Analysis of Member States' 2023 GHG projections

Submitted under Art 38 (1)(b) of the Regulation on the Governance of the Energy Union and Climate Action (EU) 2018/1999

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Contents

Executive summary

In the 2023 mandatory reporting cycle, the 27 EU Member States and the 3 EEA countries undertook their second reporting of Greenhouse Gas (GHG) projections data, as per Art. 18 (1) (b) of the Regulation on the Governance of the Energy Union and Climate Action (EU) 2018/1999.

The total **number of findings** communicated to the participating countries saw a reduction compared to the previous mandatory year. A discernible trend has emerged over successive mandatory cycles, indicating a diminishing pattern in the number of questions raised by ETC CM experts since 2019. The most significant drop occurred in 2023, with approximately 30% fewer total findings than in 2019 and 2021.

Although **timeliness** remains a persistent challenge, there was an improvement in 2023, with three additional Member States submitting their projections before or on the official reporting deadline compared to the previous mandatory year, totalling 15 MS this year. Additionally, 16 MS provided a resubmission addressing the findings identified by the ETC CM during the QA/QC process.

The **completeness** of mandatory information in 2023 remained relatively consistent for most MS compared to 2021. All Member States submitted either a specific report for projections or a combined report for projections and policies and measures, indicating a modest improvement from the previous reporting cycle. Since 2021, detailed LULUCF projections were mandated, achieving full compliance in 2023. These changes not only improve completeness but also enhance **transparency.** However, there was a notable decline in the **completeness of voluntarily** reported information in 2023, with 42 submissions compared to 48 in 2021. Regarding scenarios, nine Member States did not report a WAM scenario, and only four reported a WOM scenario. This contrasts with 2021 when five Member States did not report a WAM, but the same number reported a WOM scenario.

Most Member States opted for the base years 2020 and 2021 for their projections, all referencing the 2023 inventory submission as the underlying historical dataset. Notably, the most significant absolute deviations of the EU from the EU inventory are observed primarily in the Energy sector, followed by LULUCF.

Inconsistencies in time series also occur when countries report historical data without corresponding GHG projections, prompting requests for dataset resubmission or corrections by the ETC CM. Another challenge stems from sum errors, with 19 countries facing issues in 2023 compared to 13 in 2021, typically resolved through resubmission of corrected datasets. To ensure scenario consistency, the ETC CM compares WEM, WAM, and WOM results, triggering findings for 16 countries in 2023, an improvement from 19 countries in 2021.

Regarding the **accuracy and transparency** of the reported trends, the ETC CM sought for clarification when outliers, implausible trends or significant recalculations were identified, but without any further explanation in the written report. Most issues were clarified during the QA/QC by the responses from the Member States. For ETS emissions a separate check of the changes in trend was conducted and it showed that most changes in trends have an explanation. It was noted that, especially for smaller countries, closures or start-ups of single plants can strongly affect the trend of ETS projections.

In total, the countries reported 156 unique **parameters** across different sectors, a decrease from 389 in 2021. The ETC CM identified 38 common parameters, down from 50 in 2021. These parameters were taken into account only if reported by 14 or more Member States. Population and GDP were the most common parameters. Concerning recommended parameters from the Commission's Guidance for harmonizing

projections, four Member States closely followed the guidance for most parameters, with the fuel prices price being the most utilized recommended parameters.

A relatively large number of issues with parameter values was resolved through explanation by Member States. Although reasons usually relate to the use of national datasets, and slight differences in e.g., exchange rates, it shows that this is still a source of uncertainty. Not all Member States provided an explanation why recommended parameters were not considered, but many countries explained that they preferred parameters from national data sources and other modelling exercises.

Regardless of the challenges in the 2023 cycle, countries are successfully transitioning to improve reporting under the Gov. Reg. The primary **future challenge** lies in the timeliness of reporting, impacting the QA procedure and related products. Additionally, there is a need to enhance reporting templates to allow different base years for various sectors. The current restriction hampers accurate representation, as noted during QA/QC due to variations in starting points influenced by model exercise timing.

1 Introduction

From March 15 2021 onwards and every two years thereafter EU Member States have to report their GHG projections in accordance with Art. 18.1(b) of the Regulation Governance of the Energy Union and Climate Action (EU) 2018/1999 (Gov. Reg.) and the related Implementing Regulation (EU) 2020/1208, which repealed the EU Monitoring Mechanism Regulation (EU no. 525/2012).

With the new reporting obligation, a new reporting platform (Reportnet 3.0) and revised or new reporting tables were introduced, including new reporting elements (see Box 1.1.). Additional information and guidance documents for Member States covering changes introduced by the new Gov. Reg. and ReportNet 3.0 platform can be found here: Gov.Reg. Projections — Eionet Portal (europa.eu).

Box 1.1   **Summary of main changes in reporting under the Governance Regulation (Gov. Reg.) compared to the MMR**

- New reporting platform Reportnet 3.0.
- New reporting tables for reporting GHG projections and related information including integrated voluntary tabs to perform basic quality checks before submission.
- Detailed projections of emissions and removals from LULUCF, according to inventory and land accounting categories.
- Possibility to report projections for the unspecified mix of HCFs and PFCs, and changes to the Memo Items.
- Some key indicators already suggested in the regulation.
- Energy related parameters / variables used for projections aligned with the regulation.
- Sensitivity analysis results and their parameters have to be reported in tabular format in addition to textual report.
- Report on information relevant for the accounting towards the ESR targets and the LULUCF.

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. At the moment of writing this report, the document detailing the elements of the Union system has not been updated to reflect the transition from the MMR to the Governance Regulation.

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 outcome of the system provides data for the evaluation of progress towards EU and international commitments, as per Article 39 of the Governance Regulation and 4 and 12 of the UNFCCC and 3 of the Kyoto Protocol.

In accordance with point (a) of Article 44(1) of the Governance Regulation (EU/2018/1999), 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 (European Commission, 2015).

Figure 1.1   Union System for Policies and Measures and Projections

The Union's system for policies and measures and projections
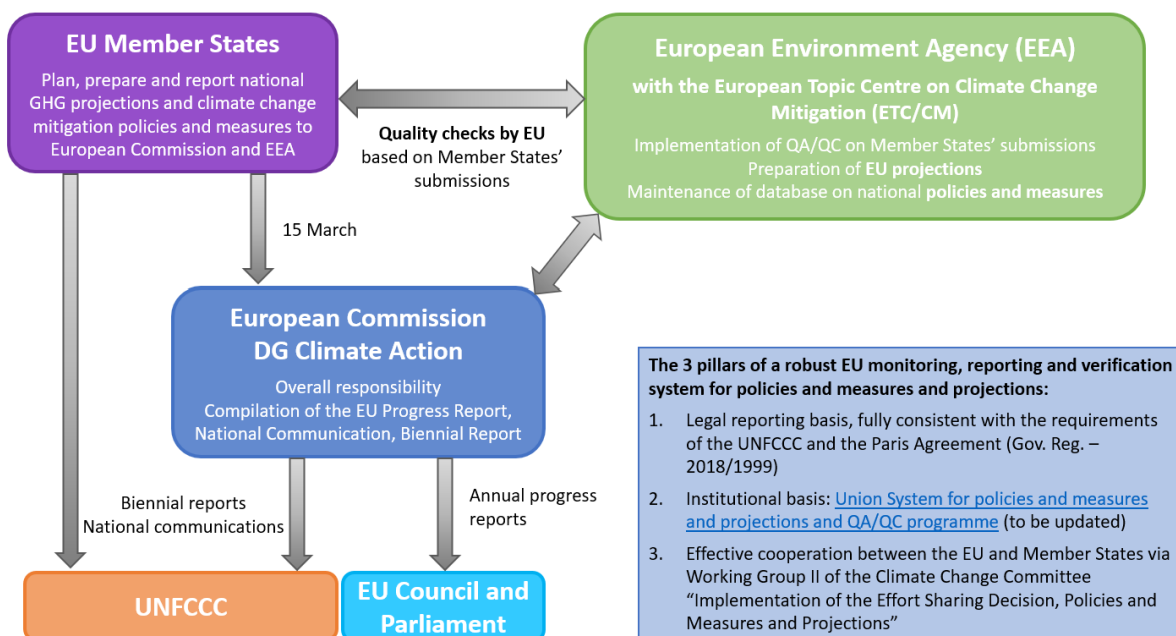
Source: Adapted from European Commission, 2015.

1.2 Reporting requirements

Article 18 (1) (b) of the Governance of the Energy Union and Climate Action Regulation (EU) 2018/1999 (Gov. Reg.) and Article 38 of the related Implementing Regulation (EU) 2020/1208 set out the details for Member States to provide information on national GHG projections. Every two years (starting from 2021 with the new reporting under the Gov. Reg.) the Member States shall report GHG projections and accompanying information to the European Union. In total there are seven reporting tables for the reporting of GHG projections and the related information under the Gov. Reg. which are briefly summarised in the following figure (Figure 1.2).

Figure 1.2 Overview of reporting tables for GHG projections and related information in accordance with Article 18 (1) (b) of the Governance of the Energy Union and Climate Action Regulation (EU) 2018/1999 (Gov. Reg.) and Article 38 of the related Implementing Regulation (EU) 2020/1208
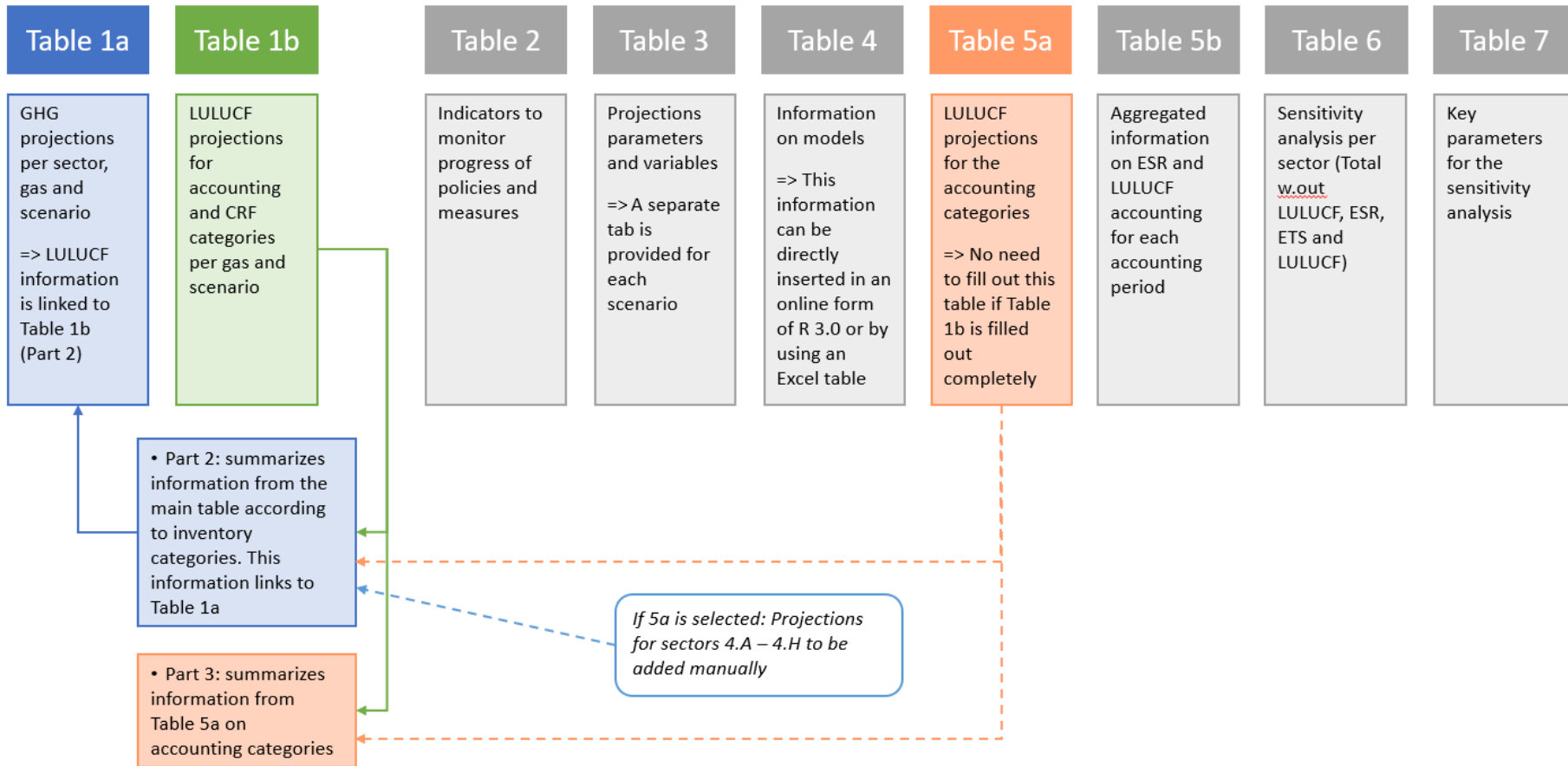
The main mandatory elements of this reporting obligation are:
- GHG projections reported by gas (Total GHGs, Total ETS GHGs, Total ESR GHGs, CO_2, CH_4, N_2O, HFC, PFC, SF_6, NF_3, unspecified mix of HFCs and PFCs)
- the base year, 2020, 2025, 2030 and 2035, 2040
- Inventory version to which the GHG projections are related
- Split by sectors and categories in line with the common reporting format (CRF) format
- Detailed LULUCF projections including projections assigned to the LULUCF accounting categories according to the Regulation (EU) 2018/841
- Sectoral split into ETS and ESR emissions
- A with existing measures scenario (WEM)
- Information on models
- Provision of a sensitivity analysis of the total GHG, ETS and ESR
- Underlying key parameters for the sensitivity analysis
- Provision of a description of methodologies, models and underlying assumptions
- Provision of parameters and variables used in the projections

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. The European Environment Agency (EEA) is responsible for the annual implementation of the QA/QC procedures and is assisted by the ETC CM.

The Union projections are compiled as the sum of all EU Member States projections, therefore it is very important that the Member States data meet certain quality objectives. 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 Member States' 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 Member States for all years, gases, sources and sinks as required under the Gov. Reg., 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 2.2).

Consistency: means to ensure internal time series consistency in all elements of national and Union GHG projections over a period of historic and future years as well as to ensure that key input parameters and assumptions are aligned across different sectors for national GHG projections and across different Member States for Union GHG projections.

Comparability: means to ensure that national estimates of projected emissions and removals reported by Member States are comparable across Member States. The allocation of different sectors and categories by gas follows the split in accordance with the Gov. Reg. which also defines projections horizon, base year

(starting year), ETS/ESR spilt, EU policies and measures to be taken into account and harmonised key assumptions.

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 Member States 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-CM_Report_2023_QAQC Procedure 10/2023.

Due to the new reporting requirements in accordance with Art 18.1 (b) of the Gov. Reg., the ETC CM had to modify and update some of its checks. Apart from the extension of all checks to the new gases and sectors, the following updates were applied:

- The completeness check is applied to all reporting tables (1a, 1b, 2, 3, 4, 5a, 5b, 6 and 7) as well as the report.
- The consistency check is extended to the LULUCF related information (provided in tables 1b and 5a).
- The sum check is extended to the LULUCF related information provided in tables 1b and 5a.
- The new sensitivity analysis checks the units, parameters and scenarios related to the sensitivity scenarios (table 6, 7 and the report).
- The new interlinkages check based on Gov.Reg. Annex VI (e) checks that information on interlinkages between PaMs and projections are provided.
- The new time series check ensures that Member States do not report historical values for sectors/categories for which no projections are available in the reporting template because this causes strange jumps in the time series.

Additional information and guidance documents for Member States covering changes introduced by the new Gov. Reg. and ReportNet 3.0 platform can be found here: [Gov.Reg. Projections — Eionet Portal (europa.eu)](europa.eu).

