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Report on the individual review of the annual submission of Finland submitted in 2020*

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 2020 annual submission of Finland, 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 31 August to 5 September 2020.

* In the symbol for this document, 2020 refers to the year in which the inventory was submitted, not to the year of publication.

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Contents

Abbreviations and acronyms

AAU	assigned amount unit
AD	activity data
Annex A source	source category included in Annex A to the Kyoto Protocol
AR	afforestation and reforestation
Article 8 review guidelines	"Guidelines for review under Article 8 of the Kyoto Protocol"
C	carbon
CER	certified emission reduction
CH_4	methane
CM	cropland management
CO	carbon monoxide
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"
CO_2	carbon dioxide
CO_2 eq	carbon dioxide equivalent
CPR	commitment period reserve
CRF	common reporting format
CSC	carbon stock change
DE%	digestible energy expressed as a percentage of gross energy
EEA	European Environment Agency
EF	emission factor
EMEP	European Monitoring and Evaluation Programme
ERT	expert review team
ERU	emission reduction unit
FAO	Food and Agriculture Organization of the United Nations
FM	forest management
FMRL	forest management reference level
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
IPCC good practice guidance for LULUCF	*Good Practice Guidance for Land Use, Land-Use Change and Forestry*
IPPU	industrial processes and product use
KP-LULUCF	activities under Article 3, paragraphs 3–4, of the Kyoto Protocol
KP reporting adherence	adherence to the reporting guidelines under Article 7, paragraph 1, of the Kyoto Protocol
LULUCF	land use, land-use change and forestry
MCF	methane correction factor
MMS	manure management system(s)
MSW	municipal solid waste
N	nitrogen
NA	not applicable
NE	not estimated
NFI	national forest inventory

NF_3	nitrogen trifluoride
NIR	national inventory report
NMVOC	non-methane volatile organic compound
NO	not occurring
N_2	dinitrogen
N_2O	nitrous oxide
PFC	perfluorocarbon
QA/QC	quality assurance/quality control
RMU	removal unit
RV	revegetation
SF_6	sulfur hexafluoride
SIAR	standard independent assessment report
UNFCCC Annex I inventory reporting guidelines	"Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual greenhouse gas inventories"
UNFCCC review guidelines	"Guidelines for the technical review of information reported under the Convention related to greenhouse gas inventories, biennial reports and national communications by Parties included in Annex I to the Convention"
WDR	wetland drainage and rewetting
Wetlands Supplement	*2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands*
2006 IPCC Guidelines	*2006 IPCC Guidelines for National Greenhouse Gas Inventories*
2019 Refinement to the 2006 IPCC Guidelines	*2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories*

I. Introduction

1. This report covers the review of the 2020 annual submission of Finland, 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 31 August to 5 September 2020 and was coordinated by Sevdalina Todorova (secretariat). Table 1 provides information on the composition of the ERT that conducted the review for Finland.

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

Area of expertise	*Name*	*Party*
Generalist	Melissa Weitz	United States of America
Energy	Dario Ruben Gomez	Argentina
	Katrina Young	United Kingdom
IPPU	Koen E.L. Smekens	Belgium
	Alexander Valencia	Colombia
Agriculture	Braulio Pikman	Brazil
LULUCF and KP-LULUCF	Rosie Brook	United Kingdom
	Inge G.C. Jonckheere	Belgium
Waste	Detelina Petrova	Bulgaria
Lead reviewers	Alexander Valencia	
	Melissa Weitz	

2. The basis of the findings in this report is the assessment by the ERT of the Party's 2020 annual submission in accordance with the UNFCCC review guidelines and the Article 8 review guidelines.

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

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

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

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

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

II. Summary and general assessment of the Party's 2020 annual submission

7. In accordance with paragraph 76 of the UNFCCC review guidelines and paragraphs 47 and 65 of the Article 8 review guidelines, the ERT has prioritized the review of issues and problems identified in previous review reports or in the initial assessment, recalculations that have changed the emission or removal estimate for a category by more than 2 per cent or national total emissions by more than 0.5 per cent for any of the recalculated years and supplementary information reported under the Kyoto Protocol. Table 2 provides the assessment by the ERT of the Party's 2020 annual submission with respect to the tasks undertaken during the desk review. Further information on the issues identified, as well as additional findings, may be found in tables 3, 5 and 6.

Table 2
Summary of review results and general assessment of the 2020 annual submission of Finland

Assessment			*Issue/problem ID#(s) in table 3, 5 or 6[a]*
Dates of submission	Original submission: NIR, 9 April 2020; CRF tables (version 4), 15 April 2020; standard electronic format tables (SEF-CP2-2019), 6 April 2020		
Review format	Desk review		
Application of the requirements of the UNFCCC Annex I inventory reporting guidelines and the Wetlands Supplement (if applicable)	Have any issues been identified in the following areas:		
	(a) Identification of key categories?	No	
	(b) Selection and use of methodologies and assumptions?	Yes	KL.1
	(c) Development and selection of EFs?	Yes	E.7
	(d) Collection and selection of AD?	Yes	E.8
	(e) Reporting of recalculations?	No	
	(f) Reporting of a consistent time series?	No	
	(g) Reporting of uncertainties, including methodologies?	Yes	L.6
	(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.4
	(j) Application of corrections to the inventory?	No	
Significance threshold	For categories reported as insignificant, has the Party provided sufficient information showing that the likely level of emissions meets the criteria in paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines?	Yes	
Description of trends	Did the ERT conclude that the description in the NIR of the trends for the different gases and sectors is reasonable?	Yes	
Supplementary information under the Kyoto Protocol	Have any issues been identified related to the following aspects of the national system:		
	(a) Overall organization of the national system, including the effectiveness and reliability of the institutional, procedural and legal arrangements?	No	
	(b) Performance of the national system functions?	No	
	Have any issues been identified related to the national registry:		
	(a) Overall functioning of the national registry?	No	

Assessment			*Issue/problem ID#(s) in table 3, 5 or 6[a]*
	(b) Performance of the functions of the national registry and the adherence to technical standards for data exchange?	No	
	Have any issues been identified related to the reporting of information on AAUs, CERs, ERUs and RMUs and on discrepancies in accordance with decision 15/CMP.1, annex, chapter I.E, in conjunction with decision 3/CMP.11, taking into consideration any findings or recommendations contained in the SIAR?	No	
	Have any issues been identified in matters related to Article 3, paragraph 14, of the Kyoto Protocol, specifically problems related to the transparency, completeness or timeliness of the reporting on the Party's activities related to the priority actions listed in decision 15/CMP.1, annex, paragraph 24, in conjunction with decision 3/CMP.11, including any changes since the previous annual submission?	No	
	Have any issues been identified related to the following reporting requirements for KP-LULUCF:		
	(a) Reporting requirements of decision 2/CMP.8, annex II, paragraphs 1–5?	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	Finland 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] The ERT identified additional issues and/or problems related to the energy, IPPU, agriculture, LULUCF and waste sectors that are not listed in this table but are included in tables 5–6.

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

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

8. Table 3 compiles the recommendations from previous review reports that were included in the most recent previous review report, published on 28 January 2019,[3] and had not been resolved by the time of publication of the review report of the Party's 2018 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. The ERT noted that the individual review of Finland's 2019 annual submission did not take place in 2019 owing to insufficient funding for the review process.

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

ID#	*Issue/problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
General			
G.1	NIR (G.2, 2018) Transparency	Include an explanation in the NIR of why indirect CO_2 emissions due to the atmospheric oxidation of CO were not reported.	Resolved. The Party reported its rationale for not reporting indirect CO_2 emissions due to the atmospheric oxidation of CO in its NIR (pp.17 and 426). Finland explained that indirect emissions from combustion or burning are not reported in order to avoid double counting, because emissions are calculated using EFs derived from the total C content of the fuel and it is assumed that all C not retained in the ash is converted to CO_2 when calculating direct CO_2 emissions, in line with the 2006 IPCC Guidelines (vol. 2, chap. 2.3).
G.2	NIR (G.2, 2018) Transparency	Include in the NIR correct information on the indirect CO_2 emissions from NMVOCs, including the average C content of NMVOCs and the allocation of NMVOCs to the CRF subcategories, which is consistent both internally and within the CRF tables.	Resolved. The Party reported information on indirect CO_2 emissions from NMVOCs (including the corrected average C content of road paving with asphalt and to which CRF subcategories emissions are allocated) in the NIR (pp.427–429). Although NIR table 9.1-2 provided more disaggregated information than the CRF tables for some categories (e.g. for subcategory 1.B.2.d), the values for each category are consistent and correspond to those in the CRF tables on the whole. The reporting for subcategory 1.B.2.d is due to the CRF structure, as it is not possible to report NMVOC emissions in CRF table 1.B.2. Therefore, the values relating to distribution of town gas under subcategory 1.B.2.d provided in CRF table 1.B.2 refer only to GHG emissions, while the four subcategories under 1.B.2.d in table 9.1-2 refer to NMVOCs. The Party reported that it plans to clarify this in the documentation box to CRF table 1s2 and to review the

[3] FCCC/ARR/2018/FIN. The ERT notes that the report on the individual inventory review of Finland's 2019 annual submission has not been published yet. As a result, the latest previously published annual review report reflects the findings of the review of the Party's 2018 annual submission.

