ensuring that, for all years and all land-use categories, the values reported in CRF table 4.1 in the "Final area" row in year X for each land-use category equal the values in the background CRF tables 4.A–4.F for the total area of the respective land-use category for the same year X.	3 (2018–2022)

ID#	Previous recommendation for issue	Number of successive reviews issue not addressed[a]
L.12	Include detailed information on the differences between the NFIs and the land-use map of the Portuguese Directorate-General for Territory for the forest land area, along with a justification for these differences and the reasons that led to the choice of the data source for the forest land area.	3 (2018–2022)
L.13	Establish a system for data collection on fuelwood gathering in order to collect the necessary information for estimating losses from living biomass and report on any updates on this matter in the NIR.	3 (2018–2022)
L.14	Provide detailed information on the scope and phases of the NFI6 in the NIR, including any updates with regard to the module/phase on the evaluation of SOC.	3 (2018–2022)
L.18	Include in the NIR information on the justification of the expert judgment applied to estimate the MAI values reported in NIR table 6.10 and an explanation stating that these MAI values do not include loss due to mortality.	3 (2018–2022)
L.20	Develop further the sampling and estimation system and the application of the sampling system when developing carbon stock change estimates for mineral soils.	5 (2014–2022)
L.21	Estimate and report all carbon stock changes in living biomass for perennial cropland types remaining under the same type in accordance with the 2006 IPCC Guidelines (vol. 4, chap. 5.2.1), taking into account the biomass growth and biomass losses associated with harvest, gathering or disturbance.	3 (2018–2022)
L.22	Do not consider below-ground biomass in annual crops, in line with the IPCC default assumption (2006 IPCC Guidelines, vol. 4, chap. 5, p.5.10).	3 (2018–2022)
Waste		
W.1	Make efforts to obtain information on the industrial waste growth rate from other experts in line with the 2006 IPCC Guidelines (vol. 1, annex 2A.1, p.2.20) and transparently report the expert judgment in the NIR, demonstrating compliance with the 2006 IPCC Guidelines.	3 (2018–2022)
KP-LULUCF		
KL.2	Develop the estimation system for carbon stock changes in mineral soils, as indicated in paragraph 95 of the 2014 ARR.	5 (2014–2022)
KL.6	In cases where the Party chooses not to report the carbon stock changes from a pool, provide transparent and verifiable information demonstrating that the pool is not a source, in accordance with decision 2/CMP.7, annex, paragraph 26.	3 (2018–2022)
KL.10	Include indirect N_2O emission estimates in CRF table 4(KP-II)3.	3 (2018–2022)
KL.13	Estimate and report all carbon stock changes in living biomass for perennial cropland types remaining under the same land type in accordance with the 2006 IPCC Guidelines, taking into account the accumulation from growth and losses associated with harvest, gathering or disturbances.	3 (2018–2022)
KL.14	Describe and report, in accordance with the Kyoto Protocol Supplement, the consequences of excluding emissions and removals from lands that were subject to CM and GM in the base year (1990) only, are no longer reported under the respective activity and were not transferred to another reported activity in any year of the second commitment period of the Kyoto Protocol.	3 (2018–2022)

a Reports on the reviews of the 2017, 2019 and 2021 annual submissions of Portugal have not yet been published. Therefore, 2017, 2019 and 2021 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 2022 annual submission

10.   Table 5 presents findings made by the ERT during the individual review of the 2022 annual submission of Portugal that are additional to those identified in table 3.

Table 5
Additional findings made during the individual review of the 2022 annual submission of Portugal

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem?*a*
General			
G.6	Notation keys	In CRF table 9 for 2020, Portugal notes three cases in which "NE" has been reported for insignificant categories, namely CO_2 and CH_4 emissions for category 2.C.2 (ferroalloys production) and N_2O emissions for category 2.G.3.b (other – propellant for pressure and aerosol products).	Not an issue/problem
		In the sectoral sections of its NIR, Portugal presented the likely level of emissions, for the CO_2 emissions for category 2.C.2, based on available AD for 2011–2014 and 2017–2020 and a default tier 1 CO_2 EF and, for the N_2O emissions for category 2.G.3.b, for 1990 and 2016. During the review, Portugal provided data on the likely level of emissions for each of the three categories for 2020.	
		The ERT encourages Portugal to include in every submission for categories for which "NE" has been reported data on the likely level of emissions or removals for the latest reported inventory year to show that it is below the significance threshold, in particular for categories included in the 2006 IPCC Guidelines.	
G.7	Inventory planning	In the previous annual review report, the ERT noted that the Party reported in its NIR (p.1-24) that future inventory improvements are defined for each sector by the relevant inventory compiler and collated in a methodological development plan, which is updated and agreed every year. However, the NIR does not include the likely implementation dates of those improvement activities or the expected scope of the work involved.	Not an issue/problem
		In table 10-1 of its NIR, Portugal stated that it is addressing this issue. During the review, Portugal presented several examples of improvements regarding the expected scope of the work involved. It also noted that the likely implementation dates for improvements are often difficult to establish, in particular where improvement activities depend on data or input from external entities.	
		To enhance the transparency of the list of Portugal's planned inventory improvement activities, the ERT encourages the Party to provide in its NIR more detail on the processes involved in the methodological development plan, including the likely implementation dates of the improvement activities and the expected scope of the work involved.	