The aggregated dataset for EU 27 does not include all emission sources as reported in the GHG projections. It includes main sectors and categories which are relevant to explain trends and which are mandatory to report. This selection increases constantly to adapt to the design of European policies and measures. The following table (Table 1.1) provides an overview of the sectors and categories included in the current EU aggregated dataset:

Table 1.1   Sector codes and sector names of the EU aggregated projections dataset

Sector code	Sector name	Sector code	Sector name
1	Energy	4	Land use, land use change and forestry (LULUCF)
1.A.1	Energy industries	4.A	Forest land
1.A.2	Manufacturing industries and construction	4.B	Cropland
1.A.3	Transport	4.C	Grassland
1.A.3.a	Domestic aviation	4.D	Wetlands
1.A.3.b	Road transportation	4.E	Settlements
1.A.3.c	Railways	4.F	Other land
1.A.3.d	Domestic navigation	4.G	Harvested wood products
1.A.3.e	Other transportation	4.H	Other
1.A.4	Other sectors	5	Waste
1.A.5	Other	M.IB aviation	Memo item: International bunkers aviation
1.B	Fugitive emissions from fuels	M.IB navigation	Memo item: International bunkers navigation
1.C	CO_2 transport and storage	Total excl. LULUCF	Total excluding LULUCF
2	Industrial processes and product use	Total excl. LULUCF incl. Int. aviation	Total excluding LULUCF including the mem item international aviation (calculated by the ETC CM)
3	Agriculture	Indirect CO_2	Indirect CO_2 emissions

The final EU27 dataset includes the GHG projections for all years, starting with the EU base year (2021) until 2050. Intermediate years were gap-filled by the ETC CM with linear interpolation if not reported. The dataset is prepared for all gases, including the ETS/ESR split.

2 Results from the quality checking procedure

In the reporting cycle of 2023, all 27 EU Member States and three EEA countries (Iceland, Norway and Switzerland) provided information on GHG projections in accordance with Art 18 (1) (b) of the Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action.

2.1 Communication with Member States

During the QA/QC procedure in 2023, the ETC CM experts raised a total of 451 questions to the Member States' experts (compared to 625 questions in the last mandatory reporting year in 2021). 49.7% of these questions could be solved directly with the Member States' experts in the communication process. A further 18.9% of the questions were solved by the reviewers and the remaining 31.5% constitute recommendations of encouragements for next submissions.

All issues, both those that were solved by the ETC CM experts and those that remain as recommendations or encouragements for the next submission were communicated to the Member States' experts in the communication log file.

Figure 2.1 presents the number of questions per Member State. On average, the ETC CM asked around 17 questions per Member State, which is less than the number of questions asked in 2021, when 22 questions were asked per Member State.

However, it should be noted that the number of questions sent to a Member State is not necessarily a suitable indicator for the quality of a submission, 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.

Figure 2.1   Number of questions per Member State
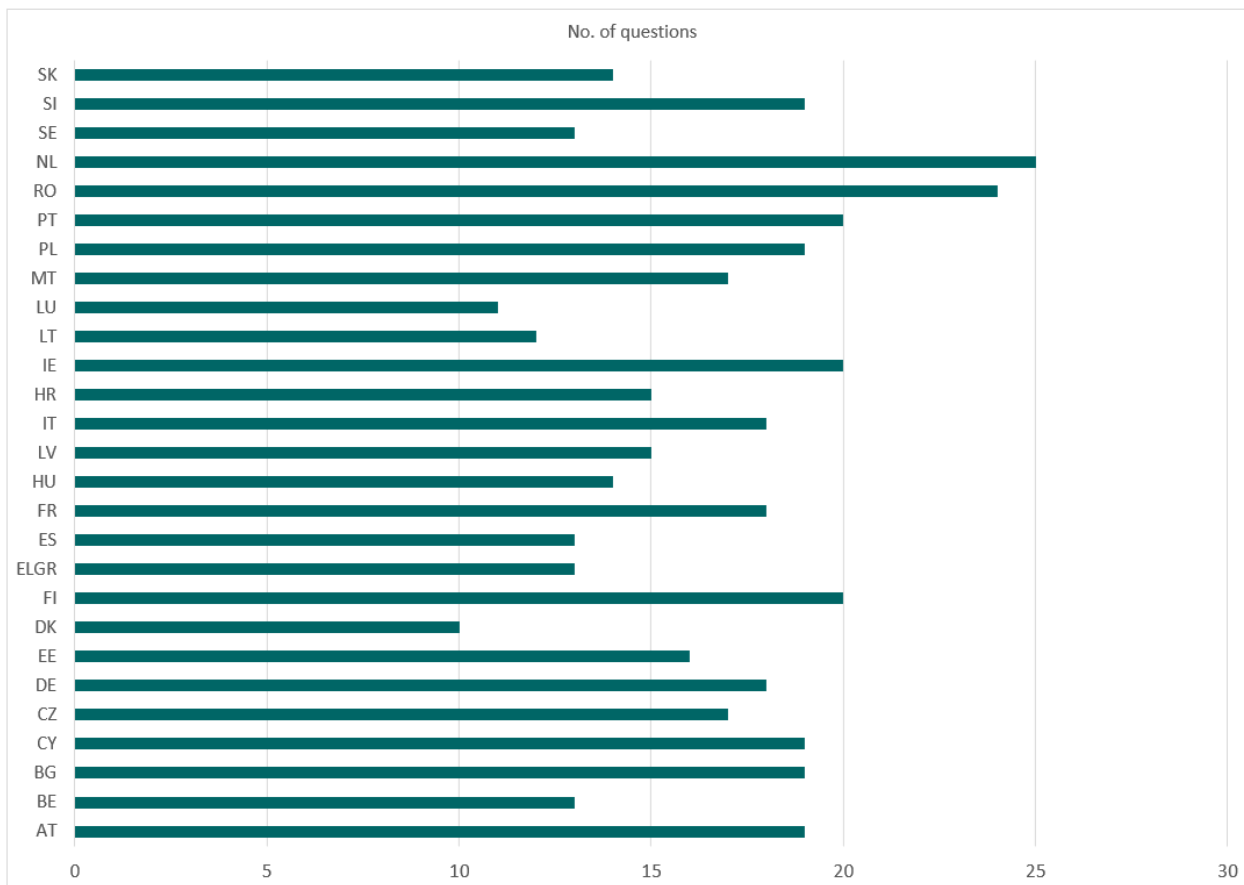
The majority of the questions were related to completeness, regarding which 163 questions were raised, constituting 36.1% of the total. However, other checks also triggered several questions, such as the check against the EC recommended parameters (43 questions constituting 9.5% of the total) and consistency (41 questions constituting 9.1% of the total). These were the three main areas where initial checks were identified by the ETC CM (Figure 2.2).

It can therefore be concluded that the initial submissions provided by the Member States before the QA/QC process was completed regularly were not fully complete, lacked consistency, and the recommended parameters provided by the EC were not fully considered by Member States in their projections. However, through the QA/QC process, the majority of the Member States provided updated and additional information, leading to a substantial improvement in the completeness, consistency, and usage of the recommended parameters.

Figure 2.2   Number of questions per check
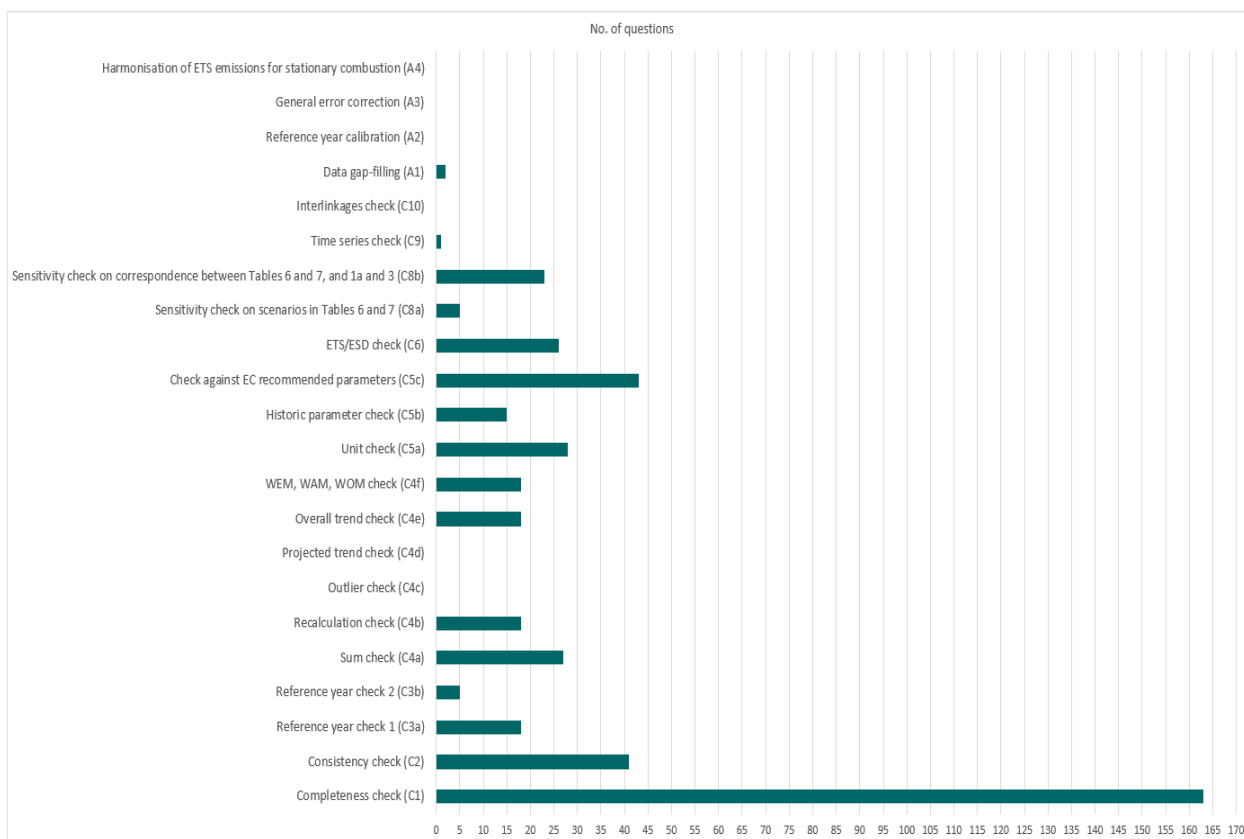
Figure 2.3 shows how the questions that were raised by the ETC CM are distributed across the different main sectors. A considerable proportion of the questions were related to all or multiple sectors (39%). Such questions typically include issues concerning the inconsistent use of notation keys or systematic sum errors. Furthermore, a significant share was also not related to any sector and labelled as NA – not applicable (38.1%). Not applicable was used for general questions regarding the submission (e.g., no model factsheet provided, reporting of indirect CO_2).

The largest share in terms of raised questions by the ETC CM is the energy sector with 6.4% of the questions followed by the LULUCF sector with 5.3% of the questions. Compared to 2021, when the energy sector constituted 17% of the raised questions, the distribution has observed a considerable shift from sector specific questions to questions either related to all or multiple sectors or not related to any sector.

Figure 2.3   Distribution of questions across sectors
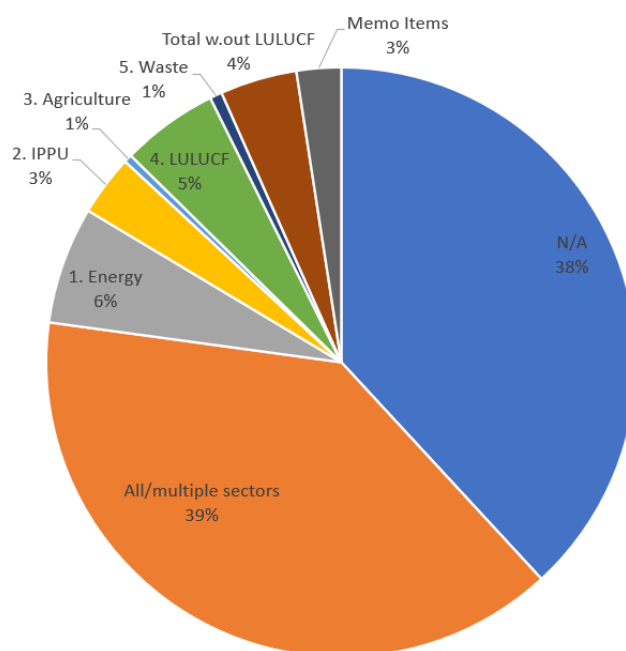
The responsiveness and overall collaboration with the Member States has been successful with most Member States replying within the given deadlines allowing the ETC CM to close the QA/QC process in time before it handed over the final dataset to the EEA. Any challenges were successfully resolved through bilateral communication between the ETC CM task leader and the Member States' experts. Some challenges included the delayed reporting of Member States or delays in resubmissions and incomplete reporting. To solve these issues and to ensure the consistency of the EU aggregated dataset, the ETC CM developed and suggested tailored solutions to the Member States concerned, which were subsequently bilaterally discussed until a mutual agreement was found.

2.2 Completeness and Timeliness

2.2.1 Date of submission and resubmissions

Figure 2.4 illustrates the timeliness of submissions in 2023. The first complete submissions are marked as green dots. Fifteen Member States submitted their projections before or on the official deadline of 15 March 2023 (Austria, Croatia, Czechia, Estonia, Finland, Greece, Italy, Malta, Netherlands, Poland, Portugal, Romania, Sweden, Slovenia, and Slovakia). This is an improvement compared to 2021, when 12 Member States had reported their projections submission before or by 15 March.

Four Member States (Cyprus, France, Ireland, and Latvia) submitted within six weeks of the deadline (compared to 7 Member States in 2021). Eight Member States submitted even later (Belgium, Bulgaria, Denmark, Germany, Hungary, Lithuania, and Spain), with Luxembourg being the last EU Member State providing its first submission at the beginning of August.

As can be observed in the figure, a substantial share, namely 16 out of 27 Member States, provided a resubmission (depicted as blue dots in Figure 2.4   ) during the QA/QC process. Eleven Member States, namely, Belgium, Cyprus, Greece, Ireland, Italy, Latvia, Lithuania, Poland, Portugal, Slovenia, and Spain, did not resubmit as the first submission passed the quality standards. This is a substantial increase from 2021, when only four countries did not resubmit. One Member State (Hungary) even provided two

resubmissions following up on the encouragements by the ETC CM to resolve certain issues identified during the QA/QC process.

On average, the time between the first submission and the final submission of the Member States that resubmitted in 2023 amounted to 54 days, which is approximately 10 days more compared to 2021. The majority of the Member States resubmitted their revised datasets in the months of May and June, with two Member States resubmitting in July and two in August.