ID#	*Issue/problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
			related descriptions in the NIR.
G.3	CPR (G.1, 2018) KP reporting adherence	Report in the NIR the same value for the CPR as reported in the initial review report (see document FCCC/IRR/2016/FIN).	Resolved. The Party reported a CPR of 216,490,140 t CO_2 eq in its NIR (p.481), which matches the value reported in the initial review report (FCCC/IRR/2016/FIN).
Energy			
E.1	1. General (energy sector) – all fuels – CO_2 (E.3, 2018) (E.11, 2016) Transparency	Make sure that the NIR and relevant CRF tables include sufficient explanation for any significant differences (more than 2 per cent) between the values reported under the sectoral approach and the reference approach.	Resolved. The 2020 submission only contained a few instances of differences in recent years between the CO_2 values reported under the sectoral approach and those reported under the reference approach that exceeded 2 per cent, the highest being for 2011 (4.5 per cent) and 2007 (3.1 per cent). Finland reported in its NIR (pp.74–75) that the difference in 2011 was likely due to errors in the stock change data for hard coal related to changes in the ownership of hard coal stockpiles, and that the difference in 2007 was due to erroneous AD on several fuels under the reference approach. Finland included a reference to this explanation in the documentation box to CRF table 1.A(c). Further, in the NIR the Party explained that a project was initiated in 2017 to ascertain the reasons for the large statistical differences and different figures in the oil balance, import and export statistics and under the reference approach. During the review, the Party clarified that the project involves ongoing activities designed to improve its understanding of these issues, strengthen cooperation within the energy industry and introduce new data collection systems.
E.2	1.A.1.b Petroleum refining – solid fuels – CH_4 and N_2O (E.5, 2018) (E.14, 2016) (E.14, 2015) Transparency	Report transparent information on the technologies and fuels reported under the subcategory petroleum refining – solid fuels, and include information on any significant changes in the plant-specific EFs.	Resolved. Solid fuel consumption for petroleum refining was reported for 1990–2007 in CRF table 1.A(a)s1. In the 2019 NIR (table 10.4.2), Finland explained that it only used hard coal as a filter material to be burned later using bubbling fluidized bed technology in one petroleum refinery plant in 1990–2007. The Party also explained that the EFs for CH_4 and N_2O were typical for bubbling fluidized bed boilers, but such plant-specific EFs cannot be included in the NIR for confidentiality reasons. The ERT noted that the CH_4 and N_2O EFs for solid fuels were constant across the time series.
E.3	1.A.2.d Pulp, paper and print – solid fuels – N_2O (E.6, 2018) (E.15, 2016) (E.15, 2015) Transparency	Provide clarification in the NIR of why the reallocation of the power plant from subcategory 1.A.1.a to 1.A.2.d took place in 2012, and provide information showing that the time-series consistency of the reporting has been ensured.	Resolved. Finland clarified in the NIR (p.92) that a combined heat and power plant is typically reallocated to a different subcategory (e.g. from 1.A.1.a to 1.A.2.d) if there is a change in ownership, for example from an industrial company to an energy company. Finland has provided detailed information on such reallocations in responses to questions raised during previous reviews and included summary

ID#	*Issue/problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
			information in the NIR. During the review, the Party confirmed that, in the case of 2012, the reallocation was due to the ownership of one plant changing from an energy company to a paper company, and shared with the ERT the confidential reasons why the plant has a high N_2O IEF, resulting in the reallocation having a significant effect on the N_2O IEF under subcategory 1.A.2.d. As also reported in the NIR (p.92), the Party explained that, although this reallocation led to variations in the IEFs at the category and fuel level, it has ensured the accuracy and time-series consistency of the emission estimates at the plant level.
E.4	1.A.3 Transport – diesel – CO_2, CH_4 and N_2O (E.12, 2018) Accuracy	Collect accurate data on diesel consumption on the basis of the actual fuel use and conduct the necessary recalculations to avoid overestimation of GHG emissions from road transport.	Resolved. The estimates in the 2020 submission are based on accurate data on diesel consumption taken from the Finnish Petroleum and Biofuels Association and fuel tax data taken from the Finnish Customs and Tax Administration (p.109). The Party reported in its 2019 NIR (p.109) the steps taken to recalculate the fuel tax based data for 2016 to take into account the increase in the diesel tax rate since 2017, which resulted in some wholesale companies choosing to pay taxes on the fuel they had in storage in advance. The effect of the recalculation was –164 kt CO_2 for 2016.
E.5	1.A.3.b Road transportation – liquid fuels – CO_2 (E.11, 2018) Accuracy	Accurately calculate the CO_2 emissions from gasoline and diesel consumption in road transport by making further efforts to collect more complete information on conversion factors (density, net calorific value and C content) of the fossil components of road transport fuels (especially paraffinic diesel).	Resolved. The 2019 submission addressed the issue of road transport emissions being overestimated by approximately 300 kt CO_2 eq for 2016, caused by the Party not taking into account the effect of the increase in the share of paraffinic diesel in road transport fuel consumption. Finland reported in its 2019 NIR (p.109) the steps taken to recalculate these CO_2 emissions on the basis of the new CO_2 EF and net calorific value, which were re-estimated to take into account the increase in paraffinic diesel since 2013. The updated net calorific value for fossil diesel oil for 2013 onward was presented in Finland's 2020 NIR (table 3.2-4).
E.6	1.A.4.a Commercial/institutional – peat – CH_4 and N_2O (E.7, 2018) (E.16, 2016) (E.16, 2015) Transparency	Report any relevant information on changes in the share of different types of plant in the emission estimates and the national EFs, particularly when they result in significant fluctuations in the time series of the reported emissions.	Resolved. The Party included an overarching explanation in its NIR (pp.83 and 125) that there are annual changes in both the shares of different types of plants using peat and the national EFs because, in Finland, it is typical to use boilers fired by a combination of fuels, the mix of which varies depending on current availability, cost and taxes, as well as the price of CO_2 in the European Union Emissions Trading System. This is particularly relevant for peat-fired boilers, under subcategory 1.A.4, where the AD are plant-specific and the EFs vary depending on the combination of fuel and technology used.

ID#	*Issue/problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
IPPU			
I.1	2.B.8 Petrochemical and carbon black production – CH_4 (I.4, 2018) Comparability	Use the correct notation key ("IE") to report CH_4 emissions from ethylene production in the CRF tables and ensure consistency between the NIR and the CRF tables.	Resolved. Finland reported AD on ethylene production (405.77 kt) in CRF table 2(I).A-Hs1 and continued to report the resulting CH_4 emissions as "NA". The Party justified the use of "NA" in the NIR. Although ethylene is produced in Finland, the CH_4 produced during this process is not emitted but used as a fuel in an oil refinery (p.542), with the resulting CO_2 emissions accounted for under the energy sector (p.162). This explanation is in line with the 2006 IPCC Guidelines (vol. 3, chap. 3, p.3.57), which stipulate that combustion emissions from fuels obtained from feedstocks should be allocated to the source category in the IPPU sector, unless the fuels are not used within the source category but transferred out of the process for combustion elsewhere, in which case the emissions should be reported under the appropriate energy sector source category. The ERT noted, however, that according to the 2006 IPCC Guidelines (vol. 3, chap. 3, p.3.69) CH_4 emissions from petrochemical processes may also be fugitive emissions and/or process vent emissions (see ID# I.4 in table 6).
I.2	2.D.1 Lubricant use – CO_2 (I.5, 2018) Convention reporting adherence	Refer, in the NIR, to the EF used to estimate CO_2 emissions from lubricant use as default instead of country-specific.	Addressing. The Party corrected the references to the EF (20 t C/TJ) used to calculate CO_2 emissions from lubricant use in NIR section 4.5.2.1 and reported it as "IPCC default" in tables 1.4-1 and 4.5-1 and in CRF table Summary3s1. However, in NIR table 4.1-1 the EF is still referred to as a country-specific value.
Agriculture			
A.1	3.A.1 Cattle – CH_4 (A.3, 2018) Transparency	Improve the explanation provided for each parameter used in the calculation of gross energy for cattle, particularly in relation to (a) the coefficients for net energy for maintenance for all cattle categories; (b) the coefficients related to pregnancy, feeding situation and growth; and (c) the parameter DE%.	Resolved. The Party improved the explanation for the parameters used in the calculation of gross energy for cattle in the NIR (p.244) as follows: (a) The Party reported that, with the exception of bulls and suckler cows (for which detailed information was already provided in the 2018 NIR), it used default values from the 2006 IPCC Guidelines (vol. 4, chap. 10, table 10.4) for the coefficients for net energy for maintenance; (b) The Party improved the discussion in the NIR on the coefficient related to pregnancy. The information on coefficients related to feeding situation now includes a description of the climatic conditions used to calculate the coefficient for net energy for maintenance. Finland updated the feeding situation description and explained that it is based on expert judgment, providing new references (e.g. to feeding recommendations (Aavikko et al., 1987;

