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Framework Convention on Climate Change

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Report on the individual review of the annual submission of Finland submitted in 2018*

Note by the expert review team

Summary

Each Party included in Annex I to the Convention must submit an annual greenhouse gas (GHG) inventory covering emissions and removals of GHG emissions 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 inventory review of the 2018 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 10 to 15 September 2018 in Helsinki.

* In the symbol for this document, 2018 refers to the year in which the inventory was submitted, not to the year of publication.

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Contents

Abbreviations and acronyms

2006 IPCC Guidelines	*2006 IPCC Guidelines for National Greenhouse Gas Inventories*
AAU	assigned amount unit
AD	activity data
Annex A sources	source categories 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
CO_2	carbon dioxide
CO_2 eq	carbon dioxide equivalent
CP	commitment period
CPR	commitment period reserve
CRF	common reporting format
DE%	digestible energy expressed as a percentage of gross energy
DOC	degradable organic carbon
DOC_f	fraction of degradable organic carbon that can decompose
DOM	dead organic matter
EEA	European Environment Agency
EF	emission factor
EMEP	European Monitoring and Evaluation Programme
ERT	expert review team
ERU	emission reduction unit
F-gas	fluorinated gas
FM	forest management
FMRL	forest management reference level
$FMRL_{corr}$	forest management reference level technical correction
GHG	greenhouse gas
GM	grazing land management
HFC	hydrofluorocarbon
HWP	harvested wood products
IE	included elsewhere
IEA	International Energy Agency
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	activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol
Kyoto Protocol Supplement	*2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol*
LULUCF	land use, land-use change and forestry
MCF	methane conversion factor
MMS	manure management system
N_2	nitrogen gas

N_2O	nitrous oxide
NA	not applicable
NF_3	nitrogen trifluoride
NFI	national forest inventory
NIR	national inventory report
NMVOC	non-methane volatile organic compound
NO	not occurring
PFC	perfluorocarbon
QA/QC	quality assurance/quality control
RMU	removal unit
RV	revegetation
SEF	standard electronic format
SF_6	sulfur hexafluoride
SWDS	solid waste disposal site
TAN	total ammoniacal nitrogen
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 Intergovernmental Panel on Climate Change Guidelines for National Greenhouse Gas Inventories: Wetlands*

I. Introduction[1]

1. This report covers the review of the 2018 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" (decision 13/CP.20). The review took place from 10 to 15 September 2018 in Helsinki and was coordinated by Mr. Nalin Srivastava (secretariat). Table 1 provides information on the composition of the ERT that conducted the review of Finland.

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

Area of expertise	*Name*	*Party*
Generalist	Ms. Regine Röthlisberger	Switzerland
Energy	Mr. Hongwei Yang	China
IPPU	Mr. Samir Tantawi	Egypt
Agriculture	Mr. Etienne Mathias	France
LULUCF	Ms. Nele Rogiers	Switzerland
Waste	Ms. Sirinthornthep Towprayoon	Thailand
Lead reviewers	Ms. Röthlisberger	
	Mr. Yang	

2. The basis of the findings in this report is the assessment by the ERT of the Party's 2018 annual submission in accordance with the Article 8 review guidelines. The ERT noted that the individual review of Finland's 2017 inventory submission did not take place during 2017 owing to insufficient funding for the review process.

3. The ERT has made recommendations that Finland resolve the findings related to issues,[2] including issues designated as problems.[3] Other findings, and, if applicable, the encouragements of the ERT to Finland to resolve them, 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 shows annual GHG emissions for Finland, including totals excluding and including the LULUCF sector, indirect CO_2 emissions and emissions by gas and by sector. Annex I also contains background data related to emissions and removals from KP-LULUCF activities, if elected, by gas, sector and activity for Finland.

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

[1] At the time of publication of this report, Finland had submitted its instrument of ratification of the Doha Amendment; however, the Amendment had not yet entered into force. The implementation of the provisions of the Doha Amendment is therefore considered in this report in the context of decision 1/CMP.8, paragraph 6, pending the entry into force of the Amendment.

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

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

II. Summary and general assessment of the 2018 annual submission

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

Table 2
Summary of review results and general assessment of the inventory of Finland

Assessment			*Issue or problem ID#(s) in table 3 and/or 5[a]*
Dates of submission	Original submission: 6 April 2018 (NIR and CRF tables), 6 March 2018 (SEF-CP1-2017 and SEF-CP2-2017)		
Review format	In-country review		
Application of the requirements of the UNFCCC Annex I inventory reporting guidelines and Wetlands Supplement (if applicable)	1. Have any issues been identified in the following areas:		
	(a) Identification of key categories	No	
	(b) Selection and use of methodologies and assumptions	Yes	E.11, L.11, L.12, W.3, KL.11, KL.12
	(c) Development and selection of EFs	Yes	KL.9
	(d) Collection and selection of AD	Yes	E.12
	(e) Reporting of recalculations	No	
	(f) Reporting of a consistent time series	No	
	(g) Reporting of uncertainties, including methodologies	Yes	L.15
	(h) QA/QC	QA/QC procedures were assessed in the context of the national system (see para. 2 in this table)	
	(i) Missing categories/completeness[b]	Yes	L.3
	(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	2. Have any issues been identified related to the national system:		
	(a) The 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	
	3. Have any issues been identified related to the national registry:		
	(a) Overall functioning of the national registry	No	

Assessment			*Issue or problem ID#(s) in table 3 and/or 5[a]*
	(b) Performance of the functions of the national registry and the technical standards for data exchange	No	
	4. Have any issues been identified related to reporting of information on ERUs, CERs, AAUs and RMUs and on discrepancies reported 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 standard independent assessment report?	No	
	5. 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 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	
	6. Have any issues been identified related to the reporting of LULUCF activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, as follows:		
	(a) Reporting requirements in decision 2/CMP.8, annex II, paragraphs 1–5	Yes	KL.2, KL.4, KL.10
	(b) Demonstration of methodological consistency between the reference level and reporting on FM in accordance with decision 2/CMP.7, annex, paragraph 14	Yes	KL.2, KL.4, KL.10
	(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 and 34	No	
CPR	Was the CPR reported in accordance with the annex to decision 18/CP.7, the annex to decision 11/CMP.1 and decision 1/CMP.8, paragraph 18?	Yes	G.1
Adjustments	Has the ERT applied an adjustment under Article 5, paragraph 2, of the Kyoto Protocol?	No	
	Did the Party submit 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 the assessment of 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	Did the ERT list questions of implementation?	No	

Assessment	*Issue or problem ID#(s) in table 3 and/or 5*[a]
implementation	

[a] The ERT identified additional issues and/or problems for all sectors, as well as general issues and for KP-LULUCF activities, that are not listed in this table but are included in table 3 and/or 5.

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

III. Status of implementation of issues and/or problems raised in the previous review report

8. Table 3 compiles all the recommendations made in previous review reports that were included in the previous review report, published on 15 March 2017.[4] For each issue and/or problem, the ERT specified whether it believes the issue and/or problem has been resolved by the conclusion of the review of the 2018 annual submission and provided the rationale for its determination, which takes into consideration the publication date of the previous review report and national circumstances.

Table 3
Status of implementation of issues and/or problems raised in the previous review report of Finland

ID#	*Issue and/or problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
General			
		No general issues were identified.	
Energy			
E.1	Comparison with international data – liquid fuels – CO_2 (E.4, 2016) (E.4, 2015) (23, 2014) Accuracy	Address the differences in apparent consumption between the reference approach and the IEA data identified in the early years of the time series.	Resolved. During the review, Finland clarified that the differences in apparent consumption between the IEA data and the reference approach are because Finland used updated data for the reference and sectoral approaches, while the IEA data for the early years of the time series have not been updated. Finland explained that it will include this explanation in the NIR of its next submission. On the basis of the information presented in the NIR and during the review, the ERT accepts Finland's explanation.
E.2	1. General (energy sector) – all fuels – CO_2 (E.11, 2016) Accuracy	Continue to explore the reasons for the difference between the values reported under the sectoral approach and the reference approach, especially for the most recent years.	Resolved. Finland provided information in the NIR (section 3.2.1) on its efforts to explore the reasons for the differences between the values reported under the sectoral approach and the reference approach. While clarifying that it has greater confidence in the data used for the sectoral approach, Finland explained that these differences are possibly due to uncertainties in the reference approach stemming from errors in the import, export and stock-change data (e.g. inclusion of biogenic feedstocks in import and export data in recent years); different data aggregation practices; and different treatments of statistical differences (e.g. regarding oil balances).

[4] The review of the 2017 annual submission of Finland did not take place during 2017 and as such, the 2017 annual review report was not available at the time of this review.Therefore, the recommendations reflected in table 3 are taken from the 2016 annual review report. For the same reason, the year 2017 is excluded from the list of years in which the issue has been identified.