Figure 2.4   Timeliness of submissions in 2021 by EU Member States
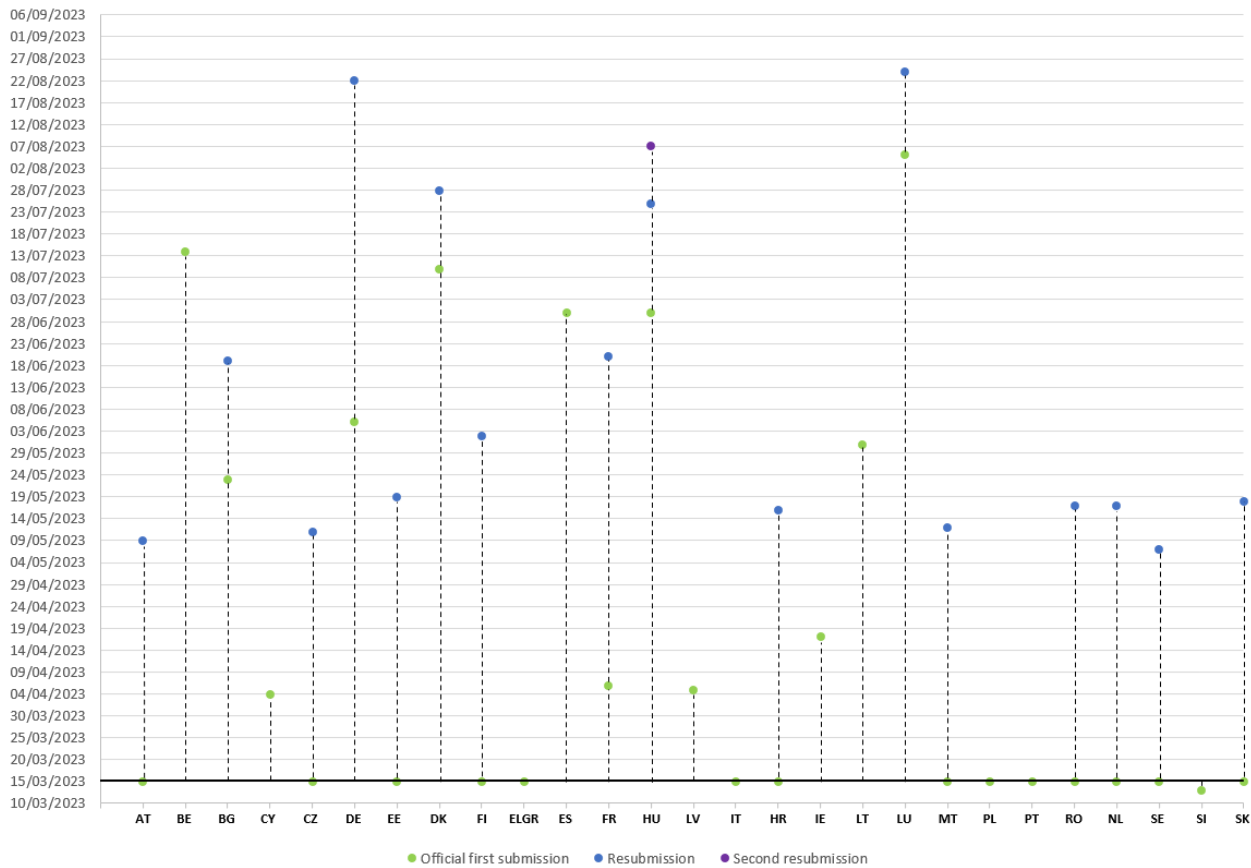
2.2.2 General completeness of submissions

The completeness of mandatory information has remained relatively consistent for most Member States in the 2023 reporting year compared to 2021 (Table 2.1). Notably, all Member States submitted the mandatory WEM scenario in Table 1a. Additionally, all Member States provided an updated projection, as well as a comprehensive sector and gas split for the WEM scenario in Table 1a. However, in 2023, only nineteen Member States furnished information on sensitivity analysis. Germany, and Italy did not supply model fact sheets in 2023, but all Member States submitted a specific report for projections or a combined report for projections and policies and measures (Art. 18 (1) of the Gov. Reg.), indicating an improvement from the 2021 reporting, when the Netherlands did not report it.

Since 2021, Member States have been obligated to provide detailed LULUCF projections, and full compliance has been achieved. In 2023, all Member States provided detailed LULUCF projections in either part 1 of Table 1b or in Table 5a. For the second time (in 2021 and 2023), information on emission and parameter sensitivity scenarios could be provided in Tables 6 and 7, respectively. nineteen out of the 27

Member States submitted at least one scenario in both Tables 6 and 7, while one Member State (Romania) exclusively submitted Table 7 (see also section 3.2).

However, the completeness of voluntarily reported information was notably lower in 2023 compared to 2021, totalling 42 against 48 in 2021. Twenty-one out of the 27 Member States reported indicators in 2023, compared to 18 in 2021. Regarding scenarios, nine Member States did not report a WAM scenario, and only four reported a WOM scenario. This contrasts with the reporting of voluntary information in 2021 when five Member States did not report a WAM, but the same number reported a WOM scenario.

Table 2.1   Overview on completeness of reporting in 2021

	Updated projections	Required sector split	Required GHG split	Detailed LULUCF Projections	LULUCF accounted projections	WAM	WEM	WOM	Provision of parameters	Sensitivity analysis	Model factsheet/ description	Report	Provision of indicators
AT	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes*	Yes	Yes	Yes
BE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes*	Yes	Yes	No
BG	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes
CY	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes
CZ	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes*	Yes	Yes	No
DE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes*	No	Yes	Yes
DK	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes
EE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes*	Yes	Yes	Yes
EL	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes*	Yes	Yes	No
ES	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes*	Yes	Yes	Yes
FI	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes*	Yes	Yes	Yes
FR	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes*	Yes	Yes	Yes
HR	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes*	Yes	Yes	Yes
HU	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes*	Yes	Yes	Yes
IE	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes*	Yes	Yes	No
IT	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes*	No	Yes	Yes
LT	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes*	Yes	Yes	Yes
LU	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes*	Yes	Yes	Yes
LV	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes*	Yes	Yes	Yes
MT	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes*	Yes	Yes	Yes
NL	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes*	Yes	Yes	Yes
PL	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes*	Yes	Yes	Yes
PT	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes
RO	Yes	Yes	Yes	Yes	Yes				Yes	Yes**	Yes	Yes	Yes
SE	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes*	Yes	Yes	No
SI	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes*	Yes	Yes	Yes
SK	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes*	Yes	Yes	Yes

Legend:
- Green — Yes, reported
- Red — Not reported (mandatory reporting items)
- Pink — Not reported but planned (mandatory reporting items)
- Orange — Not reported (voluntary reporting items)

Notes: * Tables 6 and 7 reported, ** only Table 6 or Table 7 was submitted

Table 2.2 provides an overview of the completeness of mandatory emissions data, categorized by gas, as submitted in Table 1a. The table outlines the count of countries, with a maximum of 27 (EU-27 Member States), that have submitted the required data for the year 2023, specifically focusing on numerical data. In instances where certain gases are not applicable to a particular sector, the corresponding cells are shaded in grey.

Excluding the totals, it is evident that the category with the highest number of submissions from Member States for the 2023 cycle was 2. Industrial processes, totalling 235 figures. Following closely is 1. Energy, with its subcategories like 1.A Fuel combustion, having 167 countries reporting. The average number of countries reporting for each category was 97, indicating that the former categories significantly exceed this average. Conversely, the categories with the fewest reporting countries include 1.C, 3.E, 3.J, 4.H, and CO_2 captured, all with nine or fewer countries reporting.

Table 2.2   Number of countries that reported numeric emissions data per sector and per gas for the mandatory year 2025 under the 'WEM' scenario

Category	CO2	N2O	CH4	HFC	PFC	Unspecified	SF6	NF3	Total	ETS	ESR
1. Energy	27	27	27	1	1	1	1	1	27	27	27
1.A. Fuel combustion	27	27	27	1	1	1	1	1	27	27	27
1.A.1. Energy industries	27	27	27	1	1	1	1	1	27	27	27
1.A.1.a. Public electricity and heat production	26	25	25	0	0	0	0	0	25	25	25
1.A.1.b. Petroleum refining	20	19	18	0	0	0	0	0	19	19	19
1.A.1.c. Manufacture of solid fuels and other energy industries	21	21	21	0	0	0	0	0	21	18	21
1.A.2. Manufacturing industries and construction	27	26	26	0	0	0	0	0	27	26	27
1.A.3. Transport	27	27	27	1	1	1	1	1	27	13	27
1.A.3.a. Domestic aviation	27	27	27	0	0	0	0	0	27	0	23
1.A.3.b. Road transportation	27	27	27	0	0	0	0	0	27	7	27
1.A.3.c. Railways	25	25	25	0	0	0	0	0	25	7	25
1.A.3.d. Domestic navigation	26	26	26	0	0	0	0	0	26	7	26
1.A.3.e. Other transportation	16	16	16	0	0	0	0	0	16	12	16
1.A.4. Other sectors	27	26	26	0	0	1	0	0	27	18	27
1.A.4.a. Commercial/Institutional	26	25	25	0	0	0	0	0	26	16	26
1.A.4.b. Residential	26	25	25	0	0	0	0	0	26	6	26
1.A.4.c. Agriculture/Forestry/Fishing	26	25	25	0	0	0	0	0	26	10	26
1.A.5. Other	17	16	15	0	0	0	0	0	17	6	17
1.B. Fugitive emissions from fuels	25	18	25	0	0	0	0	0	25	15	25
1.B.1. Solid fuels	9	1	13	0	0	0	0	0	14	8	14
1.B.2. Oil and natural gas and other emissions from energy production	23	15	23	0	0	0	0	0	23	11	23
1.C. CO2 transport and storage	1	1	1	0	0	0	0	0	2	2	2
2. Industrial processes	27	27	17	27	21	3	26	7	27	26	27
2.A. Mineral Industry	26	1	1	0	0	0	0	0	26	25	22
2.A.1. Cement production	21	1	1	0	0	0	0	0	21	20	7
2.B. Chemical industry	21	18	13	4	3	1	2	1	22	18	20
2.C. Metal industry	21	1	13	4	11	0	2	1	22	19	19
2.C.1. Iron and steel production	17	0	10	1	1	0	1	1	17	16	12
2.D. Non-energy products from fuels and solvent use	26	3	3	0	1	0	0	0	26	5	26
2.E. Electronics industry	1	0	1	7	8	1	7	7	12	3	12
2.F. Product uses as substitutes for ODS (8)	1	0	1	27	11	1	0	1	27	3	27
2.G. Other product manufacture and use	5	24	3	3	2	0	26	0	27	4	27
2.H. Other	5	2	1	2	1	1	1	0	8	5	8
3. Agriculture	26	27	27	1	1	1	1	1	27	0	27
3.A. Enteric fermentation	1	1	27	0	0	0	0	0	27	0	27
3.B. Manure management	1	26	27	0	0	0	0	0	27	0	27
3.C. Rice cultivation	1	1	8	0	0	0	0	0	9	0	9
3.D. Agricultural soils	1	26	0	0	0	0	0	0	26	0	26
3.E. Prescribed burning of savannahs	1	0	0	0	0	0	0	0	2	0	2
3.F. Field burning of agricultural residues	1	12	12	0	0	0	0	0	13	0	13
3.G. Liming	24	0	0	0	0	0	0	0	24	0	24
3.H. Urea application	25	0	0	0	0	0	0	0	25	0	25
3.I. Other carbon-containing fertilizers	9	0	0	0	0	0	0	0	10	0	10
3.J. Other (please specify)	0	1	1	0	0	0	0	0	2	0	2
4. Land Use, Land-Use Change and Forestry (LULUCF, reported emissions and removals) (9)	27	27	24	0	0	0	0	0	27	0	0
4.A. Forest land	27	23	21	0	0	0	0	0	27	0	0
4.B. Cropland	27	27	13	0	0	0	0	0	27	0	0
4.C. Grassland	27	24	17	0	0	0	0	0	27	0	0
4.D. Wetlands	26	19	9	0	0	0	0	0	26	0	0
4.E. Settlements	27	25	3	0	0	0	0	0	27	0	0
4.F. Other Land	16	15	1	0	0	0	0	0	17	0	0
4.G. Harvested wood products	25	0	0	0	0	0	0	0	25	0	0
4.H. Other	1	1	1	0	0	0	0	0	3	0	0
5. Waste	21	27	27	0	0	0	0	0	27	1	27
5.A. Solid Waste Disposal	1	1	27	0	0	0	0	0	27	0	27
5.B. Biological treatment of solid waste	1	26	26	0	0	0	0	0	27	0	27
5.C. Incineration and open burning of waste	19	21	19	0	0	0	0	0	22	1	23
5.D. Wastewater treatment and discharge	1	26	26	0	0	0	0	0	26	0	26
5.E. Other (please specify)	1	1	3	0	0	0	0	0	4	0	5
CO2 captured	3	0	0	0	0	0	0	0	4	1	1
CO2 emissions from biomass	14	0	0	0	0	0	0	0	14	0	1
IB.Aviation	23	22	22	0	0	0	0	0	23	0	1
IB.Navigation	20	18	19	0	0	0	0	0	20	0	1
Indirect CO2 (if available) (10)	5	0	0	0	0	0	0	0	6	0	6
International bunkers	21	20	20	0	0	0	0	0	20	0	1
Memo items	3	3	3	0	0	0	0	0	4	0	0
Total excluding LULUCF	27	27	27	27	21	4	26	10	27	27	27
Total including LULUCF	27	27	27	27	21	4	26	10	27	26	26

Note - the colour intensity implies the degree of completeness. Dark green = high level of completeness, light green = lower level of completeness

Overall, completeness is consistently high across most sectors and gas combinations. The primary instances of missing data are associated with the absence of reported notation keys, often resulting in either zero or blank values, rather than a lack of projection estimates.

Table 2.3 provides a percentage summary of the completeness of mandatory emissions data by gas, while Table 2.4 does so by sector for the year 2023. These tables quantify the numerical values (excluding notation keys and empty cells) provided by Member States for all relevant sector/gas combinations, following the common reporting format for GHG inventories. The presented percentage reflects the completeness, with 100% indicating a fully reported sector/gas. It is worth noting that certain categories, such as CO_2 emissions from category 3A Enteric Fermentation, are not included in this completeness analysis as reporting for them is not feasible according to the GHG inventory. The cells in the tables are color-coded, with greener indicating close to full completeness (100%) and red denoting the lowest (0%).

Completeness levels, while typically high for most GHGs, saw a decrease this year compared to 2021. The overall completeness for all gases and all Member States in 2023 was 36%. Notably, projections for Total GHGs, Total ESR, and CO_2 emissions exhibited the highest reporting rates, hovering around 53%. This suggests that, on average, Member States provided numerical values for half of the applicable gases, a decline from three-quarters reported in 2021.

In terms of sectors, completeness in terms of categories and sub-categories surpassed that of gases, reaching an overall completeness of 53% across all sectors and all Member States. Most sectors, with the exception of IPPU and Memo, scored 68% and above for all Member States. IPPU reported 0% completeness, while Memo only achieved 11%. At the Member State level, five countries, including Czechia, reported 0% completeness for sectors. On the other hand, Austria, Denmark, and Slovakia achieved an impressive 88% completeness, emerging as the most comprehensive Member States for sectors. This is primarily due to these three countries reporting emission projections for Memo, a distinction not shared by other Member States.

