Council of the European Union

Brussels, 1 December 2025
(OR. en)

16216/25
ADD 2

ENV 1311

COVER NOTE

From:	Secretary-General of the European Commission, signed by Ms Martine DEPREZ, Director
date of receipt:	1 December 2025
To:	Ms Thérèse BLANCHET, Secretary-General of the Council of the European Union
No. Cion doc.:	SWD(2025) 394 annex
Subject:	PART 3/3 COMMISSION STAFF WORKING DOCUMENT EVALUATION Evaluation of the National Emission Reduction Commitments Directive

Delegations will find attached document SWD(2025) 394 annex.

Encl.: SWD(2025) 394 annex

EUROPEAN
COMMISSION

Brussels, 1.12.2025
SWD(2025) 394 final

PART 3/3

COMMISSION STAFF WORKING DOCUMENT

EVALUATION

Evaluation of the National Emission Reduction Commitments Directive

{SWD(2025) 395 final}

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4 DETAILED ANALYSIS OF THE "COHERENCE" EVALUATION CRITERION

BOX 9. Summary of evaluation questions on coherence

Internal coherence - To what extent are the requirements under the NECD coherent with each other, e.g. reporting requirements including their timing?

External coherence - To what extent:

- has the NECD proved to be coherent with relevant EU policies (AAQD, source legislation, climate and energy policies, agricultural policies, biodiversity-related policies, innovation policy)?
- has EU funding contributed to the implementation of the NECD?
- has the NECD proved to be coherent with relevant international frameworks?

4.1 Internal coherence

This evaluation question explored internal coherence along the following dimensions:

- Clarity of provisions;
- Consistency of provisions (no contradiction or overlap);
- Comprehensiveness of provisions (no gaps) and;
- Unintended consequences (e.g. due to provisions or incoherence in them).

This assessment reviews internal coherence of the NECD including with the Commission Implementing Directive on a common format for the NAPCP[291] and the Guidance for the development of NAPCPs[292], both adopted based on Article 6 of the NECD. The assessment summarised in the table below is carried out based on experience gained during implementation and feedback from Member States considering the dimensions set out above.

[291] Commission Implementing Decision (EU) 2018/1522 of 11 October 2018 laying down a common format for national air pollution control programmes under Directive (EU) 2016/2284 of the European Parliament and of the Council on the reduction of national emissions of certain atmospheric pollutants, OJ L256 of 12.10.2018, p. 87.

[292] Communication from the Commission on Guidance for the development of National Air Pollution Control Programmes under Directive (EU) 2016/2284 of the European Parliament and of the Council on the reduction of national emissions of certain atmospheric pollutants, OJ C77 of 1.3.2019, p. 1.

Table A - 53 – Internal coherence analysis

Provision	Clarity	Consistency	Comprehensiveness	Unintended consequences
Article 1 **Objectives and subject matter**				
Article 2 **Scope**	Terms 'exclusive economic zone' (stemming from the Law of the Sea) and 'pollution control zone'; There is a definition of 'pollution control zone' in Article 3(13). Both terms are used in Sulphur Directive 2016/802; this has not led to any particular problem so far.			
Article 3 **Definitions**				
Article 4 **National emission reduction commitments**	The use of the word 'subsequent' in Article 4(2), third subparagraph makes it unclear as to which informative inventory report should include an explanation on reasons for deviation from the linear trajectory and the measures that would bring the Member States back on their trajectory. Article 4(3) could be misunderstood in the sense that emissions that are not counted for compliance do not have to be reported.	While Article 4(2) requires Member States to take measures aimed at limiting their 2025 emissions to meet a linear trajectory, Article 4(1) does not explicitly set out the taking of measures to reach the emission reduction commitments. In addition, measures should be taken beyond 2025 to meet the linear trajectory.		
Article 5 **Flexibilities**	Article 5(2) on a flexibility related to an exceptionally cold winter or an exceptionally dry summer lacks	The flexibility under Article 5(2) requires averaging national annual emissions 'for the year in question,	Article 5(1), subparagraph 2, only refers to emission reduction commitments for the year 2020 to	

Provision	Clarity	Consistency	Comprehensiveness	Unintended consequences
	clarity as to how winter and summer should be defined and how to determine what should be considered as 'exceptional'. Article 5(3): the TSAP 16 is not clearly referenced in the NECD.	the year preceding that year and the year following it'. This means that it can only be applied/checked in the year following the year in question. It is therefore not possible to determine whether the MS is in compliance with ERCs in the year in question, but only the year after. Likewise, the deadlines for applying and assessing the flexibility under Article 5(5) and (6) cannot be applied in the 'year concerned' as the full data allowing for a complete application and assessment will become available only in the year after.	2029, not to the years 2030 onwards. This has so far not been relevant, because compliance is so far only checked against the 2020-2029 emission reduction commitments. Article 5(1) allows for adjustments to emission inventories when improved methodology leads to higher emission estimates. The reverse situation is however not considered: When improved methodology leads to lower emission estimates, no adaptation of the emission reduction commitment for that MS is envisaged.	
Article 6 **National air pollution control programmes**	Article 6(3) requires Member States to update their NAPCP at least every four years but does not clarify as of when exactly that four-year period should be calculated. Article 6(4) requires Member States to update their Policies and Measures within 18 months of the submission of the 'latest' national emission inventory or national emission projections. However, inventories are submitted annually, hence there is an updated inventory before the 18-month period elapses. Referring to the "latest" inventory in that context is therefore not appropriate because if taken literally, the 18-month period would	Article 6(2) last sentence provides that agricultural measures set out as mandatory in Annex III Part 2 to the NECD are included in the NAPCP. Mandatory measures should however directly be transposed into national law, instead of included in the NAPCP which is a programme and has different legal quality than a law. Article 6(4) only speaks of an update of PaMs, while Article 10(1), when referring to Article 6(4) speaks of an update of the NAPCP.	Article 6(6) requires Member States to conduct transboundary consultations where appropriate when preparing the NAPCP but does not give any indication on how this should be done.	As agricultural measures identified as mandatory in Annex III Part 2 are to be included in the NAPCP according to Article 6(2) instead of implemented on the basis of the Directive, their application cannot be checked through the transposition process. It becomes difficult to verify if a Member State has made those measures mandatory, as NAPCP only details additional measures, but not necessarily measures already put in place. Article 6(3) requires Member States to update their NAPCP at least every four years. As some Member States were late in reporting their

Provision	Clarity	Consistency	Comprehensiveness	Unintended consequences
	start to run again after submission of the next inventory and would not elapse. Furthermore, Article 6(4) does not clearly spell out what kind of measures should be update. These should be measures that address the non-compliance and would bring the MS into compliance. A number of NGOs commented in the **TSC** that too little detail on PaMs was provided by Member States in their NAPCPs.			first NAPCP, the deadlines for updating their NAPCPs can be very different from one Member State to another. Participants in the **stakeholder** workshop suggested a precise timelines to provide certainty to all involved and to not given an advantage to Member States that delivered late.
Article 7 **Financial support**				
Article 8 ***National emission inventories and projections, and informative inventory reports***	Article 8(3) refers to informative inventory reports, even though those reports also have to provide background on projections. The title of the document is however identical with the same document to be submitted under the Gothenburg Protocol which facilitates alignment.			
Article 9 ***Monitoring air pollution impacts***			Article 9 requires Member States to monitor impacts of air pollution on ecosystems. However, no link has been made to Article 6 on taking measures to address those impacts. The list of habitats to be monitored according to Article 9(1) does not include certain habitats.	Article 9 gives Member State leeway in setting up their ecosystem monitoring networks and indicators to allow them to adapt to their needs. The differences in monitoring make it however difficult to compare data between Member States and draw any EU wide conclusions.
Article 10		Article 10(1), second subparagraph refers to an update of the NAPCP	Article 10(1) requires the first NAPCP as well as updates of	

Provision	Clarity	Consistency	Comprehensiveness	Unintended consequences
Reporting by Member States		under 6(4) whereas Article 6(4) refers to an update of the policies and measures only. It is therefore unclear whether Member States are only required to update their policies and measures or if a wider update of the NAPCP is required.	NAPCPs under Article 6(4) to be submitted to the Commission but is silent about the submission of an NAPCP updated under Article 6(3). Article 10(1), third subparagraph on the examination of the NAPCP by the Commissions refers explicitly to Articles 6 and 4(2) but not to Article 4(1) and Annex III, actually establishing the emission reduction commitments. Article 10((3) requires the Commission to review the national emission inventory data, however no equivalent provision requires the Commission to review the projections submitted by Member States.	
Article 11 ***Reports by the Commission***				
Article 12 ***European Clean Air Forum***				
Article 13 ***Review***				
Article 14 ***Access to information***			Article 14 (3) requires the Commission to publish the results of the examination of NAPCP, but not the results of the review of Member State emission inventories.	

Provision	Clarity	Consistency	Comprehensiveness	Unintended consequences
Article 15 ***Cooperation with third countries and coordination within international organisations***				
Article 16 ***Exercise of the delegation***				
Article 17 ***Committee procedure***				
Article 18 ***Penalties***	The penalty clause is not clear about what is meant by 'national provision adopted pursuant to this Directive'. This can be understood to only cover transposition provisions or more broadly as covering any other provisions addressing emissions to air.			
Article 19 ***Amendment to Directive 2003/35/EC***				
Annex I	Under Table A Member States are required to report on black carbon, 'if [data is] available'. Similarly, Table D provides for reporting on heavy metals and total suspended particles 'if available'. It is not clear what 'if available' means and what efforts can be expected from a Member State to report these data.	Table C sets out specific projection years for which projections should be provided. Some of these years are outdated now. The provision is thus not future proof and does not provide for an update of projection years.	Footnote 9 in Table A and footnote 1 in Table C provide for the possibility to resubmit inventories in case of errors. This possibility is not stipulated for projections.	
Annex II		Tables A and B still contain UK emission reduction commitments		

Provision	Clarity	Consistency	Comprehensiveness	Unintended consequences
		and emission reduction commitments for the EU 28. The NECD does not establish an EU emission reduction commitment in Article 4. The EU has no emissions 'of its own' on which to act. The EU percentages shown in the table are, as regards the period 2020 to 2029, those included in Annex II to the Gothenburg Protocol. The emission reduction commitments for the EU are a result of a calculation taking into account all Member State reduction commitments and related reductions in kt at the time of adoption. These amounts vary however due to recalculations in the context of historic inventories, so that the % for the EU is only indicative. Therefore, it is misleading to present the % for the EU as fixed in the NECD. The table is no longer consistent with the current situation after the UK withdrew from the EU. There is no mechanism to adapt the indicative numbers for the EU.		
Annex III	There is some uncertainty about the content and presentation of updated NAPCPs. Member States at expert group meetings raised questions as to the content and scope of updated NAPCP. The review of updated	Part 1 point 1(b) refers to 'policy option' while other provisions only refer to 'policies and measures'. Annex III, Part 2 section B introduces the ban of open field	Annex II Part 2 sets out mandatory and optional agricultural measures for inclusion in the NAPCP in accordance with Article 6(2). However, there is no obligation for MS to inform about mandatory	

Provision	Clarity	Consistency	Comprehensiveness	Unintended consequences
	NAPCPs showed that reporting on implementation of PaMs selected for adoption in the previous NAPCP would provide transparency on progress of PaM implementation.[293] The reference to 'relevant Ammonia Guidance Document' in Annex III Part 2 is not precise. On the other hand, the reference to the UNECE Framework Code for Good Agricultural Practice for Reducing Ammonia Emissions of 2014 will become outdated when superseded.	burning of agricultural harvest residue and waste and forest residue as an option but makes it mandatory to monitor and enforce the implementation of any ban implemented and provides for limitations to exemptions to the ban which is inconsistent with the introduction of a ban as voluntary.	measures that have already been implemented and are therefore not included in NAPCP as additional measures which hampers reviewing the implementation of mandatory agricultural measures.	
Annex IV	Annex IV requests MS to use the EMEP/EEA guidebook but does not clarify which version. In principle, this should be the latest applicable version. Annex IV, Part 2 point 2 on emission projections establishes that MS must provide a 'with additional measures' projections where relevant. The meaning of 'where relevant' is ambiguous and has been interpreted differently by MS. "Where relevant" could mean 'where additional PaM exist' or 'where additional PaMs are needed to meet the emission reduction commitments'. The 2023 EMEP/EEA guidebook now includes an explanation, however	Annex IV Part 2 point 1 (a) (b) and (c) set out that the projections should contain policies and measures, results of sensitivity analysis and a description of methodologies, models, underlying assumptions and key input and output parameters. However, there is an overlap with information to be provided either in the NAPCP as regards the policies and measures (Annex III, Part 1), or with the informative inventory report (Annex IV, part 3), which includes information on methodologies, assumptions, input data etc. In line with the EMEP Reporting Guidelines and the EMEP/EEA Guidebook, this information is	Annex IV, second paragraph of the introductory part clarifies that provisions of Annex I and Annex IV to the NECD prevail over the EMEP Reporting Guidelines but does not do so in relation to the EMEP/EEA Guidebook. Annex IV, Part 2 point 3 provides that national emission projections must be consistent with emission inventories for the year X-3. There is however MS (about half of MS) that use more updated inventory data for the preparation of projections, namely inventory data for the year X-2. Since the latter is more up-to-date data this has been accepted. But the NECD does not cover this case. (The EMEP	

[293] Horizontal review report of 2024

Provision	Clarity	Consistency	Comprehensiveness	Unintended consequences
	that reading might not be supported by the provisions of the NECD where Article 6(4) establishes the requirement to update PaMs. Annex IV Part 3 on informative inventory reports does not clarify that this report should also be used for projections reporting. The title of the report is misleading in this regard, while the EMEP Reporting Guidelines in accordance with which the report is to be prepared, establish that the IIR should also cover projections. Annex IV, Part 4, point 3 refers to the recalculation of adjusted emission, though is not clear regarding the years of the time series concerned.	provided in the IIR, not the projections.	Reporting Guidelines explicitly accept also data from the year X-2.)	
Annex V				Annex V sets out optional indicators for monitoring air pollution impacts referred to in Article 9. While the optional character of the indicators was chosen to provide MS with flexibility in adapting the monitoring system to their specificities, it has shown that the lack of obligatory parameters hinders comparability of data.
Commission Implementing Decision (EU) 2018/1522			The Implementing Decision provides the common format for the first NAPCP but does not provide instructions as to the preparation of	

Provision	Clarity	Consistency	Comprehensiveness	Unintended consequences
			an updated NAPCP or an update of PaMs under Article 6(4).	
Guidance for the development of the National Air Pollution Control Programmes under Directive (EU) 2016/2284			The Guidance is limited to the preparation of the first NAPCP and does not provide support for the preparation of updated NAPCPs.	

The analysis of internal coherence considered the NECD and the Commission Implementing Directive on a common format for the NAPCP and the Guidance for the development of NAPCPs, both adopted based on Article 6 of the NECD. The assessment concludes that overall, provisions of the NECD are coherent. Nonetheless, there has been a lack of clarity regarding the timing of the adoption and submission of updated NAPCP and PaMs as the provisions under Articles 6(3), 6(4), 10(1) and 10(2) do not fully interlink. Furthermore, while the NECD, the Commission Implementing Decision on the common format of the NAPCP and the Guidance are explicit on the content of the first NAPCP, they address to a lesser extent the update of NAPCPs and PaMs which has led to questions on content and some variation in submissions from the Member States.

Stakeholders mostly agreed that the structure of the NECD is logically sound and that its core elements—emission reduction commitments, planning through NAPCPs, reporting obligations, and monitoring—are complementary. However, NGOs raised concerns raised about the Directive's flexibility provisions under Article 5 lowering ambition for sustained action.

4.2 Is the NECD coherent with the current and revised Ambient Air Quality Directives)?

This question looks at complementarity, as well as overlaps, gaps and inconsistencies between the NECD and AAQD.

Although the AAQD and the NECD regulate two distinct dimensions of clean air policy, they are interconnected in certain aspects. An analysis of complementarity and additionality, as well as overlaps and gaps between the AAQD and its revised text adopted in 2024 on the one hand, and the NECD on the other, is presented in the table below.

Table A - 54 – Analysis of the coherence between the NECD and the AAQD as currently in force

Provision	Analysis of the coherence with the AAQD	Changes in analysis with the revision of the AAQD
Article 1 **Objectives and subject matter**	One of the objectives of the NECD is the achievement of the air quality objectives.	
Article 2 **Scope**	The pollutants covered by the directives are largely complementary. Despite ozone not being covered under the NECD, it sets ERCs for some ozone precursors. Despite methane being an ozone precursor, the NECD does not set ERCs for that pollutant (see sections 4.5 and 5.3).	NH_3 and black carbon, already covered by the NECD, have been included in the revised AAQD as a pollutant of emerging concern for monitoring.
Article 4 **National emission reduction commitments**	By setting national emission reduction commitments for pollutants covered by the AAQD or precursors of pollutants	The AAQD sets stricter limit values to be attained as of 2030. This timeframe is coherent with

	covered by the AAQD, the NECD contributes to the reduction of background concentrations and the attainment of air quality standards.	the stricter ERCs applying under the NECD as from 2030.
Article 6 **National air pollution control programmes**	The AAQD requires Member States to ensure that the NAPCP is implemented to achieve ozone target values where it is exceeded. The AAQD requires Member States to ensure to the extent possible that the air quality plans established in application of that Directive are consistent with programmes required under the NECD.	The AAQD requires Member States to ensure that the relevant NAPCP includes measures addressing ozone precursors covered by the NECD, where the ozone target value is exceeded. The AAQD requires Member States to ensure where feasible, consistency between air quality plans and roadmaps and NAPCPs
Article 7 **Financial support**	The provision supports the funding of measures to comply with the objectives of the NECD and thus also air quality objectives.	
Article 8 ***National emission inventories and projections, and informative inventory reports***	The preparation of national emission inventories, projections, national gridded data of emissions by source category and large point source (LPS) inventories support the implementation of the AAQD (air quality assessment and planning). Gridded and LPS data has been of limited use though for monitoring/ modelling due to the low quality of data and the low frequency of reporting, and the low resolution of gridded data.[294]	Explicit references to the use of data gathered under the NECD had been included in the revised AAQD. This data could also become more relevant with the increased role of modelling under the revised AAQD.
Article 9 ***Monitoring air pollution impacts***		The assessment of risks posed by air pollution to vegetation and natural ecosystem as well as the compliance with critical levels required under the AAQD take into account and complement the ecosystem monitoring set under the NECD. The AAQD establishes a link between the use of bio indicators and the monitoring undertaken under the NECD. The AAQD also requires a coordination between the monitoring supersites and monitoring of air pollution impacts undertaken pursuant to the NECD.

[294] Aether, CITEPA and Ricardo (2023).

Article 11 ***Reports by the Commission***	The Commission's regular implementation reports have to include an assessment of the NECD contribution to air quality levels.	
Article 12 ***European Clean Air Forum***	The European Clean Air Forum has the purpose to support the implementation of Union legislation and policies related to improving air quality.	
Annex III Part 1 ***Minimum content of national air pollution control programmes***	National air pollution control programmes under the NECD must contain information on progress in improving air quality and, where available, on the impact of the policy options considered on air quality.	

Feedback from stakeholders from the scientific community in the target consultation confirmed that the quality, type and frequency of gridded data reported under the NECD could be improved to make it more useful for air quality modelling.

Coherence between the AAQD and the NECD is high. An exception relates to ozone, where the NECD ERCs only cover a subset of relevant precursor pollutants (i.e. not for ozone) thus not fully harvesting the potential to contribute to the achievement of EU air quality standards for ozone as set in the AAQD. Coherence between the texts has also improved with the revision of the AAQD, which introduced additional direct references to the NECD to increase the use of data reported under the NECD for air quality assessment and management.

Stakeholders rated the coherence between the NECD and AAQD as the highest among the policies listed (highly coherent: 19 OPC, 13 TSC; somewhat coherent 16 OPC, 17 TSC). When answering the question whether coherence has changed over time, some NGO respondents highlighted that the revision of the AAQD should be supplemented by an ambitious but pragmatic revision the NECD, to ensure that levels of ambition are coherent. Some public authorities thought that coherence was good with the AAQD and remained at the same level as legislation has been updated in a stepwise manner.

