

TECHNICAL NOTE

Potential gap-filling procedures for the European Community LRTAP Convention inventory

Discussion paper for EIONET/TFEIP meeting May 2009

This paper was initially presented as a discussion document to a meeting of the Air and Fuels Committee (under Directive 96/62/EC) “Information on the Member States reporting under the National Emission Ceilings Directive 2001/81/EC” held in Brussels on 22 September, 2008. Some minor modifications to the document have since been made.

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Summary

In accordance with the UNECE Reporting Guidelines (UNECE, 2009), the European Community (EC) as a Party to the UNECE Convention on Long-Range Transboundary Air Pollution (CLRTAP) should annually submit an emission inventory of air pollutants⁽¹⁾. As for any Party, the European Community is required to strive to submit an emissions inventory in accordance with the best-practice criteria outlined in the Reporting Guidelines i.e. an inventory that is *transparent, consistent, comparable, accurate and complete*.

The European Environment Agency (EEA) and its Topic Centre on Air and Climate Change (ETC/ACC) each year assist the European Commission by compiling the CLRTAP inventory and accompanying informative inventory report (IIR) for the Community as a whole⁽²⁾. The EC's CLRTAP inventory is calculated by aggregating individual Member States' (MS) CLRTAP inventory submissions. Under an agreement with the EEA's EIONET country network, MS provide a copy of their respective CLRTAP submissions to the EEA for this purpose.

The EC inventory is compiled on the basis of the individual MS data submissions. Therefore complete and consistent inventory data (i.e. sectoral and national total emissions for the entire time series, and in the EMEP nomenclature for reporting (NFR) format) are needed from every single Member State⁽³⁾. However, each year, as is documented in the annual EC CLRTAP emission inventory reports (e.g. EEA, 2008a), it is clear that complete and consistent emission data provided by the required timescales are still not available for a number of Member States.

The most frequent problems observed are:

- submissions (the whole national inventory) are not provided for the most recent year and/or other years;
- historical data is not updated/recalculated which results in inconsistent time series;
- emissions of some pollutants (e.g. fine particulate matter PM_{2.5}) are not provided for either a single year/more subsequent years/the entire time series;
- some sectoral emissions are missing (NE) for a year/more subsequent years/the entire time series;
- sectoral emissions are missing and only national totals are provided.

¹ Main pollutants: SO₂, NO_x, CO, NMVOC, NH₃; Particulate matter (PM₁₀, PM_{2.5}, TSP,); Heavy metals Pb, Cd, Hg, (As, Cr Cu, Ni, Se, Zn); POPs

² In addition to submission to the Convention, the inventory report and data are also separately published on the EEA's website e.g. the 2008 report is available at http://www.eea.europa.eu/publications/technical_report_2008_7

³ It is noted that not all MS have ratified all of the individual CLRTAP protocols under which the reporting of main pollutants, heavy metals, and POPs is required.

With respect to GHG reporting in the Community, when data is missing from MS inventories gap filling procedures are used in order to compile the EC GHG inventory before its submission to UNFCCC. This gap-filling is performed on the basis of the implementing provisions (2005/166/EC) of the EU Monitoring Mechanism (280/2004/EC). The method is documented in the EC GHG inventory report (EEA, 2008b); a summary of these approaches is also presented in Appendix 1. Similarly, EMEP applies its own gap-filling procedures to data submitted under CLRTAP to compile a complete European inventory for the air quality modelling work performed by the EMEP centres (EMEP, 2004). A detailed approach for the general gap-filling of emissions data was elaborated in an earlier ETC/ACC paper (ETC/ACC, 2004).

It has not yet been formally discussed (or agreed) with the MS whether there should be any formalised process/methods developed to allow gap-filling of the EC CLRTAP inventory in cases where official data from the MS is not available. Currently there is no adopted procedure for gap filling, which would allow submission of a complete EC inventory in instances where the underlying MS data may be missing. It is however clearly recognised that, ideally, there should be no need to gap-fill the reported inventory data, it being the responsibility of reporting MS to submit full and accurate inventory data sets. Nevertheless as noted above, for various reasons the European Commission and EEA-ETC/ACC have difficulty obtaining complete, consistent MS inventory data on time.

