Quality assurance and quality control procedure for national and Union GHG projections

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European Topic Centre on Air Pollution and Climate Change Mitigation

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Cover picture: *EU Member States – QA/QC procedure collage*

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1 Introduction

1.1 Background

The quality assurance and quality control (QA/QC) procedure at hand is an element of the QA/QC programme of the Union system for policies and measures and projections[1] published in June 2015 according to Article 12 of the MMR. The European Commission (DG CLIMA) is responsible for coordinating QA/QC activities on GHG projections at EU level and ensures 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 European Topic Centre for air pollution and climate change mitigation (ETC/ACM[2]).

QA/QC procedures should be performed at several different stages during the preparation of the national and Union GHG projections in order to aim to ensure the timeliness, transparency, accuracy, consistency, comparability and completeness of the reported information.

Firstly, quality control (QC) checks of national GHG projections should be performed as technical routine activities by the MS's personnel compiling the projections. These QC checks aim at maintaining the quality of national projections as they are being compiled. Secondly, quality assurance (QA) checks of national GHG projections are carried out by the EEA and its ETC/ACM to review the quality of MS reported projections against quality criteria. Thirdly, QC checks of the aggregated Union GHG projections are performed by the EEA and its ETC/ACM to ensure that the data are compiled correctly at EU level. The QA/QC procedure document describes QA/QC checks carried out at EU level on the national reported projections from Member States and on the compiled Union GHG projections.

A checklist for pre-submission QC checks for MS' national GHG projections is proposed in Annex 1 of this document.

1.2 Objective

The objective of the QA checks is to provide evidence of the quality of MS reported projections. Where appropriate and in consultation with MS, corrective actions or gap-filling according to the MMR may be applied in order to enable a consistent compilation of Union GHG projections. The objective of the QC checks is to ensure that the data are compiled correctly at EU level.

This QA/QC procedure document describes

- the quality criteria against which the projections are assessed
- the consultation process with MS
- the QA/QC checks that are performed at EU level
- the corrective actions that may be applied to MS reported information

[1] DG CLIMA, ELEMENTS OF THE UNION SYSTEM FOR POLICIES AND MEASURES AND PROJECTIONS AND THE QUALITY ASSURANCE AND CONTROL (QA/QC) PROGRAMME AS REQUIRED UNDER REGULATION (EU) NO 525/2013, June 2015, https://ec.europa.eu/clima/sites/clima/files/strategies/progress/monitoring/docs/union_pams_projections_en.pdf

[2] ETC/ACM is a consortium of European institutes assisting the EEA in its support for European Commission

2 General procedure

2.1 Quality criteria

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 Intergovernmental Panel on Climate Change (IPCC) to characterise the quality of historic emission inventories. They have a slightly different scope in the context of emission projections.

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

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

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 MS for Union GHG projections.

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

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

An additional quality principle used in this context is **timeliness** and it means that national GHG projections are submitted by 15 March of a reporting year in accordance with the MMR.

2.2 Quality assurance and control process and MS consultation (MMR Article 14 (3))

Quality assurance and control (QA/QC) procedures are performed at several different stages during the preparation of the Union GHG projections in order to aim to ensure the timeliness, transparency, accuracy, consistency, comparability and completeness of the reported information.
The EEA and its ETC/ACM carry out QA/QC procedures at EU level. Quality assurance (QA) checks of national GHG projections are performed to assess the quality of MS reported

projections against the TCCCA quality criteria. Quality control (QC) checks of the compiled Union GHG projections are performed to ensure that the data are compiled correctly at EU level.
The QA/QC procedure under the MMD underwent a deep review and reorganisation as a result of the revised requirements of the MMR and also due to experience gained during the reporting period under the MMD. The QA/QC checks are now organised in three phases:

Phase I: Quality assurance of national projections and MS consultation
Phase I is focussing on quality assurance of reported data submitted by MS. The aim of phase I is to identify errors in the data submitted, and issues related to TCCCA.
Any potential issues identified by the reviewer, so-called findings, are communicated to MS via the communication log file. Findings deemed as significant will lead to questions. MS will be asked to provide explanations and/or data revised submission and will be informed about corrective actions that may be applied by the reviewers in case:
a) MS do not provide additional or corrected data or explanations or
b) MS do provide additional or corrected data or explanations, but it is not deemed satisfactory to solve the identified issues.
The *communication log file* also includes recommendations for the continuous improvement of national projections.

Phase II: Corrective actions
The corrective actions are part of phase II and consist of checking the MS resubmissions, filling identified data gaps, error corrections and the reference year calibration by the ETC/ACM to ensure that all issues are solved.
As soon as the ETC/ACM has finished the final country dataset, the MS will receive an individual QA feedback document which include

- recommendations for future submissions (*Recommendations)*,
- an overview of the completeness of the submission (*Completeness*),
- a comparison of the reported and final data *(Data visualisation)*.
- The final communication log including the conversations between MS and ETC/ACM (*Communication log)*.

Please note: It is the responsibility of MS to disseminate the information received about corrective actions in the course of the QA procedure to other concerned entities in a country (e.g. the respective Ministry). The MS contact person for the projections QA procedure should be a person directly involved with the compilation process of GHG projections and should be appointed by the MS (through the WG2 of the Climate Change Committee).

Phase III: Quality control of Union GHG projections
In phase III the ETC/ACM performs *internal quality control checks* and compiles the Union projections.

Figure 2-1 Overview of QA/QC procedure

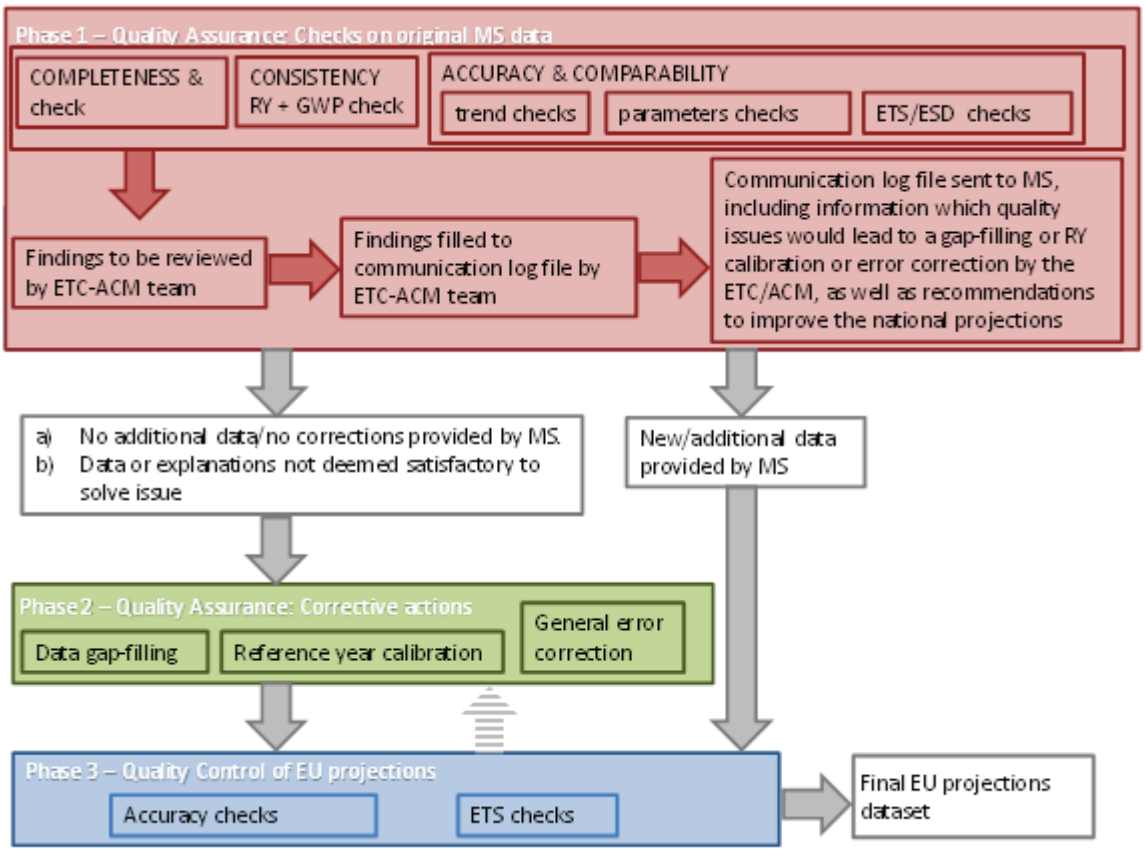
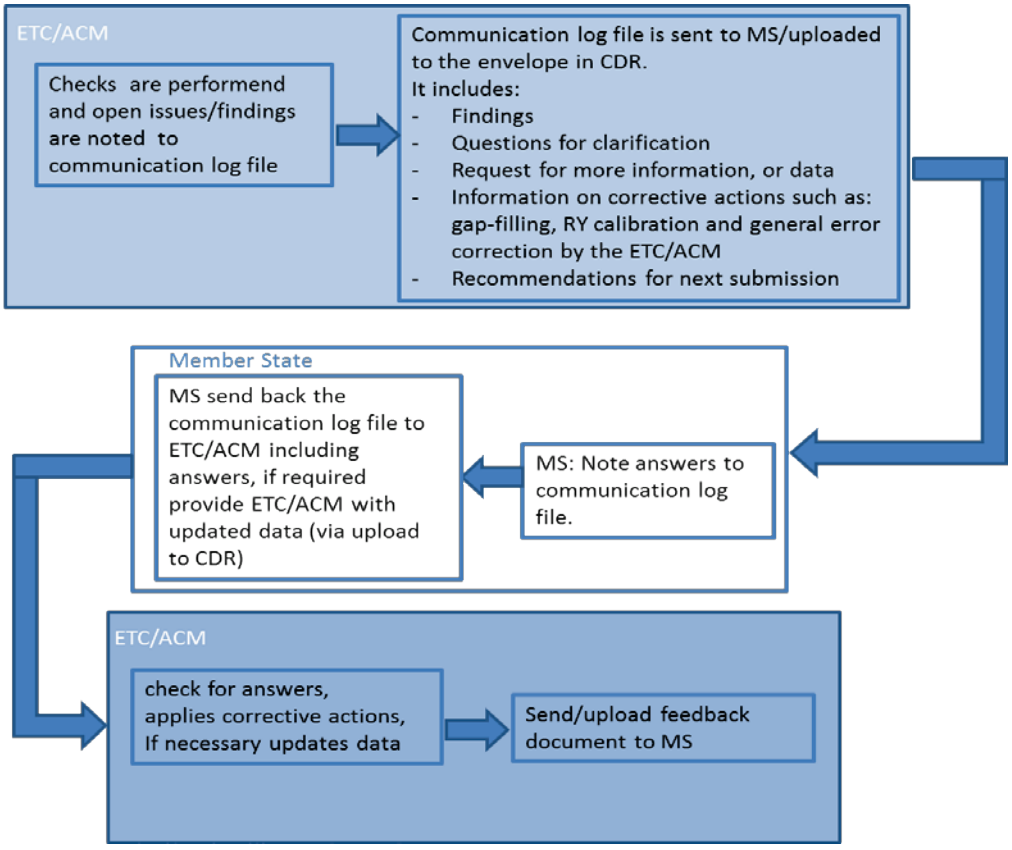


Figure 2-2 Communication process between Member States and ETC/ACM



2.3 Overview of quality checks

Table 2-1and Table 2-2 present the overview of the QA/QC checks and corrective actions for GHG projections, they are further described in section 3.