ID#	Finding classification	Description of finding with recommendation or encouragement	*Is finding an issue/problem?*[a]

Energy

| E.24 | 1.A.1.c Manufacture of solid fuels and other energy industries – solid fuels – CO_2, CH_4 and N_2O | The Party reported in its NIR table 4-39 (p.4-77) all emission streams for its iron and steel operations and provided in tabular format information on those emission streams, as well as specifying the categories under which the emissions were reported and providing a rationale for their allocation. Similar information was not provided in the energy section of the NIR. The emissions from iron and steel production are reported in both the IPPU and energy sectors, and therefore it would increase the transparency of the NIR if the IPPU and energy sections both had summary information on the emission streams from the Party's iron and steel operations. | Not an issue/problem |
| | | The ERT encourages the Party to include in NIR section 3.4.2.3.1 information on all emission streams for its iron and steel operations, the categories under which the emissions are reported and the rationale for their allocation. The ERT suggests adding a column to NIR table 4-39 with the section or page number to act as a cross reference to the methodological detail for each emission stream provided in the NIR. | |

IPPU

I.24	2.B.1 Ammonia production – CO_2	The Party reported in its NIR (pp.4-56–4-60) that category 2.B.1 (ammonia production) was estimated using a tier 1 approach and default EFs from the 2006 IPCC Guidelines. Furthermore, in its NIR (section 4.3.2.3, p.4-58), Portugal noted that according to the 2006 IPCC Guidelines, it is good practice to use the average EF for partial oxidation (which is the process used to produce ammonia in Portugal) when no information is available on the fuel type used in the process. Portugal used the total fuel requirement of 42.5 GJ/t NH_3 and CO_2 EF of 3.273 t CO_2/t NH_3) sourced from the 2006 IPCC Guidelines (vol. 3, chap. 3.2.2.2, table 3.1). The use of this EF leads to an overestimation of emissions for this category. During the review, the Party clarified that it has contacted the ammonia production facilities and was informed that they do not possess data related to feedstock consumption for 1990–2009, as the facilities have been restructured and the records are no longer available. Category 2.B.1 is a key category and so a tier 2 or 3 method should be used to estimate emissions. The ERT considers that, even though the Party correctly applied a tier 1 approach, owing to the absence of suitable time-series-consistent AD for estimation of emissions using a higher-tier method, it is not in line with the 2006 IPCC Guidelines. The ERT encourages the Party to use a higher-tier approach for estimating emissions for key category 2.B.1 (ammonia production).	Not an issue/problem
I.25	2.B.8 Petrochemical and carbon black production – CO_2	The Party reported in its NIR section 4.3.11 (pp.4-67–4-68) the production process, methodology and EFs used to estimate CO_2 emissions for category 2.B.8.c (ethylene dichloride and vinyl chloride monomer). The ERT noted that Portugal's CO_2 IEF for vinyl chloride monomer production is high (1.77) and outside the range of all Annex I Parties (0.0113–0.29). During the review, Portugal confirmed that double counting occurred in this category because it used the total EF (0.294 t CO_2/ t vinyl chloride monomer production) from NIR table 3.17, which already includes non-combustion and combustion processes, and then added the combustion emissions. The Party plans to correct this in its next annual submission.	Yes. Accuracy
		The ERT recommends that the Party revise the estimation of CO_2 emissions from vinyl chloride monomer using at least a tier 1 approach and default EFs from 2006 IPCC Guidelines (vol. 3, chap. 3.9.2.2, table 3.17).	

