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Executive Body for the Convention on Long-range
Transboundary Air Pollution

**Steering Body to the Cooperative Programme for
Monitoring and Evaluation of the Long-range
Transmission of Air Pollutants in Europe**

Working Group on Effects

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**Progress in activities of the Cooperative Programme for Monitoring
and Evaluation of the Long-range Transmission of Air Pollutants in
Europe in 2022 and future work: improvement and reporting of
emission data and adjustments under the Protocol to Abate Acidification,
Eutrophication and Ground-level Ozone**

**Technical Guidance for Emissions Inventory Adjustments
under the Amended Gothenburg Protocol**

**Inventory adjustments in the context of emission reduction
commitments**

Prepared by the Task Force on Emission Inventories and Projections

Summary

Conscious of the uncertainties inherent in estimating and projecting emission levels and the need for continuous scientific and methodological improvements, and determined that the emergence of new methodologies should not put any Party at a disadvantage in terms of its emission reduction commitments, at its thirtieth session (Geneva, 30 April–4 May 2012), the Executive Body to the Convention on Long-range Transboundary Air Pollution adopted decisions 2012/3 and 2012/4 to allow Parties to make adjustments under the Protocol to Abate Acidification, Eutrophication and Ground-level Ozone to emission reduction commitments or to inventories for the purposes of comparing total national emissions with them. At its thirty-first session (Geneva, 11–13 December 2012), the Executive Body adopted decision 2012/12 on guidance for such adjustments. Further technical guidance was then included as decision 2014/1, as adopted by the Executive Body at its thirty-third session (Geneva, 8–11 December 2014).

Recognizing that the existing technical guidance to support adjustment applications referred to emission ceilings, the Executive Body to the Convention on Long-range Transboundary Air Pollution requested



that additional technical guidance be drafted to support Parties wishing to apply for adjustments within an emission reduction commitment framework.

The present document contains that technical guidance, as drafted by the Task Force on Emission Inventories and Projections, and trialed in 2022. It outlines both best practice in quantifying adjustments within an emissions reduction commitment framework and the information that should be reported to support the technical review of the application.

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I. Introduction

A. Purpose of the present technical guidance

1. Within the Convention on Long-range Transboundary Air Pollution (Convention), there are Executive Body decisions explaining the concept of several flexibility mechanisms that can be used for demonstrating compliance with emission targets. One such mechanism is the use of adjustments that can be made to emissions inventories.¹ Under specific circumstances, such adjustments allow Parties to report national emission estimates for compliance purposes that differ from their best science national emission estimates.

2. The document Technical Guidance for Parties Making Adjustment Applications and for the Expert Review of Adjustment Applications (ECE/EB.AIR/130) explains, among other things:

(a) How a Party should apply for a new adjustment (including the information that must be provided);

(b) How the validity and quantification of the new inventory adjustment are reviewed;

(c) The steps in determining whether a new inventory adjustment application is approved or rejected;

(d) How previously approved inventory adjustments should be reported and reviewed.

3. Document ECE/EB.AIR/130 also includes case studies and worked examples to support Parties considering their options regarding making a new inventory adjustment application.

4. However, the existing technical guidance and adjustment reporting templates² support Parties who wish to use the option of inventory adjustments to demonstrate compliance with emission ceilings specified in the Protocol to Abate Acidification, Eutrophication and Ground-level Ozone (Gothenburg Protocol). The Gothenburg Protocol, as amended in 2012,³ requires Parties to demonstrate compliance with emission reduction commitments (ERCs) for 2020 onwards. Inventory adjustments that are applicable to ERCs (rather than ceilings) require different considerations and the submission of additional supporting information.

5. The present technical guidance has been prepared in response to a request from the Executive Body⁴ to the Steering Body to the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP) to draft technical guidance to support Parties wishing to use adjustments to demonstrate compliance specifically with the ERCs in the amended Gothenburg Protocol.

6. Parties signatories to the Gothenburg Protocol but not to the amended Gothenburg Protocol are required to demonstrate continued compliance with emission ceilings. It is necessary to retain the original technical guidance and associated processes that pertain to demonstrating compliance with the ceilings of the Gothenburg Protocol for these Parties. This document therefore presents technical guidance that is additional technical guidance, or guidance specifically relating to the amended Gothenburg Protocol. This guidance does not replace the existing technical guidance that refers to inventory adjustments in the context of emission ceilings set under the Gothenburg Protocol.