4.3 Has the NECD proved coherent with other legislation (sectoral legislation and wider EU policies)?

The evaluation looked at the interactions between the NECD and legislation that has a bearing on air pollutants covered by the NECD and that address specific sources of these air pollutants. It analysed legislation that was changed or adopted during the evaluation period (2016-2025).

The tables below use the term *complementary* if the policy analysed includes requirements or elements that contribute to the same overall objective as the NECD ("achieving levels of air quality that do not give rise to significant negative impacts on and risks to human

health and the environment" – Article 1) but that do not address elements covered by the NECD (e.g. if a policy addresses emission sources that are not counted towards compliance with NECD emission reduction commitments). In this case, there are no overlaps between the two policies.

The table uses the term *coherent* in cases where the analysed policy includes requirements or elements that directly contribute to complying with the NECD (e.g. by addressing the same pollutant or the same sector), and in doing so is not in contradiction with the NECD.

The text comments on the extent to which the policies are coherent with the NECD, identifies any areas of incoherence, as well as any changes in coherence over the NECD evaluation period.

4.3.1 Coherence of source-specific legislation with the NECD

Table A - 55 – Coherence between source-specific legislation with the NECD (transport and industry)

Policy area	EU policy	Remarks on coherence
Road transport	Euro emission standards	*Links between the policies* The successive Euro emission standards for vehicles set emission limits for air pollutants, with varying levels of stringency depending on the version of standards as well as the category of vehicles considered. Therefore, Euro emission standards help Member States meet their NECD emission reduction commitments (ERCs) by ensuring a reduction of relevant air pollutant emissions from road transport. To reach ERCs, emissions from road transport can be further targeted by national policies (e.g. through incentives for early adoption of clean vehicles, scrappage schemes, etc). *Coherence between the policies* The NECD does not include any specific measures related to road transport, therefore there are no overlaps of requirements. Euro emission standards help Member States meet their NECD emission reduction commitments. The legislation on Euro emission standards and the NECD are therefore coherent. *Change in coherence over time* The introduction of the most recent version of the Regulation on emission standards (Euro 7) from 2025 onwards will help to further reduce air pollutant emissions. Changes brought by the Euro 7 include limiting emissions from brakes and tyres on new light-duty vehicles (cars and vans), as well as stricter exhaust emission limits for new heavy-duty vehicles (buses and trucks). Therefore, the most recent version of the Euro emission standards (Euro 7) contributes more to the achievement of the NECD objectives and the two policies remain coherent with each other.
Transport	Fuel Quality Directive	*Links between the policies* The Fuel Quality Directive (FQD) aims to minimise the negative effects on health and environment from the use of petrol and diesel fuels in road transport and non-road mobile machinery by establishing minimum quality standards including through a ban on lead in petrol and a limit of

Policy area	EU policy	Remarks on coherence
		sulphur content in diesel fuels; and regulating vapour pressure of summer petrol. Therefore, FQD requirements help reduce emissions of air pollutants covered by ERCs in the NECD: the FQD contributes to reducing SO_2 emissions through the limit in sulphur content, to reducing particle emissions through a PAH fuel quality standard and reducing VOC emitted during fuel evaporation by a lower volatility requirement during summer. Furthermore, an evaluation of the FQD[295] estimates that technological progress brought by the sulphur threshold indirectly contributed to emission reductions for PM and NO_x (both covered by ERCs under the NECD), in conjunction with the enhanced ambition of the most recent Euro emission standards. As regards regulations on vapour pressure of summer petrol (Article 3(2) of the FQD), Member States can under certain conditions request a derogation to place on the market during the summer period petrol of higher vapour pressure (Article 3(4)). As this has implications for emissions of volatile organic compounds (which are regulated under the NECD, but as an ozone precursor are also of relevance for complying with air quality standards under the AAQD), such derogation can only be granted if the MS is compliant with standards and ERCs under clean air legislation (Article 3(5) of the FQD). According to a 2021 technical assessment study[296], Member States applying for a derogation estimate that the associated increase in NMVOC emissions ranges between 0.1% to 0.3% of total NMVOC emissions, and that this would not place them at risk of non-compliance with the NECD. It is however expected that the largest improvement in terms of NMVOC from the fuel will be reached by the most recent Euro standards which require a better system to capture evaporative emissions (i.e. NMVOC emissions escaping from the fuel system of a vehicle). *Coherence between the policies* The FQD and the NECD are coherent: FQD requirements help reduce emissions of air pollutants covered by NECD ERCs and its requirements on derogations regarding petrol of higher vapour pressure take into consideration compliance with the NECD. *Change in coherence over time* No change observed over the NECD evaluation period.
Maritime Transport	Sulphur Directive	*Links between the policies* The 2012 revised Sulphur Directive (codified in 2016) establishes maximum sulphur contents for some land and marine fuels as well as fuels used in port operations. It aligns with the sulphur in fuel limits for maritime transport set by the International Convention for the Prevention of Pollution from Ships (MARPOL) in Regulation 14 of the 2008 revised (and entered into force in 2010) Annex VI[297]. By setting maximum sulphur content limits, the Sulphur Directive primarily helps reduce SO_2 emissions, which are also covered by ERCs under the NECD. It also

[295] Commission Staff Working Document, Evaluation of Directive 98/70/EC relating to the quality of petrol and diesel fuels ('Fuel Quality Directive'), SWD(2017) 179 final.
[296] EC (2021), Technical Assessment of Transport Fuel Quality Parameters.
[297] Resolution MEPC.176(58), Revised MARPOL Annex VI.

Policy area	EU policy	Remarks on coherence
		indirectly contributes to lowering $PM_{2.5}$ concentrations[298]. In 2016, the sulphur in fuel EU acquis was also adopted in the countries of the Energy Community. Established sulphur limits are more stringent within SO_x Emission Control Areas (SO_x -ECAs), where they are recognised as leading to a significant decrease in SO_2 concentrations for coastal areas in the EU[299] The Baltic Sea and North Sea were designated by the International Maritime Organisation in 2007-8 as SO_x-ECAs. The Sulphur Directive covers SO_2 emissions in the EU from both national and international maritime traffic (Article 1). Air pollutant emissions from international maritime traffic are not included in national compliance totals under the NECD (Article 4(3)). This is coherent with the approach taken under the UNECE Air Convention. Furthermore, the Sulphur Directive contributes to reduced sea acidification resulting from the deposition of air pollutants containing sulphur into the sea. *Coherence between the policies* The Sulphur Directive is complementary to the NECD, in addressing SO_2 emissions from *international* maritime traffic. Regarding SO_2 emissions from *national* maritime traffic, the Sulphur Directive and the NECD are coherent with each other. *Change in coherence over time* The Mediterranean Sea became a SO_x -ECA following the 2022 amendment of MARPOL Annex VI[300], with the new sulphur limit taking effect from 1 May 2025. Therefore, the impact of the Sulphur Directive on SO_2 emission reductions will be enhanced. The North-East Atlantic will also become a SO_x ECA as of 2027. It is important to note that these controls are far less strict than that of emissions from land sources, including inland shipping through the NRMM. The two policies will continue to be coherent with each other.
Maritime Transport	MARPOL Annex VI- Regulation 13	*Links between the NECD and the Convention* Annex VI of the MARPOL Convention sets NO_x emission limits for marine diesel engines with a power output of more than 130 kW in Regulation 13 since the 2008 revision. Contrary to sulphur cap limits under Regulation 14, NO_x emission limits are not directly integrated in EU legislation. However, all Member States ratified Annex VI of the MARPOL Convention and thus are required to comply with these emission limits. These NO_x emission limits contribute to decreasing NO_x emissions; NOx being a pollutant covered by ERCs under the NECD. While the MARPOL Annex VI covers both national and international maritime traffic, only NO_x emissions from national maritime traffic are included in NECD compliance totals. The latter account for 15.4% of all maritime traffic NO_x emissions according to 2022 emission inventories submitted under the NECD[301].

[298] Secondary $PM_{2.5}$ is formed in the atmosphere from precursor emissions including SO_2, NO_x and NH_3.
[299] Report from the Commission on implementation and compliance with the sulphur standards for marine fuels set out in Directive (EU) 2016/802, COM(2018) 188 final.
[300] Resolution MEPC.361(79), Amendments to the Annex of the 1997 MARPOL Convention.
[301] EEA, National air pollutant emissions data viewer 2005-2022, 2024 edition, accessed 21 January 2025.

Policy area	EU policy	Remarks on coherence
		More stringent emission limits are set in NO_x-Emission Control Areas (NECAs), where Tier III limits apply. The 2017 amendment to Annex VI designated the Baltic Sea and the North Sea as NECAs, taking effect from January 2021. As both seas border EU Member States, this is expected to reduce significantly NO_x concentrations in North Sea bordering countries and eutrophication in the Baltic Sea[302]. However, as underlined by a support study published in 2018[303], the Tier III NO_x emission limits apply only for new vessels from 2021 onwards, thus NO_x emissions are expected to decrease slower than SO_2 emissions. *Coherence between the NECD and the Convention* Considering the above, the MARPOL Annex VI is complementary to the NECD in addressing NO_x emissions from *international* maritime traffic. Regarding NO_x emissions from *national* maritime traffic, the MARPOL Annex VI and the NECD are coherent with each other. *Change in coherence over time* The designation of the Baltic Sea and the North Sea as ECAs taking effect as from 2021 has further enhanced the coherence of Regulation 13 of MARPOL Annex VI with the NECD. The North-East Atlantic will also become a NO_x ECA as of 2027, which will lead to the control of NO_x from international shipping in all EU waters except in the Mediterranean and Black Sea. It is important to note that these controls are far less strict than that of emissions from land sources, including inland shipping through the NRMM.
Maritime Transport	FuelEU Maritime Regulation	*Links between the policies* The FuelEU Maritime Regulation sets targets for the reduction of the greenhouse gas intensity of fuels used by the shipping sector. It aims for an increased use of renewable and low-carbon maritime fuels. Following the beginning of application of the FuelEU Maritime Regulation in January 2025, emissions of air pollutants from maritime navigation, namely N_2O, NO_x, NMVOC, SO_2, (the three latter covered by ERCs under the NECD), are expected to decrease through the increased use of onshore power supply (OPS) or equivalent technologies by the most polluting fleet. Passenger traffic activity is also expected to slightly decrease, leading to reduced air pollutant emissions[304]. However, air pollutant emissions from international maritime traffic are not included in NECD compliance national totals. Furthermore, across relevant pollutants, the major source of maritime emissions remains international maritime traffic (see analysis on the Sulphur Directive above). *Coherence between the policies* The FuelEU Maritime Regulation is complementary to the NECD in addressing emissions from *international* maritime traffic.

[302] Report from the Commission on implementation and compliance with the sulphur standards for marine fuels set out in Directive (EU) 2016/802, COM(2018) 188 final.

[303] IIASA (2018), The potential for cost-effective air emission reductions from international shipping through designation of further Emission Control Areas in EU waters with focus on the Mediterranean Sea.

[304] Commission Staff Working Document, Impact Assessment Accompanying the Proposal for a Regulation on the use of renewable and low-carbon fuels in maritime transport, SWD(2021) 635.

Policy area	EU policy	Remarks on coherence
		Regarding *national* maritime traffic, the FuelEU Maritime Regulation and the NECD are coherent with each other. *Change in coherence over time* No change observed over the NECD evaluation period.
Non-road transport	Non-road mobile machinery Regulation	*Links between the policies* The Non-Road Mobile Machinery (NRMM) Regulation requires engine manufacturers to obtain type-approval for engines of different power ranges. To obtain this, engines must meet emission limits for air pollutants. Through this mechanism, the NRMM Regulation contributes to compliance with ERCs. *Coherence between the policies* The NRMM Regulation and the NECD are coherent. *Change in coherence over time* No change observed over the NECD evaluation period.
Transport - aviation	ReFuelEU Aviation Regulation	*Links between the policies* The ReFuelEU Aviation Regulation promotes the gradual supply and uptake of Sustainable Aviation Fuel (SAF) at Union Airports (2% share of SAF at Union Airports from 2025 up to 70% share of SAF in 2050). In principle due to their more controlled chemical composition, introduction of SAF into the aviation fuel may lead to lower pollutant emissions per flight than conventional aviation fuels. Furthermore, the ReFuelEU Aviation Regulation will assess possible measures to optimise the fuel content of aviation fuels, anticipating that this may unlock reductions in air pollutant emissions and contribute to the long-term sustainability goals. To this end, the supporting analytical work is ongoing under the Pilot Project on "European body for jet fuel standards and safety certification". It aims to investigate ways to minimise the negative environmental and climate impact of aviation fuel emissions. This primarily focuses on decreasing non-CO_2 emissions by optimising the fuels' chemical composition. However, the ReFuelEU Aviation Regulation does not cover all aviation fuels used by all types of aircrafts flying within the EU, but only aviation fuels supplied at Union Airports to aircraft operators. The NECD includes under the national compliance totals only air pollutant emissions from aviation during landing and take-off (LTO, Article 4(3)). This is in line with reporting under the UNECE Air Convention. *Coherence between the policies* The ReFuelEU Aviation Regulation is complementary to the NECD, in addressing air pollutant emissions from *aviation beyond LTO*. Regarding air pollutant emissions from *LTO*, the ReFuelEU Aviation Regulation and the NECD are coherent with each other. *Change in coherence over time* The ReFuelEU Aviation Regulation was adopted in 2023 and applies only since 1 January 2024, considering the SAF mandate have only kicked off in January 1st, 2025. It is therefore a significant change, but the real effects are still hard to judge. The two policies are expected to remain coherent with each other.

Policy area	EU policy	Remarks on coherence
Industry	Industrial Emissions Directive	*Links between the policies* Under the Industrial Emissions Directive (IED), large agricultural and industrial installations require a permit granted by national authorities to operate. The IED sets out the main principles for permitting and controlling those installations. Permit conditions are based on the best available techniques (BATs), and the conclusions of these BATs ('BATCs') are adopted as Commission implementing decisions for each relevant sector. Notably BATCs can include a range of emission limit values called BAT associated emission levels (BAT-AELs). The evaluation of the IED indicated that in 2017 installations covered by the Directive are responsible for over half of anthropogenic emissions to air of CO_2, SO_X, NMVOC and heavy metals (Cd, Hg and Pb), and are key sources of NO_X (32%) and PM_{10} (28%), and represent about 5% of NH_3 emissions. Large combustion plants, refineries, intensive rearing of pigs and poultry, and iron and steel represent the highest share of emissions covered. *Coherence between the policies* NAPCPs under the NECD can and do refer to the implementation of BATs as a means of delivering ERCs under the NECD. Annex III Part 2 of the NECD on agricultural measures to be integrated in the NAPCP explicitly requires Member States to make use of BATs to reduce NH3 emissions. The IED is an essential instrument in delivering reductions in atmospheric pollution from the installations covered, whilst covering a wider range of pollutants than the NECD ERCs and being more explicit in terms of measures to be applied to installations under its remit. The evaluation of the IED concluded that the IED had been broadly coherent with the NECD. At the same time, the NECD covers potentially all sources of the five main pollutants, depending on MS policies to reach ERCs, as its coverage is not limited to certain installations per sector as is the IED (e.g. the IED covers only 30% of pig and poultry farms, whereas MS policies to reach ERCs may cover a wider range of farms, and include other sources, e.g. from cattle rearing). The IED offers a framework for Member States that can be used to both implement the requirements of BATC and expand their scope to reach further emission reductions in line with the NECD. Considering the above, the IED and NECD are complementary and coherent with each other. In particular, the NECD complements the IED in including in its scope emissions independent of size of installations and from a wider range of economic activities (cattle rearing being an example); and the IED contributes to reaching NECD ERCs. *Change in coherence over time* The 2010 IED required MS to set emission limit values that do not exceed BAT-AELs determined in BATCs, without specifying a default value in the range of BAT-AELs. This was changed through the 2024 revision of the IED: the competent authority will have to set the 'strictest achievable' emission limit values, based on the analysis of the feasibility of meeting the strictest end of the BAT associated emission limits range and demonstrating the best overall performance that the installation can achieve (article 15(3) of the 2024 revised Directive).

Policy area	EU policy	Remarks on coherence
		Additionally, the 2024 revision of the IED[305] extended its coverage: IED will cover 37 000 industrial installations, 38 800 pig and poultry farms, as well as waste landfills, metal extraction mining and battery gigafactories. Cattle rearing is not included in the revised IED, but the Commission will review the need for Union action to comprehensively address emissions from livestock, in particular cattle by 2026. By 2050, the implementation of the revised IED is expected to reduce emissions of key air pollutants (PM, SO_2, NO_X and NMVOC) by up to 40% compared to 2020 levels. In conclusion, the 2024 revision of the IED extended the scope of pigs and poultry rearing installations covered and require Member States to set by default the strictest achievable emission limit values in permit conditions. Therefore, the coherence of the IED with the NECD has been enhanced.
Industry	Medium Combustion Plants Directive	*Links between the policies* The Medium Combustion Plants (MCP) Directive covers combustion plants equal to or greater than 1MW and less than 50MW and thus complements the IED (that covers large combustion plants) and the emission standards adopted under the Ecodesign directive (that cover small combustion plants and appliances). *Coherence between the policies* The MCP Directive implements emission limit values for MCPs, set by the 2012 revised Gothenburg protocol, for NO_x, SO_2 and PM, pollutants all covered by an ERC under the NECD. Thus, the MCP Directive is coherent with the NECD. *Change in coherence over time* No changes observed over the NECD evaluation period.

4.3.1.1 List of elements that may lead to incoherence between NECD and sectoral legislation and elements that lead to synergies and mutual reinforcement between the NECD and sectoral legislation

The analysis did not identify any elements that may lead to incoherence between the NECD and sectoral legislation. There are no overlapping requirements.

Sectoral legislation and the NECD are coherent and mutually reinforcing each other. Member States rely on requirements of sectoral legislation (e.g. reduced emissions due to the application of euro standards, reliance on IED BATs to reduce emissions from industry) and take complementary action to reach their ERCs.

For the detailed analysis, see Table A-55 above.

4.3.1.2 Change in coherence over time

Where the legislation changed during the NEC evaluation period (2016-2025), this brought about a strengthening of the coherence between policies. For example, the switch from

[305] Directive (EU) 2024/1785 amending Directive 2010/75/EU on industrial emissions (integrated pollution prevention and control) and Council Directive 1999/31/EC on the landfill of waste.

Euro 6 to Euro 7 emission standards limit emissions further, and therefore enhances the potential of the euro emission standards to contribute to the objectives of the NECD; as further maritime areas become SOx ECAs, the impact of the Sulphur Directive on SO_2 emission reductions are enhanced; with the 2024 revision of the IED and its extended scope, the coherence between the IED and the NECD is further enhanced.