Table 2.3 Completeness of mandatory reported numeric emissions data per gas for the year 2021, WEM scenario in Table 1a

MS	CO2	N2O	CH4	HFC	PFC	Unspecified mix of HFCs and PFCs	NF3	SF6	ESR emissions	ETS emissions	Total GHG emissions
AT	84%	75%	69%	50%	40%	0%	40%	50%	81%	56%	84%
BE	84%	81%	67%	80%	80%	0%	80%	80%	102%	106%	100%
BG	84%	81%	71%	40%	40%	0%	0%	40%	90%	91%	90%
CY	61%	64%	55%	40%	0%	0%	0%	40%	60%	29%	66%
CZ	77%	67%	67%	50%	50%	0%	40%	50%	85%	50%	78%
DE	79%	83%	82%	70%	70%	50%	40%	70%	89%	82%	88%
DK	82%	79%	76%	40%	40%	0%	0%	40%	81%	47%	82%
EE	70%	69%	62%	40%	0%	0%	0%	40%	69%	35%	70%
EL	80%	83%	76%	40%	40%	0%	0%	40%	79%	50%	82%
ES	82%	79%	78%	40%	50%	40%	0%	40%	92%	85%	90%
FI	71%	54%	49%	50%	50%	0%	0%	50%	71%	32%	75%
FR	105%	94%	96%	70%	60%	0%	40%	0%	92%	74%	88%
HR	66%	67%	56%	40%	0%	0%	0%	40%	69%	44%	69%
HU	82%	79%	76%	40%	40%	0%	20%	40%	81%	85%	82%
IE	75%	75%	67%	50%	40%	0%	40%	50%	75%	38%	78%
IT	52%	56%	55%	70%	60%	40%	40%	50%	67%	44%	63%
LT	82%	81%	67%	40%	0%	0%	0%	50%	79%	56%	82%
LU	66%	62%	49%	50%	0%	0%	0%	40%	62%	35%	69%
LV	70%	65%	62%	40%	0%	0%	0%	40%	65%	35%	70%
MT	52%	54%	42%	100%	90%	80%	70%	90%	58%	21%	57%
NL	84%	73%	66%	50%	60%	0%	0%	40%	85%	94%	81%
PL	82%	79%	75%	40%	40%	0%	0%	40%	85%	65%	82%
PT	70%	62%	71%	40%	40%	0%	0%	40%	77%	47%	73%
RO	82%	79%	73%	40%	50%	0%	0%	40%	85%	44%	85%
SE	75%	79%	73%	50%	40%	0%	0%	40%	75%	44%	75%
SI	80%	69%	62%	40%	40%	0%	20%	40%	87%	41%	79%
SK	84%	81%	73%	40%	40%	0%	0%	40%	79%	59%	82%

Table 2.4   Completeness of mandatory reported emissions data per sector for the year 2021 in Table 1a

	Energy	IPPU	Agriculture	LULUCF	Waste	Total without LULUCF	Total with LULUCF	Memo
AT	100%	91%	100%	100%	100%	91%	91%	100%
BE	100%	91%	100%	75%	120%	91%	91%	100%
BG	100%	82%	100%	100%	100%	82%	82%	100%
CY	100%	64%	100%	100%	80%	73%	73%	100%
CZ	100%	91%	100%	100%	100%	91%	91%	0%
DE	100%	100%	100%	100%	80%	100%	100%	100%
DK	100%	82%	100%	100%	100%	82%	82%	100%
EE	100%	64%	100%	100%	100%	73%	73%	100%
EL	100%	82%	100%	100%	100%	82%	82%	100%
ES	100%	91%	100%	100%	80%	91%	91%	100%
FI	100%	73%	100%	100%	80%	82%	64%	100%
FR	100%	82%	100%	100%	100%	82%	82%	100%
HR	100%	64%	100%	100%	80%	73%	73%	0%
HU	100%	82%	100%	100%	100%	91%	91%	100%
IE	100%	82%	100%	100%	100%	91%	91%	100%
IT	100%	100%	100%	100%	100%	100%	100%	0%
LT	100%	64%	100%	100%	100%	73%	73%	100%
LU	100%	64%	100%	75%	80%	73%	73%	100%
LV	100%	64%	100%	100%	100%	73%	73%	100%
MT	100%	64%	100%	75%	100%	100%	100%	100%
NL	100%	82%	100%	100%	100%	82%	82%	100%
PL	100%	82%	100%	100%	100%	82%	82%	100%
PT	100%	82%	100%	100%	100%	82%	82%	0%
RO	100%	82%	100%	100%	100%	82%	82%	100%
SE	100%	82%	100%	100%	100%	82%	82%	100%
SI	100%	73%	100%	100%	100%	91%	91%	100%
SK	100%	82%	100%	100%	100%	82%	82%	100%

2.2.3 Completeness of time series and gap-filling

All Member States have submitted GHG projections for the obligatory years 2020, 2025, 2030, 2035, 2040, and notably, 2050. The inclusion of 2050 marks the first time it has become a mandatory reporting year, with comprehensive data provided by all Member States. Fifteen Member States voluntarily reported projections for all intermediate years, while for the remaining 12 countries, the ETC CM applied gap-filling through linear interpolation where applicable. In the period of 2021-2024, only six countries omitted reporting for the intermediate years. However, in subsequent periods of intermediate years, there is an increase in instances where reporting is not available.

Table 2.5 delineates the completeness of the time series as reported for the Total without Land Use, Land-Use Change, and Forestry (LULUCF) in the With Existing Measures (WEM) and Total GHGs by the Member States. The table indicates instances where interpolation or extrapolation has been carried out and specifies the years to which these methods were applied. It's important to note that this situation may differ for other sectors, scenarios, and gases.

Table 2.5 Completeness of time series for Total without LULUCF (Total GHGs, WEM) as reported in the final submissions in 2023

WEM/ Total GHGs	2015	2016	2017	2018	2019	2020	2021	2021-2024	2025	2026-2029	2030	2031-2034	2035	2036-2039	2040	2041-2044	2045	2046-2049	2050
AT							BY												
BE					BY					I		I	E	I	E	I	E	I	E
BG							BY												
CY							BY	I		I		I		I		I		I	
CZ						BY													
DE					BY							I		I		I		I	
DK						BY													
EE						BY		I		I		I		I		E	I	E	
EL					BY														
ES						BY													
FI						BY													
FR	BY							I		I		I		I		I		I	
HR						BY													
HU					BY														
IE						BY			I			I		I		I		I	
IT						BY													
LT					BY														
LU						BY													
LV						BY		I		I		I		I		I		I	
MT						BY													
NL						BY												I	
PL				BY				I		I		I		I		I		I	
PT					BY											I		I	
RO						BY													
SE						BY													
SI		BY																	
SK					BY														

Legend:

(green)	reported
BY	base year
I	gap-filling of intermediate years
G	gap-filling of mandatory information, *gap-filling for ETS/ESR only
E	extrapolation of mandatory information
(orange)	Reporting not mandatory

In addition, it should be noted that the ETC CM carried out corrections, such as the correction of sums of parent categories, which did not match the sum of sub-categories as reported by Member States (for more detailed information on the sum check see chapter 2.3.5). Another typical corrective action by the ETC CM was the deletion of figures reported for historical years when no projections were available, because this would cause a jump in the time series in the EU projections (see also section 2.3.3).

For countries that do not report the WAM scenario, a gap-filling with the WEM data is applied by the ETC CM, which was done for nine Member States, and for one Member State only the LULUCF WAM needed to be gap-filled. This is an improvement compared to 2021, when 10 Member States did not report a WAM scenario. In most cases, the WAM scenario and the gases (CO_2, CH_4, N_2O and F-gases) were subject to the same corrections as the WEM scenario, as errors are usually systematic.

A summary of all corrections and gap-fillings can be found in Annex 1: Overview of corrections and gap-fillings applied by the ETC CM in 2023 cycle.

2.3 Consistency and Comparability

2.3.1 Units

The QA/QC unit check ensures that the projections are reported in the correct units in line with the reporting template and that the ETC CM seeks for clarifications if there are high deviations from historical data. As there were new reporting templates and new tables with different units introduced since 2021, some Member States were facing challenges with the application of the correct unit.

From the total of 27 Member States, five unit deviations were identified in Table 1A (Figure 2.5). The issues were clarified during the QA/QC and in those cases in which an incorrect unit was applied, the countries provided a resubmission. There was 1 and 2 for Table 1B Part 2 and Part 3, respectively.

Figure 2.5   Number of Member States which reported the correct units in the initial submission
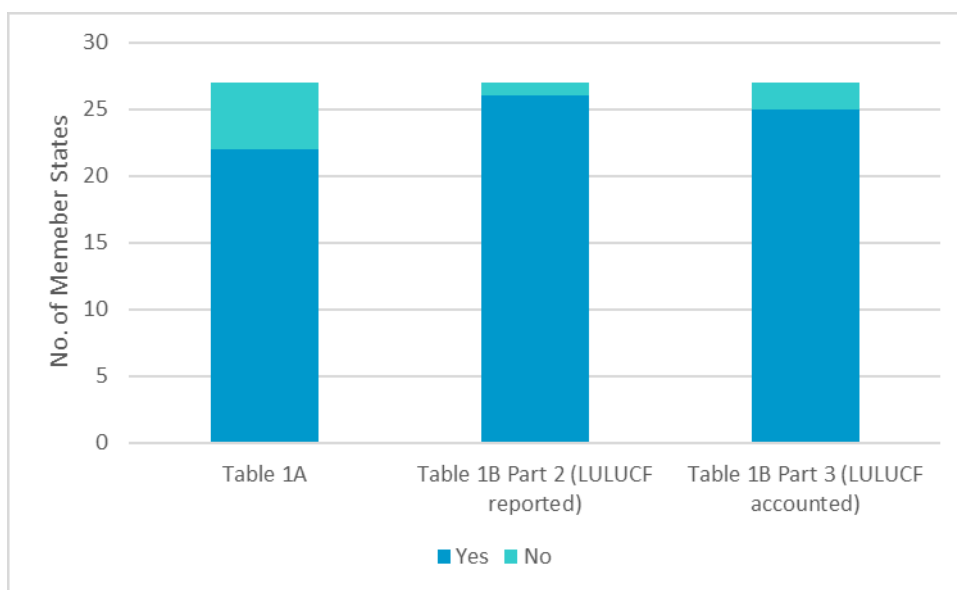
2.3.2 Base year

The predominant choice among Member States for base years was 2020 and 2021, as selected by eight countries (Figure 2.6). Seven Member States opted for 2019 as the base year, while the remaining four countries—Poland, Slovenia, Luxembourg, and France—reported different base years, specifically 2018, 2017, and 2015, respectively (Table 2.6).

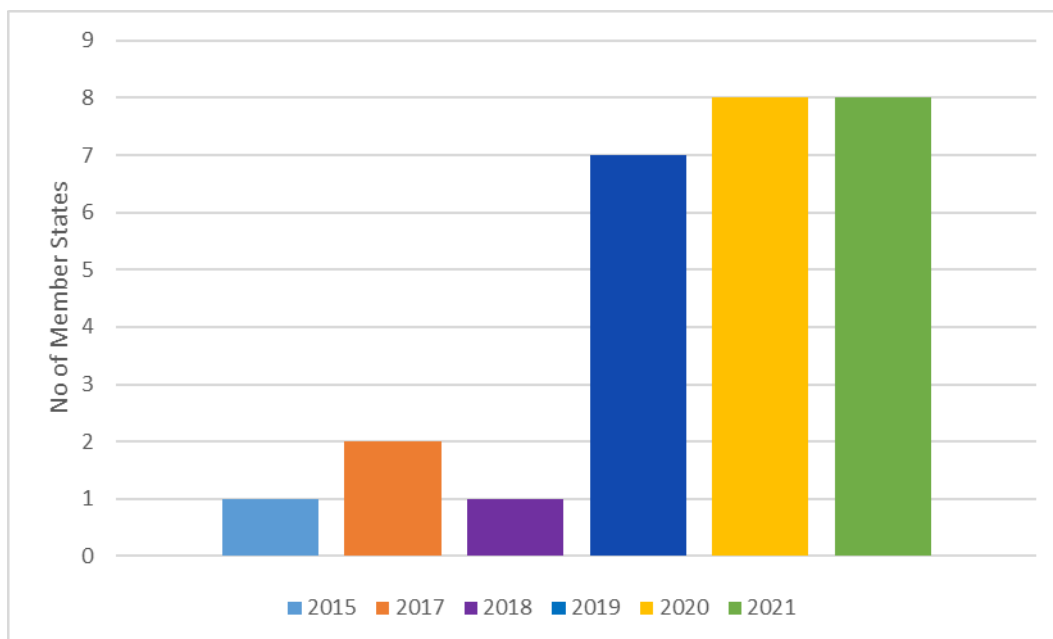**Figure 2.6   Base year reported by Member States**

Table 2.6   Base year selected by the Member States

Member State	Base Year	Member State	Base Year	Member State	Base Year
AT	2021	ES	2021	LV	2020
BE	2019	FI	2020	MT	2021
BG	2021	FR	2015	NL	2020
CY	2021	HR	2020	PL	2018
CZ	2020	HU	2019	PT	2019
DE	2019	IE	2021	RO	2020
DK	2021	IT	2021	SE	2020
EE	2020	LT	2019	SI	2017
EL	2019	LU	2017	SK	2019

A crucial quality criterion lies in the consistency of time series between projections and historical data (inventories), ensuring that projections are founded on a recent inventory version. Simply knowing the base year is insufficient to gauge if projections rely on an updated dataset. Consequently, under the new reporting regulations, it is now mandatory for Member States to specify the inventory submission version forming the basis of their projections. Table 2.7 presents the associated GHG inventory versions as indicated by the Member States, with the date aligning with the submission date of the respective inventory. Analysing the table reveals that all Member States have reported GHG projections grounded in updated GHG inventory data, underscoring the commitment to maintaining time series consistency.

Table 2.7   Inventory versions on which the GHG projections are based

Member State	Inventory version	Member State	Inventory version	Member State	Inventory version
AT	15/03/2023	ES	15/03/2023	LV	15/03/2023
BE	15/03/2023	FI	15/03/2023	MT	15/03/2023
BG	15/03/2023	FR	15/03/2023	NL	15/03/2023
CY	15/03/2023	HR	15/03/2023	PL	15/03/2023
CZ	15/03/2023	HU	15/03/2023	PT	15/03/2023
DE	15/03/2023	IE	15/03/2023	RO	15/03/2023
DK	15/03/2023	IT	15/03/2023	SE	15/03/2023
EE	15/03/2023	LT	15/03/2023	SI	15/03/2023
EL	15/03/2023	LU	15/03/2023	SK	15/03/2023

The base year for the Union GHG projections in 2023 is 2021, as this is the latest inventory year available when projections were prepared. In Figure 2.7, the difference of the base year for the Union GHG projections (2021) and the 2023 EU inventory is shown per sector. Category 1C was reported as "NO" (not occurring) by almost all Member States and is therefore not included in the figure.

The most notable absolute deviations are observed within the 1. Energy sector, specifically in categories 1.A.1 and 1.A.2, contrasting with the previous year where the emphasis was on 1.A.3 rather than 1.A.2. These sectors constitute two of the most substantial components in the EU's projections and inventory. Given the mandatory reporting this year, all countries submitted their data, and despite the majority reporting for the year 2021, significant disparities persist compared to the previous cycle. It's important to highlight that, even though there was no requirement for gap-filling in 2021 (refer to Table 2.5), substantial variations endure. Deviations are also prevalent in sectors characterized by high inter-annual variations and/or recalculations, such as the LULUCF sector (4.), especially for 4.A, as well as in categories that are too small to be modelled separately and are included in another category, such as 1.A.5.

