

# Final Review Report

## 2020 Comprehensive Review of National Greenhouse Gas Inventory Data

pursuant to Article 4(3) of Regulation (EU) No 2018/842 and to  
Article 3 of Decision No 406/2009/EC

### Croatia

30 August 2020

European Environment Agency



Reference: 340201/2019/814628/SER/CLIMA.C.2

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## Conclusions from the 2020 comprehensive review

This Final Review Report presents the findings from the 2020 review of the greenhouse gas (GHG) emission inventory of Croatia, pursuant to:

- Article 4(3) of Regulation (EU) No 2018/842 (the 'Effort Sharing Regulation', ESR), for the purpose of setting out Croatia's annual emission allocations (AEAs) for the years from 2021 to 2030 in terms of tonnes of CO<sub>2</sub> equivalent, and
- Article 3 of Decision No 406/2009/EC (the 'Effort Sharing Decision', ESD), for the purpose of verifying Croatia's GHG emissions and achievement of its GHG emission limitation target in the year 2018

The review was carried out as a comprehensive review in line with Article 19(1) of Regulation (EU) No 525/2013 (the 'Monitoring Mechanism Regulation', MMR). The global warming potentials applied are those from the IPCC Assessment Report 4.

The reviewers carried out checks to verify the transparency, accuracy, consistency, comparability and completeness of the national GHG inventory for the years 2005, 2016, 2017 and 2018 submitted in 2020 by Croatia pursuant to Article 7 of the MMR.

The review consisted of two steps. The initial checks in step 1 were performed by the EU inventory team (European Environment Agency (EEA), European Topic Centre on Climate Change Mitigation and Energy (ETC/CME), Joint Research Centre (JRC) and Eurostat). Step 2 was performed by a Technical Expert Review Team (TERT).

More information on the Effort Sharing legislation and the procedures for the 2020 comprehensive review is presented in the annexes of this review report.

Croatia did not provide a resubmission to the Commission.

### Step 1 and 2 conclusions

1. The reviewers raised 70 issues with Croatia during the first and the second step of the 2020 comprehensive ESD review (see Table 1). The TERT provided recommendations for 12 of these issues. Other issues raised during the comprehensive review were clarified and are considered non-issues for the ESD review 2020.
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 under- or over-estimates exceeding the threshold of significance pursuant to Article 31 of Commission Implementing Regulation (EU) No 749/2014.
3. Croatia provided 4 revised estimates that were accepted by the TERT. Table 2 and Table 3 below summarise the revised estimates and further information is provided in the respective chapter of this report.
4. The TERT also deemed necessary 4 technical corrections in the meaning of Article 19(3)(c) of Regulation (EU) No 525/2013 and calculated such technical corrections taking into account the consultation with Croatia on these issues. The technical corrections are presented in Table 2 and Table 3 of the present review report and are accompanied by evidence-based justification. In its response to the draft technical corrections, Croatia stated that it agrees with the technical corrections.
5. The TERT identified non-binding recommendations in order to improve the national inventory data of Croatia (see Table 6).

6. The TERT considers that it received a response from Croatia that was sufficient in order to undertake the comprehensive review appropriately.

**Table 1: Overview of issues raised with Croatia during the first and the second step**

	Issues raised step 1 <sup>1</sup>	Issues raised step 2	Recommendations	Revised estimates <sup>2</sup>	Technical corrections <sup>3</sup>
<b>Total</b>	<b>49</b>	<b>21</b>	<b>12</b>	<b>4</b>	<b>4</b>
Energy	10	11	4	2	-
IPPU	20	3	2	1	1
Agriculture	17	3	4	-	2
Waste	2	4	2	1	1
Cross-cutting	-	-	-	-	-

<sup>1</sup> Excluding findings related to Land Use, Land Use Change and Forestry (LULUCF) and Kyoto Protocol (KP) LULUCF.

<sup>2</sup> Revised estimates: changes in inventory estimates triggered by the review, which were provided by the country and accepted by the TERT.

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

## National totals for the purpose of Article 3 of Decision No 406/2009/EC (ESD)

**Table 2: National totals for the purpose of Article 3 of Decision No 406/2009/EC**

Emission source category	Reference	Emission estimates (kt CO <sub>2</sub> equivalent) <sup>1</sup> 2018
Total greenhouse gas emissions, including indirect CO <sub>2</sub> , without Land Use, Land Use Change and Forestry, without international aviation, as reported by Croatia pursuant to Article 7(4) of Regulation (EU) No 525/2013, taking into account any resubmission to the Commission	HRV_2020_1_16042020	23 792.796
<b>Difference between original estimates and revised estimates provided by Croatia and accepted by the TERT<sup>2</sup></b>		
1A3b Road Transportation, CH <sub>4</sub>	HR-1A3b-2020-0002	-16.075
1B2b Fugitive Emissions from Natural Gas, CO <sub>2</sub> , CH <sub>4</sub>	HR-1B2b-2020-0001	-17.162
5A Solid Waste Disposal, CH <sub>4</sub>	HR-5A-2020-0001	-348.400
<b>Difference between original estimates and technical corrections deemed necessary by the TERT<sup>2</sup></b>		
2F1 Refrigeration and Air Conditioning, HFCs	HR-2F-2020-0002	52.965
3A Enteric Fermentation, CH <sub>4</sub>	HR-3-2020-0001	5.365
3 Agriculture, CH <sub>4</sub> , N <sub>2</sub> O	HR-3-2020-0004	-41.440
5D Wastewater Treatment and Discharge, CH <sub>4</sub>	HR-5D-2020-0002	267.482
<b>Total greenhouse gas emissions including revised estimates and technical corrections</b>		<b>23 695.531</b>
CO <sub>2</sub> emissions from 1A3a Domestic Aviation <sup>3</sup>	HRV_2020_1_16042020	31.737
NF <sub>3</sub> emissions <sup>3</sup>	HRV_2020_1_16042020	-

<sup>1</sup> 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 are taken into account.

<sup>2</sup> A positive difference indicates an increase compared to reported emissions. A negative difference indicates a decrease compared to reported emissions.

<sup>3</sup> Included in the totals. NF<sub>3</sub> was included in the comprehensive review (see Table A-1) for the purpose of the ESR, but has to be deducted for the purpose of ESD.