ID#	*Issue/problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
			Agrifood Research Finland, 2006), diet examples (Pesonen, 2012) and feeding experiment results (Manninen, 2007)). For AD on the coefficient related to animal's feeding situation, a weighted average of the IPCC default coefficients for stalls and pasture was used, while the amount of time spent by animals on pasture is determined using survey results and expert judgment (Grönroos, 2014; Grönroos, Munther and Luostarinen, 2017). The Party also presented the country-specific coefficients related to growth for bulls (1.2), heifers (0.8) and calves (1.0). For dairy cows, the value from the 2006 IPCC Guidelines (i.e. 0.8 for females, as reported in vol. 4, chap. 10, p.10.17) was used; (c) The NIR includes additional information on digestible energy calculated using the empirically derived formula by Ramin and Huhtanen (2013) (gross energy digestibility (g/kg) = –11.3 + 0.977 × organic matter digestibility).
A.2	3.D.a.2 Organic nitrogen fertilizers – N_2O (A.8, 2018) Transparency	Update, as appropriate, the description of the N mass flow on the basis of the most recent source used (e.g. Grönroos, Munther and Luostarinen, 2017) and provide a reference to that source in the NIR.	Resolved. The Party updated the description and reference to the N mass flow model in its 2019 NIR (table 10.4-2). In its 2020 NIR (p.257) the Party reported that the N mass flow model was originally developed for its air pollutant inventory under the Convention on Long-range Transboundary Air Pollution of the United Nations Economic Commission for Europe, but has subsequently also been adopted for the GHG inventory, ensuring the consistency of AD and parameters between the two inventories. The GHG inventory uses the N mass flow model by Grönroos et al. (2009) updated with more recent data on MMS (Grönroos, 2014), data on bedding use (Hellstedt, 2016) and the most recent EFs for nitric oxide and N_2 volatilization from manure (*EMEP/EEA air pollutant emission inventory guidebook 2016*).
A.3	3.D.a.2 Organic nitrogen fertilizers – N_2O (A.8, 2018) Transparency	Include in the NIR (table 5.4-9) the N_2 EFs for animal housing and manure storage considered relevant to the calculation of N_2O emissions from spreading (no information related to N_2 emissions following spreading is required).	Resolved. The Party reported in its NIR (table 5.4-9) the required fraction of N input in manure that volatilizes as ammonia and N oxides relevant to the calculation of N_2O emissions from spreading, taking into account N_2 emissions. This value (0.08–0.09) has not changed since previous submissions, but the reference was updated to the *EMEP/EEA air pollutant emission inventory guidebook 2016*. The same value is used for pasture, manure, bedding application, sewage sludge and other organic fertilizers.
LULUCF			
L.1	4.A.1 Forest land remaining forest land –	Provide a more detailed description in the NIR of the calculation of living biomass stocks and gains in living biomass stocks at the	Resolved. The Party provided a more detailed description of the calculation of CSC in living biomass at the tree level in its NIR

ID#	*Issue/problem classification[a, b]*	*Recommendation made in previous review report*	*ERT assessment and rationale*
	CO_2 (L.9, 2018) Transparency	tree level from the NFI data collected, including information on the treatment of "tally trees" and "sample trees".	(appendix 6a). This included additional information on the different measurement variables (e.g. bark thickness, diameter increments and damages) used to determine the biomass and volumes of "tally trees" and "sample trees" in different calculation methods.
L.2	4.C.1 Grassland remaining grassland – CO_2 (L.3, 2018) (L.9, 2016) (L.9, 2015) Completeness	Report the C stock losses associated with the living biomass pool for grassland remaining grassland.	Resolved. The Party reported C stock losses associated with the living biomass pool for grassland remaining grassland in CRF table 4.C. The methodology and assumptions used for the estimates are provided in the NIR (appendix 6c). The ERT noted that the description of the methodology could be improved further (see ID# L.8 in table 6).
L.3	4(V) Biomass burning – CH_4 and N_2O (L.11, 2018) Accuracy	Either provide a transparent explanation in the NIR of the method and EFs from the IPCC good practice guidance for LULUCF used for estimating the GHG emissions from biomass burning in forest fires (including why the method and EFs applied are more appropriate as a country-specific method for Finnish conditions), or use country-specific EFs with the default method provided in the 2006 IPCC Guidelines or an alternative country-specific method, where possible. If this is not possible, use the default method and EFs from the 2006 IPCC Guidelines.	Resolved. The Party updated the EFs used to calculate CH_4 and N_2O emissions from biomass burning to the default EFs from the 2006 IPCC Guidelines (vol. 4, chap. 2, table 2.5). Information on the method applied, including the EFs, is provided in the NIR (p.355).
L.4	4(V) Biomass burning – CO_2 (L.12, 2018) Accuracy	Check the available data sets from the NFI to ensure that the C stock losses in living biomass from wildfires on forest land and grassland are not included and, if they are included, remove the CO_2 emissions from biomass burning on forest land from CRF table 4(V). If CO_2 emissions from biomass burning continue to be reported in CRF table 4(V), provide an appropriate explanation in the NIR for such reporting (following an investigation to ensure that there is no double counting of CO_2 emissions from forest land).	Resolved. The Party reported CO_2 emissions from wildfires and controlled burning in CRF table 4(V) for the whole time series and included additional information in the NIR (p.354). In the NIR the Party reported that emissions from biomass burning only include the rare events of wildfires and restoration burning (not captured by the NFI), and are based on data from emergency services under the Ministry of the Interior. During the review, Finland confirmed that checks have been made to ensure that CO_2 emissions from biomass burning are not accounted for under living biomass and are not being double counted.
L.5	4.G HWP – CO_2 (L.13, 2018) Transparency	Include in the NIR detailed information related to the improvements made to the quality and coverage of the AD used for the calculation of CSCs in HWP, including those made as part of the project by Hamberg, Henttonen and Tuomainen (2016).	Resolved. The Party reported in its NIR (section 6.11.2) information on the AD used for calculating CSC in the HWP pool and country-specific conversion factors. The results from the recent project by Hamberg, Henttonen and Tuomainen (2016) provided AD for 1900 onward and conversion factors from m^3 or t to C for a country-specific, more detailed product classification.
L.6	4.G HWP – CO_2 (L.15, 2018) Convention reporting adherence	Update the uncertainty analysis for HWP and replace the default value of uncertainty of the HWP estimates (50 per cent) with a country-specific estimate based on the results of national studies (e.g. Hamberg, Henttonen and Tuomainen, 2016). If that is not	Addressing. The Party reported an uncertainty for HWP of ±50 per cent based on tier 1 methodology from the 2006 IPCC Guidelines (vol. 4, chap. 12.3) in its NIR (p.363). However, Finland stated (NIR table 10.4-2) that it is currently in the process of updating its

ID#	*Issue/problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
		possible, validate the high value of uncertainty by calculating the overall uncertainty using the values of uncertainty of AD and other parameters from the 2006 IPCC Guidelines or those based on expert judgment.	uncertainty analysis for HWP to take into account improved AD and other parameters (see ID# L.5 above). The uncertainty estimation was also reported as a planned improvement in NIR section 6.11.6. During the review, the Party clarified that the revised uncertainty analysis will be included in the 2021 submission.
Waste			
W.1	5.A Solid waste disposal on land – CH_4 (W.2, 2018) Transparency	Include in the NIR information on the method used for estimating CH_4 recovery (i.e. based on continuous measurements at the plant level (volumes) and on periodic measurements of CH_4 content), including details of the methodology used in the case of failure of volume metering.	Resolved. Finland reported in its NIR (p.403) a description of the method used for estimating CH_4 recovery, which is based on continuous measurements at the plant level (volumes) using a pitot tube or turbine meter and on individual measurements (1–12 times per year) of CH_4 content. The Party also explained that if volume metering fails, gas recovery volumes are estimated, for example on the basis of energy production and operating hours, and if no information is available from a plant then no recovery is assumed to take place. The ERT noted that the Party improved its description of the amount of gas recovery in appendix 7b to the NIR and presented the number of landfill gas recovery plants in size categories and by volume of gas collected.
W.2	5.A Solid waste disposal on land – CH_4 (W.3, 2018) Accuracy	Make efforts to update the data on composition of municipal waste as planned.	Resolved. Finland updated the composition of MSW, which was previously assumed to remain constant for 2008–2016, and reported in its NIR (pp.401 and 406) new estimates for 2010–2017 based on more accurate and consistent data on the waste composition of mixed MSW. These estimates are based on the modelled waste composition of mixed MSW in waste flow (Sahimaa, 2017) and on the databank from waste composition studies on mixed MSW in Finnish households (Finnish Solid Waste Association, 2019). For the composition until 2009 a top-down approach and the above-mentioned references were used. The years 2010–2015 were interpolated. For 2016 onward the composition is kept constant to take into account the ban on sending organic waste to landfill, meaning that mixed MSW can only be landfilled with a special permit.
W.3	5.A Solid waste disposal on land – CH_4 (W.4, 2018) Transparency	Provide information on the industrial solid waste amounts for the whole time series for both dry and wet matter to ensure its compatibility with other types of waste.	Resolved. Finland reported information on the industrial solid waste amounts for the whole time series for both dry and wet matter in its NIR (table 7.2-8).
KP-LULUCF			
KL.1	AR – CO_2 (KL.9, 2018)	Estimate the CSC in living biomass for afforestation older than 20 years by applying age-specific values for living biomass	Addressing. The Party continued to apply living biomass increment values for afforestation less than 20 years to all cases of