¹ Executive Body decisions 2012/3, 2012/4 and 2014/1 (all Executive Body decisions referred to in the present document are available at <https://unece.org/decisions>).

² Annex II to ECE/EB.AIR/130 is used for applying for an adjustment. Annex VII to the Guidelines for Reporting Emissions and Projections Data under the Convention on Long-range Transboundary Air Pollution (ECE/EB.AIR/125) is used for reporting previously approved adjustments.

³ See <https://unece.org/environment-policy/air/protocol-abate-acidification-eutrophication-and-ground-level-ozone>.

⁴ ECE/EB.AIR/148, para. 13 (b), forthcoming.

B. Previously approved adjustments for the Gothenburg Protocol ceilings will not be valid for the amended Gothenburg Protocol emission reduction commitments

7. Parties wishing to use adjustments to demonstrate compliance with the ERCs specified in the amended Gothenburg Protocol will not be able to use existing inventory adjustments accepted for compliance with the Gothenburg Protocol ceilings. They will, in effect, need to “start again” in assessing which revisions to their inventory are eligible as adjustments. This is primarily for two reasons:

(a) The reference version of the EMEP/European Environment Agency (EEA) air pollutant emission inventory guidebook (EMEP/EEA Guidebook)⁵ (that is used to determine the scientific knowledge and understanding when the commitments were set) is the 2009 version for the commitments specified in the amended Gothenburg Protocol, i.e. different to that used for adjustments under the Gothenburg Protocol. As a result, it is likely that the validity and quantification of most adjustments will have changed;

(b) The calculations required for an adjustment under the amended Gothenburg Protocol will require consideration, and reporting, of information relating to emissions in 2005, as well as 2020 onwards. Previously accepted adjustments under the Gothenburg Protocol do not provide this information.

C. European Union National Emission reduction Commitments Directive⁶

8. Whilst this technical guidance is for use within the Convention, it is also recognized that the European Union National Emission reduction Commitments Directive (NECD) refers to Convention guidance documents. To facilitate cooperation between the Convention and NECD, reference is made to NECD in this guidance where there are relevant and material differences between the two instruments.

II. Inventory adjustments in the context of emission reduction commitments

9. It is necessary to clearly differentiate between inventory adjustments that apply in the context of a compliance regime based on emission ceilings (Gothenburg Protocol) and those that apply in the context of ERCs (amended Gothenburg Protocol) – henceforth referred to in this guidance as, respectively, “adjustments under ceilings” and “adjustments under ERCs”.

10. Adjustments under ERCs are inherently more complicated than adjustments under ceilings. This is because demonstrating compliance with ERCs requires emissions data from the compliance year in question (in this case, 2020 onwards) and 2005. For example, a “new source” adjustment (as defined in Executive Body decision 2012/12) under a ceiling compliance check always provides a beneficial revision to the compliance total. However, this is not the case when determining compliance with ERCs – a new source adjustment may aid or hinder compliance with an ERC, depending on the time trend of the new source (see para. 12 below for illustrative examples).

11. A valid adjustment under ERCs might involve either revising down the emissions in the compliance year in question, or revising up the emissions in 2005 to change non-compliance into compliance. However, in many cases, it is likely that both years would need to be revised to capture relevant changes that have an impact across the entire time series; the magnitude and direction of the revisions will determine whether the net effect would

⁵ See www.eea.europa.eu/publications/emep-eea-guidebook-2019.

