Convention on Long-range Transboundary Air Pollution

emep

Co-operative programme for monitoring and evaluation of the long-range transmission of air pollutants in Europe

TECHNICAL REPORT CEIP
04/2023

Inventory Review 2023

Review of emission data reported under the LRTAP Convention

Stage 1, 2 and 3 review

Status of gridded and LPS data

Bernhard Ullrich
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CEIP

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[1] EMEP – Co-operative Programme for Monitoring and Evaluation of the Long-range Transmissions of Air Pollutants in Europe

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EXECUTIVE SUMMARY

The main objective of the *technical review*[2] *of national inventories* is to check and assess Parties' data, with a view to improve the quality of emission data and associated information reported to the Convention.

This report summarizes the main findings of the annual technical review[3] (stage 1 and stage 2) of emission data, and status of reporting under the LRTAP Convention as of 1st June 2023.

Table 1 presents an overview on the submission status of 51 Parties to the Convention. Most of the Parties to the LRTAP Convention submitted emission data and IIRs, but particularly some countries of the EMEP East area did not provide any information. This year was a reporting year for projections. The last reporting year for gridded data and LPS data was 2021. Several of these datasets are still missing, especially from the EMEP East area (see Table 1). More detailed information can be found in the Appendix.

The assessment in Table 1 refers to:

- Article 8 of the 1979 Convention on Long-range Transboundary Air Pollution, Executive Body Decision 2013/04 (ECE/EB.AIR/122/Add.1) Annex I,
- Executive Body Decision 2013/03 (ECE/EB.AIR/122/Add.1),
- Guidelines for Reporting Emissions and Projections Data under the CLRTAP (ECE/EB.AIR/125)

[2] UNECE, 2019: EB Decision 2018/01 Updated methods and procedures for the technical reviews of air pollutant emission inventories reported under the Convention (ECE/EB.AIR/142/Add.1)

[3] Review process: detailed information see at https://www.ceip.at/review-of-emission-inventories/review-process

Table 1: Overview on the Air Convention submission status by 1st June 2023

Country	Timeliness	Completeness	IIR	Projections**	LPS**	Gridded data**
AL	☺	☺	☹	☹	☹	☹
AM	☺	😐	😐	☹	☹	☹
AT	☺	☺	☺	☺	☺	☺
AZ	☹	☹	☹	☹	☹	☹
BA	☹	☹	☹	☹	☹	☹
BE	☺	☺	☺	☺	☺	☺
BG	☺	☺	☺	☺	☺	☺
BY	☺	😐	☺	☹	☹	☹
CA*	☺					
CH	☺	☺	☺	☺	☺	☺
CY	☺	☺	☺	☺	☺	☺
CZ	☺	☺	☺	☺	☺	☺
DE	☺	☺	☺	☺	☺	☺
DK	☺	☺	☺	☺	☺	☺
EE	☺	☺	☺	☺	☺	☺
ES	☺	☺	☺	☹	☺	☺
EU***	☺	☺	☺	☺	☺	☺
FI	☺	☺	☺	☺	☺	☺
FR	☺	☺	☺	☺	☺	☺
GB	☺	☺	☺	☺	☺	☺
GE	☺	☺	☺	☹	☺	☹
GR	☺	☺	☺	☺	☺	☺
HR	☹	☹	☹	☹	☺	☺
HU	☺	☺	☺	☺	☺	☺
IE	☺	☺	☺	☺	☺	☺
IS	☺	☺	☺	☺	☺	☺

Country	Timeliness	Completeness	IIR	Projections**	LPS**	Gridded data**
IT	☺	☺	☺	☺	☺	☺
KG	☹	☹	☹	☹	☺	☺
KZ	☺	☺	☺	☹	☺	☹
LI	😐	😐	☺	☹	☺	☺
LT	☺	☺	☺	☺	☺	☺
LU	☺	☺	☺	☺	☺	☺
LV	☺	☺	☺	☺	☺	☺
MC	☺	☺	☺	☺	☺	☺
MD	☹	☹	☹	☹	☹	☹
ME	☺	☺	☺	☹	☹	☹
MK	☺	☺	☺	☹	☺	☺
MT	😐	☺	☹	☺	☺	☺
NL	☺	☺	☺	☺	☺	☺
NO	☺	☺	☺	☺	☺	☺
PL	☺	☺	☺	☺	☺	☺
PT	☺	☺	☺	☺	☺	☺
RO	☺	☺	☺	☺	☹	☹
RS	☺	☺	☺	☹	☺	☺
RU	😐	☹	☺	☹	☺	☺
SE	☺	☺	☺	☺	☺	☺
SI	☺	☺	☺	☺	☺	☺
SK	☺	☺	☺	☺	☺	☺
TR	☺	☹	☺	☹	☹	☹
UA	☺	😐	☺	☹	☹	☹
US*	😐					

Legend to Table 1:

Timeliness: ***green*** *– submission within deadline,* ***yellow*** *– submission after deadline,* ***red*** *– no submission*
Completeness : ***green*** *– full priority + activity data all years;*
yellow *– up to ca. 80% priority (i.e. 10 of 13) (or all priority but not all years and/or no activity data);*
red *– below 80% priority*

IIR: ***green*** *– IIR submitted, structure and content correlate to the template;*
yellow *– IIR submitted, structure and content differ from the template;* ***red*** *– no IIR submitted*

Projections**: ***green*** *– min. 2025, 2030 reported;* ***red*** *– no projections submitted*

Gridded and LPS data (submitted in or after 2021)**: ***green*** *– gridded data in 0.1°x0.1° for at least the years 2015 and 2019 submitted;* ***blue*** *– new gridded data for at least one year submitted,* ***red*** *– no gridded data at all submitted, empty – no obligations*

** Canada and the USA have different reporting obligations. They are not included in the EMEP LRT models so the reporting of LPS and gridded data is not required.*

*** 2023 was a reporting year for Projections. 2023 was not a reporting year for gridded data and LPS, hence all LPS and gridded datasets since 2021 are taken into account.*

**** The EU has different reporting deadlines. EU may deliver emission and projections report by 30 April, its IIR by 30 May and its gridded data and LPS by 15 June.*

1 INTRODUCTION

This report has been prepared by the Centre on Emission Inventories and Projections (CEIP). CEIP is a data centre under the European Monitoring and Evaluation Programme (EMEP). The report reflects the progress achieved in emission reporting under the Air Convention during the 2023 reporting round.

Box 1. Reporting obligations and guidelines

The EMEP Executive Body Decision 2013/03 (ECE/EB.AIR/122/Add.1) adopted the *„Guidelines for reporting emissions and projections data under the Convention on Long-range Transboundary Air Pollution"* – current version ECE/EB.AIR/125. Detailed information on reporting obligations under the Air Convention can be found on the CEIP website https://www.ceip.at/reporting-instructions.

Table 2: Reporting obligations and deadlines under Air Convention

Deadlines	Air Convention	
Emission data	15. February	annually
IIR	15. March	annually
Projections	15. March	every four years (starting year 2015)
Gridded Data	1. May	every four years (starting year 2017)
LPS information	1. May	every four years (starting year 2017)

This report summarises the main findings of the annual technical review of emission data, focusing on future challenges for improving the quality of this data reported under the Air Convention.

The review assesses the transparency, consistency, comparability, completeness and accuracy of reported data[4]. Details on the review can be found in *the Methodology Report – Review of emission data reported under the LRTAP Convention and on the CEIP website.*[5] (https://www.ceip.at/review-of-emission-inventories/review-process).

The review is structured into three stages.

- The stage 1 review assesses timeliness, completeness, format and transparency of the submission.
- The stage 2 review assesses recalculations, the share of sectors and the consistency of the time series.

[4] UNECE, 2014: See Reporting guidelines 2014, section III, para 5 (a) to (e) for definitions.

[5] CEIP, 2023 c: https://www.ceip.at/ceip-reports

- The stage 3 review is an in-depth review organised by CEIP and conducted by air emission inventory experts of the Parties of the Air Convention. The stage 3 review either analysis a certain part of all air emission inventories (e.g. emissions from the sector agriculture) submitted under the Air Convention or the complete air emission inventory of certain Parties in detail.

Findings of the stage 1 and stage 2 review on country level for the inventories submitted under the Air Convention can be found in the stage 1 and stage 2 review reports available at https://www.ceip.at/status-of-reporting-and-review-results/2023-submission

Findings of the stage 3 review are published in individual country reports at https://www.ceip.at/status-of-reporting-and-review-results/2023-submission.

All Parties to the LRTAP Convention which submitted data[6] in the *standard format* before 4th April 2023 were included in stage1 and stage 2 of the review. Resubmissions after 4th of April were not considered. Submissions of all Parties which submitted data[7] in the *standard format* before 1st April 2023 were included in stage 3 (in-depth review) of the review. The in-depth review focused on emissions from the sector agriculture with a special focus on NH_3, NMVOC and NO_x and $PM_{2.5}$ emissions in 2023.

