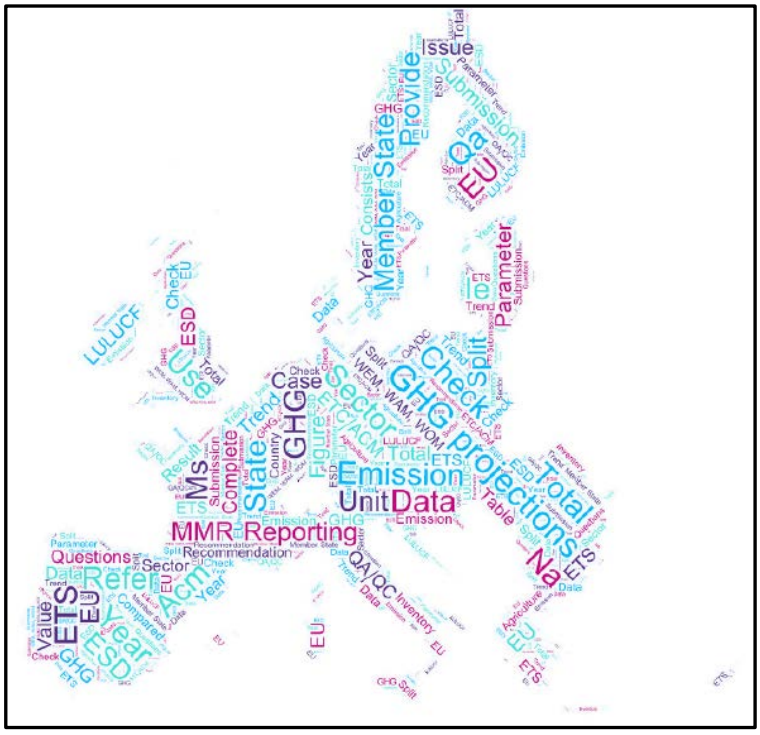
Assessment of Member States'

2017 GHG projections

Submitted under Article 14 of the EU Monitoring Mechanism Regulation

(EU) No 525/2013



ETC/ACM Technical Paper 2017/8
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Carmen Schmid, Henrik Neier, Johannes Burgstaller, Tom Dauwe, Giorgos Mellios, Hannah Förster, Sabine Gores, Carina Zell-Ziegler, Magdalena Jóźwicka

European Topic Centre
on Air Pollution and
Climate Change Mitigation

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Cover picture: EU Member States - MMR reporting collage.

Author affiliation:
Carmen Schmid, Henrik Neier, Johannes Burgstaller: Environment Agency Austria (UBA-V, AT)
Tom Dauwe: VITO (VITO, BE)
Giorgos Mellios: EMISIA (EMISIA, GR)
Hannah Förster, Sabine Gores, Carina Zell-Ziegler: Öko-Institut (ÖKO-Institut, DE)
Magdalena Jóźwicka (EEA)

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European Topic Centre on Air Pollution and Climate Change Mitigation
PO Box 1
3720 BA Bilthoven
The Netherlands
Phone +31 30 2748562
Fax +31 30 2744433
Email etcacm@rivm.nl
Website http://acm.eionet.europa.eu/

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1 Introduction

This report provides a summary of the assessment of the EU Member States' (MS) submission of greenhouse gas (GHG) projections under Article 14 of the Monitoring Mechanism Regulation (MMR) [(1)] and its Implementing Regulation [(2)] in 2017. It aims at describing the main results of the Quality Assurance and Quality Control (QA/QC) procedure as carried out by the European Topic Centre for air pollution and climate change mitigation (ETC/ACM) (see ETC Technical Paper 2017/9) in order to provide more transparency on the quality of the reported information under Art. 14 of the MMR. This includes the identification of progress and improvements made by the MS since the last mandatory reporting year (2015), and an outlook for the main challenges for future reporting.

The report is structured according to the quality criteria defined by the Intergovernmental Panel on Climate Change (IPCC) (see chapter 1.3). The first part includes a summary of the main results, followed by the chapter presenting the detailed results: Completeness and timeliness of reporting, number of resubmissions, followed by a general assessment of completeness of the reported information. The next chapter presents some statistics regarding the communication with the Member States. In the chapter on consistency and comparability a deeper insight on the quality of the data is provided, such as unit consistency, consistency with historical data, or split of ETS (Emission Trading Scheme) and ESD (Effort Sharing Decision) emissions. The assessment of accuracy and transparency provides some aggregated general results such as number of outliers and other deviations, in addition some illustrative cases are provided in this chapter in order to further explain how the checks work. A separate chapter covers a brief assessment of the reported parameters and the most common issues the ETC/ACM detected during the Quality Assurance / Quality Control (QA/QC) process. In chapter 4 sector specific QA/QC results are presented for Agriculture and Land use, Land-use change and Forestry (LULUCF). It provides detailed insights on the completeness of the sectors, most common reporting issues and the major challenges. The final chapter points out the main conclusions and recommendations for future reporting cycles.
It has to be noted that the QA/QC procedure was applied to all 28 Member States, as well as European Environment Agency (EEA) member countries. In 2017 Norway provided a voluntary submission. An overall summary for Norway is provided in chapter 5.

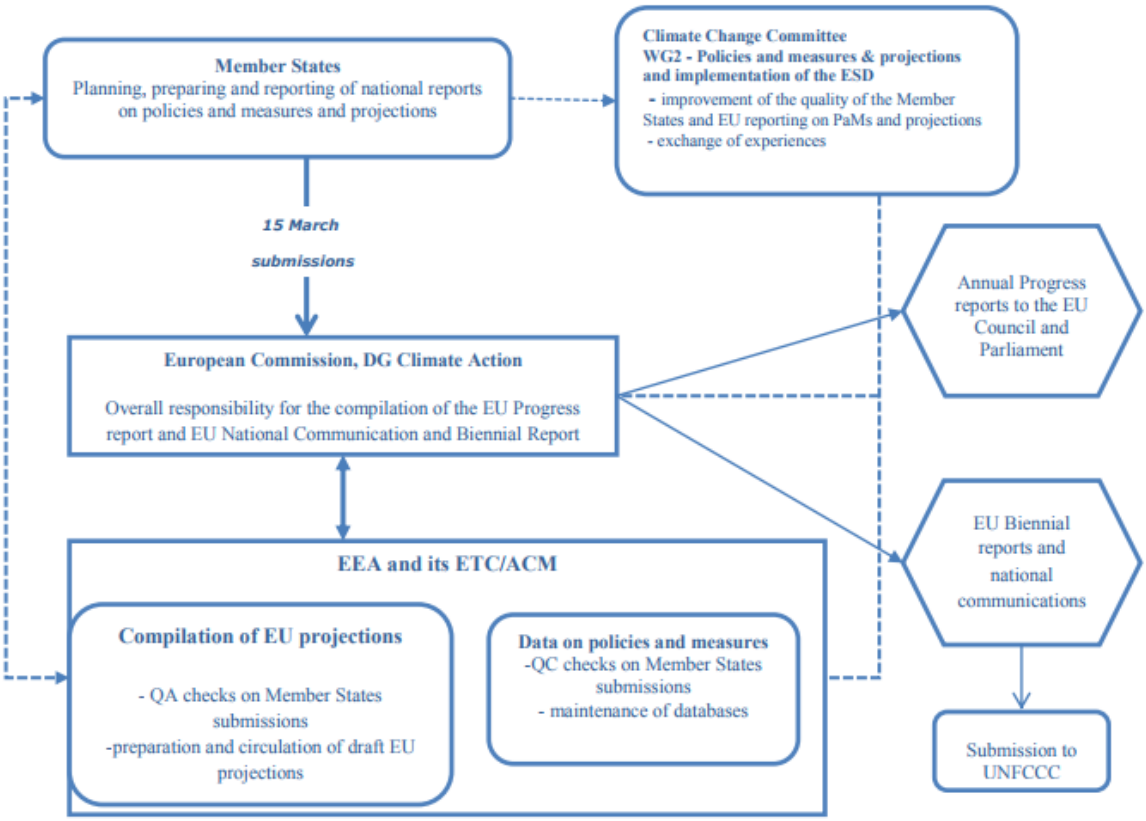
1.1 The Union System for projections

The Union system for policies and measures and for projections (Figure 1.1) represents the institutional, legal and procedural arrangements established for reporting on policies and measures and projections of anthropogenic emissions by sources and removals by sinks of greenhouse gases not controlled by the Montreal Protocol.
Overall responsibility for the Union system for policies and measures and projections of anthropogenic greenhouse gas emissions by sources and removals by sinks rests with the European Commission, more specifically its Directorate-General for Climate Action (DG CLIMA). The

[(1)] Regulation (EU) No 525/2013 of the European Parliament and of the Council of 21 May 2013 on a mechanism for monitoring and reporting greenhouse gas emissions and for reporting other information at national and Union level relevant to climate change and repealing Decision No 280/2004/EC, http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32013R0525&from=EN
[(2)] Commission Implementing Regulation (EU) No 749/2014 of 30 June 2014 on structure, format, submission processes and review of information reported by Member States pursuant to Regulation (EU) No 525/2013 of the European Parliament and of the Council, http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1503587972354&uri=CELEX:32014R0749

outcome of the system provides data for the evaluation of progress towards EU and international commitments, as per Article 21 of MMR and 4 and 12 of the UNFCCC and 3 of the Kyoto Protocol.
In accordance with Article 26(1) of Regulation (EU) No 525/2013, the Climate Change Committee established under Article 3 of Regulation (EU) No 182/2011 assists the Commission. The Committee is composed of representatives of the Member States and chaired by a representative of the Commission.
Working Group 2 'Implementation of the Effort Sharing Decision, Policies and Measures and Projections' was established under the Climate Change Committee as a regular body for exchange of information on projections and policies and measures between the Commission, the EEA and the Member States.

Figure 1.1 Union System for Policies and Measures and Projections.



Source: EC (2015)

1.2 Reporting requirements

Article 14 of the MMR and Article 23 and Annex XII of its Implementing Regulation set out the details for Member States to provide information on national GHG projections. Every two years starting from 2015 MS have to report GHG projections and accompanying information to the European Union.

The main mandatory elements of this reporting obligation are:

- GHG projections reported by gas (Total GHGs, Total ETS GHGs, Total ESD GHGs, CO_2, CH_4, N_2O, HFC, PFC, SF_6, NF_3)
- For the reference year 2015, 2020, 2025, 2030 and 2035
- Split by sectors in line with the common reporting format (CRF) format

- Sectoral split into ETS and ESD emissions
- Report a with existing measures scenario (WEM)
- Provision of a model factsheet
- Provision of a sensitivity analysis of the total GHG
- Provision of a description of methodologies, models and underlying assumptions
- Provision of input and/or output parameters
- the impact of policies and measures identified pursuant to Article 13indicators, if used

Where available, voluntary reporting items are:
- With additional measures scenario (WAM)
- Without measures scenario (WOM)
- Intermediate years

1.3 Scope of the QA/QC

The European Commission (DG CLIMA) is responsible for coordinating QA/QC activities on GHG projections at EU level and to ensure that the objectives of the QA/QC programme are fulfilled (see ETC Technical Paper 2017/9). The European Environment Agency (EEA) is responsible for the annual implementation of the QA/QC procedures and is assisted by the ETC/ACM.
The data quality objectives pursued by this QA/QC procedure are based on the core principles of data quality: transparency, completeness, consistency, comparability and accuracy. These quality principles have been initially defined by the IPCC to characterise the quality of historical emission inventories. They have a slightly different scope in the context of emission projections.

Transparency: means to ensure that transparent information is provided on underlying assumptions, methodologies used and sensitivity analysis performed in MS' national projections to enable further assessment by users of the reported information and for the purpose of the compilation of Union GHG projections.

Completeness: means to ensure that projections are reported by MS for all years, sources and sinks, gases and sectors as required under the MMR so that projections are available for the entire EU area to enable further assessment by users of the reported information and for the purpose of the Union GHG projections compilation (see also reporting requirements in Chapter 1.2).

Consistency: means to ensure that projections are reported by MS for all years, sources and sinks, gases and sectors as required under the MMR so that projections are available for the entire EU area to enable further assessment by users of the reported information and for the purpose of the Union GHG projections compilation.

Comparability: means to ensure that national estimates of projected emissions and removals reported by MS are comparable across MS. The allocation of different sources and sink categories by gas follows the split in accordance with the MMR and recommendations by the Commission with regard to projections horizon, reference year (starting year), ETS/ESD spilt, EU policies and measures to be taken into account and harmonised key assumptions are followed as appropriate.

Accuracy: means that projected estimates are accurate in the sense that they are plausible and neither systematically over- nor underestimated as far as can be judged and that uncertainties inherent to the methodology and input data are reduced as far as practicable. In addition, it should be ensured that an accurate aggregation of sectors for national GHG projections and an accurate aggregation of MS for the Union GHG projections are provided.

An additional quality principle used in this context is **timeliness** and it means that national GHG projections are submitted by 15 March for each reporting year in accordance with the MMR.
Further details on the QA/QC procedure are provided in the ETC Technical Paper 2017/9.

2 Summary of the results

In the 2017 reporting cycle a significant improvement in the quality of the submissions compared to the 2015 reporting year can be seen. The general completeness and the completeness of the time series in terms of mandatory reporting requirements such as sectors, years, gas split, parameters etc. has substantially increased. On the other hand, less voluntary information (especially the WAM and WOM scenarios) was reported than in the years before. There was no improvement in terms of timeliness of the submissions as elaborated below.

The general consistency and comparability of the data is much better than in 2015, this was illustrated by the correct application of units and more consistent ETS/ESD splits, but also in the harmonisation with historical data. The latter had resulted in reference year calibrations in previous years, but in 2017 no calibrations of MS data were necessary.

Automated checks on EEA's Central Data Repository (CDR) were applied for the first time:

- Global Warming Potential (GWP)/GHG unit check - checking whether internationally agreed GWP according to 2006 IPCC Guidelines were used in MS' submissions and whether GHG were reported in the correct unit.
- Sum check - checking that disaggregated emission projections by gas, sector equal the total sum reported by MS. If the difference is smaller than 0.25 % the result is labelled as 'warning' if the difference is bigger that 0.25 % the result is labelled as 'error'.

A majority of Member States still reported incorrect sums which were mostly explained by transcription errors or errors in the sum formulas in the reporting template.

The trend and outlier checks during the QA/QC process either led to corrective actions by Member States as they improved on data inconsistencies or the Member States provided clarifications for outliers or deviations from historical trends which are often not presented in the accompanying reports.

All Member States provided parameter data, but very often different units instead of default units were applied. Also recommended parameter values provided by the Commission were only used by part of the Member States.
The progress in the MS reporting is also visible in the decreased number of questions per Member State but and total number of questions.

As in previous reporting years a number of major challenges remain. This includes an apparent lack of internal Member States quality control procedures to ensure that the reported data is correct, the timeliness of the submissions, under reporting of voluntary elements, and insufficient transparency (e.g. very short, non-transparent reports submitted, missing information on links between GHG projections and policies and measures).

3 Results

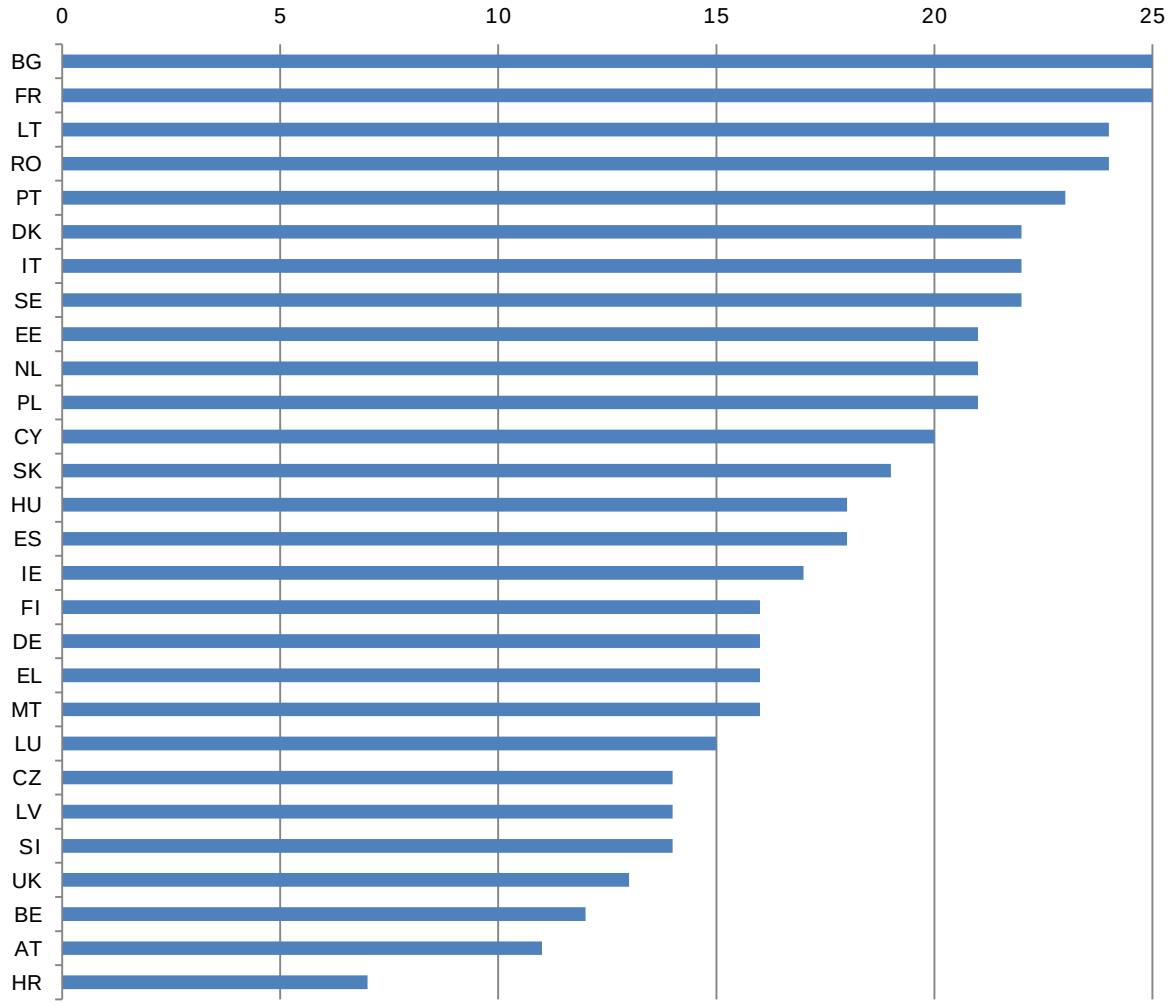
In the reporting year 2017, 28 Member States plus Norway submitted projections in accordance with Art. 14 of the MMR. This report focuses on the 28 EU Member States, with results for Norway presented separately in chapter 5. It should be noted that only greenhouse gas (GHG) projections that have been reported before end of June have been considered in this assessment and the results of the assessment refer to the draft final data-set as of 4 July 2017.

3.1 Communication with Member States

During the QA/QC procedure in 2017, the ETC/ACM sector experts raised in total 506 questions to the Member States' experts (compared to 728 questions in 2015). 85 % of these questions could be solved directly with the Member States' experts in the communication process which is an increase by 10 % compared to 2015. The remaining 15 % could not be solved because Member States preferred not to resubmit again, or for minor issues the Member States delegated the correction to the ETC/ACM. In the case of Cyprus the ETC/ACM did not receive any response during the QA/QC, so all issues remain open. However, they informed the EC and the EEA that they will provide updated submissions in March 2018.
When an issue could not be solved in this year's procedure and it was deemed rather insignificant by the ETC/ACM sector expert, the finding was translated into a recommendation for future submissions. All issues that were solved by the ETC/ACM sector experts were communicated to the MS' experts either in the communication log file or the MS feedback document which was distributed after the closure of the QA/QC procedure of the ETC/ACM.

Figure 3.1 presents the number of questions per Member State. On average the ETC/ACM asked 18 questions per Member State which is a significant reduction compared to 2015, when 27 questions per MS were asked. However, the number of questions sent to a Member State is not necessarily an indicator for the quality, as in many cases questions are grouped if a similar issue was detected for different sectors in order to reduce the number of similar questions. In addition, the ETC/ACM experts inserted findings for checks which were passed successfully in order to inform the Member State.

Figure 3.1 Number of questions per Member State



The majority of the questions were related to completeness (109 questions) and consistency (92), but also the sum check triggered 81 questions (Figure 3.2). Therefore, it can be concluded that the initial submissions provided by the Member States before the QA/QC are often incomplete and lacking consistency. However, in the course of the QA/QC the majority of Member States provided updated and additional information so the overall completeness and consistency was substantially improved.