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem?[a]
Agriculture			
A.10	3.A Enteric fermentation – CH_4	The Party reported in NIR section 5.2.7 (p.5-32) that recalculations have been applied to enteric CH_4 emissions owing to an update of national statistics on livestock numbers. However, the reasons for the update of the livestock population statistics, the assumptions applied as well as the sources of data used to carry out the updates are not documented in the NIR. During the review, the Party clarified that in future submissions it will improve the description of the recalculations. The increase in reported CH_4 emissions between the 2021 and current submission has mainly been caused by the updated EFs for sheep and goats. The Party also explained that there has been a decrease in the number of non-dairy cattle from 2018 onward.	Yes. Transparency
		The ERT recommends that the Party include information on the reasons for the update in any future updates to the livestock population statistics, assumptions applied as well as sources of data used to carry out the updates and the impact of those changes on CH4 emissions.	
A.11	3.B Manure management – CH_4, N_2O	The Party reported in NIR section 5.3.3 (p.5-36) that, since no new data on the fraction of manure handled in each MMS are available, the 2010 distribution was assumed for 2019. The values for the fraction of manure handled in each MMS in 1990 and in 2020 are presented in NIR table 5-22. The ERT requested the Party to provide values and data sources for the fraction of manure handled in each MMS in 2010 and further clarify data sources of 2020 values in table 5-22. During the review, the Party clarified that the statement in the NIR should have referred to 2020 rather than 2019. Portugal's general agriculture census for 2009 included for the first time a question for farmers related to the type of MMS in use on their farm. On the basis of that information and on the information from the national animal registration database about the number of livestock produced in pasture mode, the trend for 1990–2010 was updated in September 2017 for cattle (dairy cows, non-dairy cows and other cattle), sheep (ewes and other ovines), goats (does and other caprine) and Equidae (horses, mules and asses). The Party indicated that it is in the process of analysing data from the general agriculture census for 2019 in order to update data related to MMS in use on farms in the country and plans to include the results of the analysis in its next annual submission. The Party also stated that it plans to correct the annual percentage share of each MMS for 2011–2020 and is developing a file to be updated annually by the operators with data related to MMS on farms. The ERT noted that application of the outdated shares for MMS for 2013–2019 did not lead to an underestimation for inclusion in a 'Saturday paper'.	Yes. Accuracy
		The ERT recommends that the Party update the fraction of manure handled in each MMS using the results of the 2019 national agricultural census in the next annual submission.	
LULUCF		No findings for the LULUCF sector additional to those included in table 3 were made by the ERT during the review.	
Waste		No findings for the waste sector additional to those included in table 3 were made by the ERT during the review.	
KP-LULUCF		No findings for KP-LULUCF additional to those included in table 3 were made by the ERT during the review.	

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

VI. Application of adjustments

11.   The ERT did not identify the need to apply any adjustments for the 2022 annual submission of Portugal.

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

12.   Table I.5 presents the accounting quantities for KP-LULUCF reported by Portugal and the final values agreed by the ERT. The final quantities of units to be issued and cancelled are presented in table I.6.

VIII. Questions of implementation

13.   No questions of implementation were identified by the ERT during the individual review of the Party's 2022 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 Portugal in its 2022 annual submission

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

Table I.1

Total greenhouse gas emissions and removals for Portugal, base year–2020

(kt CO_2 eq)

	Total GHG emissions excluding indirect CO_2 emissions		Total GHG emissions and removals including indirect CO_2 emissions[a]		Land-use change (Article 3.7 bis as contained in the Doha Amendment)[b]	KP-LULUCF (Article 3.3 of the Kyoto Protocol)[c]	KP-LULUCF (Article 3.4 of the Kyoto Protocol)	
	Total including LULUCF	Total excluding LULUCF	Total including LULUCF	Total excluding LULUCF			CM, GM, RV, WDR	FM
FMRL								6 830.00
Base year[d]	66 000.50	58 873.74	66 086.62	58 959.87	4 276.76		5 174.74	
1990	65 926.62	58 799.86	66 012.75	58 885.99				
1995	58 422.65	68 586.10	58 610.84	68 774.29				
2000	79 673.98	81 681.62	79 860.38	81 868.02				
2010	62 363.33	68 864.96	62 562.92	69 064.56				
2011	64 394.35	67 370.88	64 574.45	67 550.98				
2012	64 312.69	65 434.29	64 500.86	65 622.46				
2013	63 602.11	63 560.05	63 770.40	63 728.34		−1 588.17	−421.23	3 254.78
2014	58 447.71	63 483.68	58 606.51	63 642.48		−1 481.97	−2 062.57	−28.53
2015	63 924.02	67 632.08	64 091.11	67 799.17		−1 045.08	−1 815.56	646.92
2016	66 889.68	65 785.84	67 046.43	65 942.59		−1 032.67	−1 128.10	4 927.80
2017	92 297.05	70 843.26	92 488.92	71 035.13		−637.40	1 463.26	22 395.45
2018	63 743.03	67 170.68	63 878.73	67 306.38		−1 056.25	−2 300.21	2 216.71
2019	59 109.17	63 541.62	59 265.30	63 697.74		−1 503.04	−2 337.23	1 928.31
2020	52 876.00	57 522.501	53 007.95	57 654.45		−1 665.91	−2 187.04	1 822.53

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

[a] The Party reported indirect CO_2 emissions in CRF table 6.