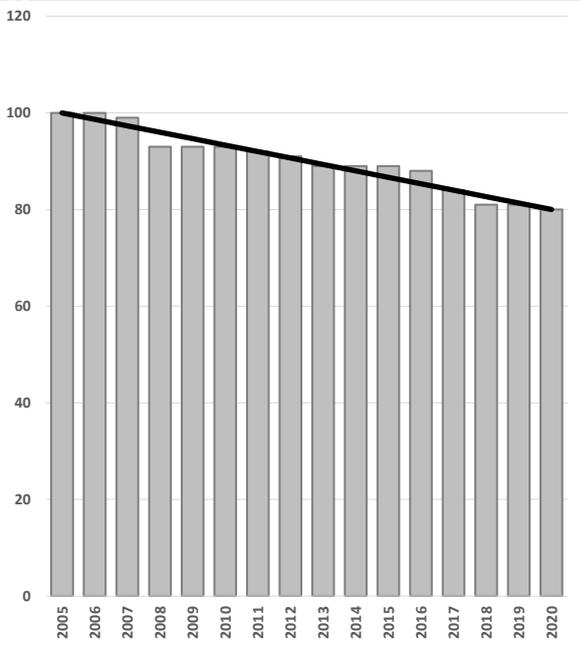
⁶ Directive (EU) 2016/2284 of the European Parliament and of the Council of 14 December 2016 on the reduction of national emissions of certain atmospheric pollutants, amending Directive 2003/35/EC and repealing Directive 2001/81/EC, *Official Journal of the European Union*, L 344 (2016), p. 1–31.

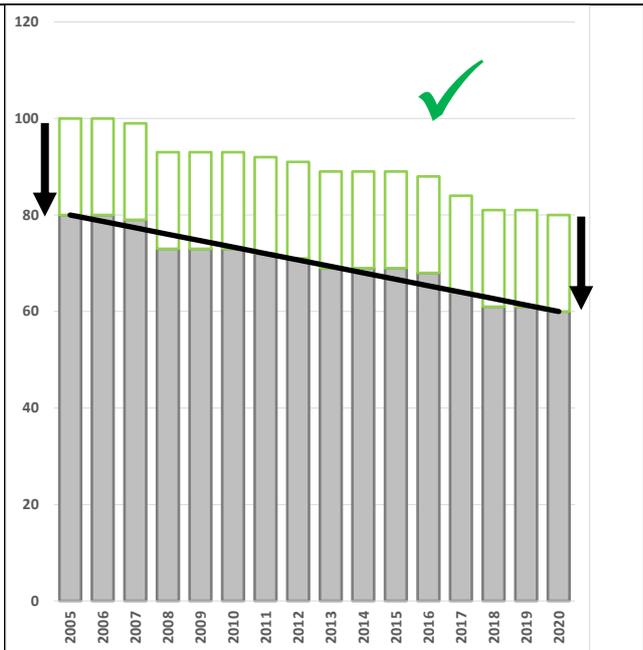
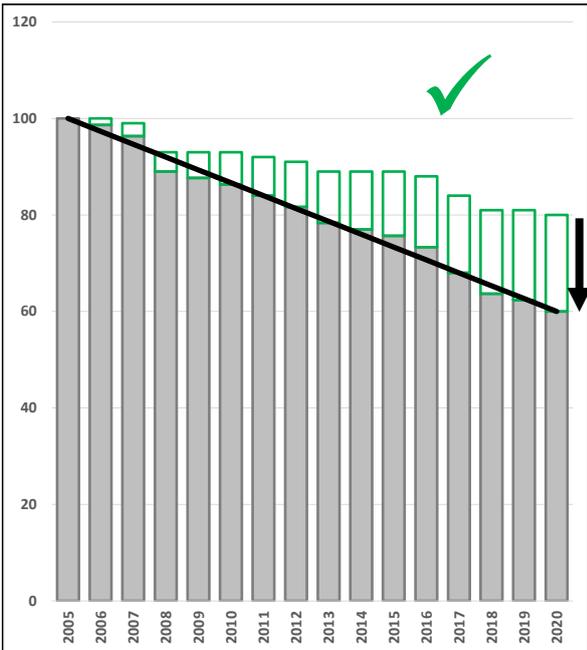
bring a Party into compliance and is therefore considered eligible for an adjustment application.

Illustrative examples of adjustments under emission reduction commitments

12. Given the relative complexity of adjustments under ERCs compared to adjustments under ceilings (both in terms of conceptualizing them, and also providing sufficient supporting information), it is helpful to consider some illustrative examples (see figure below). These examples demonstrate some of the many possible combinations that might be considered for an adjustment under ERCs application and explain which are theoretically valid and which are not.