Three options present themselves:

Option 1: A ‘do-nothing’ option. Only the LRTAP data provided to the EEA by MS is used to compile the EC CLRTAP inventory. The EC thus will submit an incomplete emissions inventory to UNECE/EMEP;

Option 2: A partial gap-filling. Other officially-submitted data from the MS (NECD, EU-MM indirect pollutants) is used to fill any gaps in the LRTAP data provided to the EEA. This is the process presently used in the compilation of the EC inventory ⁽⁴⁾. While the EC inventory from this option is significantly more complete than would result under option 1, the EC will continue to submit an incomplete emissions inventory to UNECE/EMEP;

Option 3: A complete gap-filling (similar to that used under the EU-MM). Following discussions and agreement with MS, a process could be developed to gap-fill the EC inventory where the underlying data is missing from MS submissions. This would ensure the EC meets the requirements of the Reporting Guidelines and is able to submit a complete emission inventory to CLRTAP/EMEP.

In order to help initiate discussions with MS, EEA requested its ETC/ACC to develop a technical paper describing a potential gap-filling methodology that would be consistent with option 3. This paper is Appendix 1. The proposed method proposes a stepwise approach to gap-filling based on using official MS data whenever it is available, before use of other techniques such as extrapolation and interpolation to fill remaining gaps.

⁴ No comments have been received from MS concerning the current gap-filling. The EC inventory and report is reviewed each year by country experts from EEA’s Eionet air emissions network.

Appendix 1. Possible gap filling procedures for the European Community CLRTAP inventory

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1.1 Objective

The main objective of this note is to propose suitable gap filling procedures for the EC CLRTAP inventory. It is considered desirable, in the first instance, that these gap filling procedures should be consistent with the gap filling procedures used in the compilation of the EC GHG inventory under Decision 280/2004/EC ⁽⁵⁾, with the current approaches used for gap filling of the ETC gap-filled emissions spreadsheet (the source of emissions-related data in EEA assessment reports and indicators), and harmonised as far as practicable with EMEP approaches used for gap-filling of inventories for modellers. The proposed gap-filling methodology should ultimately allow provision of a complete and transparent EC CLRTAP inventory to the Convention as far as is practicable given the available data and resource constraints.

1.2 Gap-filling approaches used for MS greenhouse gas emission inventories under the EU GHG Monitoring Mechanism

This section briefly describes the gap filling approaches used in the EC GHG inventory. The legal basis for the gap filling is Council Decision 280/2004/EC concerning a mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol.

Decision 2005/166/EC ⁽⁶⁾ establishes the legal basis for the gap filling procedure in the EC inventory:

Article 13

If a Member State does not submit all data required pursuant to Article 3(1) of Decision 280/2004/EC by 15 March of a reporting year, the Commission shall prepare estimates for data missing for that Member State to be included in the Community greenhouse gas inventory for that reporting year and source category, in accordance with the UNFCCC reporting guidelines for annual inventories and the revised 1996 IPCC guidelines for national greenhouse gas inventories.

⁵ Council Decision No 280/2004/EC concerning a mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol OJ L 49, 19.2.2004, p. 1

⁶ Commission Decision 2005/166/EC laying down rules implementing Decision 280/2004/EC of the European Parliament and of the Council concerning a mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol. OJ L 55, 1.3.2005, p. 57.

Article 14

- 1. The Commission estimates for missing data shall be based on the principles set out in paragraphs 2, 3 and 4.*
- 2. If a consistent time series of reported estimates for the relevant source category is available from the Member State for previous years that has not been subject to adjustments under Article 5(2) of the Kyoto Protocol, extrapolation of that time series shall be used to obtain the emission estimate.*

For carbon dioxide emissions from the energy sector, extrapolation of emissions should be based on the percentage change of Eurostat carbon dioxide emission estimates.

- 3. If the estimate for the relevant source category was subject to adjustments under Article 5(2) of the Kyoto Protocol in previous years and the Member State has not submitted a revised estimate, the basic adjustment method used by the expert review team as set out in the technical guidance on methodologies for adjustments under Article 5(2) of the Kyoto Protocol, hereinafter referred to as “the technical guidance for adjustments”, shall be used, without application of the conservativeness factor defined in that guidance.*

- 4. If a consistent time series of reported estimates for the relevant source category is not available and if the estimate of the source category has not been subject to adjustments under Article 5(2) of the Kyoto Protocol, the estimation shall be based on the technical guidance for adjustments, without application of the conservativeness factor defined in that guidance.*

Article 15

The Commission shall prepare the estimates referred to in Article 14 by 31 March of the reporting year, following consultation with the Member State concerned, and communicate those estimates to the other Member States.