This review report is structured as follows:

- In chapter 2, the results of the initial review (the stage 1) are presented, covering timeliness, completeness, format and transparency of the submission.
- Chapter 3 provides a summary of findings of the extended review (stage 2). Within that stage, differences in emissions due to recalculations, the share of sectors and the consistency of the time series were analysed. Additional checks were made which included the key categories emissions per capita, and gross national income.
- Completeness of gridded emission data and of large point sources (LPS) data are discussed in chapter 4.
- Chapter 5 gives an overview of the stage 3 in-depth review, including the main conclusions
- A table with detailed information per country on reporting in 2023 is provided in the Appendix.
- Summary information, detailed comparison of Parties and additional checks are presented interactively in the data viewers on CEIP's homepage at https://www.ceip.at/review-of-emission-inventories/technical-review-reports

Table 3: Overview of dataviewers 2023 with detailed information on country level

	Dataviewers 2023
1	Completeness
2	Recalculations
3	KCA
4	Share of sectors
5	Emissions per capita and per GDP

[6] See details at https://www.ceip.at/status-of-reporting-and-review-results/2023-submission

[7] See details at https://www.ceip.at/status-of-reporting-and-review-results/2023-submission

2 INITIAL (STAGE 1) REVIEW

Key messages

Over the last 15 years, timeliness and completeness of reporting has improved:

Timeliness: *Until 1st of June 2023, 46 Parties reported data, which is an increase of 21% compared to the number of Parties submitting in 2008 – 38 Parties submitted data in the same timeframe in the first year, in which the annual inventory review took place. Four Parties provided their submissions after the due date of 15 February 2023 (30 April for EU). No data were provided (by 1st June) by five Parties with mandatory reporting obligations –**Azerbaijan, Bosnia and Herzegovina, Croatia, Kyrgyzstan and the Republic of Moldova**.*

Completeness - pollutants: *Main pollutants were reported by 46 Parties in 2023 compared to 38 in 2008. Cadmium, Mercury and Lead emissions were reported by 44 Parties, additional HMs by 38, PMs by 45 and priority POPs by 43 Parties. Activity data for the year 2021 were reported by 38 Parties (see Appendix, Table 9). Black Carbon (BC) was voluntarily reported for the first time in 2015 by 28 countries. In the 2023 submission 40 Parties submitted data on BC emissions at least for the year 2021. All but one of the Parties, that submitted data, also provided an Informative Inventory Report (IIR) with their submission in 2023.*

Projections: *Parties to the 1999 Gothenburg Protocol and 2012 amended Gothenburg Protocol within the geographical scope of EMEP shall regularly update their projections and report every four years from 2015 onward their updated projections, for the years 2025 and 2030 and, where available, also for 2040 and 2050. (*ECE/EB.AIR/125). *2023 was a reporting year for projections. 32 Parties submitted emission projections in 2023 (17 in 2008, 27 in 2019 (reporting year)).*

Gridded data and LPS: *2023 was not a reporting year for gridded data and LPS data. Three Parties reported gridded data until the 1st of June 2023 (35 in 2021 (reporting year)). LPS were reported by three Parties (36 in 2021 (reporting year)).*

Albania, Azerbaijan, Bosnia and Herzegovina, Kyrgyzstan and Republic of Moldova *are in particular encouraged to make efforts to improve the regularity, completeness and transparency of their reporting.*

Although the quality of the data submitted by the Parties to the LRTAP Convention has improved over the years in terms of completeness, consistency and timeliness not all Parties provide a complete time series for emission inventory data. Hence, further improvement of submissions in the above-mentioned aspects of data quality is strongly recommended: ***Azerbaijan, Bosnia and Herzegovina, Croatia, Kyrgyzstan and the Republic of Moldova*** *did not report any data to EMEP in 2023.* ***Armenia, the Russian Federation and the United States*** *only provided data for the current reporting year.* ***Belarus (2020 to 2021)*** *– provided data for two subsequent years only.*

Format of data: *For CEIP the use of the standardised reporting format is inevitable for efficient processing of data. All Parties submitted their inventories using the revised NFR 2019-1 templates[8].*

Transparency and Informative Inventory Reports: *Transparency means that Parties provide clear documentation (IIR) and references, and that they report emissions and*

[8] Reporting templates can be downloaded from the CEIP website at https://www.ceip.at/reporting-instructions/annexes-to-the-2014-reporting-guidelines

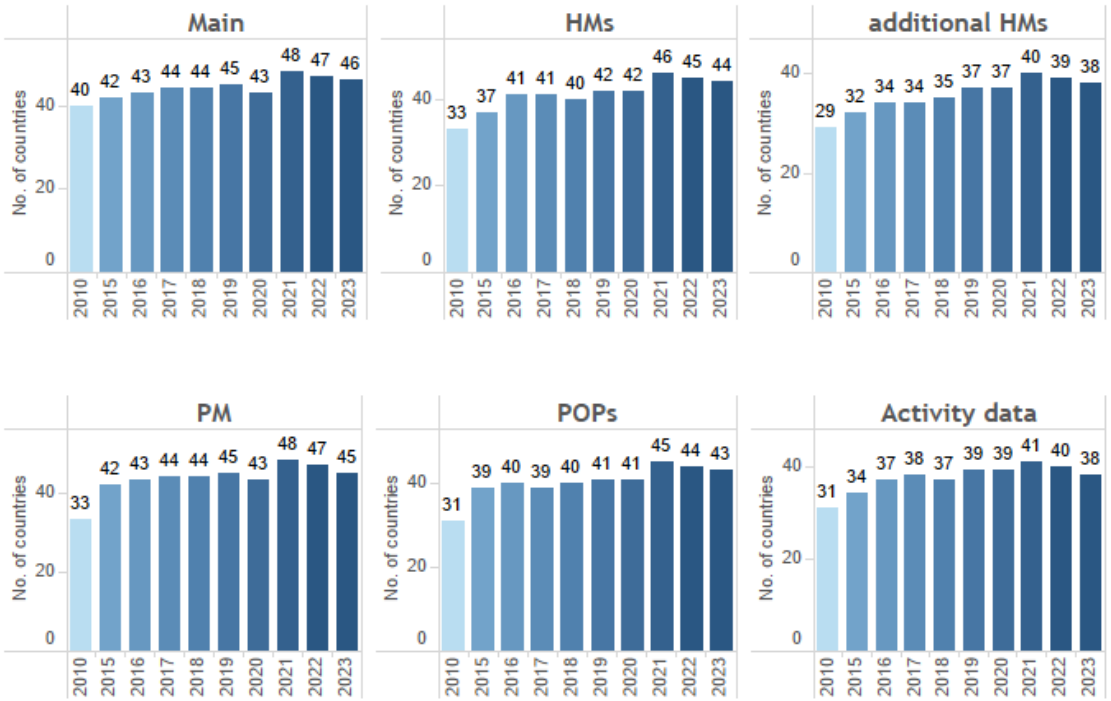
activity data at a level of disaggregation, which provides sufficient understanding of how the inventory was compiled, thereby ensuring that it meets good practice requirements. Parties are strongly encouraged to submit the IIR[9]. In recent years, the number of Parties that provided an IIR along with their inventory increased. In 2023 only one Party that submitted an air emission inventory did not provide an IIR.

Data viewer

Additional information is presented in the *Dataviewer* on the *CEIP webpage*.
Link: https://www.ceip.at/review-of-emission-inventories/technical-review-reports/rr2023

A current overview of the data submitted by Parties during the 2023 reporting round is available at https://www.ceip.at/status-of-reporting-and-review-results/2023-submission.
In addition, officially reported emission data can be accessed online at www.ceip.at/webdab-emission-database/reported-emissiondata.

[9] UNECE, 2014: See Reporting Guidelines 2014, para 43 (ECE/EB.AIR/125)



Main pollutants: SOx, NOx, NH3, NMVOC, CO
Heavy Metals (HMs): Pb, Hg, Cd
additional HMs: As, Cr, Cu, Ni, Se, Zn
Particulate Matter (PM): PM2.5, PM10
Persistant organic pollutants (POPs): PAH, DIOX, HCB, PCBs

Figure 1: Number of Parties reporting various groups of pollutants at least for the respective current reporting year in the 2010 and 2015 to 2023 reporting rounds (as of 1st June for each year)

Interactive figures and tables are provided within the Dataviewer.

