

Final Review Report

2018 annual review of national greenhouse gas inventory data

pursuant to Article 19(2) of Regulation (EU) No 525/2013

Estonia

30 June 2018



Contents

Conclusions from the 2018 annual ESD review	3
Step 1 conclusions	3
Step 2 conclusions	3
National totals	5
Greenhouse gas emissions covered by Decision 406/2009/EC.....	6
Statement from Estonia on the conclusions presented by the TERT	7
Revised estimates provided by Estonia and accepted by the TERT	8
Recommendations from the TERT including revised estimates and technical corrections	11
Annex I: Legal background and procedures of the 2018 annual ESD review	16
Annex II: Checks carried out during the 2018 annual ESD review in line with Art.29 and 32 of the Commission Implementing Regulation (EU) No 749/2014	18

List of tables

Table 1: Issues raised with Estonia during the first and the second step	4
Table 2: National totals	5
Table 3: Greenhouse gas emissions covered by Decision 406/2009/EC.....	6
Table 4: Recommendations from the TERT	11

Conclusions from the 2018 annual ESD review

This Final Review Report presents the findings from the 2018 annual review of the GHG emission inventory of Estonia, pursuant to Article 19(2) of Regulation (EU) No 525/2013, with a view to monitoring Estonia's achievement of its greenhouse gas emission reduction or limitation target pursuant to Article 3 of Decision No 406/2009/EC (the 'Effort Sharing Decision', ESD) in 2016.

The reviewers carried out checks to verify the transparency, accuracy, consistency, comparability and completeness of the national greenhouse gas inventory for the year 2016 submitted in 2018 by Estonia pursuant to Articles 7(1) and 7(3) of Regulation (EU) No 525/2013.

The review consisted of two steps:

1. The EU inventory team (European Environment Agency (EEA), European Topic Centre on Air Pollution and Climate Change Mitigation (ETC/ACM), Joint Research Centre (JRC) and Eurostat) performed the initial checks under Step 1.
2. A Technical Expert Review Team (TERT) performed Step 2 of the 2018 annual ESD review.

More information on the Effort Sharing Decision and the procedures for the 2018 annual ESD review is presented in the annexes to this review report.

Step 1 conclusions

The EU inventory team identified 1 significant issue through the checks performed in Step 1. Estonia volunteered to be subject to the second step of the 2018 annual ESD review and therefore the second step review checks went beyond the significant issue identified in the first step.

Step 2 conclusions

1. The TERT considered the significant issue from step 1 in the second step of the review 2018. The TERT also considered other observations from Step 1 and identified additional issues as part of the voluntary review. Altogether 31 issues were raised during the first and second steps (see Table 1). The TERT provided recommendations for 12 of these issues.
2. The TERT identified cases where inventory data were prepared in a manner, which is inconsistent with UNFCCC guidance documentation or Union rules. In particular, the TERT identified a number of underestimates or overestimates exceeding the threshold of significance pursuant to Article 31 of Commission Implementing Regulation (EU) No 749/2014.
3. Estonia provided 3 revised estimates. The TERT agreed with these revised estimates. Table 2 below summarises the revised estimates and further information is provided at the end of this report.
4. On that basis, the TERT did not deem necessary any technical corrections within the meaning of Article 19(3)(c) of Regulation (EU) No 525/2013 in consultation with Estonia.
5. The TERT identified non-binding recommendations in order to improve the national inventory data of Estonia (see Table 4).
6. The TERT considers that it received a response from Estonia that was sufficient in order to undertake the annual review appropriately.

Table 1: Issues raised with Estonia during the first and the second step

	Issues raised ¹	Recommendations	Revised estimates ²	Technical corrections ³
Total	31	12	3	-
Energy	10	4	-	-
IPPU	3	1	-	-
Agriculture	11	5	1	-
Waste	7	2	2	-
Cross-cutting	-	-	-	-

¹ Excluding findings related to Land use, land use change and forestry (LULUCF) and LULUCF KP.

² Revised estimates: changes in inventory estimates triggered by the review and provided by the Member State.

³ Technical corrections: changes in inventory estimates triggered by the review and provided by the TERT.