Illustrative examples of adjustments that have an impact on 2005 and 2020 emissions in different ways

<p>Example base case Emissions fall from 100 in 2005 to 80 in 2020. The reduction achieved is 20 per cent, insufficient to meet the ERC of 25 per cent. Therefore, an adjustment can be applied for.</p>  <table border="1"> <caption>Example base case emissions data</caption> <thead> <tr> <th>Year</th> <th>Emissions</th> </tr> </thead> <tbody> <tr><td>2005</td><td>100</td></tr> <tr><td>2006</td><td>99</td></tr> <tr><td>2007</td><td>98</td></tr> <tr><td>2008</td><td>93</td></tr> <tr><td>2009</td><td>92</td></tr> <tr><td>2010</td><td>91</td></tr> <tr><td>2011</td><td>90</td></tr> <tr><td>2012</td><td>89</td></tr> <tr><td>2013</td><td>88</td></tr> <tr><td>2014</td><td>87</td></tr> <tr><td>2015</td><td>86</td></tr> <tr><td>2016</td><td>85</td></tr> <tr><td>2017</td><td>84</td></tr> <tr><td>2018</td><td>81</td></tr> <tr><td>2019</td><td>80</td></tr> <tr><td>2020</td><td>80</td></tr> </tbody> </table>	Year	Emissions	2005	100	2006	99	2007	98	2008	93	2009	92	2010	91	2011	90	2012	89	2013	88	2014	87	2015	86	2016	85	2017	84	2018	81	2019	80	2020	80	
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<p>Example adjustment A: A new growing source The impact of the adjustment reduces emissions in later years by more than the earlier years. This could be from, for example, a new source that grows with time. It is an appropriate case for an adjustment application. In this case, the percentage reduction changes from 20 per cent to 40 per cent.</p>	<p>Example adjustment B: A new constant source This is an example of an adjustment that relates to a new source that is constant with time. Even though the adjustment value is the same for each year of the time series, it acts to increase the percentage reduction between the first and last years in the time series – in this case, from 20 per cent to 25 per cent. It is therefore a valid case for an application.</p>																																		



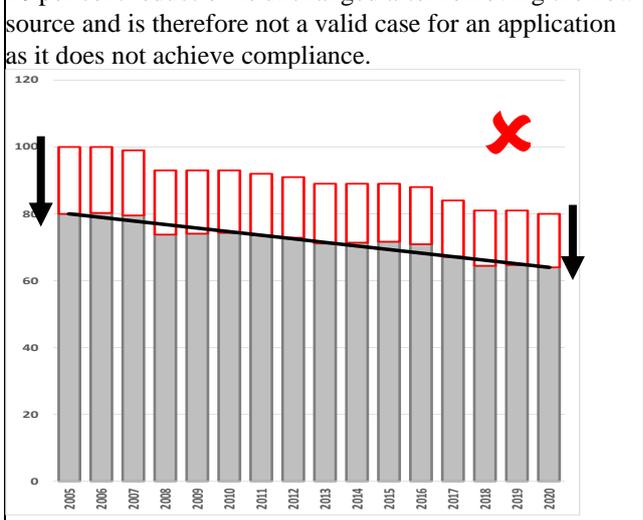
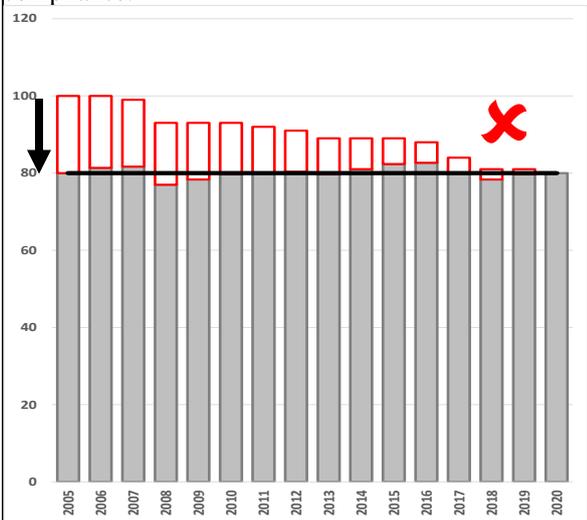
Example adjustment C: A new shrinking source, example 1

Unlike adjustments under ceilings, not all new sources lead to appropriate adjustments under ERCs. In this case, a new source (which decreases across the time series) acts to reduce the percentage reduction from 20 per cent to 0 per cent.