ID#	*Issue and/or problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
E.3	1. General (energy sector) – all fuels – CO_2 (E.11, 2016) Transparency	Make sure that the NIR and relevant CRF tables include sufficient explanations for any significant differences (more than 2 per cent).	Addressing. Although Finland explained in the NIR (section 3.2.1, pp.69 and 70) that the significant differences (more than 2 per cent) in the values reported using the two approaches for 2011 were due to problems with the stock-change data for hard coal, it noted that it cannot determine the specific reasons for the significant differences in the values for 1991–1993 and 2007 without undertaking resource-intensive investigations, and thus did not have plans to further investigate them. However, Finland also explained in the NIR that it started a project in 2017 to understand the reasons behind the large statistical differences and different figures in the oil balance, import and export statistics and the reference approach.
E.4	1.A Fuel combustion – sectoral approach – other fossil fuels – CO_2, CH_4 and N_2O (E.13, 2016) (E.13, 2015) Transparency	Include information in the NIR on the fuels reported under "mixed fuels" and their fossil and biogenic shares and allocation in the CRF tables.	Resolved. Finland provided the relevant information on the fuels reported under "mixed fuels" in the NIR (section 3.2.4.2, tables 3.2-4 and 3.2-5) together with the explanation that the CO_2 EF relates only to the fossil fraction of total energy content and that the biogenic and fossil portions of mixed fuels are included under biomass and subcategories 1.A.1.a and 1.A.2, respectively.
E.5	1.A.1.b Petroleum refining – solid fuels – CH_4 and N_2O (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.	Addressing. Finland did not provide the relevant information in the NIR. However, during the review, the Party explained that it used hard coal as a filter material to be burned later using bubbling fluidized bed technology in only one petroleum refinery plant in the period 1990–2007. The Party also explained that the EFs for CO_2, CH_4 and N_2O were typical for bubbling fluidized bed boilers.
E.6	1.A.2.d Pulp, paper and print – solid fuels – N_2O (E.15, 2016) (E.15, 2015) Transparency	Provide clarification in the NIR of why the allocation 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.	Addressing. Finland provided the clarification in the NIR (section 3.2.4.3, p.86) that the reallocation of a combined heat and power plant to a different subcategory (e.g. 1.A.1.a to 1.A.2.d) typically takes place because of a change in ownership from an industrial company to an energy company or vice versa. The Party explained that, although this reallocation may lead to unexpected variations in the implied emission factors at the level of the category and fuel, it has ensured the accuracy and time-series consistency of the emission estimates at the plant level. The Party noted in the NIR that, although it provided detailed information on such reallocations in the responses provided during the previous review, it was unable to report all of them in the NIR.
E.7	1.A.4.a Commercial/institutional – peat – CH_4 and N_2O (E.16, 2016) (E.16, 2015) Transparency	Report any relevant information on changes in the share of different types of plants in the emission estimates and the national EFs, particularly when they result in significant fluctuations in the time series	Not resolved. Finland did not provide the requested information in the NIR. During the review, the Party explained that it is not possible to report information on the changes in the shares of different types of plants using peat in the national emission estimates and EFs because, in Finland, it is typical to use boilers fired by a combination of fuels in which the fuel mix varies according to changes in the

ID#	*Issue and/or problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
		of the reported emissions.	availability of fuels as well as their price and taxes on them and to the price of CO_2 in the European Union Emissions Trading System. The ERT notes that this explanation, if provided as an overarching explanation at the beginning of the chapter on the energy sector, would help to resolve this issue.
E.8	1.C.2 Injection and storage – CO_2 (E.17, 2016) (E.17, 2015) Completeness	Further investigate and report any possible future emissions from the category.	Resolved. Finland explained in the NIR (section 3.4.1.1, p.123) that all of the captured CO_2 is used in precipitated calcium carbonate plants as a filling or coating material in different kinds of paper and paperboard. The Party also explained that the CO_2 used as precipitated calcium carbonate in paper and paperboard will remain in long-term storage except when the paper or sludge from recycled paper is combusted, in which case the emissions from combustion are included separately under the relevant categories in the energy sector (biological part of paper or sludge) and the IPPU sector (2.A.4.d – other (limestone containing sludge)).
E.9	1.C.2 Injection and storage – CO_2 (E.17, 2016) (E.17, 2015) Transparency	Justify the notation key used (e.g. "IE") with relevant explanations in the NIR.	Resolved. Finland explained in the NIR (section 3.4.1.1, p.123) that all CO_2 captured is reported as the amount captured in the subcategory 1.A.2.d – liquid fuels.
IPPU			
	2.A.4 Other process uses of carbonates – CO_2 (I.1, 2016) (I.1, 2015) Adherence to the UNFCCC Annex I inventory reporting guidelines	Implement a QC check to ensure consistency in the reference to the EF used throughout the NIR and CRF summary table 3.	Resolved. The reference to the EF for other uses of soda ash in the NIR (table 4.2-1, section 4.2.1) was changed to default. Finland implemented several QC checks to ensure consistency between the references to the EFs used throughout the NIR and CRF summary table 3. As described in the NIR (section 4.2.5.4, p.150), the Party implemented the general QC checks consistently with the QA/QC plan and the 2006 IPCC Guidelines (volume 1, chapter 6, table 6.1). During the review, the Party explained that it has developed an Excel workbook to improve the assessment of results and emission trends and to facilitate the detection of errors and inconsistencies in such references. The ERT noted an improvement in the consistency of references to the EFs used throughout the submission.
	2.C.1 Iron and steel production – CO_2 (I.2, 2016) (I.2, 2015) Transparency	Include information on the allocation of fuels used in iron and steel production between the energy sector and the IPPU sector in the next submission.	Resolved. Finland included an explanation in the NIR (section 4.4.2.2, pp.163 and 164) that fuel-based emissions from iron and steel production are allocated under the energy sector to the subcategories 1.A.1c (coke ovens), 1.A.1.a (public electricity and heat production) and 1.A.2.a (iron and steel), whereas the process-related emissions are allocated under the IPPU sector to the subcategories 2.C.1 (iron and steel production) and 2.A.2 (lime production) (in the case of lime kilns). The Party clarified in the NIR that, in order to maintain comparability of the inventory with energy statistics data (both IEA and national statistics) in the bottom-

ID#	Issue and/or problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
			up data-collection system in Finland, energy and emissions from combustion of blast furnace gases are collected and reported under the actual process or unit (e.g. power plant, sintering plant, coking plant).
Agriculture			
A.1	3. General (agriculture) (A.7, 2016) (A.7, 2015) Adherence to the UNFCCC Annex I inventory reporting guidelines	Correct the inconsistencies in the uncertainty values in the NIR between the agriculture chapter and annex 2, and report in the NIR on continued progress in improving QC measures.	Resolved. Finland chose to delete the results of the uncertainty analysis from the main text of the NIR, while keeping this information only in annex 2, thus avoiding inconsistencies in the information on uncertainty values across the NIR. Finland provided information on its continued progress in improving QC measures in the QA/QC and verification plan (section 1.2.3) and in the category-specific QA/QC procedures for the agriculture sector (section 5.2.4).
A.2	3.D.a.2.b Sewage sludge applied to soils – N_2O (A.8, 2016) (A.8, 2015) Transparency	Provide additional information in the NIR to explain that sewage sludge AD are collected on a three-year basis, and that Finland uses updated data when they become available.	Resolved. Finland included the recommended explanation in the NIR (section 5.4.2.1).
LULUCF			
L.1	4. General (LULUCF) – CO_2 (L.6, 2016) (L.6, 2015) Transparency	Provide additional information in the NIR on how land-use change and carbon stock changes were estimated prior to 1990.	Resolved. Finland included in the NIR (section 6.1, p.277, and section 6.3, p.288) additional information on how land-use change and carbon stock changes were estimated before 1990 for all land-use classes.
L.2	4.B Cropland – CO_2 (L.8, 2016) (L.8, 2015) Transparency	Use the notation key "IE" to indicate that the emissions from carbon stock change in DOM are included in the biomass loss, and include an appropriate explanation in the NIR and CRF table 9.	Resolved. Finland used the notation key "IE" in CRF table 4.B and included the requested explanation in the NIR (section 6.5.2.1, p.304). An explanation for the reporting of "IE" was not included in CRF table 9. During the review, the Party explained that the relevant explanation could not be included in CRF table 9 owing to technical issues with CRF Reporter.
L.3	4.C.1 Grassland remaining grassland – CO_2 (L.9, 2016) (L.9, 2015) Completeness	Report the carbon stock losses associated with the living biomass pool for grassland remaining grassland.	Not resolved. Finland did not estimate and report the carbon stock losses in living biomass for grassland remaining grassland. However, Finland explained in the NIR (appendix 6_c, pp.352 and 353) that it did not estimate and report those losses because of their insignificance and a lack of data on the biomass losses due to harvest and natural mortality in grasslands, noting that, as per the preliminary results from the NFI, the mean volume of growing stock on grassland is less than 20 m^3/ha and thus the losses cannot be significant. The ERT notes that, to resolve this issue, the Party may consider deriving estimates for these losses from the existing data sets (e.g. NFI and remote sensing) and, if there are no other reliable data sources, the Party may use the guidance on expert elicitation provided in the 2006 IPCC Guidelines (volume 1, chapter 2, annex 2A.1) to fill data gaps.
L.4	4(V) Biomass	Report emissions related to	Resolved. The Party reported the relevant emissions

ID#	*Issue and/or problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
	burning – CO_2 (L.5, 2016) (L.5, 2015) (50, 2014) Completeness	biomass burning in land converted to cropland, grassland remaining grassland (wildfires only), land converted to grassland, and settlements.	in CRF table 4(V) (including by using appropriate notation keys) and included a detailed description of the estimation methodology in the NIR (section 6.10.5.1).
L.5	4.G HWP – CO_2 (L.10, 2016) (L.10, 2015) Transparency	Include AD for prior to 1990 in CRF table 4.G (by setting a custom node on the data entry screen for HWP AD in CRF Reporter) and additional information regarding the collection of AD.	Resolved. Finland included in CRF table 4.G and the NIR (section 6.11.2.1) the AD for the period 1961–2016 together with additional information on the collection of AD.
L.6	4.G HWP – CO_2 (L.11, 2016) (L.11, 2015) Completeness	Accurately report carbon stock changes from HWP in SWDS.	Resolved. As explained in the NIR (p.337, section 6.11.1) and CRF table 4.G, as well as during the review, Finland did not estimate the carbon stock changes from HWP in SWDS because it is an information item. The ERT accepts the Party's explanation.
L.7	4.G HWP – CO_2 (L.12, 2016) (L.12, 2015) Accuracy	Improve the HWP estimates with a view to reducing the uncertainty of the estimates.	Resolved. The ERT noted that the Party improved the overall AD quality and coverage for HWP subcategories and used country-specific conversion factors for these subcategories in order to reduce the uncertainty of the HWP estimates. In this regard, the ERT notes the follow-up recommendations made regarding the transparency of information on quality and coverage of AD and on the uncertainty values for HWP (see ID#s L.13 and L.15 in table 5).
Waste			
W.1	5.A Solid waste disposal on land – CH_4 (W.3, 2016) (W.3, 2015) Adherence to the UNFCCC Annex I inventory reporting guidelines	Include the DOC_f values in CRF table 5.A instead of the DOC value.	Resolved. The Party replaced the value of DOC with that of DOC_f, as a percentage, in CRF table 5.A.
KP-LULUCF			
KL.1	AR – CO_2 (KL.5, 2016) (KL.5, 2015) Accuracy	Correctly account for harvesting of land under AR to ensure that emissions under AR are not underestimated.	Resolved. Finland correctly accounted for losses due to harvesting of land under AR. As described in the NIR (appendix_6c, p.355) and during the review, Finland applied a methodology based on Hamberg et al. (2016) to estimate the harvesting amounts for land subject to AR.
KL.2	FM – general (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	Addressing. The ERT noted a lack of consistency in the methods applied for estimating CO_2 removals from forest land under FM for the FMRL and for reporting on FM in the commitment period. As the Party explained in the NIR (section 11.5.4.2, p.443) and during the review, the models used for the calculation of the FMRL are still under development and the Party expects to revise the technical