National totals

Table 2: National totals

Data / Source category	Reference	Emission estimates (kt CO ₂ equivalent) ¹ 2016
Total greenhouse gas emissions, including indirect CO ₂ , without land use, land-use change and forestry as reported by Estonia pursuant to Articles 7(1) and 7(3) of Regulation (EU) No 525/2013	EST_2017_3_Inventory_14032018	19 627.042
Difference between original estimates and revised estimates provided by Estonia and accepted by the TERT²		
5.A Solid waste disposal, CH ₄	EE-5A-2018-0002	57.498
5.E Other (waste), CH ₄	EE-5E-2018-0001	-20.868
3.D.1 Direct N ₂ O emissions from managed soils, N ₂ O	EE-3D1-2018-0002	3.624
Total greenhouse gas emissions including accepted revised estimates provided by Estonia		19 667.296
CO ₂ emissions from 1.A.3.a Domestic aviation	EST_2017_3_Inventory_14032018	1.399
NF ₃ emissions	EST_2017_3_Inventory_14032018	-

¹ The tables presented in this report show numbers rounded to three decimal places, although most numbers are available with greater precision. For all calculations (in particular of total GHG emissions and total ESD emissions), all available decimal places were used. Therefore, the totals shown may slightly differ from calculation results where only three decimals would be taken into account.

² A positive difference indicates an increase compared to reported emissions. A negative difference indicates a decrease compared to reported emissions.

Greenhouse gas emissions covered by Decision 406/2009/EC

Table 3: Greenhouse gas emissions covered by Decision 406/2009/EC

Data	Reference	Emissions (kt CO ₂ equivalent) ¹ 2016
Total greenhouse gas emissions including accepted revised estimates provided by Estonia	<i>See Table 2 above</i>	19 667.296
Total verified emissions from stationary installations under Directive 2003/87/EC	Extracted by the European Commission from EUTL on 8 March 2018 (as agreed at the Working Group I of the Climate Change Committee on 18 May 2015) ²	13 447.851
CO ₂ emissions from 1.A.3.a Domestic aviation	<i>See Table 2 above</i>	1.399
NF ₃ emissions	<i>See Table 2 above</i>	-
Total ESD emissions		6 218.046

¹ The tables presented in this report show numbers rounded to three decimal places, although most numbers are available with greater precision. For all calculations (in particular of total GHG emissions and total ESD emissions), all available decimal places were used. Therefore, the totals shown may slightly differ from calculation results where only three decimals would be taken into account.

² The emissions of ETS stationary installations were independently verified and recorded in the EU Transaction Log (EUTL). These emissions do not derive from the national greenhouse gas emission inventory data and therefore the TERT was not tasked to review them.

Statement from Estonia on the conclusions presented by the TERT

Estonia agrees with the aggregated GHG emission inventory estimates presented in Table 3.

Revised estimates provided by Estonia and accepted by the TERT

1	ESD Review Tool ID:	EE-3D1-2018-0002
	ESD Review Tool URL:	https://emrt-esd.eionet.europa.eu/2018/EE-3D1-2018-0002
	Member State:	Estonia
	Sector:	3.D Direct and indirect N ₂ O emissions from managed soils
	Gases:	N ₂ O
	Fuel	n/a
	Completed by Sector Expert:	Etienne Mathias
	Reviewed by Counterpart:	Katalin Lovas
	Reviewed by Lead Reviewer:	Suvi Monni
	Reviewed by Quality Controller:	Justin Goodwin
The underlying problem:	The methodology for data collection of synthetic fertilizer use by the Statistics Estonia has changed between 2014 and 2015. The change of method has caused a gap between the former method for inorganic fertilizer use in 1990-2014 and the most recent years 2015-2016. To avoid a strong discrepancy in the times series, Estonia chose to report the data for 2014 for the 2 following years (2015-2016).	
The rationale for the corrected estimate:	The TERT considered that it would be more appropriate to extrapolate the trend of the years 2009-2014 to fill in the gaps of 2015 and 2016 or to provide another method (proxy) to estimate fertilizer consumption for most recent years. A revised estimate was calculated by Estonia based on revised data on synthetic fertilizer use in Estonia published by Statistics Estonia.	
Summarise the methodology used:	Estonia provided a revised estimate for direct and indirect N ₂ O based on updated activity data. The methodology applied to calculate emissions is similar to the methodology applied in previous years.	
References to other workbooks:		

2	Details of the corrected estimate								
			Original estimate (Gg CO₂eq)						Notes
		Year	CO ₂	CH ₄	N ₂ O	HFCs	PFCs	SF ₆	
	EE-3D1-2018-0002- OE	2016			674.277				
	Was a Revised Estimate received from the MS?		yes						
			Revised Estimate received from MS (Gg CO₂eq)						Notes
		Year	CO ₂	CH ₄	N ₂ O	HFCs	PFCs	SF ₆	
	EE-3D1-2018-0002-RE	2016			677.900				
	Was the Revised Estimate accepted by the TERT?		yes						
			Technical Correction calculated by TERT (Gg CO₂e)						Notes
	Year	CO ₂	CH ₄	N ₂ O	HFCs	PFCs	SF ₆		
EE-3D1-2018-0002-TC	2016								
Was the Technical Correction accepted by the MS?									

