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Climate Change

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Report on the individual review of the annual submission of Denmark 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 Denmark, 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 1 to 6 October 2018.

* 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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Abbreviations and acronyms

2006 IPCC Guidelines	<i>2006 IPCC Guidelines for National Greenhouse Gas Inventories</i>
AAU	assigned amount unit
AD	activity data
Annex A sources	source categories included in Annex A to the Kyoto Protocol
AR	afforestation and reforestation
ARR	annual review report
Article 8 review guidelines	“Guidelines for review under Article 8 of the Kyoto Protocol”
CEF-ne	newly established forest
CER	certified emission reduction
CH ₄	methane
CM	cropland management
CO	carbon monoxide
COD	chemical oxygen demand
CO ₂	carbon dioxide
CO ₂ eq	carbon dioxide equivalent
CPR	commitment period reserve
CRF	common reporting format
DCE	Danish Centre for Environment and Energy
DKE	county identification code for Denmark’s submission under Kyoto Protocol (mainland Denmark and Greenland)
DNK	county identification code for Denmark’s submission under the Convention (mainland Denmark, Greenland and the Faroe Islands)
DNM	county identification code for Denmark’s submission under the second commitment period of the Kyoto Protocol (mainland Denmark only)
DOC	degradable organic carbon
DOC _f	fraction of degradable organic carbon that can decompose
EF	emission factor
ERT	expert review team
ERU	emission reduction unit
EU ETS	European Union Emissions Trading System
F-gas	fluorinated gas
FM	forest management
FMRL	forest management reference level
FOM	fresh organic matter
GHG	greenhouse gas
GM	grazing land management
HFC	hydrofluorocarbon
HUM	humified organic matter
HWP	harvested wood products
IE	included elsewhere
IEF	implied emission factor
IPCC	Intergovernmental Panel on Climate Change
IPCC good practice guidance	<i>Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories</i>
IPPU	industrial processes and product use
KP-LULUCF activities	LULUCF emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol

Kyoto Protocol Supplement	<i>2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol</i>
LNG	liquefied natural gas
LPIS	Land Parcel Information System of the European Union
LULUCF	land use, land-use change and forestry
N	nitrogen
NA	not applicable
NE	not estimated
NFI	national forest inventory
NF ₃	nitrogen trifluoride
NGL	natural gas liquids
NIR	national inventory report
NO	not occurring
N ₂ O	nitrous oxide
PFC	perfluorocarbon
QA/QC	quality assurance/quality control
RMU	removal unit
ROM	resilient organic matter
RV	revegetation
SEF	standard electronic format
SF ₆	sulfur hexafluoride
SIAR	standard independent assessment report
SOC	soil organic carbon
UNECE	United Nations Economic Commission for Europe
UNFCCC	United Nations Framework Convention on Climate Change
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 Annex I 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 inventories”
UNFCCC review guidelines	“Guidelines for the technical review of information reported under the Convention related to greenhouse gas inventories, biennial reports and national communications by Parties included in Annex I to the Convention”
WDR	wetland drainage and rewetting
Wetlands Supplement	<i>2013 Supplement to the 2006 Intergovernmental Panel on Climate Change Guidelines for National Greenhouse Gas Inventories: Wetlands</i>

I. Introduction¹

1. This report covers the review of the 2018 annual submissions of Denmark² 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 1 to 6 October 2018 and was coordinated by Ms. Sevdalina Todorova (secretariat). Table 1 provides information on the composition of the ERT that conducted the review of Denmark.

Table 1

Composition of the expert review team that conducted the review of Denmark

<i>Area of expertise</i>	<i>Name</i>	<i>Party</i>
Generalist	Mr. Tomas Gustafsson	Sweden
	Ms. Sina Wartmann	Germany
Energy	Mr. Naofumi Kosaka	Japan
	Mr. Daniel Tutu Benefoh	Ghana
IPPU	Ms. Pia Forsell	Finland
	Mr. Alexander Valencia	Colombia
Agriculture	Mr. Kingsley Kwako Amoako	Ghana
	Mr. Daniel Bretscher	Switzerland
LULUCF	Mr. Doru Leonard Irimie	Romania
	Ms. Maria José Sanz Sanchez	Spain
Waste	Mr. Takefumi Oda	Japan
	Ms. Riitta Pipatti	Finland
Lead reviewers	Mr. Gustafsson	
	Mr. Tutu Benefoh	

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 notes that the individual inventory review of Denmark’s 2017 submission did not take place during 2017 owing to insufficient funding for the review process.

¹ At the time of publication of this report, Denmark 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 Denmark submitted the instrument of ratification of the Doha Amendment on behalf of Denmark and Greenland. Greenland had a reduction commitment for the first commitment period of the Kyoto Protocol; however, for the second commitment period a territorial exemption for Greenland was made in the ratification of the Doha Amendment. Therefore, the assessment of the annual submission in this report, including information on accounting, is based on the submission for mainland Denmark only, unless otherwise specified.

3. The ERT has made recommendations that Denmark resolve the findings related to issues,³ including issues designated as problems.⁴ Other findings and, if applicable, encouragements of the ERT to Denmark to resolve them, are also included.

4. A draft version of this report was communicated to the Government of Denmark, 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 Denmark, including totals excluding and including the LULUCF sector, indirect CO₂ 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 Denmark.

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

II. Summary and general assessment of the 2018 annual submission

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

Table 2

Summary of review results and general assessment of the inventory of Denmark

<i>Assessment</i>	<i>Issue or problem ID#(s) in table 3, 5 and/or 6^a</i>		
Dates of submission	Original submission: 12 April 2018 (NIR), 13 April 2018, Version 2 (CRF tables (DNM)); 14 April 2018, Version 1 (CRF tables (DNK and DKE)); 13 April 2018 (SEF-CP1-2017 and SEF-CP2-2017)		
Review format	Desk 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.3, E.6, L.1, L.13, KL.3
	(c) Development and selection of EFs	Yes	KL.1
	(d) Collection and selection of AD	Yes	I.14, KL.8
	(e) Reporting of recalculations	Yes	G.2, E.5, I.11, L.12
	(f) Reporting of a consistent time series	Yes	E.2, I.12

³ Issues are defined in decision 13/CP.20, annex, paragraph 81.

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

<i>Assessment</i>			<i>Issue or problem ID#(s) in table 3, 5 and/or 6^a</i>
	(g) Reporting of uncertainties, including methodologies	Yes	W.7
	(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	No	G.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?	No	G.3
Description of trends	Did the ERT conclude that the description in the NIR of the trends for the different gases and sectors is reasonable?	No	L.18, L.21
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	
	(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 SIAR?	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.6, KL.7
	(b) Demonstration of methodological consistency between the reference level and reporting on	No	

<i>Assessment</i>	<i>Issue or problem ID#(s) in table 3, 5 and/or 6^a</i>		
	FM in accordance with decision 2/CMP.7, annex, paragraph 14		
	(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	NA	
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	
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	Denmark 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	
Question of implementation	Did the ERT list a question of implementation?	No	

^a The ERT identified additional issues and/or problems in all sectors that are not listed in this table but are included in table 3, 5 and/or 6.

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

III. Status of implementation of 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 9 August 2017.⁵ 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.

⁵ FCCC/ARR/2016/DNK. The ERT notes that the individual inventory review of Denmark's 2017 annual submission did not take place during 2017. As a result, the latest published ARR reflects the findings of the review of the Party's 2016 annual submission.

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

<i>ID#</i>	<i>Issue and/or problem classification^{a,b}</i>	<i>Recommendation made in previous review report</i>	<i>ERT assessment and rationale</i>
General			
G.1	Uncertainty analysis – (G.3, 2016) (G.3, 2015) Adherence to the UNFCCC Annex I inventory reporting guidelines	Report uncertainties for the base year in the NIR.	Resolved. Uncertainties for the base year have been included under section 1.7 of the NIR (table 1.6).
Energy			
E.1	1. General (energy sector) – gas, liquid, solid, other fossil fuels, biomass – indirect CO ₂ and N ₂ O (E.4, 2016) (E.4, 2015) Transparency	Provide information on the calculation approaches in line with paragraphs 48 and 50 of annex I to decision 24/CP.19 and the appendix to that annex, to facilitate review, including methodological information such as the choice of methods, AD and EFs.	Resolved. Denmark included additional information on methods, AD and EFs in NIR section 11 and a reference to the 2018 report to UNECE under the Convention on Long-Range Transboundary Air Pollution providing further information on the methodologies used. Further transparency and accuracy issues regarding the indirect CO ₂ and N ₂ O emissions are discussed in table 6 below (see ID#s G.2 and E.6).
E.2	1.A.1 Energy industries – other fossil fuels – CO ₂ (E.6, 2016) (E.6, 2015) Consistency	Continue the analyses with subsequent years of EU ETS EFs on how to improve earlier time series EFs and the consistency of the full time series.	Addressing. Denmark revised the CO ₂ EFs for 2011–2016 based on plant-specific EU ETS data. In table 9.6 of the NIR Denmark indicated that the time series for earlier years will be further analysed; import of waste and the fossil energy share may be revised, if necessary, based on the ongoing analysis.
IPPU			
I.1	2.A.4 Other process uses of carbonates – CO ₂ (I.10, 2016) Accuracy	Check with the producers (Damolin, Saint Gobin and Weber) for any mistaken inclusion leading to a high IEF and potential double counting and report this as appropriate.	Resolved. Producers have clarified that the emissions they reported prior to 2013 did not take into account the carbonate content of the clays used but only the pure carbonates. Denmark recalculated the time series to ensure consistency (see section 4.11.2 of the NIR).
I.2	2.B.10 Other (chemical industry) – CO ₂ (I.11, 2016) (I.10, 2015) Consistency	Apply a linear extrapolation based on the trend for the period 1997–2001 or the period 1997–2014 to complete the time series of AD and recalculate CO ₂ emissions from catalyst and potassium nitrate production.	Resolved. The Party applied linear regression to calculate CO ₂ emissions from catalyst and potassium nitrate production for the period 1990–1995 instead of using the constant average value for the years 1997–2001, in order to ensure time-series consistency (see section 4.11.3. of the NIR). However, the change is not consistently reflected in the NIR (see ID#I.11 in table 5).
I.3	2.E.5 Other (electronics industry) – HFCs and PFCs (I.12, 2016) (I.11, 2015) Accuracy	Investigate whether there was any change in the fibre optics process during 2012 and in the F-gas consumption in 2013 and report this as appropriate.	Resolved. The HFC and PFC estimates are based on information obtained directly from the importers supplying the fibre optics industry. Denmark reported that according to importers, there was no use of HFC-23 and PFC-318 in 2013 or in 2015 and 2016 for fibre optics, which

ID#	Issue and/or problem classification ^{a,b}	Recommendation made in previous review report	ERT assessment and rationale
			confirmed that the F-gases have been phased out in fibre optics production.
I.4	2.E.5 Other (electronics industry) – HFCs and PFCs (I.12, 2016) (I.11, 2015) Accuracy	Assess the assumption of 100 per cent of F-gas consumption from industrial plants (fibre optics) to improve estimations and report on this.	Resolved. The assumption of 100 per cent of F-gas consumption has been investigated and clarified in the NIR (section 4.6.3). In addition, it has been confirmed with the industry that F-gases use has been phased out in fibre optics production.
I.5	2.F. Product uses as substitutes for ozone depleting substances – HFCs and SF ₆ (I.4, 2016) (I.4, 2015) (31, 2014) (29, 2013) Comparability	Change the notation key from “NE” to “NO” for the AD for the amounts of HFCs remaining in products at decommissioning for refrigeration and air conditioning and aerosols and the amount of SF ₆ remaining in products at decommissioning of electrical equipment.	Resolved. Notation keys for Greenland have been changed from “NE” to “NO” for AD for amounts of HFCs and the amount of SF ₆ remaining in products (the notation key for mainland Denmark was resolved in the previous ARR).
I.6	2.F. Product uses as substitutes for ozone depleting substances – HFCs and SF ₆ (I.4, 2016) (I.4, 2015) (31, 2014) (29, 2013) Transparency	Provide a transparent explanation in the NIR regarding the use of the notation key “NO” for the AD for the amounts of HFCs remaining in products at decommissioning for refrigeration and air conditioning and aerosols and the amount of SF ₆ remaining in products at decommissioning of electrical equipment.	Not resolved. The ERT noted that there is not sufficient information in the NIR explaining why some subcategories in the CRF tables include amounts in products at decommissioning and some are reported as “NO” when there is an amount of HFCs in stock.
I.7	2.F. Product uses as substitutes for ozone depleting substances – HFCs and SF ₆ (I.5, 2016) (I.5, 2015) (31, 2014) Adherence to the UNFCCC Annex I inventory reporting guidelines	Improve the QA/QC checks for the use of notation keys for the entire time series.	Resolved. This recommendation relates to the use of “NE” for Greenland for the amount of HFCs remaining in products at decommissioning in categories electrical equipment (2.G.1) and transport refrigeration (2.F.1.d). “NE” has been changed to “NO” in the 2018 submission, suggesting improved QA/QC checks.
I.8	2.G.2 SF ₆ and PFCs from other product use – SF ₆ (I.13, 2016) (I.13, 2015) Accuracy	Investigate all users of SF ₆ , to collect data and information and revise previous estimates as appropriate.	Resolved. Denmark explained in the NIR (section 4.8.4) that importers and suppliers of SF ₆ have been contacted and questioned with regard to their knowledge of SF ₆ consumption in laboratories in line with the plans noted in the ARR 2016. The responses indicated that there are no other users of SF ₆ and all emissions are included in the data provided by suppliers and importers.
I.9	2.G.2 SF ₆ and PFCs from other product use – SF ₆ (I.13, 2016) (I.13,	Report information on the particle accelerator and other SF ₆ sources.	Resolved. The particle accelerator and other SF ₆ sources are mentioned as emission sources under the SF ₆ and PFCs from the other product use category in the NIR (section 4.8.4) and emissions