ID#	*Issue and/or problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
		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.	correction to ensure consistency between the $FMRL_{corr}$ and FM estimates by implementing their results in the next inventory submission. During the review, the Party demonstrated some progress on this issue to the ERT. In this regard, the ERT noted a few issues critical to ensuring consistency between the FMRL and reporting in the commitment period that were raised in document FCCC/TAR/2011/FIN, together with possible ways to address them as follows. Finland did not include fuelwood consumption in small-scale housing in the reference scenario for the development of the FMRL (FCCC/TAR/2011/FIN, p.18). During the review, Finland provided the ERT with additional information on the time series of fuelwood consumption in small-scale housing as well as its future projections based on documents published before 2009 (e.g. National Forest Programme). The ERT noted that including fuelwood consumption in small-scale housing in the reference scenario used for the FMRL would help to ensure its consistency with the reporting in the commitment period. From the results presented during the review, the ERT noted that, following the recent recalibration, the current version of the growth model used for constructing the FMRL is able to reproduce estimates of historical increment data well within the confidence interval of the measured increment and that it has been validated successfully. However, Finland was still not able to produce a consistent time series of projected estimates because the projected estimates do not directly continue from the historical value in 2009, which is a prerequisite for the accounting at the end of the commitment period. As discussed with the Party during the review, the ERT noted a few possible ways to address this issue. The Party should prioritize further improvement of the growth model, aiming to correctly reproduce the historical estimates. However, if gaps still exist, it could consider using the overlap approach from the 2006 IPCC Guidelines (volume 1, chapter 5, section 5.3.3.1) to shift the FRML towards the historical data set based on the overlap between historical data and the data reproduced using the model. Another possibility could be to use the same model versions both for the reporting of the GHG emissions and removals from FM by using the actual biomass losses (harvesting amounts) and for the calculation of the FMRL based on the reference scenario.
KL.3	FM – general (KL.7, 2016) (KL.7, 2015) Transparency	Report the additional information on the calculation of the $FMRL_{corr}$ provided to the ERT (i.e. information showing the use of a rerun of an updated version of the Yasso model for recalculating	Resolved. The Party reported in the NIR (section 11.5.4.3, table 11.5-2) information on the use of a rerun of the same model version (Yasso07) using Scandinavian parameter values for recalculating the time series of historical DOM and soil organic matter carbon stock changes (1990–2009) and for calculating the projected $FMRL_{corr}$ for 2013–2020.

ID#	*Issue and/or problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
		the time series of historical DOM and soil organic matter carbon stock changes (1990–2009) as opposed to the application of a constant ratio to the FMRL estimates used for the projected $FMRL_{corr}$ (2013–2020)).	However, the ERT noted that the Party did not provide a transparent description in the NIR of the calculation of the technical correction used for the projected $FMRL_{corr}$ (see ID# KL.10 in table 5).
KL.4	FM – general (KL.7, 2016) (KL.7, 2015) Accuracy	Revise the technical correction with the aim of ensuring consistency between $FMRL_{corr}$ and FM estimates.	Addressing. As explained by the Party in the NIR (section 11.5.4.2, p.443) and during the review, the models used for the calculation of the FMRL are still under development and the Party expects to revise the technical correction to ensure consistency between the $FMRL_{corr}$ and FM estimates by implementing their results in the next inventory submission.
KL.5	FM – general (KL.8, 2016) (KL.8, 2015) Transparency	Ensure that all the following information is included in the NIR: (1) the rationale for calculating $FMRL_{corr}$; (2) the methods used to calculate $FMRL_{corr}$ (including all background data and parameters used); (3) the results (i.e. the $FMRL_{corr}$ and the technical correction value) and a discussion of the differences between $FMRL_{corr}$ and FMRL (causes and, where possible, for each cause the percentage impact), noting that it is good practice to report a comparison of recalculated estimates with previous estimates (see table 2.7.2 of the Kyoto Protocol Supplement); and (4) complete information to demonstrate consistency between the $FMRL_{corr}$ and the GHG estimates submitted for FM.	Resolved. Finland provided the requested additional information in the NIR (section 11.5.4.3, tables 11.5-2 and 11.5-3).
KL.6	FM – general (KL.9, 2016) (KL.9, 2015) Transparency	Provide information on the main factors responsible for a higher (or lower) sink during the commitment period, as compared with the FMRL, in accordance with the good practice outlined in the Kyoto Protocol Supplement.	Resolved. Finland provided the requested additional information in the NIR (section 11.5.4.2, p.442). The Party explained that, although the FM sink before the commitment period was higher than the FMRL owing to the low harvest levels stemming from the global economic recession, it has since decreased owing to commercial roundwood removals in Finland being at their highest level ever in the period 2013–2016.
KL.7	FM – general (KL.10, 2016) (KL.10, 2015) Accuracy	Verify the estimates of biomass net carbon stock changes.	Resolved. As described in the NIR (section 6.4.4, pp.299–300), Finland used the stock-change method to verify the gain and loss method.

ID#	*Issue and/or problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
KL.8	FM – general (KL.11, 2016) (KL.11, 2015) Adherence to the reporting guidelines under Article 7, paragraph 1, of the Kyoto Protocol	Report the correct value of the FM cap in the CRF accounting table.	Resolved. Finland reported the correct value of the FM cap (19,978.041 kt CO_2 eq) in the CRF accounting table.

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

[b] The review of the 2017 annual submission of Finland did not take place during 2017 and, as such, the 2017 annual review report was not available at the time of this review. Therefore, the recommendations reflected in table 3 are taken from the Party's 2016 annual review report. For the same reason, 2017 is excluded from the list of years in which the issue has been identified.

IV. Issues identified in three 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 has assessed that there are no issues identified in three successive reviews that have not been addressed by the Party.

Table 4
Issues identified in three successive reviews and not addressed by Finland

ID#	*Previous recommendation for the issue identified*	*Number of successive reviews issue not addressed*[a]
General		
	No such general issues were identified	
Energy		
	No such issues for the energy sector were identified	
IPPU		
	No such issues for the IPPU sector were identified	
Agriculture		
	No such issues for the agriculture sector were identified	
LULUCF		
	No such issues for the LULUCF sector were identified	
Waste		
	No such issues for the waste sector were identified	
KP-LULUCF		
	No such issues for KP-LULUCF activities were identified	

[a] The review of the 2017 annual submission of Finland did not take place during 2017. Therefore, 2017 is not taken into account when counting the number of successive years in table 4. In addition, as the reviews of the 2015 and 2016 annual submissions were held in conjunction with each other, they are not considered "successive" years and 2015/2016 is considered as one year.

V. Additional findings made during the individual review of the 2018 annual submission

10. Table 5 contains findings made by the ERT during the individual review of the 2018 annual submission of Finland that are additional to those identified in table 3.

Table 5
Additional findings made during the individual review of the 2018 annual submission of Finland

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue and/or a problem?[a] If yes, classify by type*
General			
G.1	CPR	The ERT noted that the CPR reported in the NIR (section 12.2.4) (216,490,139 kt CO_2 eq) is not exactly the same as that reported in the initial review report (FCCC/IRR/2016/FIN) (216,490,140 t CO_2 eq). During the review, Finland explained that the difference was most likely due to rounding and noted that it considered the value of the CPR reported in the NIR to be correct. While noting that the value of the CPR included in the initial review report is entered into the compilation and accounting database and thus used for the purpose of accounting, the ERT recommends that Finland report in the NIR the same value of the CPR as reported in the initial review report.	Adherence to the reporting guidelines under Article 7, paragraph 1, of the Kyoto Protocol
G.2	AD	Finland reported indirect CO_2 emissions due to atmospheric oxidation of CH_4 and NMVOCs, while excluding those due to the atmospheric oxidation of CO. However, the Party did not provide an explanation for their exclusion in the NIR. The ERT noted a few inaccuracies in the information reported in the NIR on indirect N_2O emissions from the atmospheric oxidation of NMVOCs. For example, in the NIR (table 9.1-2) subcategory 1.B.2.d comprises five subcategories, but CRF table 1.B.2 lists only the subcategory "Distribution of town gas" under 1.B.2.d, for which emissions are reported as "NO" for 2016. Further, the NIR (table 9.1-2) incorrectly lists cement production under subcategory 2.D.3 rather than 2.A.1. In addition, even though the NIR (chapter 9.1.1.1) mentions that the average carbon contents of NMVOCs from asphalt roofing and road paving are different (80 per cent for asphalt roofing and 60 per cent for road paving with asphalt), Finland included the NMVOC emissions from asphalt roofing with those from road paving with asphalt. During the review, the Party explained that it did not include indirect CO_2 emissions from atmospheric oxidation of CO to avoid double counting of emissions because it assumes complete combustion (i.e. oxidation factor of 100 per cent) for calculating direct CO_2 emissions. The Party also explained that, because of their different average carbon contents, NMVOC and indirect CO_2 emissions from asphalt roofing and road paving with asphalt are calculated separately but reported together. The Party acknowledged that the correct average carbon content of road paving with asphalt used in the calculations was 45 per cent instead of 60 per cent as reported in the NIR. The ERT recommends that Finland include an explanation in the NIR of why it did not report the indirect CO_2 emissions due to the atmospheric oxidation of CO. The ERT also recommends that the Party include in the NIR correct information on the indirect CO_2 emissions from NMVOCs, including the average carbon contents of NMVOCs and the allocation of NMVOCs to the CRF subcategories, which is consistent both internally and within the CRF tables. The ERT encourages Finland, in order to increase transparency, to expand the information provided in table 9.1-2 (e.g. by adding extra columns indicating, for the latest reported year, the CRF subcategory where the AD and NMVOC emissions are reported, the value of the NMVOC emissions, and the average carbon content of NMVOCs for each subcategory).	Transparency