ESD Review Tool ID:	EE-5A-2018-0002
ESD Review Tool URL:	https://emrt-esd.eionet.europa.eu/2018/EE-5A-2018-0002
Member State:	Estonia
Sector:	5.A Solid waste disposal
Gases:	CH ₄
Fuel	
Completed by Sector Expert:	Hans Oonk
Reviewed by Counterpart:	Juraj Farkas
Reviewed by Lead Reviewer:	Suvi Monni
Reviewed by Quality Controller:	Justin Goodwin
1 The underlying problem:	The TERT noted from the NIR that the Väätsa landfill is reported to flare exactly the same amount of landfill gas each year in 2009 to 2016. The TERT considered this as highly unlikely. In response to questions raised during the review, Estonia explained that the Väätsa landfill operator had reported data on amount of gas flared, based on the maximum flaring capacity and the calculated working hours of the burner set in the permit. Therefore, the flared amount of landfill gas had been overestimated and CH ₄ emissions from landfills underestimated.
The rationale for the corrected estimate:	Estonia obtained the actual flared amount of landfill gas from Väätsa landfill operator and used that to replace the previously used values.
Summarise the methodology used:	The amount of CH ₄ generated at landfills was the same as in the original estimate. Estonia revised the amount of CH ₄ flared at Väätsa as explained above. Landfill gas recovery in other landfills was kept unchanged in terms of m ³ flared. However, Estonia noted that in the original estimate they had assumed that companies report amount of landfill gas utilised and flared, normalised at 0°C, assuming a density of methane of 0.717 kg/Nm ³ . In the revised estimate Estonia corrected this to 20°C, assuming a methane density of 0.67 kg Nm ³ . The latter correction resulted in a 6% decrease of the amount of methane assumed to be utilised and flared.
References to other workbooks:	

Details of the corrected estimate								
		Original estimate (Gg CO ₂ eq)						Notes
	Year	CO ₂	CH ₄	N ₂ O	HFCs	PFCs	SF ₆	
	EE-5A-2018-0002- OE	2016		160.777				
Was a Revised Estimate received from the MS?		yes						
		Revised Estimate received from MS (Gg CO ₂ eq)						Notes
	Year	CO ₂	CH ₄	N ₂ O	HFCs	PFCs	SF ₆	
	EE-5A-2018-0002-RE	2016		218.275				
Was the Revised Estimate accepted by the TERT?		yes						
		Technical Correction calculated by TERT (Gg CO ₂ e)						Notes
	Year	CO ₂	CH ₄	N ₂ O	HFCs	PFCs	SF ₆	
	EE-5A-2018-0002-TC	2016						
Was the Technical Correction accepted by the MS?								