ID#	Issue/problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
	Accuracy	increment.	afforestation regardless of age. The Party reported in its NIR (p.324 and table 10.4-2) that it is currently updating its method for estimating biomass growth on afforested land to include the effect of age on the biomass growth increment. It plans to include new estimates in the 2021 submission.
KL.2	AR – CO_2 (KL.9, 2018) Transparency	Include a transparent description in the NIR of the methodology applied for the estimation of CSC in living biomass, especially regarding the gain-loss method used, including the information shared during the review based on the information contained in Hamberg, Henttonen and Tuomainen (2016) on the losses in living biomass per year for afforestation.	Resolved. Finland improved the description of the methodology used to estimate the (harvesting) losses in living biomass reported under AR in its NIR (section 11.3.1.1 and appendix 6c) using the results from Hamberg, Henttonen and Tuomainen (2016). A figure showing the values of living biomass losses per year for afforestation, which was shared with the ERT during the previous review, was added to the NIR (p.376).
KL.3	FM – general (KL.2, 2018) (KL.6, 2016) (KL.6, 2015) Accuracy	As referenced in document FCCC/TAR/2011/FIN, ensure consistency in the method applied for estimating CO_2 removals from forest land under FM activities for the FMRL and the commitment period years, including by applying IPCC methods for ensuring time-series consistency, or, if necessary, develop a customized approach or apply the overlap with historical data, as suggested in paragraph 14 of the annex to decision 2/CMP.7.	Resolved. The Party reported in its NIR (section 11.5.4.3) that it applied a technical correction to the FMRL to improve the consistency in the method applied for estimating CO_2 removals from forest land under FM activities for the FMRL and for the commitment period years. The ERT noted that two improvements were applied in the 2019 and 2020 submissions: (1) the inclusion of fuelwood consumption in small-scale housing in the reference scenario used for the FMRL and (2) adjustments to the forestry model used to estimate the predicted increment of growing stock and the amount of natural losses in order to more accurately reproduce historical results. In its NIR (figure 11.5-1), Finland demonstrated that its forestry model now produces a time series that is consistent with historical NFI data (2006–2015).
KL.4	FM – general (KL.4, 2018) (KL.7, 2016) (KL.7, 2015) Accuracy	Revise the technical correction with the aim of ensuring consistency between the FMRL technical correction and FM estimates.	Resolved. The Party reported in its NIR (table 11.5-2) that it revised the FMRL technical correction in order to improve consistency with the FM estimates. For example, Finland included the national disturbance background level, took into account changes in the estimates for biomass burning and included fuelwood consumption in small-scale housing (see ID# KL.3 above). In addition, the Yasso model was revised to improve the consistency of the soil organic matter and degradable organic C pools in the FMRL. The technical correction reported in the 2020 submission is –10,938.00 kt CO_2 eq compared with –14,545.00 kt CO_2 eq reported in the 2018 submission.
KL.5	FM – CO_2 (KL.10, 2018) Transparency	Provide transparent information in the NIR on the technical correction made to the FMRL by clearly stating which issues were addressed in the technical correction and by including references to the relevant sections of the NIR where the	Addressing. The Party reported a transparent overview of the modifications made to the GHG inventory and the FMRL technical correction in its NIR (table 11.5-2), together with information on the submission in which the technical correction was implemented.

ID#	*Issue/problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
		methodology is described.	However, references to the sections of the NIR where the methodology is described were not included.
KL.6	Biomass burning – CH_4 and N_2O (KL.11, 2018) Accuracy	Either provide transparent information in the NIR explaining the method and EFs from the IPCC good practice guidance for LULUCF used for estimating CH_4 and N_2O emissions from biomass burning in areas subject to FM (including why the method and EFs applied are more appropriate as a country-specific method for Finnish conditions), or use country-specific EFs with the default method provided in the 2006 IPCC Guidelines or an alternative country-specific method, where possible. If this is not possible, use the default method and EFs from the 2006 IPCC Guidelines.	Resolved. The Party revised the EFs applied for calculating CH_4 and N_2O emissions from biomass burning in its 2019 submission (table 10.4-2), applying those from the 2006 IPCC Guidelines (vol. 4, chap. 2, table 2.5) instead of those from the IPCC good practice guidance for LULUCF. Methodological information is provided in section 6.10.5 (on LULUCF) of the 2020 NIR, to which a reference is provided in section 11.3.1 (on KP-LULUCF) (see ID# L.3 above).
KL.7	Biomass burning – CO_2 (KL.12, 2018) Accuracy	Check the available data sets from the NFI to ensure that the C stock losses in living biomass due to wildfires are not included in the CSC in areas under FM and, if they are included, remove CO_2 emissions from biomass burning from CRF table 4(KP-II)4. If CO_2 emissions from biomass burning in FM areas continue to be reported in CRF table 4(KP-II)4, provide an appropriate explanation in the NIR (following an investigation to ensure that there is no double counting of CO_2 emissions).	Resolved. The Party reported in its 2019 NIR that CO_2 emissions from biomass burning due to wildfires and restoration burning are not double counted (section 6.10.5.1 and table 10.4-2) and justified in the 2020 NIR (p.354) its reporting of CO_2 emissions in CRF table 4(KP-II)4. The Party explained that CO_2 emissions are only reported for wildfires and restoration burning in cases where it is assumed that losses due to fires are not captured in the NFI tree measurements and hence no double counting of CSCs in living biomass is expected. However, CO_2 emissions from cutting residues are reported under CSC in dead organic matter (litter), but excluded from emissions from controlled burning to avoid double counting (see ID# L.4 above).

[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 2019 annual submission of Finland was not available at the time of this review. Therefore, the recommendations reflected in this table are taken from the 2018 annual review report. For the same reason, 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, and as documented in table 4, the ERT assessed that there were no issues identified in three or more successive reviews that had not been addressed by the Party.

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

ID#	*Previous recommendation for the issue*	*Number of successive reviews issue not addressed*[a]
General	No issues identified.	
Energy	No issues identified.	
IPPU	No issues identified.	
Agriculture	No issues identified.	
LULUCF	No issues identified.	
Waste	No issues identified.	
KP-LULUCF	No issues identified.	

[a] Reports on the reviews of the 2017 and 2019 annual submissions of Finland have not yet been published. Therefore, 2017 and 2019 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 2020 annual submission

10. Tables 5–6 present findings made by the ERT during the individual review of the 2020 annual submission of Finland that are additional to those identified in table 3. In accordance with paragraph 76(b) of the UNFCCC review guidelines, the ERT has prioritized in table 5 recalculations that changed the total emissions or removals for a category by more than 2 per cent and/or national total emissions by more than 0.5 per cent for any of the recalculated years.

Table 5
Additional findings made during the individual review of the 2020 annual submission of Finland related to recalculations

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
Energy			
E.7	1.A.1.a Public electricity and heat production –	A comparison of CRF table 1.A(a)s1 submitted in 2019 and 2020 shows that a recalculation was made between the two submissions that resulted in a 2.4 per cent (284.29 kt) increase in estimated CO_2 emissions from biomass for public electricity and heat production in 2017, despite the 1.0 per cent fall in the CO_2 IEF for 2017. During the review, the Party clarified that the recalculation was largely due to a "remapping" of fuels at one plant, which	Yes. Accuracy

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
	biomass – CO_2	recategorized gasified biomass input materials as synthetic biogas with a view to harmonizing its reporting with that of the International Energy Agency. This halved the biomass CO_2 EF for the plant. Finland stated that it will discuss this CO_2 EF with the plant operator and revise the EF in its next submission, noting that such a revision will not affect the total national emissions. It noted, however, that it will not be able to include the plant-specific EF in the NIR for confidentiality reasons. The ERT recommends that the Party determine the appropriate CO_2 EF for biogas from the referenced plant for which a remapping of fuels was carried out for the 2020 submission and transparently report this information in its NIR.	
E.8	1.A.3.d Domestic navigation – gaseous fuels – CO_2, CH_4 and N_2O	The recalculations made between the 2019 and 2020 submissions resulted in significant changes, in terms of percentage, in the AD and related estimated CO_2, CH_4 and N_2O emissions for 2016 and 2017 (gaseous fuel consumption is only reported since 2016). The AD value changed from 4.00 to 64.09 TJ (1,502.3 per cent) for 2016 and from 271.55 to 98.60 TJ (−63.7 per cent) for 2017. The Party reported in its NIR (p.118) that erroneous AD on liquefied natural gas for 2017 were corrected in the 2020 submission. During the review, the Party clarified that it has started to collect data on the use of liquefied natural gas in navigation partly by vessel and partly by terminal operator, but the system is still under development and the contradictory and erroneous AD from initial reports from the system have now been re-estimated. Finland further explained that some data stem from expert judgment. In addition, there are challenges in allocating fuel data to CRF categories because the terminal operators do not know who the final users are, and non-domestic vessels fueled by liquefied natural gas may refuel at domestic ports. The ERT noted that total GHG emissions from gaseous fuels (e.g. 4.26 kt CO_2 eq in 2018) are below the significance threshold (paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines) for Finland. During the review, the Party explained that it has been improving its process for collecting data on liquefied natural gas use in ships, noting that, while this source is currently insignificant, it may grow in the future. Emissions from gaseous fuels currently stem from a very small number of ships, preventing it from including detailed information in the NIR for confidentiality reasons. Finland also noted that the rules on ship-to-ship refuelling are not clear in the existing methodological guidance and should be clarified to avoid double counting between Parties. The ERT recommends that the Party improve its collection of AD on liquefied natural gas used for domestic navigation and transparently report estimates and any recalculations.	Yes. Accuracy
IPPU			
	2. General (IPPU)	Recalculations were made to the IPPU sector that changed the emission estimate for some categories by more than 2 per cent and/or national total emissions by more than 0.5 per cent; however, the ERT did not identify any issues or problems with these recalculations.	
Agriculture			
	3. General (agriculture)	Recalculations were made to the agriculture sector that changed the emission estimate for some categories by more than 2 per cent and/or national total emissions by more than 0.5 per cent; however, the ERT did not identify any issues or problems with these recalculations.	