ID#	Issue and/or problem classification ^{a,b}	Recommendation made in previous review report	ERT assessment and rationale
I.10	2015) Transparency 2.G.2 SF ₆ and PFCs from other product use – SF ₆ (14, 2016) (I.14, 2015) Accuracy	Assess the assumption of 100 per cent of F-gas consumption from possible sources (e.g. laboratories, universities, research laboratories and medical centres), to improve estimations and increase the consistency of the time series.	are included under the category other uses of SF ₆ (2.G.2). Resolved. The national expert judgment of 100 per cent consumption presented in the NIR (section 4.8.4) is considered justified given the negligible and comparatively constant SF ₆ use in the category.
Agriculture			
A.1	3. General (agriculture) (A.1, 2016) (A.1, 2015) (41, 2014) Adherence to the UNFCCC Annex I inventory reporting guidelines	Report, to the extent possible, the results of the comparison of total N excretion in the inventory with calculations of N excretion for all livestock production estimated by the Danish Centre for Food and Agriculture (stage IV of the QA/QC improvement plan).	Addressing. While table 9.6 of the NIR 2017 provided information on the ongoing comparisons and checks and indicated the need for more detailed data for different animal categories, the NIR 2018 provided no follow-up on this recommendation. During the review, Denmark explained that data for the total N excretion in animal manure for 2003 to 2007 have been received from the Danish Centre for Food and Agriculture and the comparisons for these years will be included in the next submission. The comparison shows the same trend as in the emission inventory, while the total N excretion (“Nex storage”) is approximately 10 per cent lower than estimated in the inventory. The next step according to Denmark would be to clarify the difference, which could possibly be explained by the amount of N deposited during grazing. The Party is working to extend the data comparison period up to 2016.
LULUCF			
L.1	4. General (LULUCF) (L.14, 2016) Accuracy	Research the impact of the land-use conversions prior to 1990 on the estimated emissions and removals from soils from 1990 onwards and revise the reporting allocation and estimates, or, if Denmark considers that a disproportionate amount of effort would be required to estimate these impacts in terms of the likely level of emissions and removals (i.e. if they would be insignificant in terms of the overall level and trend in national emissions), provide justifications in the NIR for this.	Addressing. The NIR (section 6.1.4) includes a justification stating that the switching between cropland and grassland will have a limited effect on the overall emission estimates, as a gain in one year in one category will be counteracted by a loss in the other category. However, the ERT considers that Denmark should provide more specific references/documentation substantiating the justification for insignificant change and the disproportionate effort of estimating soil emissions from pre-1990 conversions.
L.2	4. General (LULUCF) (L.15, 2016) (L.15, 2015) Adherence to the	Ensure consistent reporting of the area of organic soils between the NIR and CRF table 4 and improve QC	Not resolved. Figures presented in table 6.16 (section 6.3.1.7) of the NIR indicate 85.64 kha

<i>ID#</i>	<i>Issue and/or problem classification^{a,b}</i>	<i>Recommendation made in previous review report</i>	<i>ERT assessment and rationale</i>
	UNFCCC Annex I inventory reporting guidelines	procedures for consistent reporting of the areas of organic soils.	organic soils for cropland, whereas those in CRF table 4.B indicate 112.76 kha.
L.3	4. General (LULUCF) – CO ₂ , CH ₄ and N ₂ O (L.16, 2016) (L.16, 2015) Transparency	Provide an explanation in the NIR for the broader definition of organic soils for cropland and not for all land-use categories.	Resolved. Relevant information on organic soil classification is included in the NIR, sections 6.3.1.7 and 6.4.1.6.
L.4	Land representation (L.2, 2016) (L.2, 2015) (48, 2014) Transparency	Provide information on how data sources have been combined and used to construct the land-use and land-use change matrices, including a summary of the methodology used for estimating land use and land-use change for the period between 1990 and 2011 and 2011 to 2012.	Resolved. Relevant information on the data sources and methodologies used to construct land-use and land-use change matrices is included in the NIR. Sections 6.1.1.5–6.1.1.6 of the NIR on land presentation and methodology for land-use presentation are new in relation to the NIR 2016.
L.5	Land representation – (L.13, 2016) (L.13, 2015) Consistency	Ensure time-series consistency and transparent documentation of the new approach for constructing the land-use matrices.	Resolved. Relevant information documenting the approach is included in the NIR, sections 6.1.1.5–6.1.1.6. The NIR (p.415) indicates that in the land-use matrix, a linear approach for all land-use changes has been adopted for the periods 1990–2005 and 2005–2011. From 2011 on, annually updated data from the different data suppliers are used. Some of these data are not updated annually, and thus a time lag in the implementation of the land-use changes may occur in some areas. Conversion to annual updates may create more fluctuations in the area changes than in the previous years.
L.6	4.A.1 Forest land remaining forest land – CO ₂ (L.4, 2016) (L.4 2015) (50, 2014) Transparency	Explain in the NIR that the large inter-annual variations in the carbon stock in living biomass are actually small compared with the overall size of the pools.	Resolved. Relevant explanations on the inter-annual variations are included in the NIR, section 6.2.1.6. Inter-annual variations affecting annual accounting are discussed in table 6 (see ID# L.13 in table 6).
L.7	4.A.1 Forest land remaining forest land – CO ₂ (L.5, 2016) (L.5, 2015) (51, 2014) (51, 2013) Transparency	Provide additional information on the area and volume of clear cutting and the area subject to destructive disturbance, subject to the availability of data.	Addressing. In table 9.6 of the NIR Denmark has indicated that specific data on clear cutting area and volumes are not available because that requires forest mapping, which is not scheduled. However, the NFI-based data provide full documentation of the carbon dynamics. The Party further indicated in section 6.2 of the NIR that “the temporarily unstocked areas can be caused by e.g. clear cutting and wind throw and is generally required to be reforested within a 10-year period according to the Forest Act. It is part of standard forest management in Danish Forestry to perform clear cuttings”. However, the ERT noted that the Party does not specify what ‘destructive disturbance’ means and how it is considered in the stock change method, so that it is possible to assess whether the forest area

ID#	Issue and/or problem classification ^{a,b}	Recommendation made in previous review report	ERT assessment and rationale
			between two reference years is consistently considered in line with the 2006 IPCC Guidelines.
L.8	4.B.1 Cropland remaining cropland – CO ₂ (L.8, 2016) (L.8, 2015) (53, 2014) Adherence to the UNFCCC Annex I inventory reporting guidelines	Accurately report the area of cultivated organic soil reported in the agriculture and LULUCF sectors and improve the implementation of QC measures.	Resolved. The values on the area of cultivated organic soils reported in CRF tables 3.D and 4.B are consistent, suggesting implementation of improved QC.
L.9	4.B.1 Cropland remaining cropland – CO ₂ (L.9, 2016) (L.9, 2015) (54, 2014) (53, 2013) Transparency	Provide additional information on the large variations in the areas of set-aside to help explain the estimates associated with cropland management practices.	Resolved. Information explaining the variations in the area of set-aside cropland is included in section 6.3.1.1 of the NIR (pp.433–434).
L.10	4.B Cropland – CO ₂ (L.17, 2016) (L.17, 2015) Transparency	Report in the NIR that the set-aside area is included in the C-TOOL model as an ordinary crop with a low input of carbon of 4.2 t C/ha per year.	Resolved. Table 9.6 of the NIR 2018 confirms that the set-aside area has always been included in the modelling of carbon stock in mineral soils as a separate crop. The methodology for soil estimates in cropland using C-TOOL is presented in section 6.3.1.7 of the NIR and the relevant AD are in table 3E.13 of the NIR.
L.11	4.B Cropland – CO ₂ , CH ₄ and N ₂ O (L.18, 2016) (L.18, 2015) Comparability	Treat Christmas trees consistently and report these under forest land and under forest land changed to other land uses for the entire time series.	Resolved. Christmas trees have been reported under forest land and under forest land changed to other land uses for the entire time series in the 2018 submission. Relevant information is included in sections 6.2–6.3 of the NIR and CRF table 4(KP-I)B.1. For issues related to consistent representation of Christmas trees between forest land and cropland, see ID# L.19 in table 6.
Waste			
W.1	5. General (waste) – CH ₄ (W.2, 2016) (W.2, 2015) (59, 2014) Adherence to the UNFCCC Annex I inventory reporting guidelines	Enhance category-specific QC procedures in order to avoid discrepancies between the NIR and the CRF data.	Resolved. Data in table 7.5.2 in the NIR (previously table 8.3.2 in the 2014 annual submission) are consistent with the data in the CRF tables.
W.2	5. General (waste) – CH ₄ (W.8, 2016) (W.8, 2015) Adherence to the UNFCCC Annex I inventory reporting guidelines	Correct the errors identified in tables 7.2.1 and 7.3.1 and the description of the AD in the NIR (p.488) and enhance the QC activities by implementing a specific QA/QC procedure to ensure that consistent data are reported in the different elements of the submission.	Resolved. The errors identified in tables 7.2.1 and 7.3.1 have been corrected and the tables in the NIR are consistent with the CRF tables. The description of the AD start year (1940) in the NIR main text and its annexes is consistent in the 2018 submission.
W.3	5. General (waste) – CH ₄	Remove unnecessary references to previous IPCC	Resolved. References to the <i>Revised 1996 IPCC Guidelines for National Greenhouse Gas</i>

ID#	Issue and/or problem classification ^{a,b}	Recommendation made in previous review report	ERT assessment and rationale
	(W.9, 2016) (W.9, 2015) Transparency	guidelines from the methodological descriptions.	<i>Inventories</i> are not found in the waste section. As the first-order decay model and many parameters used are the same in the IPCC good practice guidance and the 2006 IPCC Guidelines, the references to both included in the NIR are considered justified.
W.4	5.A Solid waste disposal on land – CH ₄ (W.3, 2016) (W.3, 2015) (61, 2014) Comparability	Use the notation key “NA” to report CO ₂ emissions for solid waste disposal on land.	Addressing. The notation keys were already changed for Denmark in the 2016 submission. During the review, Denmark explained that the notation key was corrected in the CRF tables for Greenland, but was not reflected correctly in the aggregation of the DNK CRF tables. The reason will be further investigated and corrected for the 2019 submission.
W.5	5.A.1 Managed waste disposal sites – CH ₄ (W.10, 2016) (W.10, 2015) Accuracy	Provide estimates transparently based on the monitoring campaign of the generated methane gas at selected landfills when the data from the campaign become available.	Resolved. According to section 7.10 of the NIR on source-specific planned improvements, new information on the solid waste disposal site-specific data will be available in the 2019 NIR and implementation and full documentation is planned for the 2020 submission. The transparency of estimates can be reviewed only after the implementation of the planned improvement. Meanwhile Denmark used the IPCC default value for fraction of CH ₄ in generated landfill gas (0.5), as recommended by the previous ARR, and the NIR has been updated accordingly. The ERT concluded that the applied approach is in line with the 2006 IPCC Guidelines.
W.6	5.A.1 Managed waste disposal sites – CH ₄ (W.11, 2016) Transparency	Provide a transparent explanation on the method used in provision of revised estimates (DOC value of sludge).	Resolved. Denmark reported in the NIR (section 7.2.1) that the default DOC value for degradable sludge is taken from the 2006 IPCC Guidelines, volume 2, tables 2.5 and 2.6.
W.7	5.A.1 Managed waste disposal sites – CH ₄ (W.12, 2016) (W.12, 2015) Comparability	Change the approach for the uncertainty analysis by applying the updated default uncertainty values from the 2006 IPCC Guidelines.	Addressing. According to section 7.7.1 of the NIR default uncertainty values from the 2006 IPCC Guidelines are used in the uncertainty analysis with one exception. The uncertainties for the rate constants (k) are taken from the IPCC good practice guidance. During the review, Denmark responded that it considered the new uncertainty values for the rate constants too low. Denmark also informed the ERT of its plans to re-evaluate the uncertainties of the k values for the 2019 submission. The re-evaluation would include assessing the ranges provided in the 2006 IPCC Guidelines, but also whether it will be feasible to implement either a sensitivity analysis or Monte Carlo simulation in the uncertainty estimation.
W.8	5.B.1 Composting – CH ₄ and N ₂ O (W.13, 2016) (W.13, 2015) Transparency	Provide more explanation in the NIR on the large increase of composted waste between 2012 and 2013.	Resolved. The data have been updated and the large increase of composted waste in the 2016 submission (41.4 per cent) between the years 2012 and 2013 is no longer seen (currently 2.3 per cent inter-annual change in the annual waste amount treated).