1	ESD Review Tool ID:	EE-5E-2018-0001							
	ESD Review Tool URL:	https://emrt-esd.eionet.europa.eu/2018/EE-5E-2018-0001							
	Member State:	Estonia							
	Sector:	5.E Other (waste)							
	Gases:	CH ₄							
	Fuel								
	Completed by Sector Expert:	Hans Oonk							
	Reviewed by Counterpart:	Juraj Farkas							
	Reviewed by Lead Reviewer:	Suvi Monni							
	Reviewed by Quality Controller:	Justin Goodwin							
	The underlying problem:	Estonia calculated emissions from landfill gas flares, based on the results of emission measurements. However, the conclusions of the emission measurements seemed unlikely to the TERT. In response to questions raised during the review, Estonia reviewed the emission measurements and the estimate of methane destruction in their flares.							
	The rationale for the corrected estimate:	A need to revise the estimated flare efficiencies used to calculate CH ₄ emissions from flares was identified. In addition, the flared amount from Väätsa landfill were noted to be overestimated and were revised (see EE-5A-2018-0002).							
	Summarise the methodology used:	The flare efficiency at both Väätsa and Paikre were readjusted to 91% (based on measurements at these flares). For the other projects, the default flare efficiency in the 2006 IPCC Guidelines of 98% was used (see footnote e of the 2006 IPCC Guidelines, Volume 2, table 4.2.5). In addition, the amount of methane flared at Väätsa was revised (see EE-5A-2018-0002), in other words the AD in 5.E were revised in order to make 5.A and 5.E consistent and avoid double-counting. Based on this information, Estonia provided a revised estimate. Emissions are calculated as AD*EF. EF are based on emissions measurements and estimates of flare efficiencies.							
	References to other workbooks:								
	2	Details of the corrected estimate							
			Original estimate (Gg CO₂eq)						Notes
		Year	CO ₂	CH ₄	N ₂ O	HFCs	PFCs	SF ₆	
EE-5E-2018-0001- OE		2016		21.142					
Was a Revised Estimate received from the MS?		yes							
			Revised Estimate received from MS (Gg CO₂eq)						Notes
		Year	CO ₂	CH ₄	N ₂ O	HFCs	PFCs	SF ₆	
EE-5E-2018-0001-RE		2016		0.274					
Was the Revised Estimate accepted by the TERT?		yes							
			Technical Correction calculated by TERT (Gg CO₂e)						Notes
	Year	CO ₂	CH ₄	N ₂ O	HFCs	PFCs	SF ₆		
EE-2018-5E-0001-TC	2016								
Was the Technical Correction accepted by the MS?									

Recommendations from the TERT including revised estimates and technical corrections

Table 4: Recommendations from the TERT

EMRT - ID	Key category	Category, gas, year	Conclusion step 2 note	Revised estimate	Technical correction
EE-3D1-2018-0002	Yes	3.D Direct and indirect N ₂ O emissions from managed soils, N ₂ O, 2015-2016	For category 3.D.a.1 Inorganic N fertilizers and N ₂ O for 2016 the TERT noted that activity data and emissions were the same as those reported for 2015 and 2014. The TERT noted that this issue also had an impact on indirect N ₂ O emissions from managed soils (3.D.b). In response to a potential technical correction prepared by the TERT, Estonia provided revised estimates for the direct and indirect N ₂ O emissions from the use of synthetic fertilizers in 2015 and 2016. The new estimates were based on revised 2015 and 2016 data of the amounts of synthetic fertilizers used in Estonia published by Statistics Estonia. This revised data had been harmonized with the historic synthetic fertilizers data of Statistics Estonia. Estonia also explained that the same data are delivered to Eurostat. The TERT agreed with the revised estimate provided by Estonia and included in the review report. The TERT recommends that Estonia include this revised estimate in its next submission and provide in the NIR an explanation on how the revised AD was compiled by Statistics Estonia to obtain a consistent time-series.	Yes	No
EE-5A-2018-0002	Yes	5.A Solid waste disposal, CH ₄ , 2016	<p>For category 5.A Solid waste disposal, CH₄ and the years 2009-2016 the TERT noted that according to the NIR the Väätsa landfill flares exactly the same amount of landfill gas each year, which the TERT considered unlikely. In response to questions raised during the review, Estonia explained that data on amount of gas flared were retrieved from the information system for ambient air pollution, OSIS, supervised by the Estonian Environmental Board. The Väätsa landfill however had reported the flare capacity, rather than the amount that is actually flared. Estonia revised the amount of methane flared, based on the actual amount flared at Väätsa and provided a revised estimate. The TERT agreed with the revised estimate provided by Estonia and included in the review report. The TERT recommends that Estonia include the revised estimate in its next submission.</p> <p>The 2006 IPCC Guidelines (Volume 1, Chapter 6, page 6.8) describe that inventory compilers may designate QA/QC responsibilities to other agencies or organisations. The inventory compiler however should ensure that the other agency or organisation is following applicable QA/QC procedures. The TERT recommends that Estonia improve its QA/QC procedures on amount of methane flared, for example by discussing the specific IPCC quality criteria for flared landfill gas with the supervisors of OSIS and integrating IPCC quality criteria in OSIS QA/QC system. Such criteria could include, for example, that the amount of methane flared is actually measured, and that significant variations from year to year are identified and explained.</p>	Yes	No