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
LULUCF			
	4. General (LULUCF)	Recalculations were made to the LULUCF sector that changed the emission or removal estimate for some categories by more than 2 per cent and/or national total emissions by more than 0.5 per cent; however, the ERT did not identify any issues or problems with these recalculations.	
Waste			
W.4	5.D Wastewater treatment and discharge – N_2O	Finland reported in the NIR (pp.415 and 420) that it recalculated protein consumption, used for estimating N_2O emissions from domestic wastewater and discharge, for 2000–2017 owing to the use of FAO statistics. This caused N_2O emissions to decrease by 12.0 per cent, or 0.03 kt, in 2017. The ERT noted that Finland previously used national data to determine protein consumption (Tike, 2010; Luke, 2016). During the review, Finland clarified that it was difficult to use FAO statistics for protein consumption in previous submissions because the relevant data have not been available when needed for the inventories. For example, data for 2014–2017 were not available on the FAO website until this year. However, the more up-to-date Finnish data (Luke, 2016) are no longer comprehensive or published, which means that in recent years the inventory team has only had approximate information on protein consumption. To ensure time-series consistency, the Party applied data from FAO to the years in which national data were used (albeit use of these two data sources only resulted in minor differences). The ERT commends Finland for its effort to improve time-series consistency and encourages the Party to use the most accurate and up-to-date data on protein consumption.	Not an issue/problem
KP-LULUCF			
	General (KP-LULUCF)	Recalculations made to KP-LULUCF activities changed the emission or removal estimate for some categories by more than 2 per cent and/or national total emissions by more than 0.5 per cent; however, the ERT did not identify any issues or problems with these recalculations.	

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

11. Table 6 contains additional findings made by the ERT during the individual review of the 2020 annual submission that are not covered in table 3 or 5, but are within the scope of the desk review as specified in paragraph 76 of the UNFCCC review guidelines or paragraph 65 of the Article 8 review guidelines and are findings that the ERT wishes to convey to the Party.

Table 6
Additional findings made during the individual review of the 2020 annual submission of Finland

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
General			
G.4	National registry	The SIAR did not provide any recommendations related to the national registry of the Party, as information on discrepancies and notifications is reported in NIR section 12.2.2. However, the SIAR includes some specific suggestions on the use of more precise language when reporting on discrepancies and notifications in the NIR. For	Not an issue/problem

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
		example, for discrepant transactions, the SIAR suggests that the Party state specifically that "No discrepant transactions occurred in 2019", and include similar statements for reversal of storage notifications ("No reversal of storage notifications occurred in 2019"), for non-certification notifications ("No non-certification notification occurred in 2019"), for non-replacement notifications ("No non-replacement notifications occurred in 2019") and for units not valid for use towards compliance ("No inconsistencies from discrepant transactions occurred in 2019"). The ERT encourages Finland to use the language suggested in the SIAR in NIR section 12.2.2.	
Energy			
E.9	Fuel combustion – reference approach – gaseous fuels – CO_2	In CRF table 1.A(b) the Party used an erroneous unit for the conversion factor of gaseous fuels (36,500.00 TJ/10^6 m^3). During the review, the Party clarified that this had no impact on the calculations under the reference approach because the apparent consumption of gaseous fuels was also reported erroneously (e.g. the apparent consumption of natural gas in 2018 should be 2,504 10^6 m^3 and not 2.5). The Party reported that the error will be corrected for its next submission. The ERT recommends that the Party correct the reported units and values for gaseous fuels under the reference approach in CRF table 1.A(b).	Yes. Convention reporting adherence
E.10	Fuel combustion – reference approach – all fuels – CO_2	The ERT noted some unexplained changes in values reported in the 2018 and 2020 submissions under the reference approach for 2016–2017 (e.g. a 6.7 per cent decrease in CO_2 emissions from solid fuels in 2016 between submissions) in CRF table 1.A(c), as well as some erroneous figures in the reference approach calculations in the current submission (e.g. quantities of imported coke reported as petroleum coke, stock change data on gas/diesel oil, erroneous allocation of liquefied petroleum gas under other oil, and imports of gas/diesel oil that were not corrected to account for quantities of imported biofuels mixed in with the fossil diesel and gasoline), which the ERT detected when comparing the data with data from the International Energy Agency. During the review, the Party explained that some of the changes were the result of corrected erroneous fuel codes in import or export data and acknowledged the errors in the current submission, stating that these errors will be corrected for the next submission. In addition, the Party stated that it currently prepares its reference approach calculations by manually updating a large number of files, but hopes to move to an automated database system. However, it does not currently have a time schedule or the resources needed to develop such a system. Finland also explained that the changes in the values reported under the reference approach are based on energy and fuel balance data prepared as part of its national energy statistics and are only available very close to the NIR due date, meaning it is not possible to detect all errors and inconsistencies in the data for the most recent inventory year. The ERT encourages the Party to enhance its QA/QC procedures to reduce data entry errors for the reference approach calculations.	Not an issue/problem
E.11	1.C.1 Transport of CO_2 – CO_2	The Party reported in its NIR (p.132) that the amount of CO_2 captured from pulp and paper mills and transferred to precipitated calcium carbonate plants was estimated on the basis of the amount of precipitated calcium carbonate produced. The data and methodology were presented in appendix 3c to the NIR. The amount of CO_2 captured for storage was reported as an information item in CRF table 1.C in accordance with the 2006 IPCC Guidelines (vol. 2, chap. 5, table 5.4) and also reported consistently in CRF table 1.A(a)s2. However, in accordance with the 2006 IPCC Guidelines (vol. 2, chap. 5, p.5.7), any fugitive emissions occurring during the transport of captured CO_2	Yes. Comparability

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
		should be included in the national inventory total under subcategory 1.C.1, but Finland reported these emissions as "NA" in CRF table 1.C. During the review, the Party stated that its methodology includes any fugitive emissions during the transport of captured CO_2 in the emissions from the precipitated calcium carbonate plants in CRF table 1.A(a)s2. During the review, the Party agreed that it would be more appropriate to report fugitive emissions in CRF table 1.C as "IE". The ERT recommends that the Party use the most appropriate notation key for fugitive emissions of CO_2 transported between pulp and paper mills and precipitated calcium carbonate plants, ensuring consistency between CRF tables 1.A(a)s2 and 1.C, and transparently document in its NIR where the emissions are included.	
IPPU			
I.3	2.B.8 Petrochemical and carbon black production – CO_2	Finland reported AD on ethylene production (e.g. 405.77 kt in 2018) in CRF table 2(I).A-Hs1, but reported "NA" for the resulting CO_2 emissions in the same table, despite the NIR reporting that these emissions are included under the energy sector (p.162) (see also ID# I.1 in table 3). The reporting of "NA" for CO_2 is not in accordance with paragraph 37 of the UNFCCC Annex I inventory reporting guidelines. During the review, the Party reported that it will use "IE" and include in its next submission an explanation concerning CO_2 emissions under subcategory 2.B.8.b clarifying that refinery and fuel gases from petrochemical plants are reported as refinery gases and included under liquid fuels in the Finnish national GHG inventory. The ERT recommends that the Party report "IE" for CO_2 emissions from ethylene production (category 2.B.8.b) in CRF table 2(I).A-Hs1 and explain in the NIR and in CRF table 9 the allocation of the associated CO_2 emissions under subcategory 1.A.1.b.	Yes. Comparability
I.4	2.B.8 Petrochemical and carbon black production – CH_4	In response to questions related to issue ID# I.1 in table 3, the Party indicated that CH_4 emissions were reported as "NA" for subcategory 2.B.8.b ethylene since CH_4 is used as fuel in an oil refinery and the resulting CO_2 emissions are accounted for under the energy sector (NIR pp.162 and 542). However, according to the 2006 IPCC Guidelines (vol. 3, chap. 3, equation 3.25), CH_4 emissions from petrochemical processes may be fugitive emissions and/or process vent emissions. Fugitive emissions are emitted from flanges, valves and other process equipment. Emissions from process vent sources result, for example, from the incomplete combustion of waste gas in flare and energy recovery systems. During the review, the Party clarified that it relied on information provided by plant personnel, and therefore reported CH_4 emissions for this sector as "NA" (assuming that all CH_4 is combusted to CO_2 and there are no venting or fugitive emissions). The Party reported that it will check, for the next submission, whether this information is still valid. The ERT noted that, taking into account the AD on ethylene production (e.g. 405.77 kt in 2018), maximum fugitive emissions of 2.43 kt CH_4 (60.87 kt CO_2 eq) could be expected (on the basis of the 2006 IPCC Guidelines, vol. 3, chap. 3, equation 3.23 and table 3.16), which is above the significance threshold (UNFCCC Annex I inventory reporting guidelines, para. 37(b)) for Finland. The ERT believes that this issue should be considered further in future reviews to confirm that emissions are not being underestimated. The ERT recommends that the Party report CH_4 emissions from venting and flaring in ethylene production (category 2.B.8.b) or confirm with the plant operator the assumption that all CH_4 is combusted to CO_2 and no venting or fugitive emissions occur, substantiating this assumption, for example, with verified data from the measurement of emissions from flanges, valves and other process equipment or emissions from the combustion of waste gas in energy recovery systems. If emissions from venting and flaring in ethylene production do occur, the	Yes. Completeness