Figure 3.2 Number of questions per QA/QC check

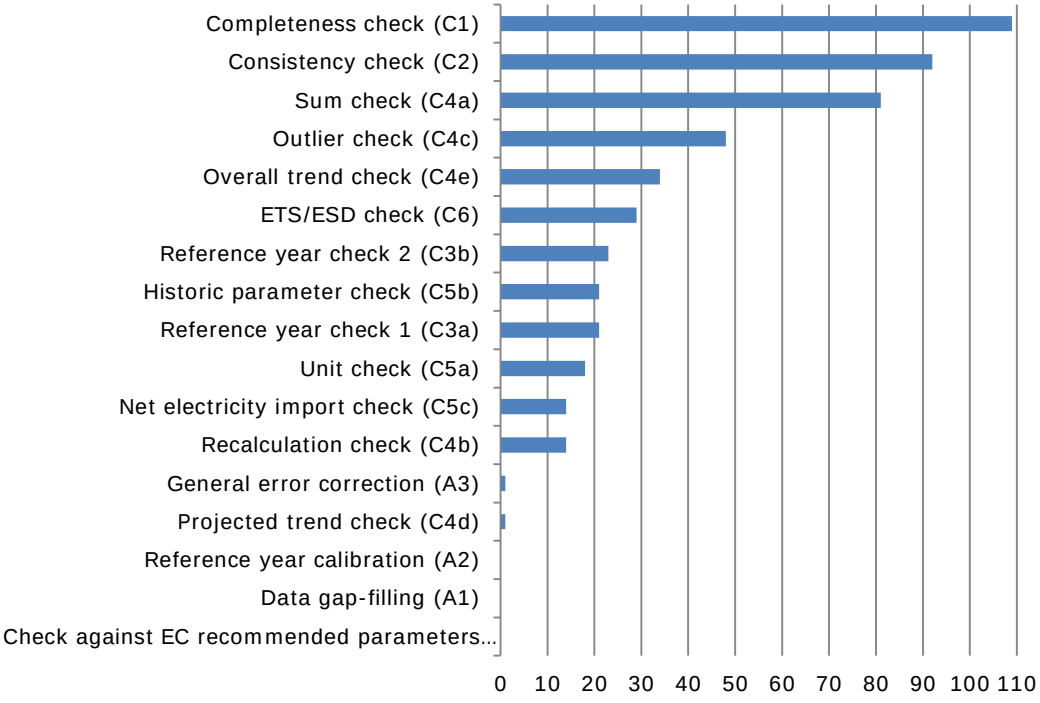
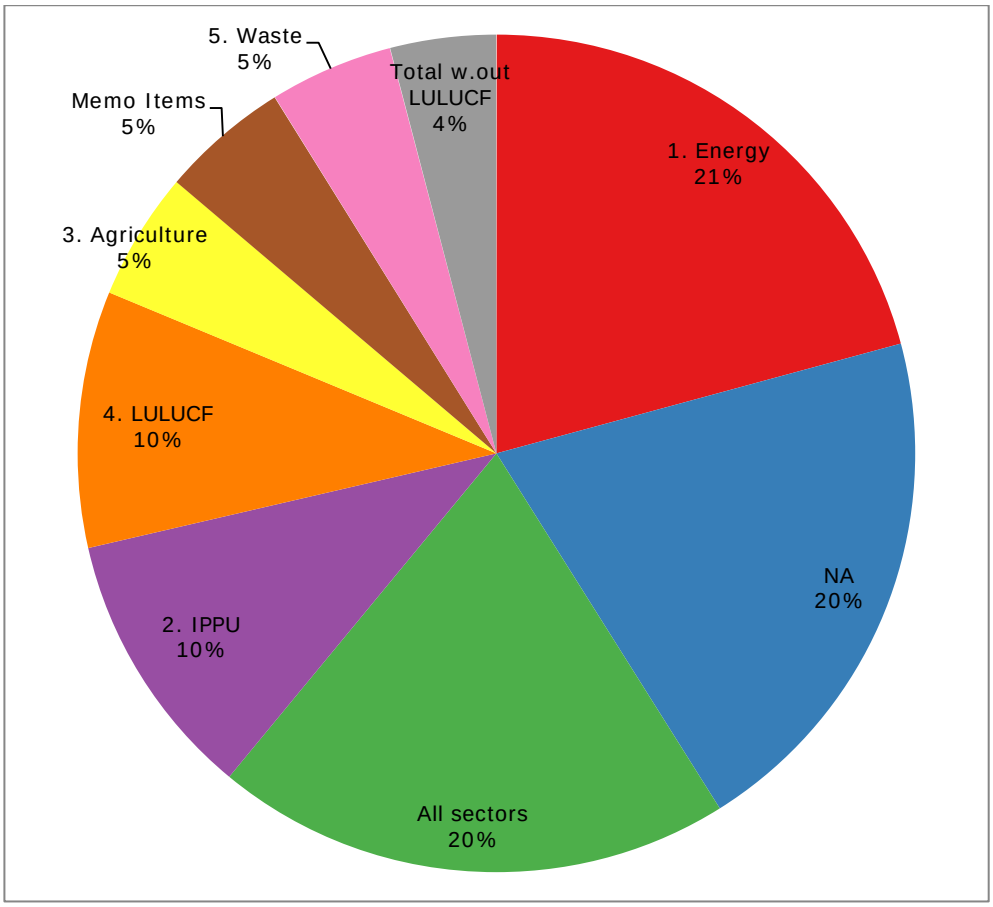


Figure 3.3 shows how the questions are distributed across the different sectors. Most of the questions were related to the Energy sector. With 20 % there is a large share of "NA" (not applicable) questions which includes general questions regarding the submission (e.g. no model factsheet provided). A large amount (20 %) of questions is concerning all sectors (e.g. inconsistent use of notation keys, systematic sum errors). The sectors LULUCF and Industry cover 10 % of the questions each.

Figure 3.3 Questions per sector



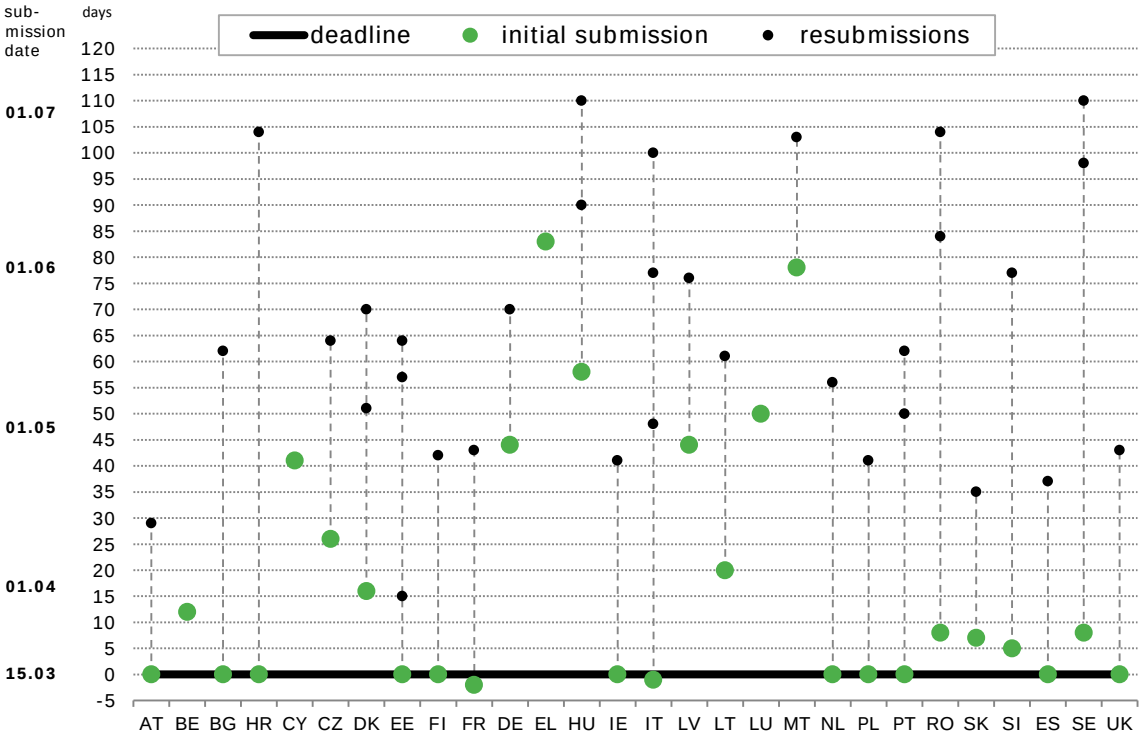
3.2 Completeness and Timeliness

3.2.1 Date of submission and resubmissions

13 Member States submitted their projections before or on the official deadline of 15 March 2017 (Austria, Bulgaria, Croatia, Estonia, Finland, France, Ireland, Italy, Netherlands, Poland, Portugal, United Kingdom and Spain). This is a slight improvement compared to 2015, when 12 Member States had reported their projections by 15 March. Nine Member States (Belgium, Cyprus, Czech Republic, Denmark, Lithuania, Romania, Slovakia, Slovenia, and Sweden) submitted within six weeks after the deadline. All other submissions were received by June 06 which is an improvement compared to 2015, when all Member States reported their first submissions by end of July. Figure 3.4 presents timeliness of submissions in 2017 by EU Member States. The first submissions are marked as green dots. As can be seen, the majority of Member States provided resubmissions (black dots) in the course of the QA/QC procedure. Only four countries did not resubmit new data (Belgium, Greece, and Luxembourg as a resubmission was not necessary, Cyprus did not reply during the QA/QC). Some Member States even provided several resubmissions; encouraged by the ETC/ACM they followed-up the issues and applied corrections directly during the process. On average the time between first

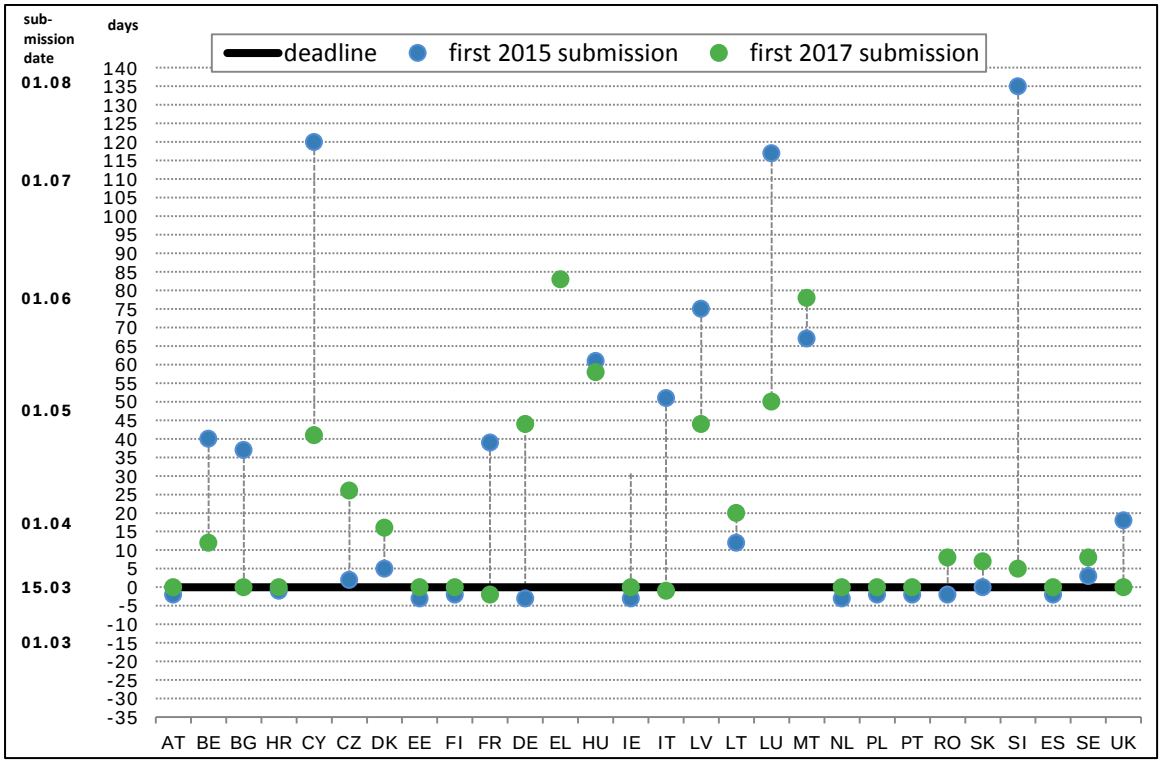
submission and final resubmission took about 46 days which is an improvement compared to 2015 when the average time was 69 days. The majority of MS resubmitted the revised datasets between April and June.

Figure 3.4 Timeliness of submissions in 2017 by EU Member States



10 Member States have submitted earlier in 2017 compared to 2015. However, six out of these 10 MS were not able to meet the reporting deadline: Belgium, Cyprus, Hungary, Latvia, Luxembourg and Slovenia (Figure 3.5). There were some Member States which performed poorer in 2017 regarding timeliness of the first submissions than in 2015 and also missed the deadline: Czech Republic, Denmark, Germany, Lithuania, Malta, Romania, Slovakia and Sweden.

Figure 3.5 Comparison of timeliness of the first submission in 2017 compared to 2015



3.2.2 General completeness of submissions

The completeness of mandatory information (Table 3.1) has improved for most Member States in the reporting year 2017. Very high completeness is already achieved in terms of sector split, GHG split (all MS), mandatory-WEM scenario (all MS) and provision of parameters (all MS). Two MS, Cyprus and Portugal, did not update their projection compared to the last reporting cycle in 2015. Model descriptions were provided by 26 Member States, except for Cyprus and Poland which could be clarified in the case of Poland during the QA/QC procedure as no models are used in the projections. Cyprus did not reply to the findings raised by the ETC/ACM, therefore the reason for non-reporting could not be clarified. Four Member States did not provide information on a sensitivity analysis (Bulgaria, Luxembourg, Malta, the Netherlands) which is mostly explained in the projections report. Regarding the report Luxembourg did not provide a report, some countries compile a consolidated report for projections and policies and measures (Art. 13 of the MMR) and therefore uploaded the reports in the PaMs folder only. However, compared to the 2015 reporting there are substantial improvements in overall completeness of the submissions, e.g. in 2015 the sensitivity analysis was only reported by 19 Member States, while for this round sensitivity analyses were provided by 25 Member States.

The completeness of voluntary information reported was substantially lower in 2017 compared to 2015, e.g. only eight Member States reported on indicators. However, during the QA/QC procedure several countries replied that they plan to report on indicators in the next years. In the 2017 reporting year for the first time estimates could be reported for the year 2040, which was done by four Member States. Regarding the scenarios only 17 Member States reported a WAM scenario, and only five reported a WOM scenario. This is a decrease in completeness of voluntary information, as in 2015 20 Member States reported a WAM, six Member States reported a WOM scenario.

It is important to note that this table presents the results **after** the QA/QC procedure which means that this includes information only for the (improved) resubmissions.

Table 3.1 Overview on completeness of reporting in 2017

	Updated projections	Required sector split	Required GHG split	Scenarios			Provision of parameters	Sensitivity analysis	Model factsheet/ description	Report	Provision of indicators	Reporting of the year 2040
AT				WEM								
BE				WEM	WAM							
BG				WEM								
HR				WEM	WAM	WOM						
CY				WEM	WAM	WOM						
CZ				WEM	WAM							
DK				WEM	WAM					*		
EE				WEM	WAM							
FI				WEM	WAM					*		
FR				WEM								
DE				WEM	WAM							
EL				WEM								
HU				WEM	WAM	WOM						

	Updated projections	Required sector split	Required GHG split	Scenarios			Provision of parameters	Sensitivity analysis	Model factsheet/ description	Report	Provision of indicators	Reporting of the year 2040
IE				WEM	WAM							
IT				WEM								
LV				WEM	WAM					*		
LT				WEM	WAM							
LU				WEM	WAM							
MT				WEM						*		
NL				WEM	WAM					*		
PL				WEM								
PT				WEM								
RO				WEM	WAM	WOM						
SK				WEM	WAM	WOM						
SI				WEM								
ES				WEM								
SE				WEM								
UK				WEM	WAM							

Legend:	
	Yes, reported
*	Reported in PaM folder
	Not reported because not used
	Not reported / (mandatory reporting items)
	Not reported (voluntary reporting items)

Table 3.2 summarizes the completeness of mandatory emissions data, by gas, submitted at a two-digit IPCC sector level. The table shows the number of countries, from the maximum of 28 (EU-28 MS), that have submitted the mandatory data for the year 2020.

Table 3.2 Number of countries that reported emissions data per sector and per gas for the mandatory year 2020

Category	CO2 (kt)	N2O (kt)	CH4 (kt)	HFC (ktCO2e)	PFC (ktCO2e)	SF6 (ktCO2e)	NF3 (ktCO2e)	Total GHGs (ktCO2e)	Split to ETS and ESD GHGs (ktCO2e)
1.A. Fuel combustion	28	28	28	24	23	24	23	28	28
1.B. Fugitive emissions from fuels	27	27	27	23	22	22	22	27	27
1.C. CO2 transport and storage	25	23	23	20	20	20	20	24	25
2.A. Mineral Industry	28	25	25	24	24	24	21	28	27
2.B. Chemical industry	27	27	27	25	24	24	20	27	27
2.C. Metal industry	28	26	28	25	25	24	21	27	27

Category	CO2 (kt)	N2O (kt)	CH4 (kt)	HFC (ktCO2e)	PFC (ktCO2e)	SF6 (ktCO2e)	NF3 (ktCO2e)	Total GHGs (ktCO2e)	Split to ETS and ESD GHGs (ktCO2e)
2.D. Non-energy products from fuels and solvent use	28	24	24	23	24	24	20	28	28
2.E. Electronics industry	25	26	26	25	26	26	22	27	27
2.F. Product uses as substitutes for ODS(2)	25	25	25	28	27	25	21	28	28
2.G. Other product manufacture and use	25	28	25	25	25	28	21	28	28
2.H. Other (please specify)	26	26	26	24	24	24	20	25	26
3.A. Enteric fermentation	24	23	28	21	21	21	20	27	27
3.B. Manure management	24	28	28	21	21	21	20	27	27
3.C. Rice cultivation	23	23	26	21	21	21	20	25	25
3.D. Agricultural soils	23	28	25	21	21	21	20	27	27
3.E. Prescribed burning of savannahs	23	24	24	21	21	21	20	24	24
3.F. Field burning of agricultural residues	23	25	25	21	21	21	20	25	25
3.G. Liming	27	22	22	21	21	21	20	27	27
3.H. Urea application	27	22	22	21	21	21	20	27	27
3.I. Other carbon-containing fertilizers	25	23	23	22	22	22	21	25	25
3.J. Other (please specify)	25	25	25	22	22	22	21	25	25
4.A. Forest land	27	27	27	21	21	21	20	26	21
4.B. Cropland	27	27	24	21	21	21	20	26	21
4.C. Grassland	27	26	25	21	21	21	20	26	21
4.D. Wetlands	27	25	23	21	21	21	20	26	21
4.E. Settlements	26	26	23	21	21	21	20	25	20
4.F. Other Land	25	24	23	21	21	21	20	24	20
4.G. Harvested wood products	26	22	23	21	21	21	20	26	21
4.H. Other	25	24	23	21	21	21	20	24	21
5.A. Solid Waste Disposal	25	23	28	21	21	21	20	28	28
5.B. Biological treatment of solid waste	25	28	28	21	21	21	20	28	28
5.C. Incineration and open burning of waste	27	27	27	21	21	21	20	27	27
5.D. Wastewater treatment and discharge	24	28	28	21	21	21	20	28	28
5.E. Other (please specify)	26	24	26	21	21	21	20	26	24
Memo items	24	24	24	21	20	20	20	25	

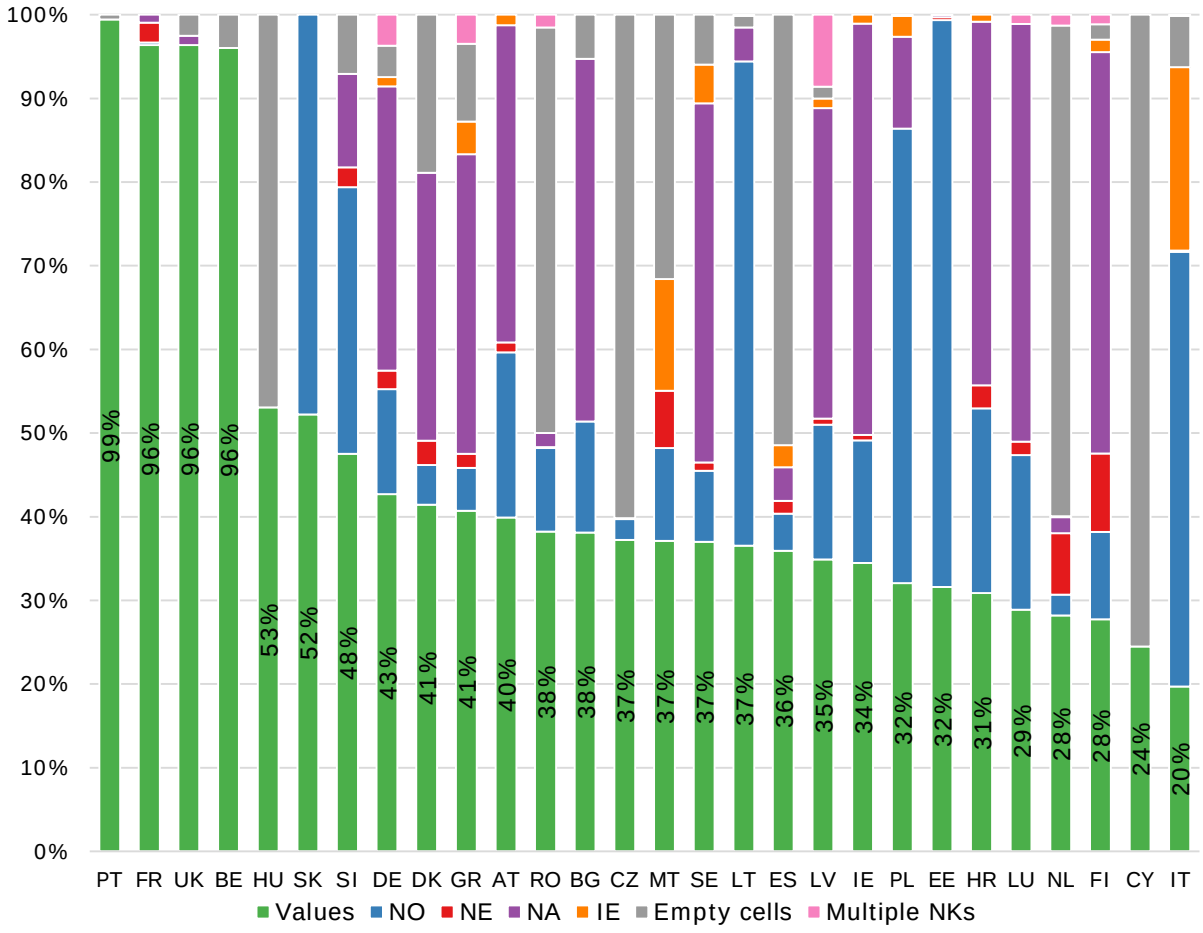
Note: The color intensity implies the degree of completeness. Dark green = high level of completeness, light green = lower level of completeness

The Industrial Processes (2) sector was the most complete in terms of emissions data reported (25.3 out of 28 on average), followed by the Energy (1) and Waste (5) sectors (24.4 and 24.0 respectively), whereas the Agriculture (3) and LULUCF (4) sectors were less complete (23.2 and 22.7 respectively). Reporting of memo items had the lowest completeness rate (21.7 out of 28 on average).