EMRT - ID	Key category	Category, gas, year	Conclusion step 2 note	Revised estimate	Technical correction
EE-5E-2018-0001	No	5.E Other (waste), CH ₄ , 2016	For category 5.E Other (waste), CH ₄ for the year 2016 the TERT noted that the flare efficiencies used to estimate methane from landfill gas flares are very low. In response to a question raised during the review, Estonia provided detailed measurement information for the flares and calculated improved flare efficiencies. In addition, Estonia revised the activity data of amount of methane flared under observation EE-5A-2018-0002. Estonia provided a revised estimate for the year 2016 based on the revised flare efficiencies and amount of methane flared. Based on the information provided, the TERT concludes that flare efficiencies at the Paikre landfill might be higher than Estonia assumed. The TERT also notes that the measurement information would allow a revision of N ₂ O emission estimates. However, the impact of the latter two issues do not result in a change in estimated emissions which would exceed the threshold of significance (compared to the revised estimate). The TERT therefore agreed with the revised estimate provided by Estonia and included in the review report. The TERT recommends that Estonia include the revised estimate in its next submission. The TERT also recommends that Estonia explore possibilities to improve the N ₂ O emission estimates from flares and estimated flare efficiency at Paikre landfill, building on the questions and answers between TERT and Estonia during the review.	Yes	No
EE-1A1a-2018-0003	Yes	1.A.1.a Public electricity and heat production, CO ₂ , 2016	For category 1.A.1.a Public electricity and heat production, other fuels, CO ₂ , 2013-2016, the TERT noted that carbon content of non-biomass fraction of waste is 16.15 t C/TJ (plant-specific value) which is low compared to the 2006 IPCC Guidelines default value of 25 t C/TJ (Volume 2 – Chapter 1 – table 1.3) and out of the range of the 2006 IPCC Guidelines default values in the same table (20-33 t C/TJ). In response to a question raised during the review, Estonia provided information from a study by Stockholm Environmental Institute and Tallinn University of Technology that presents the mean composition of mixed solid waste incinerated in the Iru power plant and the mean CO ₂ emissions for household waste and other imported waste that are incinerated in the plant. The TERT agreed that this information justifies the reported value for the carbon content of non-biomass fraction of waste. The TERT notes that this issue does not relate to an over- or underestimate and recommends that Estonia add information provided during the review in its NIR in order to justify the value used and the deviation from the range of the IPCC default values.	No	No
EE-1A3b-2018-0001	Yes	1.A Fuel combustion, CO ₂ , CH ₄ , N ₂ O 2016	For category 1.A Fuel combustion, LPG, all gases, especially years 2015 and 2016, the TERT noted from the energy balance that the supply of LPG has risen continuously and significantly since 2013 (+20% for 2013/2014; +35% for 2014/2015; +52% for 2015/2016). The TERT also noted that the allocation of the LPG consumption in the sub-sectors shows significant inter-annual variations (e.g. +544% between 2014 and 2015 in agriculture; +2863% between 2015 and 2016 in road transport). In response to questions raised during the review, Estonia explained that Statistics Estonia is now aware of these inconsistencies but since the LPG quantities represent a small percentage of the national mix of fuels, QC procedures have not been performed as thoroughly as for other fuels and the deviation has not	No	No