This would not be a valid adjustment application as it would not move a Party from non-compliance into compliance.

Example adjustment D: A new shrinking source, example 2

Example adjustment B (above) shows a new constant source that is a valid application, and example adjustment C (left) shows a shrinking source that is detrimental to achieving compliance with an ERC. There is a theoretical “neutral point” between these two examples. A new source that decreases at the same rate as the unadjusted total has no net effect if it is used as an adjustment – in this case, the 20 per cent reduction is unchanged after removing the new source and is therefore not a valid case for an application as it does not achieve compliance.



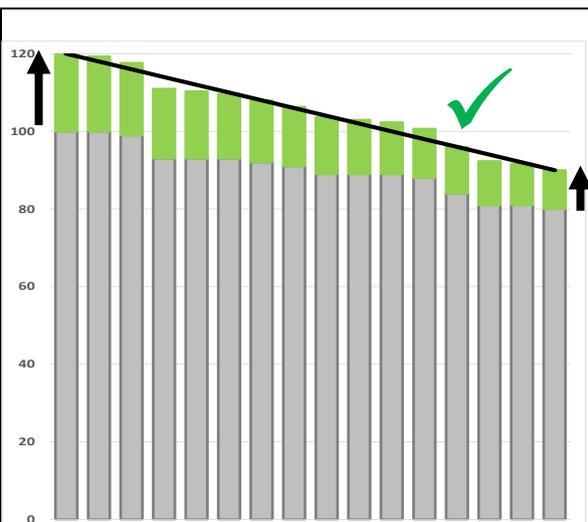
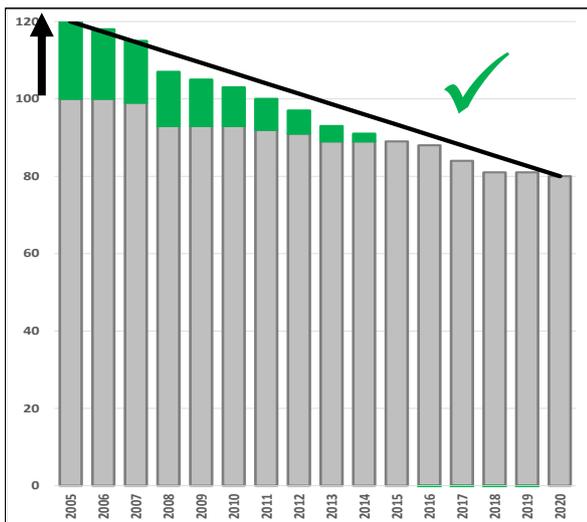
Example adjustment E: No change to 2020 emissions

There are examples of valid adjustments under ERCs that make no revision to the 2020 emissions. Rather than the adjustment reducing emissions in 2020 (example adjustments A–D), the adjustment increases emissions in 2005. The example below might arise when changes to the inventory (based on new science) have decreased the estimates for 2005. The adjustment therefore acts to remove this impact and revises up the 2005 estimates; in this example, the percentage reduction changes from 20 per cent to 33 per cent.

Example adjustment F: Increases in 2020 emissions, but greater increases in 2005 emissions

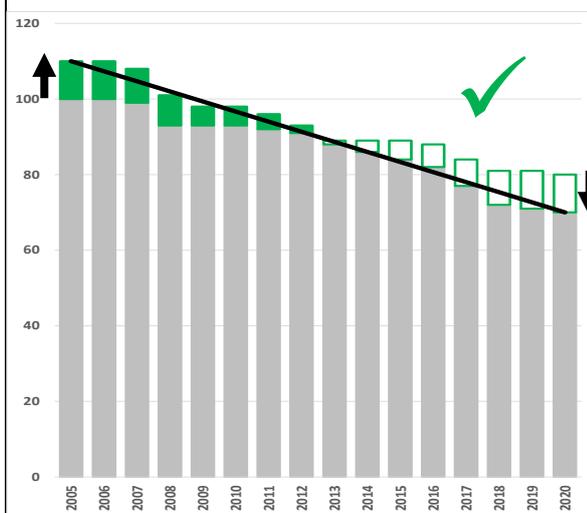
It initially seems counter-intuitive that there may be a valid case for an adjustment that involves revising up 2020 emissions. However, a slightly modified version of example adjustment E (left) can arise where an adjustment increases the 2020 emissions, but also increases the 2005 emissions to a greater extent.