3 EXTENDED (STAGE 2) REVIEW

Key messages:

***Recalculations** of 2005, 2010, 2015 and 2020 emissions: Several Parties reported recalculations **higher than 30%** on national total level for the years 2005, 2010, 2015 and 2020. High recalculations occurred most frequently for PM_{10} and $PM_{2.5}$, followed by BC. Common reasons for recalculations were changes in **activity data, methodology and emission factors**.*

***Key category analysis**: A number of emission categories have been identified as key categories for both the 'EMEP East' and 'EMEP West' area country groups. Combustion of fossil fuels in the sector energy and transport is the most important contributor to emissions of NO_X, SO_X, PM and CO. For HMs and POPs most of the key sources are found in the sectors energy and industry but also within the waste sector. NH_3 occurs mainly in the agricultural sector (the agricultural sector is responsible for more than 80% of NH_3 emissions in some countries). A significant difference for some pollutants (e.g. POPs, PMs) in the number of key categories was observed between 'EMEP East' – and 'EMEP West' areas. This might be partly due to real differences in emissions but might also indicate that inventories are often not complete and/or Parties allocate emissions to NFR categories not always in line with the EMEP/EEA Inventory Guidebook[10].*

***Emissions per capita** for at least one pollutant, in some cases for several pollutants, rose in 15 countries between 1990 and 2021 (2000 and 2021 for PMs) whereas **emissions per gross domestic product based on purchasing power parity (GDP/PPP) for at least one pollutant** rose for 6 Parties over the same time period. Changes were only analysed if the country reported values for 1990 (2000 for PMs) as well as for the current year.*

Data viewer

Additional information is presented in the *Dataviewer* on the *CEIP webpage*.
Link: https://www.ceip.at/review-of-emission-inventories/technical-review-reports/rr2023

3.1 Consistency between PM_{10}-, $PM_{2.5}$- and BC emissions (1990-2021)

The focus on checks on consistency of reporting presented in this report is on the consistency between reported PM_{10}-, $PM_{2.5}$- and BC emissions.

Checks addressing time series consistency of reported data at sector level are provided at the CEIP website and can be accessed via the interactive data viewer http://www.ceip.at/data-viewer-2.

As $PM_{2.5}$ emissions are assumed to be a subset of PM_{10} emissions, it was checked whether the former are lower than the latter in all years for all countries.

Another basic comparison was performed to check whether reported BC emissions are lower than reported $PM_{2.5}$ emissions.

[10] EMEP/EEA 2019: EMEP/EEA air pollutant emission inventory guidebook 2019, see https://www.eea.europa.eu/publications/emep-eea-guidebook-2019

A comparison of the share of the national total of $PM_{2.5}$ in the national total of PM_{10} was made to identify differences between the submitting Parties. Always the latest submission was used for this check.

Countries like *Canada, Kazakhstan, Malta, Montenegro, Türkiye and Ukraine* report data with a relatively low **$PM_{2.5}$** share up to **23%** for some years. On the upper end, countries like *Albania, Armenia, Georgia, Luxembourg and Montenegro* show a share above **90%** for some years. The timeseries of PM shares might indicate inconsistencies either for $PM_{2.5}$ or PM_{10} submissions. For example Montenegro's shares change from quite low shares to relatively high shares within the timeseries, namely from 2011 to 2012.

Albania reported high values for $PM_{2.5}$, with a share of up to 1870%, from 2009 onwards, which potentially indicates erroneous reporting. For **$PM_{2.5}$** the majority of the submitting Parties have a share around the 72% range.

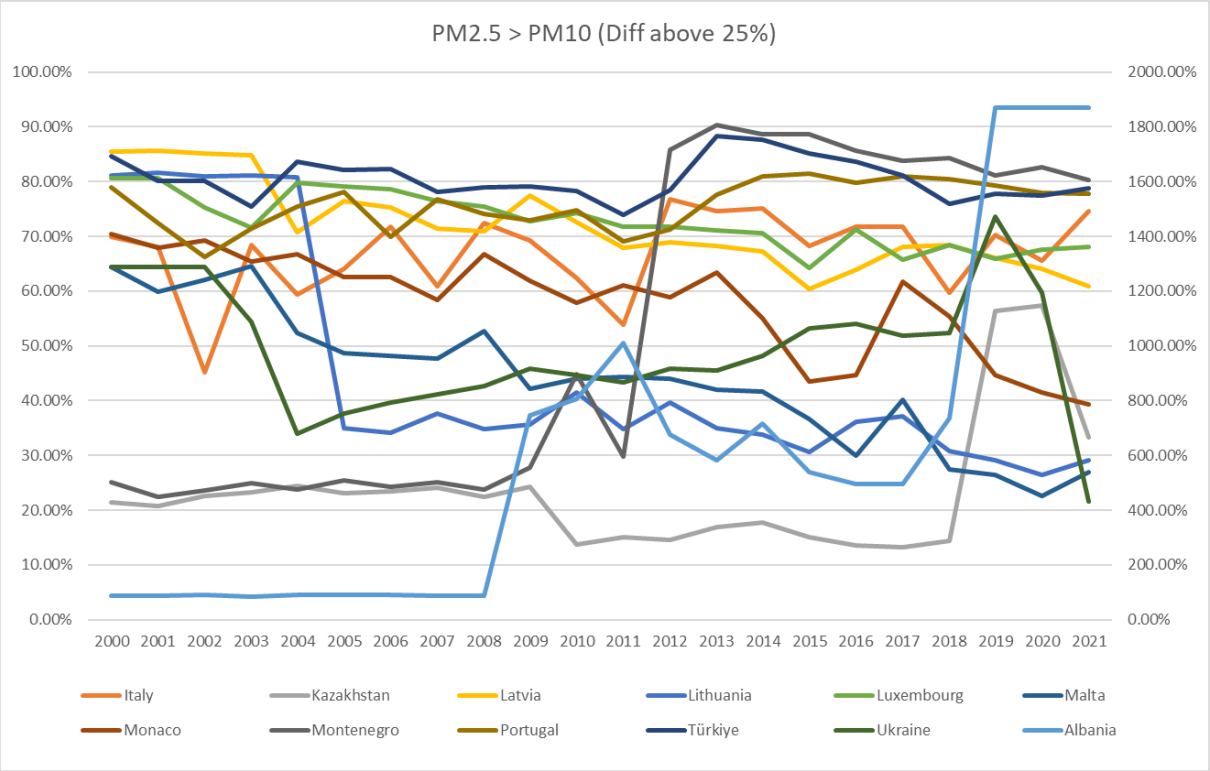


Figure 3: Share in percent of $PM_{2.5}$ national total emissions in PM_{10} national total emissions 1990-2020. Only parties shown where differences greater than 25% occurred (difference between minimum and maximum share)

Note: values for Albania are indicated on the secondary axis.

3.2 Key category analysis (KCA)

A KCA helps to identify significant air pollution sources in the EMEP area and in individual countries. Key categories are those categories that cumulatively contribute 80% of the total emissions of a specific pollutant. The Dataviewer shows the share of the key categories in the total

emissions for the two groups of Parties: on the one hand for the group of 'EMEP West'[11] area and on the other hand for the 'EMEP East' area[12]. Results of KCA for individual Parties can be downloaded from https://www.ceip.at/status-of-reporting-and-review-results/2023-submission.

Most of the reporting 'EMEP West' Parties submitted emission data for BC, except Austria, Liechtenstein and Luxembourg. Most of the reporting 'EMEP East Parties submitted emission data for this pollutant at least for one year, except Russian Federation and Türkiye.

3.3 Share of aggregated sectors (GNFR[13])

The share of aggregated NFR14 sectors for each pollutant and each Party was assessed to check consistency of reporting between the countries and also potentially identify outliers in reporting.

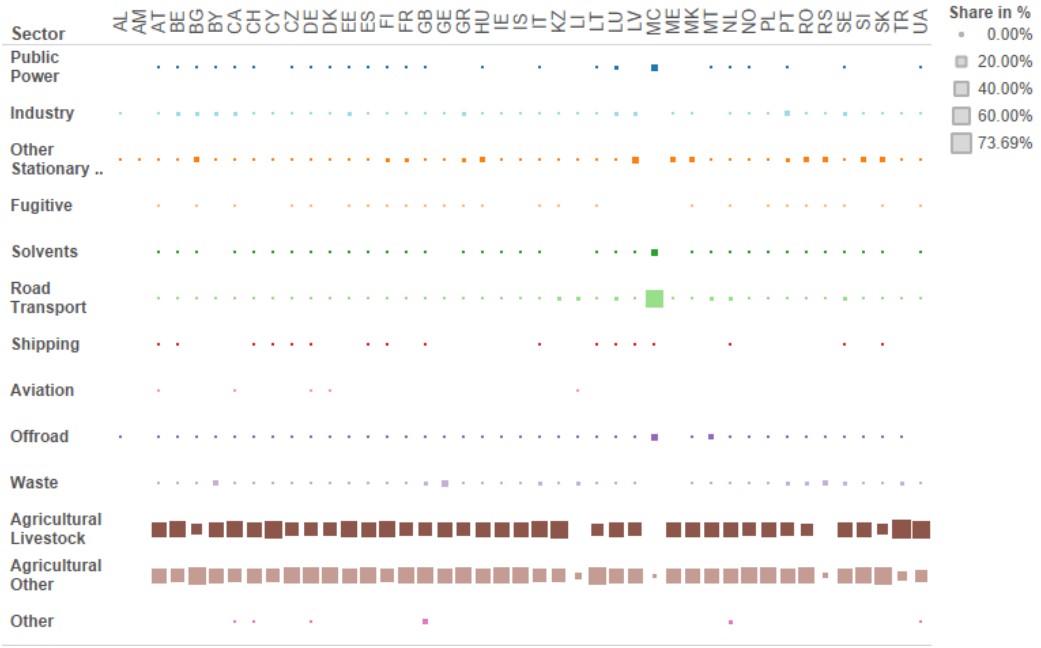


Figure 2: Comparison of the share of sectors between countries for the pollutant NH_3 in percent

Interactive figures with comparisons for other pollutants are provided within the Dataviewer.