4.3.2 Coherence between climate and energy policies and the NECD

Table A - 56 – Coherence between climate and energy policies and the NECD

EU policy	Remarks on coherence
Fit for 55/ 2030 Climate Target Plan[306]	*Link between the policies* Climate and energy policy and clean air policy are mutually reinforcing each other: climate and energy policies, while focusing on greenhouse gases, often deliver co-benefits for clean air including decreases of air pollutant emissions. NAPCPs and the 10-year National Energy and Climate Plans (NECPs) share certain policies and measures, and act in synergy on both objectives. For example, measures promoting non-combustible renewable sources of energy and more efficient energy use reduce GHG and air pollutant emissions from energy production; accelerating the adoption of clean transport reduces air pollutants from road transport. However, as underlined by the European Court of Auditors[307], there can be policy inconsistencies between climate-oriented policies and those focused on air pollution. In an EEA article[308], the promotion of renewable wood burning in some areas of Europe as well as the promotion of diesel vehicles by many countries[309] are cited as examples of policies promoted to benefit, among others, climate change, that may have unintended negative impacts on air pollution. A DG ENV commissioned study has further looked into improving policy coherence between clean air and bioenergy policies, focussing on solid biomass for heat and electricity generation[310]. *Coherence between the policies* Climate and energy policy and clean air policy are mostly coherent and mutually reinforcing each other through co-benefits. There are a few trade-offs that need to be managed (e.g. in the field of bioenergy, see section on wood burning above). *Change in coherence over time* No changes observed over the NECD evaluation period.
Energy Union and Climate Action Governance Regulation	*Links between the policies* The Energy Union and Climate Action Governance Regulation requires Member States to draft National Energy and Climate Plans (NECPs), including policies and measures to demonstrate how they will achieve their objectives in

306 Communication from the Commission: Stepping up Europe's 2030 climate ambition, Investing in a climate-neutral future for the benefit of our people, COM (2020) 562 final; Information about the Fit for 55 package (date of retrieval: February 2025)

307 European Court of Auditors (2018), Special Report 23/2018 Air Pollution: Our health still insufficiently protected.

308 EEA (2017), Cleaner air benefits human health and climate change.

309 Diesel vehicles are less CO_2-intensive than petrol vehicles but emit more NO_x emissions per km driven.

310 EC (2024), Increasing policy coherence between bioenergy and clean air policies and measures.

EU policy	Remarks on coherence
	the five dimensions of the energy union. The current plans cover the 2021-2030 period. MS were required to update their NECPs by June 2024. Additionally, MS are required to report in their NECPs on the impacts on air pollution of the policies and measures put forward. The NECD in turn requires national emission projections to be consistent with projections reported under the Governance Regulation. The Commission Implementing Decision on the common format for the NAPCP obliges MS to assess coherence between NAPCPs and NECPs. Guidance related to the NECPs published by the Commission in 2022[311] recommended "develop[ping] the updated NECPs closely with the update of their NAPCPs", especially as the timeline for updates of both national plans was in 2023, provided that Member States submitted their initial NAPCP in a timely manner. However, according to the assessment report of initial NECPs[312], there is "insufficient reporting of the projected impacts of the planned policies and measures on the emissions of air pollutants by Member States in their final plans." The assessment report specifically highlights the lack of analysis in NECPs regarding trade-offs between climate/energy and air objectives, often related to some forms of bioenergy. At the time of the evaluation of the NECD, only the draft updated NECPs had been assessed on an EU-wide basis by the Commission. The EU-wide assessment of the draft updated NECPs[313] points out that "Over half of the draft plans do not include the required information on the impact of policies on projected emissions of the main air pollutants regulated under the National Emissions Reduction Commitments Directive, nor on the alignment of National Air Pollution Control Programme (NAPCP) with energy and climate programmes." The final assessment[314] encourages Member States to further consider synergies and trade-offs of the planned measures with air pollution when implementing their updated NECPs. *Coherence between the policies* Although the Governance Regulation and the NECD are intended to be coherent, links may be limited by insufficient coordination in Member States in the preparation of NECPs and NAPCPs. Member States may find it difficult to establish the links for timing reasons (e.g. final NAPCPs not available when NECPs are drafted and vice-versa). Inconsistencies of timeline is an element that was raised by a few stakeholders in the context of the evaluation of the

311 Commission Notice on the Guidance to Member States for the update of the 2021-2030 national energy and climate plans, 2022/C 495/02.

312 Communication from the Commission, An EU-wide assessment of National Energy and Climate Plans Driving forward the green transition and promoting economic recovery through integrated energy and climate planning, COM(2020) 564 final.

313 Communication from the Commission, EU wide assessment of the draft updated National Energy and Climate Plans An important step towards the more ambitious 2030 energy and climate objectives under the European Green Deal and RePowerEU, COM(2023) 796.

314 COM(2025) 274 final.

EU policy	Remarks on coherence
	Governance Regulation[315] and repeated in the feedback received under the NECD evaluation. *Change in coherence over time* The 2022 Commission Notice recommended that Member States develop updated NECPs in conjunction with their updated NAPCPs, which would promote greater coherence with the NECD. However, based on above cited analysis, many updated NECPs lack strong synergies with the NAPCPs.
Renewable Energy Directive	*Link between the policies* Under the Renewable Energy Directive (RED), each Member State is required to set a minimum target for renewable energy in its energy mix. Increasing reliance on renewable energy reduces the use of other energy sources, such as fossil fuels, whose production and combustion contribute significantly to air pollution. Decreasing reliance on fossil fuels helps reduce air pollutant emissions, mainly of SO_2 and NO_x, and to a lesser extent of NMVOC and $PM_{2.5}$[316]. The RED also allows the use of biomass as a source of renewable energy (that is then called *bioenergy*) if it fulfils certain sustainability criteria. These criteria do not include air pollution (although it was considered during the latest amendment (2023) of the RED[317]). In 2021, bioenergy represented 58.9% of all renewable energy consumption, making bioenergy the dominant form of renewable energy in the EU[318]. Bioenergy from fuelwood is subject to combustion to produce energy, emitting significant $PM_{2.5}$ and NMVOC emissions: more than 50% of all $PM_{2.5}$ emissions are attributed to bioenergy consumption (of which 99% originate from small-scale combustion, mainly used for domestic-scale heating). Similarly, 13% of all NMVOC emissions originate from bioenergy, of which more than 90% originate from small-scale combustion[319]. At the same time, air pollution from the combustion of biomass was meant to be addressed by other policies, considered as most appropriate to address it[320]: "the Ecodesign Directive and its implementing Regulations have been identified as the most appropriate tool to set stricter emission requirements for new solid fuel boilers and space heaters, which are applicable since 1 January 2020". In addition, the use of biomass burning in housing is expected to decrease due to higher efficiency and electrification rates. Given boilers and space heaters tend

315 SWD(2024) 200 EC (2014), Study on "Contribution of industry to pollutant emissions to air and water"

316 According to emission inventories submitted under the NECD, NO_x and SO_2 emissions from energy supply represent respectively in 2022 14.2% and 41.6% of national compliance totals.

317 Commission Staff Working Document, Impact Assessment Accompanying the Proposal for a Directive amending Directive (EU) 2018/2001, Regulation (EU) 2018/1999 and Directive 98/70/EC as regards the promotion of energy from renewable sources, and repealing Council Directive (EU) 2015/652, SWD(2021) 621 final.

318 Union Bioenergy Sustainability Report, Annex to the Report State of the Energy Union Report 2023 (pursuant to Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action), COM(2023) 650 final.

319 EC (2024), Increasing policy coherence between bioenergy and clean air policies and measures.

320 Commission Staff Working Document, Impact Assessment Accompanying the Proposal for a Directive amending Directive (EU) 2018/2001, Regulation (EU) 2018/1999 and Directive 98/70/EC as regards the promotion of energy from renewable sources, and repealing Council Directive (EU) 2015/652, SWD(2021) 621 final.

EU policy	Remarks on coherence
	to be used over many years, renewal of the stock towards cleaner appliances takes time, and hence benefits from reduced pollution are not immediate. *Coherence between the policies* The RED and the NECD act mostly in a coherent manner, with the notable exception that biomass is seen as a contribution to the renewable energy target, even if the use of biomass in small, inefficient heating appliances in households contributes to $PM_{2.5}$ and NMVOC emissions. The Ecodesign Directive and its implementing regulations complement the RED in ensuring coherence with the NECD as it sets requirements to limit and reduce over time air pollution from the combustion of biomass in households (see section below). *Change in coherence over time* The 2018[321] and 2023[322] revisions to the 2012 Renewable Energy Directive included strengthened targets for the share of renewable energy in the energy mix. If leading to a further increase in small-scale combustion of biomass, this can lead to higher incoherence with the NECD, mainly because of an increase in $PM_{2.5}$ and NMVOC emissions[323].
Ecodesign Directive and Ecodesign for Sustainable Products Regulation	*Links between the policies* The 2009 Ecodesign Directive and subsequent implementing Regulations established ecodesign requirements for energy-related products. In particular, it sets energy efficiency targets and air pollutant emission limits for local space heaters, solid fuel boilers, space and combination heaters, and water heaters. Emission limits are set for NO_x for all devices, with additional limits for PM, organic gaseous compounds (OGCs), and CO specifically applied to solid fuel local space heaters and solid fuel boilers. Solid fuel local space heaters are covered by the Ecodesign Regulation for solid fuel local space heaters[324]. $PM_{2.5}$ emissions from small biomass installations amount to around 38% of the total $PM_{2.5}$ emissions by all sources and fuels, with around two thirds of that share emitted only by solid fuel local space heaters[325]. *Coherence between the policies* As NO_x, $PM_{2.5}$ and NMVOC (that are included in OGCs) are covered by ERCs under the NECD, the Ecodesign Directive helps Member States comply with the NECD. Thus, the Ecodesign Directive and its implementing Regulations, on the one hand, and the NECD on the other, are coherent. *Change in coherence over time*

321 Directive (EU) 2018/2001 on the promotion of the use of energy from renewable sources.

322 Directive (EU) 2023/2413 amending Directive (EU) 2018/2001, Regulation (EU) 2018/1999 and Directive 98/70/EC as regards the promotion of energy from renewable sources, and repealing Council Directive (EU) 2015/652.

323 EEA (2024), Dashboard – Impacts of renewable energy use on decarbonisation and air pollutant emissions [Accessed 17 February 2025].

324 Regulation (EU) 2015/1185 implementing Directive 2009/125/EC with regard to ecodesign requirements for solid fuel local space heaters.

325 JRC (2023), Improving the estimation of air pollutant emissions from small-scale combustion sector and JRC(2024), Air pollution trends in the heating and cooling sector in the EU-27: A forward look to 2030

EU policy	Remarks on coherence
	The 2009 Ecodesign Directive was repealed by the Ecodesign for Sustainable Products Regulation, adopted in 2024, extending the scope to all physical goods except for agricultural and food products and motor vehicles. This new Regulation is likely to bring more emission reductions for NECD related pollutants, thus enhancing coherence with the NECD.
Energy Efficiency Directive	*Links between the policies* The Energy Efficiency Directive (EED) recast sets EU level reduction targets in energy consumption by 2030. According to the latest available emission inventories submitted by MS under the NECD[326], energy supply is a main source of SO_2 emissions, accounting for 43.70% of total SO_2 emissions[327], and of NO_x emissions, accounting for 14.2% of total NO_x emissions[328]. According to the same inventories, energy use is also a main source of $PM_{2.5}$ emissions in 2022, as residential combustion[329], mainly linked to heating, accounts for 58.8% of total $PM_{2.5}$ emissions. As the EED will contribute to reducing energy consumption, SO_2, NO_x and $PM_{2.5}$ emission reductions are expected due to less combustion of fuels, with these three pollutants covered by ERCs under the NECD. The EED recast has set a target of reducing energy consumption by 11.7% compared to the projected consumption levels in 2030. The EED was evaluated in 2021[330] and co-benefits for clean air legislation were identified. *Coherence between the policies* By reducing energy consumption, the EED also contributes to reducing air pollutants covered by the NECD that are linked to energy production. The latest amending act to the EED explicitly mentions its contribution to improving air quality in its recitals and references the NECD. Based on the above, the EED and the NECD are coherent with each other. *Change in coherence over time* The 2018[331] and 2023[332] revisions to the 2012 Energy Efficiency Directive included strengthening targets for energy efficiency. Therefore, coherence with the NECD has been enhanced over time.
Regulations on CO_2 emission standards for light-duty vehicles and heavy-duty vehicles	*Links between the policies* The Regulations on CO_2 emissions standards for light- (Regulation 2019/631) and heavy-duty vehicles (Regulation 2019/1242) set fleet-wide CO_2 emissions performance requirements for new light-duty vehicles and for fleet-wide new heavy-duty vehicles.

326 EEA, National air pollutant emissions data viewer 2005-2022, 2024 edition, accessed 21 January 2025.
327 Excluding emissions exempted under Article 4(3) of the NECD.
328 Including agricultural emissions.
329 Nomenclature for Reporting category 1A4bi as listed in the EMEP/EEA air pollutant emission inventory guidebook (2023)
330 Commission Staff Working Document, Evaluation of Directive 2012/27/EU on energy efficiency, Accompanying the Proposal for a Directive on energy efficiency (recast) SWD(2021) 625.
331 Directive (EU) 2018/2002 amending Directive 2012/27/EU on energy efficiency.
332 Directive (EU) 2023/1791 on energy efficiency and amending Regulation (EU) 2023/955 (recast).

EU policy	Remarks on coherence
	These Regulations will "drive the shift towards zero-[CO_2]-emission vehicles, which have no pollutant tailpipe emissions"[333], thus they will help decrease exhaust emissions from the renewing fleet of light- and heavy-duty vehicles, mainly regarding NO_x and $PM_{2.5}$, both covered by ERCs under the NECD. *Coherence between the policies* The Regulations contribute to decreasing emissions of air pollutants covered by ERCs under the NECD. Therefore, Regulations on CO_2 emission standards for light- and heavy-duty vehicles are coherent with the NECD. *Change in coherence over time* The revisions in 2023 for light-duty vehicles[334] and in 2024 for heavy-duty vehicles[335] to align with Fit for 55's objectives strengthened the CO_2 emission standards and therefore contributed to an increased coherence with the NECD. In the 2015 support study related to the evaluation of 2009[336] and 2011[337] Regulations on CO_2 emission standards from light-duty vehicles, diesel cars were presented as a potential point of conflict towards clean air legislation: the CO_2 emission standards tend to incentivise fuel efficient vehicles, including diesel vehicles. However, the evaluation support study found no clear evidence that the CO_2 emission standards increased the uptake of diesel vehicles. Furthermore, the stricter CO_2 standards that will apply in the future are intended to incentivise the uptake of zero-emission vehicles. Diesel vehicles (LDV and HDV) accounted for 80% of road transport NO_x emissions in 2015 and had higher emission limit values than petrol vehicles under Euro emission standards. This was largely solved by the introduction of real-driving emissions testing for both light-duty vehicles and heavy-duty vehicles and stricter NO_x emission limits for heavy-duty diesel vehicles through the Euro 7 emission standard. The combination of Euro emission standards and CO_2 emission standards has thus ensured enhanced coherence with the NECD.

[333] Commission Staff Working Document, Impact Assessment Accompanying the Proposal for a Regulation amending Regulation (EU) 2019/631 as regards strengthening the CO2 emission performance standards for new passenger cars and new light commercial vehicles in line with the Union's increased climate ambition, SWD(2021) 613.

[334] Regulation (EU) 2023/851 amending Regulation (EU) 2019/631 as regards strengthening the CO2 emission performance standards for new passenger cars and new light commercial vehicles in line with the Union's increased climate ambition.

[335] Regulation (EU) 2024/1610 amending Regulation (EU) 2019/1242 as regards strengthening the CO2 emission performance standards for new heavy-duty vehicles and integrating reporting obligations, amending Regulation (EU) 2018/858 and repealing Regulation (EU) 2018/956.

[336] Regulation (EC) No 443/2009 setting emission performance standards for new passenger cars as part of the Community's integrated approach to reduce CO_2 emissions from light-duty vehicles.

[337] Regulation (EU) No 510/2011 setting emission performance standards for new light commercial vehicles as part of the Union's integrated approach to reduce CO_2 emissions from light-duty vehicles.

4.3.2.1 *List of elements that may lead to incoherence between the NECD and climate and energy legislation and elements that lead to synergies and mutual reinforcement*

Links between air and climate/energy policies are multiple, as emitting sources of greenhouse gases and air pollutants are often the same. Therefore, in many cases, one measure can benefit reaching both air and climate goals (e.g. development of active transport modes, better insulation of buildings to reduce energy consumption). However, in some cases, also trade-offs exist (e.g. the use of bioenergy for domestic heating). Air and energy/climate legislation refer to each other and require links to be established between the NAPCPs and the NECPs[338]. The Commission guidance on the development of NAPCPs specifically invites Member States, when drafting their NAPCP, to consider the policies and measures planned under climate and energy obligations.

It is acknowledged that, due to the sequencing of legal deadlines, NAPCPs submitted on time could only refer to draft NECPs and not to the final ones. On the other hand, the air/climate-energy links should be reflected in the final NECPs, as 26 Member States[339] received in June 2019, in the context of the Energy Union governance Regulation, a Commission recommendation on their draft NECPs to improve the assessment of the air impacts.

The analysis of the NAPCPs indicates that there is, however, scope to enhance the links between clean air and climate and energy policies, and that further integration is needed between the two planning exercises, to increase the effectiveness of the underlying policies.

In summary, see below the list of elements that may lead to inconsistency:

- consideration of biomass as a contribution to the renewable energy target (subject to the sustainability criteria, which, however, do not cover pollutant emissions), even if the use of biomass in small, inefficient heating appliances in households contributes to $PM_{2.5}$ and NMVOC emissions;
- difficulties to establish links between NAPCPs and NECPs due to differences in the timelines of reporting

A list of elements that lead to synergies and mutual reinforcement:

- co-benefits between climate and energy policies, as reductions in GHGs lead to reduction of air pollutants and vice versa, and measures related to energy efficiency (e.g. through Ecodesign) and the higher share of renewables lead to less air emissions (with the exception of combustion of biomass);

[338] See Directive (EU) 2016/2284 Article 1 (synergies); Annex III, Part 1 (consistency in priorities); Annex IV, Part 2 (consistency in projections). In parallel, see Regulation (EU) 2018/1999, Annex I, Section A, Paragraph 5(1)(i) which requires reporting projected impacts of the planned policies and measures on the emissions of the air pollutants regulated under Directive (EU) 2018/2284.

[339] All Member States but Spain and France, see https://ec.europa.eu/energy/topics/energy-strategy/national-energy-climate-plans_en.

— cross-references between policies and measures taken under NAPCPs and NECPs and that reflect how actions to reduce air emissions have co-benefits for climate and vice-versa.

4.3.2.2 Change of coherence over time

Where there were changes to the climate and energy legislation, these have mostly had an effect to reinforce coherence further. For example, the strengthened targets for energy efficiency would enhance the coherence with the objectives of the NECD; the extension of the Ecodesign framework to all physical goods except for agricultural and food products and motor vehicles has the potential to bring further co-benefits for air pollution.

Regarding renewable energy, the strengthened targets for the share of renewable energy (the latest revision dates from 2023) in the energy mix are expected to bring a mixed effect: on the one hand, less air emissions due to the wider use of renewables, on the other hand, a potential further increase in small-scale combustion of biomass resulting in higher $PM_{2.5}$ and NMVOC emissions.

4.3.3 Coherence between the Common Agricultural Policy and the Nitrates Directive and the NECD, in particular on ammonia

4.3.3.1 Extent to which EU agricultural policy supports measures defined in Annex III Part 2

Table A - 57 – Coherence between the NECD and agricultural policy

EU policy	Remarks on coherence
CAP 2014-2020 (extended to 2022)	*Links between the policies* The support study for an evaluation of the CAP 2014-2020 on climate change and greenhouse gas emissions[340] analysed the external coherence of climate-focused measures from the Common Agricultural Policy (CAP) with other EU policies in Annex 7, and in particular with the NECD. **Clear synergies were identified between the NECD and the climate-focused measures of the CAP**, but the study states that **they would deserve an integrated approach, to avoid potential conflicts** between different policy objectives. A specific evaluation on the impact of the CAP on biodiversity, soil and water (natural resources)[341] was published as well in 2021. The related evaluation support study on biodiversity[342] stated that **no CAP measures appeared to be clearly incoherent with the objectives of the NECD**. However, this same support study underlined the potential negative effects of Voluntary Coupled Support (VCS) measures related to livestock. VCS measures existed to support production to the level necessary to maintain the then current levels of production and was mainly attributed to animal production (in 2018, more than 74% was dedicated to animal products). The support study evaluated that few of the case study Member States (10) limited stock density by

340 Commission Staff Working Document, Evaluation of the impact of the Common Agricultural Policy on climate change and greenhouse gas emissions, SWD(2021) 115 final and Alliance Environnement for the European Commission (2018) *Evaluation study of the impact of the CAP on climate change and greenhouse gas emissions.*

341 Commission Staff Working Document, Evaluation of the impact of the CAP on biodiversity, soil and water (natural resources), SWD (2021) 424 final.