## National totals for the purpose of Article 4(3) of Regulation (EU) No 2018/842 (ESR)

**Table 3: National totals for the purpose of Article 4(3) of Regulation (EU) No 2018/842**

Emission source category	Reference	Emission estimates (kt CO <sub>2</sub> equivalent) <sup>1</sup>			
		2005	2016	2017	2018
Total greenhouse gas emissions, including indirect CO <sub>2</sub> , without Land Use, Land Use Change and Forestry, without international aviation, as reported by Croatia pursuant to Article 7(4) of Regulation (EU) No 525/2013, taking into account any resubmission to the Commission	HRV_2020_1_16042020	29 920.381	24 275.345	25 032.082	23 792.796
<b>Difference between original estimates and revised estimates provided by Croatia and accepted by the TERT<sup>2</sup></b>					
1A3b Road Transportation, CH <sub>4</sub>	HR-1A3b-2020-0002	-0.472	-17.343	-17.191	-16.075
1B2b Fugitive Emissions from Natural Gas, CO <sub>2</sub> , CH <sub>4</sub>	HR-1B2b-2020-0001	-31.858	-22.982	-20.698	-17.162
2A2 Lime Production, CO <sub>2</sub>	HR-2A2-2020-0002	40.620	-	-	-
5A Solid Waste Disposal, CH <sub>4</sub>	HR-5A-2020-0001	-192.832	-331.005	-344.280	-348.400
<b>Difference between original estimates and technical corrections deemed necessary by the TERT<sup>2</sup></b>					
2F1 Refrigeration and Air Conditioning, HFCs	HR-2F-2020-0002	0.941	51.200	52.274	52.965
3A Enteric Fermentation, CH <sub>4</sub>	HR-3-2020-0001	16.652	48.589	9.085	5.365
3 Agriculture, CH <sub>4</sub> , N <sub>2</sub> O	HR-3-2020-0004	-69.607	-41.452	-41.072	-41.440
5D Wastewater Treatment and Discharge, CH <sub>4</sub>	HR-5D-2020-0002	141.956	198.691	232.610	267.482
<b>Total greenhouse gas emissions including revised estimates and technical corrections</b>		<b>29 825.780</b>	<b>24 161.043</b>	<b>24 902.811</b>	<b>23 695.531</b>
CO <sub>2</sub> emissions from 1A3a Domestic Aviation <sup>3</sup>	HRV_2020_1_16042020	37.696	31.108	31.423	31.737

<sup>1</sup> 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 ESR emissions), all available decimal places were used. Therefore, the totals shown may slightly differ from calculation results where only three decimals are taken into account.

<sup>2</sup> A positive difference indicates an increase compared to reported emissions. A negative difference indicates a decrease compared to reported emissions.

<sup>3</sup> Included in the totals

## Statement from Croatia on the conclusions presented by the TERT

Croatia agrees with the Total greenhouse gas emissions including revised estimates and technical corrections presented in Table 3.

## Greenhouse gas emissions covered by Decision 406/2009/EC (ESD)

**Table 4: Greenhouse gas emissions for the purpose of Article 3 of Decision No 406/2009/EC**

Emission source category	Reference	Emission estimates (kt CO <sub>2</sub> equivalent) <sup>1</sup> 2018
Total greenhouse gas emissions including any accepted revised estimates provided by Croatia and any technical corrections deemed necessary by the TERT	See Table 2 above	23 695.531
Total verified emissions from stationary installations under Directive 2003/87/EC	Extracted by the European Commission from EUTL on 9 March 2020 (as agreed at the Working Group I of the Climate Change Committee on 18 May 2015) <sup>2</sup>	7 444.621
CO <sub>2</sub> emissions from 1A3a Domestic Aviation	See Table 2 above	31.737
NF <sub>3</sub> emissions	See Table 2 above	-
<b>Total ESD emissions</b>		<b>16 219.173</b>

<sup>1</sup> 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 are taken into account.

<sup>2</sup> 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.

## Greenhouse gas emissions covered by Regulation (EU) No 2018/842 (ESR)

**Table 5: Greenhouse gas emissions for the purpose of Article 4(3) of Regulation (EU) No 2018/842 (ESR)**

Emission source category	Reference	Emission estimates (kt CO <sub>2</sub> equivalent) <sup>1</sup>			
		2005 <sup>3</sup>	2016	2017	2018
Total greenhouse gas emissions including any accepted revised estimates provided by Croatia and any technical corrections deemed necessary by the TERT	See Table 3 above	29 825.780	24 161.043	24 902.811	23 695.531
Total verified emissions from stationary installations under Directive 2003/87/EC	Extracted by the European Commission from EUTL on 9 March 2020 (as agreed at the Working Group I of the Climate Change Committee on 18 May 2015) <sup>2</sup>	-	8 267.141	8 367.776	7 444.621
CO <sub>2</sub> emissions from 1A3a Domestic Aviation	See Table 3 above	37.696	31.108	31.423	31.737
<b>Total ESR emissions</b>		-	<b>15 862.794</b>	<b>16 503.612</b>	<b>16 219.173</b>

<sup>1</sup> 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 ESR emissions), all available decimal places were used. Therefore, the totals shown may slightly differ from calculation results where only three decimals are taken into account.

<sup>2</sup> 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.

<sup>3</sup> Due to changes in ETS scope and country coverage between 2005 and 2013, 'Total ESR emissions' cannot be calculated for 2005 by deducting 'Total verified emissions from stationary installations under Directive 2003/87/EC' and 'CO<sub>2</sub> emissions from 1A3a Domestic Aviation' from 'Total GHG emissions including any revised estimates and any technical corrections'.

## Recommendations from the TERT, considering revised estimates and technical corrections deemed necessary by the TERT

**Table 6: Recommendations from TERT (RE = Revised estimate; TC = Technical correction)**

EMRT-ID	Key category	Category, gas, year	Recommendation	Revised estimate or technical correction in 2020
HR-1A3b-2020-0002	No	1A3b Road Transportation, CH <sub>4</sub> , 2005 - 2018	For category 1A3biv Road Transportation: Motorcycles, Gasoline, CH <sub>4</sub> , and all years, the TERT noted that the implied emission factor (IEF) was increasing significantly year on year. In response to a question raised during the review, Croatia explained that this was due to increasing numbers of quads and all-terrain vehicles (ATVs) but that there was also a units error in the COPERT model. Croatia provided a revised estimate for 2005, 2016, 2017 and 2018 and stated that this correction will be included in the next submission. The TERT agreed with the revised estimate provided by Croatia. The TERT recommends that Croatia include the revised estimate in its next submission.	RE
HR-1B2b-2020-0001	Yes	1B2b Fugitive Emissions from Natural Gas, CH <sub>4</sub> , CO <sub>2</sub> , 2005-2018	For the category 1B2b1 Fugitive Emissions from Natural Gas Exploration, CO <sub>2</sub> and CH <sub>4</sub> , years 2005 and 2016-2018, the TERT noted that there is an over-estimate of emissions. This over-estimation occurs because Croatia estimated CO <sub>2</sub> and CH <sub>4</sub> emissions associated with national gas exploration by applying the Tier 1 emission factors from Table 4.2.4 of the 2006 IPCC Guidelines of categories well drilling, well testing, and well servicing but assuming that there was an error in the units presented in the Guidelines. Croatia provided revised estimates for years 2005, 2016, 2017 and 2018 and stated that these revisions will be included in the next submission. The TERT agreed with the revised estimate provided by Croatia. The TERT recommends that Croatia include the revised estimate in its next submission.	RE
HR-2A2-2020-0002	No	2A2 Lime Production, CO <sub>2</sub> , 2005	For category 2A2 Lime Production and CO <sub>2</sub> for year 2005 the TERT noted that there was a recalculation of emissions compared to the 2019 submission. CO <sub>2</sub> emissions from 2A2 decreased by 25% for 2005 compared to the previous inventory. In response to a question raised during the review, Croatia explained that these recalculations were due to improvements to the inventory, but also due to the accidental exclusion of emissions from one factory for the years 2005, 2006 and 2007 because of a change in the reporting structure from the producer. Croatia provided a revised estimate for 2005 that included CO <sub>2</sub> emissions from this factory and stated that it will be included in the next submission. The TERT agreed with the revised estimate provided by Croatia. The TERT recommends that Croatia include the revised estimate in its next submission.	RE