Article 16

The Member State concerned shall use the estimates referred to in Article 14 for its national submission to the UNFCCC to ensure consistency between the Community inventory and Member States’ inventories.

In practice the following two approaches are used: (1) Extrapolation, and (2) Use of indicators in combination with clustering of countries.

1.2.1 Extrapolation

Extrapolation was the most frequently used method; this method is fully consistent with IPCC GPG 2000 for data missing at the end or beginning of time series (see section 7.3.2.2 of IPCC GPG 2000). Three types of extrapolation have been used:

- (1) Extrapolation on basis of Eurostat CO₂ emission data:** For fuel combustion related GHG emissions (CO₂, CH₄, N₂O of sector 1A) the percentage change from Eurostat CO₂ emission estimates is used for extrapolation, where available. Eurostat annually compiles energy balance

data based on the five joint Eurostat/IEA/UNECE questionnaires on solid fuels, oil, natural gas, electricity and heat, and renewables and wastes submitted by the EC Member States. On the basis of this information Eurostat calculates CO₂ emissions from fossil fuels by Member State for the Sectoral Approach and Reference approach using IPCC default emission factors. Eurostat provides these emission estimates in March every year to the EEA/ETC-ACC in order to use it for gap-filling. EEA/ETC-ACC uses the percentage change of the Eurostat CO₂ emissions from the Sectoral approach for the extrapolation.

(2) **Linear trend extrapolation** was used for all other source categories where a smooth trend in the time series could be observed i.e. no large annual variations (dips and jumps) occurred. In general the linear trend extrapolation is based on the most recent 10-year-period; however, if only a limited number of years were available or a more consistent time series was available for specific years then these years were used for the linear trend extrapolation.

(3) **Use of previous year's values** were used in case of large annual variations (dips and jumps) because in this case the previous year value is considered to be as robust as any other value.

1.2.2 Use of indicators in combination with clustering of countries

This approach is used in order to fill the gaps for missing emissions of e.g. HFCs from 2F1 'Refrigeration and air conditioning equipment' and for SF₆ emissions from 2F8 'Electrical equipment'.

- **HFC emissions from 2F1 'Refrigeration and air conditioning equipment'**: Emissions from 2F1 were estimated on basis of average per capita emissions of either a set of similar countries, in terms of climate and economic development, (if available) or on basis of one single country (if a set of similar countries was not available). Population data was used from Eurostat. Per capita emissions are used as an indicator because it is assumed that the use of refrigeration and air conditioning equipment depends on the size of the population. The other two factors influencing HFC emissions from refrigeration and air conditioning – climate and economic development – are taken into consideration through clustering of countries.
- **SF₆ emissions from 2F8 'Electrical equipment'**: Emissions from 2F8 were estimated on basis of average emissions per final electricity consumption of either a set of similar countries, in terms of economic development, (if available) or on basis of one single country (if a set of similar countries was not available). Data on final electricity consumption was used from Eurostat. Emissions per electricity consumption are used because it is assumed that the number of switch gears (and consequently the amount of SF₆ used in switch gears) depends on the amount of electricity consumed in a country.

1.3 Possible gap-filling approaches for the EC CLRTAP inventory

Gap filling methods are proposed for use in the EC CLRTAP inventory when the estimates have not been included in *Member States' CLRTAP inventory* submissions to the European Community/EEA in the following instances:

1. To complete specific years in the CLRTAP inventory time-series for a specific MS if five years or more are available
 - for the most recent inventory year(s);
 - for years back to 1990;
 - for some years of the time series from 1990 to the most recent year.
2. To complete national inventories for individual Member States that did not estimate emissions of pollutants for any year or for less than five years of the inventory time series;
3. To provide complete NFR tables for the European Community when some Member States only provided national totals. In this case, the gap filling methods are used to further disaggregate the emission estimates provided by Member States;
4. To enable the presentation of consistent trends for the EC.
 - Some MS do not provide recalculated estimates for the complete time series which may lead to large inconsistencies between the latest and the previous inventories. If there are obvious, large inconsistencies in the time series of more than +/- 25% in the CLRTAP inventories (due to recalculations) and more consistent data is available for the complete time series under NEC or from the GHG inventories, then this latter data is used.
 - Some MS do not provide recalculated estimates for the historical years, and disaggregated emissions are available only on the level of (10) 11 SNAP sectors. It is not possible to transfer sector emissions from SNAP11 to NFR. In such case the gap filling had to be used to obtain consistent sector data series in NFR format.

Any process used as a routine to gap-fill the inventory is required to be simple and pragmatic. The gap filling routines described in the next section are proposed for the main pollutants and PMs ⁽⁷⁾ and will be performed at an appropriate sector level, depending on data availability.

⁷ In the trial period gap filling is planned for main pollutants and PMs (national totals). The methods applicable for HMs and POPs would be most probably more or less identical, but their applicability (data availability) will be considered in a subsequent stage.

1.3.1 A possible gap-filling routine

This section describes a proposed procedure, with prioritised gap filling approaches for the main ⁽⁸⁾ pollutants of the EC CLRTAP inventory. Most of these approaches are related to extrapolation; the use of indicators is not needed in practice. For the time being the gap-filling focuses on the main pollutants and of PM₁₀ and on PM_{2.5} because of the importance of these emissions for air quality/policy issues. No gap-filling ⁽⁹⁾ for HMs and POPs is foreseen. The annex provides an overview of all gap filling approaches on a case by case basis ⁽¹⁰⁾.

(1) Extrapolation on basis of NECD inventory data

- *(1a) Direct use of NECD inventory data*

For NO_x, NMVOC, NH₃ and SO₂ the equivalent values from the NECD inventory data will be used, where available.

- *(1b) The annual percentage change from the NECD inventory data will be used for extrapolation*

If the NECD national totals differ from CLRTAP national totals by more than 5% in the latest year for which data is available from both NECD and CLRTAP, the annual percentage change from the NECD inventory data will be used for extrapolation.

The NECD inventories for the year N-1 are submitted annually to the European Commission and EEA by 31 December each year under Directive 2001/81/EC on national emission ceilings for certain atmospheric pollutants. In general, the geographical and sectoral coverage of the NECD inventories is for most countries the same as the CLRTAP inventory. However, for some countries significant differences may exist in terms of sectoral and/or geographical coverage. Therefore, the percentage change from NECD inventory data is proposed for extrapolation in case of differences of more than 5%.

⁸ The main pollutants are SO_x, NO_x, CO, NMVOC, NH₃

⁹ In the trial period gap filling is planned for main pollutants and PMs. The methods applicable for HMs and POPs will be considered in the next stage.

¹⁰ The Annex would require updating once methods have been agreed upon with the MS.

(2) Extrapolation on basis of GHG inventory data (where NECD data are not available)

- *(2a) Direct use of inventory data submitted under Decision 280/2004/EC*

For NO_x, NMVOC, CO and SO₂ the equivalent values from GHG inventory data will be used, where available.

- *(2b) The annual percentage change from the CRF inventory data will be used for extrapolation*

If the CRF national totals differ from CLRTAP national totals by more than 5% in the latest available year the annual percentage change from the CRF inventory data will be used for extrapolation.

The GHG inventories for the year N-2 are submitted annually to the European Commission by 15 January under Council Decision 280/2004/EC concerning a mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol. In general, the geographical and sectoral coverage of the GHG inventories is for most countries the same as of the CLRTAP inventory. However, for some countries significant differences may exist in terms of sectoral and/or geographical coverage. Therefore, the percentage change from GHG inventory data is proposed for extrapolation in case of differences of more than 5%.

(3) Extrapolation on basis of EMEP inventory data base (where NECD and CRF inventories are not available)

For NO_x, NMVOC, CO and SO₂, PMs (HMs, POPs) the values from the EMEP inventory data base will be used, where available. Note: Some countries do not update historical data (before 2000) in the EMEP database, therefore NECD inventories and CRF inventories which are annually updated are used as primary source of data.