342 EC (2019), Evaluation of the impacts of the CAP on habitats, landscapes, biodiversity.

EU policy	Remarks on coherence
	limiting the number of animals. However, the impact of VCS payments on increasing herds are difficult to dissociate from other drivers (markets, end of milk quota, etc.). VCS were in some Member States more targeted to specific territories (e.g. mountain areas), or management systems (e.g. traditional extensive livestock) and the actual impact on emissions covered by the NECD are difficult to assess. The support study to the NECD evaluation also analysed coherence between the 2014-2020 programming period of the CAP (extended to 2022) and the NECD. The cross-compliance mechanism makes CAP direct payments under the 'first pillar' of the CAP conditional on respecting a basic set of rules stemming from EU environmental legislation (including the NECD) and good agri-environmental practice established under the CAP. Cross-compliance, and more specifically the Good Agricultural and Environmental Condition number 6 (GAEC 6), is aligned with the NECD. GAEC 6 imposes a ban on stubble burning, thus contributing to reduced emissions of air pollutants. GAEC 6 is the only GAEC that can be directly linked to the measures in Annex III, Part 2 of the NECD. CAP funding supported air pollution reduction measures included in the NECD, notably through the European Fund for Rural Development (EAFRD) under the 'second pillar' of the CAP. Member States implement EAFRD funding through Rural Development Programmes (RDPs). RDPs under the EAFRD contributed to air quality improvements by prioritizing six broad policy areas, including emissions reductions. Notably there was a synergy between CAP and the NECD in the Focus Area 5D, which specifically targets the reduction of greenhouse gases and ammonia emissions from agriculture. In addition, 28 RDPs in 16 Member States included specific interventions supporting improved manure storage, organic farming, and use of air scrubbers, which support ammonia reductions and align with NECD objectives. Other RDP interventions like investments also contributed broadly to ammonia emission reductions. These include investments in physical assets to cover manure storages, sealing stables and application of air scrubbers and the Agri-environment-climate Measures for the direct injection of slurry in the soil, actions that are in line with Annex III Part 2 of the NECD. Member States have recognised the contribution of CAP to the objectives of the NECD, with 18 Member States citing CAP support for the implementation of the NECD Annex III Part 2 measures, especially through RDPs. *Coherence between the policies* Based on the above, the CAP 2014-2020 (extended to 2022) supported to some extent the objectives of the NECD regarding ammonia.
CAP 2023-2027	*Links between the policies* Following the reform of the CAP 2023-2027, Member States had to clearly indicate in their CAP strategic plans (CSPs) that the plans contribute and are consistent with the objectives of 12 different directives and regulations, including the NECD (Article 109 of Regulation (EU) 2021/2115). The support study to this evaluation analysed coherence between the 2023-2027 programming period of the CAP and the NECD. The report analysing the CSPs[343] concludes that only 11 CSPs include actions to reduce methane or ammonia emissions from livestock. All 28 CSPs set a target value for the result indicator R.13 ("Reducing emissions in the livestock sector"), corresponding to the share of livestock units (LU) under supported commitments to reduce emissions of greenhouse gases and/or ammonia. Target values for R.13 range from 0.12% to close to 47% of LU, with an average of 2.4% at the EU level. 12 eco-schemes, designed by seven Member States, are linked to R.13 to address livestock emissions. Participation

[343] EC (2023), Approved 28 CAP Strategic Plans (2023-2027).

EU policy	Remarks on coherence
	in eco-schemes is voluntary for farmers and Member States design the measures based on their needs. Nineteen Member States defined R.20 ("Improving air quality") indicator targets on the percentage of utilised agricultural area (UAA) under commitments to reduce ammonia. The targets are below 20% of UAA to be under supported commitments to address air quality in almost all Member States (except LU, PL and BE), and under 10% in nine of these. Eight Members States have not established R.20 targets at all (CZ, DK, EE, DE, LT, MT, SK, SE). 17 Eco-schemes in 12 CSPs and 30 ENVCLIM in 15 CSPs are contributing to improving air quality. With only 6% of utilised agricultural area (UAA) targeted through R.20 and 2.43% of livestock units targeted through R13, eco-schemes, ENVCLIM and sectoral support are not widely used to tackle air pollution and ammonia emissions. Supported investments in renewable energy production capacity, including biomass (R.15 Renewable energy from agriculture, forestry and from other renewable sources) and investments into climate (R.16) can potentially reduce air pollutants. However, the combustion of biomass for energy production can have negative impacts for air quality depending on the type, combustion conditions and what it may be replacing, and these conditions are not regulated under agricultural policy. CAP interventions to sustainable nutrient management (R.22) focus on reducing nutrient emissions through run-off and leaching into soils and water. These can have a potential impact on ammonia emissions to air depending on the interventions[344]. Investments are important CAP interventions to tackle air pollution. 24 CSPs include investment interventions which respond to at least one air pollution need. The screening of investment interventions indicates that support is given to improved manure storage techniques (21 interventions in 17 CSPs) and precision farming techniques (23 interventions in 17 CSPs specifically refer to 'precision farming', however all CSPs support precision farming technologies). Investments are also programmed into fertilisation techniques to reduce nutrient losses, such as slurry injection and solid manure incorporation (four interventions in four CSPs). All of these farm practices will contribute to a reduction of ammonia emissions. In the area of conditionalities, GAEC 3 (GAEC 6 under the previous period) continues to impose a ban on stubble burning, contributing to eliminating air pollutant emissions due to this practice. GAECs conceived to maintain grassland areas (GAEC 1 and 9) have a demonstrable effect reducing emissions from the use of fertilisers. *Coherence between the policies* Based on the above, the CAP 2023-2027 framework is designed to be coherent with the objectives regarding ammonia reduction of the NECD. The CSPs will likely contribute to reducing air pollution across the EU. In particular, investments are important interventions for reducing emissions, including investments in improved manure storage (supported in 21 CSPs). However, the voluntary nature of CAP interventions is expected to limit the contribution to emission reductions; furthermore, the flexibility Member States have in designing der CSPs leads to not all strategic plans including NECD-related items. *Change in coherence over time* The coherence between the CAP and the NECD has evolved between the two CAP cycles. In the 2014-2020 CAP cycle, while some synergies were identified between the two policies, potential conflicts and areas for improvement or requiring further analysis were highlighted as well.

[344] EC 2023, Mapping and analysis of CAP strategic plans – Assessment of joint efforts for 2023-2027.

EU policy	Remarks on coherence
	The 2023-2027 CAP cycle shows improved coherence with the NECD, with Member States required to clearly indicate how their CSPs contribute to the objectives of the NECD or to explain which other measures outside of the CAP contribute to the NECD objectives. Additionally, the new CAP cycle includes interventions and measures (e.g. conditionality and eco-schemes) aimed at reducing air pollutant emissions. The contribution of voluntary interventions is summarised in indicators such as the "Reducing emissions in the livestock sector" (R.13) and "Improving air quality" (R.20) indicators, with R.13 also including greenhouse gas emissions. Despite these improvements, Member States could make better use of the voluntary measures to achieve sufficient reductions notably of ammonia emissions in line with the NECD objectives. There are some encouraging signs, such as most Member States having identified air quality as a need and several Member States having designed respective measures to make use of the instruments available under the CAP[345] but further targeting and prioritisation of the measures could be necessary. Actual uptake on the ground continues to be monitored[346].
Nitrates Directive	*Links between the policies* The Nitrates Directive requires Member States to designate Nitrate Vulnerable Zones, to establish Codes of Good Agricultural Practice to be followed on a voluntary basis, and to establish Nitrate Action Programmes (NAPs), to be followed within Nitrate Vulnerable Zones. As explained in the AAQD Fitness Check, "Although it does not apply specifically to air emissions, the Nitrates Directive has an indirect impact on air quality. It aims to protect water quality across Europe by preventing nitrates from agricultural sources to pollute both ground and surface waters and by promoting the use of good farming practices. Since manure and fertilisers are also sources of air emissions (in particular nitrogen oxides (NO_x) and ammonia (NH_3); both are precursors of particulate matter), preventing water pollution with nitrates from agriculture can have an impact on air emissions." A technical report analysing NAPs and their interactions with policies and measures in NAPCPs submitted by Member States, was published in 2020[347]. At the time of the drafting of this technical report (2019), 20 Member States had submitted their first NAPCP. The support study added further elements for a detailed analysis of coherence between NECD and Nitrates Directive[348]. Looking at impacts of measures included in NAPs on pollutants covered by the NECD, some NAP measures were identified as representing a *potential* conflict (notably measures increasing manure storage periods[349]), which *could* result in increases of NH_3 emissions. However, exact impacts on NH_3 are highly dependent on the manure collection and storage systems in which those measures are implemented. Regarding other NAP measures, they were either synergetic with or neutral towards the NECD. Regarding NECD measures that potentially impact on Nitrates Directive objectives, these were all found to be supporting those objectives or to have limited or no impact. The support study provides

345 Ibid.

346 CAP Strategic Plans - European Commission

347 Tzilivakis, J., Green, A., Warner, D.J and Lewis, K.A. (2020), Identification of approaches and measures in action programmes under Directive 91/676/EEC. Report prepared for Directorate-General Environment, European Commission.

348 See support study section 3.4.2.

349 The support study also identified restricting grazing periods to protect grassland, e.g. over wintertime, as a measure creating a possible conflict, but this is only implemented in one Member State, Hungary, and only partially. More importantly, it is not specifically required by the Nitrates Directive.

EU policy	Remarks on coherence
	a detailed mapping of measures across the two Directives and all Member States in Tables 3-14 to 3-17. *Coherence between the policies* The Nitrates Directive and the NECD are mostly coherent. Only a few marginal measures from either the Nitrates Directive or the NECD have been identified as having unintended negative effects on the other. *Change in coherence over time* No changes observed over the NECD evaluation period.

4.3.3.2 Obstacles to pollution reduction linked to EU agricultural policies/ inconsistencies between EU agricultural policies and the NECD

While the **CAP** and NECD are broadly aligned, the support study to this evaluation identified several barriers and limitations **resulting not necessarily from the CAP itself** but from the design of its implementation:

- Voluntary nature of the interventions: Eco-schemes and agri-environmental measures are voluntary and therefore rely on farmers' willingness to adopt the practices. This voluntary aspect, combined with the specific needs analysis for each CAP Plan, means that participation rates vary across Member States, which leads to variable impacts on emission reductions.

- Despite most CAP Strategic Plans identifying reducing ammonia emissions as a need (with 14 Member States considering it a 'high priority' and 10 Member States a 'medium priority'), optional targets set by Member States for the result indicators R.13 'Share of livestock units (LU) under supported commitments to reduce emissions of greenhouse gases and/or ammonia, including manure management' and R.20 'Share of utilised agricultural area (UAA) under supported commitments to reduce ammonia emission' are low. These indicators do not reflect the complete set of interventions under the CAP contributing to air quality, e.g. they do not reflect the investments in manure storage and other manure management practices. The CAP simplification package found that certain practices and needs are not yet sufficiently taken into account in the CAP legal framework, which does not permit Member States to adjust the various instruments to the specific circumstances, especially in the case of livestock. The recent package adopted by the Commission[350] will make possible payments per livestock unit for agri-environmental-climate management commitments and therefore extend the scope of eco-schemes in this sector. Furthermore, as part of a study conducted by the EU CAP Network, Member States have flagged that interventions addressing ammonia emissions were often difficult and expensive to implement[351]. However, some have successfully combined CAP support and other legislative measures, as demonstrated by the examples provided in Annex IX (examples of Austria and Ireland).

350 COM (2025) 236

351 EU CAP network (2024) Analytical work – The CAP's Green Architecture – designing green strategies, p.24.

– Risk of adverse effects: Investment for renewable energy production (R.15 and R.16) may reduce air pollutants but may also have adverse effects for air quality depending on the combustion conditions, which are not regulated by the CAP. Measures for sustainable nutrient management (R.22) that target nitrogen run-off and leaching may increase ammonia emissions to air.

The evidence of barriers and limitations are consistent with the OPC whereby respondents gave mixed responses in terms of coherence: 9% found the CAP highly coherent with the NECD, and 41% found it somewhat coherent, while 14% reported it as somewhat incoherent, and 36% viewed it as highly incoherent.

An assessment of the synergies and conflicts between measures under the **Nitrates Directive** and the NED Directive under the support study to this evaluation revealed that there are mostly synergies and where there are potential conflicts these are likely to depend on localised factors which have scope to be mitigated. Potentially increasing NH_3 emissions could arise from measures under the Nitrates Directive which address the prolongation of livestock housing and of manure storage periods. However, there is scope to minimise NH_3 losses from livestock housing and manure collection and storage, thus this will be highly dependent on the specific systems that are implemented.

4.3.3.3 Change in coherence over time

The coherence between the **CAP and the NECD** has improved between the two CAP cycles. See Table A-57 above for details.

Coherence with the Nitrates Directive did not change over the evaluation period.

4.3.4 Coherence between the NECD and biodiversity related provisions

Table A - 58 – Coherence between the NECD and EU policy related to biodiversity

EU policy	Remarks on coherence
Nature Restoration Regulation	*Links between the policies* Under the Nature Restoration Regulation (NRR), Member States are required to draft National Restoration Plans, including restoration measures that will be put in place to achieve the specific restoration targets defined in the regulation, covering a broad range of ecosystems. The impact assessment[352] identified how the NECD should help achieve the objectives of the NRR: • Air pollutants covered by the NECD affect ecosystems and biodiversity negatively and may (among others) hinder restoration efforts e.g. through eutrophication, acidification, and tissue damage. • The NECD helps reduce pressures on biodiversity, thereby contributing not only to restoration efforts but also to the "non-deterioration" requirements under the NRR.

[352] Commission Staff Working Document, Impact Assessment Accompanying the Proposal for a Regulation on nature restoration, SWD(2022) 167.

EU policy	Remarks on coherence
	Looking at the NRR's potential contributions to the NECD's objectives, the NRR aims at the restoration of ecosystems and thereby their services, including air filtration: ecosystems like wetlands, forests and grasslands can filter pollutants from the air, thus improving air quality. The impact assessment further mentions the role of urban green spaces for air quality. No quantification is provided in the impact assessment for any of these effects. However, it is very likely that these ecosystem services promoted by the NRR would have positive impacts on air pollutant concentrations in ambient air (but not on anthropogenic air pollutant emissions directly). Under Article 14 of the NRR, Member States are also required to take into account NAPCPs when drafting their National Restoration Plans. *Coherence between the policies* The NRR is expected to be complementary with the NECD, as it contributes to the same overall objective, without influencing Member States' compliance with ERCs. *Change in coherence over time* Not applicable.
Water Framework Directive	*Links between the policies* Under the Water Framework Directive (WFD), MS are required to draft River Basin Management Plans (RBMPs), Programmes of Measures (PoMs) and surveillance monitoring programmes to protect and, where necessary, restore water bodies in order to reach good chemical and ecological status of surface water bodies, good chemical and quantitative status of groundwater bodies, and to prevent further deterioration. A fitness check[353] based on the reference period 2000 – 2017 identifies clear synergies between the NECD and the WFD relating to eutrophication. Air pollutants causing eutrophication are covered by ERCs under the NECD: NO_x and NH_3. At the same time, reducing eutrophication will help to reach good ecological status of surface water bodies and good chemical status of groundwater bodies under the WFD. The NECD therefore contributes to reaching the objectives of the WFD. The fitness check report also underlines the importance of adopting a **systematic approach regarding environmental problems, using the example of the nitrogen cycle**: "If Member States do not take all environmental objectives into account in an integrated manner, there can be a risk of negative effects e.g. when measures to reduce ammonia emissions lead to nitrate pollution in water or vice versa (i.e. shifting pollution instead of reducing it)". The development of RBMPs contributes to coordinating MS' approach to eutrophication in a more comprehensive manner, as it includes a summary of PoMs adopted for the protection of water bodies against anthropic pressures, including eutrophication. Measures summarised are also mostly linked to other legislative texts, such as the Nitrates Directive and the Common Agricultural Policy.

[353] Commission Staff Working Document, Fitness Check of the Water Framework Directive, Groundwater Directive, Environmental Quality Standards Directive and Floods Directive, SWD(2019) 439 final.

EU policy	Remarks on coherence
	Reporting under the NECD includes monitoring of negative impacts of air pollution upon ecosystems (Article 9), and MS are required to coordinate this monitoring with the one conducted under the WFD. *Coherence between the policies* Based on the above, the Water Framework Directive and the NECD are coherent with one another, with mainly the NECD contributing to reaching the objectives of the WFD and with the WFD encouraging Member States to adopt a systematic approach to the nitrogen cycle in water bodies. Concerning ecosystem monitoring, the WFD and the NECD are coherent as set out by Article 9 of the NECD. *Change in coherence over time* No changes in coherence observed over the NECD evaluation period.
Marine Strategy Framework Directive	*Links between the policies* Under the Marine Strategy Framework Directive (MSFD), MS are required to develop a marine strategy for their marine waters in respect of each marine region or subregion, including an assessment to determine the good environmental status (GES) of marine waters, a monitoring programme and a programme of measures to achieve or maintain GES. Reducing human-induced eutrophication is part of the qualitative descriptors that MS have to use to assess the environmental status of marine waters and address in their marine strategies. NO_x and NH_3 emissions to air that deposit onto water surfaces are contributing directly to eutrophication. According to the Commission's assessment of the Member States' updated programme of measures[354], "pressures from airborne emissions are less consistently recognised notwithstanding legislation concerning air quality and emissions to air". The NECD is only rarely cited by Member States as a driver for measures in relation to nutrient loading, although "airborne nutrient inputs are a significant contributor to inputs especially in enclosed seas such as the Baltic and Black seas". *Coherence between the policies* Based on the above, the MSFD and the NECD are coherent with one another, with mainly the NECD contributing to reaching the objectives of the MSFD and with the MSFD encouraging MS to use clean air policies including the NECD as a driver for reducing eutrophication in marine waters. Concerning ecosystem monitoring, the MFSD and the NECD are coherent as set out by Article 9 of the NECD. *Change in coherence over time* No changes in coherence observed over the NECD evaluation period.

[354] Commission Staff Working Document, Accompanying the document Report from the Commission on the Commission's assessment of the Member States' programmes of measures as updated under Article 17 of the Marine Strategy Framework Directive (2008/56/EC), SWD(2025) 1 final.

EU policy	Remarks on coherence
Forest Monitoring Law	The Forest Monitoring Law was proposed in 2023. The legislative procedure is ongoing.

4.3.4.1 Overlaps, gaps and contradictions

The analysis did not identify any overlaps, gaps and contradictions. Article 9 of the NECD on monitoring of the impact of air pollution on ecosystems takes into consideration monitoring defined in other relevant EU legislation, and reporting under biodiversity legislation refers to the NECD, where relevant (e.g. the Nature Restoration Law requiring Member states to take into account NAPCPs when drafting their National Restoration Plans).

The NECD contributes to limiting eutrophication and acidification by limiting the emission of air pollutants.

4.3.4.2 Change in coherence over time

There were no changes in coherence observed over the NECD evaluation period. The Nature Restoration Regulation introduced a clear link to clean air by requiring Member States to take into account NAPCPs when drafting their National Restoration Plans. While this is unlikely to help Member States meet ERCs under the NECD, it is supportive of wider clean air and zero pollution objectives.

4.3.5 Coherence with other EU policies: innovation

The NECD requires Member States to reduce emissions of the five main air pollutants, but it does not specify how they have to obtain these results[355]. Member States and other affected parties (e.g. businesses) can rely on ways to reduce emissions of air pollutants that are most fit to their context and **leaves the door open to use innovative approaches and new technologies** to do so.

The European Commission provides **funding** through several streams to further encourage innovation for clean air. It has to report on the uptake of EU funds to support the objectives of the NECD. The methodology used to track EU funding available to implement clean air policy has been elaborated and adopted as part of the first NEC implementation report (see also Annex III section 4.4). It builds on the lessons learnt from climate and biodiversity tracking and ensures a consistent approach across various EU programmes.

Based on this methodology, the contribution from **Horizon Europe** over the 2014-2020 period was estimated to be EUR 4.2 billion (out of a total estimated at EUR 46.4 billion[356]). For the 2021-2027 period, the contribution from Horizon Europe is

[355] This is true also for agricultural measures in Annex III part 2 of the NECD: the bulk of the measures listed are not mandatory, with the exception of the obligation to establish a national advisory code of good agricultural practice and the prohibition of ammonium carbonate fertilisers. Thus, Member States and farms can choose the measures they enact for reducing ammonia emissions.

[356] *Programme Statement Introduction*, Directorate-General for Budget, 2021.

estimated to be EUR 3.8 billion[357] (out of a total estimated at EUR 185.5 billion[358]), however, this only includes estimates for 2021-2024 thus far.