EMRT-ID	Key category	Category, gas, year	Recommendation	Revised estimate or technical correction in 2020
HR-2F-2020-0002	Yes	2F1 Refrigeration and Air Conditioning, HFCs, 2005-2018	For category 2F1 Refrigeration and Air Conditioning, and HFC emissions throughout the time series, the TERT noted that manufacturing and disposal emissions for 2F1a and 2F1c are reported as 'NO'. In response to a question raised during the review Croatia explained that relevant data are lacking and did not provide a revised estimate. The TERT decided to calculate a technical correction for the years 2005, 2016, 2017 and 2018 which was accepted by Croatia. The estimates demonstrate that the issue is above the threshold of significance. The TERT recommends that Croatia include a revised estimate in its next submission.	TC

EMRT-ID	Key category	Category, gas, year	Recommendation	Revised estimate or technical correction in 2020
HR-3-2020-0004	Yes	3 Agriculture, CH <sub>4</sub> , N <sub>2</sub> O, 1990-2018	<p>For category 3B Manure Management, gases CH<sub>4</sub> and N<sub>2</sub>O and for years 2005, 2016, 2017 and 2018 the TERT identified a potential over-estimate of emissions exceeding the threshold of significance. In its 2020 submission, Croatia utilised a Tier 1 approach for the estimation of emissions from manure management, when in previous submissions a Tier 2 methodology was used. The TERT is of the view that this is not good practice and that estimates of N<sub>2</sub>O from category 3D Agricultural Soils are also affected. In response to a question raised during the review, Croatia provided a revised estimate that the TERT partially agreed with. For dairy cattle, CH<sub>4</sub>, Croatia provided a revised CH<sub>4</sub> emission factor for 2017. The emission factors for 2005, 2016 and 2018 were calculated by using the revised 2017 emission factor and the ratios of the annual emission factors in the original 2020 submission. The TERT agreed with this approach for the purposes of this review. For mature and growing cattle, for 2005, 2016, 2017 and 2018, Croatia calculated the emission factors based on the 2017 revised emission factor for dairy cattle and the ratios of the annual emission factors in the original 2020 submission. The TERT disagreed with this approach. In relation to N<sub>2</sub>O emissions from dairy cattle, Croatia provided a revised N excretion value for 2017 and applied this to the years 2005, 2016 and 2018 based on a ratio change. The TERT agreed for this approach for 2016-2018 for the purposes of this review. Regarding the year 2005, the TERT noted that the use of such a ratio for 2005 over-estimates nitrogen (N) excretion for 2005 on the basis that milk yield in 2017 is 31% higher than that in 2005. Therefore, the TERT disagreed with this approach for dairy cattle for the year 2005. For mature and growing cattle, 2005, 2016-2018, Croatia estimated emissions by rescaling N excretion values according to the ratio of the N excretion values in the original 2020 submission and the revised N excretion value for dairy cattle for 2017. The TERT disagreed with this approach. Furthermore, the TERT noted that N excretion values presented for growing and mature cattle were equal in the revised estimate, which the TERT disagreed with. The TERT decided to calculate a technical correction for the years 2005, 2016, 2017 and 2018 which was accepted by Croatia. The estimates demonstrate that the issue is above the threshold of significance. The TERT recommends that Croatia continue the on-going work to develop a country-specific Tier 2 approach for 3B Manure Management, gases CH<sub>4</sub> and N<sub>2</sub>O, by developing, for relevant animal categories, annual emission factors which are based on year-specific activity data. The TERT recommends that Croatia include the revised estimates for CH<sub>4</sub> and N<sub>2</sub>O from manure management and N<sub>2</sub>O from agricultural soils in its next submission.</p>	TC

EMRT-ID	Key category	Category, gas, year	Recommendation	Revised estimate or technical correction in 2020
HR-3-2020-0001	Yes	3A Enteric Fermentation, CH <sub>4</sub> , 1990-2018	For category 3A Enteric Fermentation, CH <sub>4</sub> and the years 2005, 2016, 2017 and 2018, the TERT noted that Croatia, in its 2020 submission, revised estimates for this category utilising a Tier 1 approach, when a Tier 2 approach had been used for this category in previous submissions and that this is not in line with good practice. In response to a question raised during the review, Croatia explained that a number of issues were identified in the in-country UNFCCC review in 2018 and that it is in the process of redeveloping Tier 2 estimates for this category. Croatia also stated that until the new Tier 2 methodology is fully developed it decided to move to Tier 1 estimates for this category. The TERT decided to calculate a technical correction for the years 2005, 2016, 2017 and 2018 which was accepted by Croatia. The estimates demonstrate that the issue is above the threshold of significance for 2005 and 2016. The TERT recommends that Croatia continue its work to redevelop a new tier 2 method and include the revised estimates in its next submission.	TC
HR-5A-2020-0001	Yes	5A Solid Waste Disposal, CH <sub>4</sub> , 2005-2018	For category 5A Solid Waste Disposal, CH <sub>4</sub> and the years 2005-2018 the TERT noted that in the NIR, page 313, methane oxidation at managed solid waste disposal sites (SWDS) was assumed to be zero, while the default value for the oxidation factor in 2006 IPCC Guidelines, Volume 5, Table 3.2 is 0.1 for managed landfills. In response to a question raised during the review, Croatia provided revised estimates for years 2005, 2016, 2017 and 2018 for 5A covering this observation and observation HR-5A-2020-0003 (on degradable organic carbon in industrial waste) combined and stated that it will be included in the next submission. The TERT agreed with the revised estimate provided by Croatia. The TERT recommends that country include the revised estimates in its next submission.	RE
HR-5D-2020-0002	Yes	5D Wastewater Treatment and Discharge, CH <sub>4</sub> , 2005-2018	For category 5D Wastewater Treatment and Discharge, CH <sub>4</sub> and the years 2005-2018 the TERT noted that in response to a question raised during the review Croatia provided a revised estimate that the TERT disagreed with. The TERT decided to calculate a technical correction for the years 2005, 2016, 2017 and 2018 which was accepted by Croatia. The estimates demonstrate that the issue is above the threshold of significance. The TERT recommends that Croatia include a revised estimate in its next submission.	TC