<i>ID#</i>	<i>Issue and/or problem classification^{a,b}</i>	<i>Recommendation made in previous review report</i>	<i>ERT assessment and rationale</i>
W.9	5.B.1 Composting – CH ₄ and N ₂ O (W.13, 2016) (W.13, 2015) Accuracy	Assess the accuracy of the AD for 2014 to ensure that there is not an underestimate of emissions for the latest year.	Resolved. The time series have been recalculated based on updated AD on composted wastes. According to the 2018 submission the CH ₄ and N ₂ O emissions in 2014 have increased compared with emissions in 2013.
W.10	5.B.2 Anaerobic digestion at biogas facilities – CH ₄ (W.14, 2016) (W.14, 2015) Transparency	Provide an explanation of the method used to provide revised estimates (applying the calorific value provided by the Danish Energy Agency of 23 GJ/1 000 m ³ biogas, the methane content of 65 per cent and the methane density 0.67 kg CH ₄ /Nm ³ (normal temperature and pressure defined as 20 °C and 1 atm)) in the NIR.	Resolved. The method and parameters revised in response to the previous review are transparently explained in section 7.3 of the NIR.
W.11	5.B.2 Anaerobic digestion at biogas facilities – CH ₄ (W.15, 2016) (W.15, 2015) Comparability	Either report the AD as expected in CRF table 5.B when such data are available, or use the notation key “NE”.	Resolved. The notation key “NE” is used in CRF table 5.B for AD (annual waste amount treated) for anaerobic digestion at biogas facilities. Denmark estimates the emissions based on produced biogas (TJ) instead of amount of organic waste digested. The amount of biogas produced is presented in section 7.5 of the NIR.
W.12	5.D Wastewater treatment and discharge – CH ₄ (W.17, 2016) (W.16, 2015) Transparency	Report in the NIR the COD data reported in CRF table 5.D that are actually used for the calculations.	Resolved. The total organic waste (Gg COD/year) values used in the inventory are reported in table 7.5.3 of the NIR and are consistent with the data in CRF table 5.D.
W.13	5.D Wastewater treatment and discharge – CH ₄ (W.18, 2016) (W.17, 2015) Transparency	Whenever biogas production data serve as AD in the emission calculations, include these in the NIR.	Resolved. Information on biogas production (TJ) from wastewater treatment is given in table 7.5.1 of the NIR.
KP-LULUCF			
KL.1	Afforestation and reforestation – CO ₂ (KL.6, 2016) (KL.6, 2015) Accuracy	Implement the country-specific carbon sequestration rates for broadleaves and conifers for forest floor development in CRF table 4(KP-1)A.1.	Addressing. According to the explanation included in table 9.6 of the NIR, changes in the litter pool for afforestation and reforestation activities are measured/modelled in the permanent NFI plots and used in CRF table 4(KP-1)A.1. However, the values of 0.09 and 0.31 t C/ha/year for litter layer for broadleaves and conifers referred to as used in the estimates and the resulting IEF of 0.15 t C/ha for 2014 cannot be tracked back in the relevant chapter in the NIR and broadleaves and conifers are not separately reported in CRF table 4(KP-1)A.1.
KL.2	Deforestation and forest management – CO ₂ , CH ₄ and N ₂ O	Provide documentation for the values of 10 t C/ha for above-ground living biomass and of	Resolved. Relevant information on estimates from harvesting Christmas tree plantations is included in section 6.2 and section 10.3.1 of the NIR. The

<i>ID#</i>	<i>Issue and/or problem classification^{a,b}</i>	<i>Recommendation made in previous review report</i>	<i>ERT assessment and rationale</i>
	(KL.7, 2016) (KL.7, 2015) Transparency	2 t C/ha for below-ground biomass in the next NIR, as the NIR now contains references to models and reports and does not present values.	value of 15 t C/ha for living biomass is more conservative than the previous aggregated value of 12 t C/ha in above-ground and below-ground biomass.
KL.3	Deforestation – CO ₂ (KL.3, 2016) (KL.3, 2015) (77, 2014) Accuracy	Perform a QA assessment of the approach used to determine the 100-year transition period for deforested lands that were converted to settlements, using independent model verification based on country-specific data relevant to deforestation.	Addressing. An assessment of the rationale for a 100-year transition period is referred to in table 9.6 of the NIR and annex 3E, which mostly relates to the conversion from cropland to settlements but, as explained by the Party in the NIR, can be assimilated to all conversions, including deforestation affecting a relatively small area (940 ha from 1990 to 2017). However, no independent model verification based on country-specific data dedicated to deforestation was performed. The Party also indicated that this choice of transition period will be investigated further for the next submission.
KL.4	Forest management – CO ₂ (KL.8, 2016) (KL.8, 2015) Transparency	Improve the documentation of the technical correction by providing all of the elements as included in decision 2/CMP.7, annex, paragraphs 14 and 15, and in the future report any technical correction, when needed, in line with decision 2/CMP.7 and the Kyoto Protocol Supplement.	Resolved. Additional information regarding the implementation of decision 2/CMP.7 is provided in section 10.5 of the NIR and the technical correction is reported in CRF table 4(KP-I)B.1.1. During the review, the Party explained that owing to the changed HWP data it was decided to correct the original FMRL reported in 2011 in order to ensure consistency between the HWP reporting and the FMRL, in line with decision 2/CMP.7, annex, paragraph 14.

^a References in parentheses are to the paragraph(s) and the year(s) of the previous review report(s) 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 Denmark did not take place during 2017 and as such, the ARR 2017 was not available at the time of this review. Therefore, the recommendations reflected in table 3 are taken from the ARR 2016. 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, the ERT noted that the issues included in table 4 have been identified in three successive reviews, including the review of the 2018 annual submission of Denmark, and have not been addressed by the Party.

Table 4

Issues identified in three successive reviews and not addressed by Denmark

<i>ID#</i>	<i>Previous recommendation for the issue identified</i>	<i>Number of successive reviews issue not addressed[†]</i>
General	No such general issues were identified	

<i>ID#</i>	<i>Previous recommendation for the issue identified</i>	<i>Number of successive reviews issue not addressed^a</i>
Energy		
	No such issues for the energy sector were identified	
IPPU		
I.6	Provide a transparent explanation in the NIR regarding the use of the notation key “NO” for the AD for the amounts of HFCs remaining in products at decommissioning for refrigeration and air conditioning and aerosols and the amount of SF ₆ remaining in products at decommissioning of electrical equipment	4 (2013–2018)
Agriculture		
A.1	Report, to the extent possible, the results of the comparison of total N excretion in the inventory with calculations of N excretion for all livestock production estimated by the Danish Centre for Food and Agriculture (stage IV of the QA/QC improvement plan)	3 (2014–2018)
LULUCF		
L.7	Provide additional information on the area and volume of clear cutting and the area subject to destructive disturbance, subject to the availability of data	4 (2013–2018)
Waste		
	No such issues for the waste sector were identified	
KP-LULUCF		
KL.3	Perform a QA assessment of the approach used to determine the 100-year transition period for deforested lands that were converted to settlements, using independent model verification based on country-specific data relevant to deforestation	3 (2014–2018)

^a The review of the 2017 annual submission of Denmark did not take place during 2017. Therefore, the year 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. Tables 5 and 6 contain findings made by the ERT during the individual review of the 2018 annual submission of Denmark that are additional to those identified in table 3. In accordance with paragraph 76(b) of the UNFCCC review guidelines, the ERT has prioritized in table 5 recalculations that changed the total emissions/removals for a category by more than 2 per cent and/or national total emissions by more than 0.5 per cent for any of the recalculated years.

Table 5

Additional findings made during the individual review of the 2018 annual submission of Denmark related to recalculations

ID#	Finding classification	Description of the finding with recommendation or encouragement	<i>Is finding an issue and/or a problem?^a If yes, classify by type</i>
Energy			
E.3	1.A. Fuel combustion – sectoral approach – liquid fuels – CO ₂ , CH ₄ and N ₂ O	<p>The ERT noted that Denmark has revised the methodologies of off-road vehicles and other machinery, which resulted in recalculation of the GHG emissions from liquid fuels of the subcategories manufacturing industries and construction – other – off-road vehicles and other machinery (1.A.2.g.vii), commercial/institutional – off-road vehicles and other machinery (1.A.4.a.ii), residential – off-road vehicles and other machinery (1.A.4.b.ii) and agriculture/forestry/fishing – off-road vehicles and other machinery (1.A.4.c.ii). To maintain the fuel balance (see section 3.3.4 (pp.226–228) and annex 3B-14 of the NIR), recalculation also occurred for the subcategory road transportation (1.A.3.b). The liquid fuel consumption of road transportation (1.A.3.b) increased from 1.01 (1990) to 2.20 (2015) PJ since the 2017 submission, while the liquid fuel consumption of off-road vehicles and other machinery (sum of 1.A.2.g.vii, 1.A.4.a.ii, 1.A.4.b.ii, and 1.A.4.c.ii) decreased at the same order of magnitude, which resulted in a small difference (less than 10 TJ) in the total of these five subcategories for most years. However, the ERT noted that the sum of differences was not maintained for 2009 (+74.63 TJ), 2014 (–1,340.19 TJ) and 2015 (–571.91 TJ). Denmark explained during the review that the reason for the large differences in 2014 and 2015 was that the diesel oil consumption of off-road vehicles and other machinery was scaled down to keep the national fuel balance. Denmark also explained that the reason for the 2009 value was an error in the DCE non-road model triggered by the reclassification of the airport and seaport handling equipment from manufacturing industries and construction – other – off-road vehicles and other machinery (1.A.2.g.vii) to commercial/institutional – off-road vehicles and other machinery (1.A.4.a.ii).</p> <p>The ERT recommends that Denmark report the correct estimates of off-road vehicles and other machinery for 2009 in the subcategories manufacturing industries and construction – other – off-road vehicles and other machinery (1.A.2.g.vii), commercial/institutional – off-road vehicles and other machinery (1.A.4.a.ii), residential – off-road vehicles and other machinery (1.A.4.b.ii) and agriculture/forestry/fishing – off-road vehicles and other machinery (1.A.4.c.ii). In addition, the ERT encourages Denmark to include information on the impact of recalculations across years whenever they show inconsistencies with the overall impact of the applied recalculations.</p>	Yes. Accuracy
E.4	1.A.3.d Domestic navigation – liquid and gaseous fuels – CO ₂ and CH ₄	<p>The ERT noted that Denmark included GHG emissions from domestic navigation under gaseous fuels in CRF table 1.A(a) in the 2017 submission and reallocated emissions from gaseous fuels to NGL in the CRF table in the 2018 submission. The ERT also noted that NGL is reported as “NO” in the reference approach and that the NIR (section 9.1.1) indicates use of LNG for navigation. In response to a question on fuel type, Denmark clarified that the fuel used in ferries is LNG, reported under liquid fuels in the CRF tables. The ERT considers that this is not in line with the UNFCCC Annex I inventory reporting guidelines because NGL are of crude oil origin and LNG is of natural gas origin.</p>	Yes. Comparability