Figure 3.6 illustrates the use of the standard IPCC notation keys (not occurring (NO), not estimated (NE), not applicable (NA), included elsewhere (IE), and combinations of these notation keys), as well as empty cells in the different Member States. The graph shows that with few exceptions (such as Belgium, France, Portugal and the United Kingdom), notation keys and empty cells make up for about 50 to 60% of the total mandatory data that have to be reported. The most commonly used notation

keys are NO (not occurring) and NA (not applicable). As can be seen the share of empty cells is still high in many countries (Cyprus, Czech Republic, Hungary, the Netherlands and Spain) which constitutes a lack of completeness in the reporting.

Figure 3.6 Use of notation keys per Member State (WEM scenario and mandatory reporting years)



3.2.3 Completeness of time series and gap-filling

All Member States reported the mandatory years 2015, 2020, 2025, 2030 and 2035. Intermediate years were reported voluntarily by 21 Member States, for the other seven countries the data for the intermediate years were gap-filled by linear interpolation by the ETC/ACM. Missing mandatory years until 2035 were gap-filled by a linear trend extrapolation (applied to Cyprus). Table 3.3 shows the Member States for which interpolation or extrapolation has been carried out and to which years it was applied.

On the right side of the table other gap-filling actions are listed which mainly concern the gap-filling of International Bunkers or LULUCF due to non-reporting. The method applied for these sectors is the constant application of the latest inventory value for the whole time series. Gap-filling in this sense also includes the correction of sums of sub-sectors which were not correctly reported by Member States. The ETC/ACM has gap-filled the ETS/ESD split in consultation with the countries when it was not reported. For Germany the year 2015 was gap-filled.

Table 3.3 Completeness of time series and gap-filling of MS projections

WEM / Total GHGs	2014	2015	2016-2019	2020	2021-2024	2025	2026-2029	2030	2031-2034	2035	2040	other gap-filling and corrections		
												Total GHG	ETS	ESD
AT														
BE												M.Intl. Aviation EU ETS (RY ga-filled)		
BG			I		I		I		I			M.Intl. Aviation EU ETS (gap-filled)	1.A.3.a deleted from Total w.out LULUCF	Sector 4. Removed from ESD emissions
HR			I		I		I		I			M.IB. Aviation gap-filled, 3. New interpolation, 4. Gap-filled for WAM and WOM		
CY	I								E	E		Gap-filling of sector 4., M.IB. Aviation and M.IB. Navigation		
CZ			I		I		I		I					
DK												Total w.out LULUCF corrected for 2016, because error in 1.A.4.a		
EE														
FI												Gap-filling of 4., M.IB. Aviation, M.IB. Navigation		
FR			I		I		I		I					
DE													Interpolated (2015)	Interpolated (2015)
EL												Correction of Total w.out LULUCF due to error in SF6, and correction of 4.	1.A.3a deleted from Total w.out LULUCF	
HU												Interpolation corrected for M.IB. Aviation		
IE														
IT			I		I		I		I					
LV												Correction of RY for 1.A.4., 1.A.5.	M.IB. Aviation removed from ETS	Correction of RY for 1.A.4., 1.A.5., M.IB. Aviation removed from ESD
LT														
LU												Correction of M.IB. Navigation		Sector for 4. removed from ESD emissions

MT												Gap-filling of sector 4.	1.A.3a deleted from Total w.out LULUCF	
NL									I			Gap-filling of M.IB. Aviation, M.IB. Navigation, 4.	Interpolation of intermediate years	Interpolation of intermediate years
PL	I											Gap-filling of M.IB. Aviation, M.IB. Navigation		
PT			I		I		I		I			Gap-filling of M.IB. Aviation, M.IB. Navigation		
RO													Correction of sector 2 due to inconsistencies.	Correction of sector 2 due to inconsistencies.
SK													Correction of 1.A.5.	Sector for 4. removed from ESD emissions
SI												Gap-filling of 4., M.IB. Navigation	M.IB. Aviation removed from ETS	M.IB. Aviation, M.IB. Navigation removed from ESD
ES													1.A.3a deleted from Total w.out LULUCF	
SE			I		I		I		I					
UK														

Legend:	
	Reported
I	Gap-filling of intermediate years
E	Gap-filling extrapolation of mandatory information
	Not reported (Reporting not mandatory)
	Not mandatory if the reference year is 2015

3.3 Consistency and Comparability

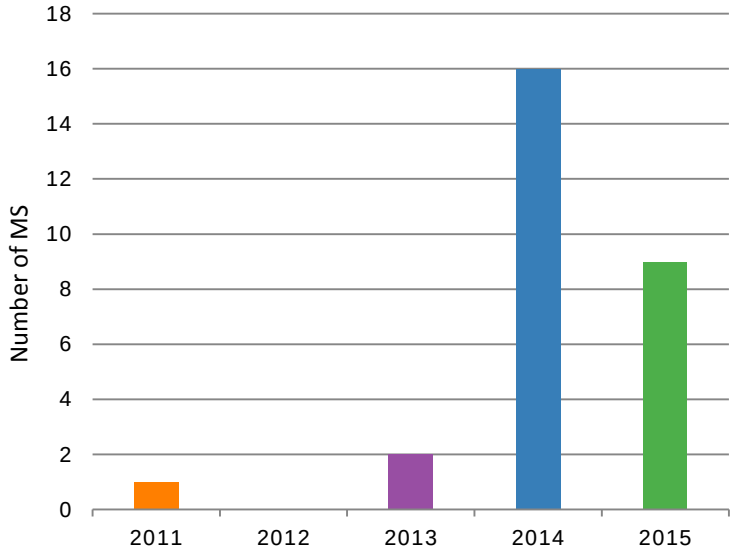
3.3.1 Units

This QA/QC check consisted of a Global Warming Potential (GWP) check as well as a unit check. In the 2017 submissions all Member States correctly applied the new GWP, therefore this check will no longer be necessary in the future QA/QC procedure. Regarding the units the check flagged 12 MS in total; however most of the flagged issues turned out not to be caused by unit errors, but helped to identify other consistency problems (e.g. summation errors, mistakes in the reporting template). This is a clear improvement compared to the 2015 submissions (three MS reported old GWP and two MS incorrect units).

3.3.2 Reference year

The majority of Member States chose the reference years (RY) close to the recent inventories, namely 2014 or 2015 (Figure 3.7). 16 Member States selected 2014 as RY, nine countries used the most recent inventory year 2015 as RY. Earlier RYs were reported by Cyprus and Poland (2013) and Portugal (2011). This is an improvement compared to 2015, when much earlier RYs were reported (e.g. 2008, 2010).

Figure 3.7 Reference year reported by Member States



AT	BE	BG	HR	CY	CZ	DK
2015	2014	2014	2014	2013	2014	2015

EE	FI	FR	DE	EL	HU	IE
2014	2014	2014	2014	2015	2015	2015

IT	LV	LT	LU	MT	NL	PL
2014	2014	2014	2015	2015	2014	2013

PT	RO	SK	SI	ES	SE	UK
2011	2014	2014	2015	2015	2014	2014

An important quality criterion is the time series consistency between projections and historical data (inventories). The reference year for the Union GHG projections in 2017 is 2015, as this is the latest inventory year available when projections were prepared. Figure 3.8 presents the percentage differences between the reported reference year for the projections and the respective value reported in the GHG inventory for each Member State. Two inventory versions were available to the

ETC/ACM for the RY check, the EU GHG inventory version of September 2016 [3] and the EU GHG inventory version of January 2017[4].
The version that was used for the check was selected based on following considerations:

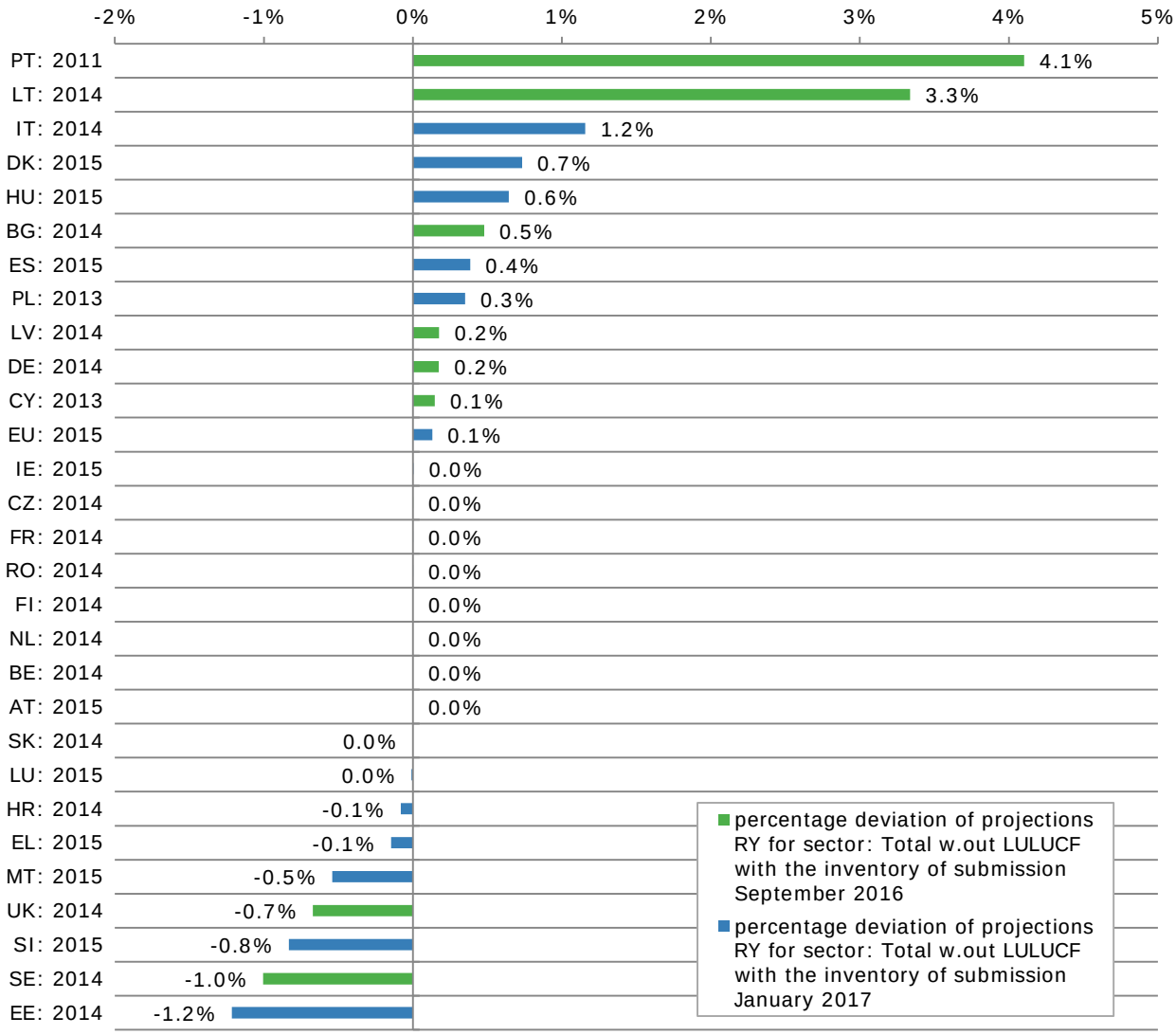
- Is the new inventory (submission 2017) available for the EU January dataset?
- Is the RY the same as the new inventory year (2015)?
- Does the MS mention the inventory data set on which the projections are based in the report?
- Which inventory suits better with the reported RY values?

In all other cases the standard approach according to the 2017 QA/QC procedure was applied and the newest inventory data available was considered.

As shown in Figure 3.8 the majority of the 2017 submissions are well harmonised with the historical data and no reference year calibration of the time series was necessary in 2017. Many MS have achieved even entire consistency with the most recent GHG inventory. The largest deviation (+4.1 %) from the historical data was identified for Portugal that selected 2011 as reference year and did not report updated projections in 2017. This was followed up by a discussion with the MS expert in which Portugal clarified that they were not able to provide an updated submission as the on-going projections project will be finalised not before the 2019 submission cycle. In accordance with the 2017 QA/QC procedure, the ETC/ACM did not to calibrate the dataset as the sectoral deviations were below the threshold of the sector-specific uncertainties, even though the total deviation exceeds the threshold of 3 %. For Lithuania the total deviation of more than 3 % which was caused by the Agriculture sector was clarified as well. Lithuania explained that the projections were harmonised with the GHG inventory which was resubmitted in October 2016. However, the other sectors were in line with the September 2016 version, therefore no RY calibration was carried out.
Compared to the 2015 reporting year a slight improvement can be seen, as in 2015 four Member States exceeded the 3 % threshold. For this reason the deviation of the EU reference year compared to the 2017 GHG inventory for the Total without LULUCF has decreased to 0.13 % (compared to 0.45 % in 2015) and the time series consistency of the Union projections has improved.

[3] The August 2016 submission of the EU GHG inventory represents the latest, official submission of the EU to the UNFCCC for 2016 and therefore constituted the most recent data set available when the RY in the MS projection was chosen to be 2014 or earlier. However, it has to be noted that the final submission for the EU GHG inventory 2016 still remains outstanding.
http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/9492.php
[4] The 2017 EU GHG inventory can be found at
http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/10116.php.
It has to be noted that since the QA/QC procedure of the 2017 projections tasks the initial submission from the MS in January 2017 has been superseded by later submissions and therefore it is - in the state of January 2017 - not accessible anymore.

Figure 3.8 Difference between total emissions of the reference years used by MS and the GHG inventory [5] (same year) for Total w.out LULUCF (CO_2.eq)

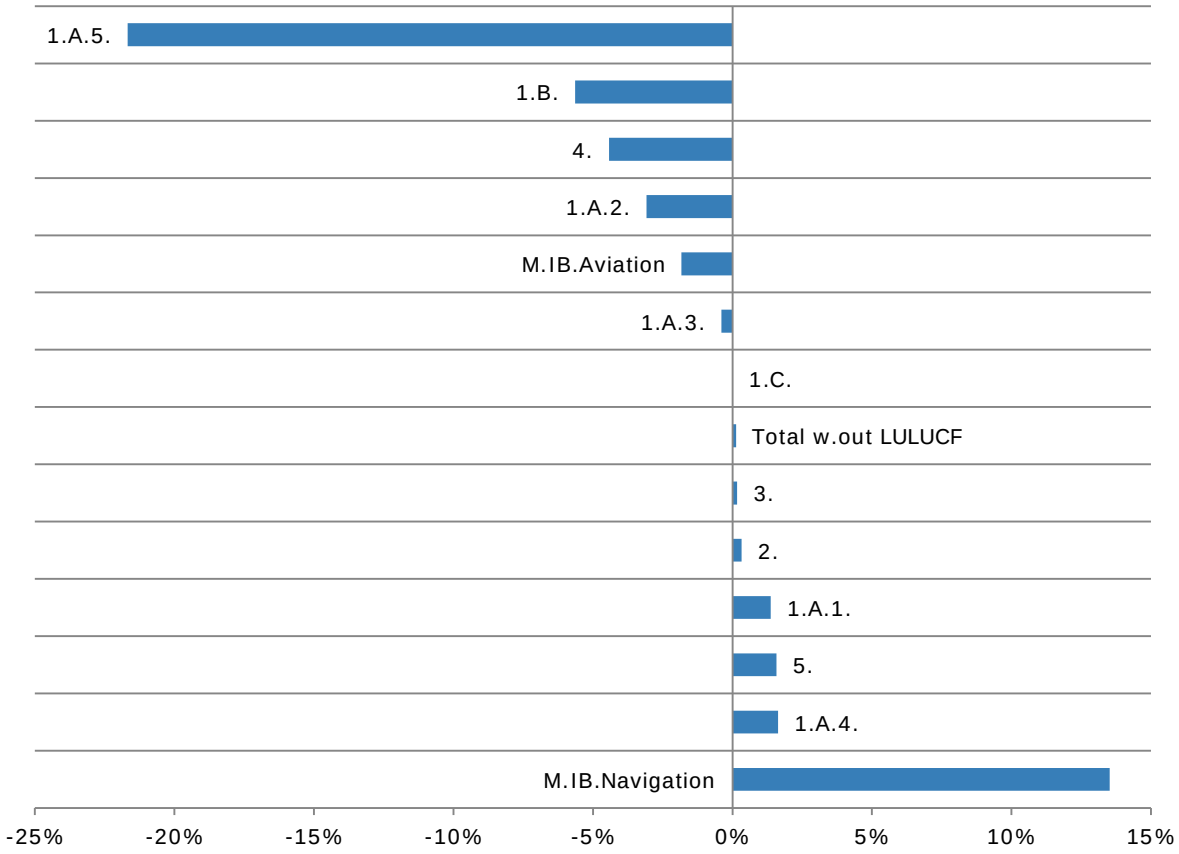


In the following figure (Figure 3.9) the percentage difference of the reference year for the Union GHG projections (2015) and the 2017 inventory is shown per sector. The highest deviations occur in sectors 1.A.5. (-22 %) and the Memo Item International Bunkers-Navigation (+14 %), which can be explained by non-reporting or the use of notation keys. Four Member States report emissions for 1.A.5. as "IE" (included elsewhere) as no sector-specific projections are available, but the sector is reported in the GHG inventory. Consequently, this leads to deviations in the sectors where these emissions are included (e.g. 1.A.4 or 1.A.1). The reason for the high deviations for the International Bunkers-Navigation needs to be further investigated and might be associated with the EU GHG inventory, as the MS reported reference year values are consistent with their GHG inventories. The deviation in sector 1.B. is caused by Poland and in sector 4. by Portugal. These issues were not followed up in the QA/QC because 1.B. was below the sector specific uncertainty of Poland and LULUCF is not part of the reference year calibration due to the high sectoral uncertainty (see Chapter

[5] Either the EU GHG inventory version of 15.01.2017 or 09.09.2016 was used.

4.2.2). A comparison with 2015 is not possible as in this year the sectors were aggregated differently (e.g. 1.A.1 and 1.B and 1.C were clustered).

Figure 3.9 Percentage difference of the EU reference year compared to the 2017 inventory by sector (for year 2015)



3.3.3 Sector allocation

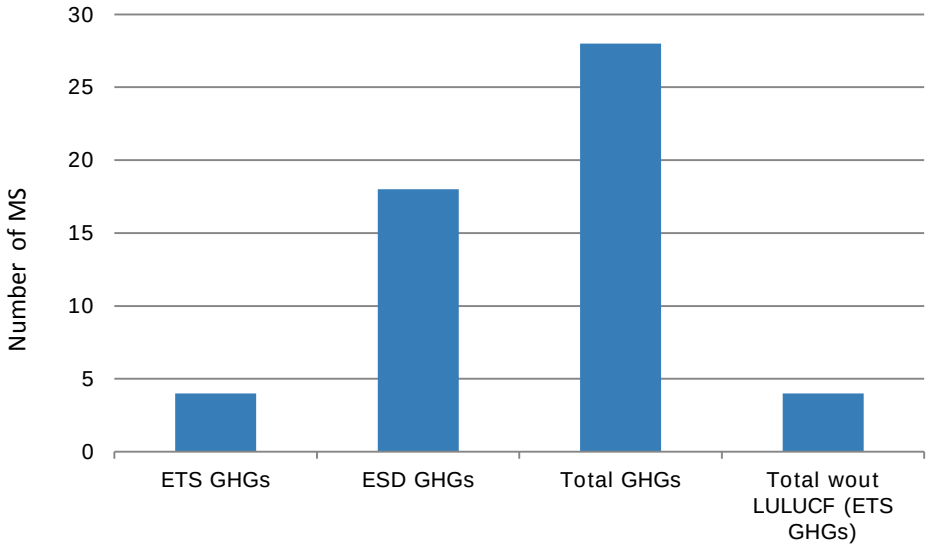
Sector allocation was identified as a large challenge in the 2015 reporting cycle, however in 2017 it has improved substantially. There still seems to be some confusion in reporting of the Memo Items "International Bunkers" and LULUCF which are sometimes reported under ETS and/or ESD. In such cases the ETC/ACM asked the countries to delete these sectors from ETS and/or ESD and only report them under Total GHGs and other gases if relevant.