EMRT-ID	Key category	Category, gas, year	Recommendation	Revised estimate or technical correction in 2020
HR-1A2-2020-0001	Yes	1A2 Manufacturing Industries and Construction, CO <sub>2</sub> , 2005-2018	For category 1A2 Manufacturing Industries and Construction, the TERT noted that Croatia uses a Tier 1 method for several subcategories and fuels, even though they are identified as key categories. In response to a question raised during the review, Croatia explained that limitation of resources has meant that improvements to other sectors had been prioritized, and that energy sector improvements remain a planned improvement. The TERT recommends that Croatia prioritise moving to Tier 2 methodology for most significant subcategories and fuels for which Tier 1 is still being used, using ETS data where possible, and that Croatia explain the progress made towards this in the next NIR.	No
HR-1A3-2020-0001	Yes	1A3b Road Transportation , CO <sub>2</sub> , 2005-2018	For category 1A3b Road Transportation, Liquid Fuels, CO <sub>2</sub> , and all years, the TERT noted that Croatia uses a Tier 1 methodology for this key category. During the review, Croatia explained that obtaining country specific emission factors for CO <sub>2</sub> is a long-term goal. The TERT re-iterates previous review findings and recommends that Croatia collect and apply country specific emission factors.	No
HR-3-2020-0003	Yes	3D Agricultural Soils, N <sub>2</sub> O, 1990-2018	For category 3Da2a Animal Manure Applied to Soils the TERT noted that there is a discrepancy between the CRF Tables 3.D and 3.B(b). The amount of N applied with animal manure in 3Da2a is too large as compared to N managed in manure management systems minus N lost as NH <sub>3</sub> +NO <sub>x</sub> or leaching. In response to a question raised during the review, Croatia provided a very transparent calculation sheet. The examination of the Excel sheet provided by Croatia revealed some errors such as inappropriate use of default figures on total nitrogen losses from manure management systems (FracLossMS) given in Table 10.23 of the 2006 IPCC Guidelines and double counting of straw used for bedding. During Step 2 of the review, Croatia provided revised estimates for years 2005, 2016, 2017 and 2018 correcting all methodological issues indicated by the TERT. Although the TERT agreed with the corrections done by Croatia, the revised estimate provided by Croatia could not be accepted because a technical correction is provided under the issue HR-3-2020-0004 affects the nitrogen excretion rates and therefore also the emissions included in the revised estimate. The TERT recommends that Croatia include the corrections done in the revised estimate and those relevant to HR-3-2020-0004 in its next submission.	No

EMRT-ID	Key category	Category, gas, year	Recommendation	Revised estimate or technical correction in 2020
HR-3B-2020-0005	Yes	3B Manure Management, CH <sub>4</sub> and N <sub>2</sub> O, 1990-2018	<p>For category 3B Manure Management, CH<sub>4</sub> and N<sub>2</sub>O, for all years the TERT noted that there is a lack of transparency regarding the use of the manure management system anaerobic lagoons in Croatia. Anaerobic lagoons in general are not used as a manure management system in Europe and liquid/slurry and pit storage manure management systems prevail. In response to a question raised during the review Croatia explained that Croatia's manure management system distribution is expert judgement from the experts at the Faculty of Agriculture, University of Zagreb. Usage of uncovered anaerobic lagoons, as specified in table 10.18, Chapter 10, Volume 4 of the 2006 IPCC guidelines, is still in place in some of the older (Yugoslavia-era) farms. Furthermore, Croatia reiterated planned improvements for sector 3B including the collection of new manure management system data through environmental permits and questionnaires. The TERT agreed with the explanation provided by Croatia. The TERT recommends that Croatia review the definitions it uses for manure management systems against the Table 10.18, Chapter 10, Volume 4 of the 2006 IPCC Guidelines prior to its next submission and that it make every effort to collect updated manure management system data as part of improvement plans outlined for the sector in the NIR.</p>	No

## Revised estimates provided by Croatia and accepted by the TERT

1	ESD Review Tool ID:	HR-1A3b-2020-0002								
	ESD Review Tool URL:	<a href="https://emrt-esd.eionet.europa.eu/2020/HR-1A3b-2020-0002">https://emrt-esd.eionet.europa.eu/2020/HR-1A3b-2020-0002</a>								
	Country:	Croatia								
	Sector:	1A3b Road Transportation								
	Gases:	CH <sub>4</sub>								
	Fuel	Liquid fuels								
	Completed by Sector Expert:	Melanie Hobson								
	Reviewed by Counterpart:	Jean-Marc Andre								
	Reviewed by Lead Reviewer:	Suvi Monni								
	Reviewed by Quality Controller:	Justin Goodwin								
The underlying problem:	CH <sub>4</sub> emissions from quad and all-terrain vehicles (ATVs) (a sub-category of motorcycles, CRF category 1A3biv) are 1,000 times too high due to there being a units error in the COPERT model.									
Summarise the methodology used:	The emission estimates have been updated by Croatia manually following advice from Emisia									
2	<b>Original estimate (Gg CO<sub>2</sub>e)</b>									
	Year	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	HFCs	PFCs	SF <sub>6</sub>	NF <sub>3</sub>	Mixed GHG	Notes
	2005		2.962							
	2016		19.097							
	2017		18.900							
	2018		17.721							
	<b>Revised Estimate received from country (Gg CO<sub>2</sub>e)</b>									
	Year	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	HFCs	PFCs	SF <sub>6</sub>	NF <sub>3</sub>	Mixed GHG	Notes
	2005		2.490							
	2016		1.754							
	2017		1.709							
	2018		1.647							
	<b>Difference between RE and OE (Gg CO<sub>2</sub>e)</b>									
	Year	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	HFCs	PFCs	SF <sub>6</sub>	NF <sub>3</sub>	Mixed GHG	
	2005		-0.472							
2016		-17.343								
2017		-17.191								
2018		-16.075								