Table 2-1 Overview of QA/QC checks for GHG projections

	Name of check	Objective	Method	Potential corrective action
C1	Completeness checks	Assess **completeness and transparency** of MS' submissions **(MMR Art. 12(2))**	Reviewing MS' reporting template and the accompanying report with regard to mandatory **(MMR Art.14)** and recommended reporting requirements. Filling in the *Status & completeness report* for each MS.	A1a, A1b,A1c, A1d, A1f, A1g
C2	Consistency check[3]	Assess **consistency and comparability** of MS' submissions **(MMR Art. 12(2))**	Checking whether GHG were reported in the correct unit. In addition it is checked whether Memo Items and sector LULUCF is allocated correctly.	A3
C3a	Reference year check 1	Assess **consistency** of MS' submissions. **(MMR Art. 12(2))**	Checking whether the reference year of projections is consistent with the historic emissions of the inventory.	No
C3b	Reference year check 2	Assess **consistency** of MS' submissions. **(MMR Art. 12(2))**	Checking whether an identified inconsistency between historic inventory and projected reference year is deemed significant.	A2
C4a	Sum check[4]	Assess **accuracy** of MS' submission **(MMR Art. 12(2))**	Checking that disaggregated emission projections by gas, sector and ETS/ESD split equal the total sum reported by MS.	A3
C4b	Recalculation check	Assess **accuracy** of MS' submission **(MMR Art. 12(2))**	Comparing the total emission projection for each scenario with the total emission projection reported by MS in the last reporting period in order to identify if the submissions is identical or updated.	No

[3] In 2017 part of this check was automated and it has been tested (more information can be found in section 3.1)
[4] In 2017 part of this check was automated and it has been tested (more information can be found in section 3.1)

C4c	Outlier check	Assess **accuracy** of MS' submission **(MMR Art. 12(2))**	Checking whether the reported emissions in a certain year are above or below the trend line of the projected emissions.	No
C4d	Projected trend check	Assess **accuracy** of MS' submission **(MMR Art. 12(2))**	Checking if projected trend line seems plausible.	No
C4e	Overall trend check	Assess **accuracy** of MS' submission **(MMR Art. 12(2))**	Checking whether the projected trend line gradient is significantly different from the historical trend line of MS' submission.	No
C5a	Parameter unit check	Assess **consistency and comparability** of MS' submission **(MMR Art. 12(2))**	Ensuring that all MS use the same units.	A3
C5b	Historic parameter check	Assess **consistency and accuracy** of MS' submission **(MMR Art. 12(2))**	This check will be performed by determining the percent difference between data reported by MS and Eurostat data for each historic time step for which data is available by both sources.	No
C5c	Net electricity import check	Assess **consistency and accuracy** of MS' submission **(MMR Art. 12(2))**	An EU-28 aggregate will be calculated and a map will be designed to visualize numbers of electricity imports/exports.	No
C5d	Check against EC parameter recommendations	Assess **consistency and comparability** of MS' submission **(MMR Art. 12(2))**	Data for projected years (2015, 2020, 2025, 2030, 2035) will be checked against recommended values.	
C6	ETS/ESD split check	Assess **consistency and comparability** of MS' submission **(MMR Art. 12(2))**	The ETS/ESD split from emission inventories and EUTL data will be compared to the ETS split reported in projections files for total and main source categories and will be checked for inconsistencies. It will be checked if 1A3a Domestic aviation and International aviation in the EU ETS are not included in the ETS emissions to allow the calculation of Total ETS emissions from stationary combustion.	A1e

Table 2-2: Overview of corrective actions

	Name of corrective action	**Objective**	**Method**
A1a	Linear interpolation of intermediate years	Seek to ensure **completeness and comparability** of Union projections **(MMR Art. 12(2))** by implementing procedures to	It is **good practice** to provide data for intermediate years (e.g. 2016-2019). In case MS cannot provide intermediate reporting years, the dataset will be gap-filled by linear interpolation as required to compile Union projections.

		estimate any missing data from national projections in consultation with MS **(MMR Art.14(3)).**	
A1b	Gap-filling of mandatory reporting years		In case MS cannot provide data for the mandatory reporting years 2015, 2020, 2025, 2030 or 2035 **(MMR Art.14(1))**, the dataset will be gap-filled using a surrogate dataset (if available) or extrapolation, as required to compile complete Union projections.
A1c	Sectoral gap-filling		In case MS cannot provide data organised by sector and gas **(MMR Art.14(1))**, the dataset will be gap-filled by using the relative shares of sectors of a surrogate dataset (if available), as required to compile sectoral Union projections. No gap-filling is foreseen for a missing gas split.
A1d	Gap-filling Memo items		In case MS cannot provide data for **mandatory memo items** (international bunkers, international aviation), the dataset will be gap-filled by using the value of the latest historic inventory year for the entire time-series, as required to compile complete Union projections.
A1e	Gap-filling ETS/ESD split		In case MS cannot provide data split by ETS/ESD **(MMR Art.14(1)(b))** but the total emissions are available or the ETS split is constant over the projected time series, the dataset will be adjusted/gap-filled by using a relative ETS/ESD share of the total emissions of a surrogate dataset. If total emissions are not available the growth rate of the ESD sector of a surrogate dataset will be used to extrapolate the MS' trend. The ETS/ESD split is required to compile Union ESD projections. No detailed gap-filling is foreseen for a missing sectoral ETS/ESD split.
A1f	Gap-filling WAM		**Where available,** a WAM and a WOM scenario shall be reported **(MMR Art. 14(1)(a))**. In case MS cannot provide a WAM scenario, the dataset will be gap-filled by using the WEM scenario as WAM scenario, in order to compile a Union projections WAM scenario. No gap-filling is foreseen for a missing WOM.
A1g	3.2.1.7. Complete gap-filling		Where a Member State does not submit complete projection estimates by 15 March every second year, and the Commission has established that gaps in the estimates cannot be filled by that Member State once identified through the Commission's QA or QC procedures, the Commission may prepare estimates as required to compile Union projections, in consultation with the Member State concerned **(MMR Art.14 (3))**.
A2	Reference year (RY) calibration	Seek to ensure time-series **consistency and accuracy** of Union projections **(MMR Art.12(2))** by implementing procedures to recalibrate the starting year (reference year) of MS national projections to the historic inventory year in consultation with MS.	It is **good practice** that the reference year of emission projections (RY) is consistent with the respective historic year of the emission inventory. In case MS show significant inconsistencies between RY and inventory year, the projections trend will be recalibrated and aligned to the historic year, as required to compile consistent Union projections.
A3	Error correction		If a potential error cannot be clarified or corrected by MS, general error correction will be applied (e.g. unit correction, sum correction), as required to compile accurate Union projections.

2.4 Timeline

The following table presents an exemplary timeline for the interactions between Member States, EEA and ETC in mandatory reporting years. The timeline presented Table 2-3 can be subject to slight modifications by the ETC/ACM and the EEA as the process depends much on the timeliness of submissions and responsiveness of the Member States.

Table 2-3 Timeline of QA/QC process in mandatory reporting years

When	What	Who
Until March 15	Preparation of the submission Completion of the reporting template Internal quality control. Annex 1 presents the recommended QC checks to be performed before the submission.	Member State
Until March 15	Preparation for QA procedure (preparation of check files, compilation of additional data used in the checks)	ETC/ACM
By March 15 every two years (and voluntary submission in intervening years)	Submission to the European Commission (upload of report and reporting templates to ReporNet CDR platform. Table 1: GHG projections by gas and categories. as xls and xml and Table 2-3-4 for parameters, indicators and model factsheets as xls.	Member State
March 15 –April 01	Performance of QA checks and feedback to MS on data gaps and other findings. If necessary, ETC/ACM request data or additional information.	ETC/ACM
April 10 – April 19	MS to respond to ETC/ACM 's answers, to comment on findings and/or provide additional data	Member State
April 20 – April 31	Processing of corrections, changes as discussed with MS in the communication cycle.	ETC/ACM
May 01 – May 14	If necessary, solve open issues by further communication with MS	ETC/ACM and MS
May 15 – May 31 May 15 – June 31	Compilation of EU projections dataset	EEA, ETC/ACM
June 01 – September 30	Assessment, analysis, compilation of EU datasets and reporting in progress report and trends and projections report.	EEA, ETC/ACM, EC
By July 15	ETC/ACM reports main results of the QA/QC process to MS (Completeness status file and Gap-filling & calibration status file)	ETC/ACM

3 Quality checks

In section 3 the checks that are performed by the ETC/ACM reviewers as well as the automated CDR checks are presented. The first part of the chapter 3 deals with the latter which have been introduced in 2017. Phase I, which is conducted by the ETC/ACM includes the quality assurance checks that assess the general quality of the submission with regard to TCCCA. The next section describes Phase II which is conducted after the communication with MS and includes all corrective actions. Finally, Phase III explains which internal consistency checks, in terms of quality control, are performed to ensure the quality of the final data.