<i>ID#</i>	<i>Finding classification</i>	<i>Description of the finding with recommendation or encouragement</i>	<i>Is finding an issue and/or a problem?^d If yes, classify by type</i>
		The ERT recommends that Denmark reallocate emissions from LNG used in ferries from NGL to gaseous fuels in CRF table 1.A(a).	
E.5	1.A.3.d Domestic navigation – gaseous fuels – CO ₂ and CH ₄	<p>According to the NIR (section 9.1.1) emissions from domestic navigation are recalculated so that emissions from LNG used in ferries are included and the corresponding LNG consumption is subtracted from diesel oil. However, the approach to subtracting was not clarified in the NIR. During the review, Denmark explained that LNG consumption is estimated by mass, converted to a calorific unit by a calorific value and then subtracted from diesel oil.</p> <p>The ERT recommends that Denmark elaborate the estimation method of fuel consumption of LNG for ferries in its NIR, including information on the calorific value used.</p>	Yes. Transparency
IPPU			
I.11	2. General (IPPU)	<p>The ERT noted that Denmark implemented several recalculations in its 2018 submission following the recommendations of the ARR 2016, correcting found errors or because of changed methodology. Recalculations are reported in sections 4.11 and 9.1.2 of the NIR and no underestimations due to the recalculation have been detected. However, the ERT noted that the new methodologies reported in section 4.11 are not reflected in section 4.2.6 (ceramics) or section 4.3.4 (catalyst production), where calculation methods ought to be described. Thus, table 4.3.3 and the text in section 4.3.4 still states that for the years 1990–1995, production is estimated as the constant average of production in 1997–2001 (see ID# I.2 in table 3). During the review Denmark clarified the methodology used to calculate emissions from ceramics and catalyst production and indicated that the explanations of the methods would be amended in the next submission.</p> <p>The ERT recommends that Denmark report the new methodology used to calculate emissions from ceramics and catalyst production in the relevant category sections of the NIR (sections 4.2.6 and 4.3.4, respectively, of the NIR 2018).</p>	Yes. Transparency
Agriculture			
A.2	3. General (agriculture)	Recalculations were made to the agriculture sector that changed the emission/removal estimate for N ₂ O from agricultural soils by 3.2 per cent in 2014; however, the ERT did not identify any issues or problems with these recalculations.	Not an issue/problem
LULUCF			
L.12	4. General (LULUCF)	The ERT noted significant recalculations in the 2018 submission compared with the 2017 submission for the sector of up to 90.9 per cent. However, the references included in the NIR did not provide sufficient information on the reasoning or the numerical impact of the recalculations over the time series in the category-specific sections of the report or in the section on recalculations (section 9.1.4), which indicates only minor changes in the estimates for cropland and grassland. The ERT noted that recalculations for total aggregate CO ₂ equivalent emissions from	Yes. Transparency

<i>ID#</i>	<i>Finding classification</i>	<i>Description of the finding with recommendation or encouragement</i>	<i>Is finding an issue and/or a problem?^a If yes, classify by type</i>
		grassland are within the range of 0.2–0.3 per cent for the entire time series. The recalculations of total aggregate CO ₂ equivalent emissions for cropland, however, result in a reduction in emissions at the beginning of the period (up to –23.0 per cent in 2001) and an increase in the later years (e.g. by 4.4 per cent for 2014). The NIR contains no numerical information on the recalculations and no explanations on the impact of the recalculation on the trend. The ERT recommends that the Party ensure that any recalculations in the sector are reported with a relevant explanation and justification in line with paragraph 44 of the UNFCCC Annex I inventory reporting guidelines. In addition, the ERT encourages the Party to include a discussion on the impact of the recalculation on the trend in emissions and removals at the category and sectoral level.	
Waste			
W.14	General (waste)	Recalculations were made to the waste sector that changed the emission/removal estimate for a category by more than 2 per cent and/or national total emissions by more than 0.5 per cent; however, the ERT did not identify any issues or problems with these recalculations.	Not an issue/problem
KP-LULUCF			
KL.5	General (KP-LULUCF)	Recalculations made to KP-LULUCF activities changed the emission/removal estimate for a category by more than 2 per cent and/or national total emissions by more than 0.5 per cent; however, the ERT did not identify any issues or problems with these recalculations.	Not a problem

^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.

11. Table 6 contains additional findings made by the ERT during the individual review of the 2018 annual submission that are not covered in table 3 or 5, but are within the scope of the desk review as specified in paragraph 76 of the UNFCCC review guidelines or paragraph 65 of the Article 8 review guidelines and are findings that the ERT wishes to convey to the Party.

Table 6

Additional findings made during the individual review of the 2018 annual submission of Denmark

<i>ID#</i>	<i>Finding classification</i>	<i>Description of the finding with recommendation or encouragement</i>	<i>Is finding an issue and/or a problem?^a If yes, classify by type</i>
General			
G.2	Recalculations	The ERT noted that recalculations were made to indirect CO ₂ and N ₂ O emissions in the 2018 submission compared with the 2017 submission. The recalculations for indirect CO ₂ emissions were mainly due to changes in estimations of CO emissions in stationary and mobile combustion. The recalculations were not transparently explained in 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
G.3	Annual submission	<p>energy sector of the NIR or in section 11 of the NIR on indirect CO₂ and N₂O emissions. Section 11.5 of the NIR on category-specific recalculations indicates only that a large number of recalculations were carried out and makes a reference to the 2016 Annual Danish Informative Inventory Report to UNECE (Nielsen et al., 2018) for further information on recalculations. Based on the reference, the ERT could not find specific information on the recalculations of the CO emissions from mobile combustion. During the review, Denmark explained that the large reduction in CO emissions was due to reallocation of gasoline from a subcategory with a high CO EF to one with a significantly lower CO EF (residential machineries to road vehicles). During the review, Denmark further explained that quantitative information on the recalculations of indirect CO₂ and N₂O emissions will be included in section 11 of the next NIR and the detailed information on the recalculations of precursors and hence indirect CO₂ and N₂O emissions will continue to be included in the Annual Danish Informative Inventory Report and referenced in the NIR.</p> <p>The ERT recommends that Denmark ensure that any recalculations of indirect CO₂ emissions included in the national totals are reported in the NIR with relevant explanations and references. The ERT further encourages the Party to include in the NIR a discussion on the impact of the recalculation on the trend of emissions and removals at the category and sectoral level.</p> <p>Section 1.8 and annex 5 of the NIR focus on the completeness of the inventory, indicating that all categories identified in the 2006 IPCC Guidelines are included. The ERT agrees with this statement regarding the DNM submission. However, it noted several categories reported as “NE” in the DNK CRF tables for Greenland and the Faroe Islands. For Greenland, emissions reported as “NE” include emissions from different HFC species under refrigeration and air conditioning (2.F.1), SF₆ emissions under electrical equipment (2.G.1) and CO₂, CH₄ and N₂O emissions and removals under forest land – drainage and rewetting (4. II); for the Faroe Islands emissions reported as “NE” include CO₂, CH₄ and N₂O emissions from various subcategories under fuel combustion (1.A), CO₂ emissions from lubricant use (2.D.1) and paraffin wax use (2.D.2), different HFC species under refrigeration and air conditioning (2.F.1), SF₆ under electrical equipment (2.G.1), indirect N₂O emissions from manure management (3.B.5), CH₄ emissions from agricultural soils (3.D), CH₄ emissions from solid waste disposal (5.A) and CH₄ and N₂O emissions from wastewater treatment and discharge (5.D). In line with the UNFCCC Annex I inventory reporting guidelines, an Annex I Party shall indicate in both the NIR and the CRF completeness table why such emissions have not been estimated. The ERT could not find any such information in the NIR or CRF table 9, “Completeness – information on notation keys”. During the review, Denmark explained that the categories were reported as “NE” owing to a lack of available AD and that the sources were considered to be minor. The Party estimated, for example, that emissions from paraffin wax use (2.D.2) amounted to less than 1 kt CO₂ eq. Denmark also explained that because of technical problems with the CRF Reporter, no explanations had been entered in CRF table 9, and that explanations in the NIR and CRF table would be added in the 2019 submission.</p> <p>The ERT recommends that Denmark estimate and report the following categories for Greenland: HFC emissions from refrigeration and air conditioning (category 2.F.1), SF₆ emissions from electrical equipment (2.G.1) and CO₂,</p>	Yes. Completeness

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
		<p>CH₄ and N₂O emissions and removals under forest land – drainage and rewetting (4. II). The ERT further recommends that Denmark estimate the following categories for the Faroe Islands: CO₂, CH₄ and N₂O emissions from missing subcategories under fuel combustion (1.A), CO₂ emissions from lubricant use (2.D.1) and paraffin wax use (2.D.2), HFC emissions from refrigeration and air conditioning (2.F.1), SF₆ emissions from electrical equipment (2.G.1), indirect N₂O emissions from manure management (3.B.5), CH₄ emissions from agricultural soils (3.D), CH₄ emissions from solid waste disposal (5.A), and CH₄ and N₂O emissions from wastewater treatment and discharge (5.D)). If it is not possible to estimate emissions, in line with the UNFCCC Annex I inventory reporting guidelines, the ERT recommends that the Party indicate in both the NIR and the CRF completeness table why the notation key “NE” has been used. Where a category is determined to be insignificant, the ERT encourages Denmark to provide a qualitative and quantitative justification in the NIR for the exclusion in terms of the likely level of emissions. Furthermore, the ERT recommends that Denmark ensure that the total national aggregate of estimated emissions for all gases and categories considered insignificant remain below 0.1 per cent of the national total GHG emissions.</p>	
G.4	National system	<p>In the 2018 submission (section 1.2 of the NIR), it is noted that the work concerning the annual GHG inventory is carried out in cooperation with other Danish ministries, research institutes, organizations and companies and, while formerly the provision of data was on a voluntary basis, currently more formal agreements between DCE and data providers are being prepared. During the review, in response to a question on the existing formal agreements with companies, Denmark explained that no formal agreements between DCE and Danish companies on data provision are in place and gave examples of organizations with which DCE has formal agreements (e.g. Danish Energy Agency, Danish Centre for Food and Agriculture, and Statistics Denmark).</p> <p>The ERT encourages Denmark to increase the transparency of the NIR by clearly explaining in which cases formal and informal agreements are in place between DCE and data providers.</p>	Not an issue/problem
G.5	QA/QC and verification	<p>The ERT noted that the latest version of the Danish QA/QC plan was published in 2013 in its “Quality manual for the Danish greenhouse gas inventory” (Nielsen et al., 2013) and thus refers the UNFCCC Annex I reporting guidelines as per decisions 18/CP.8 and 14/CP.11. In the manual (p.42) it is stated that the manual was to have been updated in 2015/2016. During the review, Denmark explained that the reason for not updating the manual before the 2018 submission was that the Party wanted to gain experiences from reporting and review under the revised UNFCCC Annex I inventory reporting guidelines (decision 24/CP.19) and review guidelines. Denmark also explained that, tentatively, an updated manual is expected to be published in 2019 following the individual review of its 2018 submission.</p> <p>The ERT recommends that Denmark update its quality manual from 2013 and ensure its consistency with the revised UNFCCC Annex I inventory reporting guidelines.</p>	Yes. Adherence to the UNFCCC Annex I inventory reporting guidelines