ESD Review Tool ID:		HR-1B2b-2020-0001							
ESD Review Tool URL:		<a href="https://emrt-esd.eionet.europa.eu/2020/HR-1B2b-2020-0001#tab-qa">https://emrt-esd.eionet.europa.eu/2020/HR-1B2b-2020-0001#tab-qa</a>							
Country:		Croatia							
Sector:		Fugitive Emissions from Natural Gas							
Gases:		CO <sub>2</sub> , CH <sub>4</sub>							
Fuel:		Gaseous fuels							
Completed by Sector Expert:		Ioannis Sempos							
Reviewed by Counterpart:		Marion Pinterits							
Reviewed by Lead Reviewer:		Suvi Monni							
Reviewed by Quality Controller:		Justin Goodwin							
1	The underlying problem:		<p>For category natural gas exploration (1B2b1), CO<sub>2</sub> and CH<sub>4</sub>, years 2005 and 2016-2018, the TERT noted that there is an over-estimate of emissions. Croatia estimated CO<sub>2</sub> and CH<sub>4</sub> emissions associated with natural gas exploration by applying the Tier 1 emission factors (EFs) from Table 4.2.4 of the 2006 IPCC Guidelines of categories well drilling, well testing and well servicing. However, Croatia applied these EFs by assuming that there was an error in the units of EFs in the Table 4.2.4 . Croatia assumed that instead of Gg per thousand m<sup>3</sup> total oil production, the units should be per million m<sup>3</sup> total natural gas production. The TERT notes that the applied CO<sub>2</sub> EF for exploration is 7.3 times higher than the proposed Tier 1 EF from Table 4.2.4 of the 2006 IPCC Guidelines for gas production (fugitives 1.4E-5 to 8.2E-5 Gg/million m<sup>3</sup> and flaring 1.2E-3 Gg/million m<sup>3</sup>). The TERT is of the view that emissions associated with gas production should be generally higher than gas exploration, because duration and gas volumes of gas production are generally multiple times more than the duration and gas volumes associated with gas exploration. Therefore, the TERT concludes that the CO<sub>2</sub> emissions of gas exploration, which were reported by Croatia are over-estimated. The TERT also calculated emissions by applying the Tier 1 method from the 2019 Refinement to the 2006 IPCC Guidelines. By comparing the applied CO<sub>2</sub> and CH<sub>4</sub> EFs of gas exploration (9101.9 kg CO<sub>2</sub>/million m<sup>3</sup> gas and 194 kg CH<sub>4</sub>/million m<sup>3</sup> gas) with the respective Tier 1 EFs from the 2019 Refinement, Volume 2, Table 4.2.4.F (50 kg CO<sub>2</sub>/million m<sup>3</sup> gas and 60 kg CH<sub>4</sub>/million m<sup>3</sup> gas), the TERT notes that the EFs applied by Croatia were 1-2 orders of magnitude higher than the Tier 1 EFs from the 2019 Refinement. During the review, Croatia clarified that it has fields where only natural gas is explored, therefore the application of the Tier 1 methodology from Table 4.2.4 of the 2006 IPCC Guidelines is not possible, without an adjustment. The TERT agrees with the country, but notes that any change of the EFs that are included in the 2006 IPCC Guidelines should be adequately justified e.g. by comparing them with the EFs applied by other countries, and /or any available technical literature. The TERT concluded that CO<sub>2</sub> and CH<sub>4</sub> emissions associated to natural gas exploration for 2005, 2016-2018 should be: either (1) reported as 'IE/NE', where 'IE' refers to the emissions associated with gas exploration in fields where combined gas and oil production is anticipated, and these emissions are reported under category 1B2a1 Oil Exploration; and 'NE' for emissions associated with gas exploration that is related to fields where a combined gas and oil production is not anticipated, since there is no Tier 1 method available in the 2006 IPCC Guidelines; or (2) estimated for gas exploration in fields where a combined gas and oil production is not anticipated by using a Country Specific, higher Tier, or any other methodology from technical literature that is consistent with the 2006 IPCC Guidelines.</p>						
	Summarise the methodology used:		In the revised estimate, CO <sub>2</sub> and CH <sub>4</sub> emissions associated to natural gas exploration (category 1B2b1) were reported as 'IE/NE' as suggested above.						
	2	Original estimate (Gg CO <sub>2</sub> e)							
Year		CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	HFCs	PFCs	SF <sub>6</sub>	NF <sub>3</sub>	Mixed GHG
2005		20.783	11.074						
2016		14.993	7.989						
2017		13.503	7.195						
2018		11.196	5.966						
Revised Estimate received from country (Gg CO <sub>2</sub> e)								Notes	

Year	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	HFCs	PFCs	SF <sub>6</sub>	NF <sub>3</sub>	Mixed GHG	
2005	IE/NE	IE/NE							
2016	IE/NE	IE/NE							
2017	IE/NE	IE/NE							
2018	IE/NE	IE/NE							
<b>Difference between RE and OE (Gg CO<sub>2</sub>e)</b>									
Year	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	HFCs	PFCs	SF <sub>6</sub>	NF <sub>3</sub>	Mixed GHG	
2005	-20.783	-11.074							
2016	-14.993	-7.989							
2017	-13.503	-7.195							
2018	-11.196	-5.966							

1	ESD Review Tool ID:	HR-2A2-2020-0002								
	ESD Review Tool URL:	<a href="https://emrt-esd.eionet.europa.eu/2020/HR-2A2-2020-0002">https://emrt-esd.eionet.europa.eu/2020/HR-2A2-2020-0002</a>								
	Country:	Croatia								
	Sector:	2A2 Lime Production								
	Gases:	CO <sub>2</sub>								
	Fuel:	N/A								
	Completed by Sector Expert:	Emma Salisbury								
	Reviewed by Counterpart:	Kristina Kaar								
	Reviewed by Lead Reviewer:	Suvi Monni								
Reviewed by Quality Controller:	Justin Goodwin									
The underlying problem:		One lime production plant was accidentally excluded from the inventory for the years 2005-2007.								
Summarise the methodology used:		The emissions from this one lime production plant were added back into the inventory.								
2	<b>Original estimate (Gg CO<sub>2</sub>e)</b>									<b>Notes</b>
	Year	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	HFCs	PFCs	SF <sub>6</sub>	NF <sub>3</sub>	Mixed GHG	
	2005	151.632								
	2016									
	2017									
	2018									
	<b>Revised Estimate received from country (Gg CO<sub>2</sub>e)</b>									<b>Notes</b>
	Year	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	HFCs	PFCs	SF <sub>6</sub>	NF <sub>3</sub>	Mixed GHG	
	2005	192.251								
	2016									
	2017									
	2018									
	<b>Difference between RE and OE (Gg CO<sub>2</sub>e)</b>									
Year	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	HFCs	PFCs	SF <sub>6</sub>	NF <sub>3</sub>	Mixed GHG		
2005	40.620									
2016										
2017										
2018										

ESD Review Tool ID:	HR-5A-2020-0001
ESD Review Tool URL:	<a href="https://emrt-esd.eionet.europa.eu/2020/HR-5A-2020-0001">https://emrt-esd.eionet.europa.eu/2020/HR-5A-2020-0001</a>
Country:	Croatia
Sector:	5A Solid Waste Disposal
Gases:	CH <sub>4</sub>
Fuel	N/A
Completed by Sector Expert:	Hans Oonk
Reviewed by Counterpart:	Céline Gueguen
Reviewed by Lead Reviewer:	Suvi Monni
Reviewed by Quality Controller:	Justin Goodwin