Figure 2.7   Difference of the EU reference year compared to the 2023 inventory by sector/category (for the year 2021)

Deviation of EU base year compared to the GHG inventory value (in kt CO2eq)
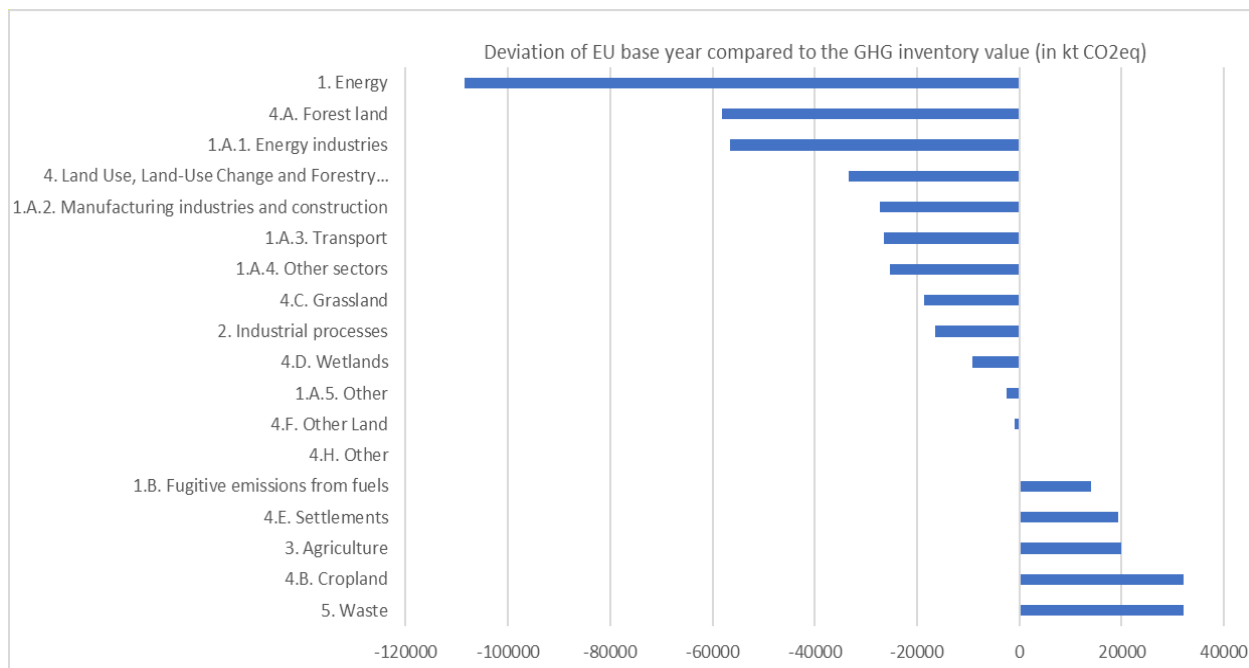
2.3.3 Time series consistency

In previous cycles, the ETC CM identified instances where certain Member States reported historical values from the GHG inventory when GHG projections were not available. This practice led to artificial jumps in the time series when aggregating Member States' projection data for EU27 projections. In response to this, a new check was introduced since 2021 to ensure that Member States refrain from reporting values in the time series for sectors and gases lacking projections.

This year, all Member States provided data for historical years in categories or sectors where projections were absent. In cases where discrepancies were identified, Member States took corrective measures through resubmissions. Consequently, there was no need for the ETC CM to implement corrections to achieve a cohesive EU-aggregated dataset for GHG projections. As a result, all countries successfully passed the time series check.

2.3.4 ETS and ESR emissions

Projected emissions are systematically reported for Emissions Trading System (ETS) and Effort Sharing (ESR) emissions in each source category. In the QA/QC process, the analysis focuses on ensuring the accurate linkage of projections to historical ETS and ESR emissions and maintaining a coherent development of ETS and ESR emissions in Member State projections.

Following the QA/QC procedure, the ETS and ESR emissions from Member State projections are aggregated to form an EU projection. This aggregated projection is crucial for monitoring the impacts of EU policies aimed at addressing climate change, and the projection data find application in numerous reports and indicators produced by the EEA and the ETC CM.

During the checking process, ETS splits serve as indicators, reflecting the relative share of ETS emissions compared to total GHG emissions. It is imperative that ETS and ESR emissions in the base years of the projections align with historical ETS and ESR emissions. This necessitates the ETS split used for projections to be consistent with historic inventory data, with gradual changes along the timeline. Significant deviations in the ETS split may prompt inquiries during QA/QC to ensure they are grounded in realistic assumptions. The rationale behind closely scrutinizing ETS splits is rooted in the expectation that, in a mitigation scenario of steadily decreasing GHG emissions, ETS emissions should decrease relatively rapidly in response to the carbon dioxide price level. This is in line with the point-source nature of GHG emissions. However, scenarios such as strong promotion of electric vehicles replacing internal combustion engine vehicles could result in the opposite trend. As ESR emissions decrease and additional electricity demand is met either with fossil or low-carbon generation capacity, emissions may shift from ESR to ETS, leading to an increased relative share of ETS in the total emissions. This complex interplay requires meticulous attention to ensure accurate and meaningful projections.

For the checks mentioned above, historical ETS splits were calculated based on the total verified emissions under the EU ETS[1] and GHG inventory data from the 2023 submission. In the following the main results of the 2023 QA/QC procedure are presented.

ETS splits

All Member States reported ETS emissions in their GHG projections in the current cycle, similarly to 2021. When comparing the latest EU Emission trading data for year 2021 against the value reported in projections for year 2021, there are some differences for several MS. Austria, Denmark, Greece, Italy, and Lithuania stood out for achieving a full match between their reported ETS emissions for the base year and the historical values from the GHG inventory, showing a 0% difference. In the remaining countries, the differences generally remained below the 10% threshold, and in many cases the differences are attributed to the lack of reporting of year 2021 (in these cases, the gap-filled value is being used for the comparison).

Estonia, identified as an outlier with a notable -19% deviation, addressed the issue through the ComLog (Id EE109) by providing a detailed explanation for the observed variations. In the energy sector, changes in electricity generation and heat production emissions were attributed to an updated Balmorel scenario, economic shifts, and a re-assessment of impact assessments. Reductions in shale oil production plant plans also influenced projections. The transport sector experienced a substantial drop in GHG emissions due to increased electric vehicle adoption, reinforced by supportive measures and assumptions for zero-emission criteria in new passenger cars from 2035. The IPPU sector saw significant changes, such as the chemical industry's inactivity, resulting in zero emissions. The agriculture sector's differences stemmed from transitioning to a more precise Agricultural Projection Model and corrections in GHG emission calculation methodologies. In the LULUCF sector, variations were explained by new felling scenarios, precise land use change considerations, and recalculations involving updated data and methodologies, reflecting the country's commitment to accurate reporting and evolving circumstances. Similarly, PT showed a 54% difference, which can be attributed to the fact that the data for year 2021 is interpolated between 2020 and 2025. Excluding the extreme values from Estonia and Portugal, the average difference among the remaining Member States was 1.22% in 2023.

Figure 2.8 visually illustrates the difference between the ETS split calculated from the reported projections for the base year and the historical ETS splits.

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[1]   From EEA EU ETS data viewer (EEA, 2023): http://www.eea.europa.eu/data-and-maps/data/data-viewers/emissions-trading-viewer

Figure 2.8   Difference of ETS splits for the base years of total GHG projections compared to historic ETS splits in respective base years
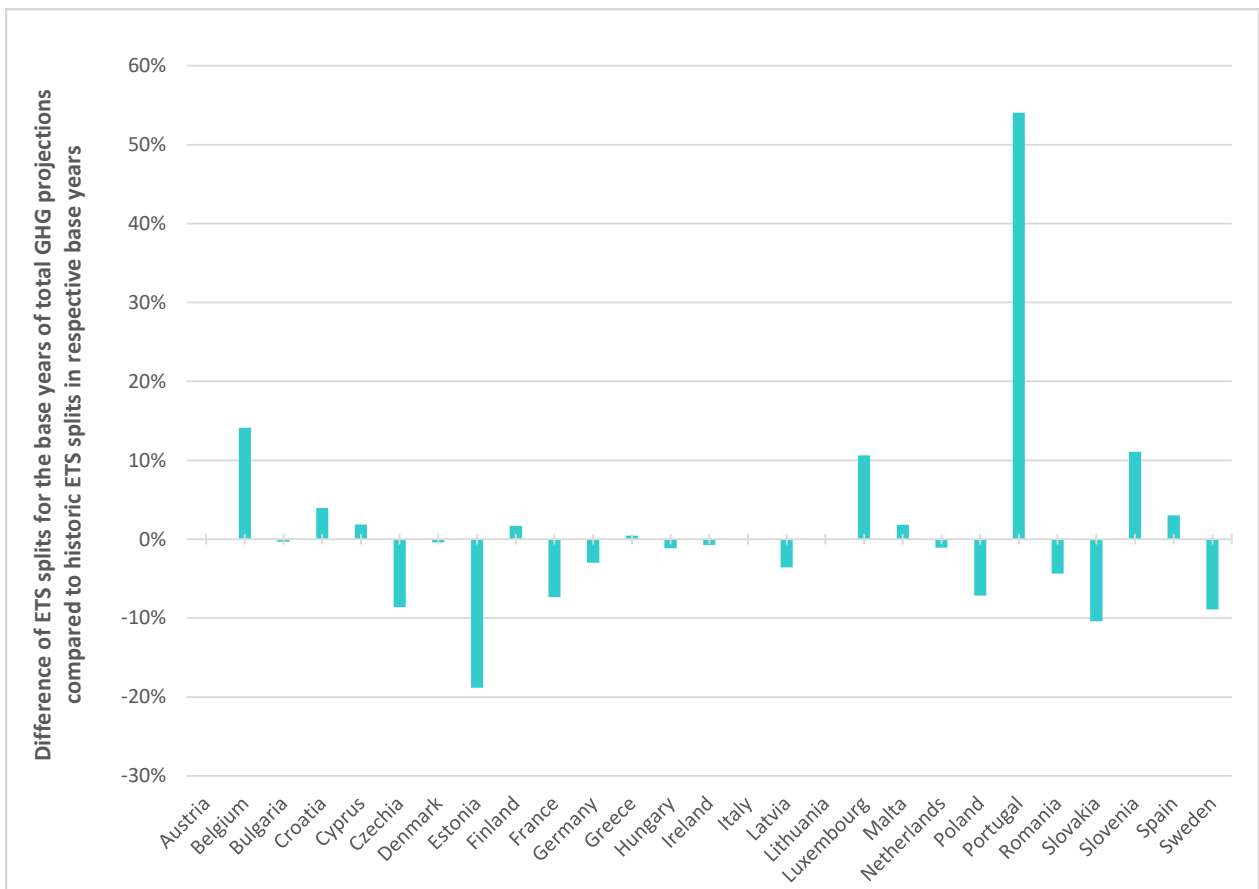
Differences in reported ETS and ESR emissions

In Figure 2.9, a comparison is made between historical and projected ETS emissions for the base year used by each of the Member States in the 2023 reporting cycle. For this cycle, the ETS comparison employed the original submission as the mandatory base year. The average difference between historical and projected ETS emissions was -1.9%, a slight increase from the previous cycle, which showed a difference of only -0.43% for the 27 countries reported that year.

Figure 2.9   Relative difference between historic and projected ETS emissions for base years
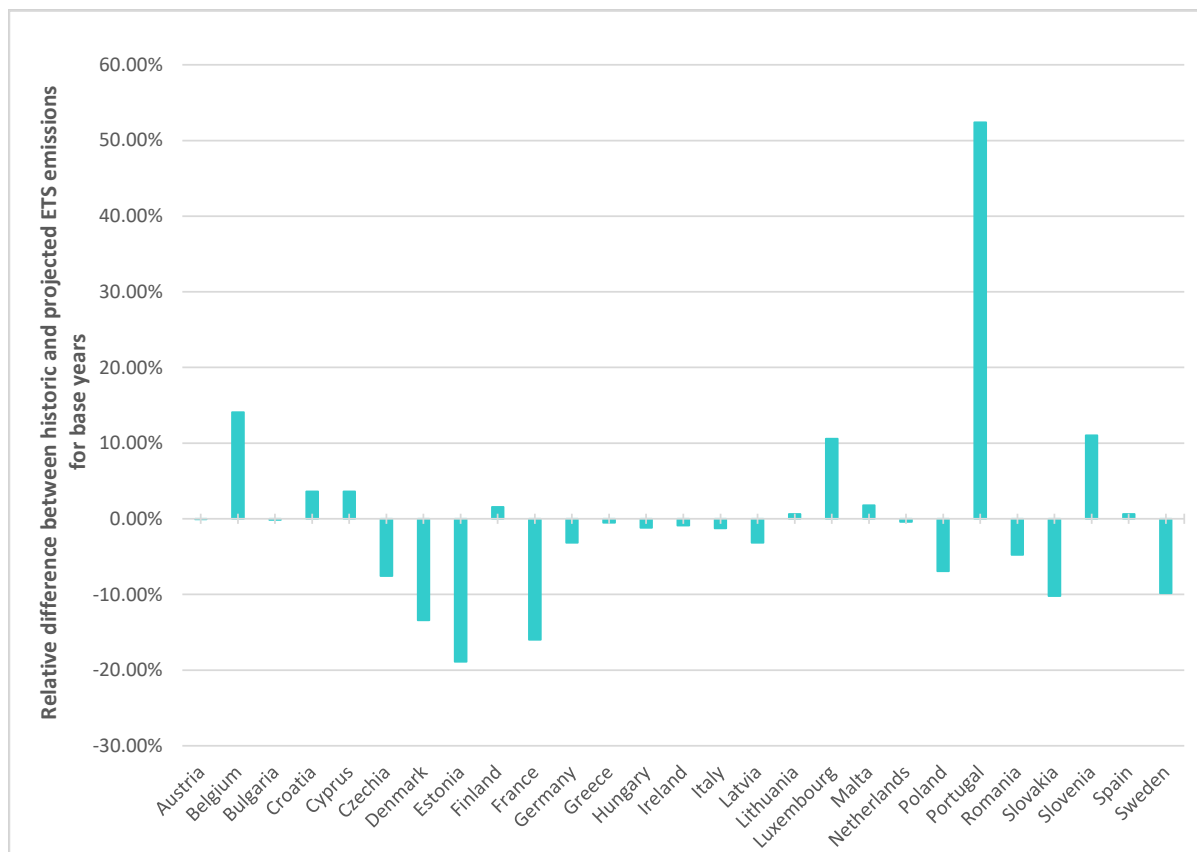
Figure 2.10 illustrates a comparison between the base-year historical emissions and the ESR emissions used as a reference year for projections in the 2023 reporting cycle. The average difference across the 27 reporting Member States was -1,42%, similar to the -0.31% difference observed in 2021 between historical emissions and those reported in the projections.

Significant variations are noticeable for Bulgaria and Hungary, with a 18% and 6% difference, respectively.