3.4 Comparability – emissions per capita, emissions per GDP

Population and GDP/PPP (gross domestic product/purchasing power parity) have been selected as indicators for the comparison with national total emissions available in standardised format for all Parties. The aim is to further elaborate the check with additional parameters that are relevant for selected key categories/pollutants.

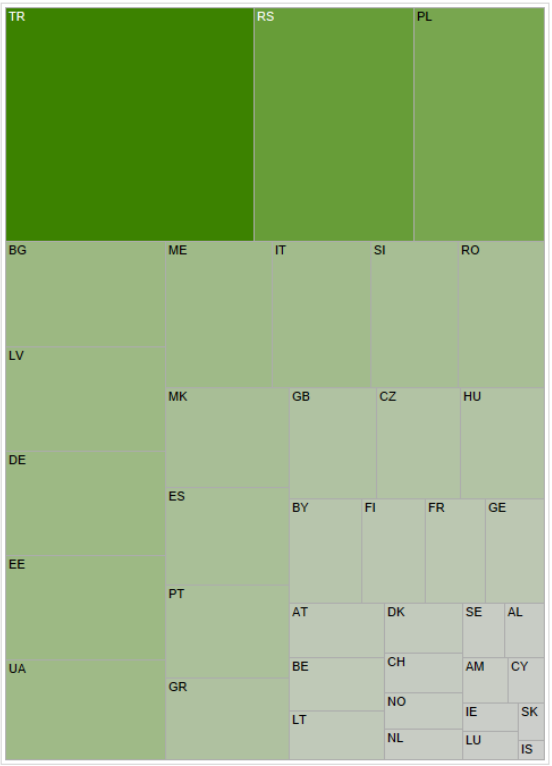
[11] Please note that for the 'EMEP West' area Croatia and Bosnia and Herzegovina is not included as no data was reported.

[12] Please note that for the 'EMEP East' area Azerbaijan, Kyrgyzstan and the Republic of Moldova are not included as no data was reported.

[13] The allocation of NFR14 sector codes to GNFR codes is provided in the conversion table on the CEIP homepage

National total emissions reported for 1990 or 2000 (for PM) and 2021 were divided by the number of inhabitants and by the total value of the GDP/PPP. Values for each Party are presented in the Dataviewer. It should be noted that not all Parties submitted 1990 and 2021 data for all analyzed pollutants, and that therefore these statistics cannot fully reflect the developments in the whole EMEP domain.

The Dataviewer shows that for all assessed pollutants the highest and lowest per capita emissions per GDP/PPP emissions differ significantly from the average values (sometimes by a few orders of magnitude). A more detailed analysis of these indicators is outside the scope of this report, but the information is regularly provided to the reviewers during the checking of national inventories under the stage 3 review. Outliers might indicate differences in national economies but also errors in calculations. Low per capita and per GDP/PPP emissions in some Parties also seem to indicate incomplete national inventories, particularly with respect to PM and POPs data. More detailed information on country level is provided in the Dataviewer on the CEIP webpage (https://www.ceip.at/status-of-reporting-and-review-results/2023-submission).



Member State	emissions Gg	per capita kg / cap / year
Albania	0.06	1.20
Armenia	0.06	1.15
Austria	1.02	2.90
Belarus	0.80	4.18
Belgium	1.19	2.75
Bosnia and Herzegovina		
Bulgaria	1.62	9.34
Cyprus	0.06	0.91
Czechia	1.42	5.14
Denmark	0.78	2.21
Estonia	0.80	9.15
Finland	1.00	3.67
France	2.64	3.45
Georgia	0.23	3.37
Germany	11.13	9.19
Greece	1.64	5.62
Hungary	1.54	5.10
Iceland	0.02	0.28
Ireland	0.32	0.86
Italy	4.47	8.07
Latvia	0.84	9.19
Liechtenstein	0.10	0.00
Lithuania	0.35	2.57
Luxembourg	0.14	0.85
Malta	0.01	0.00
Monaco	0.01	0.00
Montenegro	0.29	8.62
Netherlands	0.92	1.35
North Macedonia	0.34	6.88
Norway	0.57	1.57
Poland	11.29	16.85
Portugal	1.97	6.38
Romania	3.26	6.93
Serbia	2.98	20.59
Slovakia	0.62	0.53
Slovenia	0.86	7.06
Spain	6.94	6.68
Sweden	0.53	1.27
Switzerland	0.70	1.71
Turkiye	61.00	32.00
Ukraine	2.46	8.78
United Kingdom	5.07	5.36

Figure 3: $PM_{2.5}$ emissions per capita comparison for the current year

Note: The US and Canada are excluded from this graph

4 INITIAL CHECKS OF GRIDDED EMISSIONS AND LARGE POINT SOURCES

Key messages:

In total 37 Parties provided gridded sectoral emissions in 0.1° x 0.1° (long/lat) resolution until June 2023 in this or a previous submission. This covers ***more than 80% of the area*** *of all reporting Parties.*

Until June 2023, only three Parties reported sectoral data in the new EMEP grid resolution of 0.1° x 0.1° (long/lat) for the year 2021, but 34 Parties reported gridded sectoral data for 2019.

For about 59% of the grid cells from 48[14] Parties, data on spatially distributed emissions had to be partly or completely estimated or adjusted by CEIP.

Forty-three out of 48 Parties submitted Large Point Source (LPS) data in GNFR sector categories (in this or a previous submission).

4.1 Reporting of gridded emissions in 2023

Completeness:

Gridded data is part of the four-yearly reporting obligation and was not due in 2023.

Until June 2023, **37** of the 48 countries, which are considered part of the EMEP area, reported sectoral gridded emissions in the grid resolution of 0.1°x0.1° (long/lat).

The majority of gridded sectoral emissions in 0.1°x0.1° (long/lat) resolution have been reported for the years 2019 (34 countries) and 2015 (33 countries), (see Figure 4).

Fifteen countries reported gridded emissions additionally for previous years (one country for the whole time series from 1980 to 2021; one country for the time series from 1990 to 2021; seven countries for the years 1990, 1995, 2000, 2005 and 2010; one country for the years 1990, 2000, 2005 and 2010; one country for the years 2000, 2005 and 2010; one country for the year 2005; one country for the year 2010; and three countries for the year 2014).

No gridded sectoral data so far, neither in 0.1° x 0.1° (long/lat) nor in 50 x 50 km² PS resolution, was submitted by Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, Kazakhstan, Liechtenstein, Montenegro, Moldova and Türkiye.

For Belarus and Ukraine reported gridded sectoral data is available only in the old 50 x 50 km² PS resolution.

Completeness pollutants:

Until June 2023 36 Parties reported **sectoral gridded emissions for at least one year in 0.1° x 0.1° resolution** for main pollutants, particulate matter, heavy metals and persistent organic pollutants in this or a previous submission. One Party reported sectoral gridded emissions only for persistent organic pollutants.

[14] Without Canada, the United States of America and the EU as Party (only the individual EU Member States are considered)

Reported gridded sectoral data in 0.1° x 0.1° (long/lat) resolution covers more than 80% of the grid cells of all reporting Parties (see Figure 5).

More information on gridded data is available via the CEIP website at https://www.ceip.at/the-emep-grid.