1	<p>The underlying problem:</p> <p>The TERT noted with reference to 5A, CH<sub>4</sub> and years 2005-2018 and the NIR, page 313, that methane oxidation at managed solid waste disposal sites (SWDS) was assumed to be zero. However, according to the introduction of the paragraph on oxidation (2006 IPCC Guidelines, Volume 5, Chapter 3, page 3.15), 'covered with CH<sub>4</sub>-oxidising material' can refer to normal soils, covering the waste. So for managed landfills, covered with soil, default oxidation factor (OX) in the 2006 IPCC Guidelines, Volume 5, Table 3.2 is 0.1. Croatia has legislation in place requiring landfills to cover their waste with a daily cover and a temporary cover, when waste is not deposited for longer times (Ordinance on the methods and conditions for the landfill of waste, categories and operational requirements for waste landfills (OG 114/2015, 103/2018, 56/2019 Article 14). Therefore, the TERT considered that OX=0.1 is a better assumption than OX=0. In addition, in HR-5A-2020-0003, Croatia provided details on the composition of part of the industrial waste. Based on this information, a country-specific value for degradable organic carbon (DOC) of 0.073 could be determined for this part of the waste, which would be more appropriate than the IPCC default for industrial waste of 0.15 which was used.</p>
	<p>Summarise the methodology used:</p> <p>Emissions are calculated by Croatia, using separate IPCC waste models for managed and unmanaged waste. In both models, average DOC of industrial waste was assumed to be 0.073. For managed waste, oxidation is assumed to be 10% in agreement with the default in the 2006 IPCC Guidelines, Volume 5, Chapter 3, page 3.15.</p>

Year	Original estimate (Gg CO <sub>2</sub> e)								Notes
	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	HFCs	PFCs	SF <sub>6</sub>	NF <sub>3</sub>	Mixed GHG	
2005		1 038.936							
2016		1 716.341							
2017		1 775.230							
2018		1 771.443							

Year	Revised Estimate received from country (Gg CO <sub>2</sub> e)								Notes
	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	HFCs	PFCs	SF <sub>6</sub>	NF <sub>3</sub>	Mixed GHG	
2005		846.104							
2016		1 385.336							
2017		1 430.951							
2018		1 423.043							

Year	Difference between RE and OE (Gg CO <sub>2</sub> e)							
	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	HFCs	PFCs	SF <sub>6</sub>	NF <sub>3</sub>	Mixed GHG
2005		-192.832						
2016		-331.005						
2017		-344.280						
2018		-348.400						

## Technical corrections deemed necessary by the TERT

1	ESD Review Tool ID:	HR-2F-2020-0002								
	ESD Review Tool URL:	<a href="https://emrt-esd.eionet.europa.eu/2020/HR-2F-2020-0002#tab-qa">https://emrt-esd.eionet.europa.eu/2020/HR-2F-2020-0002#tab-qa</a>								
	Country:	Croatia								
	Sector:	2F1 Refrigeration and Air Conditioning								
	Gases:	HFCs								
	Fuel:	N/A								
	Completed by Sector Expert:	Barbara Gschrey								
	Reviewed by Counterpart:	Jacek Soszkiewics								
Reviewed by Lead Reviewer:	Suvi Monni									
Reviewed by Quality Controller:	Justin Goodwin									
The underlying problem:	Manufacturing and disposal emissions for 2F1a and 2F1c are reported as 'NO' throughout the time series.									
Summarise the methodology used:	Manufacturing and disposal emissions are estimated on the basis of the reported stock data and by means of assumptions: disposal emissions are 1/15 of the stock; EF for manufacturing: 3 % at installation on site; assumed share of domestic manufacture of growth of stock: 50 % for 2F1a and 90% for 2F1c.									
2	<b>Original estimate (Gg CO<sub>2</sub>e)</b>								<b>Notes</b>	
	Year	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	HFCs	PFCs	SF <sub>6</sub>	NF <sub>3</sub>		Mixed GHG
	2005				107.383					Commercial and Industrial refrigeration, emissions from stocks
	2016				155.406					
	2017				157.903					
	2018				160.089					
	<b>Technical Correction calculated by TERT (Gg CO<sub>2</sub>e)</b>								<b>Notes</b>	
	Year	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	HFCs	PFCs	SF <sub>6</sub>	NF <sub>3</sub>		Mixed GHG
	2005				108.323					
	2016				206.606					
	2017				210.177					
	2018				213.054					
	<b>Difference between TC and OE (Gg CO<sub>2</sub>e)</b>									
	Year	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	HFCs	PFCs	SF <sub>6</sub>	NF <sub>3</sub>	Mixed GHG	
	2005				0.941					
	2016				51.200					
	2017				52.274					
2018				52.965						

1	ESD Review Tool ID:	HR-3-2020-0001								
	ESD Review Tool URL:	<a href="https://emrt-esd.eionet.europa.eu/2020/HR-3-2020-0001#tab-qa">https://emrt-esd.eionet.europa.eu/2020/HR-3-2020-0001#tab-qa</a>								
	Country:	Croatia								
	Sector:	3A Enteric Fermentation								
	Gases:	CH <sub>4</sub>								
	Fuel	N/A								
	Completed by Sector Expert:	Bernard Hyde								
	Reviewed by Counterpart:	Chris Dore								
1	Reviewed by Lead Reviewer:	Suvi Monni								
	Reviewed by Quality Controller:	Justin Goodwin								
	The underlying problem:	For the 2020 submission, Croatia adopted a Tier 1 methodology when in previous submissions a Tier 2 methodology was utilised for emissions of CH <sub>4</sub> from enteric fermentation from cattle which is a key category. This is not in line with good practice.								
Summarise the methodology used:	The implied emission factor (IEF) for each of the cattle subcategories for the years 2005, 2016 and 2017 from the 2019 submission were used to estimate revised emission values for 2005, 2016 and 2017. For 2018, the IEF for 2017 from the 2019 submission was used.									
2	<b>Original estimate (Gg CO<sub>2</sub>e)</b>									
	Year	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	HFCs	PFCs	SF <sub>6</sub>	NF <sub>3</sub>	Mixed GHG	Notes
	2005		1 253.786							Total CH <sub>4</sub> from 3A as per CRF Table summary 2
	2016		1 042.272							Total CH <sub>4</sub> from 3A as per CRF Table summary 2
	2017		1 042.929							Total CH <sub>4</sub> from 3A as per CRF Table summary 2
	2018		983.257							Total CH <sub>4</sub> from 3A as per CRF Table summary 2
	<b>Technical Correction calculated by TERT (Gg CO<sub>2</sub>e)</b>									
	Year	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	HFCs	PFCs	SF <sub>6</sub>	NF <sub>3</sub>	Mixed GHG	Notes
	2005		1 270.438							Estimated using IEF from 2019 submission
	2016		1 090.860							Estimated using IEF from 2019 submission
	2017		1 052.014							Estimated using IEF from 2019 submission
	2018		988.622							Estimated using IEF for 2017 from 2019 submission
	<b>Difference between TC and OE (Gg CO<sub>2</sub>e)</b>									
	Year	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	HFCs	PFCs	SF <sub>6</sub>	NF <sub>3</sub>	Mixed GHG	
	2005		16.652							
2016		48.589								
2017		9.085								
2018		5.365								