EMRT - ID	Key category	Category, gas, year	Conclusion step 2 note	Revised estimate	Technical correction
			been detected in the sub-sectors. However, Estonia is confident that the data on total national imports and exports of LPG are accurate because Statistics Estonia use data coming from the Tax and Customs Board. Estonia explained also that time is needed to review the data and that Statistics Estonia will strive to fix this issue for the next submission. The TERT noted that this issue is mainly an allocation issue and that any changes in the emissions would be relevant for CH ₄ and N ₂ O and below the threshold of significance. Thus, the TERT recommends that Estonia explore the reasons behind the rise in LPG consumption and consider starting a study to refine the fuel allocation among sub-sectors in order to ensure consistency of the time series.		
EE-1A3e-2018-0001	No	1.A.3.e Other transportation, CO ₂ , CH ₄ , N ₂ O, 1990-2016	The TERT notes, with reference to CRF table 1.A(a)s3, that emissions from category 1.A.3.e.i Pipeline transport are reported as 'NO' (not occurring). However, in the NIR page 119, Estonia indicates that natural gas is distributed to customers through gas pipelines, distribution stations and gas pressure reducing stations. In response to a question raised during the review, Estonia confirmed that small amounts of combustion related emissions from natural gas pipeline transport are included under category 1.A.1 Energy industries. The TERT notes that this issue does not relate to an over or underestimate and recommends that Estonia report 'IE' instead of 'NO' in the CRF tables for category 1.A.3.e.i and add the above explanation in the relevant section of its NIR.	No	No
EE-1A4-2018-0001	Yes	1.A.4 Other sectors (fuel combustion activities), CH ₄ , 1990-2016	For category 1.A.4.b Residential, CH ₄ , biomass, all years, the TERT noted that the EF used is the default value from the 2006 IPCC Guidelines (300 kg/TJ) and that according to CRF table 7, CH ₄ emissions for 1.A.4 Other sectors (fuel combustion activities) are a key category in level and trend. As presented in the 2006 IPCC Guidelines (volume 2, chapter 2, figure 2.1), it is good practice to move to a Tier 2 approach (country-specific EF) when a category is key. In response to a question raised during the review, Estonia explained that detailed data on equipment used in the sector (e.g. type of combustion technologies, number of equipment, CH ₄ EF per technology) needed to improve CH ₄ EF in 1.A.4.b Residential sector are currently not available. Due to lack of disaggregated AD and national emission factors, the TERT is unable to determine whether the issue relates to an over or underestimate above the threshold of significance and considers that the current estimate in Estonia's inventory is the most accurate one that can be obtained with currently available information. Noting that this is a key category, the TERT recommends that Estonia include the collection of more detailed AD on technologies used as well as development of country-specific emission factors in its inventory improvement plan.	No	No
EE-2F1-2018-0002	Yes	2.F.1 Refrigeration and air	For category 2.F.1 Refrigeration and air conditioning and HFCs for year 2016 the TERT noted that the NIR does not provide information on assumptions or data for other, low-GWP refrigerants in the respective subcategory. In response to a question raised during the review, Estonia explained that the process of switching to the alternative refrigerants is ongoing, however details about these developments are based on expert judgement. The TERT recommends that Estonia include	No	No

EMRT - ID	Key category	Category, gas, year	Conclusion step 2 note	Revised estimate	Technical correction
		conditioning, HFCs, 2016	information, assumptions or data on the use of other, low-GWP refrigerants in the next submission. The TERT noted that this issue does not relate to an under- or overestimate of emissions.		
EE-3A-2018-0001	Yes	3.A Enteric fermentation, CH ₄ , 1990-2016	For category 3.A Enteric fermentation and CH ₄ for all years, the TERT noted that the split of calves into two categories (0-6 months and 6-12 months) with a 50:50 ratio could lead to a bias in emissions due to the difference of emission factors between these two subcategories. In response to a question raised during the review, Estonia explained that it is aware of this issue but indicated that statistical data is not available at the required level to improve the estimates. During the review, the TERT proposed a temporary alternative way to calculate a new split (60:40) based on statistical data and using assumptions on lifetimes for calves. The TERT notes that this alternative does not remove the need for the collection of improved data but that it could be a more realistic temporary split than the 50:50 ratio assumed in the inventory. An Excel file with these elements was sent to Estonia to help them further investigate this issue. The TERT noted that revision of the assumption as suggested by TERT would lead to changes below the threshold of significance for a technical correction. The TERT recommends that Estonia further explore additional data and the development of a more accurate split between the two categories of calves and implement a revised methodology in its next submissions.	No	No
EE-3A-2018-0003	Yes	3.A Enteric fermentation, CH ₄ , 1990-2016	For category 3.A Enteric fermentation and CH ₄ for all years, the TERT noted from the NIR that the calculation of gross energy (GE) for pigs is based on two equations where ME is metabolised energy and DE is digestible energy: $GE = ME/DE$ (equation 5.13) and $ME = 2 \cdot w^{0.63}$ (equation 5.14), which means that ME was supposed to be digestible energy but it was not precisely defined. In response to a question raised during the review, Estonia explained that ME corresponds to metabolisable energy. The TERT noted that metabolisable energy is different from digestible energy which means that there is a small bias in the methodology. The difference between digestible energy and metabolisable energy corresponds to the energy content of urine and CH ₄ emitted by enteric fermentation. To sum up, Gross energy > Digestible energy > Metabolisable energy > Net energy. Considering this, the emissions could be underestimated. However, there are deficiencies also in the methane conversion factor. By using 2006 IPCC Guidelines default values, urinary energy = 2% of GE and CH ₄ energy = 0.6% of GE, and calculating $GE = ME/(DE - 2.6\%)$, the change would lead to an increase of emissions between 3% and 3.5% for swine. The TERT noted that the issue would lead to changes below the threshold of significance for a technical correction. The TERT recommends that Estonia take into account this correction in its next submissions.	No	No
EE-3D1-2018-0003	Yes	3.D.1 Direct N ₂ O emissions from managed	For category 3.D.2.a Animal manure applied to soils and N ₂ O for all years, the TERT noted that the activity data (nitrogen input) is not equal to nitrogen excreted minus leaching and volatilisation as should be the case according to the methodology used by Estonia. In response to a question raised during the review, Estonia explained that there was an error in its calculations and that the emissions	No	No