Figure 2.10   Relative difference between historic and projected Effort Sharing emissions for base years
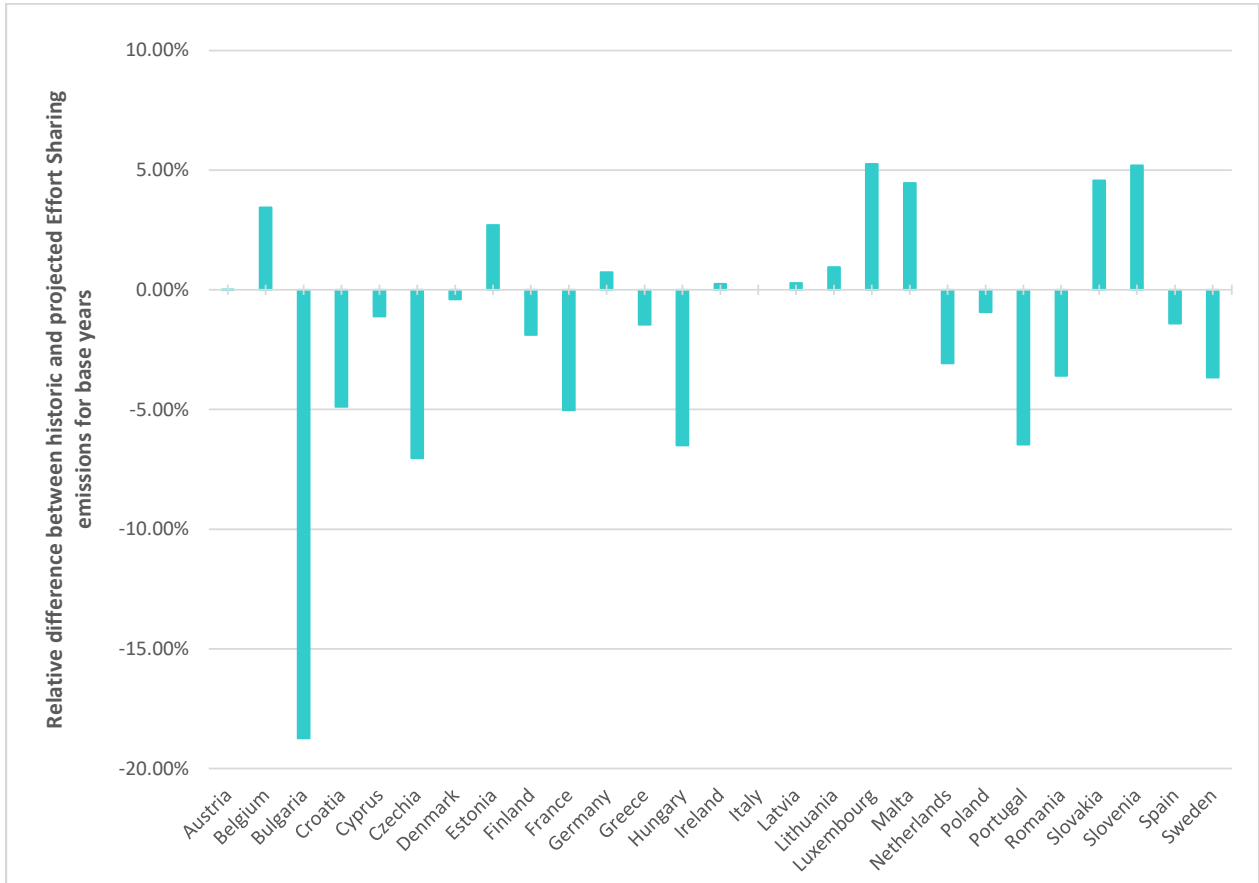
Development of ETS and ESR emissions

Changes in ETS splits, representing alterations in the proportion of ETS emissions relative to total emissions, were calculated across the projected timeline to scrutinize the evolution of ETS and ESR emission projections and ensure time series consistency (refer to XXX). Member States typically provide explanations for such changes, particularly when they are significant. For instance, in smaller countries, the closure or start-up of a single plant can heavily impact the share of ETS emissions, leading to considerable changes in projected ETS splits from one year to the next.

Table 2.8 highlights substantial increases or decreases in ETS splits, color-coded based on the magnitude of the change. Belgium is not included in this analysis as it only reported ETS projections for years 2019-2030 in the 2023 cycle.

Outliers for the 2023 cycle were identified, with Germany and Denmark exhibiting noteworthy changes for 2025-2030, Denmark again for 2035-2040, Estonia for 2040-2045, and Finland showing the most substantial change overall for 2045-2050. Upon examining individual Member States, Denmark consistently demonstrated the largest change in the share of ETS emissions relative to total emissions across all five periods, while Sweden exhibited the smallest change at -1%. When analysed by periods, the 2045-2050 period displayed the most significant changes at 57%, primarily attributed to Denmark, followed by 2025-2030 at 19%. Denmark's disparities can be attributed to the previously discussed and clarified issue.

Table 2.8   Changes in ETS splits from 2020 to 2050 in WEM scenario

Member State	2025-2030	2030-2035	2035-2040	2040-2045	2045-2050
Austria	5%	2%	1%	1%	0%
Bulgaria	15%	30%	43%	0%	0%
Cyprus	-6%	3%	5%	16%	11%
Czechia	25%	21%	5%	5%	0%
Germany	53%	30%	30%	10%	4%
Denmark	94%	7%	66%	0%	0%
Estonia	30%	20%	2%	92%	-1%
Greece	26%	9%	4%	0%	0%
Spain	-1%	15%	10%	-4%	0%
Finland	49%	38%	44%	94%	1482%
France	4%	5%	4%	4%	-3%
Croatia	1%	6%	4%	3%	3%
Hungary	23%	-1%	7%	5%	-18%
Ireland	24%	-7%	12%	-4%	2%
Island	9%	11%	-2%	-1%	-1%
Italy	9%	0%	0%	0%	0%
Lithania	-1%	3%	3%	2%	1%
Luxembourg	3%	36%	11%	-8%	0%
Latvia	-4%	-4%	-3%	-12%	-7%
Malta	42%	8%	3%	8%	4%
Netherlands	1%	15%	18%	0%	0%
Poland	38%	16%	5%	7%	2%
Portugal	29%	-6%	-5%	5%	4%
Romania	19%	27%	7%	2%	0%
Sweden	-1%	-4%	5%	-3%	-3%
Slovenia	8%	1%	-1%	1%	0%

Reporting of ETS and ESR emissions

The reporting of ETS and ESR emissions continuously improved since 2015 and became considerably more detailed in the 2017, 2019, 2021 and now 2023 submission years. With regard to absolute ESR emissions, all Member States subtracted domestic aviation from total GHG emissions to calculate ESR emissions in the final dataset. In addition, most Member States correctly implemented the inclusion of NF_3 emissions in the Effort Sharing Regulation (from 2021). 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.

2.3.5 Accuracy and Transparency

The sum check has been introduced in 2017 and has been further elaborated over the years for the new LULUCF tables 1b and 5a. The sum check revealed no issues for Belgium, Greece, Spain, Croatia, Ireland, Luxembourg, Sweden, Slovenia, and Slovakia, with the remaining 19 countries experiencing some issues with the sum check. This is a decline from 2021, when for a total of 14 countries the sum check did not reveal any issues. For the 19 countries where sum check issues were encountered, the QA/QC procedures resulted in follow-up questions to Member States. The issues were sometimes aggregated in case they applied to multiple sectors, years, GHGs and/or scenarios, resulting in 27 questions in total. This is a decrease compared to 2021, when 42 questions were asked.

Although the ETC CM experts used a clear threshold value for the checks, some Member States were informed about a difference that was below the threshold value. These instances often related to manual control which excludes that small differences were caused by rounding, with the ETC CM subsequently posing a question to the MS to explain. 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 CM.

2.3.6 Outliers and trends

The evaluation of outliers and trends in the projections relies on four distinct checks, utilizing information from reported projections in 2023, inventory data, and previously documented projection details. The analysis of trends and outliers becomes challenging when there is a scarcity of data points in the time series, particularly when intermediate years are not reported. For smaller Member States, changes in emissions can exhibit more pronounced fluctuations, especially in sectors where emissions are predominantly influenced by a limited number of point sources.

These checks operate under the assumption of linear trends and employ threshold values to signal deviations from historical and prior projection trends. The linear trend line is also employed for outlier identification, pinpointing emissions in specific years that significantly differ from expectations based on the linear trend line. It is crucial to emphasize that the findings from these checks do not necessarily indicate errors in projections; instead, they highlight the necessity for further clarification. This clarification can be achieved through visual inspection of the data by the reviewer, consultation of the technical report, or posing a question to the Member State.

Instances where a potential issue did not result in a question to the Member States include:
  • Non-linear trends: Visual inspection reveals no outliers, attributing the issue to a non-linear trend in projected emissions.
  • Trends explained in the report: If the technical report provides a comprehensive explanation for the identified trends.

A limited 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 26 questions to the Member States for outliers and trend checks combined. As with the sum check, specific issues were aggregated as much as possible per sector, category, GHG, or even QA/QC check to avoid needless duplication of questions.

2.3.7 Recalculations

When projected emissions displayed substantial deviations from previous projections without accompanying information in the report, transparency considerations led to requests for explanations from Member State experts. These experts were advised to include clarifications for recalculations in the technical reports.

A total of 18 questions related to the recalculation check were directed to eighteen distinct Member States in 2023. Typically, the primary reasons behind significantly altered projections involve modifications in PaMs, the adoption of different models or methodologies, and the introduction of new or revised data.

Conversely, this check also brings to light instances where submissions mirrored previous ones entirely, signifying a lack of updates in the projections—either no updates at all or only recalibrations to the latest emission inventory data.

In Table 2.9, as part of the Recalculation check, a comparison is made for total GHG emissions without LULUCF in the WEM and WAM scenarios. This comparison specifically focuses on the years 2025 and 2030 within the 2023 submission, contrasting them with the closest submission from either 2021 or 2022 for each respective country (i.e. for countries that submitted projections in the non-mandatory year 2022, the

2022 submission is utilized; otherwise, the 2021 submission is used). The table is color-coded, ranging from red to green, to visually represent negative and positive differences in the comparison.

Table 2.9 **Recalculation check, comparison total GHG emissions without LULUCF for WEM and WAM scenarios for 2025 and 2030 of the 2023 submission against the 2021/2022 submission**

MS	WEM				WAM		
	2025	**2030**	**2035**		**2025**	**2030**	**2035**
AT	4.3%	8.3%	13.4%				
BG	12.9%	16.8%	22.7%				
CY	12.3%	15.2%	13.1%				
CZ	17.5%	24.8%	26.0%		18.2%	26.0%	37.7%
DE	12.0%	36.0%	49.3%				
DK	25.3%	51.6%	60.6%				
EE	38.6%	37.0%	42.6%		35.1%	30.9%	38.4%
EL	15.9%	24.2%	23.1%				
ES	11.1%	12.9%	15.9%				
FI	23.5%	40.5%	49.4%		20.8%	34.4%	45.2%
FR	12.7%	17.0%	22.0%				
HR	-1.5%	1.2%	7.5%		-5.2%	-3.7%	0.3%
HU	5.8%	11.6%					
IE	9.1%	17.8%	16.6%		11.3%	22.1%	28.0%
IT	6.2%	8.7%	13.7%				
LT	3.6%	18.7%	25.7%		2.1%	21.5%	28.7%
LU	10.5%	20.9%	31.6%				
LV	8.1%	6.4%	12.5%		6.9%	6.5%	12.8%
MT	3.7%	4.6%	3.5%				
NL	5.9%	23.6%	25.3%				
PL	0.2%	1.6%	2.6%				
PT	-0.8%	-1.1%	-3.5%		-2.5%	-4.5%	-5.0%
RO	9.4%	19.2%	18.7%		8.9%	19.0%	18.6%
SE	14.0%	33.0%	44.8%				
SI	0.2%	-4.9%	-11.0%				
SK	-3.8%	-1.6%	-2.6%		-5.5%	2.6%	4.8%

Note: Negative values means that the submission in 2021/2022 was lower as the new submission in 2023 (indicated by red colour). When the new projections are lower than the previous projections this is highlighted in green.

2.3.8 WEM/WAM/WOM check

Ensures consistency and adherence to the expected order of emissions levels across scenarios, WOM emissions should be equal to or greater than WEM emissions, and WEM emissions should be equal to or greater than WAM emissions. In cases where Member States submitted a WOM scenario, an assessment was conducted to ascertain if WOM emissions equalled or exceeded those in the WEM scenario. Similarly,

for Member States submitting a WAM scenario, it was evaluated whether WEM emissions equalled or surpassed those in the WAM scenario. For sectors and gases where such equality or higher emissions were not observed, clarification questions were sent to the respective Member State. This situation applied to 16 Member States, resulting in a total of 18 questions related to WEM, WAM, and WOM scenarios. Each Member State, except for Romania and Slovenia, received one question. In most cases, the Member States provided explanations.

The reasons behind higher WAM emissions compared to WEM emissions vary, ranging from model-related errors to policy and measure considerations. For example, differences may arise due to factors such as an allowance for more flights under WAM, an assumption of higher biomass utilization, or an increased share of installed heat pumps. While the primary objective of this check is not necessarily corrective action, some questions did result in the correction of errors through resubmissions.
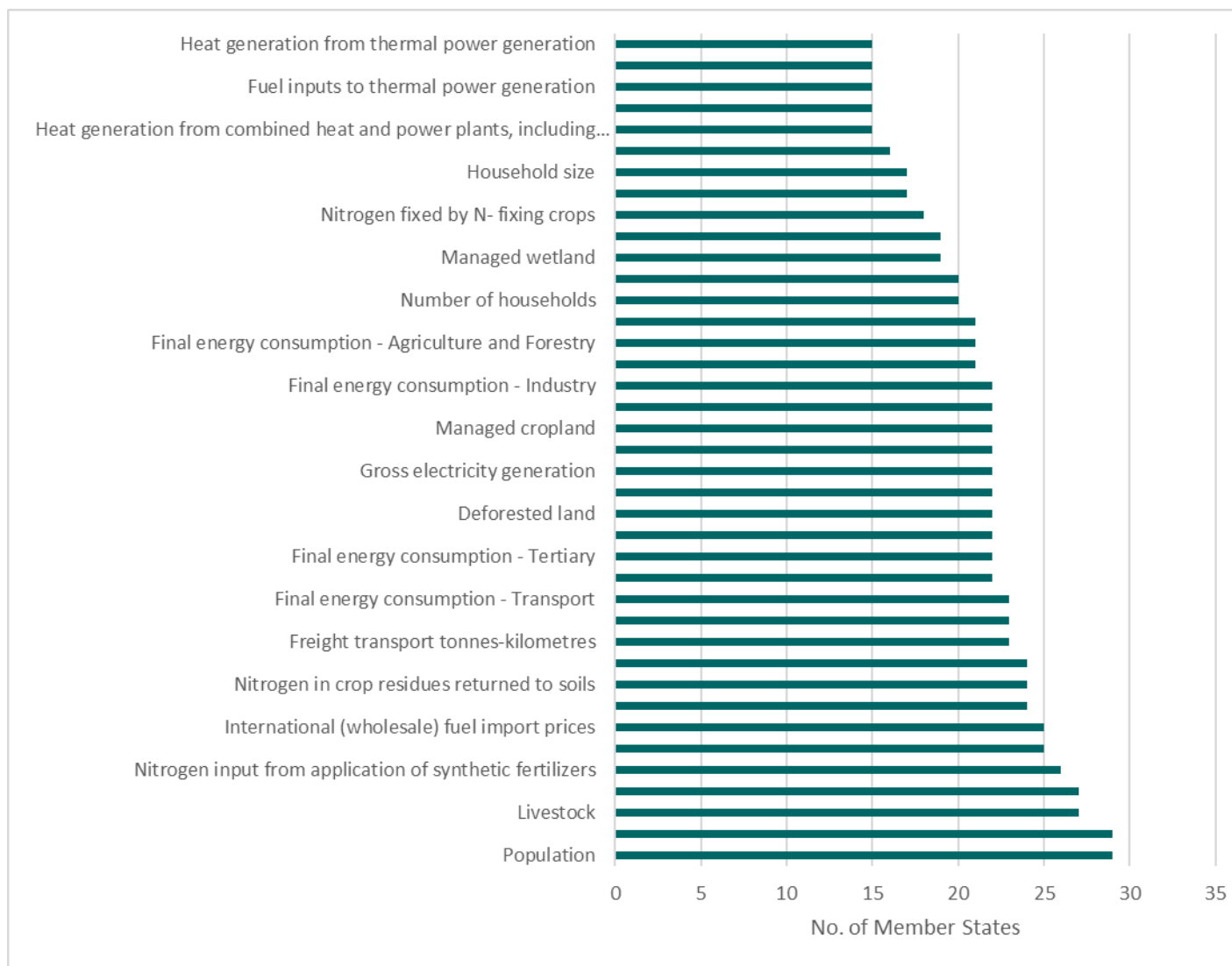
2.4 Parameters

2.4.1 Overview of reported parameters

With the introduction of the new parameter reporting Table 3 in the Implementing Regulation, there is an expanded scope for reporting numerous parameters. This expansion is evident in the parameter tables submitted by Member States, totalling 156 unique parameters, compared to 389 in 2021. It is important to note that not all Member States report all parameters, as their relevance varies based on their application in projections. Parameters like GDP and population find broader applications in general models, while others are employed in specific, often more sophisticated models.