In this example, the percentage reduction changes from 20 per cent to 25 per cent, which could be a valid case for an adjustment.



Example adjustment G: Changes to both 2005 and 2020 emissions

There are many other examples of changes, or combinations of changes, that could be applied to 2005 and 2020 emissions, and some will be valid cases for an adjustment (assuming all other requirements are met). In the example shown below, the adjustment revises up 2005, and revises down 2020, changing the percentage reduction from 20 per cent to 36 per cent



III. Principles for quantification of inventory adjustments under emission reduction commitments

A. Reference version of the EMEP/EEA Guidebook

13. The 2009 version of the EMEP/EEA Air Pollutant Emission Inventory Guidebook is to be used as the reference version for the purpose of calculating adjustments for the amended Gothenburg Protocol.⁷

⁷ Available at www.eea.europa.eu/publications/emep-eea-emission-inventory-guidebook-2009.

B. Information that needs to be reported

14. An inventory adjustment under ERCs makes revisions to the emission estimates for one or more source categories in 2005 and/or relevant years from 2020 onwards:

(a) Reporting of data: The revisions need to be reported in the adjustments under the ERC template provided – entitled “Annex IIa to ECE-EB Air130 adjustment Application”⁸. The adjustment needs to change the status of compliance with the ERC from non-compliant to compliant. This is not simple to interpret from reported data, so the template includes calculations to check that the impact of the adjustment increases the percentage emissions reduction from 2005;

(b) Accompanying methodology and results text: Sufficiently detailed supporting information also needs to be provided, in either the informative inventory report or a separate adjustments report. This is explained in the existing technical guidance for adjustments.⁹

C. Quantification of the adjustment under emission reduction commitments

15. Irrespective of whether the inventory adjustment is based on a new source, or revisions to methodologies or emission factors, the underlying calculations used to quantify the adjustment under ERCs will be the same.

16. The emission reduction (prior to any adjustments) is expressed as:

$$ER_Y (\%) = 100 \times (E_{2005} - E_Y) / E_{2005} \quad (1)$$

Where:

ER_Y is the emission reduction (prior to adjustment) in the year Y compared to emissions in 2005, expressed as a percentage

E_{2005} is the national emission total in the year 2005

E_Y is the national emission total in the year Y

When making an adjustment under ERCs application, Parties will need to demonstrate that ER_Y is lower than the corresponding ERC set for a Party for the given pollutant, i.e. the Party is in non-compliance.

17. The emission reduction after an adjustment has been applied is expressed as:

$$AER_Y (\%) = 100 \times (AE_{2005} - AE_Y) / AE_{2005} \quad (2)$$

Where:

AER_Y is the adjusted emission reduction in the year Y compared to the emissions in 2005, expressed as a percentage

AE_{2005} is the adjusted national emission total in the year 2005 (in some cases, $AE_{2005} = E_{2005}$)

AE_Y is the adjusted national emission total in the year Y (in some cases, $AE_Y = E_Y$, i.e. the emission in year Y is not adjusted)

18. When making an adjustment under an ERC application, Parties should demonstrate that the impact of all adjustments results in AER_Y being greater than the corresponding ERC, i.e. the net impact of the adjustments moves the Party from non-compliance to compliance:

AE_{2005} and AE_Y and are defined as:

$$AE_{2005} = E_{2005} + A_{2005} \quad \text{and} \quad AE_Y = E_Y + A_Y \quad (3)$$

Where:

⁸ Available at: https://www.ceip.at/fileadmin/inhalte/ceip/00_pdf_other/2022/annex_ii_a_to_ece-eb.air130_adjustment_application_v2021.xlsx

⁹ ECE/EB.AIR/130, paras. 11 and 41.