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

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

[d] "Base year" refers to the base year under the Kyoto Protocol, which is 1990 for CO_2, CH_4 and N_2O, 1995 for HFCs, PFCs and SF_6 and 2000 for NF_3. The base year for CM and GM under Article 3, para. 4, of the Kyoto Protocol is 1990. For activities under Article 3, para. 3, of the Kyoto Protocol and FM under Article 3, para. 4, only the inventory years of the commitment period must be reported.

Table I.2

Greenhouse gas emissions and removals by gas for Portugal, excluding land use, land-use change and forestry, 1990–2020

(kt CO_2 eq)

	$CO_2{}^a$	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3
1990	45 411.21	9 585.89	3 888.69	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
1995	54 712.62	10 100.64	3 886.91	59.95	NO, NE	NO, NE	13.93	NO, NA
2000	65 871.95	11 117.91	4 473.96	386.46	1.13	NO, NE	16.61	NO, NA
2010	53 200.96	10 187.92	3 575.57	2 057.46	7.95	NO, NE	34.69	NO, NA
2011	51 981.68	10 085.98	3 221.26	2 224.00	9.07	NO, NE	28.99	NO, NA
2012	50 147.88	9 846.14	3 219.01	2 368.73	10.22	NO, NE	30.48	NO, NA
2013	48 331.77	9 612.14	3 210.46	2 531.58	11.40	NO, NE	30.99	NO, NA
2014	48 104.61	9 485.45	3 350.78	2 663.18	12.65	NO, NE	25.81	NO, NA
2015	52 437.38	9 275.04	3 244.30	2 805.32	13.96	NO, NE	23.18	NO, NA
2016	50 598.98	9 193.79	3 169.65	2 941.14	15.40	NO, NE	23.62	NO, NA
2017	55 402.05	9 216.90	3 251.13	3 122.48	17.02	NO, NE	25.55	NO, NA
2018	51 594.80	9 164.66	3 261.33	3 242.71	19.08	NO, NE	23.79	NO, NA
2019	47 774.95	9 182.73	3 319.01	3 375.62	21.33	NO, NE	24.09	NO, NA
2020	41 931.85	9 035.50	3 306.64	3 333.82	23.78	NO, NE	22.88	NO, NA
Percentage change 1990– 2020	**–7.7**	**–5.7**	**–15.0**	**NA**	**NA**	**NA**	**NA**	**NA**

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

[a] Including indirect CO_2 emissions as reported in CRF table 6.

Table I.3

Greenhouse gas emissions and removals by sector for Portugal, 1990–2020

(kt CO_2 eq)

	Energy	IPPU	Agriculture	LULUCF	Waste	Other
1990	40 717.17	6 472.52	7 142.02	7 126.76	4 554.28	NO, NA
1995	49 730.52	6 754.09	7 061.91	–10 163.45	5 227.77	NA
2000	60 059.21	8 177.35	7 491.09	–2 007.64	6 140.36	NA
2010	49 037.15	7 677.01	6 545.55	–6 501.64	5 804.85	NA
2011	48 320.76	6 992.34	6 500.23	–2 976.53	5 737.65	NA

	Energy	IPPU	Agriculture	LULUCF	Waste	Other
2012	46 850.36	6 697.70	6 537.78	–1 121.60	5 536.62	NA
2013	44 675.23	7 178.29	6 518.15	42.06	5 356.68	NA
2014	44 074.99	7 673.35	6 667.18	–5 035.97	5 226.95	NA
2015	48 519.90	7 725.97	6 666.62	–3 708.05	4 886.67	NA
2016	47 348.31	7 173.32	6 694.07	1 103.84	4 726.89	NA
2017	51 940.89	7 639.89	6 793.78	21 453.78	4 660.58	NA
2018	48 586.43	7 276.06	6 864.95	–3 427.65	4 578.94	NA
2019	44 538.12	7 655.42	6 935.57	–4 432.44	4 568.63	NA
2020	38 631.76	7 612.01	6 990.07	–4 646.50	4 420.62	NA
Percentage change 1990–2020	**–5.1**	**17.6**	**–2.1**	**–165.2**	**–2.9%**	**NA**