More challenging for MS is the correct allocation of 1.A.3.a Domestic Aviation regarding the ETS/ESD split. This was already one of the major challenges in the 2015 reporting. For this reason the EEA and ETC/ACM prepared a guidance document on the correct reporting of the ETS/ESD split ("Draft guidance for reporting of ETS and ESD projections under the MMR", EEA 2017a, forthcoming[(6)]) which was shared with the MS in early 2017.
The reason why the calculation of ETS aviation projections on Member State level is difficult is because ETS aviation emissions are not related to inventory emissions of Member States, neither for domestic nor for international aviation: aviation operators are administered by single Member States

[(6)] Will be available at http://cdr.eionet.europa.eu/help/mmr

irrespective of the flight activities of these operators. As a result, the linking of inventory based aviation projections to ETS aviation projections leads to ambiguous information because ETS emissions from domestic aviation cannot be projected on MS level in a consistent way related to inventory emissions. However, if ETS emissions from domestic aviation are reported in the template, they are automatically summed up with ETS emissions from stationary installations. A mix of stationary and aviation ETS emissions is not useful for any further analysis, because of the reasons explained above. Therefore, it is necessary to focus separately on ETS emissions from stationary installations in GHG projections from Member States.
Under the ESD, only CH_4 and N_2O emissions from domestic aviation are covered, which are very low. This is why the reporting of ESD emissions from domestic aviation might be omitted in GHG projections. In the 2017 reporting this was taken into consideration by almost all Member States, only four Member States reported 1.A.3a emissions under ETS and included 1.A.3.a in the Total without LULUCF for ETS GHGs. 18 Member States allocated a portion of 1.A.3.a emissions in the ESD, but as this is a rather insignificant amount of emission this was not followed up in the QA/QC.

Figure 3.10 Reporting of sector 1.A.3.a domestic aviation



3.3.4 ESD and ETS emissions

The projected emissions have to be reported separately for ETS and ESD emissions for each source category[7]. In the QA/QC process, the proper linking of projections to historical ETS and ESD emissions and a consistent development of ETS and ESD emissions in future years in Member State projections is analysed.
In addition, after the QA/QC procedure, the ETS and ESD emissions from Member State projections are summed up to an EU projection. This projection of aggregated ETS and ESD emissions is important for the monitoring of effects of the EU policies to tackle climate change and the projections data are used in several reports of the EEA.
In the checking process, ETS splits are used as an indicator reflecting the share of ETS emissions of the Total GHG emissions. The reference years of ETS and ESD emissions in the projections should

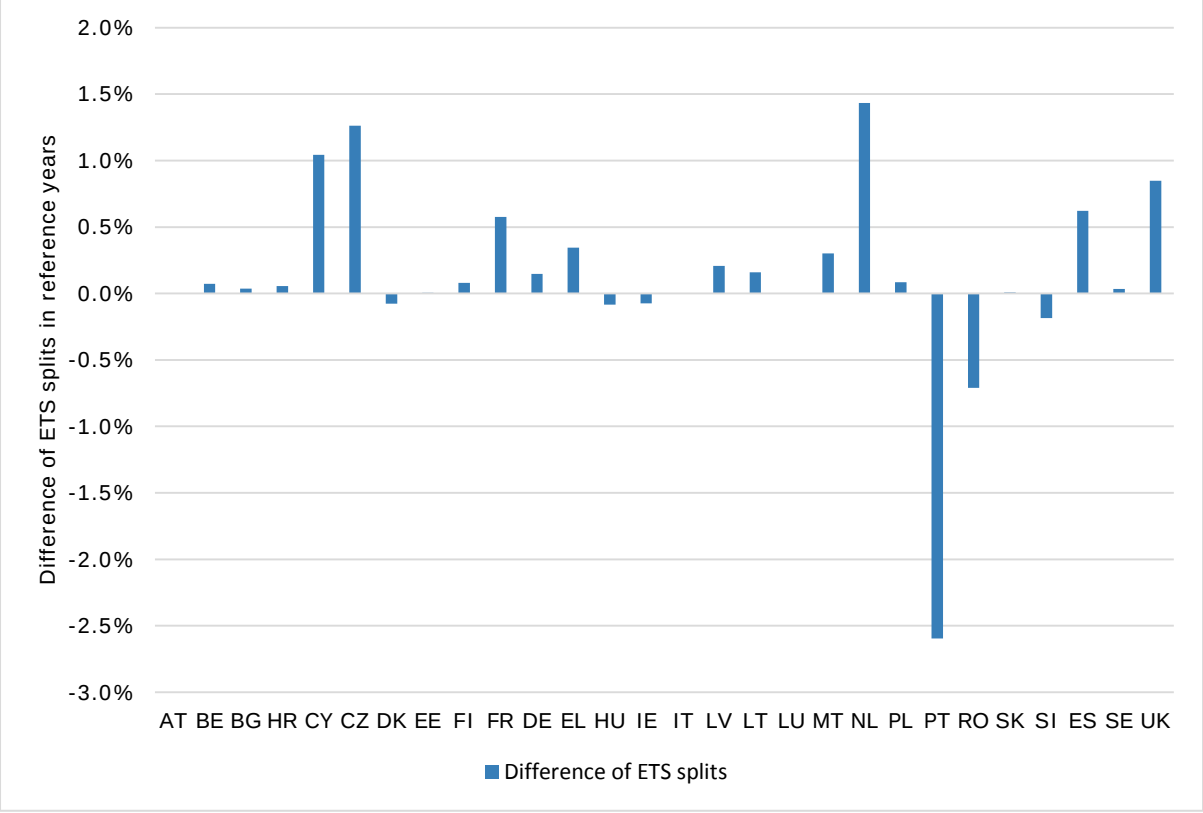
[7] Draft guidance for reporting of ETS and ESD projections available at: http://cdr.eionet.europa.eu/help/mmr This document will be updated in November 2017

match to historical ETS and ESD emissions. This implies that the ETS split used for the projections should be consistent with inventory data. In addition, the ETS split should change rather slowly along the timeline. High jumps or dips will trigger questions during the QA/QC, to ensure that such changes are based on realistic assumptions. Yet splits that remain completely constant over time will also be followed up by the ETC/ACM in order to ensure that the development of ETS and ESD emissions is projected in sufficient detail.
For these checks mentioned above, historical ETS splits were calculated based on the total verified emissions under the EU ETS[8] and GHG inventory data from 2017 submission. For historical ETS emissions on sectoral level, Member State reporting under Implementing Regulation (EU) No 749/2014, Annex V, have been taken into account. In this reporting, verified emissions under the EU ETS are compared to inventory emissions on subcategory level for the latest inventory year.
In the following the main results of the 2017 QA/QC procedure are presented.

1. ETS splits

In 2017 all MS reported ETS and ESD emissions in the GHG projections. In most GHG projections the reported reference year for ETS emissions match very well with the historical numbers from the GHG inventory, which is a strong improvement compared to projections reported in 2015.
Figure 3.11 shows the percentage differences between the historical ETS splits compared to those reported by MS for the respective reference years.

Figure 3.11 Difference of ETS splits for the reference years of total GHG projections compared to historic ETS splits in respective reference years



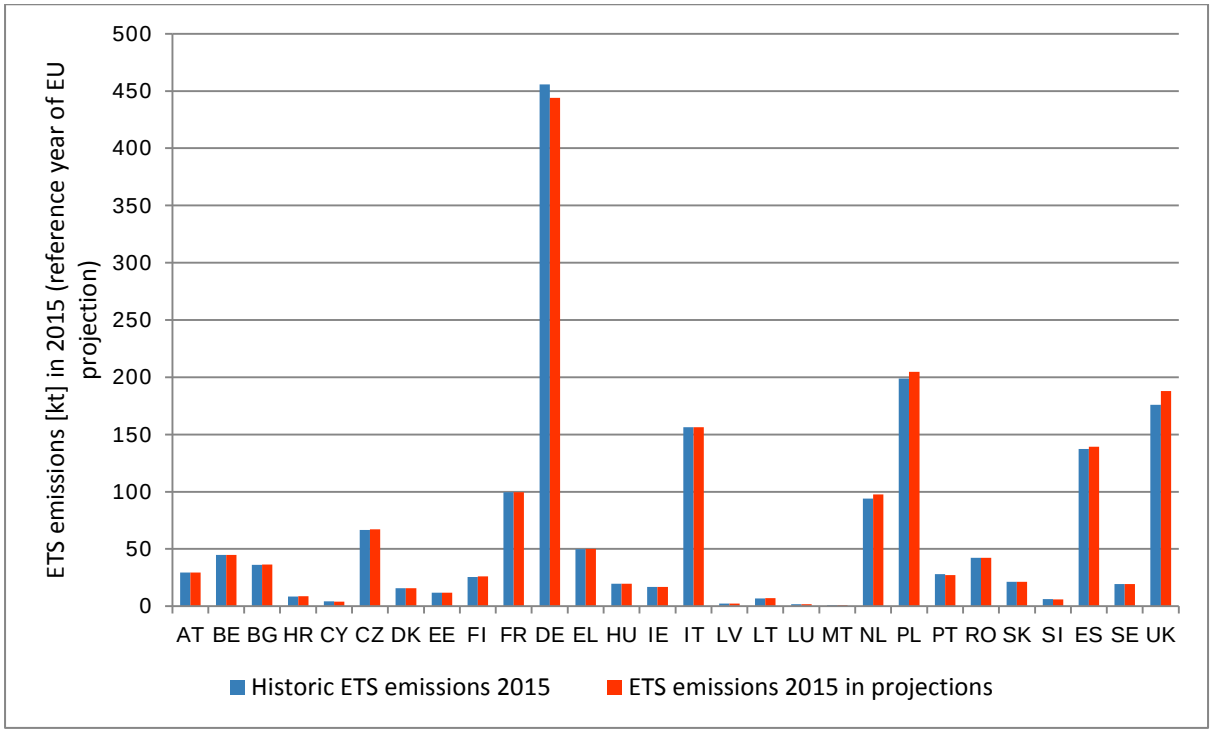
[8] from EEA EU ETS data viewer (EEA, 2017b): http://www.eea.europa.eu/data-and-maps/data/data-viewers/emissions-trading-viewer

Compared to the assessment of the 2015 submissions, the consistency of ETS splits increased considerably (see ETC/ACM Technical Paper 2015/10, chapter 5.2.4). The fact that the differences between historical ETS splits and the splits applied for the reference years decreased can be explained by increasing knowledge and awareness of ETS and ESD reporting in the projections. In addition, the reporting in 2017 was less challenging compared to 2015, as most Member States selected a reference year after 2013. For reference years after 2013, the scope of ETS emissions for reference years and projected years is clearly the same. Any reference year prior to 2013, needs an adjustment of the ETS split to the scope of the EU ETS of the third trading period 2013-2020 to ensure time series consistency.
The largest difference of the historical and reference year ETS split is identified for Portugal, apparently due to the reference year before 2013 (2011). A lower ETS split implies that the level of ETS emissions is starting at a lower point which might lead to an underestimation of future ETS emissions. As can be seen in Figure 3.11 there is a small tendency to higher ETS splits in the reference year compared to the historical data. However, the positive differences are below 1.5 % and mostly located in Member States with lower absolute emissions. In the following section, the effects of these splits are discussed regarding absolute emissions in the year 2015.

2. Absolute ETS and ESD emissions

The reference year of the aggregated EU projection dataset is 2015. For this reason it is necessary that historical ETS and ESD emissions are matching to those of the reference year, even if reference years in Member State projections are before 2015. In Figure 3.12 absolute ETS emissions are compared for the reference year of the aggregated EU projection (2015).

Figure 3.12 Absolute ETS emissions for the EU reference year (2015) compared to historical emissions



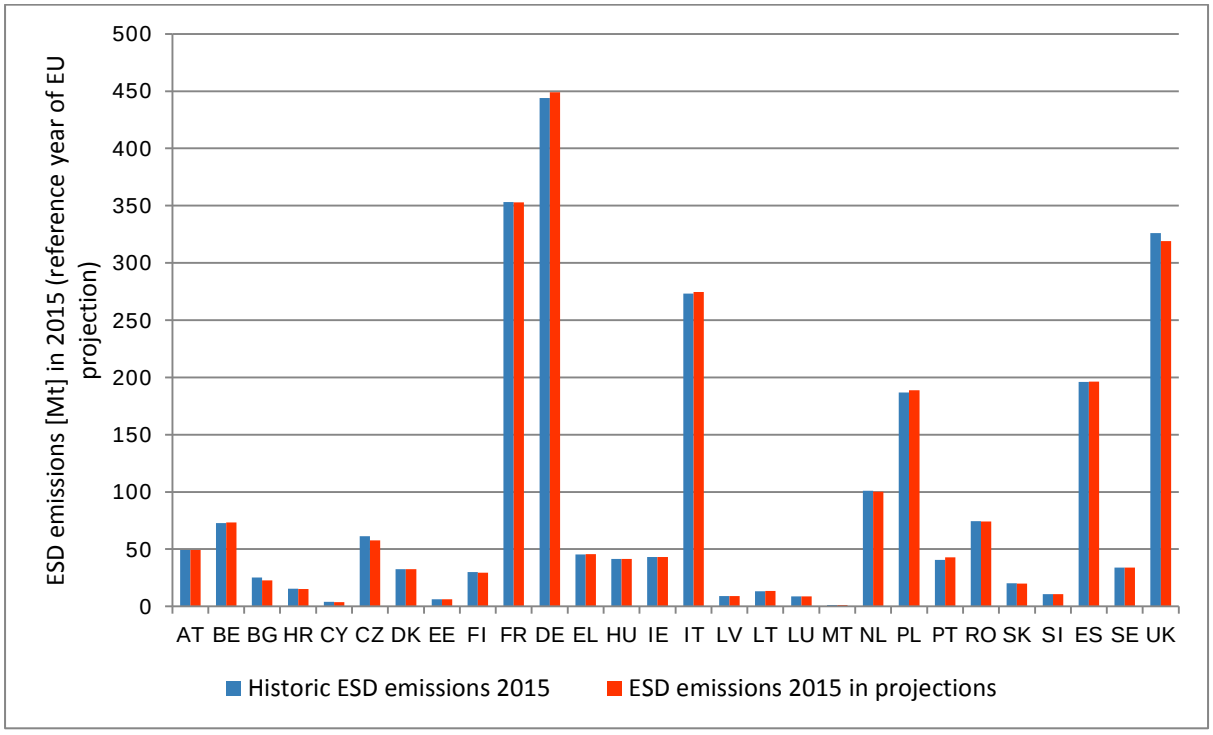
Note: No ETS data for 2015 has been provided by Germany, gap-filling by ETC/ACM.

The aggregate of ETS emissions of EU MS in 2015 is 1 789 Mt, higher by 0.7 % compared to historical ETS emissions (1 775 Mt). For the year 2016 the difference is even lower (0.3 %).

The projected level of absolute ETS emissions is important for the estimate of the amount of certificates which are needed in the ETS for the third trading period and for the period starting in 2021. These emissions are used in the "Trends and Projections in the EU ETS Report" (EEA, 2017c) for the estimate of the effect of the Market Stability Reserve.

In addition, the projected level of absolute ESD emissions is relevant as well to understand the functioning of the ESD system. In Figure 3.13 historical ESD emissions of the EU reference year (2015) are compared to the ESD emissions reported by Member State projections for 2015. Similar to the two figures before, MS projections are very close to the historical emissions. While historical ESD emissions add up to 2 519 Mt in 2015, ESD emissions in projections add up to 2 515 Mt for this year.

Figure 3.13 Absolute ESD emissions for the EU reference year (2015) compared to historical emissions



Note: No ESD data for 2015 has been provided by Germany, gap-filling by ETC/ACM.

In the "Trends and Projections Report" (EEA, 2017c) projected ESD emissions 2017-2020 are compared to latest annual emission allocation limits for each Member States. The difference between 2020 ESD emissions to Annual Emission Allowances (AEA) 2020 is relevant for the assessment. Similar to the situation in the ETS, a calculation of the use of AEA certificates is conducted to estimate the future dynamics under the ESD. In addition the amount of ESD emissions is relevant for political discussions on the possibility of Member States to reduce emissions after 2020.

3. Development of ETS and ESD emissions

ETS split changes (changes in proportion of ETS emissions to Total emissions) were calculated along the projected timeline to analyse the development of ETS and ESD emission projections and to check the time series consistency. Results are shown in Table 3.4.

Table 3.4 Changes in ETS splits from reference year to 2035 in WEM scenario [9]

	2015-ref year	2020-2015	2025-2020	2030-2025	2035-2030
AT	0%	-3%	0%	1%	1%
BE	-1%	0%	0%	2%	0%
BG	2%	2%	-2%	-1%	-1%
HR	0%	0%	-1%	0%	-2%
CY	1%	-4%	1%	1%	1%
CZ	0%	-4%	-2%	3%	1%
DK	0%	-2%	6%	3%	-1%
EE	-5%	3%	-1%	-4%	-1%
FI	-2%	2%	-4%	1%	0%
FR	-1%	3%	1%	1%	0%
DE	a)		2%	-1%	-3%
EL	0%	-6%	2%	-4%	-1%
HU	0%	1%	1%	1%	1%
IE	0%	-2%	1%	2%	3%
IT	0%	2%	0%	-2%	-1%
LV	0%	-1%	0%	1%	2%
LT	0%	3%	0%	1%	0%
LU	0%	-2%	0%	0%	0%
MT	0%	-21%	-2%	-2%	0%
NL	0%	-4%	3%	0%	-2%
PL	0%	-1%	-1%	-2%	0%
PT	4%	-4%	-1%	-1%	-1%
RO	0%	-1%	-2%	1%	0%
SK	0%	-2%	0%	0%	0%
SI	0%	4%	-1%	-1%	0%
ES	0%	2%	-2%	-1%	0%
SE	0%	4%	2%	1%	0%
UK	-2%	-8%	-2%	1%	0%

Note: a) No ETS data for 2015 has been provided by Germany.
Source: MMR MS Projections 2017.

Legend:	
	decreases of ETS splits in 5-year steps of more than 3%
	increases of ETS splits in 5-year steps of more than 3%

Higher jumps in ETS splits have been highlighted in Table 3.4: Decreases of more than 3 % in blue and increases of more than 3 % in orange. For nearly all of these higher changes explanations have been given by Member States. For smaller countries the closure or start-up of a single plant might

[9] This analysis is based on reported numbers, not on QA/QC checked numbers.

affect heavily the share of ETS emissions. With this, projected ETS splits might change considerably from one year to the next. This is e.g. the case for Malta. For Denmark the strong increase in emissions starting in 2020 is due to the expiry of policies and measures actually in place, which still need a political agreement for their continuation. This increase is a considerable contrast to the reduction of ETS emissions which has been projected in former GHG projections.

4. ETS and ESD emissions on source category level

Partially, projections of ETS splits in main source categories have been compared to reported ETS splits in Annex V tables of Implementing Regulation (EU) No 749/2014 of the GHG inventory, especially for the discussion of specific effects in some Member States. This was the case for example for the treatment of recovered CO_2 emissions in ammoniac production. A general comparison of ETS splits between projections and inventory submission was still hindered by the fact that reporting in Annex V tables is not completely harmonized: often ETS emissions are aggregated or not located to specific sectors, which prohibited a general comparison across all Member States.

5. Reporting of ETS and ESD emissions

The reporting of ETS and ESD emissions improved since 2015 and became considerably more detailed. With regard to absolute ESD emissions, on the contrary to former projections most Member States subtracted domestic aviation from total GHG emissions to calculate ESD emissions (see Figure 3.10) and a considerable number of Member States subtracted NF_3 emissions, too. Member States were asked to exclude emissions on ETS aviation from the ETS emissions to allow the calculation of a consistent set of stationary ETS emissions (see section 3.3.3).

Resulting from the QA/QC process in 2017, the "Draft guidance for reporting of ETS and ESD projections under the MMR" (EEA, 2017a forthcoming[10]) has been updated to include now some specific details on reporting of ETS and ESD emissions such as the treatment of recovered CO_2 emissions.