A_Y and A_{2005} are the adjustments made (in absolute terms) to the national emissions totals in years Y and 2005 respectively. These are calculated using the same principles outlined in the existing technical guidance, which explains how revisions to emission factors and methodologies are used in the quantification of the adjustment. In the case of adjustment under ERCs, it may be that one of A_Y and A_{2005} is zero.

19. The following worked example shows the calculations that relate to example adjustment G (see figure above), where the adjustment under ERCs application increases the emission in 2005 from 100 to 110 and decreases the emission in 2020 from 80 to 70:

Equation (1) gives:

$$\text{Emission reduction } ER_Y (\%) = 100 \times (100 - 80)/100 = 20\%$$

Equation (2) gives:

$$\text{Adjustment emission reduction } AER_Y (\%) = 100 \times (110 - 70)/110 = 36\%$$

As a reduction of 36 per cent is greater than the ERC of 20 per cent, this would move the Party from non-compliance into compliance,¹⁰ and is therefore a valid case for an adjustment under ERCs application.

IV. Good practice in calculating and reporting inventory adjustments under emission reduction commitments

20. The review of adjustments under ceilings has highlighted several points that benefit from some clarification. They are included here in relation to adjustments under ERCs, but Parties should note that this is best practice that can be applied to all adjustments.

A. Ongoing commitment to report adjustments under ceilings

21. Parties signatories to the amended Gothenburg Protocol are required to demonstrate compliance with relevant ERCs. They are no longer requested to submit adjustments that demonstrate compliance with emissions ceilings, and any such adjustments under ceilings that are submitted will not be reviewed.

22. Parties signatories to the Gothenburg Protocol, but not to the amended Gothenburg Protocol, are required to demonstrate compliance with relevant ceilings. Their potential use of adjustments remains unchanged, and they may apply for a new adjustment under ceilings and/or continue to report previously approved adjustments.

B. Level of detail of the source categories to which an adjustment applies

23. Existing technical guidance on adjustments does not provide much information on the extent to which changes across several Nomenclature For Reporting (NFR) sources could, or should, be aggregated and reported as one adjustment application, or reported as many individual adjustment applications.

24. It is considered good practice to report an adjustment for each individual source category (as defined in the NFR reporting structure), and not at a finer resolution. However, the sectoral resolution to which an adjustment is applied should be guided by the underlying reason for the methodology revisions, so that all changes can be captured in a single adjustment. This is particularly the case where there are links or impacts across different sources. For example, in manure management, if an underlying parameter is changed that has an impact on ammonia emissions from all livestock classes, then it is sensible to aggregate these and report the total impact as a single adjustment, labelled as being for the source sector "3.B Manure management" even if it is a sum of changes to several sources.

¹⁰ The value of 36 per cent is quoted here to zero decimal places for convenience. All calculations relating to compliance assessments are undertaken using full precision.

25. This approach avoids the need for Parties to include an excessive amount of data in the reporting templates, and also allows the expert reviewers to work more efficiently. However, it may not always be simple to present the adjustment in this way if there are impacts across numerous or diverse NFR sources.

26. In the example given above, it would be particularly important for the Party to provide sufficiently detailed supporting information as part of the adjustment application, so that all the revisions within 3.B Manure management are transparent and can be reviewed by an expert review team.

C.Scope of an individual adjustment

27. The adjustment process allows Parties to create a version of their national emission estimates for compliance assessment that changes non-compliance into compliance for those pollutants for which an adjustment application is requested or has, in the past, been approved. This is done by removing the impact of selected past improvements that have been made to the inventory that are detrimental to achieving compliance with given ceilings or ERCs. This process does not require the removal of revisions to the inventory that have been beneficial to achieving compliance.

28. However, when considering revisions that have been made to an individual source (an “individual source” being defined by the NFR reporting structure), many national inventory compilers have considered it appropriate to include all revisions in their adjustment application (both beneficial and detrimental) and report a net change. The expert review teams have considered this to be best practice but note that this approach is not required by the Executive Body decisions relating to adjustments.