Innovation has also been supported by the Programme for Environment and Climate Action (**LIFE)**, where priority topics for clean air include the reduction of emissions of particulate matter, the reduction of emissions from road and non-road transport, and the reduction of emissions from agriculture, through pilot and demonstration projects. Projects in e.g. industry with decarbonisation as the primary objective also often delivered important co-benefits for clean air. Based on the tracking methodology, the contribution from the LIFE programme over the 2014-2020 period was estimated to be EUR 105 million[359]. According to the clean-air tracking approach, for the 2021-2027 period, the contribution from LIFE is estimated to be EUR 267 million, but this only includes estimate for 2021 and 2022 thus far.

EU research and innovation funding has promoted projects that are of relevance across a range of pollutants and their sources. Research and innovation have particularly supported the reduction of emissions of air pollutants from energy use, transport (both road and non-road), industry and agriculture. The next section provides examples of projects funded both under Horizon Europe and Life.

In reply to the open public consultation, some business stakeholders, public authorities, environmental organisations and a consumer organisation thought that it had a positive impact, incentivising the development of technologies to reduce emissions. A non-EU citizen and an environmental NGO commented that legal certainty, in this case in the form of stable ERCs, helped companies to innovate towards these reduction commitments. Other business stakeholders thought that there was no effect on innovation, and some public authorities remarked that the impact was limited. One consumer organisation explained that measures sometimes lag behind rapid technological development, therefore limiting innovation, e.g. in the field of digitalisation and emerging technologies for monitoring and reduction of emissions. A public authority pointed out that innovation was slow in some areas, e.g. zero-emission transport.

4.3.6 Stakeholder opinions on the coherence between the NECD and other EU policy

Overall, OPC and TSC respondents thought the NECD is largely coherent with the majority of other EU policies. The Directive was seen as complementary to the AAQD, source-specific legislation such as the IED, and standards for vehicles and fuels. TSC respondents appreciated that the NECD targets emissions at source and provides a national-level framework for managing air pollutant emissions across sectors. Some OPC respondents emphasised that the Directive's legally binding reduction commitments provide a necessary counterbalance to the more localised and concentration-focused

357 Overview of clean air funding, retrieved in February 2025.
358 Clean-air tracking, retrieved in February 2025.
359 Report from the Commission to the European Parliament and the Council on the progress made on the implementation of Directive (EU) 2016/2284 on the reduction of national emissions of certain atmospheric pollutants, COM(2020) 266 final.

approach of the AAQDs, thereby reinforcing consistency and accountability across Member States.

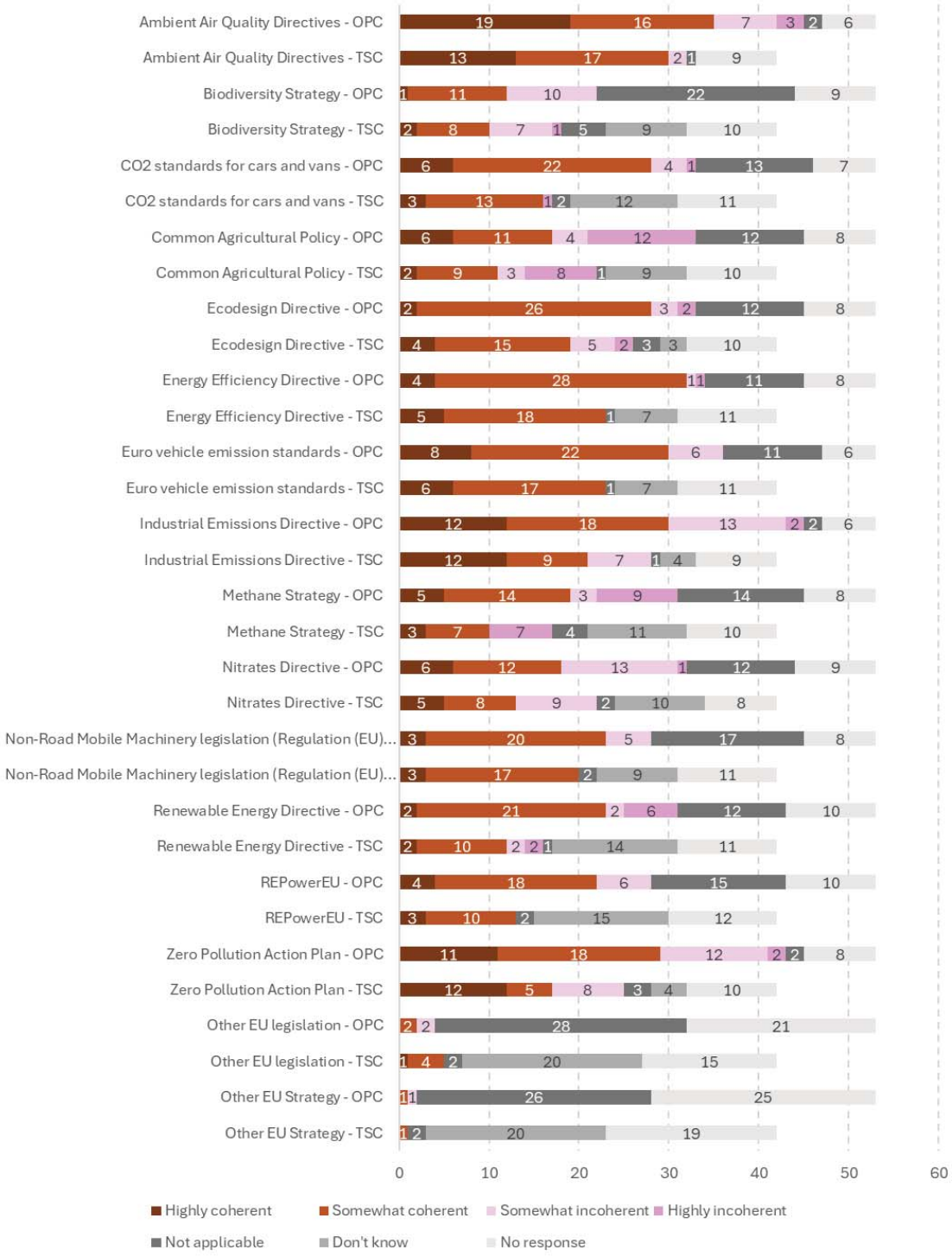

Figure A - 38 – Responses in the OPC and TSC to the question "To what extent do you think the NECD is coherent with these policies and initiatives"?

That said, several stakeholders also highlighted practical challenges and inconsistencies:

- **IED:** A stakeholder responding to the TSC pointed out that the IED does not consider ERC exceedances in IED permit conditions.

- **Renewable Energy Directive:** The inclusion of biomass as a source of renewable energy was highlighted as a point of incoherence by two stakeholders responding to the TSC (public authority, "other" category).

- **Ecodesign**: One public authority replying to the TSC commented that national legislation for small combustion installations was more ambitious than the Ecodesign provisions, leading to incoherence. A stakeholder belonging to the "other" category thought that the instrument has failed to provide for sufficient emission reductions from biomass boilers. One academic association urged to include condensable parts in limit values.

- **Agriculture-related policies:** NGOs replying to the TSC highlighted that there was a lack of comprehensive EU response to air pollution from agriculture. They highlighted the scope of the IED noting that the IED does not cover cattle facilities, and argued for stronger consideration of ammonia emissions in instruments related to CAP direct payments. An industry association thought that there should be better alignment between BAT and techniques listed in Annex III Part 2 of the NECD. Some OPC respondents also mentioned weak coordination in relation to ammonia emissions from agricultural sources, referring to several instruments (CAP, Nitrates Directive and the Methane Strategy).

According to respondents to the TSC, coherence over time was stable or increased. It was nevertheless pointed out that the updates to the IED and the AAQD should be considered in a pragmatic review of the NECD to align ambition.

4.4 To what extent has EU funding contributed to the efficient implementation of the NECD?

4.4.1 Quantity and proportion of EU funds supporting clean air

EU funding has been made available and successfully used by Member States under various financial streams, by either directly supporting clean air projects or effectively mainstreaming clean air objectives in other investments, e.g. for mobility and agriculture. **Article 7** of the NECD stipulates that the '*Commission shall endeavour to facilitate access to existing Union funds, in accordance with the legal provisions governing those funds, in order to support the measures to be taken with a view to complying with the objectives of [the NECD]*'. It does not stipulate a funding mainstreaming target, by which a certain share of the EU budget would need to be mobilised for clean air objectives.

To monitor progress in the uptake of EU funds for this clean air objective, the **Commission tracks EU funding** contributing to clean air by assessing the extent to which each funding stream contributes to this objective, in line with a tracking methodology developed for that purpose (see Box 10). The latest estimate for EU funding that contributes to the clean air objective in the budget 2021-2027 is around EUR 186 billion (see figure below), including NextGenerationEU, or around 9.7% of the multiannual financial framework.

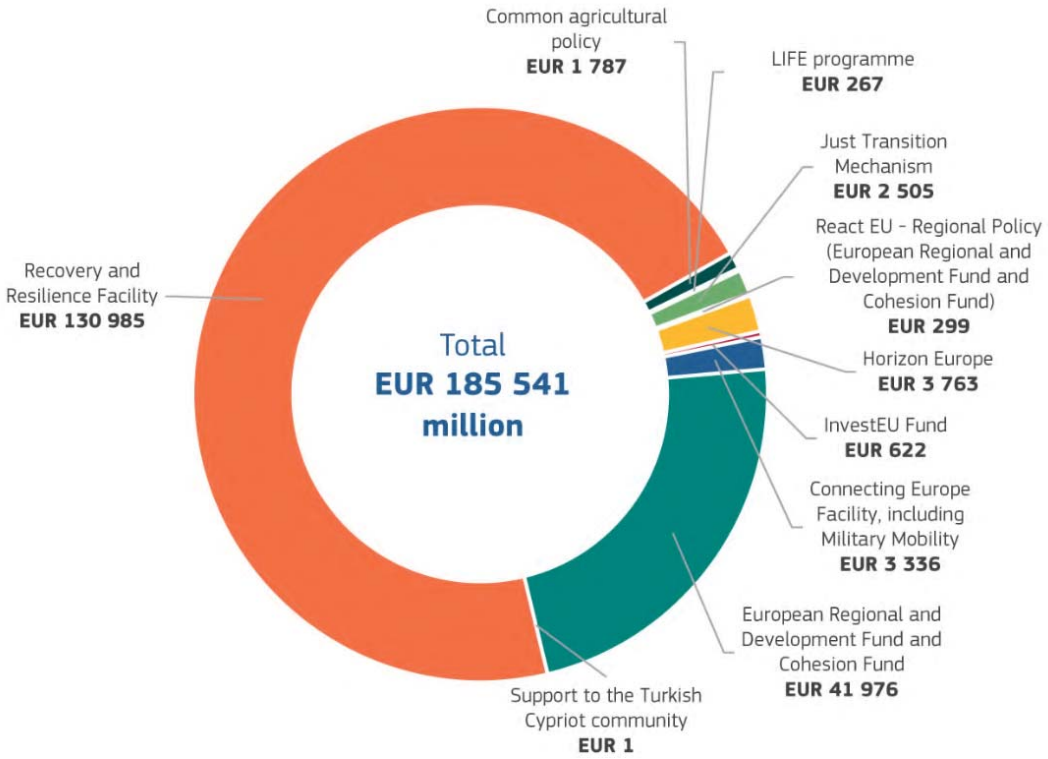

Figure A - 39 – Projected clean air contribution from 2021 to 2027 (in million EUR), source: https://commission.europa.eu/strategy-and-policy/eu-budget/performance-and-reporting/horizontal-priorities/green-budgeting/clean-air-tracking_en

Considering only the period under evaluation up to 2025 as done in the table below, the EU budget is spending €171.4 bn over the period 2021-25 to the clean air objective (or €34.3 bn per annum over the period). This is in addition to €46.4 bn reported over the 2014-20 spending period as reported by the Commission[360] (or €6.6 bn per annum). The bulk of funding over recent years comes from the Recovery and Resilience Facility. The most relevant pillar for clean air action under the RRF is the 'green transition' pillar, under which the policy areas with the highest recorded expenditure are energy efficiency, sustainable mobility and renewable energy and networks[361]. Investing in these areas often comes with clean air co-benefits, which explains the high share of RRF spending out of total clean-air spending. These co-benefits are reflected in the coefficients of the clean air tracking methodology (see Box below), which for all areas mentioned above are at least 40% (i.e. contribute significantly to the achievement of clean air objectives), and some, such as zero-emission mobility, cycling infrastructure etc. even 100% (i.e. contribute principally to the achievement of clean air objectives).

Table A - 59 – EU budget contribution – clean air (commitments, in million EUR) (source)[362]

Programme	2021	2022	2023	2024	2025
Horizon Europe	1,217.8	1,217.8	689.1	638.3	-
InvestEU Fund	0.0	83.0	539.1	-	-

360 https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1593765728744&uri=CELEX:52020DC0266
361 https://ec.europa.eu/economy_finance/recovery-and-resilience-scoreboard/green.html
362 Sums were assessed based on the tracking methodology developed for clean air spending. A more detailed explanation is available in Annex III section 4.4.1

Programme	2021	2022	2023	2024	2025
Connecting Europe Facility (CEF), including Military Mobility	1,468.1	1,525.9	342.4	-	-
Regional Policy (European Regional and Development Fund and Cohesion Fund)	0.0	6,923.5	7,166.1	7,324.2	7,532.6
Support to the Turkish Cypriot Community	0.4	0.4	0.0	-	-
Recovery and Resilience Facility	50,829.3	30,066.3	50,089.4	-	-
Common Agricultural Policy (CAP)	98.0	78.0	94.5	379.0	379.0
Programme for Environment and Climate Action (LIFE)	128.7	138.0	-	-	-
Just Transition Mechanism (JTM)	0.0	816.8	926.6	212.6	204.5
React EU	21.6	277.7	-	-	-
Total (million EUR)	**53,763.8**	**41,127.4**	**59,847.3**	**8,554.1**	**8,116**
Total in % (of the EU budget)	**12.6%**	**12.4%**	**14.4%**	**4.3%**	**4.7%**

The figures here suggest that the level of funding channelled to air quality improvement measures has been and is planned to be significant – although difficult to compare directly to estimates of abatement costs[363], this suggests that a significant proportion of the costs of achieving ERCs could be covered by public funding, hence shifting the direct burden from businesses and households to the public sector. There is thus good coherence overall between EU funding streams and the objective of the NECD, addressed in more detail for the most important funding streams in the subsequent section.

BOX 10. EU clean air tracking methodology

The methodology for tracking the contribution to clean air objectives was published along with the first implementation report mandated by Article 11 of the NECD. The methodology is based on the following rationale:

- Investment categories that contribute principally to the achievement of clean air objectives are considered with a weight of 100%.
- Investment categories that contribute significantly to the achievement of clean air objectives are given a weight of 40%.
- Any other expenditure is not considered to contribute to clean air objectives, i.e. it is given a weight of 0%.

The above clean air coefficients used in the clean air tracking methodology are aligned with the methodology used for the Recovery and Resilience Facility climate and environmental tracking and the climate tracking under the Cohesion Policy regulation for the 2021-2027. They can be found on the European Commission's clean air tracking website (tracking methodology).

[363] The most important difference is that the Clean Air Outlook modelling studies do not capture the cost of all policies and measures that abate emissions (e.g. 'climate and energy' actions are part of underlying activity projections that feed into the GAINS model and associated costs are not captured in GAINS as part of overall control costs), whereas EU funding going to e.g. energy efficiency improvements or roll-out of non-combustible renewable sources of energy is considered (at least partially, mostly at 40%) in clean air tracking.

4.4.2 Different EU funding streams of relevance for clean air

The EU funding programmes differ in nature and in the objectives they pursue, for example:

- **Horizon Europe** for research and innovation projects and hence for promoting new technologies to support clean air objectives.
- **LIFE** offers possibilities for pilot and demonstration as well as for governance and awareness projects and has been used in the past for support for the development and implementation of Air Quality Plans and National Air Pollution Control Programmes.
- The **European Structural and Investment Funds**, the **Recovery and Resilience Facility** and **Invest EU** are suited to support funding the roll-out of measures, like clean mobility and cleaner domestic heating (e.g. promoting fuel switch in households).
- The **Technical Support Instrument** offers Member States, upon their request, tailor-made technical support to design and implement key investments and reforms to support, among others, clean air objectives.
- The **Common Agricultural Policy** can fund practices to reduce fertiliser input and emissions from livestock management, including through improved manure management, to reduce emissions of ammonia (often alongside reductions of greenhouse gases, and often also reducing impacts on soil and water quality).

Horizon Europe

An overview of the Horizon Europe Programme is provided in the figure below:

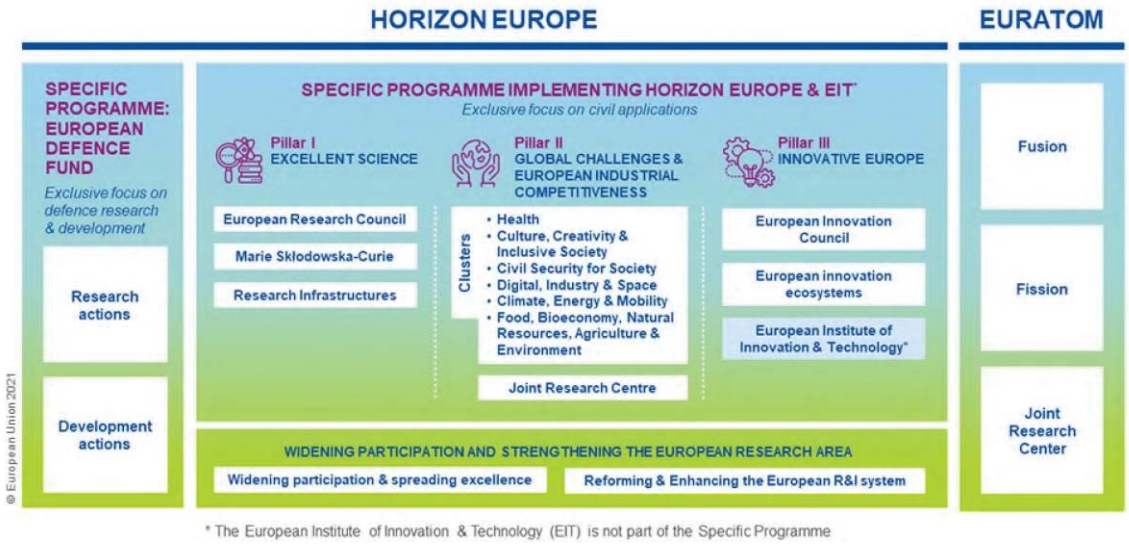

Figure A - 40 – The structure of the Horizon Europe Programme, Source : Horizon Europe website

Clean air benefits especially from the so-called clusters in **Pillar II**. The following clusters are relevant for clean air:

- Cluster 1 which deals *i.a.* with health impacts of air pollution (ambient, but also indoor as part of the ZPAP),
- Cluster 3 which includes effects of wildfires on air pollution and the impact on citizens,

- Cluster 4 which includes projects reducing emissions from industry and for earth observation (Copernicus),
- Cluster 5 with projects related to cleaner mobility (road, maritime and inland waterways, air, rail) and energy (energy efficiency, renewable energy),
- Cluster 6 with projects on *i.a.* air quality monitoring and modelling, reducing emissions from agriculture, impact of pollution on biodiversity.

Some examples of projects leading to the reduction of emissions of fine particles:

- DEXXA cluster (support for the development of diesel particulate filters);
- projects PAREGEN and UPGRADE (demonstrating filters with 96% efficiency, vs 60-70% in current generation filters, thus allowing stricter Euro 7 limits to be achieved);
- DOWNTOTEN (measuring automotive exhaust particles down to 10 nanometres);
- SUREAL23 (understanding and measuring sub-23 nm particle emissions from direct injection engines including real driving conditions).
- PEMs4NANO (portable nano-particle emission measurement system for nanoparticles below the 23nm threshold, leading also to a huge database of nanoparticle measurements that was used as evidence to support the work of the Euro 7 working group)
- GVI Green Vehicle Index and related GreenNCAP test programme, supporting consumers to choose greener vehicles. The project highlighted that some vehicles have high emissions of unregulated ammonia (which produces large amounts of secondary particulate); Projects on particle emissions from brakes: LOWBRASYS (among others, development of a test cycle as input to legislative developments and a disk with very low emissions); AeroSolfd (retrofitting brake emission reduction devices building on the LOWBRASYS project and retrofitting for gasoline engines).