In case any incomplete information or errors are detected in Phase I, the ETC/ACM will consult MS via the communication log file. MS will be asked to provide the missing information or any other clarification as necessary. If MS do not provide the requested information, the ETC/ACM may proceed with the corrective actions for quantitative information. Missing qualitative data is considered as not reported.

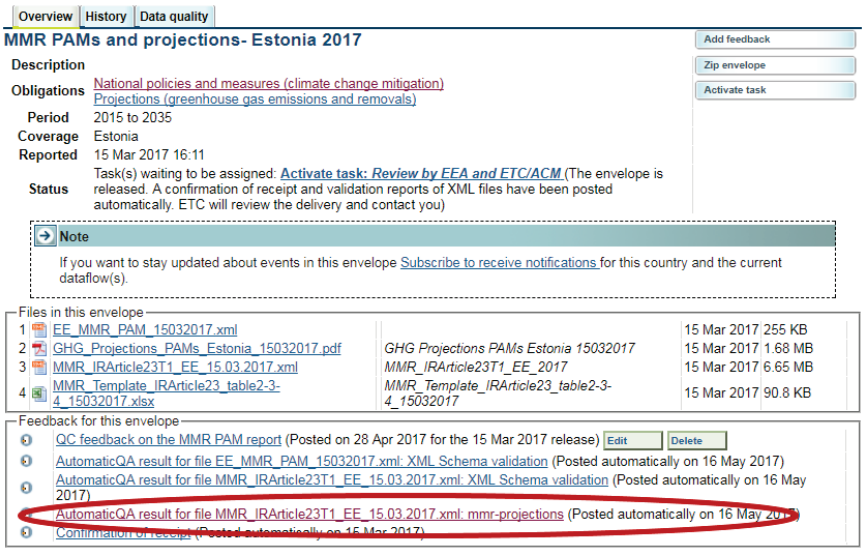
3.1 Before the submission: automated CDR checks

In March 2017 two automated checks have been implemented.

1) GWP/GHG unit check. Checking whether internationally agreed GWP according to 2006 IPCC Guidelines were used in MS' submissions and whether GHG were reported in the correct unit. The findings of this check are presented as errors or warnings
2) Sum check. Checking that disaggregated GHG projections by gas, sector equal the total sum reported by MS. The findings of this check are presented as errors or warnings.

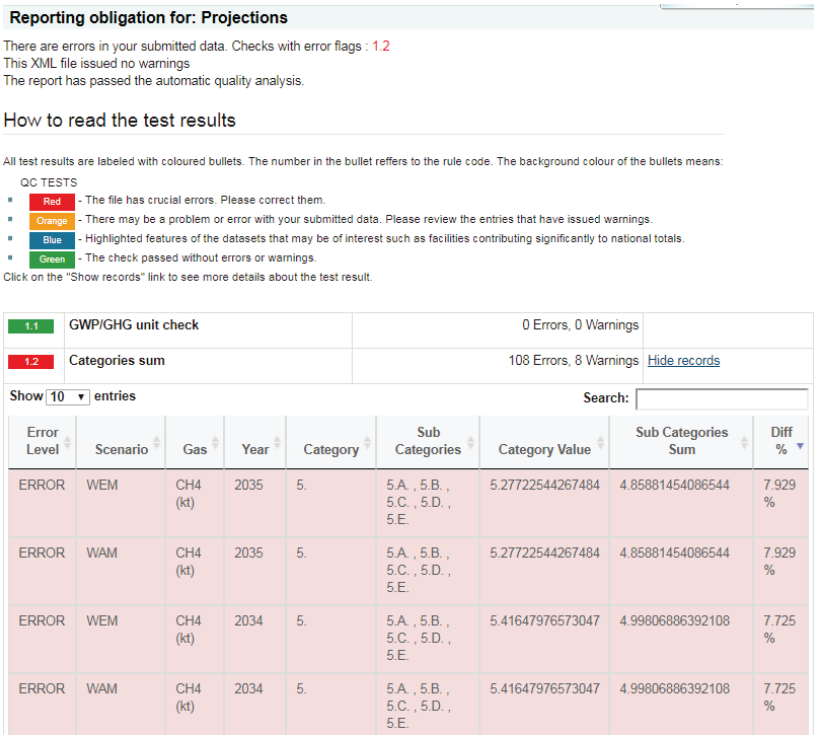
The results can be found in the envelope below the submitted files (see Figure 3-1).

Figure 3-1 where to find feedback from automated checks



The example of how the feedback from automated checks look like (Figure 3-2)

Figure 3-2 Example of an automated feedback



Reporting obligation for: Projections

There are errors in your submitted data. Checks with error flags : 1.2
This XML file issued no warnings
The report has passed the automatic quality analysis.

How to read the test results

All test results are labeled with coloured bullets. The number in the bullet reffers to the rule code. The background colour of the bullets means:

QC TESTS

- Red - The file has crucial errors. Please correct them.
- Orange - There may be a problem or error with your submitted data. Please review the entries that have issued warnings.
- Blue - Highlighted features of the datasets that may be of interest such as facilities contributing significantly to national totals.
- Green - The check passed without errors or warnings.

Click on the "Show records" link to see more details about the test result.

1.1	GWP/GHG unit check	0 Errors, 0 Warnings	
1.2	Categories sum	108 Errors, 8 Warnings	Hide records

Show 10 entries Search:

Error Level	Scenario	Gas	Year	Category	Sub Categories	Category Value	Sub Categories Sum	Diff %
ERROR	WEM	CH4 (kt)	2035	5.	5.A. , 5.B. , 5.C. , 5.D. , 5.E.	5.27722544267484	4.85881454086544	7.929 %
ERROR	WAM	CH4 (kt)	2035	5.	5.A. , 5.B. , 5.C. , 5.D. , 5.E.	5.27722544267484	4.85881454086544	7.929 %
ERROR	WEM	CH4 (kt)	2034	5.	5.A. , 5.B. , 5.C. , 5.D. , 5.E.	5.41647976573047	4.99806886392108	7.725 %
ERROR	WAM	CH4 (kt)	2034	5.	5.A. , 5.B. , 5.C. , 5.D. , 5.E.	5.41647976573047	4.99806886392108	7.725 %

3.2 Phase I - QA of national projections and MS consultation

Phase I consists of the following checks:

- Completeness checks (C1)
- GWP/GHG check (C2)
- Reference year checks 1 and 2 (C3)
- Accuracy checks (C4)
- Parameter checks (C5)
- ETS/ESD checks (C6)

3.2.1 Completeness checks (C1)

Name of check	Completeness checks
Objective	Assess **completeness and transparency** of MS' submissions **(MMR Art. 12(2))**
Method	Reviewing MS' reporting template and the accompanying report with regard to mandatory **(MMR Art.14)** and recommended reporting requirements. Filling in the *Status & completeness report* for each MS.
Potential corrective actions	Data gap-filling (A1a, b, c, d, f, g)
Threshold for significance	No

The completeness check comprises the following detailed checks:

- projections are reported on time and in the correct format via the CDR (mandatory)
- organised by sectors (incl. LULUCF) and memo items (mandatory)
- organised by gases: CO2, CH4, N2O, HFC, PFC, NF3, SF6 (or group of F-gases) (mandatory)
- for all years: RY, 2015, 2020, 2025, 2030, 2035 (mandatory), 2040 (voluntary) and intermediate years (good practice)

- for all scenarios: WEM (mandatory), WAM (where available), WOM (where available)
- EU ETS/ESD split for sectors, years and scenarios (mandatory).
- notation keys in case of missing emissions data (good practice)
- projection parameters for mandatory years and scenarios (mandatory)
- projection indicators (voluntary)
- Report including:
    - description of methodologies and models used (model factsheet) (mandatory)
    - underlying assumptions (mandatory)
    - results of sensitivity analysis (mandatory)

With regard to the parameters reported, it is examined if the key supra-nationally determined parameters have been used and the completeness of projection parameters data is assessed by ensuring that a value has been provided for all years for all parameters reported.
The reports submitted by MS will be analysed regarding sensitivity analysis, transparent descriptions of methodologies, assumptions and models and whether sectoral, geographical and temporal coverage are explained in the report. With regard to models, the ETC/ACM verifies that MS have filled the model factsheet.

3.2.2 Consistency check (C2)

Name of check	Consistency check
Objective	Assess **consistency and comparability** of MS' submissions **(MMR Art. 12(2))**
Method	Checking whether GHG were reported in the correct unit. In addition it is checked whether Memo Items and sector LULUCF is allocated correctly.
Potential corrective action	Error correction (A3)
Threshold for significance	No

This check ensures that the correct units are reported by the MS. MS may report in t CO_{2eq} instead of kt CO_{2eq}, CH_4 in kt CO_2eq instead of kt CH_4, or a copy-paste error may have occurred. For this reason, the GHG unit check assesses that all MS consistently use the correct units. However, there could be other reasons why a value is not reported in the correct unit (E.g. sum errors).
The check consists of two steps:

1) General unit check: Here the projected values are compared to the inventory values and it is checked if they do not exceed or fall below a range of -/+10% to highlight extreme outliers. This check applies to all gases and on a sectoral level.
2) Then the sum (in $CO_{2eq)}$ of the Total (excluding LULUCF) for each gas by multiplying with the GWP is calculated. This sum is compared to the reported Total (excluding LULUCF) in CO_{2eq}:

    a) Calculate the Total

$$Total_{calc}(kt\ CO_{2eq}) = Total_{rep}(kt\ CO_2) + Total_{rep}(kt\ CH_4) * 25 + Total_{rep}(kt\ N_2O) * 298 + Total_{rep}(kt\ CO_{2eq}\ HFC) + Total_{rep}(kt\ CO_{2eq}\ PFC) + Total_{rep}(kt\ CO_{2eq}\ SF_6) + Total_{rep}(kt\ CO_{2eq}\ NF_3)$$

    b) Calculate the difference between $Total_{calc}$ und $Total_{rep}$ and check if smaller/larger than zero:

$$Total_{calc}(kt\ CO_{2eq}) - Total_{rep}(kt\ CO_{2eq}) \neq 0$$

In case the range is exceeded (step 1) and/or the calculated Total is different from the reported Total (step 2), the MS will be consulted to seek for clarifications.
In this check it is also investigated if Memo Items (e.g. International Aviation) and sector LULUCF are correctly allocated. These sectors should not be reported under ETS or ESD. The ETC/ACM will consult the MS and re-allocate the sectors during the Corrective Actions Phase if necessary.