EMRT - ID	Key category	Category, gas, year	Conclusion step 2 note	Revised estimate	Technical correction
		soils, N ₂ O, 1990-2016	were slightly underestimated. Estonia provided an estimate of the underestimation for 2016 (1.9 kt CO ₂ eq) and stated that the error will be corrected in the next submission. In addition, the TERT noted that Estonia's calculation of the N in manure applied to soils does not take into consideration N lost as N ₂ and N ₂ O during manure management. The TERT therefore recommends that Estonia, in addition to correcting the identified error, revise its estimate by subtracting all relevant N losses when applying the 2006 IPCC Guidelines methodology (Equation 10.34) to calculate N in manure applied to soils. The TERT recommends that Estonia include this corrected estimate in its next submission. The TERT noted that the issue is below the threshold of significance for technical correction. The TERT further notes that Estonia could consider the application of EMEP/EEA Guidebook to estimate N ₂ emissions, in particular estimation of TAN (total ammonia nitrogen) after housing.		
EE-3D1-2018-0004	Yes	3.D.1 Direct N ₂ O emissions from managed soils, N ₂ O, 1990-2016	During the review, the TERT noted that the calculation for category 3.D.a.6 Cultivation of histosols, N ₂ O and all years, excludes organic soils for grassland that are only managed to a limited extent although these areas are included in CRF table 4.C. The TERT agrees with Estonia's assumption that these do not classify as managed/drained organic soils as referred to in the 2006 IPCC Guidelines and therefore these areas are not included in the estimation under category 3.D.a.6. The TERT recommends that Estonia clarify the above in its next NIR.	No	No

Annex I: Legal background and procedures of the 2018 annual ESD review

The Effort Sharing Decision No 406/2009/EC (ESD) sets national emission limits for greenhouse gas (GHG) emissions in the sectors outside the EU's Emission Trading System (ETS) for the period 2013-2020. The ESD and the Monitoring Mechanism Regulation (EU) 525/2013 (MMR) lay down annual reporting obligations, compliance checks and a Union review process to ensure that the compliance with annual GHG emission limits is assessed in a credible, consistent, transparent and timely manner. The requirements for the Union review of the national inventory data submitted by Member States are set out in Article 19 of the MMR.

The details concerning the review process, such as the timing and steps of conducting the annual and comprehensive reviews are set out in Chapter III and Annex XVI of the Commission Implementing regulations (EU) No 749/2014.

The objectives of the 2018 annual ESD review of Member States' GHG emission inventories are:

- a) to support the European Commission by ensuring it has accurate, reliable and verified information on annual GHG emissions for determining compliance with ESD targets for the year 2016 in a credible, consistent, transparent and timely manner, according to Article 19 (2) of the MMR;
- b) to assist Member States in improving the quality of their GHG inventories.

The 2018 annual ESD review of national greenhouse gas (GHG) inventory data was carried out for the compliance year 2016 pursuant to Article 19 of the MMR. The EEA review secretariat (consisting of Melanie Sporer, Claire Qoul and Emma Salisbury) coordinated the 2018 annual ESD review as foreseen in Article 28 of the Commission Implementing Regulation (EU) No 749/2014.

The scope of the 2018 annual ESD review is presented in Table A.1.1. The checks carried out during the 2018 annual ESD review are presented in Annex I.

The review consisted of 2 steps. Step 1 was combined with the 'EU QA/QC procedures' (i.e. initial checks) and was carried out by the EU inventory team (EEA, ETC/ACM, JRC, Eurostat). All findings from the initial checks that were relevant for the ESD and that were not resolved within the initial check phase were followed up in the second step of the annual review.