29. In some cases, selecting only the revisions that would be beneficial to attaining compliance would be very complex. For example, quantifying an adjustment under ERCs for passenger cars by accounting for revisions to emission factors is expected to be complex. It is even more involved for a national inventory compiler to selectively include only the changes to specific types of passenger cars or driving conditions that would be beneficial for compliance with an ERC.

V. Applying for an inventory adjustment under emission reduction commitments

30. Applying for an adjustment under ERCs uses the same process as for adjustments under ceilings, with the exception that the ERC version of the adjustment application template should be used. The template entitled “Annex IIa to the ECE-EB Air130 adjustment Application” accompanies this technical guidance and is specifically for applying for adjustments under ERCs. The template is similar in format to the template that is used for adjustments under ceilings. Instructions are included in a “Read me” sheet in the template.

VI. Review of inventory adjustments under emission reduction commitments

31. The review of inventory adjustments under ERCs uses the same process as for adjustments under ceilings and is detailed in existing technical guidance.

VII. Reporting a previously approved inventory adjustment under emission reduction commitments

32. From 2023 onward, reporting of previously approved inventory adjustments under ERCs uses the same process as for inventory adjustments under ceilings, with the exception that the ERC version of the annex VII adjustments summary template (to be developed and made available at CEIP’s website) should be used.

VIII. Source-specific observations relating to inventory adjustments under emission reduction commitments

33. As illustrated in section II above, there is a complex relationship between revisions made to the inventory and valid examples of adjustments under ERCs. Some sector-specific comments are made in the sections below.

34. Road transport: There have been numerous revisions to emission factors for different classes of road vehicles; hence, there are likely to have been some substantial revisions to the emission estimates. However, as previously noted, Parties will need to undertake detailed analysis of the revisions and the trends with time to understand whether the revisions are a valid basis for an adjustment under ERCs.

35. Anaerobic digestion: An adjustment under ERCs that relates to anaerobic digestion needs to split the digestate into that which comes from animal manure, and that which is other organic material:

(a) “Other organic material”: As the 2009 version of the EMEP/EEA Guidebook does not include a methodology for “Other organic material”, this can be considered a new source. Therefore, the adjustment process would act to remove it from the current estimates. This is expected to be beneficial for achieving compliance for most Parties, because it is likely to be a source that has grown with time (see figure above, example adjustment A);

(b) “Animal manure”: Given that there was no specific methodology included in the 2009 version of the EMEP/EEA Guidebook, it is reasonable to assume that ammonia emissions from anaerobic digestion and digestate application to soils would be calculated in the same way as applying the manure directly to soils. Hence, the adjustment would require the following to be quantified:

Current emission estimates (from anaerobic digestion and digestate application to land, caused by animal manure only – irrespective of whether these are reported in agriculture or waste)	Minus	Emission calculated from “normal” manure application (using emission factors from the 2009 version of the EMEP/EEA Guidebook)
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For 2005 and all relevant compliance years. This may or may not be beneficial for compliance, depending on the trends with time, and the differences in emission factors. Parties will need to undertake their own assessment.

36. Nitrogen oxides (NO_x) and non-methane volatile organic compound (NMVOC) emissions from 3.B Manure management and 3.D Agricultural soils – For some Parties to the Convention (such as the European Union member States), NO_x emissions from 3.D Agricultural soils are included in reporting requirements but are excluded when calculating ERCs. NO_x adjustment applications under ERCs for this source category are therefore not valid in the Convention. In NECD, emissions of both NO_x and NMVOC from both 3.B Manure management and 3.D Agricultural soils are reported but are excluded when calculating ERCs. Adjustment applications under ERCs are therefore not valid for NO_x and NMVOC from these source categories in NECD.

37. Sources moved into/out of the national total – There may be examples of sources being reported in “6.B Other (not included in national total)”, and then moved to another NFR source that is included in the national total, or vice versa. These are often small sources but may be valid cases for adjustments under ERCs. Parties will need to assess whether the revision to reporting and the emission trends with time would mean that an adjustment under ERCs based on these changes would result in a beneficial change to achieving compliance and would therefore be a valid basis for an adjustment application.