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.6	1. General (energy sector)	<p>The ERT noted that in response to recommendation ID# E.4 from the ARR 2016 (see ID# E.1 in table 3), Denmark included additional information on the calculation of indirect emissions from the energy sector in section 11 of the NIR. However, in trying to replicate the estimates, the ERT arrived at results for indirect CO₂ and N₂O emissions that differed from the values reported by the Party in CRF table 6. During the review, Denmark identified some minor errors in the estimates and indicated that the indirect CO₂ emissions were slightly overestimated owing to the inclusion of the sources where the default IPCC CO₂ EFs (i.e. the oxidation factor is 1) for kerosene, brown coal, liquefied petroleum gas and coke were used. Moreover, the indirect N₂O emissions were slightly underestimated owing to the exclusion of biomass fuels in the estimate.</p> <p>The ERT recommends that Denmark report the correct estimates of indirect CO₂ emissions by excluding the sources where the default IPCC CO₂ EFs were used and report the correct estimates of indirect N₂O emissions by including the emissions from biomass.</p>	Yes. Accuracy
E.7	International bunkers and multilateral operations – liquid fuels – CO ₂	<p>The ERT noted discrepancies between CRF tables 1.D. and 1.A(b) for jet kerosene reported for international aviation bunkers for the time series 1990–2000. Discrepancies also occur between CRF table 1.D and table 1.A(b) for residual fuel oil (international navigation bunkers). For example, in 2016 the value reported in CRF table 1.D is 8,933.71 TJ and the value reported in CRF table 1.A(b) is 9,162.67 TJ. During the review, Denmark explained that the discrepancies are due to an error in reported fuel values in the reference approach which will be corrected in the next submission.</p> <p>The ERT recommends that the Party ensure consistent reporting between CRF tables 1.D and 1.A(b) for jet kerosene consumed in international aviation bunkers (1990–2000) and for residual fuel oil consumed in international navigation bunkers.</p>	Yes. Adherence to the UNFCCC Annex I inventory reporting guidelines
IPPU			
I.12	2.F.1 Refrigeration and air conditioning – HFCs	<p>While checking the trend of the reported emissions under category 2.E.5 other (electronics industry) (see ID# I.3 in table 3), the ERT noted that the 2012 and 2013 trend in PFC emissions is also affected by the use of PFC-14 in 2013 and 2014 in laboratory freezers for export. The use of PFC-14 is reported using the notation key “NO” in 2015 and 2016 for category 2.E.5 in CRF table 2(II)B–Hs1, because emissions from laboratory freezers in these years are reported under 2.F.1 refrigeration and air conditioning (see sections 4.6.3 and 4.7.1 of the NIR).</p> <p>The ERT recommends that Denmark ensure consistent reporting of the emissions from laboratory freezers in the CRF tables across the time series and include in the NIR an explanation on the methodology used and allocation of the emissions from this subcategory.</p>	Yes. Consistency

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
I.13	2.F.1 Refrigeration and air conditioning – HFCs	<p>The ERT noticed that the value of the product life factor for HFC-134a from domestic refrigeration (1.25 per cent in 2016) is among the highest of all reporting Parties (ranging from 0.008 to 1.26 per cent in 2016). Similarly, the product life factors (1.26 per cent) for HFC-125 and HFC-143a are the highest of all reporting Parties in 2016. During the review Denmark explained that by mistake emissions from destruction have been reported together with emissions from stock. This resulted in the increase in the IEFs from 2010 onwards and the high IEF in 2016. The emissions will be reallocated in the 2019 submission.</p> <p>The ERT recommends that Denmark separate HFC emissions from destruction from those from stock for HFC-134a, HFC-125 and HFC-143a from domestic refrigeration.</p>	Yes. Comparability
I.14	2.F.1 Refrigeration and air conditioning – HFCs	<p>The ERT noticed significant inter-annual changes in the HFC product life factors (e.g. for HFC-134a from transport refrigeration in 2001/2002 (119.0 per cent) and 2015/2016 (108.2 per cent)) and significant inter-annual changes in HFC product life factors in domestic refrigeration, including for HFC-143a (1995/1996 (112.6 per cent), 1997/1998 (124.3 per cent)) and HFC-125 (1996/1997 (28.9 per cent), 1997/1998 (16.9 per cent), 1999/2000 (59.5 per cent), 2013/2014 (22.5 per cent) and 2014/2015 (–17.2 per cent)). The ERT also noted that no emissions of HFC-134a from stock were reported for 2000 despite amounts of fluid reported in operating systems. During the review Denmark explained that besides other reasons for the fluctuations, the emissions from stock are calculated based on the stock on 1 January, while the stock reported is for 31 December, which causes the fluctuations in the IEFs. Denmark indicated that the reporting approach will be corrected in the next submission. Furthermore, Denmark explained that HFC-134a is used both as a pure substance and as part of blend HFC-404A and that the use of the pure substance started in 2001 and therefore that year there are only emissions from filling and not from stock. The reporting will be corrected accordingly for the next submission.</p> <p>The ERT recommends that Denmark correct its reporting by using the same quantity of stocks for reporting AD and emissions and recheck the product life factors in transport refrigeration across the time series, including a relevant explanation in the NIR in the case of remaining significant variations in the values. The ERT further recommends that Denmark include consistent information on quantities in operating systems and relevant emissions of HFC-134a for 2000.</p>	Yes. Accuracy
Agriculture			
A.3	3. General (agriculture)	<p>The ERT noticed that Denmark stated in the NIR (section 5.1.1) that in 2016, there are 6 key categories according to level and trend for approach 1 and 10 key categories for approach 2 and table 5.2 is referenced. However, in table 5.2, the ERT observed that for 2016, 11 sources are listed as key categories according to level and trend for approach 2. Information contained in the text is thus not consistent with the information in the referenced table.</p>	Yes. Adherence to the UNFCCC Annex I inventory reporting guidelines

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
		<p>During the review, Denmark confirmed that there are 11 key categories in the sector, as stated in table 5.2, and that the information in the text is a typographical error.</p> <p>The ERT recommends that Denmark ensure the consistency of the information in the NIR on the key categories between the explanatory text and the table on key categories (table 5.2 of the NIR).</p>	
A.4	3.D Direct and indirect N ₂ O emissions from agricultural soils – N ₂ O	<p>The ERT noticed some inconsistencies between the NIR and CRF tables and within the NIR. The NIR indicates a reduction in atmospheric deposition from 75,862 t N in 1990 to 40,992 t N in 2016 (p.386), while in CRF table 3.D, the figure entered against atmospheric deposition is 40,997,394.31 kg N/year and table 5.24 of the NIR gives a total emission of 40,998 t N. In response to a question on the apparent inconsistency in the data in the NIR and between the NIR and CRF table 3.D, Denmark explained that the correct value is 40,997 t N as provided in the CRF table, while the value in section 5.7.3 of the NIR (40,992) is a typographical error (it should have been 40,997) and the value in table 5.24 is due to rounding of the numbers in the table.</p> <p>Furthermore, the ERT found that according to the NIR (p.383) “the N content in crop residues has increased from 122 million kg N in 1990 to 123 million kg N in 2016, which is mainly a result of a lower amount of N in harvested straw”, while N in crop residues reported in table 5.21 is 129.8 million kg N for 2016, consistent with the value reported in CRF table 3.D (129,763 000 kg N/year). During the review, Denmark stated that the 123 million kg N in the text is a typographical error and the value should have been 130 million kg N as given in table 5.21.</p> <p>The ERT recommends that Denmark correct the errors in the NIR and ensure the consistency of the provided information on the atmospheric deposition of nitrogen and N content in crop residues between the CRF tables and the NIR and within the NIR.</p>	Yes. Adherence to the UNFCCC Annex I inventory reporting guidelines
A.5	3.D.a.6 Cultivation of organic soils (i.e. histosols) – N ₂ O	<p>The ERT noticed that Denmark is subdividing cultivated organic soils in areas with >12 per cent and areas with 6–12 per cent SOC and that Denmark is referring to the default EF from table 2.5 of the Wetlands Supplement for N₂O emissions from these organic soils. In the NIR (p.384) Denmark stated that for areas with 6–12 per cent SOC the EFs for cropland, grassland and shallow-drained, nutrient-rich grassland are halved to 6.5, 4.1 and 0.8 kg N₂O-N per ha per year, respectively. However, the ERT could not find in the NIR a satisfactory rationale for halving the EFs. During the review, Denmark provided arguments to support the halving of the EFs, indicating that the Danish definition of organic soils are >10 per cent organic matter equivalent to about 6 per cent SOC as defined in 1975. Agricultural soils in use under Danish conditions will normally have a carbon content of 1.5–3 per cent SOC. This is the equilibrium state with the degradation conditions and crop residue inputs. Drained land under agricultural use will therefore approach a SOC content of 1.5–3 per cent. Furthermore, Denmark highlighted that almost all measurements on N₂O emissions from organic soils in the literature are performed on soils having >12 per cent SOC. Consequently, for cultivated organic soils having 6–12 per cent SOC, Denmark has chosen to use 50 per cent of the values in the Wetlands Supplement for N₂O emissions. During the review, Denmark provided further supporting documentation (Taghizadeh-Toosi et al., 2014 and Madsen et al., 1992) for the low country-specific N₂O EFs.</p>	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
<p>The ERT recommends that Denmark provide further explanations to support the halving of the N₂O EFs for cultivated organic soils with 6–12 per cent SOC and relevant references in the NIR.</p>			
LULUCF			
L.13	4.A Forest land – CO ₂	<p>The ERT noted large inter-annual variations in removals/emissions figures throughout the forest land time series. In the NIR (section 6.2.1.6) the Party explained that when estimating the change in stocks rather than the stocks themselves (i.e. when using the stock change method using a one-year reporting interval), the uncertainty depends on both the uncertainty of the estimate for the first and second period and their covariance. Moreover, where the annual change is small and the pools are large, the relative uncertainty is expected to be very large. This means that the changes in carbon stocks between subsequent time points one year apart are not statistically significant. When changes are less than the standard error, an alternative option would be to change the period of change observed/reported to over one year. During the review, Denmark also pointed out that an analysis was performed with five-year change intervals, and the relative errors became much smaller and changes in carbon stocks were statistically significant. Therefore, the explanation for the variations in the reported values is the fact that they are based on direct measurements, reported with a shorter time interval than justified in the measurement accuracy. The Danish National Forest Inventory Report (2016) indicates that the NFI is a continuous, sample-based inventory, with partial replacement of sample plots based on a 2 x 2-km grid covering the Danish land surface and all the permanent and temporary field plots are measured in a five-year cycle. The ERT notes that the 2006 IPCC Guidelines indicate that “under tier 3, process-based estimation will have access to detailed forest inventory or monitoring system with data on growing stock and past and projected net annual increment and functions relating to growing stock or net annual increment directly to biomass and biomass growth” (section 4.2.1.2), but do not specify a time interval for the stock change method.</p> <p>The ERT considers that the method used by Denmark to estimate emissions/removals from forest land is in line with the 2006 IPCC Guidelines. A possible underestimation of emissions or overestimation of removals from forest land that may affect the accounting under the Kyoto Protocol would therefore be linked with the uncertainties that are inherent in the method per se, rather than its implementation in the specific case. The ERT recommends that the Party make a simulated comparative analysis between the stock change method (at one-year and five-year reporting intervals) and the gain–loss method, including the associated uncertainty analysis, and report the results of this comparison in its next NIR. Based on the results of this analysis, the ERT encourages the Party to consider adopting a longer reporting interval for the stock change method in forest land (e.g. five years; i.e. the complete NFI cycle).</p>	Yes. Accuracy
L.14	4.A Forest land – CO ₂	<p>The ERT noted that according to the NIR (sections 6.1.1.5 and 6.2.1.3) the estimation of carbon stock changes in forest land is based on a combination of previous forest surveys (National Forest Census, 1990 and 2000) and the NFI from 2002 onwards. Owing to differences in methodologies, major inconsistencies in forest areas and other forest variables are observed between the two data sets. To ensure their consistency, the approach taken involved</p>	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
		<p>the integration of sampling, image processing and estimation. During the review, the Party confirmed that the estimates of all forest carbon pools are based on direct NFI measurements from 2002 and onward (with no usage of yield tables), and since there are no data prior to 2002, there is no systematic way of harmonizing NFI data with the previous census data. The area and species distribution have been compared and reported in previous publications such as Nord-Larsen et al. (2008).</p> <p>The ERT recommends that Denmark include in the NIR summary information regarding the harmonization of the two different types of forest data (NFI and National Forest Census), relevant for the stock change method in use.</p>	
L.15	4.A Forest land – CO ₂	<p>The ERT noted in section 6.2.1.4 of the NIR (p.423) that for coniferous species an expansion factor model developed for Norway spruce (Skovsgaard et al., 2011) is applied whereas for deciduous species an expansion factor model developed for beech (Skovsgaard and Nord-Larsen, 2012) is used. During the review, the Party provided further information on the tree species composition of the Danish forest area and biomass expansion factor values used in the models. The Party also made a reference to the documentation of the estimation of biomass and carbon pools (Nord-Larsen and Johannsen, 2016) and for areas and volume by species (Nord-Larsen et al., 2017). According to the provided materials, for the calculation of forest biomass and carbon pools, local individual tree volume and biomass functions are available for beech, oak, ash (broadleaves) and silver fir, Norway spruce, grand fir, Douglas fir, Sitka spruce and Japanese larch (conifers), representing 57 per cent of the area and 73 per cent of the total standing volume. For the remaining species, generic models for beech and Norway spruce have been applied. Although not tested systematically, these methodological assumptions are not expected by the Party to be biased in terms of biomass or carbon estimates.</p> <p>The ERT accepts the explanations provided by the Party regarding the measures in place to avoid over- or underestimation in living biomass and recommends that Denmark include in the NIR information on the methodology used to develop a biomass expansion factor for conifers and broadleaved species in forest land.</p>	Yes. Transparency
L.16	4.A Forest land – CO ₂	<p>The ERT noted that according to section 6.2.1.4 of the NIR (p.423) the total growing stock, biomass or carbon stocks with a given characteristic are estimated as the sum of the stocks with the particular characteristic divided by the inventoried plot area, multiplied by the total forest area. However, the NIR does not provide information on the details of the characteristics of the forest stands considered. During the review, the Party provided documentation on the NFI calculations (Nord-Larsen and Johannsen, 2016), containing information regarding the NFI design.</p> <p>The ERT recommends that Denmark include in the NIR synthesized information on the main parameters defining the characteristics used in the calculation of biomass and growing stocks.</p>	Yes. Transparency
L.17	4.A.1 Forest land remaining	<p>The ERT noted that the Wetlands Supplement (p.2.25) provides a default EF of 2.0 kg CH₄/ha from drainage of nutrient-rich organic soils in boreal forests, while CRF table 4(II) of Denmark reports an IEF of 64.24 kg CH₄/ha. During the review, Denmark explained that the reported CH₄ emissions arise from multiple sources, whereby</p>	Yes. Transparency