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
		ERT recommends that the Party improve the transparency of its NIR by including background information on estimated CH_4 emissions from venting and flaring. If emissions from venting and flaring are assumed to be insignificant, the ERT further recommends that Finland provide relevant justifications in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.	
Agriculture			
A.4	3.A.1 Cattle – CH_4	Finland applied the methodology from the 2006 IPCC Guidelines (vol. 4, chap. 10.3) to estimate CH_4 emissions from enteric fermentation for calves, using the default CH_4 conversion factor of 6.5 per cent (2006 IPCC Guidelines, vol. 4, chap. 10, table 10.12) for the entire population. However, as noted by the previous ERT (see document FCCC/ARR/2018/FIN, ID#A.4), according to the 2006 IPCC Guidelines (vol. 4, chap. 10, p.10.30) the CH_4 conversion factor should be assumed to be zero for all juveniles consuming milk only (i.e. milk-fed lambs as well as calves). This is because rumination, which causes CH_4 emissions from enteric fermentation, only takes effect when the juveniles are a few months old. The previous ERT therefore encouraged Finland to investigate the possibility of applying the appropriate CH_4 conversion factor (either lower than the current value or zero) to younger milk-consuming calves by further breaking down the calf population by age. During the review, Finland reported that it compiled data on the diet of calves through a recent project on cattle N excretion (Natural Resources Institute Finland, 2020). It plans to investigate the possibility of applying a separate CH_4 conversion factor to younger milk-consuming calves, while examining the outputs of the project in question. In response to a question raised by the ERT on the project's references, results and timeline for implementation, Finland indicated that the project confirmed and improved, as necessary, the calculation of excretion from dairy and beef cattle in Finland. An English-language report of the results, which has not been peer-reviewed, will be published in the next few months. The Party's GHG inventory will assess the effects of the results on GHG emissions from young milk-consuming calves within the next year. The ERT commends Finland for the actions it has undertaken and encourages the Party to carry out the task of applying a separate CH_4 conversion factor to younger milk-consuming calves according to the schedule indicated in the Party's response (i.e. in 2021) and report on progress made towards updating the CH_4 conversion factor in its NIR.	Not an issue/problem
A.5	3.B Manure management – CH_4 and N_2O	The previous ERT noted (see document FCCC/ARR/2018/FIN, ID# A.6) that Finland used the EFs and parameters for liquid/slurry MMS with natural crust cover to calculate N_2O and CH_4 emissions from slurry MMS with floating cover, but that these EFs and parameters were not appropriate owing to microorganism activity in the natural crust cover that influences both CH_4 and N_2O emissions. The 2006 IPCC Guidelines provide different values of EFs for N_2O emissions (vol. 4, chap. 10, table 10.21) and of CH_4 conversion factors (vol. 4, chap. 10, table 10.17) for liquid/slurry MMS with and without natural crust cover. The previous ERT encouraged Finland to divide emissions from liquid/slurry MMS into the following two subcategories, using data available from national studies: liquid/slurry MMS with natural crust cover (including cover with permeable natural materials); or liquid/slurry MMS without natural crust cover (including cover with composite material and impermeable plastic foils). Finland was also encouraged to investigate the possibility of estimating emissions from liquid/slurry MMS using EFs and parameters that are more specific to the different types of cover used in such systems, taking national or international studies as a basis, but the ERT has not yet seen any progress in the NIR in this regard.	Yes. Transparency

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
		During the review, Finland reported that it will continue to survey the use of different types of cover on slurry in future farm surveys on manure management. At present, the Party has no research and survey results from which to derive new EFs as there is little information on the subject in the available data sets. The Party will continue to monitor the scientific literature and other similar sources, both domestic and international, to obtain more information on the effect of different types of cover on emissions, and will consider applying any new EFs or parameters it obtains. In the meantime, the Party will continue to assume that the effect of permeable floating cover is similar to that of the natural crust, as suggested by VanderZaag et al. (2008). The 2019 Refinement to the 2006 IPCC Guidelines (table 10.21) recommends, on the basis of an extensive literature review, using the N_2O EF for natural crust for all covers, but notes that little research has been conducted on the topic.	
		The ERT recommends that the Party incorporate in the NIR the explanation provided during the review on limited data and research on different types of cover on slurry and any additional information to justify the appropriateness of the assumption used to calculate N_2O and CH_4 emissions from slurry MMS with floating cover. The ERT encourages the Party to keep monitoring any research developments, domestic or international, with a view to estimating emissions from liquid/slurry MMS using EFs and parameters that are more specific to the different types of cover used in such systems.	
A.6	3.B Manure management – N_2O	Finland estimated the N excretion for all animals using the methodology provided in the 2006 IPCC Guidelines (vol. 4, chap. 10.5) together with the annual average population of animals from official statistics. In the previous review, given that N excretion rates are generally obtained for the entire lifespan of an animal, the ERT encouraged Finland (see document FCCC/ARR/2018/FIN, ID# A.7) to investigate the possibility of comparing the value of N excreted derived from the annual average population with that derived from the number of animals produced per year as an additional QA/QC procedure, particularly for animals living less than a year, especially fattening pigs and broilers. The ERT noted that such a comparison was not carried out for the 2020 submission. During the review, Finland indicated that such a comparison would require additional knowledge about mortality and that it aims to perform this check when reviewing the N excretion calculations for poultry and swine in the coming years.	Not an issue/problem
		The ERT acknowledges that the comparison will be most suitable for animals with short lifespans and encourages Finland to present a plan and schedule for the review of its N excretion calculations for poultry and swine, as well as the related QA/QC procedures, in the relevant improvement section of its NIR.	
A.7	3.D.a Direct N_2O emissions from managed soils – N_2O	During the previous review, the ERT encouraged Finland (see document FCCC/ARR/2018/FIN, ID# A.8, and ID# A.3 in table 3 above) to explain in the NIR that, owing to the large proportion of manure being separated into urine and dung in solid storage MMS, losses of N as N_2 during storage are relatively low. The ERT noted that this explanation was not included in the NIR. During the review, Finland responded that it will include the explanation in its next submission.	Not an issue/problem
		The ERT reiterates the encouragement from the previous review report that the Party add the explanation of the low losses of N as N_2 during storage in its NIR.	
LULUCF			
L.7	4. General (LULUCF)	During the previous review, the ERT encouraged Finland (see document FCCC/ARR/2018/FIN, ID# L.8) to include additional information in its NIR on the stratification used for calculating the CSC for the different pools in the various land-use categories and clearly explain that the level of detail used for the calculations is different from	Not an issue/problem

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
		that used in the CRF tables. The previous ERT also encouraged the Party to include in its NIR a general section on stratification, taking the above information as a basis. Although the Party did not include such a section in the NIR, it did add some additional general information on land stratification (section 6.3). During the review, the Party reported that the stratification used for calculating CSC is described in the methodology section of each pool, as well as in section 6.3. The ERT considers that the Party could enhance the transparency of its reporting by including information on the types of stratification used for calculating CSC for different land-use subcategories or pools, such as the information provided to the ERT in the 2018 review. The ERT reiterates the encouragement from the previous review report for Finland to include additional information in appendix 6c to the NIR on the stratification used for calculating the CSC for the different pools in the various land-use categories, and clearly explain that the level of detail used for the calculations is different from that used in the CRF tables.	
L.8	4.C.1 Grassland remaining grassland – CO_2	The Party reported C stock losses associated with living biomass for grassland remaining grassland in CRF table 4.C (see ID# L.2 in table 3). In its NIR (p.375), Finland reported that the decrease in growing stock due to fellings and recovered natural losses was assumed to be 25 per cent of the average of 65 per cent for forests. In response to a question from the ERT during the review, the Party explained that it is the best assumption available, and is derived from expert judgment based on NFI data on losses in living biomass on grassland with trees of natural origin converted to forest land. The ERT recommends that the Party include information on the expert judgment applied to losses from living biomass on grassland remaining grassland in its NIR, together with a justification of how this approach improves upon the tier 1 approach detailed in the 2006 IPCC Guidelines (vol. 4, chap. 6.2.1.1).	Yes. Transparency
Waste			
W.5	5.D Wastewater treatment and discharge – CH_4	In the NIR (p.415), Finland reported that it used expert judgment from 1999 to estimate the MCF parameters for domestic wastewater treatment (Jouttijärvi, Laukkanen and Pipatti, 1999), explaining that the parameter values (0.01 for domestic wastewater and 0.005 for industrial wastewater) are within the range of default parameters provided in the 2006 IPCC Guidelines (vol. 5, chap. 6.2). As in the previous review (see document FCCC/ARR/2018/FIN, ID# W.5), the ERT noted that, owing to changes in technology over time, the MCF parameters based on expert judgment may now be invalid. Therefore, the Party updating the values to take into account current research or expert judgment could improve the accuracy of the estimates. During the review, Finland explained that the average EF for domestic wastewater based on the yearly measurements carried out by one plant for 2012–2017 (0.01 kg CH_4/kg biochemical oxygen demand) is in line with the MCF estimated using expert judgment, and is also within the range of default values (0–0.1) provided in the 2006 IPCC Guidelines (vol. 5, chap. 6, p.6.13). The Party also explained that, owing to the relatively low contribution of emissions from wastewater treatment, it does not currently have plans to improve its estimation methodology. Finland informed the ERT that this issue will be reconsidered following the adoption of the 2019 Refinement to the 2006 IPCC Guidelines. As these considerations are still ongoing, Finland did not include any specific information related to this in its NIR. The ERT recommends that Finland explain in the NIR that the MCF parameters for domestic wastewater treatment based on expert judgment (Jouttijärvi, Laukkanen and Pipatti, 1999) were confirmed by measurements carried out	Yes. Transparency

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
		in 2012–2017.	
KP-LULUCF			
KL.8	AR – CO_2	In relation to ID# KL.1 in table 3, the Party reported in its NIR (section 6.4.6 and table 10.4-2) that it is currently updating its method for estimating biomass growth on afforested land to include the effect of age on biomass growth increment. During the review, the Party confirmed its plans to include new estimates in its 2021 submission. The ERT welcomes this information and encourages Finland to update in its NIR the description of the new methodology for calculating gains in living biomass for AR to include specific information on the effect of age on biomass increment.	Not a problem

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

VI. Application of adjustments

12. The ERT did not identify the need to apply any adjustments for the 2020 annual submission of Finland.

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

13. Finland elected commitment period accounting and therefore the issuance and cancellation of units for KP-LULUCF is not applicable to the 2020 review.