Table 2.9 highlights parameters reported by over half of the 27 EU Member States. Specifically, a parameter is considered included if reported by 14 or more Member States, and this criterion is met for 38 parameters, as opposed to 51 parameters reported last year. Notably, parameters related to population and GDP receive widespread reporting from most Member States. Additionally, frequently reported parameters are predominantly associated with Agriculture, Forestry, and Other Land Use (AFOLU), such as nitrogen input, indicating their significance in projecting the agricultural sector. These are followed by parameters linked to the economy and energy, such as fuel import prices and carbon prices, along with various indicators related to households, waste, and the transportation system.

For the 118 parameters not considered, 109 of them are utilized only once, exemplified by unique entries like "Share of lagoons with natural crust from cattle's liquid manure storages." In contrast, more commonplace parameters exhibit a usage frequency ranging from 8 to 13 instances, with examples such as "Disposable income of households", among the other 9. This diversity in parameter usage underscores the specialized nature of certain parameters, while others find broader applicability across multiple contexts.

Figure 2.11   Parameters reported by more than 14 Member States (values for the year 2023)

2.4.2 Most common parameter issues

The parameter table (IR Annex XXV Table 3) was submitted by 27 Member States. The comprehensive overview given in Table 2.10 summarizes the QA/QC process for each Member State and the reported key parameters. It can be clearly seen that few follow-ups were 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 (light green) or explanations were provided by the countries (blue) that solved the issue. The overview also shows that GDP was not an input parameter in projections of five Member States and that net electricity imports was not used in the projections of nine Member States.

In most cases, the communication with Member States successfully solved the issues regarding the submitted parameters. This was the case when e.g. data consistent with the surrogate data (light green) was resubmitted or when an explanation of the differences was given by Member State experts (indicated in 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 from the data used by the reviewers. However, some issues could not be solved (pink) as there was no reply from the Member State on the findings. In some cases, Member States did not submit base year values or the base year in the first submission, so it was asked for it in the

communication log. After the resubmission of these values and years, in some cases a deviation from reference data was found, but this was not followed-up due to time constraints.

A relatively large number of issues with parameter values was resolved through explanation by Member States. Although reasons usually relate to the use of national datasets, and slight differences in e.g. exchange rates, it shows that this is still a source of uncertainty.

Table 2.10 — Heat Map of QA/QC procedure and most common issues of the parameter checks

Member States	Population		GDP		Electricity Imports	
	Initial submission	Follow-up	Initial submission	Follow-up	Initial submission	Follow-up
AT	green	green	green	green	light blue	dark blue
BE	green	green	yellow	yellow	green	green
BG	purple	purple	green	green	green	green
CY	light blue	pink	light blue	pink	yellow	yellow
CZ	purple	purple	light blue	dark blue	yellow	yellow
DE	green	green	green	green	light blue	orange
DK	light blue	dark blue	green	green	green	green
EE	green	green	green	green	light blue	dark blue
EL	light blue	purple	light blue	light green	green	green
ES	light blue	light green	light blue	purple	yellow	yellow
FI	green	green	green	green	green	green
FR	purple	purple	yellow	yellow	green	green
HR	green	green	green	dark blue	green	green
HU	light blue	light green	yellow	yellow	light blue	orange

Member States	Population		GDP		Electricity Imports	
	Initial submission	Follow-up	Initial submission	Follow-up	Initial submission	Follow-up
IE	light blue	orange	light blue	orange	light blue	orange
IT	purple	purple	green	green	yellow	yellow
LT	green	green	green	green	yellow	yellow
LU	green	green	yellow	yellow	yellow	yellow
LV	green	green	green	green	purple	purple
MT	light blue	dark blue	light blue	dark blue	yellow	yellow
NL	purple	purple	green	green	green	green
PL	green	green	light blue	dark blue	yellow	yellow
PT	purple	purple	light blue	orange	light blue	light green
RO	purple	purple	purple	purple	light blue	purple
SE	green	green	light blue	dark blue	yellow	yellow
SI	green	green	light blue	light blue	light blue	green
SK	light blue	light green	yellow	yellow	yellow	yellow

Legend:

Initial submission:

- green: value in line with surrogate data
- pink: value not in line with surrogate data
- purple: no use of default unit -> corrected by reviewer
- yellow: no values submitted / values not used

Follow up: issue solved

- light green: resubmission of value consistent to surrogate data
- dark blue: explanation of reason for difference

Follow up: issue not solved

- pink: no resubmission of Member States
- orange: resubmission of value NOT consistent to surrogate data / no explanation of reason for differences but issue also not followed up

Note: Data of Member States was checked against surrogate datasets from Eurostat (Eurostat 2023a-c) a): Population – Eurostat demo_pjan; GDP - Eurostat nama_10_gdp; net electricity import - Eurostat nrg_bal_c. Thresholds for the checks were 2 % for population and GDP and 4 % for net electricity imports.

2.4.3 Deviation from recommended parameters

In line with the Implementing Regulation (Article 38(3)) to increase EU wide consistency of projections the European Commission provided Member States with recommended supranational parameters on ETS carbon price, international oil and coal prices and other parameters e.g., international gas prices, GDP growth, population for the preparation of GHG projections (European Commission, 2023). Checks were carried out to understand whether Member States used the provided values (Table 2.11). The classification was made by setting deviation threshold for individual parameters. Note that it is possible that for two projection years parameters do not deviate, but for other projection years they do (e.g. when national parameters are available, but not for the full time series). In these instances, the ETC CM made an expert judgement if it can be assumed that the recommended parameters were used or not. In addition, it is possible that values happen to be in the same range as the recommended values, without actual use of the Commission's Guidance. Similarly, due to potential exchange rate issues of price data (ETC CM converts all monetary values to constant EUR2010 for the comparison), some parameters may have been classified as not following the Commission Guidance. It should be noted that in the 2023 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 on the parameters presented in the table below, using the reported data for the first mandatory year after the reference year, 2025[2].

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[2]   Numerous issues were found with the reference year and the starting year for reporting parameters. For this reason, and aiming at having a complete EU dataset to be cross-checked, 2025 data was used for the comparison.

Table 2.11   Overview: Use of recommended parameters by the European Commission

	Coal price	Gas price	Oil price	Carbon price	Population	GDP		Coal price	Gas price	Oil price	Carbon price	Population	GDP
AT	no	no	no	no	no	no	IT	no	no	no	no	no	not used
BE	not used	not used	not used	not used	not used	not used	LV	no	no	no	no	no	no
BG	no	no	no	no	yes	not used	LT	not used	not used	not used	not used	no	no
HR	no	no	no	no	no	no	LU	no	no	no	not used	no	no
CY	not used	not used	no	no	not used	not used	MT	not used	not used	not used	not used	not used	no
CZ	no	no	no	no	not used	not used	NL	no	no	no	yes	no	not used
DK	no	no	no	no	no	no	PL	no	no	no	no	no	no
EE	no	no	no	no	not used	no	PT	yes	yes	yes	no	no	no
FI	no	no	not used	not used	no	no	RO	no	no	no	no	yes	no
FR	not used	not used	no	no	not used	yes	SK	not used	not used	not used	not used	not used	not used
DE	no	no	no	no	no	no	SI	no	no	yes	no	no	not used
EL	yes	yes	yes	no	yes	not used	ES	no	no	no	no	no	not used
HU	no	no	no	no	yes	no	SE	no	no	no	no	not used	not used
IE	yes	yes	yes	yes	no	no							

	Coal price	Gas price	Oil price	Carbon price	Population	GDP
Number Member States using guidance in 2023	**3**	**2**	**4**	**2**	**4**	**1**
Number Member States using guidance in 2021	**3**	**4**	**4**	**8**	**10**	**1**
Number Member States that used guidance in 2019	9	9	9	12	9	0
Number Member States that used guidance in 2017	9	8	10	11	6	3

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 population and GDP

In general, it can be observed that the parameters related to fuel prices are the ones that Member States have followed the guidance mostly.

Not all Member States provided an explanation why recommended parameters were not taken into account, but rather indicated that they had opted for reporting values from other modelling exercises. For example, Germany explained that the parameters were taken into account, but that it was decided to use different values from more recent publications, such as the International Energy Agency's (IEA) World Energy Outlook, which suggested lower fuel prices. A similar reasoning was provided by the Netherlands. In the case of the carbon price, Germany only used the recommended parameters from 2030 onwards. In addition, some Member States used the values for the parameters used for their National Energy and Climate Plan projections, instead of the recommended parameters.

3 Specific analysis of new reporting elements

3.1 New detailed LULUCF tables (1b, 5a, 5b)

In the updated reporting framework under the Gov. Reg., the reporting for the requirements for the LULUCF sector have undergone substantial enhancements. This stems from the anticipated inclusion of the LULUCF sector in the EU's climate mitigation target. Consequently, more detailed information on LULUCF projections and the projected accounting outcomes, including credits or debits, is mandated. The Implementing Regulation (EU) 2020/1208 introduces two tables—Table 1b or 5a for reporting LULUCF projections and Table 5b for cumulative projected accounting results. Within this framework, countries must select one of the tables (1b or 5a) for reporting LULUCF projections, and Table 5b is utilized to report cumulative projected accounting results for LULUCF accounting categories and the ESR cumulative projections for two accounting periods. It's noteworthy that Table 1b includes two mandatory summary tables that require completion regardless of the selection between Table 1b or 5a.

While certain sections are voluntary, ETC CM had to remind countries to provide comprehensive information for these tables. Some countries opted not to report all three gases, aligning with the IPCC Guidelines. This allowance is made in cases where specific management practices or land use/land use changes do not occur in the country. For instance, the occurrence of methane (CH4) due to forest fires or drainage of organic soils might not be applicable in all Member States and, consequently, may not be reported.

To ensure comprehensive coverage, the ETC CM cross-checked all main sectors and categories with the GHG inventory. In instances where a category/gas combination was present in the GHG inventory but absent in the projections, a clarification question was directed to the respective Member State.

Among the 27 Member States, 23 reported, with the four non-reporting countries being Bulgaria, Denmark, Spain, and Ireland. Out of the 23 reporting Member States, 20 provided information for all gases and the total in both Table 1b Part 2 and Part 3. The Member States with some missing information were consistent across both tables and for the same gas—methane (CH4), with Belgium, Luxembourg, and Malta being the countries in question (Table 3.1).

Table 3.1   Reported summary tables (part 2 and part 3 of table 1b) for the LULUCF sector

MS	Table 1b part 2				Table 1b part 2			
	Total GHGs (ktCO$_2$e)	CO2 (ktCO2e)	CH4 (ktCO2e)	N2O (ktCO2e)	Total GHGs (ktCO$_2$e)	CO2 (ktCO2e)	CH4 (ktCO2e)	N2O (ktCO2e)
AT	✓	✓	✓	✓	✓	✓	✓	✓
BE	✓	✓	✗	✓	✓	✓	✗	✓
CY	✓	✓	✓	✓	✓	✓	✓	✓
CZ	✓	✓	✓	✓	✓	✓	✓	✓
DE	✓	✓	✓	✓	✓	✓	✓	✓
EE	✓	✓	✓	✓	✓	✓	✓	✓
EL	✓	✓	✓	✓	✓	✓	✓	✓
FI	✓	✓	✓	✓	✓	✓	✓	✓
FR	✓	✓	✓	✓	✓	✓	✓	✓
HR	✓	✓	✓	✓	✓	✓	✓	✓
HU	✓	✓	✓	✓	✓	✓	✓	✓
IT	✓	✓	✓	✓	✓	✓	✓	✓
LT	✓	✓	✓	✓	✓	✓	✓	✓
LU	✓	✓	✗	✓	✓	✓	✗	✓
LV	✓	✓	✓	✓	✓	✓	✓	✓
MT	✓	✓	✗	✓	✓	✓	✗	✓
NL	✓	✓	✓	✓	✓	✓	✓	✓
PL	✓	✓	✓	✓	✓	✓	✓	✓
PT	✓	✓	✓	✓	✓	✓	✓	✓
RO	✓	✓	✓	✓	✓	✓	✓	✓
SE	✓	✓	✓	✓	✓	✓	✓	✓
SI	✓	✓	✓	✓	✓	✓	✓	✓
SK	✓	✓	✓	✓	✓	✓	✓	✓

3.2 New tables on the sensitivity analysis (Table 6 and 7)

With the new reporting under the Gov. Reg. the reporting of sensitivity scenarios was updated, and Member States have to provide the results of the sensitivity scenarios in standardised format for the following sectoral totals: Total without LULUCF, Total ETS, Total ESR and LULUCF. In addition, the related key parameters had to be reported in a separate table.

The quantity of sensitivity scenarios reported by the 19 Member States contributing data to either Table 6 or 7 is detailed in Table 3.2. On average, Member States provided four scenarios for both Tables 6 and 7, showcasing an increase from the three reported in the preceding cycle, with a slightly higher average observed for Table 6. Notably, there are no instances where Member States submitted data for one table but not the other, indicating a consistent reporting pattern.

Within Table 6, Spain maintained its lead by submitting the highest number of sensitivity scenarios, closely trailed by Germany. In terms of parameters, Germany reported the maximum at nine, followed by Spain with eight.
 As these tables were newly introduced in 2021, ongoing checks are meticulously delving into the details to thoroughly investigate any existing discrepancies. Furthermore, comprehensive checks are under development to enhance scrutiny in future reporting cycles.

Table 3.2 Overview of reporting of sensitivity analysis scenarios

| Member States | Number of scenarios reported | |
	Emissions (Table 6)	Parameters (Table 7)
AT	4	4
BE	4	4
BG	0	0
CY	0	0
CZ	4	4
DE	7	9
DK	0	0
EE	2	2
ES	10	8
FI	2	2
FR	0	0
GR	3	3
HR	6	6
HU	1	1
IE	3	1
IS	4	4
IT	0	0
LT	4	4
LU	4	3
LV	6	6
MT	0	0
NL	1	1
PL	6	6
PT	0	0
RO	1	1
SI	4	4
SK	0	0

4 Summary of QA/QC results for Iceland, Norway and Switzerland

Iceland, Norway and Switzerland are member countries of the EEA network, which share a number of environmental commitments with the EU, such as for GHG emission reduction targets and mechanisms: Iceland and Norway take part in the EU ETS, while the Swiss Emission Trading System is linked to the EU ETS since 2020. In addition, Iceland and Norway have national targets under the ES Regulation (EU 2018/842). For these reasons, these EEA countries can voluntarily participate in the QA/QC procedure of the EEA and the ETC CM.