(4) Linear trend extrapolation

Linear trend extrapolation will be used where emissions are not available from NECD, GHG or EMEP databases. Linear extrapolation will be applied only if emissions were reported for five years and more:

- *(4a) For all source categories where a smooth trend in the time series could be observed i.e. no large annual variations (dips and jumps) occurred. In general the linear trend extrapolation is based on the most recent 10-year-period; however, if only a limited number of years were available or a more consistent time series was available for specific years then these years were used for the linear trend extrapolation.*
- *(4b) If emission estimates are not available for years within the time series linear trend interpolation is used.*

(5) Use of previous/next year's values

Previous/next year's value will be used in case of large annual variations (dips and jumps) and where emission estimates are available for five years or more. In the case of large annual variations the previous year value is considered to be as robust as any other value.

(6) Extrapolation of the NFR category (sector) splits

If MS reported only national total emissions the sector split of emission will be extrapolated to NFR categories. The NFR category (sector) splits are extrapolated:

- *(6a) On basis of the previous/next year's NFR category splits*

If the NFR category split is available for the previous /next 3 years then this category split will be applied for all missing years in this interval:

- from CLRTAP inventories, or
- from NECD inventories or if not available on the basis of
- CRF category split

- *(6b) NFR category split based on cluster of countries*

If no NFR/CRF category split is available at all from any previous/next 3 years then the NFR category split from a cluster of similar countries (EU15, EU12, EU27). can be used.

(7) Other

Other gap filling procedures would be needed in case that a Member State does not report inventories for a specific gas for any of the reporting years or for less than five years. In such a situation data from other emission databases will be used (7a) or indicators in combination with clustering of countries will be used (7b). Such methods ⁽¹⁾ will be mainly relevant for NH₃, PM₁₀ and PM_{2.5} (HMs, POPs) while for the other main pollutants (SO₂, NO_x, CO, NMVOC) estimates are mostly available at least for five years.

- *(7a) Other databases*

Missing MS national total emissions for the EC inventory will be taken from the spreadsheet ⁽²⁾ “Emissions data from the ETC-ACC Air Emissions DB (year N-1)” (for PM₁₀ and PM_{2.5} national total emissions for the years 1990,1995, 2000 and 2005 are taken from the RAINS model and interpolated/ extrapolated for missing years.) The emissions for the actual year will be gap filled with methods (4a) or (5).

The NFR sector split will be calculated as a percentage obtained from a cluster of countries (6b).

¹¹ Methods (7a) and (7b) are applied by EEA/ETC ACC currently for gap-filling in spreadsheets used for indicators.

¹² This spreadsheet is compiled annually within ETC ACC.

- *(7b) Clustering of countries with indicators*

Emissions for national total emissions will be estimated with indicators (e.g. per GDP or per capita) if no data is available in “*Emissions data from the ETC-ACC Air Emissions DB (year N-1)*”. Trends for national total emissions will be estimated with the percentage of an average trend of cluster of countries (e.g. EU12, resp. EU15, or other feasible).

The NFR sector of emission will be calculated then in the same way as proposed by the method (6b).

(8) Removing large inconsistencies

The methods for gap-filling can be also used for replacing data showing obvious large inconsistencies with recently reported emission estimates (more than +/- 25%). Such procedures will be considered only in very limited cases when the inconsistent data would significantly influence the EC trend. Only officially submitted data under NECD or MM are considered. In such cases the whole annual inventory (national total and sectoral data) has to be replaced. In any case this procedure will be communicated to/discussed with the relevant country. It is not expected that inconsistent data would occur in current inventories/for main gases but some countries do not update the whole CLRTAP time series when changing methods/EFs.

1.3.2 Consultation with Member States

The EEA will prepare the gap filled estimates following consultation with the Member State concerned, and communicate those estimates to the Member States.

1.3.3 Record of gap-filling

Gap filling of inventories must be recorded and presented in a transparent way in the EC inventory and in the EC inventory report as well. A proposal for coding of gap filled data in excel files and in summary tables is given in the table below (Table 1). In addition to that, colouring of gap filled data in excel spreadsheets should ensure the transparency of the whole process. Colours for all types of gap filling elements will be harmonised with other relevant activities and will be described in the working files.

Table 1. Proposal for description of gap filled data in excel files and summary tables.