The targeted stakeholder consultation asked about the contribution of the Horizon programme to the objectives of the NECD. Out of the 15 responses addressing the question in substance, 7 respondents (6 NGOs and one "other" stakeholder) thought that it had a significant positive influence, 5 (three public authorities, one from academia and one "other" stakeholder) that it had a somewhat positive influence and 3 that it had no influence (two public authorities, one NGO and one from academia). 26 respondents indicated that they didn't know or provided not answer. In the more detailed answers, the funding towards research on modelling, monitoring, impacts and policy implementation of air pollution was considered to have helped the implementation of the AAQD and the NECD.

LIFE

The LIFE programme includes Standard Action Projects (SAP) for clean air, with priority topics for reducing particulate matter, reducing emissions from transport, reducing emissions from agriculture, as well as LIFE SAPs for governance and awareness, e.g. for better Air Quality Plans or better information for the public. Additionally, LIFE Strategic

Integrated Projects aim at supporting the implementation and further development of Air Quality Plans and National Air Pollution Control Programmes. These are done through open calls. For specific issues, there have been targeted calls, e.g. for measuring emissions from solid fuel heaters, for small air quality sensors, for Emission Control Areas at sea. Some examples of projects:

- LIFE Green-Stove pilot project to further develop and test pellet stoves with lower emissions of PM.
- LIFE Green Ammonia aims to develop, scale-up and market commercial models that allow the management of livestock waste through the absorption of ammonia, considerably reducing its environmental impact.
- LIFE project - LIFE Małopolska implementation of the regional Air Quality Plan in Małopolska (Poland), eco-managers to advise the public on how to reduce emissions from domestic heating, better public transport in Krakow, citizen science and school projects, air quality information panels in Krakow.
- LIFE MODERn (NEC) supports the monitoring system in Italy to improve ecosystem monitoring under the NECD (Article 9).

The targeted stakeholder consultation asked about the contribution of the LIFE programme to the objectives of the NECD. Out of the 18 responses addressing the substance, 10 respondents (7 NGOs, one public authority, one individual and one "other" stakeholder) thought that it had a significant positive influence, 6 (three public authorities, one NGO, one from academia and one "other" stakeholder) that it had a somewhat positive influence, one that it had no influence (from academia) and one that it had a somewhat negative influence (public authority). 23 respondents indicated that they didn't know or provided no answer. In the more detailed answers, one individual in a professional capacity highlighted that the LIFE programme is actively supporting the monitoring of ecosystem impacts and should continue to do so. The role of the LIFE programme in research related to modelling, monitoring, impacts and policy implementation was also mentioned. A public authority commented that applying for funding was difficult and represented further administrative burden for Member States. A respondent to the open public consultation brought an example that had limited advantages for clean air. In the opinion of the respondent, the PREPAIR project, aiming to help the Po valley to adopt improving practices, overlooked planning and air quality and had in practice provided few or no advantages.

Recovery and Resilience Facility (RRF)

The RRF is a temporary instrument aimed at mitigating the economic and social impact of the coronavirus pandemic and making European economies and societies more sustainable, resilient and better prepared for future challenges and opportunities including the green and digital transitions. For that purpose, the RRF regulation requires that the Recovery and Resilience Plans to contribute through reforms and investment to the climate target with at least 37% and to the digital target with at least 20% of the total allocation. Clean air benefits especially from investment in climate transition, such as those promoting energy efficiency

of public and private buildings; future-proof clean technologies to accelerate the use of sustainable, accessible and smart transport, including the installation of charging and refuelling stations and the extension of public transport; and the advancement of future-proof clean technologies and the acceleration of the development and use of renewables. Therefore, the RRF contributes to reaching the objectives of the NECD by offering substantial EU funding for clean air initiatives and financing projects that deliver significant clean air co-benefits.

The targeted stakeholder consultation asked about the contribution of the RRF programme to the objectives of the NECD. Out of the 8 answers that addressed the question in substance, two (public authorities) thought that it had a significant positive influence, 5 (four public authorities and one "other" stakeholder) that it had a somewhat positive influence and one that it had no influence (NGO). 33 respondents did not know or provided no answer. In more detailed answers, a stakeholder brought the example of partial funding for the "Plan de Relance Wallon", which has been also used for the renovation of buildings and the transition towards clean energy, which contributes to the objectives of the NECD. A stakeholder commented that this was a newer funding mechanism, no detailed analysis is available on the magnitude of its influence, e.g. on clean air.

Common Agricultural Policy (CAP)

CAP funding, both under the 'first pillar' (cross-compliance, conditionality, eco-schemes) through direct payments from the EAGF and under the 'second pillar' through Rural Development Programmes and CAP Strategic Plans via the EAFRD, has supported the implementation of a number of measures and projects aimed at reducing emissions of ammonia from agriculture. According to the assessments of NAPCPs and targeted engagement with Member States to support the evaluation, 18 Members States mention support of the CAP to implementation of Annex III Part 2 agricultural measures. Among other things, the CAP offers support for investments in physical assets such as systems to cover manure storages and sealing stables, and application of air scrubbers. Investments also concern fertilisation techniques to reduce nutrient losses, such as slurry injection and solid manure incorporation. Under the CAP 2014-2020 funding period, agri-environment-climate commitments (AECCs) supported specifically voluntary farming practices such as incorporating or injecting nitrogen fertilisers, manure or slurry directly into soil to avoid ammonia volatilisation. Under the CAP 2023-2027 funding period, eco-schemes for farms and livestock fund practices that specifically address air quality objectives, such as precision crop farming to reduce inputs and improved manure management and storage. An estimated contribution from the CAP is provided in Table 55 above, based on the tracking methodology that has been adapted for the post 2023 CAP.

European Structural and Investment Funds (ESIF)

The level of investment in clean air targets under Cohesion Policy (ERDF, ESF+ and the JTF) has increased significantly compared to the previous period. In 2014-2020, Cohesion Policy allocated around EUR 30 billion to investments aimed at reducing air pollution. For the 2021-2027 programming period, a total investment of more than EUR 71.4 billion is

planned in reducing air pollution under Cohesion Policy, of which over EUR 52.1 billion is in EU funding and the rest is co-funding by Member States or their regions (situation in February 2024)[364]. Comparing this amount in relation to the total allocation of the funds programmed, this represents around a 13% share for 2021-2027[365]. Cohesion funding for clean air is used for *inter alia* energy efficiency measures reducing heat demand, replacement of heaters by more efficient and cleaner ones, non-combustion renewable energy, more and cleaner public transport, cycling infrastructure, air quality monitoring.

The targeted stakeholder consultation asked about the contribution of funding under regional policy to the objectives of the NECD. Out of the seven respondents addressing the question in substance, two (public authorities) thought that it had a significant positive influence, three (two public authorities and one "other" stakeholder) that it had a somewhat positive influence, one that it had no influence (academia) and one that it had a somewhat negative influence (NGO). 33 respondents didn't know or did not answer. Among more detailed answers, a general comment was made on EU funding for road infrastructure, fossils and some other investments leading to more energy and material consumption and therefore representing a negative influence.

Connecting Europe Facility (CEF)

Focused on infrastructure investment at EU level, the CEF fund promotes growth, jobs and competitiveness by developing high-performing, sustainable and efficiently interconnected trans-European networks in the fields of transport, energy and digital services. It promotes easier and more sustainable travel, contributes to improving the interoperability of energy networks across borders, and ensures the security of supply by developing smart energy networks, enhancing the use of renewable energy. Projects include cross-border railway connections, maritime and inland waterway and port infrastructure, cross-border grid connections and cross-border renewable energy.

The targeted stakeholder consultation asked about the contribution of funding under CEF to the objectives of the NECD. Out of the six respondents addressing the question in substance, one (public authority) thought it had a significant positive influence, two (public authorities) that it had a somewhat positive influence, one that it had no influence (academia) and two (NGOs) that it had a somewhat negative influence. In the more detailed answers, one stakeholder highlighted the role of the CEF in Italy in subsidising LNG port facilities, leading to an increase in methane emissions, a precursor to ozone, leading to worsened air quality.

[364] The difference between the EUR 52 bn and the EUR 42 bn in **Error! Reference source not found.** above for EDRF+Cohesion Fund is likely due to the data having been compiled at different points in time, with the cohesion data portal reflecting later amendments to operational programmes that increased the clean air related funding (as well as a slightly different presentation of funds, e.g. the cohesion data portal includes the Just Transition Fund, whereas this sits separately on the clean air tracking overview).

[365] https://cohesiondata.ec.europa.eu/stories/s/21-27-Clean-air-tracking/ff8w-rrvm

InvestEU

The InvestEU programme is an instrument for boosting green growth, innovation and job creation in Europe, providing long-term financing by leveraging private and public funds in support of sustainable recovery. It intends to help mobilise private investments for the EU's policy priorities, such as the European Green Deal and the digital transition. This programme is based on the provision of a budgetary guarantee derisking financial instruments offered by its implementing partners.

There are four thematic "windows" under the InvestEU fund:

- sustainable infrastructure (EUR 9.9 billion),
- research, innovation and digitisation (EUR 6.6 billion)
- SMEs (EUR 6.9 billion)
- social investment and skills (EUR 2.8 billion)

At least 30% of the InvestEU Programme, in line with the European Green Deal objectives, shall support financing for investments that contribute to EU's climate objectives. Moreover, 60% of the investments supported under the "Sustainable Infrastructure Window" of the InvestEU Fund shall contribute to EU's climate and environmental objectives. For clean air this window is especially relevant. Projects include retrofitting of industry, rolling stock for public transport, large scale insulation of social housing.

Technical Support Instrument

The Technical Support Instrument is the EU programme that provides tailor-made technical expertise to EU Member States to design and implement reforms. The support is demand driven and does not require co-financing from Member States.

With a budget of EUR 864 million for the period 2021-2027, the technical support is provided in a wide range of policy areas, including in relation to clean air objectives. This includes capacity building support for implementing the revised EU Emissions Trading System, the Industrial Emissions Directive as well as for monitoring air quality data.

4.4.3 Facilitating access to Union funds and setting-up a one-stop shop

Beyond making available EU funding to support clean air objectives, the NECD recognises the need to facilitate access to funding to ensure uptake of available funding streams. Article 7 of the NECD sets out that the European Commission:

- *'shall endeavour to facilitate access to existing Union funds, in accordance with the legal provisions governing those funds, in order to support the measures to be taken with a view to complying with the objectives of this Directive'; and that it*
- *'shall evaluate the possibility of creating a one-stop shop, where any interested party can easily check the availability of Union funds, and the related access procedures, for projects which address air pollution concerns'.*

To respond to the first requirement on **facilitating access to existing Union funds**, DG ENV contributed to the elaboration of the legal acts governing the Recovery and Resilience Facility and funding instruments within the Multiannual Financial Framework like

European Structural and Investment Funds, relevant funding under Common Agriculture Policy, framework programme for research and innovation (Horizon Europe), LIFE programme and others to facilitate eligibility of projects contributing to air pollution reduction.

DG ENV informed Member States representatives during Ambient Air Quality Expert Group (NECD) meetings on 11 February 2021, 21 October 2022, 20 April 2023 and 27 June 2024 on funding possibilities to facilitate preparation of clean air policy relevant projects in the context of cohesion policy, RRF, and the Technical Support Instrument.

To respond to the second requirement on **evaluating the possibility of a one-stop-shop**, DG ENV evaluated the possibility to create a one-stop shop where any interested party would be able to access information on available EU funding sources and the respective procedures related to air pollution. The following criteria were considered:

- Easy accessibility to broad public;
- Cost-efficiency of the measure;
- Complementarity with other existing information sources;
- Avoiding duplication with and ensuring precision of information given.

It was concluded that a digital solution would respond best to the above-mentioned criteria, achieving easy access and providing precise, up-to-date information, being cost-efficient and avoiding duplication.

To respond to the requirement of accessibility of information in one single place (one-stop shop), a dedicated web page was prepared that collects links to the most relevant web-based sources to provide information on funding opportunities and relevant procedures in place: Funding for clean air. By linking directly to the relevant web sources of each funding instrument, covering the wide set of key polluting sectors, it avoids outdated or erroneous information as well as duplication. This solution was thus considered the most cost-efficient way to achieve the aim of informing any interested party.

4.4.4 Stakeholder opinions regarding the contribution of EU funding to the objectives of the NECD

The majority of stakeholders responding to the open public consultation thought that EU funding had an at least somewhat positive influence. Four stakeholders saw significant positive influence (one trade union, one NGO, one non-EU citizen and one other stakeholder). 28 stakeholders indicated that it had a somewhat positive influence. Business stakeholders saw the opportunities in EU funding and would like to see them expanded. This was echoed by a citizen respondent. One consumer organisation, one NGO and one "other" stakeholder acknowledged the availability of funding for reducing ammonia under the CAP and for modelling monitoring and emission reduction under Horizon and LIFE.

Three NGOs and one environmental organisation saw a somewhat negative influence and one EU citizen no influence. According to respondents, the somewhat negative influence is due to insufficient monitoring of programmes. Some of the funding goes to projects that lead to few or no advantage and in some cases counterproductive results (e.g. in the field

of energy). Another respondent noted that CAP direct payments did not include instruments to reduce ammonia emissions and in this context questioned the coupled support to livestock.

More detailed stakeholder comments on specific funding streams are included in the chapters above.

4.4.5 Change in coherence over time

The numbers presented above have shown that the amount of funding for clean air objectives has increased over time and under the 2021-27 MFF. This is driven to a large extent to the additional funding available through the Recovery and Resilience Facility. Apart from the scaling up, no change in coherence over time has been observed.

4.5 Coherence with the international framework: Have the NECD and the Gothenburg Protocol proved to be sufficiently coherent?

4.5.1 Alignment of NECD ERCs and those established under the amended Gothenburg Protocol

The two instruments have common objectives aimed at reducing anthropogenic emissions of sulphur dioxide, nitrogen oxides, ammonia, non-methane volatile organic compounds and fine particulate matter, set at a national scale and using the same "percentage reduction against baseline" approach. A study details all issues related to the two instruments.

They set the same ERCs for 2020 and beyond although for the NECD, ERCs are specified for 2020-29 and further ERCs apply from 2030 onwards whereas the GP only has ERCs for 2020 onwards.

Both instruments allow for adjustments to emission inventories where there is non-compliance under certain conditions although the NECD is much more explicit on the justification required.

Other common flexibilities allowed for under both the NECD and GP for compliance checking include a 3-year averaging of emissions if an exceedance is due to climatological or infrastructure (power and/or heating supply or production system) issues.

The two instruments share common emission inventory compilation and reporting requirements although these are more explicit in the NECD itself relative to the GP where some of the specific requirements are set out in supporting guidance and decisions. However, they both rely on the same set of guidance documents and guidebook (developed jointly by EMEP/EEA).

Both the NECD and the GP require to draw up and disseminate a Code for Agricultural Practice to control ammonia emissions. Both frameworks specify what should be covered

by the Code, and the lists of issues are identical, building on the recommendations of the Air Convention ammonia guidance document[366].

The GP and NECD require countries to prioritise emission reduction measures for black carbon when implementing measures to reduce particulate matter emissions.

Stakeholders generally confirmed coherence between the NECD and the GP. A majority of stakeholders felt that the NECD provides a coherent mechanism for implementing the emission reduction commitments under the Protocol. In the TSC, several public authorities, NGOs and industry representatives acknowledged that embedding the GP reduction commitments in EU law helps ensure compliance, creates legal certainty, and facilitates enforcement. The inclusion of common reporting methodologies, such as those developed under the UNECE CLRTAP (e.g. EMEP/EEA guidelines), was also seen as promoting coherence and efficiency in monitoring and evaluation.

4.5.2 List of elements that may lead to incoherence between the NECD and the Gothenburg Protocol

Differences in geographical scope reflects the coverage of the different bodies concerned (EU and UNECE).

The GP Annexes include emission limits and other requirements for stationary and mobile sources, fuels and NMVOC contents of products which are not included within the NECD. However, these requirements are captured under other EU legislation such as the Industrial Emissions Directive, Euro standards for vehicle emissions, Fuel Quality Directive, etc.

The GP only includes ERCs for 2020 and beyond whereas the NECD sets ERCs for 2020-29 and 2030 and beyond. In addition, the NECD includes a legal requirement to follow in 2025 a linear trajectory towards the 2030 ERCs (except where it can be demonstrated that it is economically or technically more efficient to follow a non-linear trajectory).

The NECD excludes emissions of NOx and NMVOC from activities falling under NFR codes 3B (manure management) and 3D (agricultural soils) for the assessment of compliance against the ERCs.

Member States are required to draw up, adopt and implement their respective National Air Pollution Control Programmes (NAPCPs) under the NECD.

The GP includes explicit definitions for critical load and critical levels which are not set out in the NECD. However, the NECD includes explicit requirements for monitoring and reporting of air pollution impacts on ecosystems (NECD article 9).

Article 13 (Adjustments) to the GP allows Parties to the Convention to apply to the Executive Body for their ERC(s) to be changed. No equivalent adjustment of ERCs is included within the NECD.

366 UNECE (2012), Guidance document for preventing and abating ammonia emissions from agricultural sources, ECE/EB.AIR/120.

In some instances, the NECD provides a more detailed description, relative to the GP, of possible measures to be considered for reducing emissions of ammonia from agriculture. Both the NECD and GP make reference to the Air Convention ammonia guidance document on measures for agriculture where significantly more detail is provided on specific measures for manure application and storage, livestock housing and livestock feeding strategies. The NECD also refers to the Air Convention guidance on national nitrogen budgets, which was adopted after the most recent amendments to the GP.

The NECD also includes possible optional measures to be considered for the control of PM and black carbon emissions from agriculture linked to management of harvest/forestry residue and waste. No such equivalent is included within the GP.

And most importantly, the NECD has a much stronger enforcement mechanism, backed up by infringement cases for any of the obligations in the Directive, while the GP lacks such strong enforcement mechanisms. The Implementation Committee of the Air Convention yearly reviews the reporting by contracting parties, but there is no real enforcement or follow-up of non-compliance cases.

4.5.3 Change in coherence over time

The above analysis was done on the basis of the Gothenburg Protocol as amended in 2012, thus there were no changes to coherence throughout time. The GP is currently under revision (process planned to be completed not before end 2026 with even later application). This may affect the coherence and relevance of the NECD respectively to the GP in the future.

Decision 2021/3 of the Executive Body[367] provided for a mechanism whereby the EU can submit a correction of the values in the row for the EU total, in tables, 2 to 6 of Annex II to the Gothenburg Protocol to account for changes in the membership to the European Union. The EU made use of this possibility and submitted a technical correction to reflect the accession of Croatia and the withdrawal of the United Kingdom in the values set out for the EU. This technical correction was communicated by the Executive Secretary to the Parties to the Air Convention. Subsequently, the percentages reduction commitment for NOx changed from 42% to 40%. The indicative percentage for the EU for NO_x in Annex II to the NECD remains at 42%.

4.6 To what extent has the non-inclusion of methane in the NECD hampered reduction of methane emissions (from agriculture, waste, energy) at EU and international level?

4.6.1 Emissions of methane over time, split by sector

The EEA has published a briefing in 2025 on 'Methane, climate change and air quality in Europe: exploring the connections'[368], which discusses the role of methane both as an ozone precursor and as a potent greenhouse gas (responsible for 12% of greenhouse gas

[367] Decision 2021/3, ECE/EB.AIR/148

[368] EEA (2025) Methane, climate change and air quality in Europe: exploring the connections, EEA Briefing No 01/2025.

emissions in Europe). The briefing also sets out the development of methane emissions over past decades and focuses on the three main source sectors: agriculture (livestock management), waste and energy.

The figure below shows the development in methane emissions in the EU over time, showing the main sources of emissions. Anthropogenic methane emissions amounted to around 410 million tonnes CO2e in 2022 (EEA, 2025), which corresponds to a reduction of about 38% since 1990. The agriculture, waste and energy sectors are the largest sources of anthropogenic methane emissions in Europe.