ESD Review Tool ID:	HR-3-2020-0004
ESD Review Tool URL:	https://emrt-esd.eionet.europa.eu/2020/HR-3-2020-0004
Country:	Croatia
Sector:	3 Agriculture
Gases:	CH <sub>4</sub> , N <sub>2</sub> O
Fuel	N/A
Completed by Sector Expert:	Bernard Hyde
Reviewed by Counterpart:	Chris Dore
Reviewed by Lead Reviewer:	Suvi Monni
Reviewed by Quality Controller:	Justin Goodwin

1	The underlying problem:	Croatia revised its methodological approach for nitrogen excretion from cattle from a Tier 2 methodology in its 2019 submission to a Tier 1 methodology in the 2020 submission. Croatia also revised CH <sub>4</sub> emissions from manure management from cattle from a Tier 2 methodology to a Tier 1 methodology. This is not in line with good practice.
	Summarise the methodology used:	<p><u>3B CH<sub>4</sub></u>: For Other mature cattle and Growing cattle in all years (2005, 2016, 2017, 2018): the 2019 submission was used to derive IEFs for the relevant year of the time series (2017 values used for 2018). For Mature dairy cattle in all years (2005, 2016, 2017, 2018): IEFs provided by Croatia in its revised estimate were used. The method uses a revised EF for 2017, and for other years the 2020 submission IEFs are rescaled using the ratio of the new 2017 EF and the 2017 EF from the 2020 submission.</p> <p><u>3B N<sub>2</sub>O</u>: Calculation files provided by Croatia were used to derive estimates for N<sub>2</sub>O emissions from manure management.</p> <p>Mature and growing cattle: N excretion values from the 2020 submission were used to estimate emissions for the years 2005, 2016, 2017 and 2018.</p> <p>Dairy cattle: N excretion values for 2016, 2017 and 2018 from Croatia's revised estimate were used. For 2005, the value was taken from the 2020 submission.</p> <p><u>3D N<sub>2</sub>O</u>: The impact on N<sub>2</sub>O emissions from soils of revising N<sub>2</sub>O emissions from manure management was calculated. CRF Table 3D was used also used.</p>

Year	Original estimate (Gg CO <sub>2</sub> e)								Notes
	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	HFCs	PFCs	SF <sub>6</sub>	NF <sub>3</sub>	Mixed GHG	
2005		456.598	1 502.432						N <sub>2</sub> O is sum of direct and indirect N <sub>2</sub> O from manure management and N <sub>2</sub> O emissions from soils, CRF Table Summary 2. CH <sub>4</sub> is total emissions from category 3B
2016		432.994	1 127.355						
2017		424.902	1 256.092						
2018		401.273	1 259.805						
Year	Technical Correction calculated by TERT (Gg CO <sub>2</sub> e)								Notes
	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	HFCs	PFCs	SF <sub>6</sub>	NF <sub>3</sub>	Mixed GHG	
2005		448.957	1 440.466						N <sub>2</sub> O is sum of direct and indirect N <sub>2</sub> O from manure management and N <sub>2</sub> O emissions from soils, CRF Table Summary 2. CH <sub>4</sub> is total emissions from category 3B

2016		425.551	1 093.346					
2017		417.358	1 222.564					
2018		392.357	1 227.281					
<b>Difference between TC and OE (Gg CO<sub>2</sub>e)</b>								
Year	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	HFCs	PFCs	SF <sub>6</sub>	NF <sub>3</sub>	Mixed GHG
2005		-7.641	-61.966					
2016		-7.443	-34.009					
2017		-7.544	-33.528					
2018		-8.916	-32.523					

ESD Review Tool ID:	HR-5D-2020-0002
ESD Review Tool URL:	<a href="https://emrt-esd.eionet.europa.eu/2020/HR-5D-2020-0002">https://emrt-esd.eionet.europa.eu/2020/HR-5D-2020-0002</a>
Country:	Croatia
Sector:	5D Wastewater Treatment and Discharge
Gases:	CH <sub>4</sub>
Fuel	N/A
Completed by Sector Expert:	Hans Oonk
Reviewed by Counterpart:	Elisabeth Kampel
Reviewed by Lead Reviewer:	Suvi Monni
Reviewed by Quality Controller:	Justin Goodwin

1	<p>The underlying problem:</p> <p>The TERT noted with reference to 5D, CH<sub>4</sub> and years 2005-2018, that the NIR, table 7.5-1 provided insufficient insight on (1) how 'sludge removed' was used in the calculation; (2) whether emissions due to discharge of collected, untreated waste water were included in the inventory and (3) how emissions due to primary treatment were included. In a response, Croatia provided a revised estimate, that was not accepted by the TERT for two reasons: (i) For septic tanks, the calculation of total organic product in Table 7.5-1 was correct. However, this was corrected for the total amount of sludge, removed via all treatment pathways in Croatia. For septic tanks, only sludge removed from septic tanks is of importance. In addition, according to the 2006 IPCC Guidelines (Volume 5, Chapter 6, Table 6.3), the MCF already accounts for removal of sludge. (ii) Emissions related to direct discharge of untreated wastewater were not calculated. In addition, since this is a collected wastewater stream, the correction factor for additional industrial BOD discharged into sewers (I) of 1.25 (2006 IPCC Guidelines, Volume 5, Chapter 6, page 6.14) needs to be applied.</p>
	<p>Summarise the methodology used:</p> <p>Emissions are calculated by the TERT, starting from the information on share of the population, connected to septic tanks as specified in the NIR, Table 7.5-1. In addition, statistics on share of the population, whose water was not treated were obtained from Croatia and used in the calculation. Emissions are calculated, using the methodology and default values from the 2006 IPCC Guidelines.</p>

Year	Original estimate (Gg CO <sub>2</sub> e)								Notes
	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	HFCs	PFCs	SF <sub>6</sub>	NF <sub>3</sub>	Mixed GHG	
2005		294.942							Refers only to 5D1
2016		183.100							Refers only to 5D1
2017		115.353							Refers only to 5D1
2018		60.608							Refers only to 5D1

Year	Technical Correction calculated by TERT (Gg CO <sub>2</sub> e)								Notes
	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	HFCs	PFCs	SF <sub>6</sub>	NF <sub>3</sub>	Mixed GHG	
2005		436.898							Refers only to 5D1
2016		381.791							Refers only to 5D1
2017		347.964							Refers only to 5D1
2018		328.089							Refers only to 5D1

Year	Difference between TC and OE (Gg CO <sub>2</sub> e)							
	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	HFCs	PFCs	SF <sub>6</sub>	NF <sub>3</sub>	Mixed GHG
2005		141.956						
2016		198.691						
2017		232.610						
2018		267.482						

## Annex I: Legal background and procedures of the 2020 comprehensive 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 countries 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 Regulation (EU) No 749/2014.