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue and/or a problem?[a] If yes, classify by type*
Energy			
E.10	1.A.2.a Iron and steel – solid, liquid and gaseous – CO_2	Finland reported CO_2 emissions from iron and steel production in both the energy and the IPPU sector, and included transparent information on the allocation of emissions between the two sectors in the NIR (section 4.4.2.2). The Party explained in the NIR that, in the CRF tables, it allocates emissions from fuel consumption in iron and steel production to subcategories 1.A.1.a, 1.A.1.c and 1.A.2.a in the energy sector and the process-related emissions from lime production in iron and steel plants and iron and steel production to subcategories 2.A.2 and 2.C.1, respectively, in the IPPU sector. However, the ERT noted that the Party did not include the actual values of CO_2 emissions at the plant level for the energy and IPPU sectors to ensure that there is no double counting. During the review, the Party explained that it performs and checks the calculations of CO_2 emissions using plant-level data to ensure that there is no double counting and that it will check the descriptions in the NIR and prepare a graph showing the carbon balance and allocation of CO_2 emissions to the two sectors in the next submission. The ERT encourages Finland to provide transparent information on the plant-level allocation of CO_2 emissions between the energy and IPPU sectors, including through a graph showing the plant-level carbon balance, to ensure that it avoids double counting of CO_2 emissions.	Not an issue/problem
E.11	1.A.3 Transport – liquid fuels – CO_2	The ERT noted that, despite the increase in the share of biofuels in fuel consumption in road transport since 2008, the AD and EFs for gasoline and diesel used by Finland did not reflect this increase. During the review, Finland explained that, in the methodology used in the inventory calculations, the increases in the biogenic contents of diesel and gasoline do not have any effect on the CO_2 EFs because fossil and biogenic emissions are calculated and reported separately using AD (in terms of fossil-based or biogenic energy consumed (TJ)) and EFs specific to those components. Further, such increases do not influence the CH_4 and N_2O EFs because they are based on AD in terms of kilometres travelled instead of energy consumed (TJ) (LIISA calculation model; see http://lipasto.vtt.fi/en/liisa/index.htm). However, the Party acknowledged a potential overestimation of emissions by 300 kt CO_2 eq (based on preliminary estimates) caused by not taking into account the effect of the increase in the share of paraffinic diesel (from 15 per cent in 2013 to 66 per cent in 2017), explaining that, owing to the lower density of paraffinic fossil diesel compared with standard fossil diesel, this may result in a decrease in the value of the total fuel consumption and thus lower the CO_2 emission estimates. The Party also explained that it is studying the effect of paraffinic diesel on the conversion factors of diesel oil, and, although the information on the shares of biogenic components is complete and accurate, it is making efforts to collect complete information on the conversion factors (density, net calorific value and carbon content) of the fossil contents of the road transport fuels (especially paraffinic diesel). The ERT recommends that Finland 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 carbon content) of the fossil components of road transport fuels (especially paraffinic diesel).	Yes. Accuracy

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue and/or a problem?[a] If yes, classify by type*
E.12	1.A.3 Transport – diesel – CO_2, CH_4 and N_2O	As explained during the review, Finland calculated the amount of diesel consumption on the basis of the tax paid by wholesale companies. However, the Party acknowledged during the review that it overestimated the amount of diesel consumption in 2016 based on taxes paid because, following an increase in the diesel tax rate from 2017 (announced in August 2016), wholesale companies were allowed to pay in advance the taxes for the fuel they had in storage. During the review, the Party informed the ERT that the process to correct the reported diesel consumption for 2016 was ongoing. The ERT recommends that Finland 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.	Yes. Accuracy
IPPU			
I.3	2. General (IPPU)	Finland reported the emissions and/or AD for some categories as confidential or as "IE" in the CRF tables and/or NIR, including AD for phosphoric acid production, AD for raw materials used in glass production, AD for limestone use in the iron and steel industry and AD and emissions for some F-gases (e.g. fluoroform, tetrafluoromethane, hexafluoroethane, SF_6). During the review, Finland explained that, as per the treatment of confidentiality issues described in the NIR (section 1.2.3.7), as a rule, data on single units cannot be published and are thus reported in an aggregated manner, with data on at least three units being required for the aggregate value to be made publicly available. If a single producer is dominant in a specific category, the whole category is treated as confidential. The Party also explained that, while some producers are unwilling to allow publication of confidential data, some other producers have agreements with the inventory agency, which may allow it to report their confidential data in the CRF tables. However, the Party noted that the emissions from the categories reported as confidential are small or insignificant and, in many cases, the confidential AD are supplied by small companies, which often change over time. Consequently, while in many cases it would not be possible to change the reporting, in some other cases it would require a disproportionate amount of effort relative to the potential improvement in transparency. While acknowledging the explanation provided by the Party, the ERT encourages Finland to continue its efforts to report confidential data for the above-mentioned categories, to the extent possible.	Not an issue/problem
I.4	2.B.8 Petrochemical and carbon black production – CH_4	As reported in the NIR (section 4.3.1, p.151), Finland used the CH_4 emissions from ethylene production as fuel in the ovens of cracking, benzene and cumene units and thus included them in the energy sector. However, the ERT noted that the Party used the notation key "NA" instead of "IE" for these emissions in CRF table 2(I).A-Hs1. During the review, Finland explained that it correctly used the notation key "NA" for CH_4 emissions from ethylene production consistently with the UNFCCC Annex I inventory reporting guidelines, according to which the notation key "NA" is to be used for activities under a given source or sink category that does occur within the country but does not result in emissions or removals of a specific gas, because in Finland ethylene production does not lead to CH_4 emissions. However, the Party acknowledged that it used the incorrect notation key ("NO") for ethylene production in the NIR (annex 5), which will be corrected in the next submission. The ERT notes, however, that, as per the UNFCCC Annex I inventory reporting guidelines, emissions and removals	Yes. Comparability

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue and/or a problem?[a] If yes, classify by type*
		included elsewhere in the inventory instead of under the expected source/sink category, such as the CH_4 emissions from ethylene production, should be reported using the notation key "IE" in the CRF tables. The ERT therefore recommends that Finland 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. During the review, the Party reiterated that it does not agree with the recommendation of the ERT and believes that its use of "NA" is consistent with the correct interpretation of the UNFCCC Annex I inventory reporting guidelines. Finland noted that, according the UNFCCC Annex I inventory reporting guidelines, "NA" should be used when the source occurs in the country but does not result in emissions or removals of a specific gas. Finland also noted that the CH_4 produced in ethylene production is not emitted to the atmosphere because it is burned in the ovens of cracking units and the CO_2 emissions resulting from such burning are reported in the energy sector.	
I.5	2.D.1 Lubricant use – CO_2	Finland reported the EF used to calculate CO_2 emissions from lubricant use as "country specific" in the NIR (section 4.5.1, table 4.5-1). However, the ERT noted that the value of the EF (20 t C/TJ) given in the NIR (section 4.5.2.1, p.174) is the same as the default EF provided in the 2006 IPCC Guidelines (volume 2, chapter 1, table 1.3) and hence the EF should be referred to as default instead of country specific. During the review, the Party acknowledged the error and agreed to make the necessary corrections in the next submission. The ERT recommends that in the NIR Finland refer to the EF used to estimate CO_2 emissions from lubricant use as default instead of country specific.	Yes. Adherence to the UNFCCC Annex I inventory reporting guidelines
I.6	2.F.1 Refrigeration and air conditioning – HFCs	As described in the NIR (section 4.7.2.4, p.197), Finland is implementing the "Nordic policy cluster for F-gases" project during 2017–2019, which aims to compare the F-gas inventories of the Nordic countries. In response to the information presented in the NIR and during the review, the ERT concluded that the project resulted in the verification of the leakage rate level used for the largest single emission source of F-gases in Finland, namely the lifetime emissions of centralized commercial refrigeration systems, on the basis of the leakage rates for direct centralized systems measured by the Swedish Refrigeration & Heat Pump Association. The ERT commends Finland for the extensive efforts made to improve the reporting on consumption figures, data sources, emission estimation methodologies, EFs and emissions of F-gases.	Not an issue/problem
Agriculture			
A.3	3.A.1 Cattle – CH_4	Finland applied the methodology provided in the 2006 IPCC Guidelines to estimate the CH_4 emissions from enteric fermentation for cattle and provided detailed information on the parameters and assumptions used to calculate the gross energy consumption in the NIR (section 5.2.2.3). The ERT noted, however, that the information provided in the NIR on the parameters used for the calculation of gross energy lacks transparency regarding a few important elements. For example, the NIR provides the values of the coefficient for calculating net energy for maintenance only for bulls and suckler cows and not for other cattle categories. The description of the pregnancy coefficient should be revised and improved (e.g. by removing the brackets around the last part of the sentence). The NIR does not present any information on the coefficient corresponding to animal's feeding situation, such as any weighting of the	Yes. Transparency