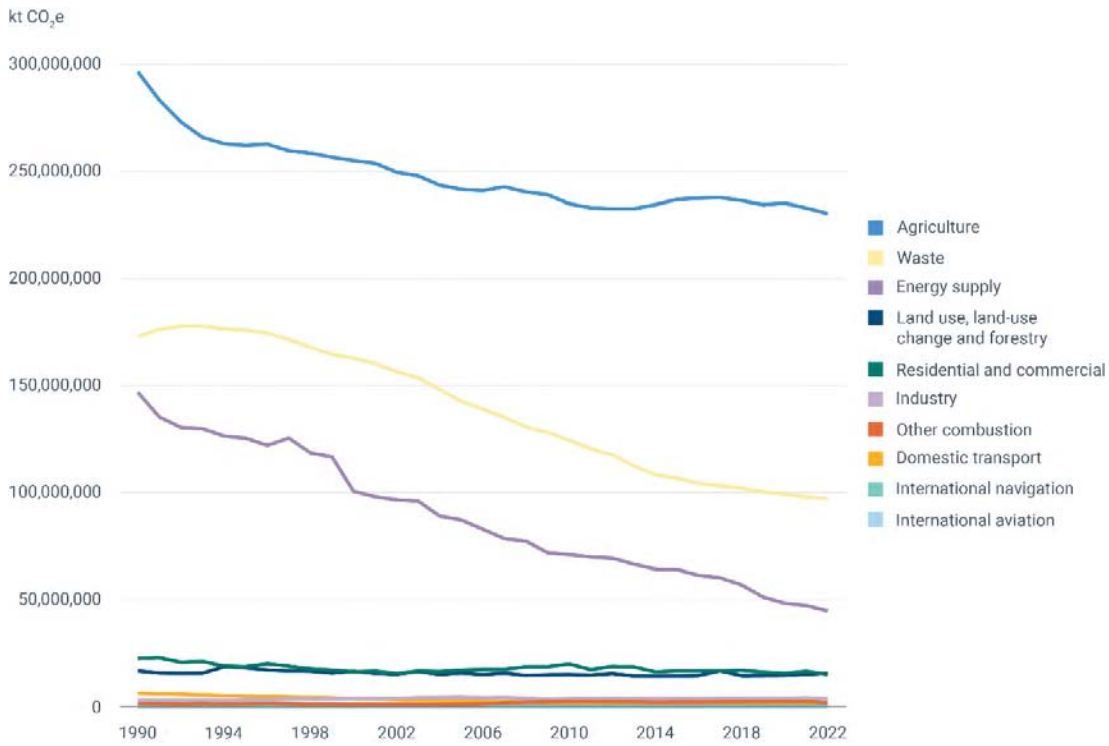

Figure A - 41 – Methane emission trends by sector in the EU-27, 1990-2022 (Source: EEA 2025 Methane briefing)

While methane emissions are decreasing in the EU, **global methane emissions** and the relative contribution of methane to global warming is increasing. Global methane emissions also significantly influence ground-level ozone concentrations in Europe. The overall increase in global emissions is apparent when looking at the level of global methane concentration (see figure below), which is now around 1 925 ppb, which is over two-and-a-half times greater than pre-industrial levels (722 ppb). When talking about methane concentrations is it worth noting that methane is emitted from natural and anthropogenic sources, with natural sources making up around 40% (wetlands being the main source) of total global emissions, with the remainder due to human activities[369].

[369] IEA, 2024, 'Global Methane Tracker 2024 – Analysis'.

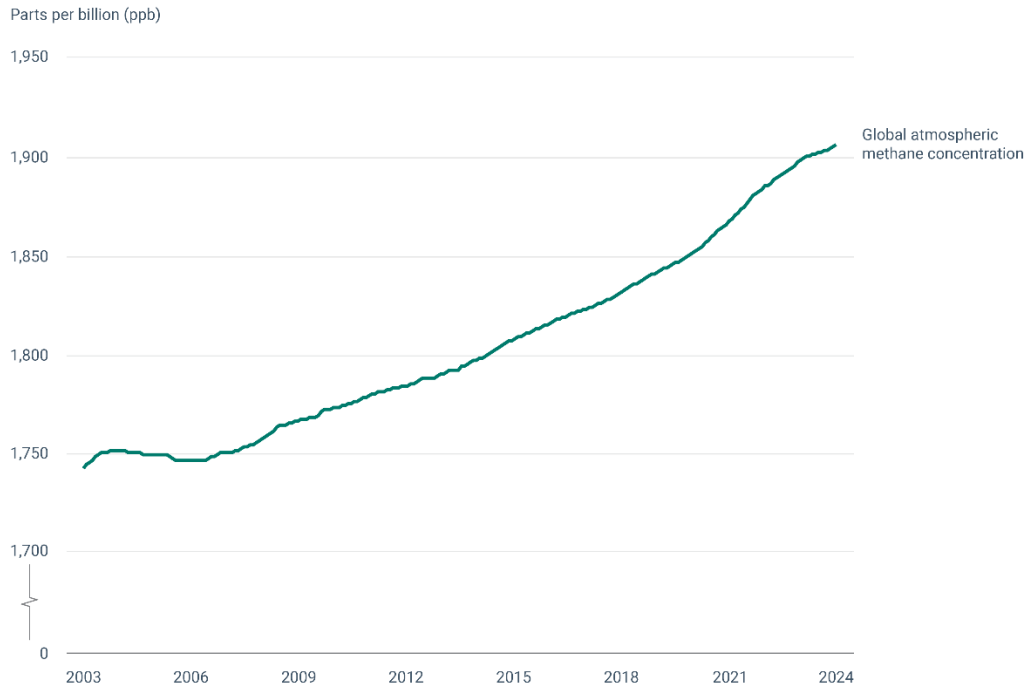

Figure A - 42 – Atmospheric methane measured in ppb (as dry-air mole fraction) (Source: EEA 2025 Methane briefing)

Methane was included in the Commission's 2023 proposal for the NECD given its role as an ozone precursor. Ground-level ozone harms human health and is linked to respiratory diseases and premature deaths. In the EU, it remains above levels recommended by the World Health Organization (WHO), with 94% of the EU's urban population exposed to harmful levels. Staying within WHO's Air Quality Guideline values could potentially prevent 70,000 premature deaths annually in the EU (EEA, 2025). The revised AAQD maintains the target value of 120 µg/m^3, but it reduces the number of calendar days that this value may be exceeded to 18 (down from 25) days averaged over three years. Furthermore, the revised Directive introduced methane in the list of relevant ozone precursors that may be monitored at air quality stations as it can also be a relevant regional or local precursor in some areas.

Ground-level ozone also impacts ecosystems and agricultural production. It reduces growth rates and crop yields and is estimated to cause at least EUR 2 billion in damage to food crops every year in Europe[370].

CAO4 provides analysis changing the assumptions on mitigation of ozone precursors (methane and non-methane ones), in the EU and globally. The modelling confirms that there is great potential globally to reduce methane and other ozone precursors (NOx, NMVOC and carbon monoxide). Joint action at global level reduces ozone concentrations in Europe, bringing many additional stations in compliance with the ozone target set in the Ambient Air Quality Directive, to a greater degree than if the EU alone took action or if global action is taken to reduce only methane, not the other precursors. The impact of

370 Further information is available in https://www.eea.europa.eu/en/analysis/publications/impacts-of-air-pollution-on-ecosystems-in-europe.

additional mitigation is particularly pronounced as of 2040. A similar message emerges from a report by the JRC[371].

The EEA (2025) also concludes that further action is needed to control and reduce methane emissions, as well as other ozone precursors, at the European and international levels to mitigate climate change, improve air quality and reduce health impacts.

4.6.2 Coverage of methane in targets and measures under climate, agriculture, energy and waste policies at EU and international level, identification of gaps relevant for the NECD

The Commission launched on 14 October 2020 the **Methane Strategy**[372], aiming to reduce methane emissions, consisting of actions within the EU in energy, agriculture, waste and wastewater sectors, and envisages a binding legislation for energy-related methane emissions.

Regarding methane emissions from **agriculture**, the 2023-2027 Common Agricultural Policy allows MS to introduce measures to reduce methane in their CAP Strategic Plans (CSP) in order to address one of the 10 key objectives: contribute to climate change mitigation and adaptation, including by reducing greenhouse gas emissions and enhancing carbon sequestration, as well as promoting sustainable energy. While most of the CAP support to climate mitigation comes from actions to improve soil health, nitrogen efficiency and manure management and support to investments in manure storage and processing, only 11 out of 28 CSP set out actions towards reducing livestock methane emissions from enteric fermentation. It is worth noting that most measures to reduce methane emissions from manure management would also reduce ammonia emissions, the air pollutant for which no-compliance with emission reduction commitments is most frequent[373].

Regarding methane emissions from **waste**, these are tackled indirectly but rather effectively, as seen above, due to a comprehensive policy framework on waste in the EU, with the Waste Framework Directive[374], the Landfill Directive[375] and other circular economy policies and actions promoting waste treatment options higher up the waste hierarchy, hence reducing environmental impacts from landfilling, including emissions of methane.

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371 Bessagnet B et al. (2024), Trends of methane emissions and their impact on ozone concentrations at the European and Global levels.

372 COM(2020) 663 final.

373 See a guidance prepared by the Taskforce on Reactive Nitrogen (TFRN) under UNECE: 'Co-mitigation of methane and ammonia emissions from agricultural sources: policy brief and guidance'.

374 Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives.

375 Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste.

Regarding **energy** sector emissions, the EU adopted in 2024 the Regulation on methane emissions in the energy sector[376] (here after mentioned as Methane Regulation), which entered into force on 4 August 2024 and which sets:

1. Mandatory requirements on measuring and reporting of methane emissions in the EU;
2. Mandatory measures on mitigation of methane emissions in the oil, fossil gas and coal sectors in the EU (prohibiting avoidable and routine flaring, and reducing flaring and venting to exceptional situations such as emergencies or technical malfunctions);
3. Mandatory requirements towards importers of energy in the EU (comparable level of MRV than inside the EU as well as an online methane transparency database available to the public).

There are also some provisions under the **Industrial Emissions Directive (IED)**, and the Best Available technique conclusions (BATc) adopted under its remit, of relevance for methane. BATc that address methane emissions include monitoring and prevention/reduction of VOC emissions in the BATc for refineries (2018) and the chemical sector (2016 and 2022), and emissions level in large combustion plants (2017). While landfills are covered by the IED (around 3000 across the EU), work on BATc for landfills has only started in 2024, addressing the key environmental issues related to the operation of waste landfills, including significant emissions of methane. BATc on large pig and poultry farms have some relevance for methane emissions. There are no BATc related to cattle facilities, which are a significant source of EU methane emissions.

Finally, methane emissions are regulated amongst other greenhouse gases under **EU climate policy**. Methane emissions fall mostly under the **Effort Sharing Regulation** (ESR), which sets annual national emission reduction targets. These targets cover all GHG from the ESR sectors, such as buildings, transport and agriculture. EU Member States are responsible for meeting these targets, but they have the flexibility to decide how to achieve the required mitigation across the ESR sectors and the different greenhouse gases. In other words, there are no targets for specific sectors or GHG, like N_2O in agriculture, F-gases in refrigeration, or CH_4 in waste management. It is EU sectoral policies that may trigger reductions in methane emissions, as presented above.

Regarding emissions from **international shipping** and their treatment under climate policy: In 2023, the European Union Emission Trading System (EU ETS) was extended and adopted to cover, as of January 2024, GHG emissions from all large ships (of 5,000 gross tonnage and above) entering European Economic Area ports, regardless of the flag they fly[377]. Shipping companies will have to purchase and surrender EU ETS emission allowances for each tonne of reported GHG emissions in the scope of the EU ETS system,

376 Regulation (EU) 2024/1787.

377 Regulation (EU) 2023/957 of the European Parliament and of the Council of 10 May 2023 amending Regulation (EU) 2015/757 in order to provide for the inclusion of maritime transport activities in the EU Emissions Trading System and for the monitoring, reporting and verification of emissions of additional greenhouse gases and emissions from additional ship types.

which will cover carbon dioxide (CO_2) as of 2024 and additionally methane (CH_4) and nitrous oxide (N_2O) as of 2026.

International action: Due to the global transport of methane and the intercontinental transport of ozone, it is necessary to consider methane, along with other precursors, in the context of a broader intercontinental approach to reduce background ozone concentrations in Europe. This is also why methane is on the agenda for the revision of the Gothenburg Protocol.

The required global efforts in methane mitigation are recognised in the **Global Methane Pledge** (GMP), which is a collective voluntary commitment to reduce global anthropogenic methane emissions across all sectors by at least 30% below 2020 levels by 2030. The pledge was launched at COP26 by the EU and the United States of America and currently includes 159 participants. Finally, UNEP funded Climate and Clean Air Coalition also supports actions on "super pollutants" including support to the GMP.

4.6.3 Stakeholder opinion regarding the non-inclusion of methane

A majority of stakeholders in both TSC and OPC responded that methane's exclusion from the NECD had limited reductions of its emissions across the main source sectors agriculture, energy and waste, driven by a vast majority of NGO responses indicating non-inclusion had limited the reduction potential. There was more of a mixed view among public authorities, while businesses or industry associations mostly disagreed that non-inclusion had hampered methane emission reductions. Below figure gives the example of the agriculture sub-question in the OPC, with energy and waste sub-questions showing a similar pattern of replies across stakeholder groups. Many stakeholders also agreed that excluding methane has limited the potential to reduce ozone levels. Overall, the **findings suggest stakeholder support for reconsidering the scope of the NECD to include methane**, aligning it more closely with scientific understanding of pollutant interactions and reinforcing synergies with climate policy.

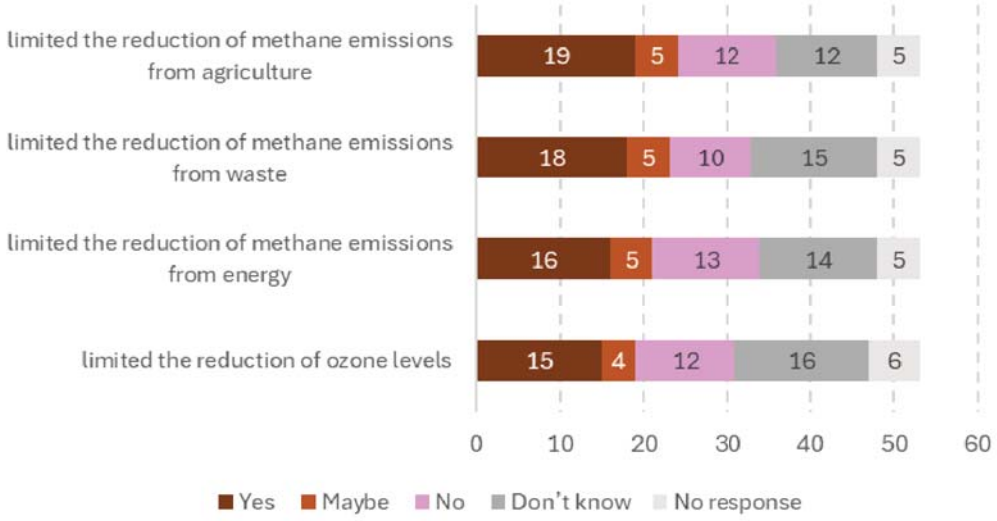

Figure A - 43 – Replies to OPC question 'Has the non-inclusion of methane in the NECD limited the reduction of … ?'

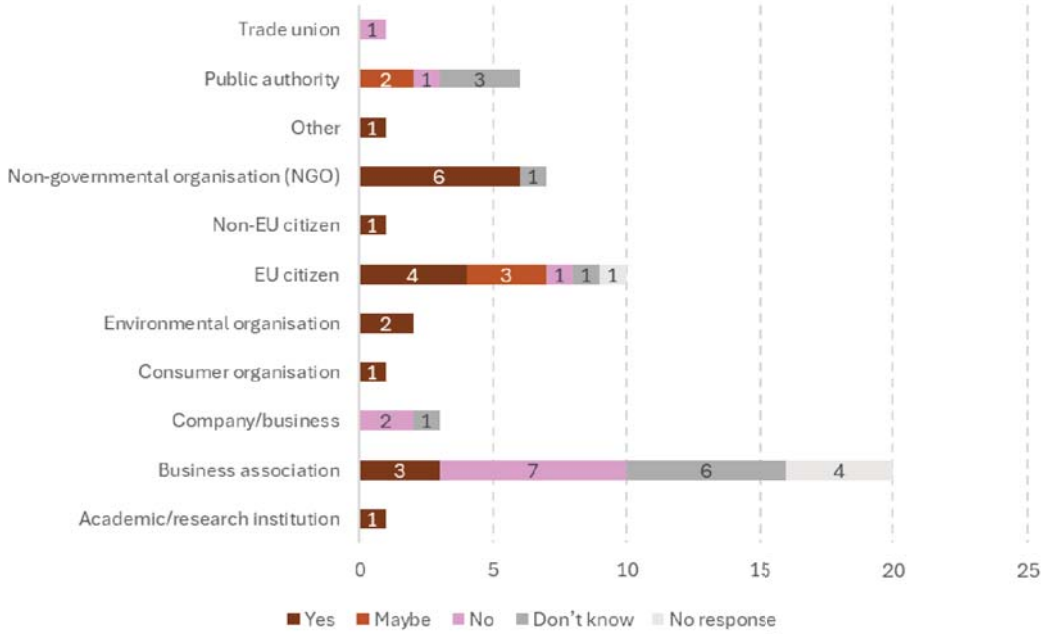

Figure A - 44 – Replies to OPC question 'Has the non-inclusion of methane in the NECD limited the reduction of methane emissions from agriculture?'

Seven **NGOs** provided additional comments in the OPC, highlighting methane's dual role as a potent GHG and ozone precursor and the need to address methane emissions in agriculture in particular. Four **public authorities** provided additional comments in the OPC. Statements made included that the non-inclusion of methane does not preclude action to be taken to reduce methane emissions, as well as pointing to the dual role of methane as a GHG and ozone precursor, meaning implementation of abatement measures would result in lower ozone levels.

4.7 Has coherence changed over time?

Overall, the analysis of coherence shows that there is a large degree of coherence between the NECD and other policies or frameworks, with a few exceptions as noted in above sections. **Over time, coherence was** in many cases **maintained**, while in some cases it **increased.**

Coherence with the **AAQD** has increased with the revised AAQD adopted in 2024, notably because of provisions that will require enhanced alignment between air quality plans and NAPCP and additional direct references to the NECD to increase the use of data reported under the NECD for air quality assessment and management.

Regarding **source legislation**, where the legislation changed during the NECD evaluation period (2016-2025), this brought about a strengthening of the coherence between policies. For example, the switch from Euro 6 to Euro 7 emission standards limit emissions further, and therefore enhances the potential of the euro emission standards to contribute to the objectives of the NECD; as further maritime areas become SOx ECAs, the impact of the Sulphur Directive on SO_2 emission reductions are enhanced; with the 2024 revision of the IED and its extended scope, the coherence between the IED and the NECD is further enhanced.

Regarding **climate and energy legislation**, changes have mostly reinforced coherence further. For example, the strenghtened targets for energy efficiency would enhance the coherence with the objectives of the NECD; the extension of the scope of the Ecodesign framework has the potential to bring further co-benefits for air pollution. Regarding renewable energy, the strengthened targets for the share of renewable energy (the latest revision dates from 2023) in the energy mix are expected to bring a mixed effect: on the one hand, less air emissions due to the wider use of renewables, on the other hand, a potential further increase in small-scale combustion of biomass resulting in higher $PM_{2.5}$ and NMVOC emissions.

Between the two cycles of the **Common Agricultural Policy**, synergies improved. This is mainly due to explicit references to the objectives of the NECD, and the specific indicators for interventions to reduce ammonia emissions from livestock. However, actual take-up will need to be monitored over the CAP 2023-2027 implementation period..

Regarding **biodiversity** and **innovation** related policies, no substantial changes in coherence have been observed over the NECD evaluation period though the absolute amount of funding for clean air objectives has increased with the introduction of the Recovery and Resilience Facility.

Coherence with the **Gothenburg Protocol** has not changed as the latest revision of the GP dates from 2012, however, the GP is currently under revision (process due to be completed not before end 2026 with even later application), which may affect the coherence and relevance of the NECD respectively to the GP in the future.