Notes: (1) Portugal did not report emissions or removals for the sector other (sector 6); the corresponding cells in the CRF tables were left blank; (2) totals include indirect CO_2 emissions reported 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–2020, for Portugal

(kt CO_2 eq)

	Article 3.7 bis as contained in the Doha Amendment[a]	Activities under Article 3.3 of the Kyoto Protocol		FM and elected activities under Article 3.4 of the Kyoto Protocol				
	Land-use change	AR	Deforestation	FM	CM	GM	RV	WDR
FMRL				–6 830.00				
Technical correction				6 703.37				
Base year[b]	4 276.76				1 212.88	3 961.87	NA	NA
2013		–2 800.71	1 212.55	3 254.78	–1 306.66	885.43	NA	NA
2014		–2 638.20	1 156.23	–28.53	–1 517.68	–544.89	NA	NA
2015		–2 167.50	1 122.42	646.92	–1 531.32	–284.24	NA	NA
2016		–1 987.26	954.60	4 927.80	–1 543.51	415.41	NA	NA
2017		–1 558.68	921.28	22 395.45	–101.74	1 565.00	NA	NA
2018		–1 885.97	829.72	2 216.71	–1 834.87	–465.34	NA	NA
2019		–2 297.68	794.64	1 928.31	–1 865.71	–471.52	NA	NA
2020		–2 434.44	768.53	1 822.53	–1 962.98	–224.06	NA	NA
Percentage change base year–2020					**–261.8**	**–105.7**	**NA**	**NA**

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

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

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

2. Table I.5 provides information on the Party's accounting quantities for reporting under Article 3, paragraphs 3–4, of the Kyoto Protocol.

Table I.5
Accounting quantities for activities under Article 3, paragraph 3, and forest management and any elected activities under Article 3, paragraph 4, of the Kyoto Protocol for Portugal

(kt CO$_2$ eq)

GHG source/sink activity	Base year[b]	Net emissions/removals									Accounting parameters	Accounting quantities[a]
		2013	2014	2015	2016	2017	2018	2019	2020	Total[c]		
A.1. AR		−2 800.712	−2 638.196	−2 167.501	−1 987.262	−1 558.683	−1 885.971	−2 297.676	−2 434.439	−17 770.441		−17 770.440
Excluded emissions from natural disturbances[d]		NO	NO	NO	NO	NO	NO	NO	NO	NO		NO
Excluded subsequent removals from land subject to natural disturbances		NO	NO	NO	NO	NO	NO	NO	NO	NO		NO
A.2. Deforestation		1 212.547	1 156.227	1 122.418	954.595	921.282	829.723	794.639	768.527	7 759.958		7 759.958
B.1. FM										37 163.974		38 177.025
Net emissions/removals		3 254.780	−28.534	646.924	4 927.799	22 395.452	2 216.707	1 928.313	1 822.535	37 163.974		
Excluded emissions from natural disturbances[d]		NO	NO	NO	NO	NO	NO	NO	NO	NO		NO
Excluded subsequent removals from land subject to natural disturbances		NO	NO	NO	NO	NO	NO	NO	NO	NO		NO
Any debits from newly established forest		NA	NA	NA	NA	NA	NA	NA	NA	NA		NA
FMRL[e]										−6 830.000		

GHG source/sink activity	Net emissions/removals										Accounting parameters	Accounting quantities[a]
	Base year[b]	2013	2014	2015	2016	2017	2018	2019	2020	Total[c]		
Technical corrections to FMRL											6 703.369	
FM cap											17 010.374	38 177.025
B.2. CM (if elected)	1 212.875	–1 306.664	–1 517.681	–1 531.321	–1 543.509	–101.744	–1 834.869	–1 865.711	–1 962.980	–11 664.480		–21 367.480
B.3. GM (if elected)	3 961.869	885.430	–544.893	–284.240	415.408	1 565.000	–465.343	–471.520	–224.061	875.781		–30 819.174
B.4. RV (if elected)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA
B.5. WDR (if elected)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA

[a] The accounting quantity is the total quantity of units to be issued or cancelled for a particular activity.

[b] Net emissions and removals from CM, GM, RV and/or WDR, if elected, in the Party's base year as established in decision 9/CP.2.

[c] Cumulative net emissions and removals for all years of the commitment period reported in the annual submission under review.