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem?[a] If yes, classify by type
		parameter on the basis of the actual time spent by an animal in grazing, which is taken into account in the calculation. There is also no information on the value of the coefficient related to growth used for cows. Regarding the parameter DE%, the explanation in the NIR could be improved by presenting the equations for both gross energy and digestible energy and by clearly distinguishing between the concepts of "digestible energy" and "digestibility of energy". During the review, the Party explained that it used the default values of the coefficient corresponding to animal's feeding situation from the 2006 IPCC Guidelines (volume 4, chapter 10, table 10.5) and agreed to include this information in the NIR in the next submission. The ERT recommends that Finland improve the explanation provided for each parameter used in the calculation of gross energy for cattle, particularly in relation to the coefficients for net energy for maintenance for all cattle categories; the coefficients related to pregnancy, feeding situation and growth; and the parameter DE%. To increase transparency, the ERT encourages the Party to add a table linking each animal category with each parameter.	
A.4	3.A.1 Cattle – CH_4	Finland applied the methodology provided in the 2006 IPCC Guidelines to estimate the CH_4 emissions from enteric fermentation for calves using the default value of methane conversion factor (6.5 per cent) for the entire population. However, the ERT noted that, according to the 2006 IPCC Guidelines (volume 4, chapter 10, p.10.30), the methane conversion factor is to be assumed as zero for all juveniles consuming only milk (i.e. milk-fed lambs as well as calves) because rumination, which causes CH_4 emissions from enteric fermentation, is effective only after a few months. The ERT therefore considers that the Party should use zero or a lower methane conversion factor for enteric fermentation during the initial part of the life cycle of calves, while acknowledging that this period of lower emissions cannot be easily determined as it depends on the level of solid intake by the calves. During the review, the Party explained that there are no subcategories under "calves" and it applies the same parameter to the total population of calves. The ERT encourages Finland to investigate the possibility of applying the appropriate methane conversion factor (either lower than the current value or zero) to younger milk-consuming calves by further classifying the population of calves on the basis of their age.	Not an issue/problem
A.5	3.A.1 Cattle – CH_4	Finland estimated the gross energy used for cattle using a constant value for DE% (70 per cent for dairy cows and bulls; 64 per cent for suckler cows; 69 per cent for heifers; and 71.5 per cent for calves), which was calculated using an equation from McDonald et al. (2011) together with feed-consumption data based on expert judgment and other sources (data from the advisory service, ProAgria, and feed tables from the statistics database of Natural Resources Institute Finland). The ERT noted that the constant value of DE% stems from all the underlying parameters being kept constant over the entire time series. However, the ERT also noted that this is not a valid assumption because, on the basis of the information presented in the NIR, these parameters have increased significantly across the time series owing to the improvements in genetics and animal feed. For example, cows milk production (NIR, section 5.2.2.3, table 5.2-6) and the mature weight of bulls (appendix 5_a, table 2_App-5a) increased by 52 per cent and 27 per cent, respectively, over the period 1990–2016. The ERT further noted that, given the decrease in the availability of green grass stemming from a decrease in the area under pasture, it is likely that digestibility of feed increased during the	Not an issue/problem

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue and/or a problem?[a] If yes, classify by type*
		inventory time series because of an increase in the use of concentrates in animal feed. During the review, the Party provided additional information on the methodology used for the calculation of DE%. The ERT encourages Finland to investigate the possibility of estimating a dynamic value of DE%, reflecting the changes and improvements in genetics and animal feed, especially for dairy cows, for which the changes in practices and animal characteristics are better known.	
A.6	3.B Manure management – CH_4 and N_2O	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. The ERT noted that these EFs and parameters are not appropriate owing to microorganism activity in the natural crust cover that influences both CH_4 and N_2O emissions. The ERT also noted that the 2006 IPCC Guidelines provide different values of EFs for N_2O emissions (volume 4, chapter 10, table 10.21) and of methane conversion factors (volume 4, chapter 10, table 10.17) for liquid/slurry MMS with and without natural crust cover. The ERT further noted that, given the availability of a variety of data sources on MMS in Finland, including additional data on slurry systems available from Finish data sources such as Grönroos (2017), Finland can further classify the liquid/slurry MMS into subcategories on the basis of the type of cover for the slurry tank, namely tight roof (concrete), semi-tight roof (floating covers), natural crust and tent. During the review, the Party explained that, although the 2006 IPCC Guidelines provide different EFs for N_2O and CH_4 emissions for liquid/slurry MMS with and without natural crust cover, they do not provide the EFs for liquid/slurry MMS with floating covers, which encompass materials with varying effects on GHG emissions, including some that are similar in their effects on GHG emissions to those of MMS with natural crust cover, such as permeable natural materials (e.g. peat, straw and expanded clay aggregates), composite materials and impermeable plastic foils. The Party informed the ERT that it would investigate the possibility of using the data related to MMS provided in Grönroos (2017) to produce more accurate estimates of the CH_4 and N_2O emissions from liquid MMS. Acknowledging the explanation provided by the Party, the ERT encourages Finland to present the emissions from liquid/slurry MMS by splitting them into the following two subcategories based on the type of cover, using the data available from national studies: (1) liquid/slurry MMS with natural crust cover (including cover with permeable natural materials); and (2) liquid/slurry MMS without natural crust cover (including cover with composite material and impermeable plastic foils). The ERT also encourages Finland to investigate the possibility of estimating the emissions from liquid/slurry MMS using EFs and parameters that are more specific to the different types of cover used in such systems, derived from national or international studies.	Not an issue/problem
A.7	3.B Manure management – N_2O	Finland estimated the nitrogen excretion for all animals using the methodology provided in the 2006 IPCC Guidelines together with the annual average population of animals from official statistics. However, the ERT noted that for animals living less than a year, especially fattening pigs and broilers, as a useful QC check Finland could make a comparison of the nitrogen excretion estimates with those derived using the number of animals produced per year, because this value is generally less uncertain given that the nitrogen excretion rates are generally obtained for the entire life of the animal.	Not an issue/problem

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem?[a] If yes, classify by type
		The ERT encourages Finland to investigate the possibility of making a comparison between the value of nitrogen excretion obtained on the basis of annual average population with that obtained on the basis of the number of animals produced per year as an additional QC check.	
A.8	3.D.a.2 Organic nitrogen fertilizers – N_2O	Finland used the methodology provided in the 2006 IPCC Guidelines in combination with a nitrogen mass model to estimate ammonia emissions from animal housing, manure storage and spreading. According to the NIR (section 5.3.2.1, p.237) this nitrogen mass model is based on a publication (Grönroos et al., 2009). However, the ERT noted that Finland has already implemented in the GHG inventory for the agriculture sector the improvements described in a more recent publication (Grönroos et al., 2017), particularly those relating to the contribution of N_2 and N_2O emissions, which is not clearly cited in the NIR. The ERT sought clarification from the Party regarding how the methodology used differs from the one provided in the *EMEP/EEA air pollutant emission inventory guidebook 2016*, particularly regarding the estimation of N_2 emissions during storage, because if these emissions during storage are calculated using the EFs from the guidebook (which correspond to a loss of 30 per cent of TAN during storage for solid storage MMS), it may lead to high losses of nitrogen as N_2 for solid storage MMS. During the review, the Party explained that it has not yet implemented all the methodological changes resulting from Grönroos et al. (2017) in the inventory, particularly those relating to manure management. The Party also explained that the methodology used for the GHG inventory differs from the one provided in the *EMEP/EEA air pollutant emission inventory guidebook 2016* in that the methodology for immobilization by straw is country specific (i.e. it is included in TAN), and that the ammonia emissions from housing and building are based on total nitrogen instead of TAN. The Party further explained that the losses of nitrogen as N_2 for solid storage MMS are not high because a large proportion of manure management using solid storage involves the separation of urine and dung, which leads to much lower N_2 emissions during storage owing to the low amount of TAN in dung after the separation of urine. The ERT recommends that Finland update, as appropriate, the description of the nitrogen mass flow on the basis of the most recent source used (e.g. Grönroos et al. (2017)) and provide a reference to that source in the NIR. The ERT encourages Finland to provide the explanation in the NIR that, owing to the large proportion of manure being separated into urine and dung in solid storage MMS, the losses of nitrogen as N_2 during storage are relatively low. In this regard, the ERT also recommends that Finland 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).	Yes. Transparency
LULUCF			
L.8	4. General (LULUCF)	In the CRF tables Finland reported the CO_2 emissions and removals for the land-remaining categories for forest land, cropland, grassland, wetlands and settlements (i.e. subcategories 4.A.1, 4.B.1, 4.C.1, 4.D.1 and 4.E.1) using only one stratum. The ERT noted that, as explained in the NIR (section 6.2) and during the review, although Finland performed calculations for those land-use subcategories by further stratifying them, it did not report CO_2 emissions and removals using those strata in the CRF tables. During the review, Finland explained that, depending on the available data sources or studies, it performed the calculations following different types of stratification for the	Not an issue/problem