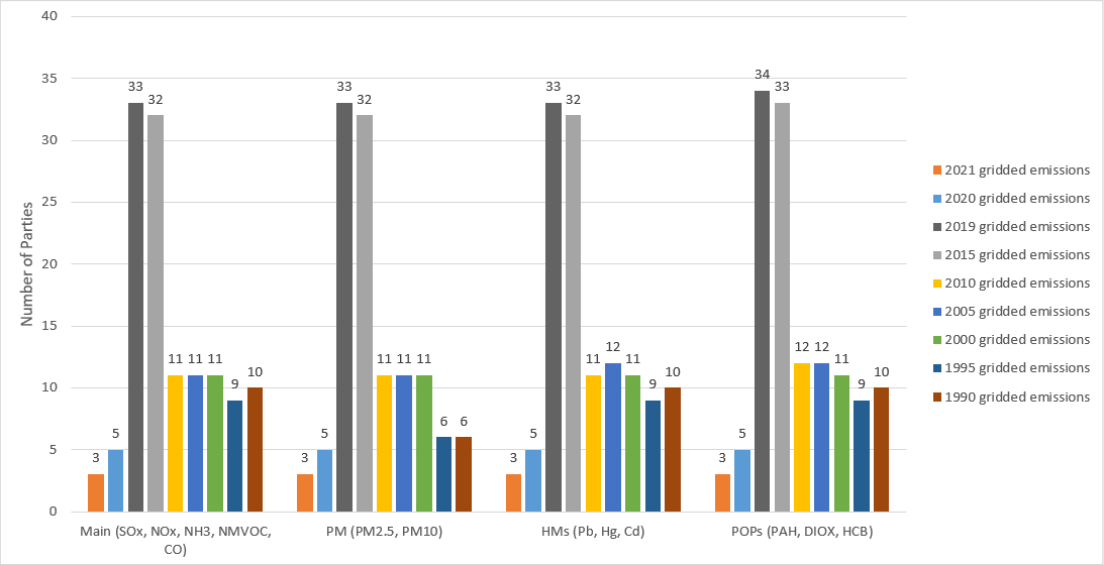


Figure 4: Total number of Parties reporting gridded sectoral data in 0.1° x 0.1° (long/lat) resolution for the years 1990, 1995, 2000, 2005, 2010, 2015, 2019, 2020 and 2021, reported to EMEP by 2023

Main pollutants (NO_X, NMVOC, SO_X, NH_3, CO) and PM ($PM_{2.5}$, PM_{10})

Priority heavy metals (Pb, Cd, Hg) and POPs (PCDD/PCDF, PAH and HCB)

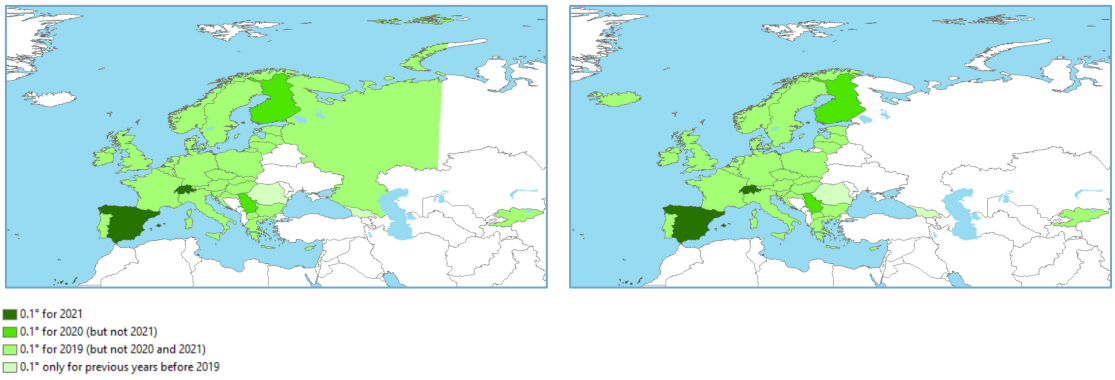


Figure 5: Visualisation of reported gridded emissions in 0.1° x 0.1° (long/lat) resolution in the EMEP area.

For *Portugal* and *Spain* the spatial disaggregation of sector 'F – Road Transport' was replaced by CAMS proxies. Reported gridded data from *Italy, Lithuania* and *Serbia* was replaced by CAMS proxies. Reported gridded data from *Kyrgyzstan* and the *Russian Federation* was replaced by EDGAR proxies. Gridded data from Iceland was reported only for POPs, therefore gridding was done with CAMS and EDGAR proxies.

For about 59% of the grid cells from 48 reporting Parties to the LRTAP Convention[15] data on spatially distributed emissions had to be partly or completely estimated or adjusted by air pollutant emission experts in 2023. This is, either because this information was missing or because the reported data could not be used (areas with no reporting at all, like the sea areas, North Africa and areas in the extended EMEP domain are not considered here).

More detailed information on the gap-filling and gridding for emission data used in EMEP models can be found in the „EMEP Status Report 1/2023[16] and in the „Methodologies applied to the CEIP GNFR gap-filling 2023" reports.[17]

4.2 Large point sources (LPS)

„Large point sources" (LPS) are defined as facilities whose combined emissions, within the limited identifiable area of the site premises, exceed certain pollutant emission thresholds[18]. LPS reporting is encouraged to include information on stack heights according to the stack height class categories as defined in the emission reporting guidelines[19]. Submitted LPS information should be consistent with the information reported for European Pollutant Release and Transfer Register (E-PRTR) facilities[20]

Until June 2023, **43** of the 48 countries, which are considered part of the EMEP area, reported LPS data in GNFR sector categories[21].

The majority of LPS data have been reported for the year 2015 (38 countries) and 2019 (35 countries). LPS data for 2010 have been reported by 28 countries, for 2005 by 14 countries, for 2000 by nine countries, for 2014 by eight countries, for 2009 and 2013 by seven countries, for 2011 and 2012 by six countries, for 2008, 2016, 2017 and 2018 by five countries, for 2007 and 2020 by four countries, for 2021 by three countries and for 2006 by two countries.

One country reported LPS data for the whole time series from 1990 to 2021, one country for the whole time series from 2007 to 2021, one country for the whole time series from 2014 to 2021 and seven countries for the years 1990, 1995, 2000, 2005 and 2010.

Five parties (Belarus, Bosnia and Herzegovina, Liechtenstein, Montenegro and the Republic of Moldova) did not report any LPS data in GNFR sector categories.

Figure 6 presents maps for main pollutants, PMs, priority heavy metals and POPs with Large Point sources reported until 2023.

[15] Without Canada, the United States of America and the EU as Party (only the individual EU Member States are considered)

[16] EMEP, 2023: http://www.emep.int/mscw/mscw_publications.html

[17] CEIP, 2023 a and CEIP, 2023 b: https://www.ceip.at/ceip-reports

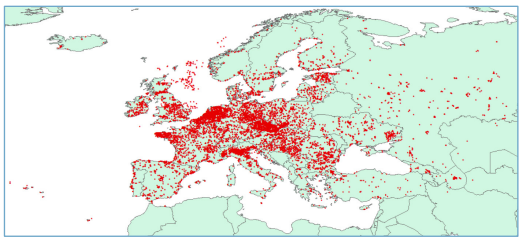
[18] These thresholds have been extracted from the full list of pollutants in Regulation (EC) No. 166/2006 of the European Parliament and of the Council of 18 January 2006 concerning the establishment of a European Pollutant Release and Transfer Register and amending Council Directives 91/689/EEC and 96/61/EC (E-PRTR Regulation) and its annex II 6. See Table 1 in Guidelines for Reporting Emissions and Projections Data under the Convention on Long-range Transboundary Air Pollution – ECE/EB.AIR/125 (www.unece.org/fileadmin/DAM/env/documents/2013/air/eb/ece.eb.air.125_E_ODS.pdf)

[19] UNECE, 2014. See Table 2 in Guidelines for Reporting Emissions and Projections Data under the Convention on Long-range Transboundary Air Pollution – ECE/EB.AIR/125 (www.unece.org/fileadmin/DAM/env/documents/2013/air/eb/ece.eb.air.125_E_ODS.pdf)

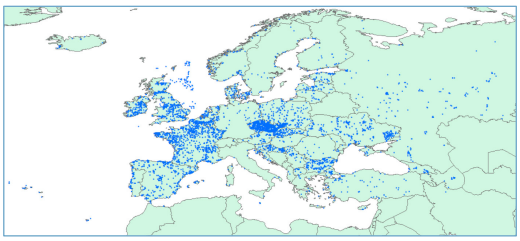
[20] https://ec.europa.eu/environment/industry/stationary/e-prtr/legislation.htm

[21] Other non-GNFR sector categories reported prior to 2010 are not considered.

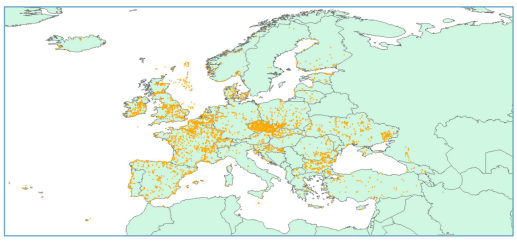
Main pollutants (NO_X, NMVOC, SO_X, NH_3, CO)



Particulate matter ($PM_{2.5}$, PM_{10})



Priority heavy metals (Pb, Cd, Hg)



POPs (PCDD/PCDF, PAH and HCB)

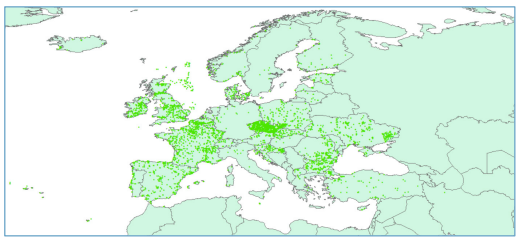


Figure 6: Maps with Large Point Sources reported until 2023

5 IN-DEPTH REVIEW (STAGE 3)

The mandate and overall objectives for the emission inventory review process under the Air Convention is given by the UNECE document 'Updated methods and procedures for the technical reviews of air pollutant emission inventories reported under the Convention'([22]) – hereafter referred to as the 'Review Guidelines 2018'.