[d] The Party indicated in its report to facilitate the calculation of the assigned amount for the second commitment period of the Kyoto Protocol its intent to apply the provisions from natural disturbances to its accounting of AR and FM at the end of the commitment period. The Party decided not to exclude emissions and subsequent removals from natural disturbances in its accounting for the 2022 annual submission.

[e] As inscribed in the appendix to the annex to decision 2/CMP.7 in kt CO_2 eq per year.

3. Table I.6 provides an overview of key data from Portugal's reporting under Article 3, paragraphs 3–4, of the Kyoto Protocol.

Table I.6
Key data for Portugal under Article 3, paragraphs 3–4, of the Kyoto Protocol from its 2022 annual submission

Parameter	*Data values*
Periodicity of accounting	(a) AR: commitment period accounting
	(b) Deforestation: commitment period accounting
	(c) FM: commitment period accounting
	(d) CM: commitment period accounting
	(e) GM: commitment period accounting
	(f) RV: not elected
	(g) WDR: not elected
Elected activities under Article 3, paragraph 4, of the Kyoto Protocol	CM and GM
Election of application of provisions for natural disturbances	Yes, for AR and FM
3.5% of total base-year GHG emissions, excluding LULUCF and including indirect CO_2 emissions	2 126.297 kt CO_2 eq (17 010.374 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	Issue 17 770 440 RMUs
2. Deforestation	Cancel 7 759 958 units
3. FM	Cancel 38 177 025 units
4. CM	Issue 21 367 480 RMUs
5. GM	Issue 30 819 174 RMUs

Note: Values in this table reflect the accounting quantities for activities under Article 3, para. 3, and FM and any elected activities under Article 3, para. 4, of the Kyoto Protocol as reported in table I.5.

Annex II

Information to be included in the compilation and accounting database

Tables II.1–II.8 include the information to be included in the compilation and accounting database for Portugal. 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 2020, including on the commitment period reserve, for Portugal
(t CO_2 eq)

	Original submission	Revised submission	Adjustment	Final value
CPR	**386 623 773**	**386 623 773**	**–**	**386 623 773**
Annex A emissions				
CO_2	41 931 845	–	–	41 931 845
CH_4	8 966 769	9 035 499	–	9 035 499
N_2O	3 306 636	–	–	3 306 636
HFCs	3 333 819	–	–	3 333 819
PFCs	23 777	–	–	23 777
Unspecified mix of HFCs and PFCs	NO, NE	–	–	NO, NE
SF_6	22 876	–	–	22 876
NF_3	NO, NA	–		NO, NA
Total Annex A sources[a]	**57 585 723**	**57 654 453**	**–**	**57 654 453**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–2 434 439	–	–	–2 434 439
Deforestation	768 527	–	–	768 527
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	1 822 535	–	–	1 822 535
CM	–1 962 980	–	–	–1 962 980
CM for the base year	1 212 875	–	–	1 212 875
GM	–224 061	–	–	–224 061
GM for the base year	3 961 869	–	–	3 961 869

[a] The sum of the values for the individual gases and groups of gases may not match the total owing to rounding.

Table II.2
Information to be included in the compilation and accounting database for 2019 for Portugal
(t CO_2 eq)

	Original submission	Revised submission	Adjustment	Final value
Annex A emissions				
CO_2	47 774 953	–	–	47 774 953
CH_4	9 109 021	9 182 734	–	9 182 734
N_2O	3 319 011	–	–	3 319 011
HFCs	3 375 616	–	–	3 375 616
PFCs	21 335	–	–	21 335
Unspecified mix of HFCs and PFCs	NO, NE	–	–	NO, NE
SF_6	24 095	–	–	24 095
NF_3	NO, NA	–	–	NO, NA
Total Annex A sources[a]	**63 624 030**	**63 697 743**	**–**	**63 697 743**

	Original submission	Revised submission	Adjustment	Final value
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–2 297 676	–2 297 676	–	–2 297 676
Deforestation	794 639	794 639	–	794 639
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	1 928 313	–	–	1 928 313
CM	–1 865 712	–	–	–1 865 712
CM for the base year	1 212 875	–	–	1 212 875
GM	–471 520	–	–	–471 520
GM for the base year	3 961 869	–	–	3 961 869

[a] The sum of the values for the individual gases and groups of gases may not match the total owing to rounding.