VIII. Questions of implementation

14. No questions of implementation were identified by the ERT during the individual review of the Party's 2020 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 Finland in its 2020 annual submission

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

Table I.1

Total greenhouse gas emissions for Finland, base year[a]–2018

(kt CO_2 eq)

	Total GHG emissions excluding indirect CO_2 emissions		*Total GHG emissions including indirect CO_2 emissions[b]*		*Land-use change (Article 3.7 bis as contained in the Doha Amendment)[c]*	*KP-LULUCF (Article 3.3 of the Kyoto Protocol)[d]*	*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								–20 466.00
Base year	56 435.22	71 200.89	56 601.03	71 366.69	NA		NA	
1990	56 299.60	71 065.26	56 465.41	71 231.07				
1995	57 594.82	71 656.56	57 727.75	71 789.49				
2000	51 247.53	70 145.35	51 355.26	70 253.08				
2010	53 187.36	75 649.74	53 256.56	75 718.95				
2011	45 165.26	67 899.41	45 230.91	67 965.06				
2012	36 969.32	62 419.24	37 030.99	62 480.91				
2013	43 814.86	62 856.36	43 874.51	62 916.01		3 707.36	NA	–48 033.17
2014	37 357.49	58 700.07	37 413.18	58 755.76		3 437.22	NA	–46 805.19
2015	36 216.82	55 086.25	36 271.36	55 140.79		3 121.33	NA	–41 359.82
2016	41 286.18	58 039.64	41 340.98	58 094.44		2 928.33	NA	–37 887.16
2017	38 154.24	55 336.72	38 207.19	55 389.67		2 705.17	NA	–36 832.18
2018	46 091.24	56 359.07	46 143.44	56 411.26		2 526.85	NA	–28 989.70

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

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

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

[c] 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 report to facilitate the calculation of the assigned amount for the second commitment period of the Kyoto Protocol of the Party.

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

Table I.2
Greenhouse gas emissions by gas for Finland, excluding land use, land-use change and forestry, 1990–2018
(kt CO_2 eq)

	CO_2[a]	*CH_4*	*N_2O*	*HFCs*	*PFCs*	*Unspecified mix of HFCs and PFCs*	*SF_6*	*NF_3*
1990	57 137.68	7 684.62	6 356.06	0.02	0.21	NO	52.48	NO
1995	58 278.37	7 420.03	5 902.75	149.81	1.54	NO	36.98	NO
2000	57 145.98	6 561.35	5 801.01	715.47	3.21	NO	26.06	NO
2010	64 168.66	5 354.96	4 808.35	1 362.57	2.62	NO	21.79	NO
2011	56 731.30	5 183.20	4 668.63	1 355.28	2.97	NO	23.67	NO
2012	51 283.81	5 128.19	4 660.70	1 382.15	3.90	NO	22.16	NO
2013	51 810.61	4 989.56	4 699.46	1 380.92	4.76	NO	30.70	NO
2014	47 699.55	4 892.21	4 759.14	1 366.19	4.41	NO	34.25	NO
2015	44 168.26	4 856.62	4 764.81	1 327.54	2.00	NO	21.56	NO
2016	47 282.35	4 728.34	4 777.34	1 275.36	1.55	NO	29.50	NO
2017	44 726.01	4 605.28	4 819.60	1 212.64	1.70	NO	24.44	NO
2018	45 901.54	4 540.85	4 768.97	1 178.06	1.81	NO	20.03	NO
Percentage change 1990–2018	**–19.7**	**–40.9**	**–25.0**	**5 623 525.5**	**772.9**	**NA**	**–61.8**	**NA**

Note: Emissions and removals reported in 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 by sector for Finland, 1990–2018
(kt CO_2 eq)

	Energy	*IPPU*	*Agriculture*	*LULUCF*	*Waste*	*Other*
1990	53 523.83	5 539.39	7 498.69	–14 765.66	4 669.16	NO
1995	55 335.58	5 165.23	6 692.66	–14 061.74	4 596.02	NO
2000	53 757.38	6 074.40	6 604.16	–18 897.82	3 817.15	NO
2010	60 271.50	6 210.42	6 673.92	–22 462.39	2 563.10	NO
2011	52 838.07	6 162.07	6 489.78	–22 734.14	2 475.15	NO
2012	47 593.73	6 004.67	6 464.90	–25 449.92	2 417.60	NO
2013	48 161.36	5 896.20	6 564.72	–19 041.50	2 293.73	NO
2014	44 323.65	5 657.79	6 614.35	–21 342.58	2 159.97	NO
2015	40 626.27	5 837.17	6 584.70	–18 869.43	2 092.65	NO
2016	43 407.44	6 046.50	6 685.01	–16 753.46	1 955.49	NO

	Energy	*IPPU*	*Agriculture*	*LULUCF*	*Waste*	*Other*
2017	41 028.37	5 869.68	6 634.65	–17 182.48	1 856.98	NO
2018	42 148.16	5 880.79	6 562.49	–10 267.82	1 819.81	NO
Percentage change average for 1990–2018	**–21.3**	**6.2**	**–12.5**	**–30.5**	**–61.0**	**NA**

Notes: (1) Finland did not report emissions or removals in the sector other (sector 6); (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[a]–2018, for Finland

(kt CO_2 eq)

	Article 3.7 bis as contained in the Doha Amendment[b]	*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				–20 466.00				
Technical correction				–10 938.00				
Base year	NA				NA	NA	NA	NA
2013		–469.62	4 176.98	–48 033.17	NA	NA	NA	NA
2014		–475.15	3 912.37	–46 805.19	NA	NA	NA	NA
2015		–449.55	3 570.88	–41 359.82	NA	NA	NA	NA
2016		–371.74	3 300.06	–37 887.16	NA	NA	NA	NA
2017		–434.00	3 139.16	–36 832.18	NA	NA	NA	NA
2018		–519.43	3 046.28	–28 989.70	NA	NA	NA	NA
Percentage change base year–2018					**NA**	**NA**	**NA**	**NA**

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

[a] Finland has not elected any activities under Article 3, para. 4, of the Kyoto Protocol. For activities under Article 3, para. 3, of the Kyoto Protocol, and FM under Article 3, para. 4, only the inventory years of the commitment period must be reported.

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

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

Table I.5
Key relevant data for Finland under Article 3, paragraphs 3–4, of the Kyoto Protocol from its 2020 annual submission

Parameter	*Data values*
Periodicity of accounting	(a) AR: commitment period accounting (b) Deforestation: commitment period accounting (c) FM: commitment period accounting (d) CM: not elected (e) GM: not elected (f) RV: not elected (g) WDR: not elected
Elected activities under Article 3, paragraph 4, of the Kyoto Protocol	None
Election of application of provisions for natural disturbances	Yes, for FM
3.5% of total base-year GHG emissions, excluding LULUCF and including indirect CO_2 emissions	2 497.255 kt CO_2 eq (19 978.041 kt CO_2 eq for the duration of the commitment period)
Cancellation of AAUs, CERs and ERUs and/or issuance of RMUs in the national registry for:	
1. AR	NA
2. Deforestation	NA
3. FM	NA

Annex II

Information to be included in the compilation and accounting database

Tables II.1–II.6 include the information to be included in the compilation and accounting database for Finland. 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 2018, including on the commitment period reserve, for Finland
(t CO_2 eq)

	Original submission	*Revised estimate*	*Adjustment*	*Final*
CPR	216 490 140	–	–	216 490 140
Annex A emissions				
CO_2	45 901 541	–	–	45 901 541
CH_4	4 540 854	–	–	4 540 854
N_2O	4 768 970	–	–	4 768 970
HFCs	1 178 057	–	–	1 178 057
PFCs	1 807	–	–	1 807
Unspecified mix of HFCs and PFCs	NO	–	–	NO
SF_6	20 030	–	–	20 030
NF_3	NO	–	–	NO
Total Annex A sources	**56 411 260**	–	–	**56 411 260**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–519 428	–	–	–519 428
Deforestation	3 046 280	–	–	3 046 280
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–28 989 696	–	–	–28 989 696

Table II.2
Information to be included in the compilation and accounting database for 2017 for Finland
(t CO_2 eq)

	Original estimate	*Revised estimate*	*Adjustment*	*Final value*
Annex A emissions				
CO_2	44 726 010	–	–	44 726 010
CH_4	4 605 280	–	–	4 605 280
N_2O	4 819 598	–	–	4 819 598
HFCs	1 212 636	–	–	1 212 636
PFCs	1 700	–	–	1 700
Unspecified mix of HFCs and PFCs	NO	–	–	NO
SF_6	24 443	–	–	24 443
NF_3	NO	–	–	NO
Total Annex A sources	**55 389 668**	–	–	**55 389 668**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–433 996	–	–	–433 996
Deforestation	3 139 163	–	–	3 139 163
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–36 832 180	–	–	–36 832 180

Table II.3
Information to be included in the compilation and accounting database for 2016 for Finland
(t CO_2 eq)

	Original submission	*Revised estimate*	*Adjustment*	*Final*
Annex A emissions				
CO_2	47 282 348	–	–	47 282 348
CH_4	4 728 339	–	–	4 728 339
N_2O	4 777 340	–	–	4 777 340
HFCs	1 275 361	–	–	1 275 361
PFCs	1 554	–	–	1 554
Unspecified mix of HFCs and PFCs	NO	–	–	NO
SF_6	29 501	–	–	29 501
NF_3	NO	–	–	NO
Total Annex A sources	**58 094 442**	–	–	**58 094 442**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–371 736	–	–	–371 736
Deforestation	3 300 062	–	–	3 300 062
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–37 887 157	–	–	–37 887 157