Paragraph 7 (c) of the 'Review Guidelines 2018' defines that stage 3 Reviews may be annual centralized reviews or ad hoc reviews. Paragraph 18 of the 'Review Guidelines 2018' further specifies that such ad hoc reviews could, for instance, focus on specific source sectors, specific pollutants such as heavy metals or persistent organic pollutants, gridded and projections data, or on other areas as requested by the Implementation Committee.

At its eighth joint session in September 2022, the Steering Body and the Working Group on Effects approved the plan for the in-depth review in 2023 to focus on emissions from agriculture with a special emphasis on NH_3, NMVOC and NO_x emissions including gridded data. While the focus was set on the above pollutants, also all other pollutants covered by the Air Convention and its protocols (i.e. SO_2, NO_x, NMVOC, NH_3, $PM_{2.5}$, PM_{10}, BC, priority HMs and POPs) were checked for the time series years 1990 – 2021 to the extent possible. For these other pollutants particularly completeness of reporting was assessed.

This report provides a summary of the review. Detailed results are available for each reviewed Party in the country review reports. [23]

The review was coordinated by the EMEP Centre on Emission Inventories and Projections (CEIP) acting as Review Secretariat. The review took place between April and June 2023 and was performed as a desk review between 31 March to 5 May 2023 and an in-person meeting between 22 of May 2023 and 26 May 2023 (centralized review). Seventeen experts from fifteen Parties to the Air Convention conducted the review. Initial checks performed by CEIP and visualisation tools developed by CEIP supported the work of the expert review team. The expert review team assessed the transparency, accuracy, completeness, comparability and consistency[24] of the submitted inventories.

In total the review team elaborated 260 questions and the Parties provided 229 answers to these questions. These questions and answers can result in three classes of findings – a recommendation, a technical correction or a revised estimate. Alternatively, the issue is clarified and closed without resulting in a finding. Recommendations are findings where an identified issue has not been resolved during the course of the review but which is not above the threshold of significance. The threshold of significance for the in-depth review in 2023 was set at 2% of the national total, i.e. a finding that has been identified to result in an over- or under-estimate of emissions of more than 2% of the national total. If the expert review team concludes that emissions are being significantly underestimated or overestimated, the Party will be asked during the review to submit a

[22] Decision 2018/1 adopted by EB: *Updated methods and procedures for the technical review of air pollutant emission Inventories reported under the Convention*. ECE/EB.AIR/142/Add.1 http://www.unece.org/fileadmin/DAM/env/documents/2002/eb/air/EB%20Decisions/Decision_2018_1.pdf

[23] https://www.ceip.at/status-of-reporting-and-review-results/2023-submission

[24] UNECE, 2014: See Reporting guidelines 2014, section III, para 5 (a) to (e) for definitions.

Revised Estimate that addresses the issue raised. Should the Party decline to do this, or should it not be possible to agree on the quantification of a Revised Estimate i.e. the expert review team does not accept a Revised Estimate provided by the Party, the expert review team may calculate a 'Technical Correction'. The methods for calculating Technical Corrections are set up in the 'EMEP/UNECE Review Guidelines 2018' and use the EMEP/EEA Emission 'Inventory Guidebook' as a reference for methods and emission factors.

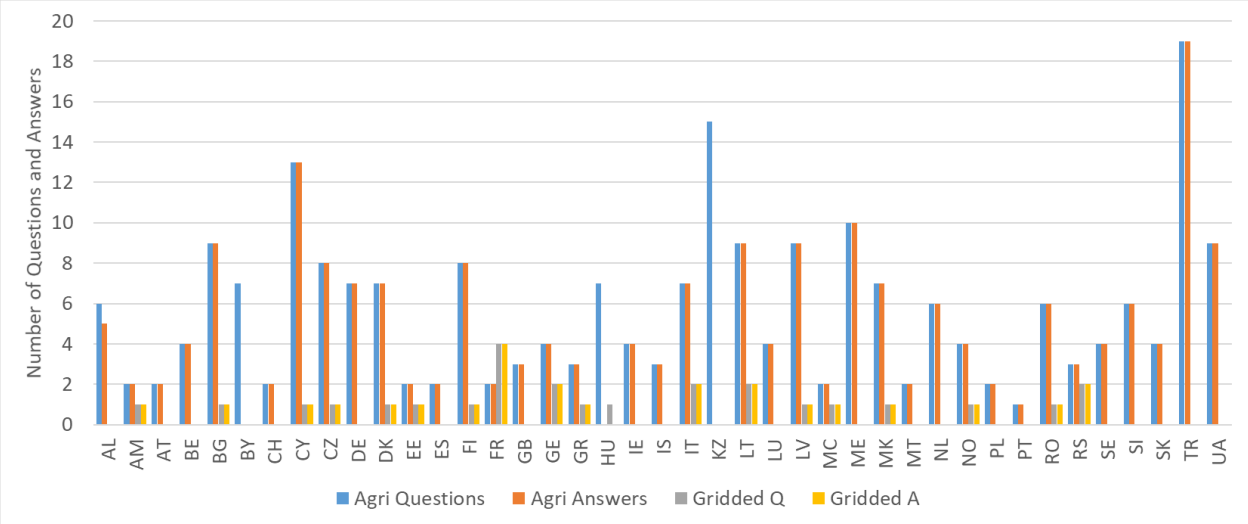


Figure 7: Number of questions and answers per reviewed Party.

In total the expert review team made 190 recommendations for inventory improvement. Four countries sent revised estimates for the sector agriculture and the expert review team calculated a technical corrections for one country.

Findings were classified into transparency, accuracy, completeness, comparability and consistency. A finding could be assigned to several classes. Most of the findings related to transparency (90), followed by accuracy (79), consistency (59), completeness (29) and comparability (9).[25]

The expert review team issued recommendations on a variety of topics in the agriculture sector. Recurring topics included manure management (e.g. abatement techniques used in animal housing and manure storage), NH_3 abatement measures for N-fertilization (inorganic and organic fertilizers), methodological improvements regarding N-flow, sewage sludge applied to soils, field burning and HCB emissions from pesticides.

The review identified 25 cases where a tier 1 method was used for a key category. A tier 1 method is the simplest method for estimating emissions that, usually based on the equation

"*Activity data x emission factor*". Tier 1 methodologies tend to overestimate emissions and generally do not allow to take into account the impacts of existing policies and measures. Optimally, a tier 2 or higher tier method is used for the calculation of key categories. These more sophisticated methods usually include more detail, like for example abatement measures.

[25] Note a finding can be related to several quality criteria (transparency, accuracy, completeness, comparability and consistency)

Recurring general topics in the recommendations were:

- problems with activity data or the need to obtain country specific activity data, especially livestock numbers
- missing information on recalculations
- including better information on the emission factors used
- a better description of methods used
- use of the latest available Guidebook
- inclusion of uncertainty analysis
- allocation of emissions to correct NFR categories

The review of gridded data found that several countries did not describe the methods used for the spatial distribution of the emissions not detailed enough or at all.

Conclusion

The quality of the submitted inventories varied greatly from country to country. In general, the quality of the inventories submitted has improved in recent years. Many Parties had also implemented the recommendations of previous reviews. However, there is still a number of inventories that show problems related to completeness and accuracy and time series consistency. Improvement of transparency of the Informative Inventory Reports is an issue for the majority of the Parties. However, for many Parties only comparatively small, targeted improvements are needed. The responsiveness of Parties to the questions from the expert review team has increased significantly in recent years.

6 UNITS AND ABBREVIATIONS

6.1 Units

kg ..... 1 kilogram = 10^3 g (gram)
t ..... 1 tonne (metric) = 1 megagram (Mg) = 10^6 g
kt ..... 1,000 tonnes …
Mg ..... 1 megagram = 10^6 g = 1 tonne (t)
Gg ..... 1 gigagram = 10^9 g = 1 kilotonne (kt)
Tg ..... 1 teragram = 10^{12} g = 1 megatonne (Mt)
TJ ..... 1 terajoule

6.2 Abbreviations

As ..... Arsenic
BC ..... Black carbon – carbonaceous particulate matter that absorbs light
Cd ..... Cadmium
CEIP ..... EMEP Centre on Emission Inventories and Projections
CH_4 ..... Methane
CLRTAP ..... LRTAP Convention, Air Convention
CO ..... Carbon monoxide
CO_2 ..... Carbon dioxide
Cr ..... Chromium
Cu ..... Copper
EEA ..... European Environment Agency
EMEP ..... Co-operative Programme for Monitoring and Evaluation of the Long-range Transmissions of Air Pollutants in Europe
E-PRTR ..... European Pollutant Release and Transfer Register
EU ..... European Union
GDP, PPP ..... Gross domestic product converted to international dollars using purchasing power parity rates
HCB ..... Hexachlorobenzene – Chemical Abstracts Service (CAS) Registry Number 118-74-1
Hg ..... Mercury
HMs ..... Heavy metals
IIR ..... Informative inventory report
KCA ..... Key category analysis
LRTAP Convention ..... UNECE Convention on Long-range Transboundary Air Pollution
LRT ..... Long Range Transport
LPS ..... Large point source
Main pollutants ..... NO_x, NMVOC, SO_x, NH_3 and CO
Main HMs ..... Cd, Hg and Pb
NECD ..... National Emission reduction Commitments Directive (Directive 2016/2284)