Table II.3
Information to be included in the compilation and accounting database for 2018 for Portugal
(t CO_2 eq)

	Original submission	Revised submission	Adjustment	Final value
Annex A emissions				
CO_2	51 594 803	–	–	51 594 803
CH_4	9 085 603	9 164 661	–	9 164 661
N_2O	3 261 332	–	–	3 261 332
HFCs	3 242 712	–	–	3 242 712
PFCs	19 081	–	–	19 081
Unspecified mix of HFCs and PFCs	NO, NE	–	–	NO, NE
SF_6	23 790	–	–	23 790
NF_3	NO, NA	–	–	NO, NA
Total Annex A sources[a]	**67 227 321**	**67 306 379**	**–**	**67 306 379**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–1 885 971	–	–	–1 885 971
Deforestation	829 723	–	–	829 723
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	2 216 707	–	–	2 216 707
CM	–1 834 869	–	–	–1 834 869
CM for the base year	1 212 875	–	–	1 212 875
GM	–465 343	–	–	–465 343
GM for the base year	3 961 869	–	–	3 961 869

[a] The sum of the values for the individual gases and groups of gases may not match the total owing to rounding.

Table II.4
Information to be included in the compilation and accounting database for 2017 for Portugal
(t CO_2 eq)

	Original submission	Revised submission	Adjustment	Final value
Annex A emissions				
CO_2	55 402 055	–	–	55 402 055
CH_4	9 132 108	9 216 898	–	9 216 898
N_2O	3 251 131	–	–	3 251 131
HFCs	3 122 475	–	–	3 122 475
PFCs	17 022	–	–	17 022
Unspecified mix of HFCs and PFCs	NO, NE	–	–	NO, NE
SF_6	25 553	–	–	25 553
NF_3	NO, NA	–	–	NO, NA
Total Annex A sources[a]	**70 950 343**	**71 035 134**	**–**	**71 035 134**

	Original submission	Revised submission	Adjustment	Final value
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–1 558 683	–	–	–1 558 683
Deforestation	921 282	–	–	921 282
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	22 395 452	–	–	22 395 452
CM	–101 744	–	–	–101 744
CM for the base year	1 212 875	–	–	1 212 875
GM	1 565 000	–	–	1 565 000
GM for the base year	3 961 869	–	–	3 961 869

[a] The sum of the values for the individual gases and groups of gases may not match the total owing to rounding.

Table II.5
Information to be included in the compilation and accounting database for 2016 for Portugal
(t CO_2 eq)

	Original submission	Revised submission	Adjustment	Final value
Annex A emissions				
CO_2	50 598 985	–	–	50 598 985
CH_4	9 102 852	9 193 790	–	9 193 790
N_2O	3 169 654	–	–	3 169 654
HFCs	2 941 143	–	–	2 941 143
PFCs	15 398	–	–	15 398
Unspecified mix of HFCs and PFCs	NO, NE	–	–	NO, NE
SF_6	23 623	–	–	23 623
NF_3	NO, NA	–	–	NO, NA
Total Annex A sources[a]	**65 851 655**	**65 942 594**	**–**	**65 942 594**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–1 987 262	–	–	–1 987 262
Deforestation	954 595	–	–	954 595
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	4 927 799	–	–	4 927 799
CM	–1 543 509	–	–	–1 543 509
CM for the base year	1 212 875	–	–	1 212 875
GM	415 408	–	–	415 408
GM for the base year	3 961 869	–	–	3 961 869

[a] The sum of the values for the individual gases and groups of gases may not match the total owing to rounding.

Table II.6
Information to be included in the compilation and accounting database for 2015 for Portugal
(t CO_2 eq)

	Original submission	Revised submission	Adjustment	Final value
Annex A emissions				
CO_2	52 437 375	–	–	52 437 375
CH_4	9 177 505	9 275 037	–	9 275 037
N_2O	3 244 296	–	–	3 244 296
HFCs	2 805 316	–	–	2 805 316
PFCs	13 962	–	–	13 962
Unspecified mix of HFCs and PFCs	NO, NE	–	–	NO, NE
SF_6	23 179	–	–	23 179
NF_3	NO, NA	–	–	NO, NA
Total Annex A sources[a]	**67 701 634**	**67 799 166**	**–**	**67 799 166**

	Original submission	Revised submission	Adjustment	Final value
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–2 167 501	–	–	–2 167 501
Deforestation	1 122 418	–	–	1 122 418
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	646 924	–	–	646 924
CM	–1 531 321	–	–	–1 531 321
CM for the base year	1 212 875	–	–	1 212 875
GM	–284 240	–	–	–284 240
GM for the base year	3 961 869	–	–	3 961 869

[a] The sum of the values for the individual gases and groups of gases may not match the total owing to rounding.