3.2.3 Reference year check 1 (C3a)

Name of check	RY check 1
Objective	Assess **consistency** of MS' submissions. **(MMR Art. 12(2))**
Method	Checking whether the reference year of projections is consistent with the historic emissions of the inventory.
Potential corrective action	Reference year (RY) calibration (A2)
Threshold for significance	Yes

This check compares the starting year of projections (defined as reference year) on a sectoral level to the respective year reported in the latest available emission inventory. It is assessed if there is an inconsistency between the historic and the projected value of this year and whether the difference is below a defined threshold of significance. The threshold was defined as the sector specific level uncertainty given in the latest available NIR of MS. If the uncertainty is not available for a MS, the EU average of the latest available Union NIR will be used.

Table 3-1 Example of a reference year check 1 (C3a)

Sector	Reference Year	RY projected (kt CO2eq)	Inventory emissions of reference year (kt CO2eq)	Absolute difference (kt CO2eq)	Relative difference to inventory (%)	Sector specific uncertainty (%)	Check passed
3	2012	100	120	20	16.7%	5	no
2	2012	85	90	5	5.6%	10	yes

If the difference is larger than the sector specific uncertainty *Reference Year check 2* will be applied. In case the difference is below the threshold, the MS passes the check and no further action is required.

3.2.4 Reference year check 2 (C3b)

Name of check	RY check 2
Objective	Assess **consistency** of MS' submissions. **(MMR Art. 12(2))**
Method	Checking whether an identified inconsistency between historic inventory and projected reference year is deemed significant.
Potential corrective action	Reference year (RY) calibration (A2)
Threshold for significance	Yes

MS' projections that did not pass Reference Year check 1 will be further assessed if the sum of the absolute difference between the RY of the projections and the inventory has significant influence on the reported total emissions of the national projections. The difference will be compared against a threshold of 3% of the reported total emissions. The threshold was defined on the basis of the experience gained during the QA/QC process in the previous reporting cycles.
If the difference exceeds the threshold of significance for the total emissions the MS will be consulted by the ETC/ACM that a reference year calibration across the whole time series may be applied to harmonise the MS submissions with the latest inventory data.
If the difference is below the threshold of significance for the ETS or ESD emissions, the MS will be consulted by the ETC/ACM, but no calibration will be applied by the ETC/ACM. A recommendation may be given to encourage MS to update the dataset for the next submission.

Table 3-2: Example of a reference year check 2 (C3b)

RY 1 check passed	Sector	Reference Year	RY projected (kt CO2eq)	Inventory emissions of reference year (kt CO2eq)	Absolute difference (kt CO2eq)	Relative difference to inventory (sum)	Thres hold	RY 2 Check passed	Sector calibratio n
	Total	2012		1500					
No	3	2012	100	120	***20***				
Yes	2	2012	85	90	5				
yes	1	2012	20	21	1				
no	5	2012	15	50	***35***				
				sum	61	4%	3%	no	yes

For detailed information on the methodology of the RY calibration see chapter 3.2.2.

3.2.5 Accuracy checks (C4)

3.2.5.1 Sum check (C4a)

Name of check	Sum check
Objective	Assess **accuracy** of MS' submission **(MMR Art. 12(2))**
Method	Checking that disaggregated emission projections by gas and sector equal the total sum reported by MS.
Potential corrective action	Error correction (A3)
Threshold for significance	Yes

Disaggregated values for each year are summed up and compared with the total. Sum of emissions of individual GHGs are compared to total GHG emissions and sum of emissions in subsectors and compared to reported sector emissions. The difference should be less than 0.25% of the total emissions. 0.25% was chosen as threshold for significance since a smaller difference could be attributed to rounding. Nevertheless, if manual control excludes that small differences are caused by rounding, this could result in a question to the MS to either explain or adjust the reporting.

3.2.5.2 Recalculation check (C4b)

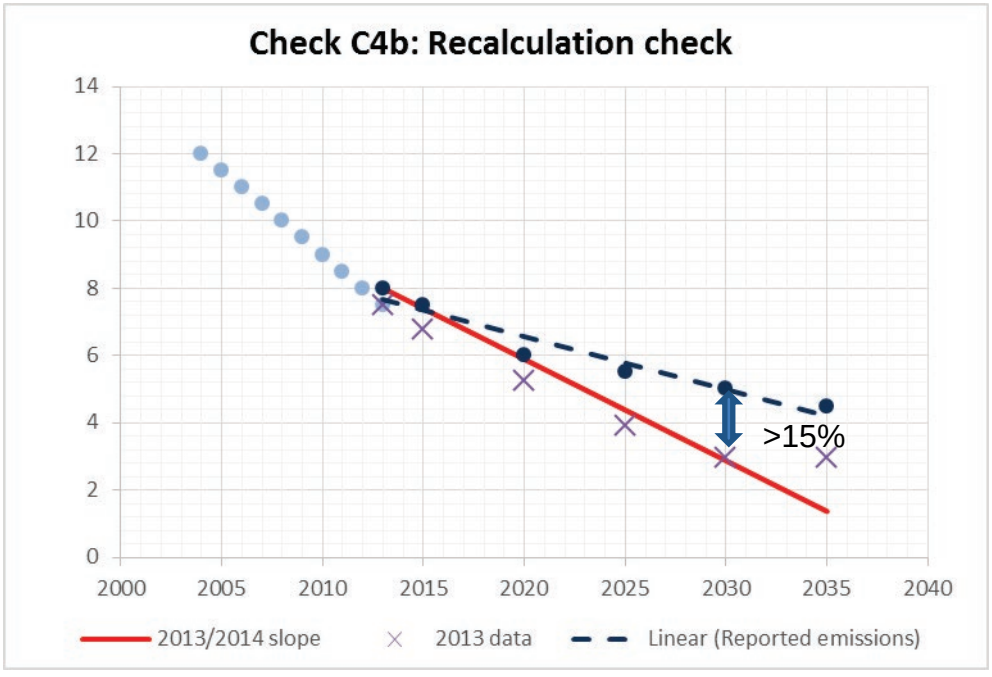
Name of check	Recalculation check
Objective	Assess **accuracy** of MS' submission **(MMR Art. 12(2))**
Method	Compare the total emission projection for each scenario with the total emission projection reported by MS in the last reporting period.
Potential corrective action	No
Threshold for significance	Yes

The total emission projection for each scenario reported by MS and the total emission projection reported in the last reporting period will be compared. This includes the slope and the average emissions over the period. This check consists of two elements:

a) The threshold of significance is 15%. If the threshold is exceeded, visual inspection of the data in a graph confirms a marked difference and no explanation is provided in the report (e.g. change of projection model, new assumptions), the MS will be consulted by the ETC/ACM, but no corrective action will be applied by the ETC/ACM as this is a transparency issue. A recommendation may be given to encourage MS to provide an explanation in the next submission.

b) The new submission is identical to the previous submission (for a certain sector or gases or years). The Member States will be consulted by the ETC/ACM in order to clarify why the projections were not updated.

Figure 3-3 Example of a recalculation check (C4b)

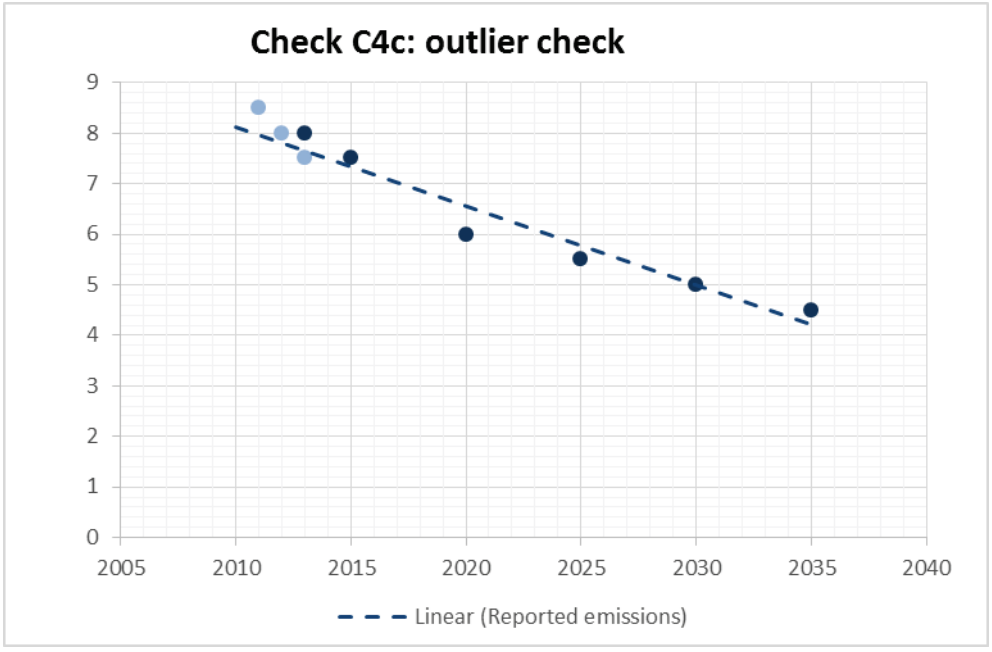


3.2.5.3 Outlier check (C4c)

Name of check	Outlier check
Objective	Assess **accuracy** of MS' submission **(MMR Art. 12(2))**
Method	Checking whether the reported emissions in a certain year are above or below the trend line of the historic emissions.
Potential corrective action	No
Threshold for significance	Yes

It is checked whether there are outliers within the time-series of projected emissions by scenario and sector. An outlier is identified when the difference between the reported emissions and the emissions based on the linear trend line of projected emissions is more than 5% and visual inspection of the data in a graph. If the threshold is exceeded and no explanation is apparent (e.g. non-linear trend line) or is provided in the report, the MS will be consulted by the ETC/ACM, but no corrective action will be applied by the ETC/ACM. A recommendation may be given to encourage MS to provide an explanation in the next submission.