[10] Will be available in MMR folder at the EEA CDR http://cdr.eionet.europa.eu/help/mmr

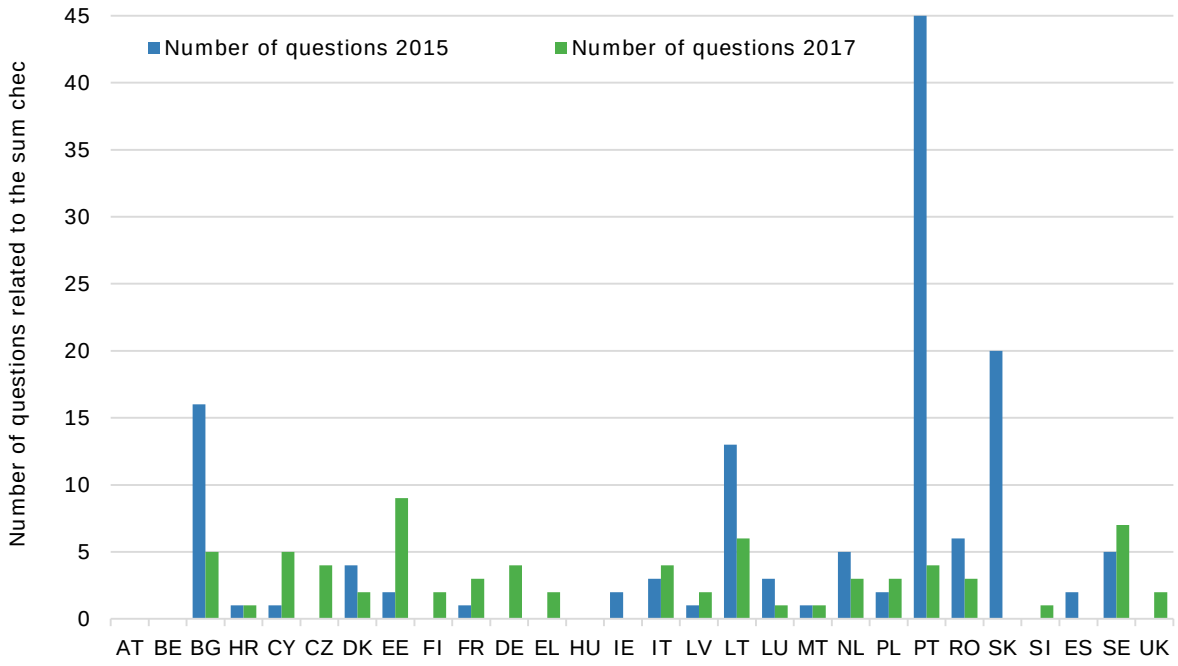
3.4 Accuracy and Transparency

To assess the accuracy of projections, a new automated sum check was introduced to the CDR which checks the Member States data after being uploaded to the CDR and before the QA/QC process by the ETC/ACM starts. Since this check was tested for the first time the ETC/ACM performed a sum check in parallel as part of the QA/QC process. In principal the automatic checks provided feedback to Member States and it is recommended to adjust the submission if the automatic sum check failed. For following countries the sum check did not reveal any issues: Austria, Belgium, Finland, Hungary, Ireland, Slovakia, and Spain. For the other countries the sum check resulted in follow-up questions to MS experts in the QA/QC procedure. The issues were sometimes aggregated in case they applied to multiple sectors, years, GHGs and/or scenarios, resulting in 74 questions in total (Figure 3.14).

Although the ETC/ACM sector experts used a clear threshold value for the checks, some MS were informed about a difference that was below the threshold value, but nevertheless much higher than for all other sectors.

In all cases where the difference was larger than the threshold value, corrective action was applied by the Member State (including a resubmission) or by the ETC/ACM. Some sum errors persisted, such as for Bulgaria, Cyprus, Estonia, Germany, Italy and Latvia.

Figure 3.14 Number of questions related to the sum check per MS in 2015 and 2017.

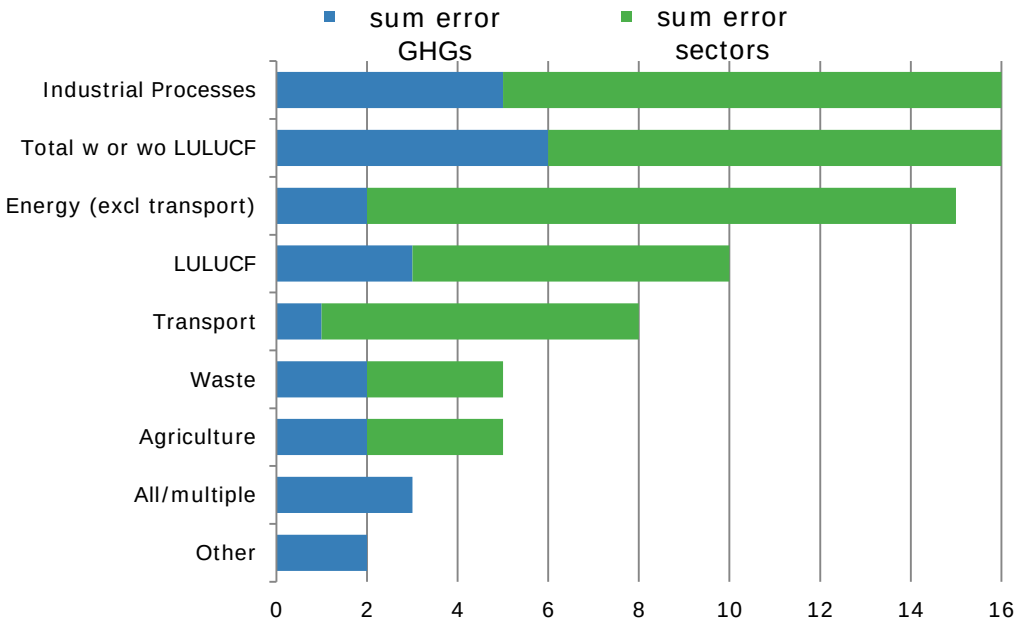


Note: for Portugal and Slovakia, the number of questions is higher because the questions were less aggregated.

The most important problem was that the sum of the emissions of the subsectors did not correspond with the emission of the parent sector (52 questions to 19 Member States). There could be several reasons for this, including incomplete reporting. However, in most cases this was caused by an error in reporting. A total of 20 questions pointed out that the sum of reported emissions of individual GHGs was not the same as the reported total GHG emissions (to 13 Member States). Most of the failed sum checks related to the sectors Industrial Processes, the total with or without LULUCF and Energy (Figure 3.15).

In their response Member State experts mentioned two main reasons for failed sum checks: either there was a transcript error and an incorrect value was reported in the template or there was an error in a summation formula in the Excel template. This can be an indication that the Member State has not implemented an effective internal QC system for the national projections reporting.

Figure 3.15 Number of issues per sector (split per type of error).



The introduction of the automatic checks did not seem to have a marked impact on the number of errors in the 2017 reporting yet. Automatic checks detected the sum check errors, but did not seem to have resulted in corrective actions by the Member State. Consultation with the Member States could identify possible reasons for this, which could be used to apply changes to the implementation and communication of the automatic checks in upcoming reporting years to make them more effective. Some of the failed checks however could have a reasonable explanation and therefore introducing more stringent automatic checks, e.g. blocking submissions, might be too restrictive.

3.4.1 Outliers and trends

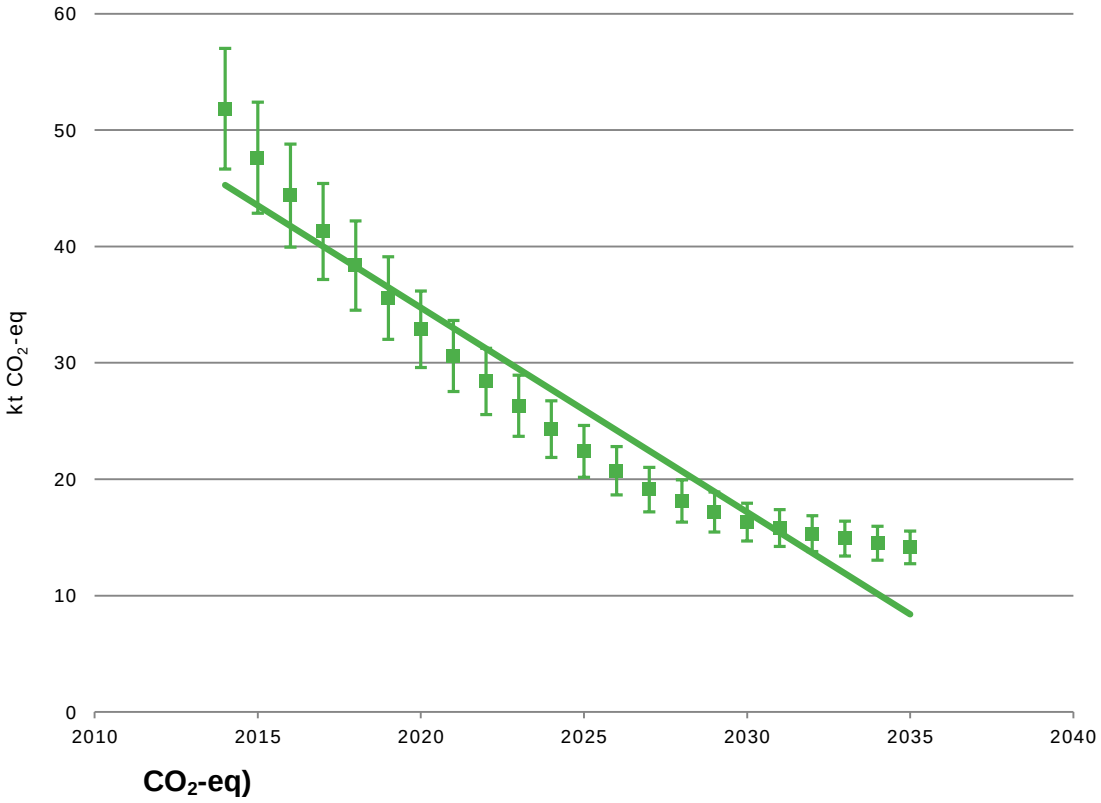
The outcome of the assessment of outliers and trends in Member States projections is based on four different checks. These checks are based on the reported projections information in 2017, inventory data and previously reported information on projections. Assessing trends and outliers is difficult if there are few data points in the time series (i.e. if no intermediate years are reported). For smaller Member States changes in emissions can show larger fluctuations in emissions, especially in sectors where emissions are dominated by few point sources (for example in the case of Malta).

The checks assume linear trends and use threshold values to indicate that the linear trend deviates from historical trends and previous projection trends. The linear trend line is also used to identify

outliers, i.e. emissions in specific years that are much higher or lower than expected based on the linear trend line. It is important to highlight that findings based on these checks are not necessarily revealing an error in projections, but rather point out the need for further clarification, either via visual inspection of the data by the reviewer, consultation of the technical report, or a question to the Member State. Examples of cases where a potential issue did not result in a question to the Member States are:

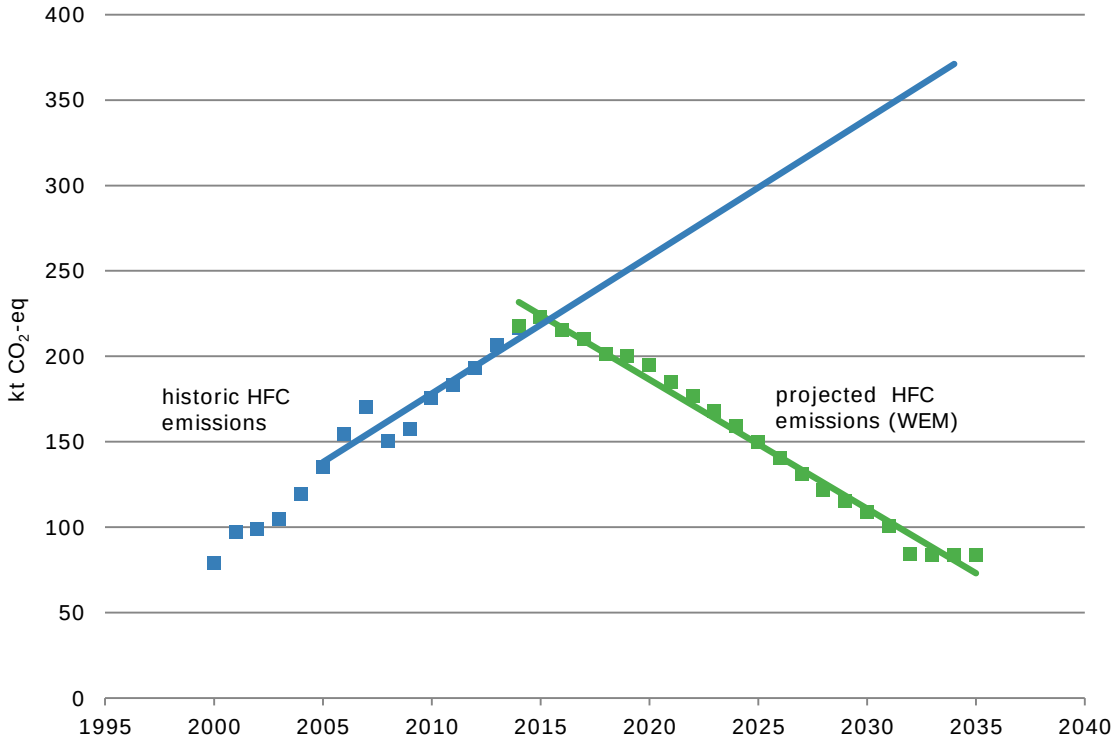
- *Non-linear trends*: For example, the projection of total GHG emissions in the sector Waste of Belgium (Figure 3.16), which failed the quality check for outliers. Visual inspection shows however that there is no outlier but that the failed quality check is caused by a non-linear trend in projected emissions. All similar cases have been carefully analysed by the ETC/ACM experts and did not result in a question to the Member State.

Figure 3.16 Outlier check, example for Belgium, CH_4 emissions sector Waste, in kt



- *Trends explained in the report*: For example, in the case of almost all Member States, the quality checks showed a different trend in historical and projected HFC emissions. This is explained by the implementation of the F-gas regulation (in 2014), as explained in many technical reports, and therefore did not result in follow-up questions. In some cases, consultation of the technical report revealed inconsistencies between the report and the xml in the reported values (Figure 3.17).

Figure 3.17 Overall trend check, example for Estonia, HFC emissions sector Industrial Processes, in kt CO_2-eq)



Despite these examples a number of potential issues could not be resolved by inspection of the data or consultation of the technical report. This resulted in a total of 85 questions to the Member States. As with the sum check, specific issues were aggregated as much as possible per sector, GHG, or even QA/QC check to avoid needless duplication of questions.

In 22 cases Member State experts adjusted the report or the issue was resolved following other corrections (e.g. sum check). The following list provides examples for findings during the QA/QC procedure:

- Germany adjusted emission of ESD, N_2O and CH_4 emissions in respectively the sector Energy industries, Agriculture (other) and Waste after the outlier check revealed deviating emissions.
- Spain corrected an error in the HFC emissions after the outlier check revealed that emission dropped markedly after 2035.
- Hungary adjusted reported information on total GHGs and CH_4 in the sector Energy and N_2O emissions in the sector Waste. An outlier problem related to PFC emissions was solved after sum error correction.
- Ireland adjusted reported ETS emissions for the sector Industrial Processes after outlier check revealed a potential problem.

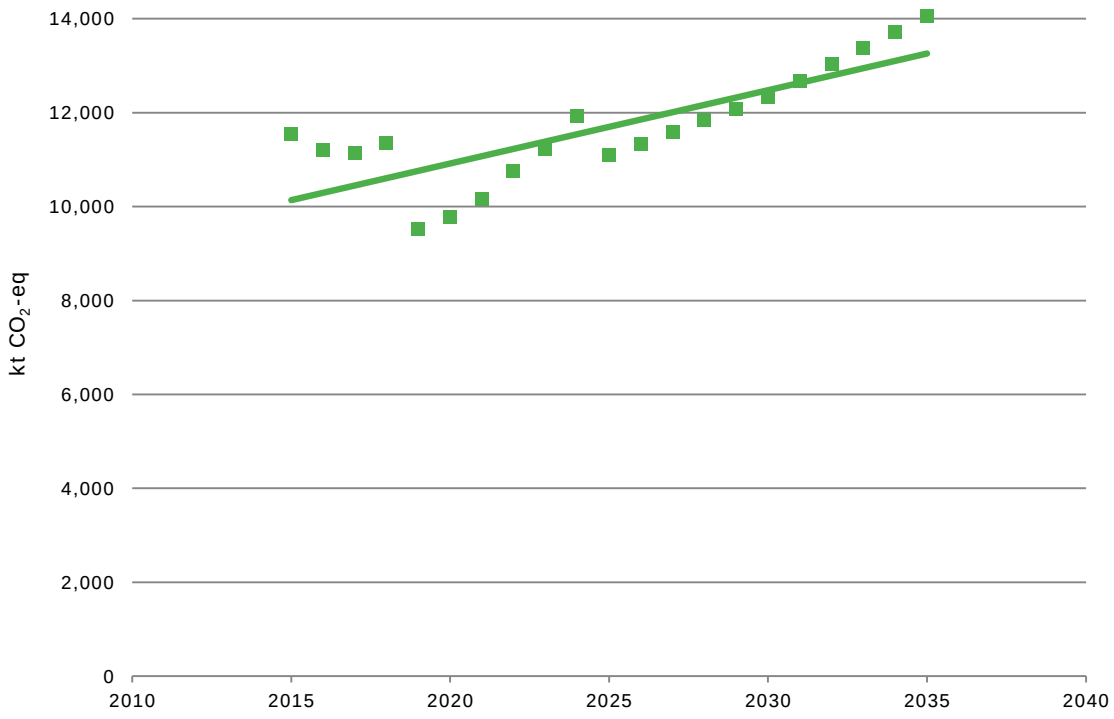
- The Netherlands reported emissions in years ending with 0 and 5 were markedly different from intermediate years for the Energy sector and the Total with LULUCF.
- Both Finland and Portugal reported negative emissions, probably related to formulas being used when filling in the excel file.
- Incorrect interpolation of data was an issue in Slovakia in the sectors Energy and Industrial Processes.

In almost all cases when adjustments were done, this was solely related to the outlier check.

In the majority of cases (63), the Member State did not adjust emissions. In these cases Member States provided an explanation or a reference to the technical document was provided. Most of the issues that were identified that could not be explained by visual inspection of the data related to following aspects:

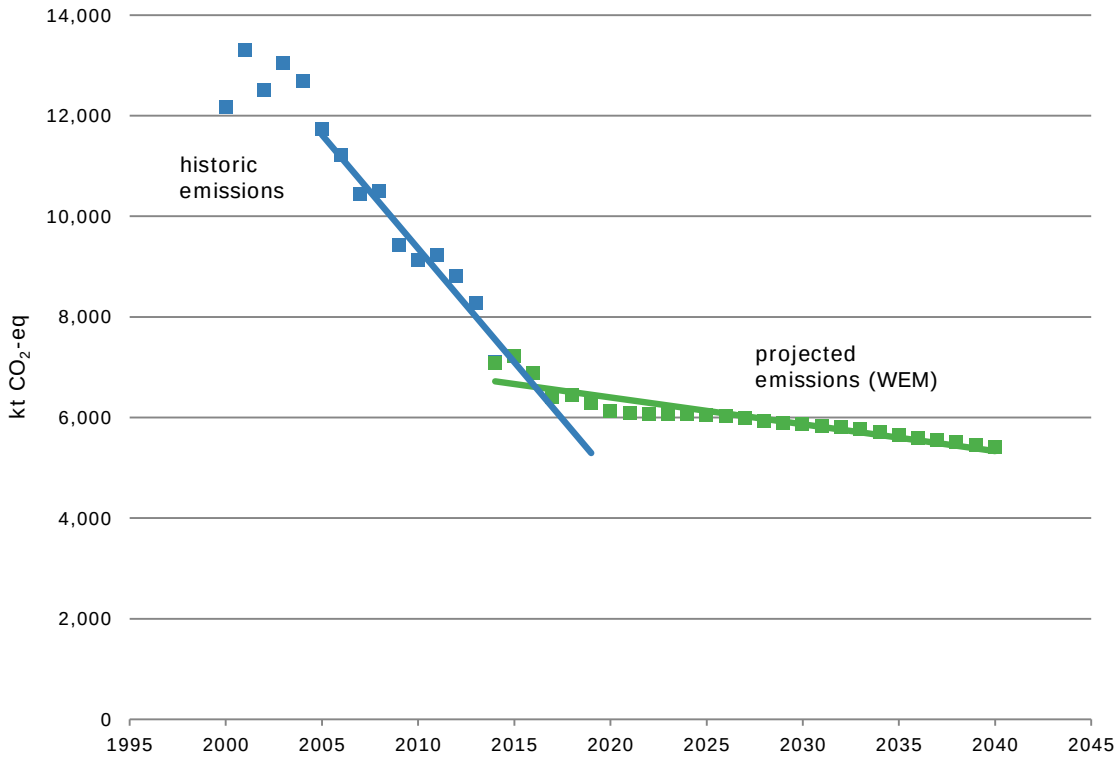
- The outlier check detected projected emissions that deviated from the linear trend that could not be explained. Member States providing an explanation in these cases referred to planned activities that affect emissions significantly. In the case of the Energy sector, this was mostly due to fuel switch or the planned closure of fossil-fuelled power plants (e.g. Finland, Ireland, Lithuania, Malta, Romania and the United Kingdom). In some cases the impact on projected emissions is very significant, as is the case for Malta, but could also be more subtle, such as for Ireland (Figure 3.18).