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	forest land – CH ₄	<p>several tier 1 default EFs were used (depending on the site (e.g. rich versus poor nutrient soils) and management type (e.g. drained versus rewetted)) with higher values compared with the default EF for drained organic soil.</p> <p>The ERT recommends that the Party include in the NIR information on the methodologies and factors used for the estimation of CH₄ emissions from the drainage of different types of forest organic soils reported under drained organic soil/forest land in CRF table 4(II).</p>	
L.18	4.A.2 Land converted to forest land – CO ₂	<p>The ERT noted in section 6.2 of the NIR (p.420) that “the area with forest land has increased since 1990 due to an intensive afforestation programme. In the beginning of the 1990s, approximately 3,000 ha were afforested every year. In recent years approximately 1,900 ha are afforested per year.” However, table 6.5 of the NIR shows relatively constant AD from 2013 onwards, at approximately 637 kha. During the review, the Party explained that the average of 1,900 ha is based on the full period of 1990–2016, and the trend is declining. The Party also mentioned that updates for the estimation of land areas converted to forests are now done by use of the LPIS.</p> <p>The ERT recommends that the Party improve the transparency of the NIR by explaining how land converted to forest land changed over the entire time series.</p>	Yes. Transparency
L.19	4.B Cropland – CO ₂	<p>The ERT noted in section 6.3.1.5 of the NIR (p.436) some areas of Christmas tree plantations are included in cropland. At the same time, section 6.2.2.7 of the NIR (p.433) indicates planned improvements regarding estimates from Christmas tree plantations included in forest land. Following up on recommendation ID# L.18 in the ARR 2016 (see ID# L.11 in table 3), the ERT asked the Party to specify the areas of Christmas tree plantations included under the categories forest land (4A) and cropland (4B) in the 2018 submission, and the approach/method used to avoid gaps/overlaps between the two. The Party responded that all Christmas trees are included under forest reporting and subject to the NFI. The ERT noted further that the NIR (p.436) states that the “analysis of the rotations showed that up to 80 per cent of Christmas trees was followed by an annual crop or grass. The major part of this crop growing could therefore not be seen as afforestation followed by deforestation”, and asked for clarification. The Party acknowledged the existence of redundant text on Christmas trees on cropland from the previous NIR and recognized the need for correction in the next submission.</p> <p>The ERT recommends that the Party correct the description of the representation of Christmas tree plantations and provide up-to-date information on their estimation and allocation in the NIR.</p>	Yes. Transparency
L.20	4.B Cropland – CO ₂	<p>The ERT noted that the NIR (p.438) states that C-TOOL, a three-pooled dynamic model used for the estimate of soil carbon turnover, uses the approximate average half-life values of 0.6–0.7 years, 50 years and 600–800 years, respectively, for the three different pools, FOM, HUM and ROM. However, the ERT noted that the values used are not referenced or justified in the NIR. During the review, Denmark provided specific references for these values</p>	Yes. Transparency

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		<p>and the technical documentation for C-TOOL, including a more detailed description of the methodology employed for the calculations.</p> <p>The ERT recommends that the Party include in the NIR summary information on the half-life values used in the estimation of the tree soil pools (FOM, HUM and ROM) by the C-TOOL model.</p>	
L.21	4.B Cropland – CO ₂	<p>The ERT noted that as reported in the NIR (p.441) the FOM pool reported under composted crop residues has a very fast turnover rate and low share (approximately 1 per cent) in the agricultural soil. The reported changes in the cropland soil pool assume an instant turnover of the FOM pool, hence the model in place only consists of the other two pools, HUM and ROM. The ERT noted, however, that while the HUM and ROM pools are relatively constant in the time series 1980–2016, the change in all pools (FOM, HUM and ROM) has relatively large inter-annual fluctuations according to figures 6.6 and 6.7 of the NIR (p.442). During the review, Denmark explained the trends, stating that crop residues normally have an input of 3–4 t C/ha/year, but vary between years owing to actual harvest yields. In the model set-up, this is added to the soil in August/September after harvest. On the contrary, the carbon stock “deadline” for inventory purposes is 31 December, hence the fluctuations between years. If the reporting were by, for example, 31 July, the FOM amount would have been levelled out because the undegraded FOM in the reporting year will degrade the following summer and level out the trend in the FOM pool.</p> <p>The ERT recommends that the Party include in the NIR summary information explaining the inter-annual variation between the FOM, HUM and ROM soil pools.</p>	Yes. Transparency
L.22	4.B Cropland – CO ₂	<p>According to the NIR (p.448) “for land converted to cropland a standard default gain value of 9,577 kg DM (dry matter)/ha in above-ground biomass and 2,298 kg DM/ha in below-ground biomass are used. This value is equivalent to the average harvest of living biomass for all cereals grown in Denmark from 2000 to 2010, including straw, stubble and glumes”. The ERT noted that the choice of values is not supported by a specific reference from the NIR and asked for clarification. The Party responded that the default values of 9,577 kg DM/ha and 2,298 kg DM/ha are based on average cereal grain yield over 10 years combined with default factors for estimating straw, stubble and husks, which is higher than the IPCC default of 4.7–5 t C/ha. The Party also confirmed that the values have been used for all land-use changes for all years as a loss (where cropland has been converted to other land uses) and as a gain (when other land uses are converted to cropland).</p> <p>The ERT recommends that Denmark include in the NIR specific information and references on the selection of the values on gains in living biomass used for land converted to cropland and cropland converted to other land.</p>	Yes. Transparency
L.23	4.C.2 Land converted to grassland – CO ₂	<p>The NIR (p.451) states that as there has been a fairly high conversion of cultivated organic soils to permanent grass, emissions from organic soils on grassland have increased over recent years. The ERT noted, however, that the total emissions in table 6.19 of the NIR showed a decreasing trend in emissions, as follows: 769.1 kt CO₂ eq in 2014; 743.1 kt CO₂ eq in 2015; and 673.5 kt CO₂ eq in 2016. The trend of decreasing emissions/increasing removals from land undergoing a change from more intensive (i.e. cultivated organic soils) to less intensive (i.e.</p>	Yes. Transparency

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		<p>permanent grassland) use is indeed closer to ERT expectations. During the review, the Party explained that the text in the NIR is left over from a previous submission and indicated the changed approach in handling conversion from cropland to grassland.</p> <p>The ERT recommends that Denmark correct the text in the NIR on emissions from organic soils on grassland related to the trend in conversion of cultivated organic soils to permanent grassland.</p>	
L.24	4.D.2 Land converted to wetlands – CH ₄	<p>According to the NIR (p.456) since 1990, 17,001 ha of converted wetlands have been established, primarily on cropland and grassland. In accordance with the Wetlands Supplement the CH₄ emissions (216 kg CH₄-C per ha for temperate areas, equivalent to 288 kg CH₄ per ha from restored rich wetlands (chapter 3, table 3.3)), the resulting CH₄ emissions have been included in the inventory. The ERT noted that CRF table 4(II) includes only values for rewetted organic soils in cropland, while for forest land and grassland the notation key “IE” is used, which is not further explained in CRF table 9 or in the NIR. During the review, the Party explained that the value of 288 kg CH₄/ha is used only for known rewetted soils, which are reported in table 4(II) under category D.3 (other wetlands). The Party also pointed out difficulties in verifying changes in agricultural practice leading to rewetting of drained organic soils, which depends on the availability of data in LPIS on active rewetting of these areas. Based on the information in LPIS it can be observed when some farmers are no longer applying for subsidies for some land, hence the assumption that the land no longer qualifies as “farmed land”. For the organic soils, Denmark continues to report the land in cropland, but assumes that it can no longer be used for agricultural purposes as it is too wet (deepening ditches in Denmark is not permitted).</p> <p>The ERT recommends that Denmark include in the NIR information on methodological assumptions made to estimate and allocate CH₄ emissions from land converted to wetlands and provide an explanation of the use of notation key “IE” in CRF table 4(II).</p>	Yes. Transparency
	Waste		
W.15	5. General (waste) – CO ₂ , CH ₄ and N ₂ O	<p>The ERT noted that total emissions from the waste sector in table 7.1.1 in the NIR and those in CRF table 10s1 differ. The emissions for 2016, for example, are 1,271.28 kt CO₂ eq in the CRF table versus 1,212 kt CO₂ eq according to the summary table in the NIR, mainly owing to a difference in the value for CH₄ emissions from biological treatment of solid waste. During the review, Denmark explained that the correct values are reported in the CRF table.</p> <p>The ERT recommends that Denmark provide correct data for the aggregate emissions in CO₂ eq from the waste sector in the corresponding NIR table.</p>	Yes. Adherence to the UNFCCC Annex I inventory reporting guidelines