In 2023, Iceland, Norway and Switzerland submitted GHG projections on a voluntary basis. An overview of the reported information is provided in Table 4.1 below:

Table 4.1   Overview of QA/QC results for Iceland, Norway and Switzerland

Country	Iceland	Norway	Switzerland
First submission	15/03/2023	15/03/2023	15/03/2023
Resubmission	15/03/2023	06/07/2023	18/08/2023
Base Year	2020	2020	2021
Time series	2018-2050	2020-2035	2015-2050
Scenarios	WEM	WEM WOM WAM	WEM WAM
Gases	All gases	WEM WOM WAM PFC CH4 N2O NF3 HFC CO2 SF6	All gases
Main sectors reported	No	No	No
Report	Yes	Yes	Yes
Parameters	Yes	Yes	Yes
Model factsheet	Yes	Yes	Yes
Sensitivity Scenarios	No	No	Yes

In the course of the QA procedure, the ETC CM directed 8 queries to Iceland, 20 to Norway, and 15 to Switzerland. In response to minor summation errors, Iceland submitted revised data. The cumulative number of questions across these three countries amounted to 43, with completeness checks being the most frequently conducted type (16 instances). The figure below (Figure 4.1) presents the number of questions by type.
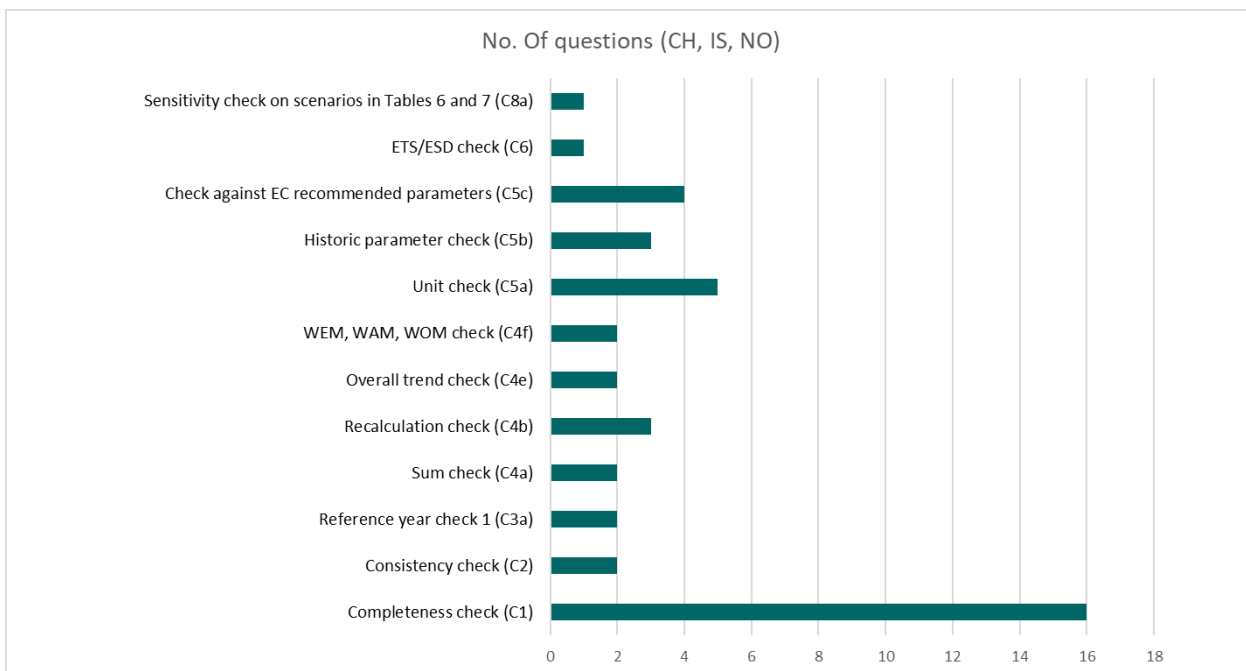
Figure 4.1   Number of questions per check

Figure 4.2 illustrates the distribution of questions raised by the ETC CM across various main sectors. A substantial portion of the questions (40%) pertained to all or multiple sectors, often addressing issues such as inconsistent notation key usage or systematic sum errors. Additionally, a significant portion (40%) was labelled as NA (not applicable), indicating general questions related to the submission, such as the absence of a model factsheet or reporting of indirect CO2. The sector receiving the highest number of questions was LULUCF, accounting for 9% of the total raised questions.

Figure 4.2   Distribution of questions across sectors
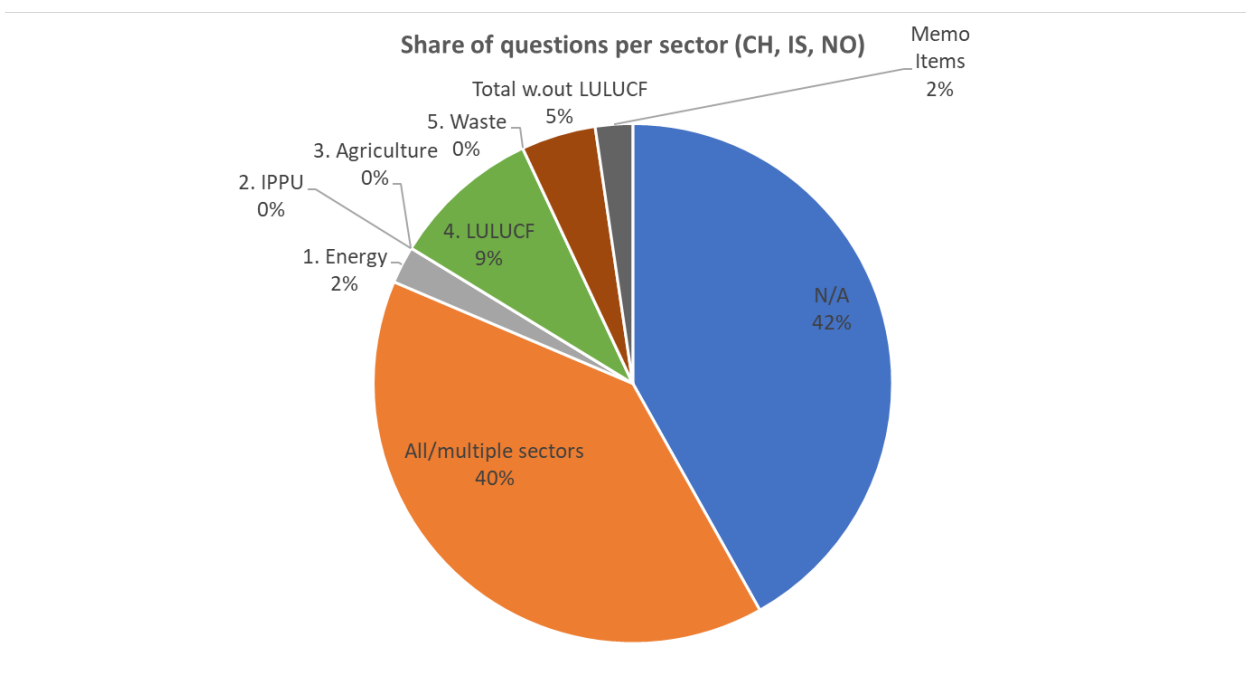
5 Conclusions and outlook for 2023

The 2023 QA/QC results indicate the significance of the procedure within the Union GHG projection system, serving to identify reporting inconsistencies and errors while encouraging enhancements in national systems among Member States. The reporting landscape underwent a major shift in 2021 with the adoption of the new reporting platform, Reportnet 3.0, and the Gov. Reg. reporting templates, necessitating substantial updates in Member States' reporting systems. Despite the challenges associated with these changes, the QA/QC procedure and collaborative efforts between Member States, EEA, and ETC CM proceeded seamlessly, benefitting from a well-established process developed over preceding years. Notably, webinars and guidance documents facilitated an effective transition between the two reporting systems. Despite this shift, key statistics, such as the average number of questions per Member State and the count of resubmissions, remain comparable to previous reporting periods.

Despite some improvements in comparison to 2021, there remains an issue of untimely submissions in the current reporting cycle. Although the official reporting deadline is March 15, only 15 Member States managed to submit on or before the deadline, a slightly higher figure than in 2019 but lower than the previous cycle in 2021 (which saw only 11 timely submissions). This lack of timeliness becomes particularly challenging when countries are required to resubmit due to errors or inconsistencies in their datasets. The average duration between the initial submission and any subsequent resubmissions was 54 days, considering the 16 Member States that underwent this process. These delays not only disrupt the smooth flow of data within the ETC CM tasks but also pose challenges for the timely analysis and processing of EU projections data. Moreover, late datasets hinder effective assessments and progress monitoring conducted by the EEA and the European Commission.

In terms of completeness in submissions, the situation misaligns with patterns observed in previous reporting years. There are noticeable shifts in certain reporting aspects. The number of Member States providing a WAM scenario has decreased to 19, compared to 22 in 2021. For the recently introduced reporting tables, such as sensitivity analysis and related key parameters, there was a decrease in completeness for the former and an improvement for the latter (with only one Member State missing) compared to the previous year.

The completeness of the time series, covering mandatory and intermediate years, displays patterns similar to those observed in previous reporting years; however, there is a notable shift this year. While the allocation of sectors to ETS and ESR emissions presented minimal challenges in 2021, there has been an increase, with 26 questions raised in this aspect during the current reporting cycle. Despite changes introduced in the reporting template for table 1a in 2021—where cells were shaded in grey to highlight implausible category-gas combinations, assisting Member States in accurate reporting—this year's performance in this regard fell short of expectations.

In general, the corrections applied by the ETC CM were similar to those applied in 2021, and more basic than in past years, because on the one hand, the Member States tend to correct most errors by themselves via resubmissions and on the other hand, there are fewer errors flagged. In addition, the new set of reporting templates have a series of automated quality checks integrated in the Excel files to flag potential sum errors or inconsistencies already before the submission since cycle 2021. This seems to be an effective tool to prevent basic reporting errors and there could be further potential to integrate such checks also in the reporting platform 3.0.

It is important that the projections time series is well connected with the historical time series of the GHG inventory. In the past years, the ETC CM applied a so-called base year check to identify potential discrepancies between the historical and projected time series with the option to conduct a base year calibration when the deviation is above a certain threshold. 2023 is the fourth consecutive year in which

no such base year calibration was necessary, and it can be concluded that the countries are sufficiently aware of the importance of a consistent time series. With the new reporting, Member States have to indicate to which inventory version the projections time series is related to increase transparency. All Member States reported a recent inventory version created in 2023, while for 2021 only two countries used an older inventory version but were not flagged in the check. Therefore, it can be concluded that the reported GHG projections are consistent with historical emissions.

The accuracy and transparency checks are an important source of information to understand trends, outliers and recalculations, as the information in the reports is often lacking. With the recalculations more knowledge is gained on how much projections change from submission to submission and to identify and to know the reasons for the most significant changes. For future QA/QC cycles it would be useful to also implement this check for ETS and ESR projections to understand the impacts of the recalculations on the progress towards the targets. The WEM/WAM/WOM check is an important check to identify inconsistencies in scenario definitions and to better understand the scenarios. In addition, in some cases it also helped to identify minor errors in the data.

A challenge for the parameters checks was that in some cases, Member States did not submit base year values or the base year in the first submission, so it first had to be asked in the communication log. As the checking procedure does not foresee a second round of communication with countries (with the only exception for severe issues that affect the EU dataset), the follow-up with countries cannot be completed due to the time constraints.

Concerning the new Tables 6 and 7 focusing on sensitivity scenarios, as well as 1b, 5a, and 5b addressing LULUCF, there is potential to further develop advanced and in-depth checks. These checks could delve into the analysis of time series, particularly for sensitivity scenarios, and assess progress towards targets in the LULUCF sector. Such enhancements could serve as incentives for Member States to provide additional figures for sensitivity analysis scenarios, as eight Member States missed doing so in the current cycle 2023.

Moreover, potential improvements are needed for reporting templates. Specifically, there is a need to allow the reporting of different base years for various sectors. The current limitation of selecting only a common base year for all sectors hinders accurate representation, as it became apparent during the QA/QC procedure that not all sectors use the same starting point, influenced by the timing of the model exercise.

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Abbreviations

CH$_4$	Methane
CO$_2$	Carbon dioxide
DG CLIMA	Directorate-General for Climate Action (at the European Commission)
EEA	European Environment Agency
ESR	Effort sharing regulation
ETC CM	European Topic Centre on Climate change Mitigation
ETS	Emission trading scheme
F-Gases	Fluorinated gases (see HFC, PFC, SF$_6$ and NF$_3$)
GDP	Gross domestic product
GHG	Greenhouse gas
GJ	Gigajoule
Gov. Reg.	Governance Regulation (standing for the Regulation on the Governance of the Energy Union and Climate Action Regulation (EU) 2018/1999)
GWP	Global warming potential
HFC	Hydrofluorocarbons
Kt	Kilotons (1000 tons)
LULUCF	Land use, land-use change and forestry (a sector of the GHG inventory)
MMR	Monitoring Mechanism Regulation (EU) No 525/2013
MS	Member State (of the European Union)
N$_2$O	Nitrous Oxide
NA, NE, NO, IE (or NK)	Not applicable, Not estimated, Not occurring, Included elsewhere (Notation keys according to 2006 IPCC Guidelines)
NF$_3$	Nitrogen trifluoride
PaMs	Policies and measures
PFC	Perfluorocarbons
QA/QC	Quality assurance and quality control
SF$_6$	Sulphur hexafluoride
Total wout LULUCF	Total without LULUCF (Total emissions of a country excluding the sector LULUCF)
WAM	With additional measures
WEM	With existing measures
WOM	Without measures

Annex 1: Overview of corrections and gap-fillings applied by the ETC CM in 2023 cycle

MS	Error correction or gap filling	Gap filling of WAM with WEM	Sums (sectoral/national totals not reported)	Interpolation of intermediate years	Extrapolation to 2050	Other - specify
AT	Yes	Yes	No	No	No	Conversion to EUR(2016) has been carried out for parameters. Relocation of the emissions of CH4 to 1A2 (the same approach used in projections) for creating the EU27 projections dataset to avoid inconsistencies.
BE	Yes	No	No	Yes	Yes	The negative emissions reported by BE in category 2A1 are adjusted to zero by the ETC CM in view of the calculation of the EU27 dataset.
BG	Yes	No	Yes	Yes	No	Corrective action applied to correct parameters to the default unit.
CY	Yes	Yes	No	Yes	No	NA
CZ	Yes	No	No	Yes	No	Memo items were gap filled using inventory data.
DE	Yes	No	No	Yes	No	NA
DK	Yes	Yes	No	No	No	Significant differences were found between the reference year (2021) and the same year from the latest inventory submission. As agreed with the MS, the ETC CM used the inventory for the reference year.
EE	Yes	No	No	No	No	Corrective action applied (conversion factor for oil-, gas- and coal price for conversion from EU(2020)/MWh to EU(2016)/GJ
EL	Yes	Yes	No	Yes	Yes	Population data will be converted to default unit by ETC CM.
ES	Yes	No	No	No	No	Corrective action applied by the ETC CM (conversion to correct unit for GDP as well as conversion factor for oil-, gas- and coal price and ETS carbon price for conversion from EUR(2020) to EUR(2016))
FI	Yes	No	No	No	No	A conversion to ktoe has been carried out (by ETC CM) to parameter 'total net electricity imports' The ETC CM applied a gap filling to obtain the disaggregated emissions of sector 4, using the same value reported in the last available year for years 2041-2050 in order to calculate the Union projections.
FR	Yes	Yes	No	Yes	No	Unit correction in parameters
HR	Yes	No	No	No	No	Memo items were gap filled using inventory data.
HU	Yes	Yes	No	Yes	No	Unit correction in parameters

MS	Error correction or gap filling	Gap filling of WAM with WEM	Sums (sectoral/national totals not reported)	Interpolation of intermediate years	Extrapolation to 2050	Other - specify
IE	No	No	No	No	No	In the category 4.A., gases CH4 and N2O, emissions were reported in the reference year while projections were reported with a notation key. The emissions reported in 2021 were deleted to avoid inconsistencies in the EU dataset.
IT	Yes	Yes	No	Yes	No	Memo items were gap filled using inventory data.
LT	No	No	No	No	No	NA
LU	Yes	No	Yes	No	No	Unit correction in parameters
LV	No	No	No	No	No	NA
MT	Yes	Yes	No	Yes	No	Deleting of reference year when no projections are reported.
NL	Yes	No	No	Yes	Yes	Two interventions have been done: i) for years 2040-2050, WEM scenario, the emissions disaggregated categories have been gapfilled by applying the % split of 2040 to the reported sector emissions. ii) for the WAM, the emissions of all gases and categories (not reported), have been calculated by applying the same interannual growth of the WEM by category and gas. Reference year has been removed, along all the emissions reported in category 1A3e for N2O
PL	No	No	No	No	No	NA
PT	Yes	No	No	Yes	No	Unit correction in parameters
RO	Yes	No	No	No	No	Unit correction in parameters Memo items were gap filled using inventory data.
SE	Yes	Yes	No	Yes	No	Unit correction in parameters
SI	Yes	No	No	Yes	No	NA
SK	Yes	No	No	No	No	Unit correction in parameters

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