NFR ..... UNECE Nomenclature For Reporting (of air pollutants)

NH_3 ..... Ammonia

Ni ..... Nickel

NMVOCs ..... Non-methane volatile organic compounds – all organic compounds of an anthropogenic nature, other than methane, that are capable of producing photochemical oxidants by reaction with nitrogen oxides in the presence of sunlight

NO_2 ..... Nitrogen dioxide

NO_X ..... Nitrogen oxides – means nitric oxide and nitrogen dioxide, expressed as nitrogen dioxide (NO_2);

PAHs ..... Polycyclic aromatic hydrocarbons – for the purposes of emission inventories, the following four indicator compounds shall be used: benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, and indeno(1,2,3_cd)pyrene;

Pb ..... Lead

PCBs ..... Polychlorinated biphenyls – aromatic compounds formed in such a manner that the hydrogen atoms on the biphenyl molecule (two benzene rings bonded together by a single carbon-carbon bond) may be replaced by up to 10 chlorine atoms;

PCDD/PCDF ..... Dioxins and furans – polychlorinated dibenzo-p-dioxins (PCDD) and polychlorinated dibenzofurans (PCDF), tricyclic, aromatic compounds formed by two benzene rings, connected by two oxygen atoms in PCDD and by one oxygen atom in PCDF, and the hydrogen atoms of which may be replaced by up to eight chlorine atoms;

PM ..... Particulate matter – air pollutant consisting of a mixture of particles suspended in the air. These particles differ in their physical properties (such as size and shape) and chemical composition.

PM_{10} ..... Particulate matter, or particles with an aerodynamic diameter equal to or less than 10 (μm);

$PM_{2.5}$ ..... Particulate matter, or particles with an aerodynamic diameter equal to or less than 2.5 micrometres (μm);

POPs ..... Persistent organic pollutants

Se ..... Selenium

SO_2 ..... Sulphur dioxide

SO_X ..... Sulphur oxides – means all sulphur compounds expressed as sulphur dioxide (SO_2) (including sulphur trioxide (SO_3), sulphuric acid (H_2SO_4), and reduced sulphur compounds, such as hydrogen sulphide (H_2S), mercaptans and dimethyl sulphides, etc.);

TSP ..... Total suspended particles

UNECE ..... United Nations Economic Commission for Europe

UNFCCC ..... United Nations Framework Convention on Climate Change

VOCs ..... Volatile organic compounds

Zn ..... Zinc

6.3 ISO Country codes

AL .....Albania
AM .....Armenia
AT .....Austria
AZ .....Azerbaijan
BA .....Bosnia and Herzegovina
BE.....Belgium
BG .....Bulgaria
BY .....Belarus
CA .....Canada
CH .....Switzerland
CY .....Cyprus
CZ.....Czechia
DE .....Germany
DK.....Denmark
EE.....Estonia
ES .....Spain
EU .....European Union
FI .....Finland
FR.....France
GB .....United Kingdom
GE .....Georgia
GR .....Greece
HR .....Croatia
HU .....Hungary
IE .....Ireland
IS .....Iceland
IT ..... Italy
KG ..... Kyrgyzstan
KZ..... Kazakhstan
LI ..... Liechtenstein
LT ..... Lithuania
LU..... Luxembourg
LV..... Latvia
MC..... Monaco
MD..... Republic of Moldova
ME ..... Montenegro
MK..... North Macedonia
MT ..... Malta
NL..... Netherlands
NO ..... Norway
PL ..... Poland
PT ..... Portugal
RO..... Romania
RS ..... Serbia
RU..... Russian Federation
SE ..... Sweden
SI..... Slovenia
SK ..... Slovakia
TR..... Türkiye
UA ..... Ukraine
US ..... United States of America

'**EMEP West'** comprises Albania, Austria, Belgium, Bosnia & Herzegovina, Bulgaria, Croatia, Cyprus, Czechia, Germany, Denmark, Estonia, European Union, Finland, France, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, North Macedonia, Malta, Monaco, Montenegro, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

'EMEP East' comprises Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Republic of Moldova, Russian Federation, Türkiye and Ukraine.

7 REFERENCES

EMEP, 2023: "Transboundary particulate matter, photo-oxidants, acidifying and eutrophying components" Joint MSC-W & CCC & CEIP & CIAM Report, EMEP Status Report 1/2023. Available at: emep.int/publ/common_publications.html

EMEP/EEA, 2019: EMEP/EEA air pollutant emission inventory guidebook 2019, EEA Report No. 13/2019 European Environment Agency, Copenhagen. Available at: https://www.eea.europa.eu/publications/emep-eea-guidebook-2019

CEIP, 2023 a: Methodologies applied to the CEIP GNFR gap-filling 2023. Part I: Main pollutants ((NO_X, NMVOCs, SO_X, NH_3, CO) and Particulate Matter ($PM_{2.5}$, PM_{10}, PM_{coarse}) and Black Carbon (BC) for the years 1990 to 2020. Technical report CEIP 02/2023. Available at: https://www.ceip.at/ceip-reports

CEIP, 2023 b: Methodologies applied to the CEIP GNFR gap-filling 2023: Part II: Heavy Metals and POPs (Pb, Cd, Hg, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Indeno(1,2,3-cd)pyrene, Total polycyclic Methodologies aromatic hydrocarbons, Dioxin and Furan, Hexachlorobenzene, Polychlorinated biphenyls), Technical Report CEIP 03/2024, Stephan Poupa. (in preparation) Available at: https://www.ceip.at/ceip-reports

CEIP, 2023 c: Methodologies applied to the technical review of emission data 2023. EMEP/ CEIP Technical Report CEIP 05/2023. (in preparation) Available at: https://www.ceip.at/ceip-reports

UNECE, 2019: Updated methods and procedures for the technical reviews of air pollutant emission inventories reported under the Convention (ECE/EB.AIR/142/Add.1). Available at https://unece.org/fileadmin/DAM/env/documents/2018/Air/EB/ECE_EB.AIR_142_Add.1-1902937E.pdf

UNECE, 2014: Guidelines for Reporting Emissions and Projections Data under the Convention on Long-range Transboundary Air Pollution (ECE/EB.AIR/125). Available at: https://unece.org/DAM/env/documents/2013/air/eb/ece.eb.air.125_E_ODS.pdf

APPENDIX

Status of 2023 reporting

Table 4: Status of reporting under the LRTAP Convention as of 1st June 2023.

PARTY	Submission Date EMEP	Latest re-submis-sion	NFR template (version)	Grid-ded Data	LPS Data	2023 Proj.	IIR 2023
Albania	15.02.2023		2019-1				
Armenia	15.02.2023		2019-1				x
Austria	15.02.2023		2019-1			x	x
Azerbaijan							
Belarus	15.02.2023		2019-1				x
Belgium	15.02.2023	15.03.2023	2019-1			x	x
Bosnia & Herzegovina							
Bulgaria	15.02.2023	04.04.2023	2019-1			x	x
Canada	15.02.2023		2019-1			x	x
Croatia							
Cyprus	15.02.2023	15.03.2023	2019-1			x	x
Czechia	15.02.2023	15.03.2023	2019-1			x	x
Denmark	15.02.2023		2019-1			x	x
Estonia	10.02.2023	14.03.2023	2019-1			x	x
EU	27.04.2023	31.05.2023	2019-1			x	x
Finland	10.02.2023		2019-1			x	x
France	07.02.2023		2019-1			x	x
Georgia	14.02.2023	29.03.2023	2019-1				x
Germany	10.02.2023	14.03.2023	2019-1			x	x
Greece	16.02.2023	03.03.2023	2019-1			x	x
Hungary	15.02.2023	21.03.2023	2019-1			x	x
Iceland	15.02.2023	15.03.2023	2019-1			x	x
Ireland	15.02.2023	15.03.2023	2019-1			x	x
Italy	15.02.2023	15.03.2023	2019-1			x	x
Kazakhstan	27.10.2022	29.03.2023	2019-1				x
Kyrgyzstan							
Latvia	15.02.2023	27.04.2023	2019-1			x	x
Liechtenstein	13.04.2023		2019-1				x
Lithuania	15.02.2023	08.04.2023	2019-1			x	x
Luxembourg	10.02.2023		2019-1			x	x
Malta	28.02.2023		2019-1			x	x
Monaco	13.02.2023		2019-1	x	x	x	x
Montenegro	15.02.2023	15.04.2023	2019-1				x
North Macedonia	14.02.2023	06.03.2023	2019-1				x
Norway	14.02.2023		2019-1			x	x
Poland	15.02.2023		2019-1			x	x
Portugal	14.02.2023	14.03.2023	2019-1			x	x
Republic of Moldova							

PARTY	Submission Date EMEP	Latest re-submis-sion	NFR template (version)	Grid-ded Data	LPS Data	2023 Proj.	IIR 2023
Romania	15.02.2023	15.03.2023	2019-1			x	x
Russian Federation	23.05.2023		2019-1				x
Serbia	14.02.2023	05.04.2023	2019-1				x
Slovakia	15.02.2023	14.03.2023	2019-1			x	x
Slovenia	02.02.2023		2019-1			x	x
Spain	14.02.2023		2019-1	x	x	x	x
Sweden	03.02.2023		2019-1			x	x
Switzerland	13.02.2023		2019-1	x	x	x	x
the Netherlands	15.02.2023	27.03.2023	2019-1			x	x
Türkiye	15.02.2023	15.03.2023	2019-1				x
Ukraine	14.02.2023	15.03.2023	2019-1				x
United Kingdom	14.02.2023		2019-1			x	x
USA	15.03.2023	15.04.2023	2019-1				x

Table 5: Completeness of submissions under the Air Convention as of 1st June 2023.