3-4 Example of a recalculation check



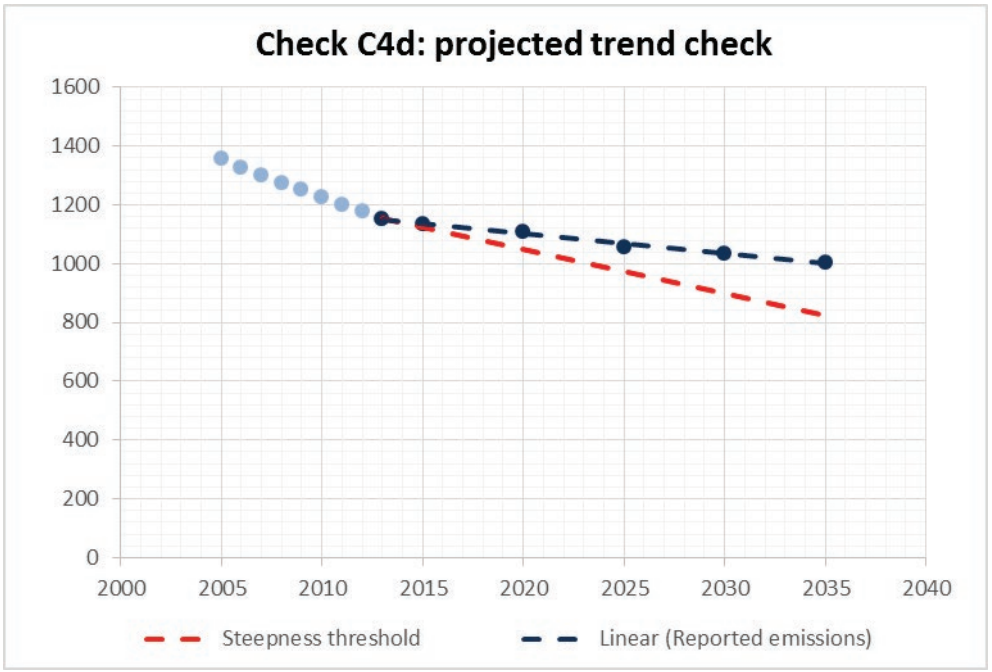
3.2.5.4 Projected trend check

Name of check	Projected trend check
Objective	Assess **accuracy** of MS' submission **(MMR Art. 12(2))**
Method	Checking if projected trend line seems plausible.
Potential corrective action	No
Threshold for significance	Yes

The slope of the trend line of projected emissions is calculated to check whether the trend line seems too steep. This check is done on a sectoral level. If the slope of the sectoral projections

is higher or lower than 5%, the ETC/ACM will attempt to determine the reasons for the steep gradient in the projections report and by comparison with the recent historic emission trends. If no explanation can be found, the ETC/ACM will consult the MS to identify the reason. No corrective action will be applied by the ETC/ACM. A recommendation may be given to encourage MS to provide an explanation in the next submission.

Figure 3-5 Example of a projected trend check (C4d)

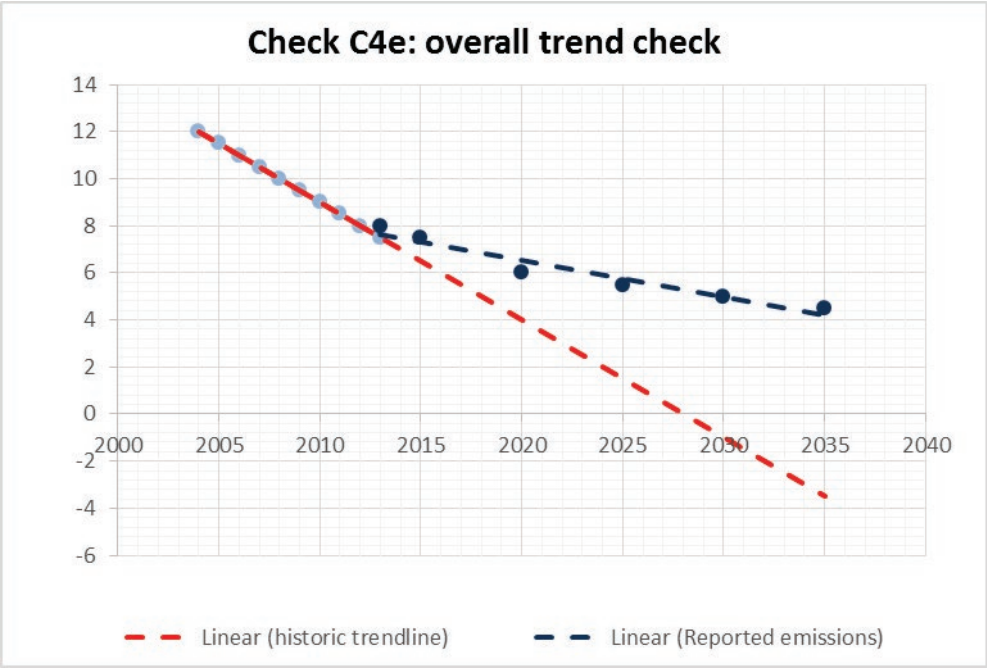


3.2.5.5 Overall trend check (C4e)

Name of check	Overall trend checks
Objective	Assess **accuracy** of MS' submission **(MMR Art. 12(2))**
Method	Checking whether the projected trend line gradient is significantly different from the historical trend line of MS' submission.
Potential corrective action	No
Threshold for significance	Yes

It will be assessed whether the projected trend line gradient is significantly different from the historical trend line by MS and scenario for totals and for matching sets of sector and gas. If the projected trend is inconsistent with the trend of the GHG inventory (standard deviation is more than 50% of emission levels), the ETC/ACM will attempt to determine the reasons behind the difference in the trend from the projections reports. If no explanations are found, the ETC/ACM will consult the MS to identify the reason. No corrective action will be applied by the ETC/ACM. A recommendation may be given to encourage MS to provide an explanation in the next submission.

Figure 3-6 Example of an overall trend check (C4e)



3.2.6 Parameters checks (C5)

3.2.6.1 Unit check (C5a)

Name of check	Unit check
Objective	Assess **consistency and comparability** of MS' submission **(MMR Art. 12(2))**
Method	Ensuring that all MS use the same units.
Potential corrective action	Error correction (A3)
Threshold for significance	No

In the first step historical numbers from Eurostat will be compared with reported projection numbers for the given reference year. If these are similar it is assumed that the unit is correct. If difference can be explained because of different units, numbers may be converted accordingly.
If differences between historical numbers and projections numbers can easily be explained because of incorrect units, MS will be informed. If no explanations are found, the ETC/ACM will consult the MS to identify the reason.

3.2.6.2 Historic parameter check (C5b)

Name of check	Historic parameter check
Objective	Assess **consistency and accuracy** of MS' submission **(MMR Art. 12(2))**
Method	This check will be performed by determining the percent difference between data reported by MS and Eurostat data for each historic time step for which data is available by both sources.
Potential corrective action	No
Threshold for significance	No

Projected numbers for important parameters such as GDP and population should start from historical values to ensure time series consistency. This check will be performed by determining the percentage difference between data reported by MS and surrogate data for the projection reference year. Surrogate data for GDP, population are taken from the corresponding Eurostat datasets.
Historic values should be very close to the data reported in the datasets indicated above. Small differences may occur if data in the surrogate data set was updated after the preparation of each individual projection. It can be assumed that historic values should only differ insignificantly after updates of surrogate data sets, but a certain discrepancy should be taken into account and not be considered as an implausibility indication. The deviation is calculated as the difference between data surrogate data source and MS' parameter data divided by the data of the surrogate data source. If no explanations are found, the ETC/ACM will consult the MS to identify the reason.

3.2.6.3 Net electricity import check (C5c)

Name of check	Net electricity import check
Objective	Assess **consistency and accuracy** of MS' submission **(MMR Art. 12(2))**
Method	An EU-28 aggregate will be calculated and a map will be designed to visualize numbers of electricity imports/exports.
Potential corrective action	No
Threshold for significance	No

Projections for net electricity import are mostly done by each MS without taking into account projections of other MS. With this check, net electricity imports will be visualised across MS and to highlight whether projected numbers aggregate to a feasible EU-28 situation.
For this check, historic net electricity imports reported by MS are summed up to an EU-28 aggregate. Additionally, on a map we visualize, for each MS, whether they import or export electricity by a specific colour (with different colour intensities) to gain insights into the spatial distribution of electricity imports/exports. MS will be informed about the results of this comparison. No corrective action will be applied by the ETC/ACM.

3.2.6.4 Check against EC recommended parameters (C5d)

This check is undertaken in order to explore whether the recommended parameters by the EC have been considered by Member States in their projections.[5]

Name of check	Check against EC parameter recommendations
Objective	Assess **consistency and comparability** of MS' submission **(MMR Art. 12(2))**
Method	Data for projected years (2015, 2020, 2025, 2030, 2025) will be checked against recommended values.
Potential corrective action	No
Threshold for significance	No

5 EC (2016): Recommended parameters for reporting on GHG projections in 2017. Final, 14/06/2016

This check is implemented for population, GDP, carbon price, gas, coal and oil import prices. This check is for informational purposes only. No corrective action will be applied. While for population and price data absolute values are checked against each other, for GDP growth rates will be checked against each other.

3.2.7 ETS/ESD check (C6)

Name of check	ETS/ESD check
Objective	Assess **consistency and comparability** of MS' submission **(MMR Art. 12(2))**
Method	The ETS/ESD split calculated from EUTL data and emission inventories will be compared to the ETS split reported in projections files for total and main source categories and checked for inconsistencies.
Potential corrective action	Data gap-filling (A1e)
Threshold for significance	Yes

Projected emissions shall be reported separately for ETS and ESD emissions for each source category. ETS splits, calculated as ETS emissions divided by total emissions per category, should be consistent and plausible between EUTL and inventory data and projections for historic years and should change along the timeline only in small steps. ETS splits allow a fast analysis of underlying shares of emissions under the ETS and ESD sector.
Firstly, it will be checked if total projected emissions have been reported separately for emissions in ETS and ESD sector and if sectoral sums add up correctly. If this is not the case on the level of total GHG, gap-filling will take place as explained in section 3.2.1.5.