Step 2 of the 2018 annual ESD review was performed by a Technical Expert Review Team (TERT) under service contract 340201/2017/765292/SER/CLIMA.C2 of the Directorate General for Climate Action of the European Commission. The TERT consisted of the following experts:

- Lead Reviewers: Suvi Monni, Klaus Radunsky
- Energy: Laetitia Nicco, Graham Anderson, Ioannis Sempas
- IPPU: Kristina Kaar, Eva Krtkova
- Agriculture: Etienne Mathias, Katalin Lovas
- Waste: Hans Oonk, Juraj Farkas
- Quality controller: Justin Goodwin
- Co-ordinator: Bernd Gugele

The lead reviewers and sector review experts did not review emission inventories of Member States where these individuals have themselves contributed to the compilation of that inventory, or presently are or have been any part of the decision-making process related to the compilation of that inventory. Reviewers who are nationals of the Member State whose inventory is concerned, did not take part in the review of that inventory.

Step 2 of the review was performed on the basis of GHG emission data and the national inventory report (NIR) officially reported by Member States by 15 March 2018 under the MMR. Where relevant, the TERT calculated technical corrections for over- or underestimates identified in a mandatory category in the

Member States' GHG inventories that exceed the threshold of significance. Technical corrections were calculated for the year 2016.

Table A.1.1: Scope of the 2018 annual ESD review

Element	Scope	Further information
Member States	EU geographical coverage of the Member States	
Years	2016	
Gases	CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs, SF ₆	NF ₃ is not covered by the ESD
Sectors	All emission source sectors excluding LULUCF	National totals exclude emissions from LULUCF and emissions reported under memo items
Indirect CO ₂ emissions	Included in national total	
Inventory Submission	Submissions received by 15 March 2018	

Annex II: Checks carried out during the 2018 annual ESD review in line with Art.29 and 32 of the Commission Implementing Regulation (EU) No 749/2014

As part of the EU's effort to assist Member States in improving the quality of the GHG inventories, the checks to verify the transparency, consistency, comparability and completeness of the greenhouse gas inventory included:

First step review checks:

1. Assessment whether all emission source categories and gases required under Regulation (EU) No 525/2013 are reported;
2. Assessment whether emissions data time series are consistent;
3. Assessment whether implied emission factors across Member States are comparable taking the IPCC default emission factors for different national circumstances into account;
4. Assessment of the use of 'Not Estimated' notation keys where IPCC tier 1 methodologies exist and where the use of the notation key is not justified in accordance with paragraph 37 of the UNFCCC reporting guidelines on annual greenhouse gas inventories as included in Annex I to Decision 24/CP.19;
5. Analysis of recalculations performed for the inventory submission, in particular if the recalculations are based on methodological changes;
6. Comparison of the verified emissions reported under the Union's Emissions Trading System with the greenhouse gas emissions reported pursuant to Article 7 of Regulation (EU) No 525/2013 with a view of identifying areas where the emission data and trends as submitted by the Member State under review deviate considerably from those of other Member States;
7. Comparison of the results of Eurostat's reference approach with the Member States' reference approach;
8. Comparison of the results of Eurostat's sectoral approach with the Member States' sectoral approach;
9. Assessment whether recommendations from earlier Union or UNFCCC reviews, not implemented by the Member State could lead to a technical correction;
10. Assessment whether there are potential overestimations or underestimations relating to a key category in a Member State's inventory.

Second step review checks:

1. Detailed examination of the inventory estimates including methodologies used by the Member State in the preparation of inventories;
2. Detailed analysis of the Member State's implementation of recommendations related to improving inventory estimates as listed in its most recent UNFCCC annual review report made available to that Member State before the submission under review or in the final review report pursuant to Article 35(2) of this Regulation; where recommendations have not been implemented a detailed analysis of the justification provided by the Member State for not implementing them;
3. Detailed assessment of the time series consistency of the greenhouse gas emissions estimates;
4. Detailed assessment whether the recalculations made by a Member State in the given inventory submission as compared to the previous one are transparently reported and made in accordance with the 2006 IPCC Guidelines for National Greenhouse Gas Inventories;
5. Follow-up on the results of the checks referred to in Article 29 of the Commission Implementing Regulation (EU) No 749/2014 and on any additional information submitted by the Member State under review in response to questions from the technical experts review team and other relevant checks.