PARTY	SO_2, NO_X, CO, NH_3, NMVOC	Cd, Hg, Pb	additional HMs	$PM_{2.5}$, PM_{10}	TSP	BC	POPs (PAH PCDD/PCDF, HCB, PCBs)	Activity Data
Albania	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021
Armenia	2021	2021	2021	2021	2021	2021	2021	
Austria	1990 - 2021	1990 - 2021		1990, 1995, 2000 - 2021	1990, 1995, 2000 - 2021		1990 - 2021	1990 - 2021
Azerbaijan								
Belarus	2020, 2021	2020, 2021	2020, 2021	2020, 2021	2020, 2021	2020, 2021	2020, 2021	2020, 2021
Belgium	1990 - 2021	1990 - 2021	1990 - 2021	2000 - 2021	2000 - 2021	2000 - 2021	1990 - 2021	1990 - 2021
Bosnia & Herzegovina								
Bulgaria	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021
Canada	1990 - 2021	1990 - 2021		1990 - 2021	1990 - 2021	2013 - 2021	1990 - 2021	
Croatia								
Cyprus	1990 - 2021	1990 - 2021	1990 - 2021	2000 - 2021	2000 - 2021	2000 - 2021	1990 - 2021	1990 - 2021
Czechia	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021
Denmark	1980 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1980 - 2021
Estonia	1990 - 2021	1990 - 2021	1990 - 2021	2000 - 2021	1990 - 2021	2000 - 2021	1990 - 2021	1990 - 2021
EU	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	
Finland	1980 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021
France	1980 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021
Georgia	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021
Germany	1990 - 2021	1990 - 2021	1990 - 2021	1995 - 2021	1990 - 2021	2000 - 2021	1990 - 2021	1990 - 2021
Greece	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021
Hungary	1990 - 2021	1990 - 2021	1990 - 2021	2000 - 2021	2000 - 2021	2000 - 2021	1990 - 2021	1990 - 2021
Iceland	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021
Ireland	1987, 1990-2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021

PARTY	SO_2, NO_X, CO, NH_3, NMVOC	Cd, Hg, Pb	additional HMs	$PM_{2.5}$, PM_{10}	TSP	BC	POPs (PAH PCDD/PCDF, HCB, PCBs)	Activity Data
Italy	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021
Kazakhstan	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021
Kyrgyzstan								
Latvia	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021
Liechtenstein	1990 - 2021	1990 - 2021		1990 - 2021	1990 - 2021		1990 - 2021	
Lithuania	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021
Luxembourg	1990 - 2021	1990 - 2021		1990 - 2021	1990 - 2021		1990 - 2021	1990 - 2021
Malta	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021
Monaco	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021
Montenegro	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021
North Macedonia	1980, 1987, 1988, 1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1980, 1987, 1988, 1990 - 2021
Norway	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021
Poland	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021
Portugal	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021
Republic of Moldova								
Romania	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021
Russian Federation	2021							
Serbia	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021
Slovakia	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021
Slovenia	1980 - 2021	1990 - 2021	1990 - 2021	2000 - 2021	2000 - 2021	2000 - 2021	1990 - 2021	1990 - 2021
Spain	1990 - 2021	1990 - 2021	1990 - 2021	2000 - 2021	2000 - 2021	2000 - 2021	1990 - 2021	1990 - 2021
Sweden	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	2000 - 2021	1990 - 2021	1990 - 2021
Switzerland	1980 - 2021	1980 - 2021		1980 - 2021	1980 - 2021	1980 - 2021	1980 - 2021	1980 - 2021
the Netherlands	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021
Türkiye	1990 - 2021	1990 - 2021		1990 - 2021				
Ukraine	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	
United Kingdom	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021	1990 - 2021
USA	2021			2021				

Table 6: Completeness of submissions under the Air Convention as of 1st June 2023 (since 2015 reporting of Projections mandatory every 4 years, since 2017 reporting of Gridded data and LPS data mandatory every 4 years).

PARTY	Template version 2014-1,2014-2 or NFR-2019-1				Gridded	LPS Emissions
	Projections WM	Projections WaM	Activity data WM	Activity data WaM	0.1° x 0.1°	
Austria	2025, 2030		2025, 2030			
Belgium	2025, 2030	2025, 2030				
Bulgaria	2025, 2030		2025, 2030			
Canada	2025, 2030, 2035		2025, 2030, 2035			
Cyprus	2025, 2030	2025, 2030	2025, 2030	2025, 2030		
Czechia	2025, 2030, 2040, 2050		2025, 2030, 2040, 2050			
Denmark	2025, 2030, 2035, 2040					
Estonia	2025, 2030, 2035, 2040, 2050	2025, 2030, 2035, 2040, 2050	2025, 2030, 2035, 2040, 2050	2025, 2030, 2035, 2040, 2050		
Finland	2025, 2030, 2040, 2050		2025, 2030, 2040, 2050			
France	2025, 2030, 2050	2025, 2030, 2050				
Germany	2025, 2030, 2035, 2040	2025, 2030				
Greece	2025, 2030		2025, 2030			
Hungary	2025, 2030		2025, 2030			
Iceland	2025, 2030, 2035	2025, 2030, 2035	2025, 2030, 2035	2025, 2030, 2035		
Ireland	2025, 2030, 2035, 2040, 2050	2025, 2030, 2035, 2040, 2050	2025, 2030, 2035, 2040, 2050	2025, 2030, 2035, 2040, 2050		
Italy	2025, 2030	2025, 2030	2025, 2030	2025, 2030		
Latvia	2025, 2030, 2040, 2050	2025, 2030, 2040, 2050	2025, 2030, 2040, 2050	2025, 2030, 2040, 2050		
Lithuania	2025, 2030, 2035, 2040, 2050	2025, 2030, 2035, 2040, 2050	2025, 2030, 2035, 2040, 2050	2025, 2030, 2035, 2040, 2050		
Luxembourg	2025, 2030, 2035, 2040		2025, 2030, 2035, 2040			
Malta	2025, 2030	2025, 2030	2025, 2030	2025, 2030		
Monaco	2025, 2030		2025, 2030	2025, 2030	2014 - 2021	2014 - 2021
Norway	2025, 2030, 2035		2025, 2030, 2035			
Poland	2025, 2030, 2035, 2040	2025, 2030, 2035, 2040	2025, 2030, 2035, 2040	2025, 2030, 2035, 2040		
Portugal	2025, 2030, 2040, 2050		2025, 2030, 2040, 2050			

PARTY	Template version 2014-1,2014-2 or NFR-2019-1				Gridded	LPS Emissions
	Projections WM	Projections WaM	Activity data WM	Activity data WaM	0.1° x 0.1°	
Romania	2025, 2030	2025, 2030	2025, 2030, 2040, 2050	2025, 2030, 2040, 2050		
Slovakia	2025, 2030, 2040, 2050	2025, 2030, 2040, 2050	2025, 2030, 2040, 2050	2025, 2030, 2040, 2050		
Slovenia	2025, 2030, 2040, 2050	2025, 2030, 2040, 2050	2025, 2030, 2040, 2050	2025, 2030, 2040, 2050		
Sweden	2025, 2030, 2035, 2040, 2045, 2050		2025, 2030, 2035, 2040, 2045, 2050			
Switzerland	2025, 2030, 2035, 2040, 2050		2025, 2030, 2035, 2040, 2050		1980 - 2021	2007 - 2021
the Netherlands	2025, 2030, 2035, 2040	2025, 2030, 2035, 2040	2025, 2030, 2035, 2040	2025, 2030, 2035, 2040		
United Kingdom	2025, 2030					

DATAVIEWER

The dataviewer containing five different subcategories is available on CEIP's homepage at: www.ceip.at/review-of-emission-inventories/technical-review-reports

Table 7: Overview of dataviewer content to the Inventory Report 2023

Dataviewer 2023	
1	Completeness
2	Recalculations
3	KCA
4	Share of sectors
5	Emissions per capita and per GDP

emep

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