Figure 3.18 Outlier check, example for Ireland, total ETS emissions, sector Energy industries, WEM (in kt CO_2-eq)



- The trend of historical emissions deviated from the trend of projected emissions. In total 26 questions were directed to the Member States to clarify different trends in projected emissions and inventory data. An example of the findings is presented below for Slovakia (Figure 3.19). In their response Member States experts pointed towards the projected changes in underlying activity variables and the implementation and impact of PaMs.

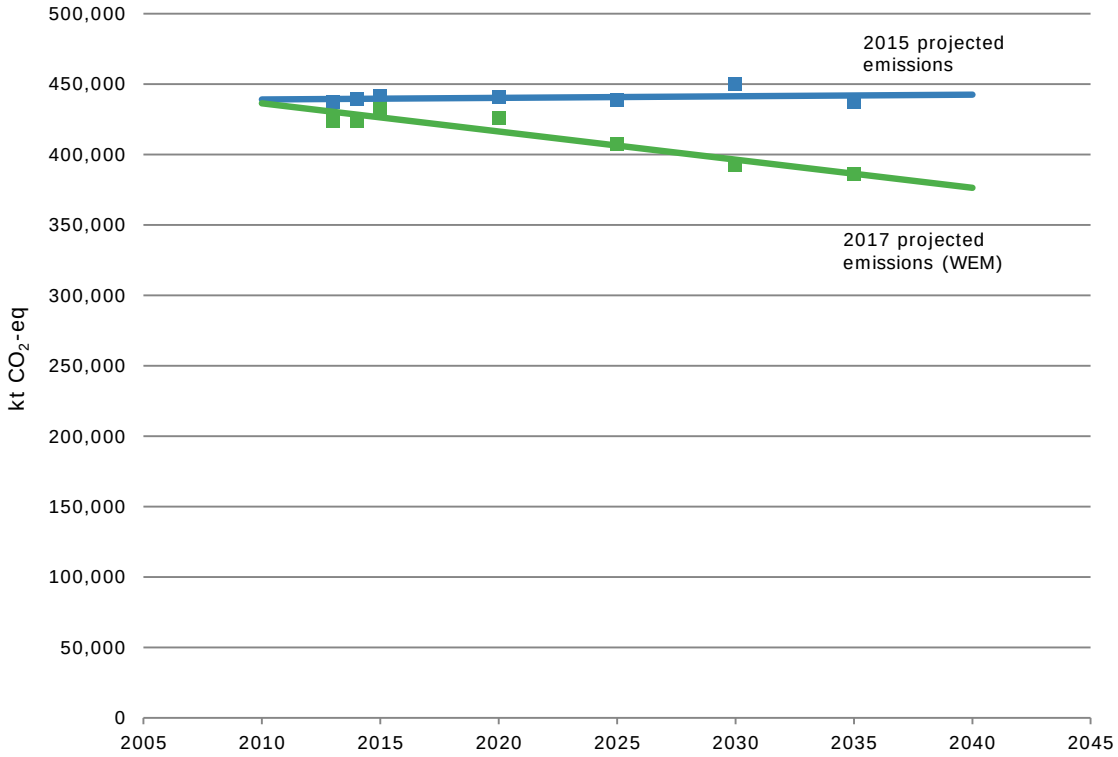
Figure 3.19 Overall trend check, example for Slovakia, total GHG emissions, sector Energy industries (in kt CO_2-eq)



3.4.2 Recalculations

In the case when projected emissions were markedly different from previous projections and no further information could be found in the report, for reasons of transparency MS experts were requested for an explanation and recommended to incorporate explanations for the recalculations in the technical reports. As an example, see Figure 3.20 for Italy which reported substantially different projections in 2017 compared to 2015. In total, questions concerning the recalculation check were asked to 13 different Member States.

Figure 3.20 Recalculation check, example for Italy, total GHG emissions, total without LULUCF (in kt CO_2-eq)



On the other hand, this check also identifies submissions that were identical to previous submission which indicates that the projections were not updated. Tot the total without LULUCF sector, WEM and WAM projections for Cyprus and Portugal were identical or almost identical to previous reporting year for all GHGs. Portugal has clarified the reasons in the report and via email during the QA/QC. For Bulgaria (HFC, PFC), Greece (HFCs) and Belgium (HFC, PFC, SF6) projections of fluorinated GHGs were not updated compared to previous reporting.

3.5 Parameters

3.5.1 Reported parameters

The following tables (Tables 3.5) summarise the reporting of parameters that countries have used for their projections. The table shows the number of countries, from the maximum of 28 (EU-28 Member States), that have used the parameters listed in the table for the years 2015-2035 and the reference year.

Evidently, not all parameters are used for projections. This reflects that some parameters such as GDP and population are more broadly applied in general models, while some are used only in specific, and usually more sophisticated, models.

Tables 3.5 Number of member states that reported using the below projections parameters for given projection years and sectors

General parameters	Base/ Reference year	2015	2020	2025	2030	2035
Population	26	26	26	26	26	25
Gross domestic product (GDP):-Real growth rate	20	22	24	24	24	24
Gross domestic product (GDP):-Constant prices	24	24	24	24	24	24
Gross value added (GVA) total industry	21	23	23	23	23	23
Exchange rates EURO (for non-EURO countries), if applicable	15	17	17	17	17	17
Exchange rates US DOLLAR, if applicable	15	17	17	17	17	17
EU ETS carbon price	18	20	23	23	23	22
International (wholesale) fuel import prices:-Electricity Coal	16	18	21	21	21	21
International (wholesale) fuel import prices:-Crude Oil	16	18	21	21	21	21
International (wholesale) fuel import prices:-Natural gas	16	16	19	19	19	19

Energy parameters	Base/ Reference year	2015	2020	2025	2030	2035
National retail fuel prices (with taxes included):-Coal, industry	15	17	17	17	17	17
National retail fuel prices (with taxes included):-Coal, households	14	15	15	15	15	15
National retail fuel prices (with taxes included):-Heating oil, industry	16	18	18	18	18	18
National retail fuel prices (with taxes included):-Heating oil, households	15	16	16	16	16	16
National retail fuel prices (with taxes included):-Transport, gasoline	16	17	17	17	17	17
National retail fuel prices (with taxes included):-Transport, diesel	16	17	17	17	17	17
National retail fuel prices (with taxes included):-Natural gas, industry	16	18	18	18	18	18
National retail fuel prices (with taxes included):-Natural gas, households	16	17	17	17	17	17
National retail electricity prices (with taxes included):-Industry	16	17	17	17	17	17
National retail electricity prices (with taxes included):-Households	18	17	17	17	17	17

Energy parameters	Base/ Reference year	2015	2020	2025	2030	2035
Gross inland consumption: solid fuels	19	21	22	22	22	22
Gross inland consumption: total petroleum products	19	21	22	22	22	22
Gross inland consumption: gas	19	21	22	22	22	22
Gross inland consumption:-Renewables	19	21	22	22	22	22
Gross inland consumption:-Nuclear	19	21	22	22	22	22
Gross inland consumption:-Other	19	21	22	22	22	22
Gross inland consumption:-Total	18	21	22	22	22	22
Gross electricity production:-Coal	19	22	23	23	23	23
Gross electricity production:-Oil	20	23	24	24	24	23
Gross electricity production:-Natural gas	20	23	24	24	24	23
Gross electricity production:-Renewables	20	23	24	24	24	23
Gross electricity production:-Nuclear	19	22	23	23	23	23
Gross electricity production:-Other	20	21	22	22	22	22
Gross electricity production:-Total	21	23	24	24	24	23
Total net electricity imports	21	22	23	23	23	23
Gross final energy consumption	17	19	19	19	19	19
Final energy consumption:-Industry	22	24	25	25	25	24
Final energy consumption:-Transport	22	24	25	25	25	24

Energy parameters	Base/ Reference year	2015	2020	2025	2030	2035
Final energy consumption:-Residential	22	24	25	25	25	24
Final energy consumption:-Agriculture/Forestry	22	24	25	25	25	24
Final energy consumption:-Services	21	23	24	24	24	23
Final energy consumption:-Other	19	20	20	20	20	19
Final energy consumption:-Total	20	22	23	23	23	22
Number of heating degree days (HDD)	18	20	20	20	20	20
Number of cooling degree days (CDD)	14	15	15	15	15	15

Transport parameters	Base/ Reference year	2015	2020	2025	2030	2035
Number of passenger-kilometres (all modes)	18	21	21	21	21	21
Freight transport tonnes-kilometres (all modes)	18	21	21	21	21	21
Final energy demand for road transport	21	22	22	22	22	21

Buildings parameters	Base/ Reference year	2015	2020	2025	2030	2035
Number of households	18	20	20	20	20	20
Household size	18	19	19	19	19	19

Agriculture parameters	Base/ Reference year	2015	2020	2025	2030	2035
Livestock:-Dairy cattle	24	26	26	26	26	25
Livestock:-Non-dairy cattle	24	26	26	26	26	25
Livestock:-Sheep	24	26	26	26	26	25
Livestock:-Pig	24	26	26	26	26	25
Livestock:-Poultry	24	26	26	26	26	25
Nitrogen input from application of synthetic fertilizers	23	25	25	25	25	24
Nitrogen input from application of manure	20	21	22	22	22	22
Nitrogen fixed by N-fixing crops	17	18	18	18	18	19
Nitrogen in crop residues returned to soils	20	20	21	21	21	21
Area of cultivated organic soils	18	19	19	19	19	19

Waste parameters	Base/ Reference year	2015	2020	2025	2030	2035
Municipal solid waste (MSW) generation	23	25	25	25	25	24
Municipal solid waste (MSW) going to landfills	23	25	25	25	25	24
Share of CH_4 recovery in total CH_4 generation from landfills	20	22	22	22	22	21

Other parameters	Base/ Reference year	2015	2020	2025	2030	2035
Other relevant parameters	8	8	8	8	8	8

3.5.2 Most common parameter issues

Parameter tables (Table 3: Reporting on parameters for projections used) were submitted by all 28 Member States (compared to 25 in 2015). The comprehensive overview given in Table 3.6 summarizes the QA/QC process for each Member State and each parameter which has been checked.
It can be clearly seen that least follow up was needed for the parameter population. There were a few countries which did not use the default units (purple), so the unit was converted by reviewers or countries resubmitted values (medium green) or explanations (blue) that solved the issue.
The overview also shows that for Belgium and Luxembourg GDP was not an input parameter for their projections and that net electricity import was not used in the projections of seven Member States (yellow).
It shows moreover that a follow up with Member States was needed often, but nearly all issues could be solved. This was the case because either data consistent to surrogate data was resubmitted (middle green), because a notation key was resubmitted (light green) or because an explanation of the differences was given by Member State experts (blue). Explanations why GDP was not in line with surrogate data were mainly that Member States used data from their statistical office which is different to Eurostat or because conversion rates differed between the Member States and data used by the reviewers.
However, seven issues could not be solved (orange colors). In most of the cases, Member States did not submit reference year values or the reference year in the first place, so this was asked for in the first communication round. After the resubmission of these values and years, there was not enough time for follow-ups. However, in 2017, just three issues could not be solved for the three parameters.

Table 3.6 'Heat Map' of QA/QC procedure and most common issues of the parameter checks

	Population	GDP	Electricity Imports
AT			
BE			
BG			
CY			
CZ			
DE			
DK			
EE			
EL			
ES			
FI			
FR			
HR			
HU			

	Population	GDP	Electricity Imports
IE			
IT			
LT			
LU			
LV			
MT			
NL			
PL			
PT			
RO			
SE			
SI			
SK			
UK			

Legend:
No follow up:
value in line with surrogate data
no use of default unit -> corrected by reviewer
no values submitted / values not used

Follow up: Neither value nor notation key given OR value not in line with surrogate data; issue solved
resubmission of notation key -> issue solved
resubmission of value consistent to surrogate data -> issue solved
explanation of reason for difference -> issue solved

Follow up: Neither value nor notation key given OR value not in line with surrogate data; issue NOT solved
no resubmission of MS -> issue not solved
resubmission of value NOT consistent to surrogate data / no explanation of reason for differences but issue also not followed up-> issue not solved

Note: Data of Member States was checked against surrogate datasets from Eurostat (Eurostat 2017a, 2017b) and entso-e (Entso-e, 2017): Population – Eurostat demo_pjan; GDP - Eurostat nama_10_gdp; electricity import: entso-e detailed electricity exchange. Thresholds for the checks were 2 % for population and GDP and 4 % for net electricity imports.

3.5.3 Deviation from recommended parameters

In line with the MMR implementing legislation to increase EU wide consistency of projections, in June 2016, the European Commission provided Member States with recommended supranational parameters on ETS carbon prices and fuel prices and suggested a number of other macro parameters for use in the preparation of GHG projections (COM, 2016). Checks were carried out to gain insights into whether Member States experts used the provided values (Table 3.7). It should be noted that in the 2017 QA procedure this check is of informative nature only and no follow up was made in case parameters deviated from the recommendations of the European Commission. The check was applied only the parameters presented in the table below.

Table 3.7 Overview: Use of recommended parameters by the European Commission

	Coal price	Gas price	Oil price	Carbon price	Population	GDP
AT	yes	yes	yes	no	close	no
BE	not used	not used	not used	not used	no	not used
BG	yes	no	yes	yes	close	no
HR	yes	yes	yes	yes	yes	yes
CY	not used	not used	not used	no	no	no
CZ	yes	yes	yes	yes	no	no
DK	no	no	no	no	close	no
EE	no	no	no	no	no	no
FI	yes	not used	yes	yes	close	no
FR	yes	yes	yes	yes	no	yes
DE	yes	yes	yes	yes	yes	yes
EL	no	yes	yes	no	no	no
HU	not used	not used	not used	no	no	no
IE	no	no	no	yes	no	no

	Coal price	Gas price	Oil price	Carbon price	Population	GDP
IT	no	no	no	yes	yes	close
LV	no	no	no	no	no	no
LT	no	no	no	no	yes	no
LU	not used	not used	not used	not used	no	not used
MT	not used	not used	not used	not used	yes	no
NL	no	no	no	no	close	no
PL	no	no	no	no	close	no
PT	no	no	no	no	no	no
RO	yes	yes	yes	yes	yes	no
SK	yes	yes	yes	yes	no	close
SI	no	no	no	no	no	no
ES	not used	not used	not used	not used	close	no
SE	no	no	no	yes	no	no
UK	no	no	no	no	close	no

	Coal price	Gas price	Oil price	Carbon price	Population	GDP
Number MS using guidance in 2017	**9**	**8**	**10**	**11**	**6**	**3**
Number MS having used guidance in 2015	11	6	7	10	8	0

Legend:	
not used	parameter not used for projections
no	deviation to COM guidance > 3 % for prices >0.5 % for population and GDP
yes	deviation to COM guidance < 3 % for prices, < 0.5 % for populatiom and GDP
close	deviation up to +/- 2 % for GDP and population

In general, it can be observed that mainly the parameters for carbon price (used by 11 Member States) and oil price (used by 10 Member States) have been used by Member States as provided through the guidance. Germany and Croatia used all of the parameters provided in the guidance.

During the checking process it became clear that comparisons of parameters with monetary units can only be done with uncertainty. The reasons are:

- Default units in the parameter reporting template are Euro / GJ - no reference year for the monetary part is given
- Default units for reporting GDP are Euro (2010) / GJ – the reference year for the monetary part is 2010
- Recommended parameters from the Commission for energy prices are in Euro (2013) / GJ - the reference year for the monetary part is 2010

Thus, if Member States

- reported in default units of the reporting template, or
- reported in another units which is different from the units provided via the guidance,

conversion is needed to facilitate a comparison.
In this case uncertainty is introduced, because assumptions need to be taken. The following assumption were taken:

- If Member States reported in default units, it was assumed that the unit was Euro (2010) / GJ (based on the default unit for GDP). This introduces uncertainty, because it cannot be confirmed.
- The Commission guidance was converted into Euro (2010) / GJ in order to facilitate comparison. An EU-wide deflator of 0.969 was applied for this purpose (based on Eurostat dataset implicit_price_deflator_nama_10_gdp, downloaded 24/02/2017).
- If Member States reported in different units a conversion into Euro (2010) / GJ took place for comparison and the conversion also took place on the EU-wide deflator.

Due to these assumptions which introduce uncertainties deviations under +/- 4 % were categorised as having used the recommended parameters.

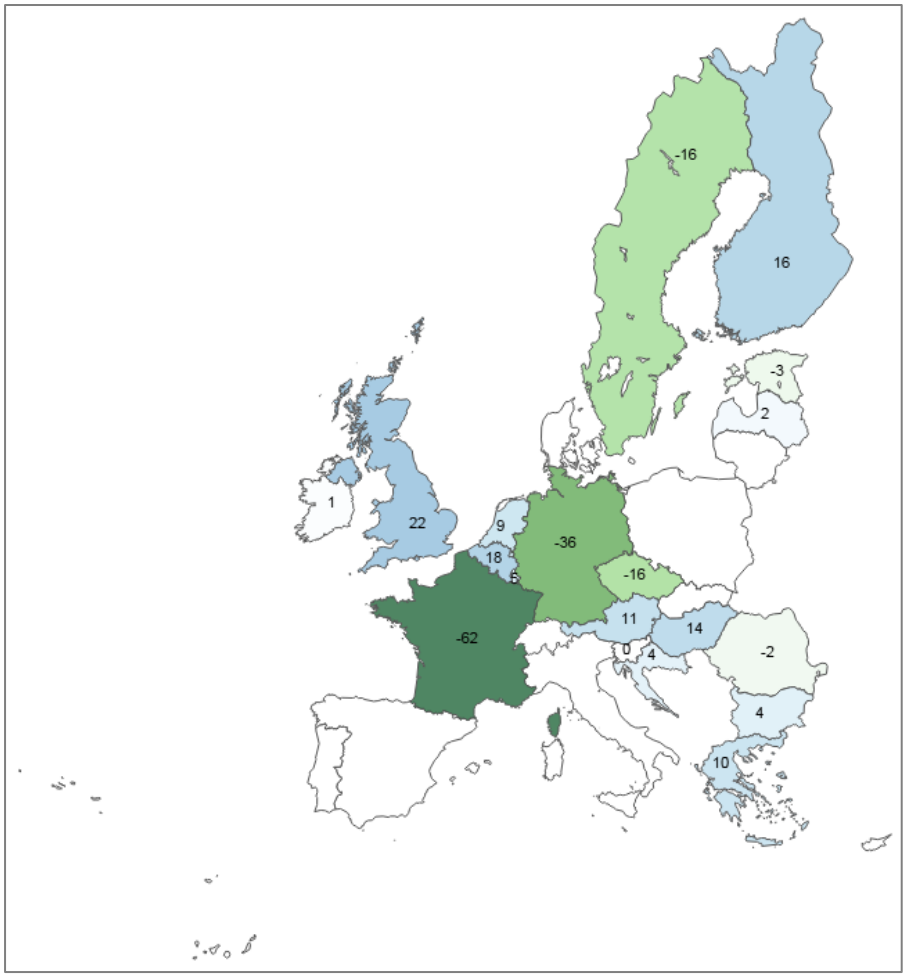
3.5.4 Net electricity imports

An assessment of net electricity imports parameter for the reference year and 2020 (WEM scenario) is shown in Figure 3.21 for reference years and in Figure 3.22 for the year 2020. The reduction of electricity imports or the increase of electricity exports are one of the main reasons for increasing ETS emissions. 19 Member States reported on the parameter *net electricity imports* for their reference year and the year 2020. In their 2017 submissions no Member State projects to change the direction of net electricity imports until 2020, the same held true in the 2015 submissions.
In total seven Member States reported to be exporters of electricity in the reference year and in 2020 in the WEM scenario (Czech Republic, Estonia, France, Germany, Romania, Slovenia, Sweden), while the others report to import electricity. The same held true in the 2015 submissions[(11)].
Adding up the results for the year 2020 confirms what had already been projected in the 2015 submissions: taking into account all Member States who reported net electricity imports results in a WEM projection of more exports than imports of electricity (166 TWh and 85 TWh respectively). It

[(11)] Sweden had not reported on net electricity imports in 2015

needs to be noted that this only includes the data of the 19 Member States who reported on net electricity imports. No gap-filling took place.