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue and/or a problem?[a] If yes, classify by type*
		different land-use categories and/or pools. Finland also explained that it reported the information using only one stratum in order to enhance the readability of the CRF tables and that more detailed reporting in the CRF tables may not necessarily increase the transparency of the submission. However, the ERT found that the additional information on the stratification used for the different land-use subcategories/pools, which was provided in the NIR and during the review, was very useful in enhancing the transparency of the submission. The ERT encourages Finland to include additional information in the NIR on the stratification used for the calculation of carbon stock changes for the different pools in the various land-use categories together with a clear explanation that the level of detail used for performing the calculations is different from that used in the CRF tables. The ERT also encourages the Party to include in the NIR a general section on stratification using such information.	
L.9	4.A.1 Forest land remaining forest land – CO_2	Finland provided information in the NIR (appendix_6c) on the calculation of the carbon stock changes in living biomass of trees, including transparent information on the method applied to calculate the biomass stocks of trees using biomass models and biomass conversion and expansion factors. The ERT noted, however, that the description could benefit from additional details on the calculation of living biomass stocks and gains in living biomass stocks at the tree level from the NFI data collected. During the review, Finland provided additional information on the calculation of living biomass stocks and gains in living biomass stocks at the tree level, including the measurement of tree variables in the NFI for "tally trees" and "sample trees", for which different characteristics are measured for use in different methods for the calculation of carbon stock changes in living biomass. The ERT recommends that Finland provide a more detailed description in the NIR of the calculation of living biomass stocks and gains in living biomass stocks at the tree level from the NFI data collected, including information on the treatment of "tally trees" and "sample trees".	Yes. Transparency
L.10	4.A.1 Forest land remaining forest land – CO_2	Finland used data on commercial fellings from official statistics to calculate the total losses in living biomass in order to estimate the carbon stock changes in living biomass in forest land. However, the ERT noted that in the information on the losses in living biomass in the NIR (appendix_6c) Finland did not provide an indication of the data quality of the estimates of commercial fellings sourced from the annual official statistics. The ERT also noted that, in several European countries, official statistics often underestimate the wood removals because not all harvested wood is reported officially. During the review, Finland provided information to the ERT demonstrating the reliability of the statistics on commercial fellings, including a document on industrial roundwood used (containing data collected annually by sampling from forest industry enterprises), which showed that the difference between the amount of commercial industrial roundwood removal reported in the official statistics and that used by the wood processing industry is 0.6 per cent of the value reported in the official statistics. The ERT encourages Finland to include in the NIR (in the description of the calculation method for the losses of living biomass in forest land) the information provided during the review on the quality of the data on industrial roundwood removals from official statistics.	Not an issue/problem

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue and/or a problem?[a] If yes, classify by type*
L.11	4(V) Biomass burning – CH_4 and N_2O	Finland applied the methodology and default EFs from the IPCC good practice guidance for LULUCF, instead of those from the 2006 IPCC Guidelines, to calculate CH_4 and N_2O emissions from biomass burning on forest land, without providing in the NIR any explanation for their use. During the review, Finland explained that it applied the method and EFs from the IPCC good practice guidance for LULUCF because the nitrogen content of tree species in Finnish forests is generally lower than that for the tree species used to determine the default EF for N_2O emissions from biomass burning provided in the 2006 IPCC Guidelines, and therefore the value of the default EF is too high for the conditions in Finland. The Party informed the ERT that it is exploring ways to apply a country-specific method for estimating N_2O emissions from biomass burning. The Party also explained that the combustion efficiency used for the calculations in the Finnish inventory is based on expert judgment (Natural Resources Institute Finland) and is comparable with the default value for surface fires in boreal forests given in the 2006 IPCC Guidelines (volume 4, chapter 2, table 2.6). Finland also provided information to the ERT demonstrating that wildfires seldom develop to crown fires because of an effective fire prevention system and a dense forest road network. The ERT recommends that Finland either provide a transparent explanation in the NIR of the method and EFs from the IPCC good practice guidance for LULUCF that it 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, the ERT recommends that Finland use the default method and EFs from the 2006 IPCC Guidelines.	Yes. Accuracy
L.12	4(V) Biomass burning – CO_2	Finland reported CO_2 emissions from wildfires but reported CO_2 emissions from controlled burning as "IE" for forest land for the entire time series. However, the ERT noted that this could result in a potential double counting of CO_2 emissions from wildfires because the CO_2 emissions from biomass burning are generally included in the losses of living biomass reported in CRF tables 4.A.1 and 4.C.1, respectively. The Party explained in the NIR (annex 5) and CRF table 9 that the CO_2 emissions from controlled burning on forest land, being residues, are included in the carbon stock changes in DOM. During the review, Finland explained that it estimated the CO_2 emissions from wildfires on forest land separately (i.e. not assuming them to be included in the carbon stock changes) to ensure the accuracy of the estimates because wildfires in forests are very rare in Finland and, as such, they might not be captured in the sampling design used for the NFI, which provided the data for estimating the carbon stock changes in living biomass. The ERT recommends that Finland check the available data sets from the NFI to ensure that the carbon 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). Following an investigation to ensure that there is no double counting of CO_2 emissions from forest land, if the Party wishes to continue to report the CO_2 emissions from biomass burning in CRF table 4(V), the ERT recommends that the Party provide an appropriate explanation in the NIR for such reporting.	Yes. Accuracy
L.13	4.G HWP – CO_2	The ERT noted that, although Finland improved the quality and coverage of the AD used for the calculation of carbon stock changes in HWP, it did not clearly mention in the NIR the specific improvements made. During the	Yes. Transparency

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue and/or a problem?[a] If yes, classify by type*
		review, Finland provided extensive information on the improvements made to the AD for HWP, including those made as part of a recent project (Hamberg et al., 2016), such as the extension of the time series of AD used for the calculation of HWP to the period 1900–1960 and the generation of AD for HWP categories and country-specific conversion factors for them. The ERT noted the usefulness of the information provided in enhancing the transparency of the submission. The ERT recommends that the Party include in the NIR detailed information related to the improvements made to the quality and coverage of the AD used for the calculation of carbon stock changes in HWP, including those made as part of the above-mentioned project.	
L.14	4.G HWP – CO_2	The ERT noted significant fluctuations in the annual carbon stock changes in various HWP categories (e.g. solid wood, and paper and paperboard), both for domestic consumption and for exports. For example, for domestic consumption of solid wood, the carbon stock change went from 157.08 kt C in 2014 to –3.66 kt C in 2015, while, for exports of paper and paperboard, the carbon stock change went from –24.47 kt C in 2013 to 72.66 kt C in 2014. During the review, the Party explained that the annual fluctuations in the time series in the carbon stock changes in HWP are due to the changes in the economic situation, which particularly influence the paper and paperboard stocks because of their short half-life compared with other categories of HWP. The ERT encourages the Party to explain the general drivers of the inter-annual fluctuations in the carbon stock changes in HWP (e.g. changes in wood supply and demand), both for domestic consumption and for exports, across the time series by including in the NIR a qualitative interpretation of such fluctuations.	Not an issue/problem
L.15	4.G HWP – CO_2	Finland continued to use a default value for uncertainty of 50 per cent for the HWP estimates. The ERT noted that, although it is not necessarily true, any improvements in the quality and coverage of AD (see ID# L.13 above) should typically lead to a reduction in the overall uncertainty of the estimates. The ERT therefore noted that the Party could consider replacing the default value of uncertainty with a value calculated using the country-specific uncertainties of the AD and other parameters (e.g. conversion factors, wood density, decay rate) based on the results of the above-mentioned project (Hamberg et al., 2016). If those are not available, the Party could also use the default uncertainty values of those parameters from the 2006 IPCC Guidelines (volume 4, chapter 12, table 12.6) or those based on expert judgment in order to validate or better explain which data or assumptions lead to a high value of overall uncertainty. The ERT recommends that the Party update the uncertainty analysis for HWP and replace the default value of uncertainty of the HWP estimates (50 per cent) by a country-specific estimate based on the results of national studies (e.g. Hamberg et al., 2016). If that is not possible, the ERT recommends that the Party 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.	Yes. Accuracy

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue and/or a problem?[a] If yes, classify by type*
Waste			
W.2	5.A Solid waste disposal on land – CH_4	As described in the NIR (section 7.2.2.3, p.380), Finland obtained the data on CH_4 recovery from landfills from the Finnish Biogas Plant Register. The ERT noted that the information on the amount of gas recovery by recovery plants presented in the NIR (table 7.2-10 and appendix 7b) does not include a description of the method used for estimating CH_4 recovery. The ERT also noted that this is an important piece of information because, as per the 2006 IPCC Guidelines (volume 5, chapter 3), while it is good practice to report CH_4 recovery on the basis of metering of the gas recovered for energy and flaring or on monitoring of the amount of electricity produced from gas (taking into account load factors, heating value and other relevant factors influencing the amount of gas used to produce the electricity), estimation of CH_4 recovered using more indirect methods should be done with more care, using substantiated assumptions. During the review, Finland informed the ERT that landfill gas recovery data obtained from the Finnish Biogas Plant Register are based on information received from plants. The Party explained that, in general, the volumes of landfill gas recovery are based on continuous measurements using a pitot tube or a turbine meter and on individual measurements (1–12 times per year) of CH_4 content. However, in cases of failure of volume metering, gas recovery volumes are estimated using other means (e.g. according to energy production and operating hours), and if no information is available from a plant then no recovery is assumed. Noting that Finland's reporting of CH_4 recovery is in line with the 2006 IPCC Guidelines, because its method for estimation of CH_4 recovery is based on continuous metering, the ERT recommends that Finland 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.	Yes. Transparency
W.3	5.A Solid waste disposal on land – CH_4	As reported in the NIR (section 7.2.2.2, table 7.2-6), Finland assumed a constant composition of municipal solid waste in the period 2008–2016. However, from the information provided in the NIR, the ERT noted that this assumption is not valid for such a long period because composition of municipal solid waste in Finland has been steadily changing across the time series. The ERT also noted that a change in the composition of municipal solid waste can affect the accuracy of estimation of CH_4 from SWDS. During the review, the Party explained that it plans to update the composition of municipal solid waste in the 2020 annual submission. The ERT welcomes Finland's plan to update the composition of municipal solid waste in 2020 and recommends that the Party make efforts to update the composition of municipal waste as planned. The ERT encourages the Party to add this information to the improvement plan in the next submission.	Yes. Accuracy
W.4	5.A Solid waste disposal on land – CH_4	The ERT noted that the entire time series of amounts of landfilled industrial solid waste reported in the NIR (section 7.2.2.3, table 7.2-8) is different from that reported in the NIR of the previous submission. During the review, Finland explained that the two time series are different because, in the 2018 submission, it reported the dry matter amounts by applying the default moisture contents to the industrial solid waste instead of reporting the wet matter amounts, as	Yes. Transparency