The Effort Sharing Regulation (EU) 2018/842 (ESR) sets national emission limits for greenhouse gas emissions in the sectors outside the EU's ETS for the period 2021-2030. In Article 4(3) of the ESR, the Commission is required to adopt implementing acts setting out annual emission allocations (AEAs) for the period 2021-2030 in terms of CO<sub>2</sub> equivalents, for which it shall carry out a comprehensive review.

The 2020 Union review was thus held as a comprehensive review in line with MMR Article 19 (1) in concert with the Union review required by the ESR.

### Objectives

The objectives of the comprehensive review of countries' GHG emission inventories in 2020 are:

- a) to support the European Commission by ensuring it has accurate, reliable and verified information on annual GHG emissions for
  - o determining compliance with ESD targets for the years 2018 in a credible, consistent, transparent and timely manner, and for
  - o setting out countries' annual emission allocations (AEAs) for the years from 2021 to 2030 in terms of tonnes of CO<sub>2</sub> equivalent, according to Article 4(3) of the ESR.
- b) to assist countries in improving the quality of their GHG inventories.

### Procedures

The scope of the 2020 comprehensive review is presented in Table A-1. The checks carried out during the 2020 comprehensive review are presented in Annex II. The review consisted of two steps.

The Step 1 was combined with the 'EU QA/QC procedures' (i.e. initial checks) and was carried out by the EU inventory team (ETC/CME, JRC, Eurostat). All findings from the initial checks that were partly resolved or not resolved within the initial check phase were followed up in the second step of the review.

The EU inventory team consisted of the following experts:

- ETC/CME task manager: Nicole Mandl, Marion Pinterits (ETC/CME)
- Energy: Julien Vincent, Coralie Jeannot, Eva Krtková, Marion Pinterits, Matina Kastori, Giorgos Mellios, Markéta Müllerová, Bernd Gugele (ETC/CME), Michael Goll (Eurostat)
- IPPU: Barbara Gschrey, Lorenz Moosmann, Kristina Kaar, Lukas Emele, Maria Purzner, Ils Moorkens (ETC/CME)
- Agriculture: Adrian Leip, Janka Szemesová, Alexander De-Meij (JRC)
- Waste: Céline Gueguen (ETC/CME)
- LULUCF: Raúl Abad-Viñas (JRC)

- Quality coordinators: Adrian Leip, Giacomo Grassi (JRC), Bernd Gugele, Nicole Mandl, Marion Pinterits, Maria Purzner, Julien Vincent, Giorgos Mellios, Ils Moorkens, Kaat Jespers (ETC/CME)
- Cross-cutting: Nicole Mandl (ETC/CME)

Step 2 of the comprehensive review 2020 was performed by a Technical Expert Review Team (TERT) under service contract **340201/2019/814628/SER/CLIMA.C.2** of the Directorate General for Climate Action of the European Commission. The lead reviewers and sector review experts did not review emission inventories of countries 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 country whose inventory is concerned, did not take part in the review of that inventory.

The TERT consisted of the following experts:

- CRF categories 1A1, 1A2, 1A4, 1A5 (Stationary Combustion) + Reference Approach: Katrina Young, Julien Vincent and Stephan Poupa;
- CRF categories 1A3 Transport + 1D International Bunkers: Melanie Hobson, Jean-Marc André and Matina Kastori;
- CRF categories 1B Fugitive + 1C CO<sub>2</sub> Transport and Storage: Ioannis Sempos, Marlene Plejdrup and Marion Pinterits;
- CRF categories IPPU Fluorinated Gases: Barbara Gschrey, Jacek Skoskiewicz and Stephanie Barrault;
- CRF categories IPPU Other Gases than Fluorinated Gases: Emma Salisbury, Kristina Kaar and Wolfram Jörß;
- CRF categories 3A Enteric Fermentation and 3B Manure Management: Chris Dore, Steen Gyldenkærne and Bernard Hyde;
- CRF categories 3C-3J: Katalin Lovas, Etienne Mathias and Michael Anderl;
- CRF sector 5 Waste: Céline Gueguen, Elisabeth Kampel and Hans Oonk;
- Lead reviewers: Karin Kindbom, Suvi Monni, Ole-Kenneth Nielsen and Ralph Harthan;
- The following experts supported the team on request of the TERT: Tomas Gustafson (IPPU), Maria Purzner (F-gases), Beatriz Sanchez (Agriculture), Katja Pazdernik (Waste).

The second step of the review was coordinated by Bernd Gugele and Justin Goodwin.

The EEA review secretariat consisting of Melanie Sporer, Claire Qoul, Kirsten May, Justine Raoult and Henry Irvine prepared and coordinated the Union comprehensive review as foreseen in Article 28 of Commission Implementing regulations (EU) No 749/2014 and Article 42 of the Governance Regulation (EU) 2018/1999.

The step 2 of the review was performed on the basis of the 15 April submissions of GHG emission data and the national inventory report (NIR) under the Monitoring Mechanism. Resubmissions reported by countries were taken into account until 8 May 2020.

Where relevant, the TERT calculated technical corrections for over- or under-estimates identified in a mandatory category in the countries' GHG inventories that exceed the threshold of significance. Technical corrections have been calculated only for the years 2005 and 2016-2018. If the technical correction exceeds the threshold of significance for at least one year of the inventory under review (2005, and 2016-2018) but not for all the years the technical correction was calculated for all years under review in order to ensure time series consistency.

**Table A-1: Scope of the comprehensive review 2020**

<b>Element</b>	<b>Scope</b>	<b>Further information</b>
Countries	EU geographical coverage of the Member States, the United Kingdom, Norway and Iceland	
Years	2005, 2016, 2017, 2018	According to MMR Article 27(2); According to MMR Article 19(1); According to ESR Article 4(3)
Gases	CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O, HFCs, PFCs, SF <sub>6</sub> , NF <sub>3</sub>	
Sectors	All emission source sectors excluding LULUCF	National totals exclude emissions from LULUCF and emissions reported under memo items
Indirect CO <sub>2</sub> emissions	Included in national total	

## Annex II: Checks carried out during the 2020 comprehensive review in line with Art. 29, 32 and 33 of the Commission Implementing Regulation (EU) No 749/2014

### **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 over-estimations or under-estimations 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.