If ETS and ESD emissions are reported separately, the ETS emissions will be compared to historic ETS emissions from EUTL. If projected total emissions are different by more than +/- 5% compared to ETS emissions of the respective historic year, MS will be asked for clarification.

The ETS split calculated from ETS data and emission inventories will be compared to the ETS split reported in projections files for the reference year for total GHG emissions as well as for the main source categories. Differences might occur because of different ETS scopes or GWP used, if reference years are before 2013. If the difference between ETS splits from inventories and reference year of projections is higher than 5 %, the ETC/ACM reviewer will ask the MS for clarification. No correction will take place.

Secondly, projected ETS splits will be calculated along the timeline and checked for time series consistency. If no change of ETS split can be seen on the level of total GHG, MS will be asked for clarification to ensure that ETS and ESD emissions have been projected in sufficient detail.

If the annual change of ETS splits is higher or lower than 3%, MS will be asked for underlying reasons of this, if no information has been given in projection reports.

3.2.7.1 Additional check: ETS stationary combustion

With this additional check it is investigated if the sectors 1A3a and International aviation in the EU ETS were reported under sector 1 Energy for Total ETS GHGs. In this case, Member States are asked to delete reported ETS emissions from these sectors. If it is not conducted by Member States, the ETC/ACM will subtract these emissions from sector 1 and the Total (excl.

LULUCF) to derive a harmonised EU Total for stationary combustion in the EU ETS (see chapter 3.3.4).

3.3 Phase II - Corrective actions

Phase II consists of the following corrective actions:

- Data gap-filling (A1)
- Reference year (RY) calibration (A2)
- Error correction (A3)

3.3.1 Data gap-filling (A1)

In the following section different gap-filling methods are described. Examples are provided to demonstrate transparently how the ETC/ACM may fill data gaps.

Objective of data gap-filling: Seek to ensure **completeness and comparability** of Union projections according to **MMR Art.12(2)** by implementing procedures to estimate any missing data from national projections in consultation with MS according to **MMR Art.14(3)**.

3.3.1.1 Linear interpolation of intermediate years (A1a)

Name of corrective action	Linear interpolation of intermediate years
Method	It is **good practice** to provide data for intermediate years (e.g. 2016-2019). In case MS cannot provide intermediate reporting years, the dataset may be gap-filled by linear interpolation as required to compile Union projections.

In order to fill the data gaps between mandatory reporting years (e.g. 2016-2019) the ETC/ACM reviewer applies linear interpolation between the reported years. The interpolation is applied for CO_{2eq} on sectoral and total level.

Table 3-3 Reported by Member State

	Total GHG (kt CO_2eq)					
Years / Sector	2015	2016	2017	2018	2019	2020
1A	1000					800
2B	150					50

Table 3-4: Gap-filled by ETC/ACM (A1a)

	Total GHG (kt CO_2eq)					
Years / Sector	2015	2016	2017	2018	2019	2020
1A	1000	960	920	880	840	800
2B	150	130	110	90	70	50

3.3.1.2 Gap-filling of mandatory reporting years (A1b)

Name of corrective action	Gap-filling of mandatory reporting years
Method	In case MS cannot provide data for the mandatory reporting years 2015, 2020, 2025, 2030 or 2035 **(MMR Art.14(1))**, the dataset will be gap-filled using a surrogate dataset (if available) or extrapolation, as required to compile complete Union projections.

In order to fill the data gaps of mandatory reporting years (e.g. 2015) the ETC/ACM reviewer applies linear interpolation between reported years. The interpolation is applied for CO_{2eq} on sectoral and total level. When a MS only reports data from 2012 – 2020, but no data for 2025, 2030 and 2035, the ETC/ACM reviewer will extend too short time series to the mandatory projection horizon. This will be done by using the relative change for these years of the latest available Commission projection.
If no appropriate Commission projection is available, the pre-2020 trend of the national projections may be extrapolated.

Table 3-5 Reported by MS

	Total GHG (kt CO_2eq)		
Years / Sector	2020	2025	2030
1A	1000		
2B	150		

Gap-filled by ETC/ACM:
Latest available Commission projection:

Sector 1A: Change 2020-2025: +4%
Change 2025-2030: -2%

Sector 2B: Change 2020-2025: 0.5%
Change 2025-2030: -1%

Table 3-6: Gap-filled by ETC/ACM (A1b)

	Total GHG (kt CO_2eq)		
Years / Sector	2020	2025	2030
1A	1000	1040	1019.2
2B	150	150.8	149.2

3.3.1.3 Sectoral gap-filling (A1c)

Name of corrective action	Sectoral gap-filling
Method	In case MS cannot provide data organised by sector and gas **(MMR Art.14(1))**, the dataset will be gap-filled by using the relative shares of sectors of a surrogate dataset (if available), as required to compile sectoral Union projections. No gap-filling is foreseen for a missing gas split.

In order to gap-fill a missing sectoral split, the ETC/ACM reviewer applies relative shares of sectors of the latest available Commission projection.
If no appropriate Commission projection is available, the relative share of sectors of previously reported national projections may be used.

Example 1:
Reported by MS: Sector 1A2 is not reported nor included in the Total emissions

Table 3-7 Reported by MS

	Total GHG (kt CO2eq)					
Sector	2015	2016	2017	2018	2019	2020
Total (excl. LULUCF)	774	770	788	788	797	793
Energy supply (1A1 + 1B+1C)	60	55	55	54	54	51
Energy use industry (1A2)						
Transport (1A3)	650	655	670	671	680	680
Energy use in households, services and other (1A4 + 1A5)	40	41	42	41	40	40
Industrial Process (2)	5	2	2	2	2	2
Agriculture (3)	11	10	12	13	14	13
Waste (5)	8	7	7	7	7	7

Gap-filling by ETC/ACM:
Latest available Commission projection:

Table 3-8: Relative share of total emissions for sector: energy use industry (1A2)

	2015	2016	2017	2018	2019	2020
Energy use industry (1A2)	5%	4%	4%	3.5%	3%	3%

Table 3-9: Corrected table (A1c)

	Total GHG (kt CO2eq)					
Sector	2015	2016	2017	2018	2019	2020
Total (excl. LULUCF) *	813	801	820	816	821	817
Energy supply (1A1 + 1B+1C)	60	55	55	54	54	51
Energy use industry (1A2)	39	31	32	28	24	24
Transport (1A3)	650	655	670	671	680	680
Energy use in households, services and other (1A4 + 1A5)	40	41	42	41	40	40
Industrial Process (2)	5	2	2	2	2	2

Agriculture (3)	11	10	12	13	14	13
Waste (5)	8	7	7	7	7	7

*Note: This changes the national total and the total for sector 1 Energy.

Example 2:
The MS only reports emission for sector 1, but no disaggregation on sub-sectoral level.

Table 3-10: Reported by MS

	Total GHG (kt CO2eq)					
Sector	2015	2016	2017	2018	2019	2020
Total (excl. LULUCF)	824	829	811	782	773	762
Energy total (1)	800	810	790	760	750	740
Energy supply (1A1 + 1B+1C)						
Energy use industry (1A2)						
Transport (1A3)						
Energy use in households, services and other (1A4 + 1A5)						
Industrial Process (2)	5	2	2	2	2	2
Agriculture (3)	11	10	12	13	14	13
Waste (5)	8	7	7	7	7	7

Gap-filling by ETC/ACM:

Latest available Commission projection:

Table 3-11: Relative share of sub-sectors in sector 1

	2015	2016	2017	2018	2019	2020
Energy supply (1A1 + 1B+1C)	31%	32%	34%	33%	33%	32%
Energy use industry (1A2)	15%	14%	14%	13.5%	13%	13%
Transport (1A3)	25%	29%	28%	30%	27%	26%
Energy use in households, services and other (1A4 + 1A5)	29%	25%	24%	27%	27%	29%

Table 3-12: Gap-filled dataset (A1c)

	Total GHG (kt CO2eq)					
Sector	2015	2016	2017	2018	2019	2020
Total (excl. LULUCF)[(a)]	824	829	811	782	773	762
Energy total (1)	800	810	790	760	750	740

Energy supply (1A1 + 1B+1C)	248	259	269	251	248	237
Energy use industry (1A2)	120	113	111	103	98	96
Transport (1A3)	200	235	221	228	203	192
Energy use in households, services and other (1A4 + 1A5)	232	203	190	205	203	215
Industrial Process (2)	5	2	2	2	2	2
Agriculture (3)	11	10	12	13	14	13
Waste (5)	8	7	7	7	7	7

[(a)] Note: In this example the Total is not changed.

3.3.1.4 Gap-filling of Memo items (A1d)

Name of corrective action	Gap-filling of Memo items
Method	In case MS cannot provide data for **mandatory memo items** (international bunkers, international aviation), the dataset will be gap-filled by using the value of the latest historic inventory year for the entire time-series, as required to compile complete Union projections.

If the time series of memo items (international bunkers, international aviation) is missing, the latest historic value of the latest available national inventory is applied to the future time series.

3.3.1.5 Gap-filling of ETS/ESD split (A1e)

Name of corrective action	Gap-filling of ETS/ESD split
Method	The ETS/ESD split is required to compile projections ETS and ESD emissions of the European Union. In case MS cannot provide data split by ETS/ESD **(MMR Art.14(1)(b))** but the total emissions are available, the dataset will be adjusted /gap-filled by using a relative ETS/ESD share of the total emissions of a surrogate dataset. If total emissions are not available a surrogate dataset will be used to extrapolate the MS' trend for ETS and ESD emissions. Gap-filling takes place also for a missing sectoral ETS/ESD split on key source level.