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue and/or a problem?[a] If yes, classify by type*
		had been done previously. The Party noted that the treatment of moisture content in industrial solid waste is now similar to that for other types of solid waste. The Party also explained that, although this does not affect the DOC contents, it makes the total amount of landfilled industrial solid waste more reasonable to report. While welcoming the improvement in reporting, the ERT recommends that Finland 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.	
W.5	5.D Wastewater treatment and discharge – CH_4	As reported in the NIR (section 7.5.2), Finland used expert judgment to estimate the MCF parameters for domestic wastewater treatment since 1999, explaining that the parameter values are within the range of default parameters provided in the 2006 IPCC Guidelines. However, the ERT noted that, owing to changes in technology over time, the MCF parameters based on expert judgment may not remain valid and thus updating the values on the basis of 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 in 2012–2017 (0.01 kg CH_4/kg biochemical oxygen demand) is in agreement with the MCF estimated using expert judgment and is also within the range of the default values in the 2006 IPCC Guidelines. The Party also explained that, owing to the relatively low contribution of emissions from wastewater treatment, it did not plan to improve the estimation methodology at present. Finland informed the ERT that this issue will be reconsidered following the adoption of the 2019 refinement to the 2006 IPCC Guidelines, which is currently being prepared by the IPCC. The ERT noted the usefulness of the explanation provided by Finland in enhancing its understanding. While welcoming the Party's plan to reconsider its approach to the estimation of the MCF parameters for domestic wastewater treatment, the ERT encourages Finland to make efforts to update the MCF parameters. The ERT also encourages the Party to add information on its planned actions to the planned improvements in the NIR.	Not an issue/problem
KP-LULUCF			
KL.9	AR – CO_2	As described in the NIR (section 11.3.1.1, p.432), Finland used different methodologies for the estimation of carbon stock changes in deadwood, litter and soil organic carbon for afforestation younger and older than 20 years. However, the ERT noted that the NIR does not include a transparent description of the methodology used for the estimation of carbon stock changes in living biomass for afforestation younger and older than 20 years, including whether it used the gain-loss or stock-change method from the 2006 IPCC Guidelines. During the review, the Party explained that the estimation of carbon stock changes in living biomass in afforestation is based on the gain-loss method and is exactly the same method as that applied for the estimation of changes in living biomass stocks for other land-use categories converted to forest land, as described in the NIR (appendix_6c, pp.353 and 355). Finland also shared with the ERT a graph showing the values of living biomass losses per year for afforestation, estimated using a methodology from Hamberg et al. (2016). From the information provided, the ERT noted that, because Finland applied the living biomass increment values for afforestation younger than 20 years to all afforestation regardless of age, it underestimated the gains in carbon stock in living biomass for afforestation older than 20 years.	Yes. Accuracy

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem?[a] If yes, classify by type
		The ERT recommends that Finland estimate the carbon stock changes in living biomass for afforestation older than 20 years by applying age-specific values for living biomass increment. The ERT also recommends that the Party include a transparent description in the NIR of the methodology applied for the estimation of carbon stock changes in living biomass, especially regarding the gain-loss method used, including the information shared during the review based on the information contained in Hamberg et al. (2016) on the losses in living biomass per year for afforestation.	
KL.10	FM – CO_2	Finland did not transparently indicate in the NIR (section 11.5.4.3, pp.442 and 443) whether it had performed any specific technical correction to the FMRL. The NIR stated only that the development of models to address two pending issues from the technical assessment of the FMRL is ongoing. However, from the information provided in table 11.5-3 of the NIR and CRF table 4(KP-I) B.1.1, the ERT concluded that Finland made a technical correction to the FMRL for its 2018 submission. The ERT noted that, although the NIR (section 11.5.4.3, table 11.5-2) lists several issues to be addressed through a technical correction, it did not clearly indicate whether those have already been addressed by performing a technical correction, and, if so, when the relevant technical correction was performed. During the review, Finland explained that all the issues listed in table 11.5-2 of the NIR have already been addressed by performing a technical correction to the FMRL for the 2018 annual submission, including the corrections made to the carbon stock changes in deadwood, litter and soil carbon due to the change in the area subject to FM and to those in HWP using new AD and conversion factors. The ERT recommends that the Party 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 methodology is described.	Yes. Transparency
KL.11	Biomass burning – CH_4 and N_2O	Finland applied the methodology and default EFs from the IPCC good practice guidance for LULUCF instead of those from the 2006 IPCC Guidelines to calculate CH_4 and N_2O emissions from biomass burning in areas subject to FM, without providing in the NIR any explanation for their use (see ID# L.11 above). The ERT recommends that the Party either provide transparent information in the NIR explaining the method and EFs from the IPCC good practice guidance for LULUCF that it 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, the ERT recommends that Finland use the default method and EFs from the 2006 IPCC Guidelines.	Yes. Accuracy
KL.12	Biomass burning – CO_2	Finland reported CO_2 emissions from wildfires but reported CO_2 emissions from controlled burning in areas subject to FM as "IE" for the entire time seriees. However, the ERT noted that this may potentially lead to double counting of CO_2 emissions from wildfires because CO_2 emissions from biomass burning are generally included in the losses of living biomass reported in CRF tables 4.A.1 and 4.C.1, respectively. The Party explained in the NIR (annex 5) that CO_2 emissions from controlled burning in FM areas are included in carbon stock changes in living biomass because biomass burned in controlled burning, being mainly cutting residues, is included in the losses in living biomass.	Yes. Accuracy

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue and/or a problem?[a] If yes, classify by type*
		Similar to the practice of reporting CO_2 emissions from wildfires on forest land (see ID# L.12 above), Finland explained that it estimated CO_2 emissions from wildfires in FM areas separately (i.e. not assuming them to be included in the carbon stock changes in living biomass) to ensure the accuracy of the estimates because wildfires in forests are very rare in Finland and, as such, they might not be captured in the sampling design used for the NFI, which provided the data for estimating the carbon stock changes in living biomass. The ERT recommends that Finland check the available data sets from the NFI to ensure that the carbon stock losses in living biomass due to wildfires are not included in the carbon stock changes in areas under FM and, if they are included, remove CO_2 emissions from biomass burning from CRF table 4(KP-II)4. Following an investigation to ensure that there is no double counting of CO_2 emissions, if Finland wishes to continue to report CO_2 emissions from biomass burning in FM areas in CRF table 4(KP-II)4, the ERT recommends that the Party provide an appropriate explanation in the NIR for such reporting.	

[a] Recommendations made by the ERT during the review are related to issues as defined in paragraph 81 of the UNFCCC review guidelines, or problems as defined in paragraph 69 of the Article 8 review guidelines. Encouragements are made to the Party to address all findings not related to such issues or problems.

VI. Application of adjustments

11. The ERT has not identified the need to apply any adjustments to the 2018 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

12. Finland has elected commitment period accounting and therefore the issuance and cancellation of units for KP-LULUCF activities is not applicable for the 2018 review.

VIII. Questions of implementation

13. No questions of implementation were identified by the ERT during the individual review of the Party's 2018 annual submission.

Annex I

Overview of greenhouse gas emissions and removals for Finland for submission year 2018 and data and information on activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, as submitted by Finland in its 2018 annual submission

1. Tables 6–9 provide an overview of total GHG emissions and removals as submitted by Finland.

Table 6
Total greenhouse gas emissions for Finland, base year[a]–2016
(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 activities (Article 3.3 of the Kyoto Protocol)[d]*	*KP-LULUCF activities (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	57 248.62	71 268.38	57 414.84	71 434.60	NA		NA	
1990	57 123.67	71 143.42	57 289.89	71 309.64				
1995	58 123.92	71 806.01	58 254.27	71 936.36				
2000	47 627.83	70 044.07	47 733.01	70 149.25				
2010	47 930.42	75 461.66	48 000.43	75 531.66				
2011	38 730.20	67 735.66	38 793.27	67 798.74				
2012	29 547.17	62 265.18	29 607.25	62 325.25				
2013	35 738.64	63 003.56	35 796.67	63 061.58		3 661.52	NA	–55 914.70
2014	27 990.76	58 854.73	28 045.00	58 908.96		3 221.56	NA	–55 531.50
2015	26 589.00	55 347.02	26 641.80	55 399.82		3 565.30	NA	–51 314.83
2016	31 680.26	58 736.71	31 733.14	58 789.59		2 959.34	NA	–47 230.62

Note: Emissions/removals reported in the sector other (sector 6) are not included in 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, paragraph 4, of the Kyoto Protocol. For activities under Article 3, paragraph 3, of the Kyoto Protocol and FM under Article 3, paragraph 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 refers to 1990.

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

Table 7
Greenhouse gas emissions by gas for Finland, excluding land use, land-use change and forestry, 1990–2016
(kt CO_2 eq)

	CO_2[a]	*CH_4*	*N_2O*	*HFCs*	*PFCs*	*Unspecified mix of HFCs and PFCs*		*NF_3*
1990	57 133.21	7 746.42	6 377.31	0.02	0.21	NO	52.48	NO
1995	58 271.91	7 447.74	6 039.05	139.20	1.49	NO	36.98	NO
2000	57 146.71	6 614.29	5 663.84	695.69	2.65	NO	26.06	NO
2010	64 061.76	5 373.09	4 700.12	1 373.49	1.41	NO	21.79	NO
2011	56 607.22	5 202.10	4 577.34	1 386.39	2.01	NO	23.67	NO
2012	51 171.96	5 151.67	4 555.27	1 421.72	2.47	NO	22.16	NO
2013	51 959.59	5 016.96	4 612.94	1 437.83	3.57	NO	30.70	NO
2014	47 853.89	4 920.43	4 660.27	1 436.66	3.45	NO	34.25	NO
2015	44 398.88	4 873.71	4 671.12	1 415.49	3.06	NO	37.56	NO
2016	47 979.26	4 734.91	4 632.20	1 390.76	4.44	NO	48.03	NO
Per cent change 1990–2016	**–16.0**	**–38.9**	**–27.4**	**6 638 914.4**	**2 043.8**	**NA**	**–8.5**	**NA**

Note: Emissions/removals reported in the sector other (sector 6) are not included in total GHG emissions.
[a] CO_2 emissions include indirect CO_2 emissions reported in CRF table 6.