Table II.4
Information to be included in the compilation and accounting database for 2015 for Finland
(t CO_2 eq)

	Original submission	*Revised estimate*	*Adjustment*	*Final*
Annex A emissions				
CO_2	44 168 259	–	–	44 168 259
CH_4	4 856 616	–	–	4 856 616
N_2O	4 764 815	–	–	4 764 815
HFCs	1 327 541	–	–	1 327 541
PFCs	1 999	–	–	1 999
Unspecified mix of HFCs and PFCs	NO	–	–	NO
SF_6	21 565	–	–	21 565
NF_3	NO	–	–	NO
Total Annex A sources	**55 140 795**	–	–	**55 140 795**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–449 546	–	–	–449 546
Deforestation	3 570 879	–	–	3 570 879
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–41 359 816	–	–	–41 359 816

Table II.5
Information to be included in the compilation and accounting database for 2014 for Finland
(t CO_2 eq)

	Original submission	*Revised estimate*	*Adjustment*	*Final*
Annex A emissions				
CO_2	47 699 554	–	–	47 699 554
CH_4	4 892 211	–	–	4 892 211
N_2O	4 759 143	–	–	4 759 143
HFCs	1 366 193	–	–	1 366 193
PFCs	4 411	–	–	4 411
Unspecified mix of HFCs and PFCs	NO	–	–	NO

	Original submission	*Revised estimate*	*Adjustment*	*Final*
SF_6	34 251	–	–	34 251
NF_3	NO	–	–	NO
Total Annex A sources	**58 755 764**	–	–	**58 755 764**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–475 146	–	–	–475 146
Deforestation	3 912 370	–	–	3 912 370
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–46 805 190	–	–	–46 805 190

Table II.6
Information to be included in the compilation and accounting database for 2013 for Finland
(t CO_2 eq)

	Original submission	*Revised estimate*	*Adjustment*	*Final*
Annex A emissions				
CO_2	51 810 614	–	–	51 810 614
CH_4	4 989 555	–	–	4 989 555
N_2O	4 699 461	–	–	4 699 461
HFCs	1 380 919	–	–	1 380 919
PFCs	4 764	–	–	4 764
Unspecified mix of HFCs and PFCs	NO	–	–	NO
SF_6	30 700	–	–	30 700
NF_3	NO	–	–	NO
Total Annex A sources	**62 916 015**	–	–	**62 916 015**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–469 623	–	–	–469 623
Deforestation	4 176 981	–	–	4 176 981
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–48 033 168	–	–	–48 033 168

Annex III

Additional information to support findings in table 2

Missing categories that may affect completeness

The only category for which an estimation method is included in the 2006 IPCC Guidelines that was reported as "NE" or for which the ERT otherwise determined that there may be an issue with the completeness of the reporting in the Party's inventory is 2.B.8.b ethylene (CH_4 emissions from venting and flaring) (see ID# I.4 in table 6).

Annex IV

Reference documents

A. Reports of the Intergovernmental Panel on Climate Change

IPCC. 2000. *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories.* J Penman, D Kruger, I Galbally, T Hiraishi, et al. (eds.). Hayama, Japan: Institute for Global Environmental Strategies. Available at https://www.ipcc-nggip.iges.or.jp/public/gp/english/.

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

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

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

IPCC. 2019. *2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories.* E Calvo Buendia, K Tanabe, A Kranjc, J Baasansuren, et al. (eds). Hayama, Japan: Institute for Global Environmental Strategies. Available at https://www.ipcc-nggip.iges.or.jp/public/2019rf/index.html.

B. UNFCCC documents

Annual review reports

Reports on the individual reviews of the 2015, 2016 and 2018 annual submissions of Finland, contained in documents FCCC/ARR/2015/FIN, FCCC/ARR/2016/FIN and FCCC/ARR/2018/FIN, respectively.

Other

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

Annual status report for Finland for 2020. Available at https://unfccc.int/sites/default/files/resource/asr2020_FIN.pdf.

Report of the technical assessment of the forest management reference level submission of Finland submitted in 2011. Available at https://unfccc.int/sites/default/files/resource/docs/2011/tar/fin01.pdf.

C. Other documents used during the review

Responses to questions during the review were received from Pia Forsell (Statistics Finland), including additional material on the methodology and assumptions used. The following references have been reproduced as received:

Aavikko, J., Holmström, M.-H., Herlin, A., Jahkola, P., von Limburg-Stirum, M., Mahlamäki, K., Numminen, J., Ojala, M., Puntila, M.-L., Ritala, J., Saloniemi & H., Vehmaan-Kreula, E., 1987: Lihakarjan kasvatus. Hereford-kerho. Otava Keuruu 1987, 202 pp., ISBN 951-1-08209-4.

Agrifood Research Finland 2006. Rehutaulukot ja ruokintasuositukset [Feed tables and feeding recommendations]. MTT:n selvityksiä 106. Jokioinen: Agrifood Research Finland (in Finnish) Available at: http://jukuri.luke.fi/bitstream/handle/10024/441617/mtts106.pdf?sequence=1.

EMEP/EEA, 2016. Air Pollutant Emission Inventory Guidebook. Technical guidance to prepare national emission inventories. EEA Report No 21/2016. Available at https://op.europa.eu/en/publication-detail/-/publication/f85b9212-9ace-11e6-868c-01aa75ed71a1/language-en.

Finnish Solid Waste Association, 2019. Suomen Kiertovoima ry. KIVO Finland. Koostumustietopankki. Data bank on MSW composition studies. Available at https://kivo.fi/ymmarramme/koostumustietopankki/.

Grönroos, J., Mattila, P., Regina, K., Nousiainen, J., Perälä, P., Saarinen, K. and Mikkola-Pusa, J. 2009. Development of the ammonia emission inventory in Finland. Finnish Environment Institute. The Finnish Environment 8/2009. 60 p. Available at https://helda.helsinki.fi/handle/10138/38030.

Grönroos, J. 2014. Maatalouden ammoniakkipäästöjen vähentämismahdollisuudet ja –kustannukset (Reduction possibilities and costs of agricultural ammonia emissions). Ympäristöministeriön raportteja 26, Helsinki (in Finnish). Available at https://helda.helsinki.fi/handle/10138/152766.

Grönroos, J., Munther, J. and Luostarinen, S. 2017. Calculation of atmospheric nitrogen and NMVOC emissions from Finnish agriculture - Description of the revised model. Finnish Environment Institute. Available at https://helda.helsinki.fi/handle/10138/229364.

Hamberg, L., Henttonen, H. M., Tuomainen, T. 2016. Puusta valmistettujen tuotteiden hiilivaraston muutoksen laskenta kasvihuonekaasuinventaariossa: Menetelmäkehitys Suomen kasvihuonekaasuinventaarioon. Luonnonvara- ja biotalouden tutkimus 73/2016. Luonnonvarakeskus (Luke). (In Finnish) [Method to assess carbon stock changes in harvested wood products pool for the greenhouse gas inventory: Method development for the Finnish greenhouse gas inventory. Natural resources and bioeconomy studies 73/2016. Natural Resources Institute Finland (Luke).] Available at http://urn.fi/URN:ISBN:978-952-326-340-6.

Hellstedt, M. 2016, Research Scientist (expert of animal production environment and welfare), Natural Resources Institute Finland. Personal communication. (Bedding use and nitrogen content).

Jouttijärvi, T., Laukkanen, T. and Pipatti, R. 1999. Finnish Environment Institute and Technical Research Centre of Finland. Personal communications. 1999.

Luke 2016. Ravintotase 2015, ennakkotiedot ja Ravintotase 2014, lopulliset tiedot. Balance Sheet for Food Commodities 2015, preliminary and 2014 final figures. Luonnonvarakeskus. Natural Resources Institute Finalnd. (In Finnish) https://stat.luke.fi/ravintotase

Manninen, M. 2007. Winter feeding strategies for suckler cows in cold climatic conditions. Academic dissertation. University of Helsinki. Available at https://helda.helsinki.fi/handle/10138/20768?show=full&locale-attribute=fi.

Pesonen, M. 2012. Personal communication on suckler cow feeding.

Ramin, M. & Huhtanen, P. 2013. Development of equations for predicting methane emissions from ruminants. Journal of Dairy Science. 96:2076-2093. Natural Resources Institute Finland, 2020. Narutesti: The effects of the estimation methods of cattle feeding and excretion on the national excretion calculations. Available at https://www.luke.fi/en/projektit/narutesti/.

Sahimaa, O. 2017. Waste model in “Recycling potential of municipal solid waste in Finland”. Aalto University publication series. Doctoral dissertations 184/2017. 132 p. Helsinki 2017. Available at https://aaltodoc.aalto.fi/bitstream/handle/123456789/28097/isbn9789526076348.pdf?sequence=1&isAllowed=y.

Tike 2010. Ravintotase 2008 ja Ravintotase 2009 (ennakko). Balance Sheet for Food Commodities 2009 and 2010 (preliminary). Maa- ja metsätalousministeriön tietopalvelukeskus. Information Centre of the Ministry of Agriculture and Forestry. 27 p. (In Finnish).

VanderZaag, A. C., Gordon, R. J., Glass, V. M. & Jamieson, R. C. (2008). Floating covers to reduce gas emissions from liquid manure storages: a review. Applied Engineering in Agriculture, 24(5), 657-671.