If MS do not provide GHG emissions for ETS and ESD sectors, the ETC/ACM reviewer applies option a) in case total emissions are provided and option b) in case total emissions are not reported by MS.

a) The relative ETS/ESD share for 2020 of the latest available Commission projection will be applied to the total that has been reported by MS.
b) The 2015-2030 growth rate of ETS and non ETS emissions of the latest available Commission projection will be applied to ETS and ESD emissions.

On the level of key source categories, ETS and ESD emissions are necessary to compile a consistent EU projection, too. This is why gap-filling is foreseen for a missing sectoral ETS/ESD split on key source category level. In case ETS and ESD emissions are missing for a key source category, these will be gap-filled applying the ETS split reported with latest GHG inventory in Annex V or an average EU ETS split derived from reported data.

Example:
In the case that:

- no ETS/ESD projection is reported or
- no ETS/ESD projection is reported on key source level but
- projection of total GHG is available

an adjustment will take place:

ESD (year n) = Total GHG (n)*ESD share (n) of EC projection

In the case that no projection of total emission is reported, ESD data will be gap-filled:

ESD (year n) = Total emissions of latest inventory year * ESD Growth rate of EC projection (n-2015)

3.3.1.6 Gap-filling of WAM (A1f)

Name of corrective action	Gap-filling of WAM
Method	**Where available,** a WAM and a WOM scenario shall be reported **(MMR Art. 14(1)(a))**. In case MS cannot provide a WAM scenario, the dataset will be gap-filled by using the WEM scenario as WAM scenario, in order to compile a Union projections WAM scenario. No gap-filling is foreseen for a missing WOM.

The ETC/ACM will use the national WEM scenario reported by MS as WAM scenario.

3.3.1.7 Complete gap-filling (rejection of submitted dataset) (A1g)

Name of corrective action	Complete gap-filling
Method	Where a Member State does not submit complete projection estimates by 15 March every second year, and the Commission has established that gaps in the estimates cannot be filled by that Member State once identified through the Commission's QA or QC procedures, the Commission may prepare estimates as required to compile Union projections, in consultation with the Member State concerned (**MMR Art.14 (3)**)..

Where Member States do not submit complete projections and the gaps cannot be filled in consultation with the Member State during this QA procedure, the Commission may prepare estimates to compile the Union projections, also in consultation with the Member State (MMR Art.14 (3)). The QA procedure predefines following criteria and cases which could trigger a complete gap-filling:

- No projections provided at all.
- No updated projections provided, the submission contains the same data as previously submitted.
- The RY is out-dated and the trend between RY and 2015 deviates substantially from the historic trend in the inventory.
- The submission is delayed and cannot be checked in the QA procedure.

In all cases the Member State will be contacted first to seek for further clarification. If sufficient explanation is provided and it can be ensured that the quality of the Union projections is not affected, the provided dataset will be accepted. If there is no data available or the risk of introducing bias in the Union projections, an alternative data set will be selected by the experts of the Commission, EEA and the ETC/ACM for gap-filling the Member States' projections.

3.3.2 Reference year calibration (A2)

Objective of reference year calibration: Seek to ensure time-series **consistency and accuracy** of Union projections **(MMR Art.12(2))** by implementing procedures to recalibrate the starting year (reference year) of MS national projections to the historic inventory year in consultation with MS.

Name of corrective action	RY calibration
Method	It is **good practice** that the reference year of emission projections (RY) is consistent with the respective historic year of the emission inventory. In case MS show significant inconsistencies between RY and inventory year, the projections trend will be recalibrated and aligned to the historic year, as required to compile consistent Union projections.

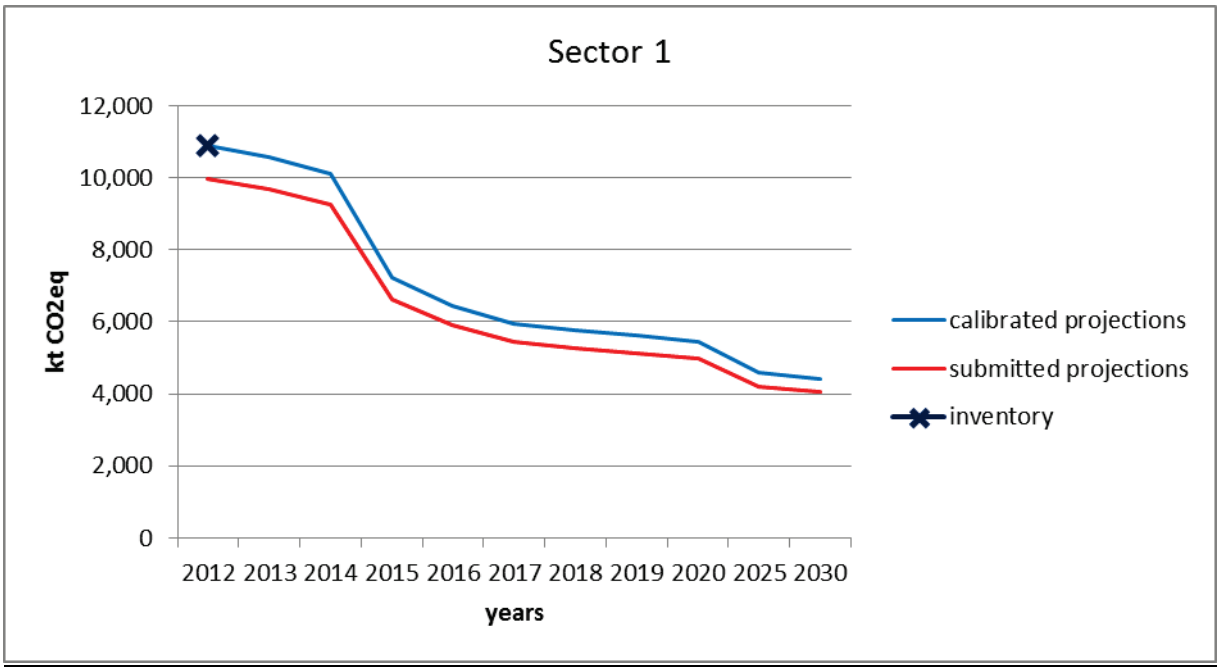
The staring year of national projections is defined as reference year. If the reference year shows significant inconsistencies with the respective historic year from the latest available national inventory (see RY year check 1 and 2 in chapters 3.2.3 and 3.2.4), the projected trend will be recalibrated. To calibrate MS' projections with historic inventory data, a calibration factor will be calculated for each sector and multiplied with the MS' time-series (sectoral and total emissions).

$$calibration\ factor = \frac{inventory\ year}{reference\ year}$$

Example:
Sector 1 emissions of a MS:
RY 2012: 9 953 kt CO_{2eq}
Inventory year 2012: 10 879 kt CO_{2eq}

- Calibration factor: 1.093
- The submitted time series (red line) of sector 1 is multiplied by this factor and is shifted above (blue line)
- For the other sectors the same methodology applies to result in a consistent value for Total (excl. LULUCF)

Figure 3-7 Example of a reference year calibration (A2)



3.3.3 General error correction (A3)

Name of corrective action	Error correction
Method	If a potential error cannot be clarified or corrected by MS, general error correction will be applied (e.g. unit correction, sum correction), as required to compile accurate Union projections.

Here the correction of general errors such as units and copy paste errors are included. As there is no general method for this type of corrective action, a suitable method will be applied for each specific case.

3.3.4 Harmonisation of ETS emissions for stationary combustion (A4)

Name of corrective action	Harmonisation of ETS emissions for stationary combustion
Method	If aviation emissions (1A3a, International aviation in the EU ETS) are reported for ETS in sector 1 Energy/Total w.out LULUCF, these emissions will be subtracted to derive a consistent value for stationary ETS emissions and to compile accurate Union projections.

To provide a proper estimate for the EU ETS projections for stationary combustion, it is necessary that sector 1 ETS emissions do not include emissions from sector 1A3a domestic aviation or Memo item International aviation in the EU ETS. For this reason the ETC/ACM subtracts the aviation emissions from sector 1 and the Total (excl. LULUCF) for ETS and ensures that 1A3a and International aviation in the EU ETS are only reported for Total GHGs.

3.4 Phase III - QC of Union GHG projections

In phase III the ETC/ACM repeats a selected set of checks to the final corrected dataset in order to make sure that no errors have been introduced during Phase II. The following checks will be performed in this phase (see description in previous chapters):

- Sum check (C4a)
- Outlier check (C4c)
- ETS/ESD check (C6)

The sum check will be extended and performed not only on a sectoral, but also on a MS level to ensure that no errors have been introduced during the aggregation of MS' projections to Union GHG projections

Abbreviations

BAM	Baseline with Adopted Measures
CDR	Central Data Repository
DG CLIMA	Directorate-General for Climate Action
EC	European Commission
EEA	European Environment Agency
ESD	Effort Sharing Decision
ETC/ACM	European Topic Centre for Air Pollution and Climate Change Mitigation
ETS	European Trading System
EU	European Union
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GWP	Global Warming Potential
IPCC	Intergovernmental Panel on Climate Change
LULUCF	Land Use, Land-Use Change and Forestry
MMD	Monitoring Mechanism Decision
MMR	Monitoring Mechanism Regulation
MS	Member State
NIR	National Inventory Report
PaMS	Policies and Measures
QA	Quality Assurance
QC	Quality Control
RY	Reference Year
SWD	Commission Staff Working Document
TCCCA	Transparency, Consistency, Completeness, Comparability, Accuracy
UNFCCC	United Nations Framework Convention on Climate Change
WAM	With Additional Measures
WEM	With Existing Measures
WOM	Without Measures

Annex 1

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Annex 2

Table 0-1 Example of communication log file

Communication Log sheet:
This sheet is used to record communications to and from Member States relating the Quality Assurance / Quality Control procedure and to track the progress of the QA/QC procedure. The **orange** columns are filled by the ETC/ACM reviewer.
The MS can provide responses and information in the **blue** columns.