Table II.7
Information to be included in the compilation and accounting database for 2014 for Portugal
(t CO_2 eq)

	Original submission	Revised submission	Adjustment	Final value
Annex A emissions				
CO_2	48 104 609	–	–	48 104 609
CH_4	9 380 843	9 485 447	–	9 485 447
N_2O	3 350 783	–	–	3 350 783
HFCs	2 663 178	–	–	2 663 178
PFCs	12 647	–	–	12 647
Unspecified mix of HFCs and PFCs	NO, NE	–	–	NO, NE
SF_6	25 812	–	–	25 812
NF_3	NO, NA	–	–	NO, NA
Total Annex A sources[a]	**63 537 873**	**63 642 477**	**–**	**63 642 477**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–2 638 196	–	–	–2 638 196
Deforestation	1 156 227	–	–	1 156 227
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–28 534	–	–	–28 534
CM	–1 517 681	–	–	–1 517 681
CM for the base year	1 212 875	–	–	1 212 875
GM	–544 893	–	–	–544 893
GM for the base year	3 961 869	–	–	3 961 869

[a] The sum of the values for the individual gases and groups of gases may not match the total owing to rounding.

Table II.8
Information to be included in the compilation and accounting database for 2013 for Portugal
(t CO_2 eq)

	Original submission	Revised submission	Adjustment	Final value
Annex A emissions				
CO_2	48 331 770	–	–	48 331 770
CH_4	9 499 954	9 612 143	–	9 612 143
N_2O	3 210 456	–	–	3 210 456
HFCs	2 531 577	–	–	2 531 577
PFCs	11 404	–	–	11 404
Unspecified mix of HFCs and PFCs	NO, NE	–	–	NO, NE
SF_6	30 992	–	–	30 992
NF_3	NO, NA	–	–	NO, NA
Total Annex A sources[a]	**63 616 155**	**63 728 343**	**–**	**63 728 343**

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–2 800 712	–	–	–2 800 712
Deforestation	1 212 547	–	–	1 212 547
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	3 254 780	–	–	3 254 780
CM	–1 306 664	–	–	–1 306 664
CM for the base year	1 212 875	–	–	1 212 875
GM	885 430	–	–	885 430
GM for the base year	3 961 869	–	–	3 961 869

[a] The sum of the values for the individual gases and groups of gases may not match the total owing to rounding.

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Activities under Article 3, paragraph 3, of the Kyoto Protocol				

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) 2.A.2 lime production – CO_2 emissions (see ID# I.5 in table 3);

(b) 2.C.1 iron and steel production – CO_2 emissions from use of limestone and dolomite in iron and steel production (see ID# I.15 in table 3);

(c) 2.E.2 thin-film transistor flat-panel displays – PFC, SF_6 and NF_3 emissions (see ID# I.18 in table 3);

(d) KP-LULUCF activities – carbon stock changes in a pool for the appropriate activity (see ID# KL.6 in table 3);

(e) Deforestation – indirect N_2O emissions from N mineralization/immobilization due to loss/gain of SOC (see ID# KL.10 in table 3);

(f) CM – CO_2 emissions and removals from carbon stock changes in living biomass for perennial cropland types (see ID# KL.13 in table 3).

Annex IV

Reference documents

A. Reports of the Intergovernmental Panel on Climate Change

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

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

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

B. UNFCCC documents

Annual review reports

Reports on the individual reviews of the 2013, 2014, 2015, 2016, 2018 and 2020 annual submissions of Portugal, contained in documents FCCC/ARR/2013/PRT, FCCC/ARR/2014/PRT, FCCC/ARR/2015/PRT, FCCC/ARR/2016/PRT, FCCC/ARR/2018/PRT and FCCC/ARR/2020/PRT 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/documents/510888.

Annual status report for Portugal for 2022. Available at https://unfccc.int/sites/default/files/resource/asr2022_PRT.pdf.

C. Other documents used during the review

Responses to questions during the review were received from Teresa Costa Pereira (Climate Change Department of the Portuguese Environmental Agency), 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:

Brinkmann, T, Falcke, H, and Holbrook, S., et al. 2018 'Best Available Techniques (BAT) Reference Document for the Production of Large Volume Organic Chemicals'. European Commission, Joint Research Centre, 2018. https://data.europa.eu/doi/10.2760/77304.

EEA. 2019. *EMEP/EEA air pollutant emission inventory guidebook 2019*. Luxembourg: Publications Office of the European Union. Available at https://www.eea.europa.eu/publications/emep-eea-guidebook-2019.

Thomas Fischer. 'Sun and Wind Energy'. *Sun and Wind Energy*, 2009.