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W.16	5.A Solid waste disposal on land – CH ₄	<p>The ERT noted that DOC_f in CRF table 5.A is given as 4.08 per cent when according to the NIR (p.477) the default value of 0.5 is used. Denmark confirmed that the error was in the CRF table and that it does not affect the emission estimation.</p> <p>The ERT recommends that Denmark correct the erroneous entry of DOC_f in CRF table 5.A.</p>	Yes. Adherence to the UNFCCC Annex I inventory reporting guidelines
W.17	5.A Solid waste disposal on land – CH ₄	<p>According to table 7.2.2 of the NIR, Denmark uses half-life values for sludge from table 3.4 in the 2006 IPCC Guidelines corresponding to a dry climate, while for other waste types values for a wet climate are used. Denmark's climate is categorized as wet. In response to the ERT's request for clarification on the choice made, Denmark explained that a country-specific half-life for sludge is used, based on expert judgment. It takes into account that the sludge landfilled is normally the end product from anaerobic digestion with a lower degradation rate than that of undigested sludge. Hence the IPCC default for slowly degrading waste (paper, textiles) corresponding to a wet climate in table 3.4 in the 2006 IPCC Guidelines was considered to be more suitable for sludge from anaerobic digestion.</p> <p>The ERT considers the explanation provided by the Party during the review plausible and recommends that Denmark include in the NIR information and references justifying the country-specific half-life for sludge.</p>	Yes. Transparency
KP-LULUCF			
KL.6	Afforestation and reforestation CO ₂	<p>The ERT noted in section 10.2 of the NIR (p.543) that the Party indicated that there may be a slight time delay in the actual recording of the afforestation/AR but that Denmark plans more frequent land-use mapping and improved methods for mapping in the coming years. The ERT considered that this delayed reporting may have an impact on afforestation/AR estimates and asked Denmark whether and how the provisions of the Kyoto Protocol Supplement (chapter 2, sections 2.5.1 and 2.5.2) are applied in order to demonstrate that the geographical location of the boundaries of the areas that encompass lands subject to AR activities are identifiable (in addition to information already included in sections 10.2 and 10.3 of the NIR). The Party referred to the support schemes for afforestation, which require that the plants are in the soil and can be documented within a short time frame. This is recorded in the LPIS system and used as input to the continuous update of the land-use matrix and mapping of geographical boundaries of Denmark. Furthermore, the forests are inventoried and mapped at intervals, to supplement and validate the registered information.</p> <p>The ERT recommends that Denmark include information to support the geographical location of boundaries of AR activities in the NIR, for both plantations and natural expansion of forests.</p>	Yes. Transparency
KL.7	Deforestation – CO ₂	<p>Section 10.2.1 of the NIR (p.543) states that deforestation is identified where areas at the beginning of the commitment period were covered by forest and where subsequent information (through remote sensing or NFI) is recorded to have another land use. The identification of the areas is in most cases supported by reports on, for example, nature restoration or establishment of settlements. From the statement, the ERT was not able to assess</p>	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
		<p>how the provisions of the Kyoto Protocol Supplement (chapter 2, section 2.6.1) are applied in order to demonstrate that the geographical location of the boundaries of the areas that encompass lands subject to deforestation activities are identifiable. During the review, the Party explained that through the cadastral data of Denmark, all settlements (roads, houses, etc.) are clearly geographically located. For nature restoration, the information on the changes is documented through the LPIS system used for managing support instruments for nature restoration. Furthermore, for all restoration projects on publicly owned land, the planning data and maps with high accuracy are available as input for documentation of these changes.</p> <p>The ERT recommends that Denmark amend the information to support the geographical location of boundaries of deforestation activities in the NIR, including information on how deforestation (i.e. land-use change) is distinguished from regeneration clear-cuts in forest land (i.e. temporary change in land cover), and how different end uses of deforested land (e.g. settlements versus 'nature restoration') are distinguished from one another.</p>	
KL.8	Cropland management – CO ₂	<p>The ERT noted that the description of land cover types included under cropland (p.538 of the NIR) did not include hedgerows. The ERT also recalled that under planned improvements for the cropland estimates under the LULUCF sector (p.447) “verification and investigation of the hedgerows will take place in 2018”. However, according to table 6.14 of the NIR, there are consistent records of hedgerows established up to 2013 on cropland and section 10.6.3 of the NIR (p.548) indicates that above- and below-ground living biomass for perennial fruit plantations, hedgerows and willow plantations for bioenergy purposes on agricultural land are reported under cropland management. During the review, Denmark confirmed that hedgerows are considered under cropland management, covering around 60,000 ha. In 2007, Denmark made stereoscopic analysis of 144 2 x 2-km² aerial photos for 1990 and 2005 to estimate the area, width, height and changes between the two periods to estimate the carbon stock. The method was able to detect changes, which were combined with information from the LPIS system on subsidies for new hedges. For a couple of years there have been no subsidies for hedges and therefore there were no new data on new and removed hedges for those years. Hence there were no changes in the area but there was still a build-up in previously planted hedges. The Party informed the ERT of its plan to update the estimates on hedgerows in its next submission based on new information and Light Detection and Ranging data analysis.</p> <p>The ERT welcomes the planned improvements and recommends that Denmark provide updated estimates on hedgerows across the entire time series and include transparent documentation on the methodologies used to estimate annual changes to AD in the NIR.</p>	Yes. Accuracy
KL.9	Grazing land management – CO ₂	<p>The ERT noted that section 10.7.2 of the NIR (p.549) states that since all the grazed grassland is more or less unimproved without fertilizer or limited fertilization, no changes in management practice has been applied. This is considered in accordance with the 2006 IPCC Guidelines, chapter 6, and the Kyoto Protocol Supplement, chapter 2.10. Nevertheless, the ERT noted that CRF table NIR-1 and table 4(KP-I)B.3 suggest that soil estimates for grazing land are reported, which appears to be inconsistent with the no-change assumption referred to above. During the review the Party explained that its modelling tool, C-TOOL, is used on all agricultural mineral soils (<6 per cent organic carbon) with area data and crop yields from Statistics Denmark and LPIS data. This area also</p>	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
		<p>includes permanent grassland for agricultural purposes. As Denmark uses only “managed land” in the reporting, marginal land such as heathland was included in managed grassland, but not in the modelling, as this is not included in the agricultural statistics. So, de facto, grassland can be considered as being two different areas, one agricultural part and one non-agricultural. C-TOOL is running on the agricultural part covering both land in rotation and permanent grassland. Therefore carbon stock changes in grassland are reported under cropland in the Convention reporting and in KP.B.2, while the notation key “IE” is used for grassland (4.C). However, when land reported under the Kyoto Protocol is changed to grazing land management, this has to be reported and “R” (reported) is used in CRF table NIR-1. There is a slight increase in carbon stocks in mineral soils due to conversion of land from other land-use classes to grassland. When running C-TOOL, Denmark uses for the permanent agricultural grassland a carbon input factor, which matches the degradation in the soil. The net outcome is around zero for permanent agricultural grassland.</p> <p>The ERT recommends that Denmark include in its next NIR the information on grazing land management estimates obtained through C-TOOL, including the methodological changes compared with grassland estimates under the Convention.</p>	
KL.10	Harvested wood products – CO ₂	<p>The ERT noted that in CRF table 4(KP-I)C removals in the HWP pool resulting from deforestation activities are accounted for (0.46 kg CO₂ eq in 2016). The ERT also noted that section 10.10 of the NIR (p.551) states that “HWP accounting in the current commitment period is solely based on changes in the HWP pool in this period. Hereby the emissions in the first commitment period have no influence on the current reporting.” The ERT considered that this is not in line with the Kyoto Protocol Supplement, table 1, where it is stipulated that HWP resulting from deforestation shall be accounted on the basis of instantaneous oxidation, and emissions occurring in the second commitment period from HWP removed from forests prior to the start of the second commitment period shall also be accounted for. Asked to explain the different approaches on deforestation and the relation between the first and second commitment periods, compared with the guidelines in the Kyoto Protocol Supplement, the Party explained that potential HWP from deforestation is accounted as instantaneous oxidation and that the HWP accounting is based on emissions from the full HWP pool, as well as the new inflow to the HWP pool. These emissions/removals represent the basis of the changes in the HWP pool in the second commitment period, hence the estimates are in line with the Kyoto Protocol Supplement. The Party also committed to improving the explanations of the estimates in the next NIR.</p> <p>The ERT recommends that Denmark improve the transparency of the NIR by clarifying that deforestation is accounted as instantaneous oxidation and explain in detail what the revised HWP accounting is based on, as well as the specific means used to discount deforestation from the HWP inflow.</p>	Yes. Transparency

^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

12. The ERT has not identified the need to apply any adjustments to the 2018 annual submission of Denmark.

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

13. Annex I shows the accounting quantities for KP-LULUCF activities as reported by the Party and the final values after the review. The final quantity of units to be issued and cancelled are presented in the same annex.

VIII. Questions of implementation

14. No questions of implementation were identified by the ERT during the individual review of the 2018 annual submission.

Annex I

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

1. Tables 7–10 provide an overview of total GHG emissions and removals as submitted by Denmark.

Table 7

Total greenhouse gas emissions for Denmark, base year^a–2016

(kt CO₂ eq)

	<i>Total GHG emissions excluding indirect CO₂ emissions</i>		<i>Total GHG emissions including indirect CO₂ emissions^b</i>		<i>Land-use change (Article 3.7 bis as contained in the Doha Amendment)^c</i>	<i>KP-LULUCF activities (Article 3.3 of the Kyoto Protocol)^d</i>	<i>KP-LULUCF activities (Article 3.4 of the Kyoto Protocol)</i>	
	<i>Total including LULUCF</i>	<i>Total excluding LULUCF</i>	<i>Total including LULUCF</i>	<i>Total excluding LULUCF</i>			<i>CM, GM, RV, WDR</i>	<i>FM</i>
FMRL								409.00
Base year	74 335.66	69 546.98	75 498.77	70 710.09	8.807		5 234.95	
1990	74 033.37	69 244.69	75 196.48	70 407.80				
1995	80 755.82	77 268.69	81 832.54	78 345.42				
2000	73 512.11	69 986.01	74 308.61	70 782.52				
2010	62 082.65	62 883.45	62 541.60	63 342.41				
2011	55 336.87	57 713.35	55 741.68	58 118.16				
2012	52 874.25	53 015.29	53 245.70	53 386.73				
2013	56 031.01	54 822.90	56 378.60	55 170.49		58.81	3 611.01	–2 546.19
2014	50 968.76	50 693.99	51 283.41	51 008.63		–210.31	4 226.42	–3 774.13
2015	52 421.27	48 199.56	52 723.56	48 501.86		–354.86	3 895.27	667.73
2016	55 604.61	50 191.41	55 891.54	50 478.35		251.25	4 429.37	677.95

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 CO₂, CH₄ and N₂O and 1995 for HFCs, PFCs, SF₆ and NF₃. CO₂, CH₄ and N₂O emissions included in the base year do not include the net emissions minus removals from conversion of forests (deforestation) that were included in Denmark's initial report for the second commitment period of the Kyoto Protocol for the base year and subsequently used for the calculation of the assigned amount. The base year for CM and GM under Article 3, paragraph 4, of the Kyoto Protocol is 1990 for Denmark. 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 has reported indirect CO₂ 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 8

Greenhouse gas emissions by gas for Denmark, excluding land use, land-use change and forestry, 1990–2016(kt CO₂ eq)

	<i>CO₂^a</i>	<i>CH₄</i>	<i>N₂O</i>	<i>HFCs</i>	<i>PFCs</i>	<i>Unspecified mix of HFCs and PFCs</i>	<i>SF₆</i>	<i>NF₃</i>
1990	54 763.98	7 628.93	7 972.47	NO, NA	NO, NA	NO, NA	42.41	NO, NA
1995	62 705.22	8 059.84	7 235.66	241.67	0.63	NO, NA	102.40	NO, NA
2000	55 104.06	7 919.76	6 975.62	704.44	22.57	NO, NA	56.07	NO, NA
2010	49 751.23	7 362.11	5 223.25	951.40	18.66	NO, NA	35.76	NO, NA
2011	44 720.35	7 200.15	5 225.38	887.21	15.68	NO, NA	69.39	NO, NA
2012	40 252.30	7 075.24	5 128.33	806.69	12.18	NO, NA	112.00	NO, NA
2013	42 172.64	6 973.99	5 098.46	783.98	10.84	NO, NA	130.58	NO, NA
2014	37 938.17	6 974.96	5 246.87	707.66	8.61	NO, NA	132.37	NO, NA
2015	35 617.41	6 906.53	5 230.72	639.18	4.94	NO, NA	103.08	NO, NA
2016	37 404.28	7 021.74	5 345.93	610.58	4.00	NO, NA	91.83	NO, NA
Per cent change 1990– 2016	–31.7	–8.0	–32.9	NA	NA	NA	116.5	NA

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

^a CO₂ emissions include indirect CO₂ emissions reported in CRF table 6.

Table 9

Greenhouse gas emissions by sector for Denmark, 1990–2016(kt CO₂ eq)

	<i>Energy</i>	<i>IPPU</i>	<i>Agriculture</i>	<i>LULUCF</i>	<i>Waste</i>	<i>Other</i>
1990	53 547.03	2 370.85	12 673.48	4 788.68	1 816.43	NO
1995	61 648.70	2 909.03	12 134.66	3 487.12	1 653.03	NO
2000	54 313.81	3 663.83	11 261.56	3 526.10	1 543.32	NO
2010	49 672.13	2 043.40	10 408.43	–800.80	1 218.45	NO
2011	44 315.62	2 191.02	10 398.60	–2 376.49	1 212.92	NO
2012	39 699.19	2 141.11	10 369.22	–141.03	1 177.21	NO
2013	41 533.28	2 145.18	10 348.79	1 208.11	1 143.24	NO
2014	37 224.96	2 082.78	10 520.41	274.77	1 180.48	NO

	<i>Energy</i>	<i>IPPU</i>	<i>Agriculture</i>	<i>LULUCF</i>	<i>Waste</i>	<i>Other</i>
2015	34 940.07	2 007.77	10 392.01	4 221.70	1 162.01	NO
2016	36 542.48	2 130.69	10 533.89	5 413.20	1 271.28	NO
Per cent change 1990–2016	-31.8	-10.1	-16.9	13.0	-30.0	NA

Notes: (1) Emissions/removals reported in the sector other (sector 6) are not included in total GHG emissions. (2) Totals include indirect CO₂ emissions reported in CRF table 6.