Version	MS	Date	Comment ID	Status	Name of ETC/ACM reviewer	Sector	Gas	Year(s)	Check performed (refers to "QA/QC Activity Description")	Finding	Question to MS/recommendation	Proposed corrective action	MS answer	Response supplied by	Contact details (Email)	Date	Conclusion

Table 0-2 Example of status files (completeness) (1/3)

Status & completeness report for							
Member State							
General information		**Date of receipt**		**Latest resubmission**		**Comments**	
	Projections report	15 March 2017		12 April 2017			
	Excel template	15 March 2017		12 April 2017			
	Reference year	2015					
	Projections provided for years	2015, 2020, 2025, 2030, 2035					
	Gases covered	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	NF3
		☑	☑	☑	☑	☑	☑	☑
	Reporting obligation	Article 14 of Regulation (EU) No. 525/2013						
	Language	English						
	Correct geographical coverage	☐						
		Sheets included		**Comments**				
	Emission projections	☑						
	Projections parameters	☑						
	Model factsheet	☑						
	Indicators	☐						
		Description included in the report		**Comments**				
	Methodologies	☑						
	Models	☑						
	Underlying Assumptions	☑						
	Sensitivity analysis	☑						

Table 0-3 Example of status files (completeness) (2/3)

PART I: Sectors included in the projections							
Sectoral split		Energy	Energy	Industrial Processes	Agriculture	LULUCF	Waste	Memo Items
	Sector	1 ☑	1 ☐	2 ☑	3 ☑	4 ☑	5 ☑	
	Sub-sectors	1.A ☑	1.A.4 ☐	2.A ☑	3.A ☑	4.A ☑	5.A ☑	M.C in wastes ☑
	Schmid Carmen: check if total GHG are reported, column CJ-CV.	1.A.1 ☑	1.A.4.a ☐	2.A. Cement ☑	3.B ☑	4.B ☑	5.B ☑	M.CO2 biomass ☑
		1.A.1.a ☑	1.A.4.b ☐	2.A. non cement ☑	3.C ☑	4.C ☑	5.C ☑	M.CO2 capt ☑
		1.A.1.b ☑	1.A.4.c ☐	2.B ☑	3.D ☑	4.D ☑	5.D ☑	M.IB.Aviation ☑
		1.A.1.c ☑	1.A.5 ☐	2.C ☑	3.E ☑	4.E ☑	5.E ☑	M.IB.Navigation ☑
		1.A.2 ☑	1.B ☐	2.C. Iron and steel ☑	3.F ☑	4.F ☑		M.Indirect N2O ☑
		1.A.3 ☑	1.B.1 ☐	2.C.non Iron and steel ☑	3.G ☑	4.G ☑		M.International bunkers ☑
		1.A.3.a ☑	1.B.2 ☐	2.D ☑	3.H ☑	4.H ☑		M.Intl. aviation EU ETS ☑
		1.A.3.b ☑	1.C ☐	2.E ☑	3.I ☑			Memo items ☑
		1.A.3.c ☑		2.F ☑	3.J ☑			
		1.A.3.d ☑		2.G ☑				
		1.A.3.e ☑		2.H ☑				
	Total	including LULUCF ☑		excluding LULUCF ☑				

		CO_2	CH_4	N_2O	HFCs	PFCs	SF_6
GHG split	Provided for years	☑ 2015, 2020, 2025, 2030, 2035	☑ 2015, 2020, 2025, 2030, 2035	☑ 2015, 2020, 2025, 2030, 2035	☑ 2015, 2020, 2025, 2030, 2035	☑ 2015, 2020, 2025, 2030, 2035	☑ 2015, 2020, 2025, 2030, 2035
		☐ 2040	☐ 2040	☐ 2040	☐ 2040	☐ 2040	☐ 2040
		☑ intermediate years	☑ intermediate years	☑ intermediate years	☑ intermediate years	☑ intermediate years	☑ intermediate years

Scenario	Scenarios provided	WEM	WAM	WOM
		☑	☐	☐

		EU ETS	all sectors	EU ESD	all sectors
EU ETS split	provided	☑	☑	☑	☑
	provided for years	2015, 2020, 2025, 2030, 2035	☑	2015, 2020, 2025, 2030, 2035	☑
		2040	☐	2040	☐
		intermediate years	☑	intermediate years	☑

Notation keys and blanks	Used for mandatory years	☐				
	Use of	NA ☑	NE ☑	NO ☑	IE ☑	
	Comments					

Table 0-4 Example of status files (completeness) (3/3)

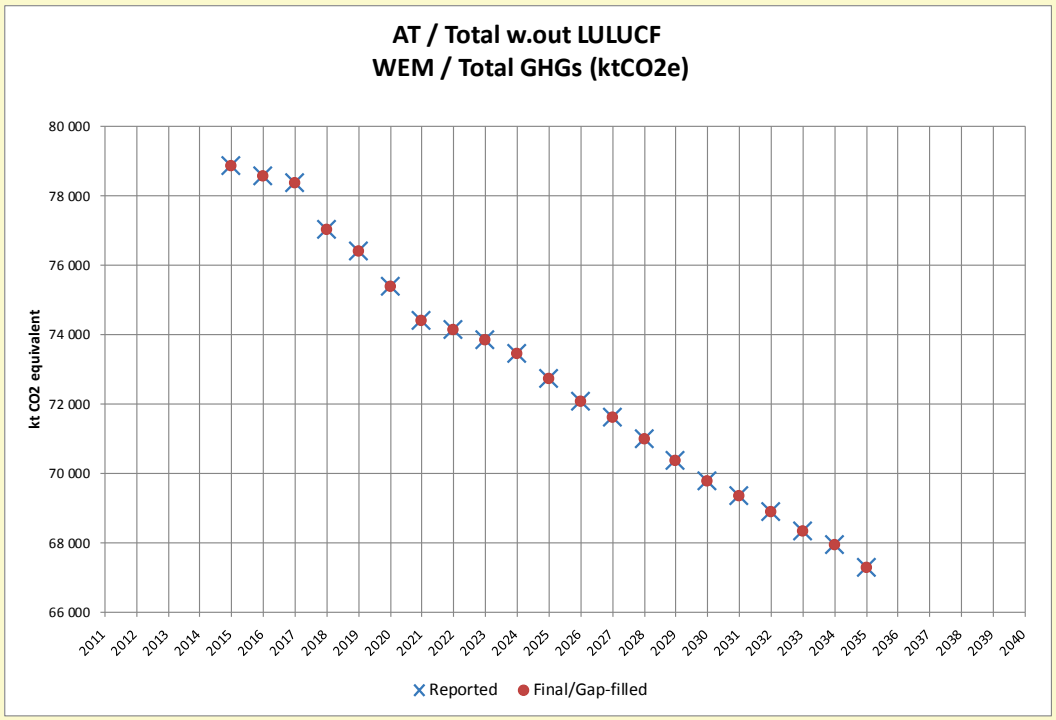
PART II:
Provision of projection parameters

	Parameter	Custom units provided	Reference year (year)	Reference year (value)	2015	2020	2025	2030	2035	2040	Intermediate years	Scenario (WEM&WAM)
Projection parameters	Population	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Gross domestic product (GDP):-Real growth rate	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Gross domestic product (GDP):-Constant prices	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Gross value added (GVA) total industry	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Exchange rates EURO (for non-EURO countries), if applicable	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Exchange rates US DOLLAR, if applicable	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	EU ETS carbon price	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	International (wholesale) fuel import prices:-Electricity Coal	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	International (wholesale) fuel import prices:-Crude Oil	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	International (wholesale) fuel import prices:-Natural gas	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Energy parameters											
	National retail fuel prices (with taxes included):-Coal, industry	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	National retail fuel prices (with taxes included):-Coal, households	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	National retail fuel prices (with taxes included):-Heating oil, industry	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	National retail fuel prices (with taxes included):-Heating oil, households	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	National retail fuel prices (with taxes included):-Transport, gasoline	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	National retail fuel prices (with taxes included):-Transport, diesel	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	National retail fuel prices (with taxes included):-Natural gas, industry	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	National retail fuel prices (with taxes included):-Natural gas, households	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	National retail electricity prices (with taxes included):-Industry	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	National retail electricity prices (with taxes included):-Households	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Gross inland (primary energy) consumption:-Solid fuels	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Gross inland (primary energy) consumption:-Total petroleum products	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Gross inland (primary energy) consumption:-Natural gas	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Gross inland (primary energy) consumption:-Renewables	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Gross inland (primary energy) consumption:-Nuclear	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Gross inland (primary energy) consumption:-Other	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Gross inland (primary energy) consumption:-Total	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Gross electricity production:-Coal	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Gross electricity production:-Oil	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Gross electricity production:-Natural gas	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Gross electricity production:-Renewables	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Gross electricity production:-Nuclear	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Gross electricity production:-Other	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Gross electricity production:-Total	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Total net electricity imports	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Gross final energy consumption	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Final energy consumption:-Industry	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Final energy consumption:-Transport	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Final energy consumption:-Residential	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Final energy consumption:-Agriculture/Forestry	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Final energy consumption:-Services	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Final energy consumption:-Other	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Final energy consumption:-Total	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Number of heating degree days (HDD)	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Number of cooling degree days (CDD)	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Transport parameters											
	Number of passenger-kilometres (all modes)	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Freight transport tonnes-kilometres (all modes)	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Final energy demand for road transport	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Buildings parameters											☐
	Number of households	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Household size	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Agriculture parameters											
	Livestock:-Dairy cattle	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Livestock:-Non-dairy cattle	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Livestock:-Sheep	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Livestock:-Pig	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Livestock:-Poultry	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Nitrogen input from application of synthetic fertilizers	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Nitrogen input from application of manure	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Nitrogen fixed by N-fixing crops	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Nitrogen in crop residues returned to soils	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Area of cultivated organic soils	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Waste parameters											
	Municipal solid waste (MSW) generation	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Municipal solid waste (MSW) going to landfills	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Share of CH4 recovery in total CH4 generation from landfills	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐
	Other parameters											

Table 0-5 Example of Data visualisation

Data Visualisation

MS	<- choose sector	<- choose scenario	<-choose gas
AT	Total w.out LULUCF	WEM	Total GHGs (ktCO2e)



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Reported					78 850.8	78 546.7	78 375.9	77 008.0	76 406.3	75 392.8
Final/Gap-filled					78 850.8	78 546.7	78 375.9	77 008.0	76 406.3	75 392.8
Deviation (reported vs. Final data)					0.0	0.0	0.0	0.0	0.0	0.0