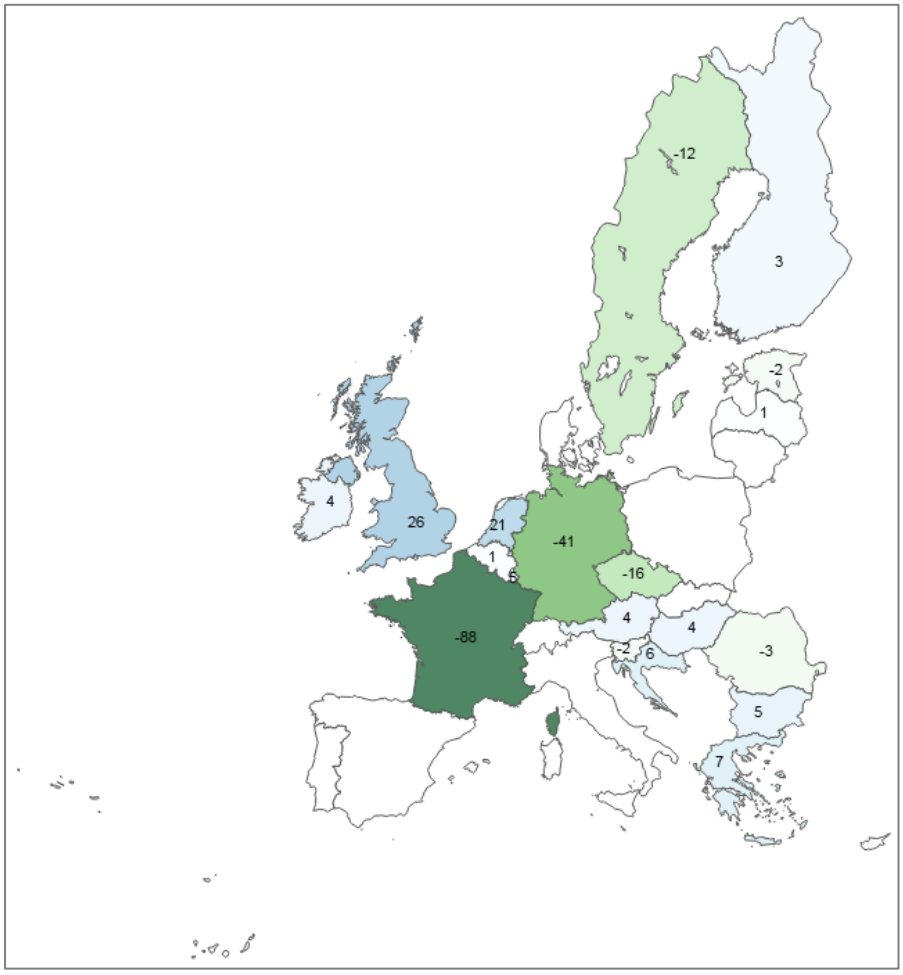
Figure 3.21 Net electricity imports and exports in reference years



Note: Negative numbers show net export, positive numbers net imports.

Source: MMR MS Projections 2017.

Figure 3.22 Net electricity imports and exports in the year 2020 (WEM scenario)



Note: Negative numbers show net export, positive numbers net imports.

Source: MMR MS Projections 2017.

Of the 12 electricity importing countries, eight project a decrease of net electricity imports. The strongest relative change is projected by Belgium (-94 %), followed by Finland (-83 %) and Hungary (-73 %). From the seven electricity exporting countries, all except Sweden are projecting higher exports in 2020 compared to the reference year.

4 Sector specific QA/QC results for Agriculture and LULUCF

For the first time this Technical Paper deals with an in-depth sectoral analysis which aims for a better understanding of the characteristics of sector-specific projections. The methodologies for preparing GHG projections cover a broad spectrum depending on data availability, availability of sources, but also on the sector characteristics. As with the to the GHG inventory, countries are encouraged to make efforts to increase the accuracy of projections and decrease the uncertainty of the estimates. According to the 2006 IPCC Guidelines for GHG inventories the focus of improvements should be laid on key categories and key sources where higher Tier methods should be applied and this rule can be also applied to projections. Nevertheless, the issue is of course influenced by limits to resource allocation and the application of simpler methodologies can be reasonable for less significant source categories.
In the following chapter only the sectors Agriculture and LULUCF are described in more detail, starting with a brief overview of the projected trend, followed by a description of the reporting situation in terms of completeness, and finally a presentation of the main challenges regarding the quality of the submissions. These sectors were selected because they are in the focus of on-going political discourses and are also considered in the 2030 climate targets.

4.1 Agriculture

The trend (2015-2035) of the sector Agriculture (Figure 4.1) as reported in 2017 is rather constant, ranging from 430 000 kt CO_2-eq in 2035 to 437 000 kt CO_2-eq in 2015. The overall contribution of this sector to the Total without LULUCF is constant as well, namely between 10 % and 12 %. The nine countries with the largest share of emissions in the EU Total are shown in Figure 4.1, whereby the countries with fewer emissions (about 22 % of the emissions in sector 3) are summed up in the grey area. For the four largest emitting countries (France, Germany, Spain and the United Kingdom) in the sector Agriculture the trend shows a decline compared to the year 2015. On the other hand, Poland and Romania project an increase of emissions, Italy, Ireland and the Netherlands remain rather stable (Table 4.1).

Figure 4.1 Projected trend of GHG emissions in the sector 3 Agriculture (final data as prepared by the ETC/ACM)

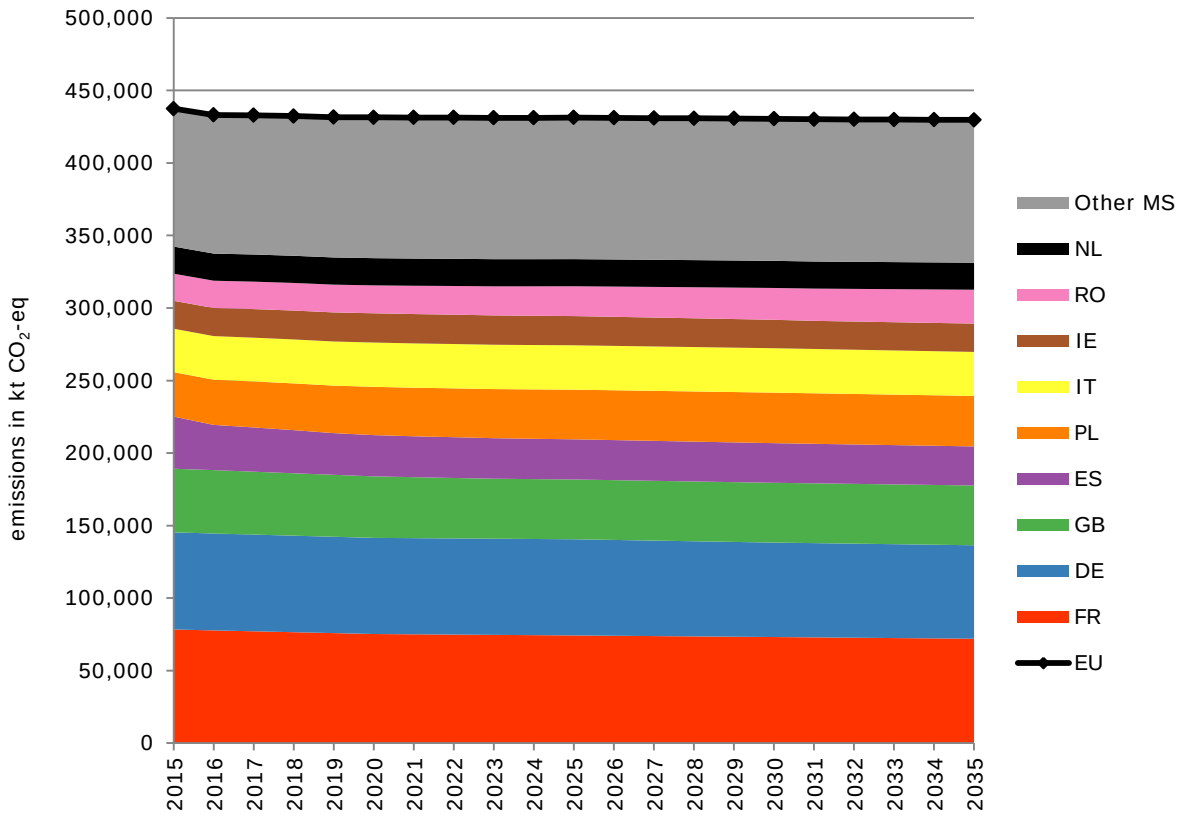


Table 4.1 Percentage change of emission trend in 2035 compared to 2015 for the nine largest emitting countries (sorted by size of absolute emissions)

Member State	FR	DE	GB	ES	PL	IT	IE	RO	NL
Percentage change 2035 vs. 2015	-8 %	-4 %	-6 %	-25 %	14 %	1 %	2 %	25 %	0 %

4.1.1 Reporting situation in the sector

Table 4.2 presents the current reporting of the sector Agriculture in 2017. All Member States provided estimates for the main category 3.Agriculture, whereas the reporting of sub-sectors is often incomplete. Incomplete in this sense means reporting of blank cells (4 MS) or zeros (10 MS), where notation keys should be reported instead. The most relevant sub-categories 3.A Enteric fermentation, 3.B Manure management and 3.D Agricultural soils are reported by 26 MS, Italy reports IE (included elsewhere, namely in sector 3), and the Netherlands reported blank cells. So for these categories the reporting is rather complete. The situation is different for sub-categories for which no emissions are reported, because they are not occurring or not applicable (e.g. 3.C Rice cultivation, 3.E Prescribed burning of savannahs). For these categories, countries could improve the consistent use of notation keys.

Table 4.2 Completeness of reporting: Agriculture [12]

WEM / Total GHGs	3. Agriculture	3.A. Enteric fermentation	3.B. Manure management	3.C. Rice cultivation	3.D. Agricultural soils	3.E. Prescribed burning of savannahs	3.F. Field burning of agricultural residues	3.G. Liming	3.H. Urea application	3.I. Other carbon-containing fertilizers	3.J. Other (please specify)
AT	x	x	x	NO	x	Z	x	x	x	x	NO
BE	x	x	x	Z	x	Z	Z	x	Z	Z	Z
BG	x	x	x	x	x	NO	x	NO	x	NO	NO
HR	x	x	x	NO	x	NO	NO	x	x	NA	NO
CY	x	x	x		x				x		
CZ	x	x	x		x			x	x		
DK	x	x	x	Z	x	Z	x	x	x	x	Z
EE	x	x	x	NO	x	NO	NO	x	x	NO	NO
FI	x	x	x	NO	x	NO	x	x	x	NA	NO
FR	x	x	x	x	x	Z	x	x	x	Z	Z
DE	x	x	x	NA/ NO	x	NA/ NO	NA/ NO	x	x	NA/ NO	x
EL	x	x	x	x	x	Z	x	Z	x	Z	Z
HU	x	x	x	x	x	Z	Z	x	x	x	x
IE	x	x	x	NO	x	NO	NO	x	x	NO	NO
IT	x	IE	IE	IE	IE	NO	IE	IE	IE	NO	NO
LV	x	x	x	NO	x	NO	NO	x	x	NO	NO
LT	x	x	x	NO	x	NO	NO	x	x	NO	NO
LU	x	x	x	NO	x	NO	NO	x	NE	NO	NO
MT	x	x	x	Z	x	Z	Z	Z	Z	Z	Z
NL	x							x			
PL	x	x	x	NO	x	NO	x	x	x	NO	NO
PT	x	x	x	x	x	Z	x	Z	Z	Z	Z
RO	x	x	x	x	x	NO	x	x	x	NO	NO
SK	x	x	x	NO	x	NO	NO	x	x	NO	NO
SI	x	x	x	Z	x	Z	Z	x	x	Z	Z
ES	x	x	x	x	x		x	x	x	NO	NO
SE	x	x	x	NO	x	NO	NO	x	x	NO	NO
UK	x	x	x	Z	x	Z	Z	x	x	Z	Z

Legend:	
x…value reported	blank cell reported
zero reported	notation key reported

[12] The results of this table are based on an assessment of the year 2020 reported in 2017

Apart from Total GHGs (in CO_2 equivalents) for the sector Agriculture three GHGs can be reported depending on the occurrence of the respective sub-categories: CO_2, CH_4 and N_2O, Table 4.3 presents the reporting of these gases by Member States. It can be concluded that the gas split is very complete, only Portugal is reporting zeros instead of notation keys for CO_2.

Table 4.3 Reporting of gas split for the sector Agriculture [13]

Agriculture	Total GHG	CO_2	CH_4	N_2O
AT	x	x	x	x
BE	x	x	x	x
BG	x	x	x	x
HR	x	x	x	x
CY	x	x	x	x
CZ	x	x	x	x
DK	x	x	x	x
EE	x	x	x	x
FI	x	x	x	x
FR	x	x	x	x
DE	x	x	x	x
EL	x	x	x	x
HU	x	x	x	x
IE	x	x	x	x

Agriculture	Total GHG	CO_2	CH_4	N_2O
IT	x	x	x	x
LV	x	x	x	x
LT	x	x	x	x
LU	x	x	x	x
MT	x	NO	x	x
NL	x	x	x	x
PL	x	x	x	x
PT	x	Z	x	x
RO	x	x	x	x
SK	x	x	x	x
SI	x	x	x	x
ES	x	x	x	x
SE	x	x	x	x
UK	x	x	x	x

Legend:	
x…value reported	blank cell reported
zero reported	notation key reported

4.1.2 Methodological issues and major challenges

When analysing Agriculture projections, it needs to be kept in mind that the numbers reported are subject to a very high uncertainty which is characteristic for this sector as the methodologies are complex and the input data is often of inhomogeneous. The sectoral uncertainties of Agriculture in the GHG inventory (as reported in 2017) range between 19 % and even 138 %. However, the majority of the Member States report an uncertainty around 50 %. Therefore, the projected emissions of this sector are even more uncertain. For a better understanding of the quality of the Agriculture projections, it would be necessary to intensively study the national methodologies and the respective parameters and assumptions, however for this project we can only provide an overview. In terms of methodologies applied, from the model factsheets it can be seen that 13 Member States use models for the Agriculture projections. This includes various types of models such as bottom up models, optimisation models, regression analysis, economic models and Excel-based approaches.

For the Agriculture sector 24 questions were raised to 11 Member States during the QA/QC process of the 2017 reporting. All of those could be solved during the QA/QC procedure. Most of the findings in the QA/QC were related to the consistency check and differences between the reference year value and the value reported in the inventory. A quite common issue in the Agriculture sector was that

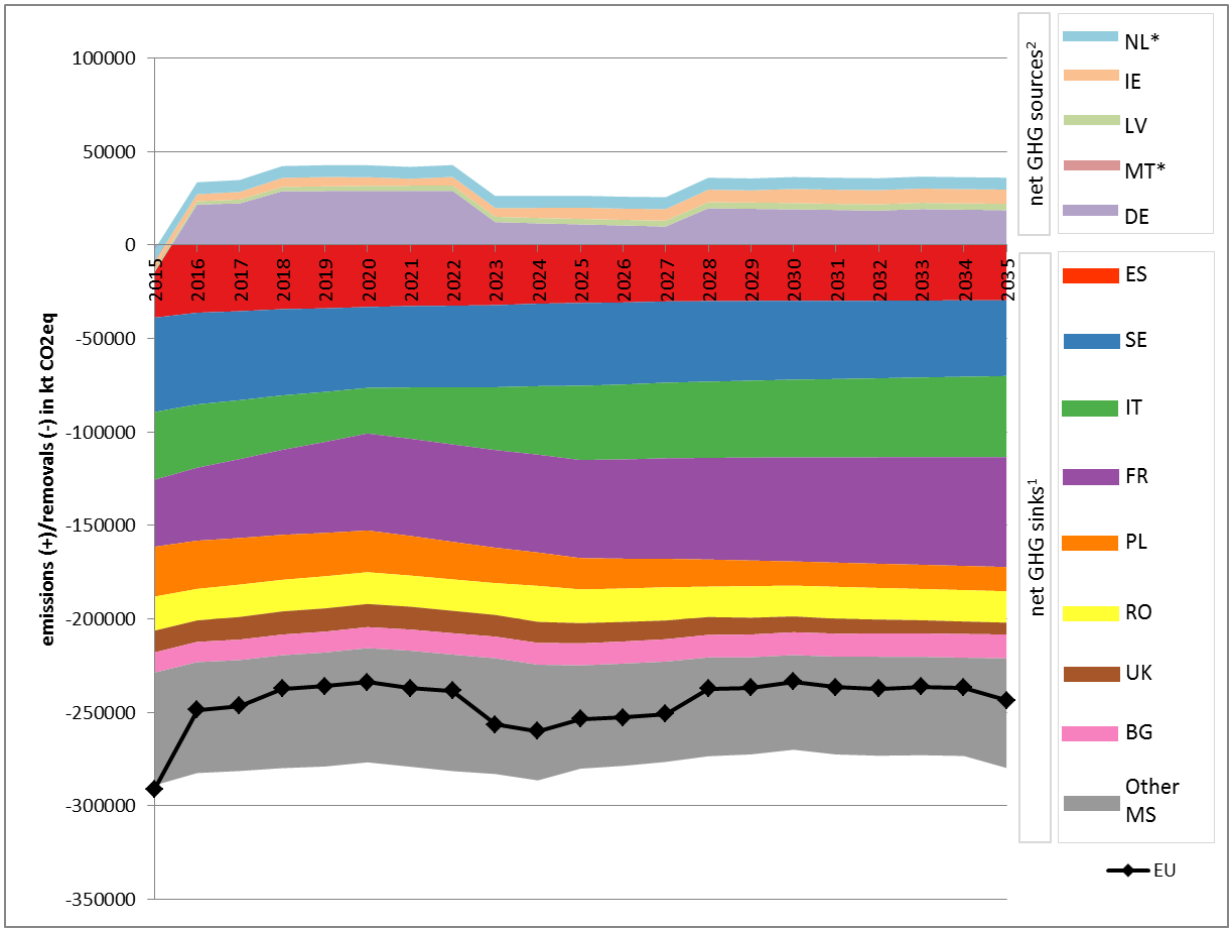
[13] The results of this table are based on an assessment of the year 2020 reported in 2017

reported emissions of sector 3 were different from the sum of emissions of the subsectors. Additionally there were a few findings regarding the overall trends where historical emissions deviate from the projected trends as well as concerning outliers. The rest of the findings related to recalculations, completeness, and other reporting inconsistencies.

4.2 Land use, land use change and forestry (LULUCF)

The trend (2015-2035) of the LULUCF sector (Figure 4.2) as reported in 2017 is also rather constant and the whole sector remains a net sink of GHG emissions, ranging from 291 000 kt CO_2-eq and 233 000 kt CO_2-eq. The projected net sink potentially absorbs approximately 6-7 % of the Total EU emissions in the reported period. The LULUCF sector can be either a sink (net removals of CO_2-eq) or a source (net emissions of CO_2-eq). Most countries in the EU report removals, however, Ireland and Latvia report emissions for the whole projection time series, in Denmark and Greece the source turns into a sink and in Germany the sink turns into a source. Cyprus, the Netherlands, Malta and Slovenia did not report projections for LULUCF and were gap-filled with the inventory by the ETC/ACM. The steep decline in the removals between 2015 and 2016 is caused largely by Germany that reported removals in 2015 and emissions in 2016.

Figure 4.2 Projected trend of GHG emission in the sector 4 LULUCF (final data as prepared by the ETC/ACM)



* **Note**: NL, MT: no emissions/removals reported in the 2017 submission. The projections time series was gap-filled with the latest available inventory value.

Table 4.4 shows the trend for the eight largest contributors to the EU sink (Spain, Sweden, Italy, France, Poland, Romania, United Kingdom and Bulgaria). The trend of Germany which is turning from sink to source has influence on the fluctuations of EU trend. . The other MS (less than -10 000 kt CO_2-eq removals) are a constant sink in the range of -50 000 to -60 000 kt CO_2-eq.

Table 4.4 Percentage change of emission trend in 2035 compared to 2015 for the eight largest contributing countries

Trend description	sink ↓	sink ↓	sink ↑	sink ↑	sink ↓	sink ↓	sink ↓	from sink to source ↑	stable sink
Member State	**SE**	**ES**	**IT**	**FR**	**PL**	**RO**	**UK**	**DE**	**other MS**
Percentage change 2035 vs. 2015	-20 %	-24 %	20 %	64 %	-51 %	-8 %	-46 %	228 %	-3 %

4.2.1 Reporting situation in the sector

The reporting for the sector LULUCF is less complete than for Agriculture (Table 4.5). Four countries did not provide any estimates for this sector: Malta and the Netherlands reported "NE" (not estimated), Slovenia reported "zero" values and Cyprus reported only blank cells. Finland reported values for all sectors except for (4.F, 4.G and 4.H) but it did not provide estimates for the Total GHGs (CO_2-eq), so this was also gap-filled and calculated based on the reported data by the ETC/ACM. Italy reports emissions/removals only on the aggregated level and no split by sub-sectors. Similar to Greece which reports values for 4.A. Forest land and all other categories as "IE" (included elsewhere). As for the sector Agriculture there is a frequent use of reporting zeros or blank cells which should be replaced by the appropriate notation keys when no emissions/removals are estimated. In terms of reporting sub-sectors the situation is a bit different to Agriculture where some sub-categories do not exist in many countries (e.g. rice cultivation). On the other hand, for LULUCF, it can be assumed that apart from some exceptions most sub-categories occur in all the EU Member States and should therefore be reported, or at least be reported with a notation key.
This lack of completeness can be explained to some extent by the fact that in the EU climate policy framework Agriculture is already accounted under the ESD (Effort Sharing Decision) and LULUCF has not yet been included. There is thus the possibility that in the past when preparing national GHG projections LULUCF has been treated as a low priority sector by some Member States. However, in the new 2030 Framework LULUCF will be accounted towards the Union climate targets as well, therefore it can be expected that also the reporting will improve in the upcoming years. LULUCF specific projections guidelines can be found in a report which was published by the EC in 2012 [(14)].