Table 10

Greenhouse gas emissions/removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol by activity, base year^a–2016, for Denmark
(kt CO₂ eq)

	<i>Article 3.7 bis as contained in the Doha Amendment^b</i>			<i>Article 3.3 of the Kyoto Protocol</i>					<i>FM and elected Article 3.4 activities of the Kyoto Protocol</i>			
	<i>Land-use change</i>	<i>AR</i>	<i>Deforestation</i>	<i>FM</i>	<i>CM</i>		<i>GM</i>		<i>RV</i>	<i>WDR</i>		
FMRL				409.00								
Technical correction				-82.62								
Base year	8.807				4 305.53	929.41	NA	NA				
2013		22.98	35.83	-2 546.19	2 431.79	1 179.22	NA	NA				
2014		-326.75	116.44	-3 774.13	3 137.57	1 088.85	NA	NA				
2015		-607.62	252.76	667.73	2 614.00	1 281.27	NA	NA				
2016		40.84	210.42	677.95	3 306.35	1 123.02	NA	NA				
Per cent change Base year–2016					-23.2	20.8	NA	NA				

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

^a The base year for CM and GM under Article 3, paragraph 4, of the Kyoto Protocol is 1990 for Denmark. 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.

- Table 11 provides information on the accounting quantities for reporting under Article 3, paragraphs 3 and 4, of the Kyoto Protocol.

Table 11
Accounting quantities for activities under Article 3, paragraph 3, and forest management and any elected activities under Article 3, paragraph 4, of the Kyoto Protocol, for Denmark
 (kt CO₂ eq)

Greenhouse gas source and sink activities	Net emissions/removals						Accounting parameters	Accounting quantity ^c
	Base year ^a	2013	2014	2015	2016	Total ^b		
A.1. AR		22.980	-326.753	-607.618	40.836	-870.555		-870.555
Excluded emissions from natural disturbances ^d		NA	NA	NA	NA	NA		NA
Excluded subsequent removals from land subject to natural disturbances								
A.2. Deforestation		35.831	116.445	252.755	210.418	615.449		615.449
B.1. FM						-4 974.631		-6 280.163
Net emissions/removals		-2 546.191	-3 774.127	667.734	677.952	-4 974.631		
Excluded emissions from natural disturbances ^d		NA	NA	NA	NA	NA		NA
Excluded subsequent removals from land subject to natural disturbances								
Any debits from CEF-ne FMRL ^e		NA	NA	NA	NA	NA	409.000	
Technical corrections to FMRL							-82.617	
FM cap							19 388.512	-6 280.163
B.2. CM (if elected)	4 305.533	2 431.791	3 137.569	2 614.001	3 306.345	11 489.706		-5 732.425
B.3. GM (if elected)	929.413	1 179.219	1 088.853	1 281.268	1 123.020	4 672.361		954.707
B.4. RV (if elected)	NA	NA	NA	NA	NA	NA		NA
B.5. WDR (if elected)	NA	NA	NA	NA	NA	NA		NA

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

^b Cumulative net emissions and removals for all years of the commitment period reported in the current submission.

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

^d The Party has indicated it does not intend to exclude emissions from natural disturbances.

^e FM reference level as inscribed in the appendix of the annex to decision 2/CMP.7, in kt CO₂ eq per year.

3. Table 12 provides an overview of relevant key data for Denmark's reporting under Article 3, paragraphs 3 and 4, of the Kyoto Protocol.

Table 12

Key relevant data for Denmark under Article 3, paragraphs 3 and 4, of the Kyoto Protocol in the 2018 annual submission ^{a,b}

<i>Key parameters</i>	<i>Values</i>
Periodicity of accounting	(a) AR: annual accounting (b) Deforestation: annual accounting (c) FM: annual accounting (d) CM: annual accounting (e) GM: annual accounting (f) RV: not elected (g) WDR: not elected
Election of activities under Article 3, paragraph 4	CM, GM
Election of application of provisions for natural disturbances	No
3.5% of total base-year GHG emissions, excluding LULUCF and including indirect CO ₂ emissions	2 477.758 kt CO ₂ eq (19 822.068 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	Issue 570 652 RMUs
2. Deforestation in 2016	Cancel 446 972 units
3. FM in 2016	Cancel 692 921 units
4. CM in 2016	Issue 3 380 684 RMUs
5. GM in 2016	Cancel 667 062 units
6. RV in 2016	NA
7. WDR in 2016	NA

^a Data in this table are based on information provided by the Party in its 2018 annual submission for mainland Denmark.

^b The review of the 2017 annual submission of Denmark did not take place during 2017 and as such, there was no cancellation and issuance of units based on that submission. The values for cancellation of AAUs, ERUs, CERs and issuance of RMUs in the national registry reported in this table are calculated based on the final accounting quantity in the 2018 annual submission and where the quantities issued or cancelled based on the 2015 and 2016 annual review reports have been subtracted.

Annex II

Information to be included in the compilation and accounting database

Tables 13–16 include the information to be included in the compilation and accounting database for Denmark. 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 13

Information to be included in the compilation and accounting database for 2016, including on the commitment period reserve, for Denmark

(t CO₂ eq)

	<i>Original submission</i>	<i>Revised estimates</i>	<i>Adjustment</i>	<i>Final</i>
CPR	242 440 102			242 440 102
Annex A emissions for 2016				
CO ₂ ^a	37 404 279			37 404 279
CH ₄	7 021 737			7 021 737
N ₂ O	5 345 927			5 345 927
HFCs	610 577			610 577
PFCs	3 996			3 996
Unspecified mix of HFCs and PFCs	NA, NO			NA, NO
SF ₆	91 828			91 828
NF ₃	NA, NO			NA, NO
Total Annex A sources	50 478 345			50 478 345
Activities under Article 3, paragraph 3, of the Kyoto Protocol for 2016				
3.3 AR	40 836			40 836
3.3 Deforestation	210 418			210 418
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol for 2016				
3.4 FM	677 952			677 952
3.4 CM	3 306 345			3 306 345
3.4 CM for the base year	4 305 533			4 305 533
3.4 GM	1 123 020			1 123 020
3.4 GM for the base year	929 413			929 413

^a CO₂ emissions include indirect CO₂ emissions reported in CRF table 6.

Table 14

Information to be included in the compilation and accounting database for 2015, for Denmark

(t CO₂ eq)

	<i>Original submission</i>	<i>Revised estimates</i>	<i>Adjustment</i>	<i>Final</i>
Annex A emissions for 2015				
CO ₂ ^a	35 617 412			35 617 412
CH ₄	6 906 527			6 906 527
N ₂ O	5 230 716			5 230 716
HFCs	639 176			639 176
PFCs	4 945			4 945

	<i>Original submission</i>	<i>Revised estimates</i>	<i>Adjustment</i>	<i>Final</i>
Unspecified mix of HFCs and PFCs	NA, NO			NA, NO
SF ₆	103 082			103 082
NF ₃	NA, NO			NA, NO
Total Annex A sources	48 501 858			48 501 858
Activities under Article 3, paragraph 3, of the Kyoto Protocol for 2015				
3.3 AR	-607 618			-607 618
3.3 Deforestation	252 755			252 755
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol for 2015				
3.4 FM	667 734			667 734
3.4 CM	2 614 001			2 614 001
3.4 CM for the base year	4 305 533			4 305 533
3.4 GM	1 281 268			1 281 268
3.4 GM for the base year	929 413			929 413

^a CO₂ emissions include indirect CO₂ emissions reported in CRF table 6.

Table 15

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

(t CO₂ eq)

	<i>Original submission</i>	<i>Revised estimates</i>	<i>Adjustment</i>	<i>Final</i>
Annex A emissions for 2014				
CO ₂ ^a	37 938 174			37 938 174
CH ₄	6 974 959			6 974 959
N ₂ O	5 246 868			5 246 868
HFCs	707 658			707 658
PFCs	8 607			8 607
Unspecified mix of HFCs and PFCs	NA, NO			NA, NO
SF ₆	132 369			132 369
NF ₃	NA, NO			NA, NO
Total Annex A sources	51 008 633			51 008 633
Activities under Article 3, paragraph 3, of the Kyoto Protocol for 2014				
3.3 AR	-326 753			-326 753
3.3 Deforestation	116 445			116 445
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol for 2014				
3.4 FM	-3 774 127			-3 774 127
3.4 CM	3 137 569			3 137 569
3.4 CM for the base year	4 305 533			4 305 533
3.4 GM	1 088 853			1 088 853
3.4 GM for the base year	929 413			929 413

^a CO₂ emissions include indirect CO₂ emissions reported in CRF table 6.

Table 16

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

	<i>Original submission</i>	<i>Revised estimates</i>	<i>Adjustment</i>	<i>Final</i>
Annex A emissions for 2013				
CO ₂ ^a	42 172 642			42 172 642
CH ₄	6 973 993			6 973 993
N ₂ O	5 098 458			5 098 458
HFCs	783 977			783 977
PFCs	10 840			10 840
Unspecified mix of HFCs and PFCs	NA, NO			NA, NO
SF ₆	130 583			130 583
NF ₃	NA, NO			NA, NO
Total Annex A sources	55 170 493			55 170 493
Activities under Article 3, paragraph 3, of the Kyoto Protocol for 2013				
3.3 AR	22 980			22 980
3.3 Deforestation	35 831			35 831
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol for 2013				
3.4 FM	-2 546 191			-2 546 191
3.4 CM	2 431 791			2 431 791
3.4 CM for the base year	4 305 533			4 305 533
3.4 GM	1 179 219			1 179 219
3.4 GM for the base year	929 413			929 413

^a CO₂ emissions include indirect CO₂ emissions reported in CRF table 6.

Annex III

Additional information to support findings in table 2

Missing categories that may affect completeness

No mandatory categories of the 2006 IPCC Guidelines were identified as missing for Denmark mainland. The categories for which methods are included in the 2006 IPCC Guidelines that were reported as “NE” for Greenland or the Faroe Islands or for which the ERT otherwise determined that there may be an issue with the completeness of reporting in the Party’s inventory are as specified in ID# G.3 in table 6 as follows:

(a) For Greenland: HFC emissions (different species) from refrigeration and air conditioning (2.F.1), SF₆ emissions from electrical equipment (2.G.1), and CO₂, CH₄ and N₂O emissions and removals from forest land – drainage and rewetting (4. II);

(b) For the Faroe Islands: CO₂, CH₄ and N₂O emissions from missing subcategories under fuel combustion (1.A), CO₂ emissions from lubricant use (2.D.1) and paraffin wax use (2.D.2), HFC emissions (different species) from refrigeration and air conditioning (2.F.1), SF₆ emissions from electrical equipment (2.G.1), indirect N₂O emissions from manure management (3.B.5), CH₄ emissions from agricultural soils (3.D), CH₄ emissions from solid waste disposal (5.A), and CH₄ and N₂O emissions from wastewater treatment and discharge (5.D).

Annex IV

Documents and information used during the review

A. Reference documents

IPCC reports

IPCC. 2000. *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*. J Penman, D Kruger, I Galbally, et al. (eds.). Hayama, Japan: IPCC/Organisation for Economic Co-operation and Development/International Energy Agency/Institute for Global Environmental Strategies. Available at <http://www.ipccnggip.iges.or.jp/public/gp/english/>.

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

Annual review reports

Reports on the individual review of the 2013, 2014, 2015 and 2016 annual submissions of Denmark, respectively, contained in documents FCCC/ARR/2013/DNK, FCCC/ARR/2014/DNK, FCCC/ARR/2015/DNK and FCCC/ARR/2016/DNK.

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 Denmark for 2018. Available at https://unfccc.int/sites/default/files/resource/asr2018_DNK.pdf.

B. Additional information provided by the Party

Responses to questions during the review were received from Mr. Ole-Kenneth Nielsen (Department of Environmental Science, Aarhus University), including additional material on the methodology and assumptions used. The following documents¹ were also provided by Denmark:

Johannsen, V. K., Arndal, M. F., Riis-Nielsen, T., Thomsen, I. M., Suadicani, K., & Jørgensen, B. B. (2017). *Skove og plantager 2016: Forest statistics 2016*. Frederiksberg.

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