Coding	Description
NEC 1a	Emission value equal to value reported under NECD
NEC 1b	Emission value calculated on basis of percentage change of NEC inventory data
CRF 2a	Emission value equal to value reported under EU-MM
CRF 2b	Emission value calculated on basis of percentage change of GHG inventory data
3 EMEP	Emission value equal to value in EMEP database
4a	Emission value calculated on basis of linear trend extrapolation
4b	Emission value interpolated
5	Emission value equal to the previous/ or next reported emission value
6a	Sectoral NFR split derived on basis of previous year CLRTAP NFR ,NEC NFR or GHG CRF split
6b	Sectoral NFR split derived on basis of current year CLRTAP NFR split of a cluster of countries
7a	Other database
7b	Cluster of countries
8	Inconsistent data replaced

1.4 References

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Annex: Gap filling for the EC CLRTAP inventory for submission to UNECE for main pollutants (NO_x, CO, NMVOC, SO_x, NH₃)

Gas	Gaps	Check	CLRTAP estimates for previous years available	NEC estimates for latest year available	GHG inventory estimates for latest inventory available	Gap filling
NO _x , SO ₂ , NMVOC	No national total estimates available for the latest year	Check if national totals are available for the previous year and/or from NEC/GHG for the latest year	Yes	Yes	Yes	<ul style="list-style-type: none"> Use equivalent values from the NECD inventory data
			Yes	Yes	No	<ul style="list-style-type: none"> If the NEC national totals differ from CLRTAP national totals by more than 5% in the latest available year the percentage change from the NECD inventory data will be used for extrapolation.
			Yes	No	Yes	<ul style="list-style-type: none"> Use equivalent values from the GHG inventory data If the CRF national totals differ from CLRTAP national totals by more than 5% in the latest available year the percentage change from the GHG inventory data will be used for extrapolation.
			Yes	No	No	<p>In case values for several previous years are available:</p> <ul style="list-style-type: none"> Use linear trend extrapolation where a smooth trend in the time series can be observed i.e. no large annual variations (dips and jumps) occurred. In general the linear trend extrapolation is based on the most recent 10-year-period; however, if only a limited number of years is available or a more consistent time series was available for specific years then use these years for linear trend extrapolation. Use previous year's values in case of large annual variations (dips and jumps) because in this case the previous year value is considered to be as robust as any other value. <p>In case only a value for one previous year is available:</p> <ul style="list-style-type: none"> Use percentage change of CLTRAP inventory from a cluster of countries.
			No	Yes	Yes	<ul style="list-style-type: none"> Use latest NEC inventory; if there is evidence that the NEC inventory differs significantly from the CLRTAP inventory, the NEC inventory data need to be adjusted
			No	Yes	No	<ul style="list-style-type: none"> Use latest NEC inventory; if there is evidence that the NEC inventory differs by more than 5% from the CLRTAP inventory, the NEC inventory data need to be adjusted
			No	No	Yes	<ul style="list-style-type: none"> Use latest GHG inventory; if there is evidence that the GHG inventory differs by more than 5% from the CLRTAP inventory,

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Gas	Gaps	Check	CLRTAP estimates for previous years available	NEC estimates for latest year available	GHG inventory estimates for latest inventory available	Gap filling		
						the GHG inventory data need to be adjusted		
			No	No	No	<ul style="list-style-type: none"> Other approaches e.g. use of indicators (e.g. per capita emissions) in combination with clustering of countries or use of other emission databases 		
	National total estimates available for the latest year (either reported or derived from gap-filling), but no detailed NFR categories available	Check if detailed NFR categories are available for the previous year and/or from NEC/GHG for the latest year	Yes	Yes	Yes	<ul style="list-style-type: none"> Use NFR split of most recent year of CLRTAP inventory 		
Yes			Yes	No				
Yes			No	Yes				
Yes			No	No				
					No	Yes	Yes	<ul style="list-style-type: none"> Use NFR split of NEC inventory
					No	Yes	No	
					No	No	Yes	<ul style="list-style-type: none"> Use CRF split of GHG inventory
					No	No	No	<ul style="list-style-type: none"> Use NFR split of a cluster of countries