[(14)] EC (2012): GHG Projection Guidelines – Part B: Sectoral Guidelines, final report CLIMA.A.3./SER/2010/0004 https://ec.europa.eu/clima/sites/clima/files/strategies/progress/monitoring/docs/ghg_projection_guidelines_b_en.pdf

Table 4.5 Completeness of reporting: LULUCF [15]

WEM/Total GHGs	4. LULUCF	4.A. Forest land	4.B. Cropland	4.C. Grassland	4.D. Wetlands	4.E. Settlements	4.F. Other Land	4.G. Harvested wood products	4.H. Other
AT	X	x	x	x	x	x	x	x	NO
BE	X	x	x	x	Z	x	Z	x	Z
BG	X	x	x	x	x	x	x	x	NO
HR	X	x	x	x	x	x	NO	x	NO
CY									
CZ	X	x	x	x	x	x	x	x	
DK	X	x	x	x	x	x	Z	x	Z
EE	X	x	x	x	x	x	x	x	
FI	NE	x	x	x	x	x			
FR	X	x	x	x	x	x	x	x	x
DE	X	x	x	x	x	x	NA/ NO	x	NA/ NO
EL	X	x	IE	IE	IE	IE	IE	IE	IE
HU	X	x	x	x	x	x	x	x	Z
IE	X	x	x	x	x	x	x	NE	NO
IT	X	IE	IE	IE	IE	IE	IE	IE	NO
LV	X	x	x	x	x	x	NO	x	NO
LT	X	x	x	x	x	x	x	x	NO
LU	X	x	x	x	x	x	x	NO	NO
MT	NE	NE	NE	NE	NE	NE	NE	NE	NE
NL	NE (16)								
PL	X	x	x	x	x	x	NO	NO	NO
PT	X	x	x	x	x	IE	IE	Z	Z
RO	X	x	x	x	x	x	x	x	NO
SK	X	x	x	x	NO	x	x	x	NO
SI	Z	Z	Z	Z	Z	Z	Z	Z	Z
ES	X	x	x	x	x	x		x	
SE	X	x	x	x	x	x	NO	x	NO
UK	X	x	x	x	x	x	Z	x	Z

Legend:	
x…value reported	blank cell reported
zero reported	notation key reported

[15] The results of this table are based on an assessment of the year 2020 reported in 2017

[16] LULUCF projections were not submitted under the MMR in 2017 by NL. However, in its latest National Energy Outlook 2017 new LULUCF projections are available: http://www.pbl.nl/publicaties/nationale-energieverkenning-2017

In the following table (Table 4.6), an overview of the completeness of the gas split is provided. As in the Agriculture sector, it is possible to report on Total GHGs (CO_2-eq), as well as CO_2, CH_4 and N_2O individually. Most Member States report on all three gases including the Total GHG, so the reporting is rather complete for countries which did report LULUCF projections. Finland did report CO_2 emissions but only on sub-sector level.

Table 4.6 Reporting of gas split for the sector 4. LULUCF [17]

LULUCF	Total GHG	CO_2	CH_4	N_2O
AT	x	x	x	x
BE	x	x	Z	x
BG	x	x	x	x
HR	x	x	x	x
CY		Z	Z	Z
CZ	x	x	x	x
DK	x	x	x	x
EE	x	x	x	x
FI	NE		x	x
FR	x	x	x	x
DE	x	x	x	x
EL	x	x	x	x
HU	x	x	x	x
IE	x	x	x	x

LULUCF	Total GHG	CO_2	CH_4	N_2O
IT	x	x	x	x
LV	x	x	x	x
LT	x	x	x	x
LU	x	x		x
MT	NE	NE	NE	NE
NL	NE	NE	NE	NE
PL	x	x	x	x
PT	x	x	x	x
RO	x	x	x	x
SK	x	x	x	x
SI	Z	Z	Z	Z
ES	x	x	x	x
SE	x	x	x	x
UK	x	x	x	x

Legend:	
x…value reported	blank cell reported
zero reported	notation key reported

4.2.2 Methodological issues and major challenges

Similar to the Agriculture sector, the LULUCF uncertainty is also high (36.7 % level uncertainty, 18.6 % trend uncertainty according to EU NIR (EEA, 2017d). Similar to the Agriculture sector the methodologies applied in LULUCF are very complex, the data sources are often inhomogeneous and the results of this sector are net results (the sum of sources and sinks leading to higher relative uncertainties). Thus, the uncertainties can be very high in this sector, even higher than 100 %. The paradox of this sector is that even sophisticated methods do not necessarily decrease uncertainty. Similarly, a certain methodology may provide a more refined projected time series, but this does not imply by any means that the uncertainty is lower than if a simple approach is applied. Nevertheless, a more elaborate approach allows consideration of more aspects and better reflects the (complex) dynamics within the sector, but such approaches, especially models, are work and data -intensive.
This is the main reason why the ETC/ACM does not apply a reference year calibration to the LULUCF sector, because due to the high uncertainty a calibration does not necessarily lead to an increased accuracy.
In the 2017 reporting questions regarding LULUCF were raised to 24 Member States. Most of the findings in the QA were related to deviations of the reference year compared to the inventory which

[17] The results of this table are based on an assessment of the year 2020 reported in 2017.

did not lead to a calibration but clarification was requested from the Member State (this finding applied for 12 Member States). One of the main reasons is that the LULUCF projections were not updated every two years. Another common issue in the LULUCF sector is that the emissions/removals were reported under the ESD sector. In this case the MS were asked to only report LULUCF for Total GHGs, CO_2, CH_4 and N_2O. Other findings concerned outliers, sum errors and other reporting inconsistencies. According to the model factsheet analysis six Member States apply models in the LULUCF sector, whereby it was difficult to further categorise the type of model due to a lack of information presented in the model factsheets.

5 Summary of QA/QC results for Norway

Norway is a member country of the EEA, but not the EU. As an EEA country, Norway shares a number of environmental commitments with the EU, such as for GHG emission reductions. For this reason Norway can voluntarily participate in the QA/QC procedure of the EEA and the ETC/ACM.
In 2017 Norway submitted projections on a voluntary basis for the WEM scenario for the years 2015-2030 on 11/05/2017 and provided a resubmission on 31/05/2017 as a result of the QA/QC. The submission covers all years (also intermediate years) to 2030, all sectors and gases, as well as ETS emissions. Norway also reported on parameters and the model factsheet. 2015 was selected as reference year for all sectors except for LULUCF (RY is 2012) which are in line with the latest GHG inventory. In total Norway received 17 questions, mainly concerning minor consistency and completeness issues.
During the QA/QC together with the ETC/ACM and Norway an approach was agreed to harmonise the LULUCF time series in order to report the data consistently with the other sectors. The time series was gap-filled and extrapolated from 2030-2035 by the ETC/ACM to ensure that the dataset was consistent with the final EU/EEA dataset.
Due to the outcome of the QA/QC checks of Norway's submission, namely comparably low number of questions consisting of rather minor issues and the active collaboration with the national experts, it can be concluded that the overall quality of the submission is good and that Norway is interested to further improve the projections.

6 Conclusions and recommendations

6.1 Conclusions

The mandatory biennial reporting of the GHG projections by EU Member States is an important source of information in terms of monitoring the achievement and tracking progress towards EU GHG reductions targets.

The results of the QA/QC procedure in 2017 clearly show that the Member States projections improved substantially compared to previous submission years and provide evidence that the existing QA/QC procedure applied is effective in both identifying errors and stimulating improvement. This can also be seen in the high number of resubmissions in the course of the communication with the Member States in 2017, which underpins the constructive and pro-active collaboration between the Member States experts and the ETC/ACM as well as EEA experts.

The results presented in this report prove the progress made in terms of completeness, consistency and accuracy of the submissions. The switch to the 2006 IPCC Guidelines and the change in GWP are complete in 2017 and the ETS/ESD split is more consistent and more complete. This is also demonstrated by the fact that in 2017 no reference year calibration was necessary and all submissions were deemed to be consistent with historical emissions.

Regarding the parameters in 2017 all Member States provided the parameter table. The major reasons for questions during the QA/QC process were the application of incorrect units and deviations from historical surrogate data sets (Eurostat 2017a, 2017b and Entso-e, 2017). In most cases the Member States either provided explanations or revised parameters. Regarding the use of the recommended parameters by the European Commission which were selected for this analysis, showed that the recommendations were only followed by less than half of the Member States. However, this check was performed only for informative purposes and there were no follow ups with Member States in this QA/QC cycle. Therefore, there is a need to further develop this check for future reporting years.
In the 2017 reporting year, for the first time the automated CDR checks were successfully tested by the EEA. Unfortunately, the checks did not lead to visible improvements in terms of number of summation errors detected by the ETC/ACM during the QA/QC procedure. Nevertheless, due to these checks, it is expected that in upcoming reporting years when basic reporting errors, such as sum errors are displayed, the increased level of awareness will trigger corrective actions by the MS before submitting the data and thus before the actual QA/QC procedure takes place. This could significantly improve the quality of the submissions and make the whole procedure lighter and more efficient.

It is foreseen that in the future the ETC/ACM will be able to put more focus on methodological aspects, detailed trend analyses, underlying assumptions, policy-related interlinkages, and other more content-related analyses of the projections. Therefore, the ETC/ACM together with the EEA is constantly improving and adapting the procedure in order to be ready for new challenges and to be able to deal with more refined and more sophisticated reporting. The following example demonstrates how reporting and checking challenges can suddenly change and tools need to be updated accordingly. In 2017, e.g. for the first time Lithuania correctly reported negative (recovered) emissions in sector 2.B.1. Chemical Industry[(18)] for the ETS sector. This was flagged as an error in the current checking tools, which highlighted the negative emissions in the sum check. In addition this was flagged in the ETS split check, as the ESD/ETS split was not consistent with the Total GHGs, although the reporting of Lithuania is correct. It is therefore required that the ETC/ACM will adjust its tools in order to reflect this advanced level of reporting.

6.2 Recommendations

Although the reporting has improved constantly in the past, some reporting challenges persist for Member States and the ETC/ACM. In the following the main recommendations derived from the QA/QC procedure 2017 are listed. It has to be noted that these recommendations do not apply for all MS, but can be seen as a general summary of prevalent issues. A complete list of all recommendations in 2017 is provided in Annex 1.

Timeliness:

- Further improvement of the timely reporting of MS' submissions would allow for a more efficient and faster QA/QC procedure. The responsiveness of MS experts is crucial especially when more than one communication loop is necessary. Increased timeliness would also help minimising the administrative burden for all parties involved i.e. MS, EEA, ETC/ACM and EC.

Completeness:

- Further increasing the completeness of mandatory information such as detailed underpinning explanatory data and a detailed, transparent report would facilitate more in-depth cross-

[(18)] CO2 from ammonia production is recovered for downstream use.

comparison of reported projections and thus enhance the quality of the aggregated EU projections.

- Additionally increasing the completeness of voluntary information such as notation keys would give additional information on the scope and completeness of estimated emission sources in a MS and would help identify typical errors such as transcript or sum errors.
- The voluntary reporting of a WAM scenario is especially valuable since they should complement the interpretation of the projected progress to target assessment of a WEM scenario as the scenario sheds light on the sum of policy effects of additional measures (WAM-WEM), in particular as a WAM scenario will often cover policies which are adopted at EU level but not yet at MS level.
- Voluntary reporting of a WOM scenario, if done in a methodologically consistent way, can be helpful to shed light on the sum of policy effects of implemented measures (WEM-WOM).

Consistency and comparability:

- Introducing or increasing quality control checks as a routine activity by MS experts before submitting the dataset would significantly reduce the number of questions and resubmissions necessary. A checklist for pre-submission QC checks for MS' national GHG projections is proposed in Annex 2 of this document. In addition, the new automated CDR checks will provide immediate feedback to the MS before they officially submit the data and enable MS to adjust the data if necessary. However, there is a small risk that it might lead to delays of the submission date.
- Further improvement of the internal consistency of MS' submissions could be facilitated by providing additional guidance on sector allocation (e.g. ETS/ESD split, LULUCF, aviation) and would significantly reduce the effort of re-allocating sectors by the ETC/ACM.

Accuracy and transparency:

- It is important for MS experts to explain sectoral trend changes and outliers in emission trends in the report that accompanies the submission of the national GHG projections dataset in order to increase the efficiency of the QA/QC process.

Parameters:

- To facilitate a comparison with less uncertainty in the future it is recommended to update the reporting template with unmistakable units for all energy prices, e.g. same reference year as for GDP (Euro (2010)).
- It is recommended to follow up with Member States if they do not use supranational recommended parameters by the Commission so that for every deviation at least a clear explanation is documented.

References

COM (2016): Recommended parameters for reporting on GHG projections in 2017. Final after consultation, 14/06/2016.

EC (2015): Elements of the Union System for Policies and Measures and Projections and the Quality Assurance and Control (QA/QC) Programme as Required under Regulation (EU) NO 525/2013 (online: https://ec.europa.eu/clima/sites/clima/files/strategies/progress/monitoring/docs/union_pams_projections_en.pdf, 15/09/2017)

EEA (2017a – unpublished): Draft guidance for reporting of ETS and ESD projections under the MMR, will be available at: http://cdr.eionet.europa.eu/help/mmr

EEA (2017b): EU Emissions Trading System (ETS) data viewer, https://www.eea.europa.eu/data-and-maps/dashboards/emissions-trading-viewer-1

EEA (2017c): Trends and projections in Europe 2017 - Tracking progress towards Europe's climate and energy targets, European Environment Agency (online: https://www.eea.europa.eu/themes/climate/trends-and-projections-in-europe/trends-and-projections-in-europe-2017/index, 15/11/2017)

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Eurostat (2017a): Population (demo_pjan). Available from: http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=demo_pjan&lang=en. Last update: 07/02/2017

Eurostat (2017b): GDP and main components (nama_10_gdp). Available from: http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_10_gdp&lang=en. Last update: 21/02/2017.

Oeko-Institut (2015 - unpublished): Short briefing paper on the consistency of GHG projections parameters.

Annex 1 List of recommendations 2017

key words	Sector(s)	Gas(es)	Year(s)	Check performed	Recommendation as a result of the QA/QC procedure 2017
QC for consistent dataset	all	all	all	Consistency check (C2)	It is recommended for future reporting to implement QC procedures which ensure that the submitted dataset is correct and consistent.
Consistent use of notation keys	all	NA	NA	Consistency check (C2)	In case no projections are estimated it is recommended to not to report a reference year value, but only a notation key for the whole time series.
Default units parameters	NA	NA	NA	Unit check (C5a)	It is recommended to use the default units for reporting parameters.
Reporting of 1A3a	1A3a	ETS GHGs	all	ETS/ESD check (C6)	It is recommended to exclude domestic aviation (1A3a) from ETS emissions due to following reasons: 1. It is very challenging to estimate ETS emissions from domestic aviation in a consistent way related to inventory emissions. 2. If ETS emissions from domestic aviation are reported in the template, they will be summed up for ETS emissions from stationary installations (e.g. sector 1, Total w.out LULUCF). A mix of stationary and aviation ETS emissions doesn't seem to be useful for further analysis. However, ESD emissions (CH_4 and N_2O) from domestic aviation can be reported under ESD, if available.
QC for correct sums	all	all	all	Sum check (C4a)	It is recommended for future reporting to implement QC procedures which ensure that the sub-sectors and gases are summed up correctly.
Description of methodologies etc.	NA	NA	NA	Completeness check (C1)	It is recommended to provide a description of methodologies, assumptions and results of sensitivity analysis together with the projections data.
Explanation of IE	NA	NA	NA	Completeness check (C1)	It is recommended to provide explanations for "IE" entries either in the report or the Excel sheet.
Indicators	NA	NA	NA	Completeness check (C1)	For future submissions it is recommended to report on indicators.
Indicate unit of parameter	NA	NA	Reference Year	Historical parameter check (C5b)	It is recommended for future submissions to indicate in column C of the parameter template the additional unit

key words	Sector(s)	Gas(es)	Year(s)	Check performed	Recommendation as a result of the QA/QC procedure 2017
					information if the default unit was not used.
Use of consistent parameters	NA	NA	Reference Year	Historical parameter check (C5b)	It is recommended for future projections to use parameter data which are in line with official statistical data of your country or other official sources (e.g. Eurostat) that is published and also used in other contexts.
Use of notation keys for non-reported parameters	NA	NA	NA	Completeness check (C1)	It is recommended to report notation keys for parameters which are not used in future submissions.
Non reporting of MIB aviation/navigation	M.IB. Aviation, Navigation	Total GHGs ($ktCO_2e$)	all	Completeness check (C1)	It is recommended to provide projections for MIB Aviation and Navigation
Provision of model factsheet	NA	NA	NA	Completeness check (C1)	It is recommended to provide the model factsheet in the next submission
Provision of LULUCF	LULUCF	all	all	Consistency check (C2)	It is recommended to report on LULUCF emissions in the next submission.
Reporting of MIB in ETS/ESD	M.IB. Aviation, M.Intl. aviation EU ETS	ETS/ESD GHG	all	Consistency check (C2)	It is recommended not to report MIB aviation/MIB aviation EU ETS in the sectors ESD and ETS, but only for Total GHGs. Please note that in such case the ETC/ACM removes the values from the ETS/ESD.
Reporting of reference year value and year	NA	NA	Reference year	Historical parameter check (C5b)	For future submissions it is recommended to report the reference year value and indicate the reference year in the headings of column D.
Provision of updated projections	all	all	all	Recalculation check (C4b)	It is recommended to report updated projections.
ETS consistency with historical data	all	ESD/ETS GHGs	Reference year/all years	ETS/ESD check (C6)	It is recommended for future reporting that the total GHG and ETS emissions for reference year and the projected time series are harmonised with historical values.
Intermediate years for all gases	all	ETS/ESD GHGs	all	ETS/ESD check (C6)	It is recommended to provide a complete ETS/ESD split, also for intermediate years in case Total GHGs are reported for intermediate years.
Explanation of recalculations	NA	NA	NA	Recalculation check (C4b)	It is recommended to include a section in the technical report, highlighting differences with previous reporting.
Provision of sensitivity analysis	NA	NA	NA	Completeness check (C1)	It is recommended to carry out a sensitivity analysis.

key words	Sector(s)	Gas(es)	Year(s)	Check performed	Recommendation as a result of the QA/QC procedure 2017
QC for correct units	NA	CH_4, N_2O	NA	Consistency check (C2)	It is recommended to implement QC procedures which ensure that N2O and CH_4 are reported in kt CH_4/N_2O and not in CO_2equivalents.
Reporting of LULUCF in ETS/ESD	LULUCF	Total ESD GHGs ($ktCO_2e$)	all	Consistency check (C2)	It is recommended not to report LULUCF emissions under ESD. Please note that in such case the ETC/ACM removes the values in the final dataset.
Consistent ETS/ESD split	all	ETS/ESD GHGs	all	ETS/ESD check (C6)	It is recommended to provide a full and consistent ETS/ESD split in future submissions.
Timely provision of report	NA	NA	NA	Completeness check (C1)	It is recommended to provide a report together with the data submission.

Annex 2 Checklist for quality control (QC) checks for MS' national GHG projections under MMR Art. 14

1. Check whether all mandatory and available recommended reporting requirements are included

- Excel template includes GHG emissions:
    - organised by sectors (incl. LULUCF) and memo items (mandatory)
    - organised by gases: CO_2, CH_4, N_2O, HFC, PFC, NF_3, SF_6, (or group of F-gases) (mandatory)

  Please note: LULUCF is reported only under Total GHG/CO_2, CH_4 and N_2O; Memo Items are only reported under Total GHG and not for ETS/ESD; No emissions for 1A3a domestic aviation reported under ETS
    - for all years: RY, 2015, 2020, 2025, 2030, 2035 (mandatory) and intermediate years (good practice)

  Please note: the reference year needs to be reported for all gases and sectors
    - for all scenarios: WEM (mandatory), WAM (where available), WOM (where available)
    - EU ETS/ESD split for sectors, years and scenarios (mandatory).
    - notation keys in case of missing emissions data (good practice)
    - projection parameters for mandatory years and scenarios (mandatory):

  Please note: Only report those parameters that are used as input to the modelling of scenarios; Units are reported according to the default units as indicated in the reporting template. If this is not possible, please indicate the applied unit; Reference year and reference year value for the parameters need to be reported as well.
- Report including:
    - description of methodologies/models used (model factsheet) (mandatory)
    - underlying assumptions (mandatory)
    - results of sensitivity analysis (mandatory)

2. Check whether internationally agreed GWP according to 2006 IPCC Guidelines were used and whether GHG were reported in the correct unit

- CO_2 in Gg CO_2; CH_4 in Gg CH_4, N_2O in Gg N_2O
- F-Gases in Gg CO_2eq
- Total GHG in CO_2eq = Gg CO_2 + Gg CH_4*25 + Gg N_2O *298 + Gg CO_2eq F-Gases

3. Check whether the reference year (= starting year, base year) of projections is consistent with the historic emissions of the latest available inventory

- Total GHG emissions
- Total ETS emissions
- Sectoral level on main source category level of total GHG from latest GHG inventory

Please note: the sectoral difference between emissions in the reference year of the projections and historic emissions of the same year should be lower than the sector specific uncertainty reported in the NIR for emission inventories

4. Checking that disaggregated emission projections equal the total sum you reported.

- by gas
- by sector (Total GHG, ETS and ESD): Sector 1 = 1A1+1A2+1A3+1A5+1A5 etc.

  Please note: the sectors should add up correctly especially when notation keys are used (IE)
- ETS/ESD: ESD+ETS+CO2 domestic aviation=Total GHG

  Please note: the difference should be less than 0.25 % of the total emissions (excl. LULUCF). 0.25 % was chosen as threshold for significance since a smaller difference could be attributed to rounding