Table 8
Greenhouse gas emissions by sector for Finland, 1990–2016
(kt CO_2 eq)

	Energy	*IPPU*	*Agriculture*	*LULUCF*	*Waste*	*Other*
1990	53 577.44	5 534.78	7 525.47	–14 019.76	4 671.95	NO
1995	55 353.40	5 149.77	6 836.88	–13 682.09	4 596.31	NO
2000	53 774.58	6 054.36	6 470.28	–22 416.24	3 850.03	NO
2010	60 182.25	6 186.19	6 579.97	–27 531.23	2 583.25	NO
2011	52 729.80	6 153.73	6 413.04	–29 005.46	2 502.17	NO
2012	47 498.05	6 002.80	6 375.26	–32 718.00	2 449.14	NO
2013	48 325.66	5 916.34	6 487.76	–27 264.92	2 331.82	NO
2014	44 488.38	5 695.39	6 518.59	–30 863.96	2 206.60	NO
2015	40 872.23	5 902.91	6 490.95	–28 758.02	2 133.72	NO
2016	44 105.36	6 157.01	6 533.73	–27 056.46	1 993.50	NO
Per cent change 1990–2016	**–17.7**	**11.2**	**–13.2**	**93.0**	**–57.3**	**NA**

*Note*s: (1) Emissions/removals reported in the sector other (sector 6) are not included in total GHG emissions; (2) totals include indirect CO_2 emissions reported in CRF table 6.

Table 9

Greenhouse gas emissions/removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol by activity, base year[a]–2016, for Finland

(kt CO_2 eq)

	Article 3.7 bis as contained in the Doha Amendment[b]	*Article 3.3 of the Kyoto Protocol*		*FM and elected Article 3.4 activities of the Kyoto Protocol*				
	Land-use change	*AR*	*Deforestation*	*FM*	*CM*	*GM*	*RV*	*WDR*
FMRL				–20 466.00				
Technical correction				–14 545.00				
Base year	NA				NA	NA	NA	NA
2013		–247.26	3 908.78	–55 914.70	NA	NA	NA	NA
2014		–407.84	3 629.40	–55 531.50	NA	NA	NA	NA
2015		273.82	3 291.48	–51 314.83	NA	NA	NA	NA
2016		–308.15	3 267.49	–47 230.62	NA	NA	NA	NA
Per cent change base year–2016					**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, paragraph 4, of the Kyoto Protocol. For activities under Article 3, paragraph 3, of the Kyoto Protocol, and FM under Article 3, paragraph 4, only the inventory years of the commitment period must be reported.

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

2. Table 10 provides an overview of relevant key data for Finland's reporting under Article 3, paragraphs 3 and 4, of the Kyoto Protocol.

Table 10
Key relevant data for Finland under Article 3, paragraphs 3 and 4, of the Kyoto Protocol in the 2018 annual submission

Key parameters	*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
Election of activities under Article 3, paragraph 4	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, ERUs, CERs and/or issuance of RMUs in the national registry for:	
1. AR in 2016	NA
2. Deforestation in 2016	NA
3. FM in 2016	NA
4. CM in 2016	NA
5. GM in 2016	NA
6. RV in 2016	NA
7. WDR in 2016	NA

Annex II

Information to be included in the compilation and accounting database

Tables 11–14 include the information to be included in the compilation and accounting database for Finland. Data shown are from the original annual submission of the Party, including the latest revised estimates submitted, adjustments (if applicable) as well as the final data to be included in the compilation and accounting database.

Table 11
Information to be included in the compilation and accounting database for 2016, including on the commitment period reserve, for Finland
(t CO_2 eq)

	Original submission	*Revised estimates*	*Adjustment*	*Final*
CPR	216 490 139	216 490 140		216 490 140
Annex A emissions for 2016				
CO_2[a]	47 979 259			47 979 259
CH_4	4 734 907			4 734 907
N_2O	4 632 200			4 632 200
HFCs	1 390 765			1 390 765
PFCs	4 439			4 439
Unspecified mix of HFCs and PFCs	NO			NO
SF_6	48 025			48 025
NF_3	NO			NO
Total Annex A sources	**58 789 594**			**58 789 594**
Activities under Article 3, paragraph 3, of the Kyoto Protocol for 2016				
3.3 AR	–308 150			–308 150
3.3 Deforestation	3 267 488			3 267 488
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol for 2016				
3.4 FM	–47 230 623			–47 230 623

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

Table 12
Information to be included in the compilation and accounting database for 2015 for Finland
(t CO_2 eq)

	Original submission	*Revised estimates*	*Adjustment*	*Final*
Annex A emissions for 2015				
CO_2[a]	44 398 881			44 398 881
CH_4	4 873 712			4 873 712
N_2O	4 671 118			4 671 118
HFCs	1 415 494			1 415 494
PFCs	3 056			3 056
Unspecified mix of HFCs and PFCs	NO			NO
SF_6	37 561			37 561
NF_3	NO			NO
Total Annex A sources	**55 399 821**			**55 399 821**
Activities under Article 3, paragraph 3, of the Kyoto Protocol for 2015				
3.3 AR	273 823			273 823

	Original submission	*Revised estimates*	*Adjustment*	*Final*
3.3 Deforestation	3 291 480			3 291 480
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol for 2015				
3.4 FM	–51 314 834			–51 314 834

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

able 13

Information to be included in the compilation and accounting database for 2014 for Finland

($t\ CO_2\ eq$)

	Original submission	*Revised estimates*	*Adjustment*	*Final*
Annex A emissions for 2014				
CO_2[a]	47 853 893			47 853 893
CH_4	4 920 431			4 920 431
N_2O	4 660 273			4 660 273
HFCs	1 436 662			1 436 662
PFCs	3 445			3 445
Unspecified mix of HFCs and PFCs	NO			NO
SF_6	34 251			34 251
NF_3	NO			NO
Total Annex A sources	**58 908 965**			**58 908 965**
Activities under Article 3, paragraph 3, of the Kyoto Protocol for 2014				
3.3 AR	–407 841			–407 841
3.3 Deforestation	3 629 400			3 629 400
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol for 2014				
3.4 FM	–55 531 503			–55 531 503

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

Table 14

Information to be included in the compilation and accounting database for 2013 for Finland

($t\ CO_2\ eq$)

	Original submission	*Revised estimates*	*Adjustment*	*Final*
Annex A emissions for 2013				
CO_2[a]	51 959 593			51 959 593
CH_4	5 016 957			5 016 957
N_2O	4 612 938			4 612 938
HFCs	1 437 827			1 437 827
PFCs	3 567			3 567
Unspecified mix of HFCs and PFCs	NO			NO
SF_6	30 700			30 700
NF_3	NO			NO
Total Annex A sources	**63 061 582**			**63 061 582**
Activities under Article 3, paragraph 3, of the Kyoto Protocol for 2013				
3.3 AR	–247 262			–247 262
3.3 Deforestation	3 908 784			3 908 784
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol for 2013				
3.4 FM	–55 914 701			–55 914 701

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

Annex III

Additional information to support findings in table 2

Missing categories that may affect completeness

The only category for which a method is included in the 2006 IPCC Guidelines that was reported as not estimated 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 grassland remaining grassland (losses in living biomass carbon stocks).

Annex IV

Documents and information used during the review

A. Reference documents

Reports of the Intergovernmental Panel on Climate Change

IPCC. 2003. *Good Practice Guidance for Land Use, Land-Use Change and Forestry*. J Penman, M Gytarsky, T Hiraishi, et al. (eds.). Hayama, Japan: Institute for Global Environmental Strategies. Available at http://www.ipccnggip.iges.or.jp/public/gpglulucf/gpglulucf.html.

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 http://www.ipcc-nggip.iges.or.jp/public/kpsg.

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, Switzerland: IPCC. Available at http://www.ipcc-nggip.iges.or.jp/public/wetlands/.

Annual review reports

Reports on the individual reviews of the 2013, 2014, 2015 and 2016 annual submissions of Finland, respectively, contained in documents FCCC/ARR/2013/FIN, FCCC/ARR/2014/FIN, FCCC/ARR/2015/FIN and FCCC/ARR/2016/FIN.

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 Finland, contained in document FCCC/IRR/2016/FIN.

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%20report_2018.pdf.

Annual status report for Finland for 2018. Available at http://unfccc.int/resource/docs/2018/asr/FIN.pdf.

B. Additional information provided by the Party

Responses to questions during the review were received from Ms. Pia Forsell (Statistics Finland), including additional material on the methodology and assumptions used. The following documents[1] were also provided by Finland:

EEA. 2016. *EMEP/EEA air pollutant emission inventory guidebook 2016*. Available at https://www.eea.europa.eu/publications/emep-eea-guidebook-2016.

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 – Revised model for agriculture. *The Finnish Environment*. 8. Available at https://helda.helsinki.fi/handle/10138/38030.

[1] Reproduced as received from the Party.

Grönroos J, Munther J and Luostarinen S. 2017. Calculation of atmospheric nitrogen and NMVOC emissions from Finnish agriculture – Description of the revised model. *Reports of the Finnish Environment Institute*. 37. Available at https://helda.helsinki.fi/handle/10138/229364.

Hamberg L, Henttonen HM and Tuomainen T. 2016. Puusta valmistettujen tuotteiden hiilivaraston muutoksen laskenta kasvihuonekaasuinventaariossa: Menetelmäkehitys Suomen kasvihuonekaasuinventaarioon. *Luonnonvara- ja biotalouden tutkimus*. 73. Luonnonvarakeskus. (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. Natural Resources Institute Finland.] Available at http://urn.fi/URN:ISBN:978-952-326-340-6.

McDonald P, Edwards RA, Greenhalgh JFD, Morgan CA, Sinclair RA and Wilkinson RG. 2011. *Animal Nutrition*. Seventh edition. Pearson. Available at http://gohardanehco.com/wp-content/uploads/2014/02/Animal-Nutrition.pdf.