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Gas	Gaps	Check	CLRTAP estimates for previous years available	NEC estimates for latest year available	GHG inventory estimates for latest inventory available	Gap filling
NH3	No national total estimates available for the latest year	Check if national totals are available for the previous year and/or from NEC for the latest year	Yes	Yes	Not relevant	<ul style="list-style-type: none"> Use equivalent values from the NECD inventory data If the NEC national totals differ from CLRTAP national totals by more than 5% in the latest available year the percentage change from the NECD inventory data will be used for extrapolation.
			Yes	No	Not relevant	<p>In case values for several previous years are available:</p> <ul style="list-style-type: none"> Use linear trend extrapolation in where a smooth trend in the time series can be observed i.e. no large annual variations (dips and jumps) occurred. In general the linear trend extrapolation is based on the years 2000-previous year; however, if only a limited number of years is available or a more consistent time series was available for specific years then use these years for linear trend extrapolation. Use previous year's values in case of large annual variations (dips and jumps) because in this case the previous year value is considered to be as robust as any other value. <p>In case only a value for one previous year is available:</p> <ul style="list-style-type: none"> Use percentage change of CLTRAP inventory from a cluster of countries.
			No	Yes	Not relevant	<ul style="list-style-type: none"> Use latest NEC inventory; if there is evidence that the NEC inventory differs by more than 5% from the CLRTAP inventory, the NEC inventory data need to be adjusted
			No	No	Not relevant	<ul style="list-style-type: none"> Other approaches e.g. use of indicators (e.g. per capita emissions) in combination with clustering of countries or use of other emission databases
	National total estimates available for the latest year (either reported or derived from gap-filling), but no detailed NFR categories available	Check if detailed NFR categories are available for the previous year and/or from NEC for the latest year	Yes	Yes	Not relevant	<ul style="list-style-type: none"> Use NFR category split of previous CLRTAP inventory
			Yes	No	Not relevant	
			No	Yes	Not relevant	<ul style="list-style-type: none"> Use NFR category split of latest NEC inventory
			No	No	Not relevant	<ul style="list-style-type: none"> Use NFR split of a cluster of countries

Appendix 1 - Possible gap filling procedures for the European Community CLRTAP inventory

Gas	Gaps	Check	CLRTAP estimates for previous years available	NEC estimates for latest year available	GHG inventory estimates for latest inventory available	Gap filling
CO	No national total estimates available for the latest year	Check if national totals are available for the previous year and/or from GHG for the latest year	Yes	Not relevant	Yes	<ul style="list-style-type: none"> Use equivalent values from the GHG inventory data If the CRF national totals differ from CLRTAP national totals by more than 5% in the latest available year the percentage change from the GHG inventory data will be used for extrapolation.
			Yes	Not relevant	No	<p>In case values for several previous years are available:</p> <ul style="list-style-type: none"> Use linear trend extrapolation in where a smooth trend in the time series can be observed i.e. no large annual variations (dips and jumps) occurred. In general the linear trend extrapolation is based on the years 2000-previous year; however, if only a limited number of years is available or a more consistent time series was available for specific years then use these years for linear trend extrapolation. Use previous year's values in case of large annual variations (dips and jumps) because in this case the previous year value is considered to be as robust as any other value. <p>In case only a value for one previous year is available:</p> <ul style="list-style-type: none"> Use percentage change of CLTRAP inventory from a cluster of countries.
			No	Not relevant	Yes	<ul style="list-style-type: none"> Use latest GHG inventory; if there is evidence that the GHG inventory differs by more than 5% from the CLRTAP the GHG inventory data need to be adjusted
			No	Not relevant	No	<ul style="list-style-type: none"> Other approaches e.g. use of indicators (e.g. per capita emissions) in combination with clustering of countries or use of other emission databases
	National total estimates available for the latest year (either reported or derived from gap-filling), but no detailed NFR categories available	Check if detailed NFR categories are available for the previous year and/or from NEC for the latest year	Yes	Not relevant	Yes	<ul style="list-style-type: none"> Use NFR category split of most recent year of CLRTAP inventory
			Yes	Not relevant	No	
			No	Not relevant	Yes	<ul style="list-style-type: none"> Use CRF category split of GHG inventory
			No	Not relevant	No	<ul style="list-style-type: none"> Use CRF category split of a cluster of countries