As regards the **non-inclusion of methane** and the potential this creates for incoherence, advances have been made since the adoption of the NECD yet the global methane emissions continue to increase. At international level this includes the signature of the Global Methane Pledge. The future effectiveness of this global voluntary framework initiated jointly by the EU and the USA, needs to be observed closely, however. Methane is also discussed for potential inclusion under the Gothenburg Protocol. In the EU, methane emissions from the energy sector are now regulated through the Regulation on methane. Evidence from modelling studies makes a strong case for tackling methane globally, along other precursors, in order to effectively reduce ozone levels. There remains thus an urgent need to address methane both given its role as a potent GHG gas and as a precursor for ozone – and it remains to be seen under which framework further action to reduce methane could be pursued most effectively.

5 DETAILED ANALYSIS OF THE "RELEVANCE" EVALUATION CRITERION

BOX 11. Summary of evaluation questions on relevance

- Has the relevance of the objectives of the NECD and the means of achieving them changed?
- Have the needs the NECD intends to address evolved and how are they likely to evolve in the future? Would the current objectives still match the needs?

- Does the scope of the NECD remain relevant?

5.1 Has the relevance of the objectives of the NECD and of the means of achieving them changed over the past years?

5.1.1 Relevance with respect to changes in related policy fields (e.g. European Green Deal, Union climate and energy policies)

The objectives of the NECD and the means of achieving them remain highly relevant in light of developments in related policy fields. Air pollution still causes considerable harm for human health and the environment. More stringent energy and climate legislation as well as increased ambition in source legislation as adopted under the European Green Deal have contributed to reducing emissions of the main air pollutants regulated by the NECD, hence yielding important co-benefits. However, not all of the main air pollutants 'benefit' equally from such co-benefits. SO_2 and NO_x emissions have benefitted in particular from increased ambition on energy efficiency, less reliance on solid fossil fuels and roll-out of stricter emission standards for vehicles (and in particular more reliable emissions tests in real driving conditions) as well as growing electrification rates in road transport. For $PM_{2.5}$, while many energy and climate measures achieve reductions in particulate matter, the growing reliance on bioenergy (a significant source of particulate matter emissions and other pollutants) promoted alongside other renewable energy sources means that dedicated pollutant abatement strategies continue to be needed and relevant[378]. Ammonia has seen the least reductions of the five main pollutants and is the one that is less addressed by other legislation, while being an important precursor for particulate matter, hence contributing to negative health impacts, and contributing directly to eutrophication of ecosystems.

Source legislation on its own cannot cap the overall, combined impact of relevant sources (e.g. road transport, domestic heating, industrial emissions), as – by design – it regulates what a single source (e.g. a car, a stove, an industrial installation) emits. The NECD draws the attention to the combined effect of these sources and provides a legal framework to bring these down at national level. This mechanism is unique to the NECD and remains relevant in the evolving policy context, considering also the continued need to address the main air pollutants.

5.1.2 Relevance with respect to technical and scientific progress, including with regard to UNECE guidance related to ammonia and BAT under the Industrial Emissions Directive?

5.1.2.1 Understanding of human and environmental health risk of exposure to air pollution and methodologies to assess effects

The objectives of the NECD to move towards achieving levels of air quality that do not give rise to significant negative impacts on and risks to human health and the environment

[378] EC (2024), Increasing policy coherence between bioenergy and clean air policies and measures includes a 'toolbox' addressed at policy makers on how to best manage air quality trade-offs from using bioenergy.

remain relevant, also in light of reconfirmed evidence on human and environmental health risk of exposure to air pollution – see, for example, the updated World Health Organization (WHO) global air quality guidelines on particulate matter, ozone, nitrogen dioxide, sulphur dioxide and carbon monoxide (as published in 2021).

As regards human health, EU clean air policy bases itself on scientific evidence, taking into account relevant WHO guidelines and programmes. This evidence of harmful effects of air pollution **is well established and has been further developed over the past decade** – indeed the 2021 edition of WHO air quality guidelines confirms that **for several air pollutants adverse health impacts occur at concentration levels below what had been stated in previous editions**[379].

In addition, a growing body of research points to the relevance of considering various components of particulate matter, such as black carbon or ultrafine particles[380] (see also Annex III section 5.3 below).

BOX 12. World Health Organization Air Quality Guidelines

Previous versions of WHO Air Quality Guidelines were published in a 2000 edition, and in a 2005 edition. The 2000 edition provided recommendations on a wide range of air pollutants, whereas the 2005 edition indicated more refined guidelines for the major health-damaging air pollutants, including particulate matter ($PM_{2.5}$ and PM_{10}), ozone (O_3), nitrogen dioxide (NO_2) and sulphur dioxide (SO_2).

In September 2021, a revised edition of the WHO global Air Quality Guidelines was published. This revision focused on particulate matter ($PM_{2.5}$ and PM_{10}), ozone, nitrogen dioxide, sulphur dioxide and carbon monoxide. For these air pollutants, the WHO offers updated evidence-informed recommendations in the form of guideline levels, including an indication of the shape of the concentration-response functions in relation to critical health outcomes, as well as interim targets to guide reduction efforts.

The 2021 WHO Air Quality Guidelines were formulated following systematic reviews[381] of the evidence and meta-analyses of quantitative effect estimates; assessments of the level of certainty of the bodies of evidence resulting from these systematic reviews; and the identification of guideline levels, that is, the lowest levels of exposure for which there is evidence of adverse health effects.

Following the 2021 WHO Air Quality Guidelines, the AAQD impact assessment and the EEA Air Quality in Europe reports have employed an **evolved approach to estimating health impacts using the WHO Air Quality Guideline levels (5 µg/m^3 for $PM_{2.5}$ and 10 µg/m^3 for NO_2) as lower cut-offs** for health impact calculations.

The EMAPEC (Estimating the Morbidity from Air Pollution and its Economic Costs) study coordinated by WHO and published in 2024[382] yielded updated **morbidity functions**

379 This has been elaborated in detail for a number of air pollutants in Annex 10 of the impact assessment underpinning the Commission's proposal to revise the AAQD (SWD(2022) 545 final, PART 4/4).

380 The 2021 WHO Air Quality Guidelines note both short-term and long-term effects of exposure to ultrafine particles, including cardiovascular, ischemic heart disease and pulmonary health impacts – but also conclude that the body of epidemiological evidence was not yet sufficient to formulate guideline levels.

381 The systematic reviews that informed the formulation of WHO Air Quality Guidelines levels and other related evidence discussed during the process are available in a special issue of Environment International published in 2021, entitled 'Update of the WHO global Air Quality Guidelines: systematic reviews'.

382 Forastiere F., Spadaro J.V., Ancona C., et al. (2024) Choices of morbidity outcomes and concentration–response functions for health risk assessment of long-term exposure to air pollution. Environmental Epidemiology 8(4):p e314.

for $PM_{2.5}$ and NO_2. These include updated functions for certain health outcomes, including ischaemic heart disease, chronic obstructive pulmonary disease (COPD), stroke, diabetes, acute lower respiratory infections and new incidence of asthma, and an additional function for dementia. Besides causing people to die prematurely, there is thus also **growing evidence on air pollution causing illness with the potential to severely lower the quality of life of those affected**.

The scientific evidence informing health impact analysis continues to evolve. In October 2024, first scientific papers have been published considering updated **mortality functions** for $PM_{2.5}$, NO_2 and O_3, drafted in the context of another study coordinated by the WHO – HRAPIE 2[383] – for which no final WHO recommendations are available yet.

The health impact assessment in the Clean Air Outlook, which by extension informed the Zero Pollution Monitoring and Outlook reports, has been updated over the past years, to reflect new evidence, provided by WHO and other academic publications in the area. Amongst the more substantial changes was the integration of the concentration-response functions from the 2021 WHO guidelines for the CAO3, for $PM_{2.5}$, NO_2, and O_3[384], and the EMAPEC results on morbidity for CAO4.

For the **valuation of health impacts**, which underpins cost-benefit analysis conducted in past CAO reports, all sources of evidence are documented in CAO reports. What is worth noting is that the adult "value of statistical life" estimate of EUR (2015) 3.6 million originates from a 2012 OECD study. The OECD updated this study in 2025[385]. The update included a meta-analysis of a wider range of VSL studies (more than 4000 estimates in 277 studies). The estimated mean based VSL for OECD and high-income countries was adjusted upwards, to USD 8.5 million (corresponding to EUR 7.4 million at the time of writing this evaluation).

Methods to estimate and value impacts on materials, crops, forests and ecosystems have remained more stable, with the exception of **updated critical load data on eutrophication and acidification** (updating a dataset from 2017), to establish the extent of ecosystem area in the EU where critical loads are exceeded, meaning ecosystems that are at risk from acidification or eutrophication. This new dataset evolves from work by the Coordination Centre for Effects of the Working Group on Effects (WGE) under the Air Convention, finalised in 2021. This new dataset has been used since CAO3 and yielded at EU level similar results for ecosystems at risk compared to using the old critical load data (with more significant shifts (going in either direction) at the level of individual Member States),

383 Health Response to Air Pollutants in Europe 2.

384 Details are provided in Klimont et al., "Support to the development of the third Clean Air Outlook", IIASA, 2022 [IIASA 2022], available at: https://environment.ec.europa.eu/topics/air/clean-air-outlook_en.

385 OECD (2012) Mortality Risk Valuation in Environment, Health and Transport Policies and OECD (2025), Mortality Risk Valuation in Policy Assessment: A Global Meta-Analysis of Value of Statistical Life Studies.

hence confirming that acting on air pollution to reduce harmful impacts on ecosystems remains relevant.

5.1.2.2 Robustness of UNECE Guidance on ammonia

The UNECE Guidance Document on Preventing and Abating Ammonia Emissions from Agricultural Sources of 2014 (the 'Ammonia Guidance Document')[386], and the 2015 UNECE Framework Code for Good Agricultural Practice for Reducing Ammonia Emissions[387] are referred to in and have informed Annex III Part 2 of the NECD setting out emission reduction measures for ammonia. They are currently under revision. The Commission supports the revision process and hosted a workshop in June 2025 to povide a forum to discuss further the ongoing revision. A separate Guidance on integrated sustainable nitrogen management was adopted in 2021, aiming at controlling pollution from agricultural sources in the context of the wider nitrogen cycle in an integrated manner harvesting multiple co-benefits of improved nitrogen management. Among the improvements suggested are introducing emission factors, more information on livestock feeding strategies, ensuring coherence with the UNECE Guidance Document on Integrated Sustainable Nitrogen Management, addressing the interaction between manure management and manure application techniques, including measures on biochar as a synthetic fertiliser in use, including emissions from fertiliser production in the Ammonia Guidance Document, and detailing precision farming technologies[388].

At this state, the reference in Annex III Part 2 to the UNECE documents remains relevant, but some updates might become necessary in light of their revision and additional guidance material.

5.1.2.3 Range, cost and effectiveness of abatement techniques across different sectors

As has been seen throughout the analysis, reductions in air pollutant emissions over time are broadly triggered by two types of changes:

- Changes in the activity level of certain economic activities. This may be linked to increased uptake of new activities, e.g. shift from fossil fuel combustion to non-combustible renewable sources of energy.
- Changes in the way a given economic activity is conducted. This includes employing abatement techniques, to render an existing activity less polluting (e.g. end-of-pipe abatement through installation of particle filters in mobile or stationary combustion, change of practices in the way animal manure is handled).

Such changes in the patterns of production are reflected in emission inventories, as they influence the key data points needed to estimate emission levels, i.e. activity data and emission factors. There have been no breakthrough developments over the evaluation period in abatement techniques that would have rendered the NECD less relevant. Rather, various developments, including policies stimulating a transition towards cleaner energy

386 Decision 2012/11/EC, ECE/EB/AIR/113/Add. 1.
387 Decision ECE/EB.AIR/127, paragraph 36e.
388 UNECE (2024) Report of the Task Force on Reactive Nitrogen.

and industrial systems, or external factors (Covid-19, Russian military aggression against Ukraine), have favoured **gradual shifts in economic activity and uptake of existing abatement techniques that mitigate emissions of air pollutants**. This gradual roll-out is built into many of the policies that, as seen above, also lead to reductions of air pollutants. E.g. best available techniques under the IED are seeing their effects increase with every new permit that is issued in line with the latest available BAT conclusions. Ecodesign criteria also see a gradual phase-in as they apply to new appliances, so the rate of stock renewal is an important determinant of how quickly reductions in air pollutant emissions materialise. The same holds for Euro standards, whose effect is linked to fleet turnover rates. All this means that source and other related legislation continues to contribute (and in some cases increasingly so, see sections above related to coherence) to achieving the objectives of the NECD. What source legislation by design does not achieve is setting un upper level to national emissions, which is where the NECD and its emission reduction commitments come in by providing a framework to guide sectoral policies and measures in pursuit of overall health and environmental objectives.

5.2 How have the needs which the NECD was meant to address and identified in the intervention logic evolved and how would they evolve in the future? Would the current objectives of the NECD still address them?

The NECD was meant to address impacts of air pollution on human health and the environment and to help Member States meet EU air quality standards and obligations under the Gothenburg Protocol.

Before going into the detailed analysis, it is worth highlighting that across both consultation exercises **stakeholders** overwhelmingly agreed with the continued relevance of the NECD to address the identified needs. In the OPC, the vast majority of stakeholders responding agreed that the pollutants targeted by the Directive —SO_2 , NO_x, NMVOC, NH_3 and $PM_{2.5}$ — continue to pose significant risks to human health, ecosystems, and climate. Many respondents stressed that, despite notable improvements in air quality over the past two decades, emission levels of key pollutants remain too high in many areas, and that further action is needed to address persistent exceedances of air quality standards. This view was strongly echoed in the TSC, where stakeholders across all groups — including public authorities, NGOs, industry representatives, and academia — indicated that **the Directive addresses issues that are still highly relevant today**.

5.2.1 Levels of human health and environmental impacts, now and in the future (considering ZPAP and 2021 WHO Guidelines) and levels of compliance with air quality standards, now and in the future (number of exceedances)

Section 2.1 of this annex provides quantified impacts on human health and the environment, including compared to the **zero-pollution targets**. It shows that under current policies (baseline):

- the EU is **unlikely to meet** the zero-pollution target of reducing the ecosystem area where air pollution threatens biodiversity by 25% in 2030 compared to 2005, with only a 19% reduction expected in areas at risk between 2005 and 2030[389].
- the EU is **on track** to meet the zero-pollution target of reducing premature deaths due to $PM_{2.5}$ exposure by 55% in 2030 compared to 2005.

Ecosystems remain under considerable pressure. As shown in Annex III section 2.1.5 and based on the 4th Clean Air Outlook, even in a scenario where Member States meet the 2030+ ERCs ('ERC scenario') in 2030, progress is not sufficient (even if the EU comes closer to meeting the 25% reduction in ecosystem area at risk from eutrophication). 73% of the ecosystems in the EU were subjected to nitrogen deposition above critical loads in 2022 with NH_3 emissions from agriculture being a main cause[390]. **The current ambition level of ERCs can thus be considered insufficient to address the need of reducing impacts on the environment**, and to ensure the EU meets the zero-pollution target for ecosystems.

Additional measures would be required to ensure the necessary reductions in particular of ammonia emissions materialise. The latest two CAO editions have shown that there is a mix of *technical* measures available to ensure the 25% reduction is achieved ('ZPAP scenario' modelled in both reports). In particular, this would require additional efforts from Member States to address ammonia emissions from livestock manure (in particular, spreading manure on fields), followed by measures to mitigate emissions from using mineral fertilisers and from breeding pigs and poultry.

BOX 13. Stakeholder responses on adequacy of ERCs

On **adequacy of ERCs**, the responses reveal a range of stakeholder perspectives, often reflecting the specific challenges and policy environments in different Member States:

- For SO_2 and NO_x, many respondents considered the current emission reduction commitments to be appropriate or achievable, though a number also flagged implementation issues, especially in sectors like energy and transport.
- For NMVOC, opinions were more mixed. While some stakeholders viewed the targets as reasonable, others questioned their adequacy, citing ongoing emissions from solvents and industrial processes.
- NH_3 stood out as a particular concern. Many respondents described the commitments as insufficiently ambitious, expressing concerns about increases in emissions from intensive agriculture. Several also expressed frustration with the lack of enforcement or sectoral coverage.
- For $PM_{2.5}$, perceptions varied widely. Some believed the commitments were adequate, while others stressed that residential heating, especially wood burning, remains a major unaddressed source of pollution.

Compliance with **air quality standards set in the Ambient Air Quality Directive(s)** has improved over time. As presented in Table A-61, for the year 2023, Member States have reported 27 zones in exceedance of the annual mean for NO_2 compared to 119 zones in exceedance for the year 2016. They also reported 38 zones in exceedance of the daily mean in 2023 for PM_{10} compared to 96 zone in exceedance for the year 2016. Therefore, whilst broad compliance has been reached for a number of key pollutants, poor air quality remains

389 Under these circumstances the 25% reduction target is expected to be met between 2040 and 2045.

390 Impacts of air pollution on ecosystems in Europe – EEA Briefing 2024

a concern in specific locations. Hence, as of November 2025, there were 23 ongoing infringement cases related to exceedances of EU limit values set by the Ambient Air Quality Directives against 15 Member States.

In addition, and looking ahead, the revised Ambient Air Quality Directive adopted in 2024 sets stricter air quality standards which are presented in the table below. The revised Directive also introduces an average exposure reduction obligation for $PM_{2.5}$ and NO_2 at average exposure territorial unit level to be met by 2030.

Table A - 60 – Comparison of air quality standards under the current AAQD and the revised AAQD

Pollutant	**AQ standard**	**Averaging Period**	**Directive 2008/50/EC**		**Directive (EU) 2024/2881** (to be attained as from 2030)	
			Air quality standard		**Air quality standard**	
NO2	Hourly Limit Value (HLV)	1 hour	200 mg/m^3	not to be exceeded more than 18 times per calendar year	200 mg/m^3	not to be exceeded more than 3 times per calendar year
	Daily Limit Value (DLV)	1 day	-		50 µg/m3	not to be exceeded more than 18 times per calendar year
	Annual Limit Value (ALV)	Calendar year	40 mg/m^3		20 g/m3	
PM10	Daily Limit Value (DLV)	24 hours	50 mg/m^3	not to be exceeded more than 35 times per calendar year	45 µg/m3	not to be exceeded more than 18 times per calendar year
	Annual Limit Value (ALV)	Calendar year	40 mg/m^3		20 µg/m^3	
PM2.5	Daily Limit Value (DLV)	24 hours	-		25 mg/m^3	not to be exceeded more than 18 times per calendar year
	Annual Limit Value (ALV)	Calendar year	25 mg/m^3		10 µg/m³	
SO_2	Hourly Limit Value (HLV)	1 hour	350 mg/m^3	not to be exceeded more than 24 times per calendar year	350 mg/m^3	not to be exceeded more than 3 times per calendar year
	Daily Limit Value (DLV)	24 hours	125 mg/m^3	not to be exceeded more than 3 times per calendar year	50 µg/m^3	not to be exceeded more than 18 times per calendar year
	Annual Limit Value (ALV)	-	-		20 µg/m^3	

Pollutant	AQ standard	Averaging Period	Directive 2008/50/EC		Directive (EU) 2024/2881 (to be attained as from 2030)	
			Air quality standard		Air quality standard	
Ozone	Target Value	Maximum daily 8h mean	120 mg/m^3	not to be exceeded on more than 25 days per calendar year averaged over 3 years	120 mg/m^3	not to be exceeded on more than 18 days per calendar year averaged over 3 years
	Long Term Objective	-	120 mg/m^3		100 mg/m^3	99th percentile (i.e. 3 exceedance days per year)

As presented in the figure below, a significant proportion of stations is already reporting for the year 2023 values below the 2030 air quality standards, particularly for NO_2 , where more than 70% of stations reported concentrations below the annual limit value for 2030 and 91% of stations reported concentrations below the daily limit value for 2030. Data reported for 2023 also shows that a large majority of stations are already reporting concentrations below the 2030 annual limit value for $PM_{2.5}$ and over 71% of reporting stations were below the ozone target value.

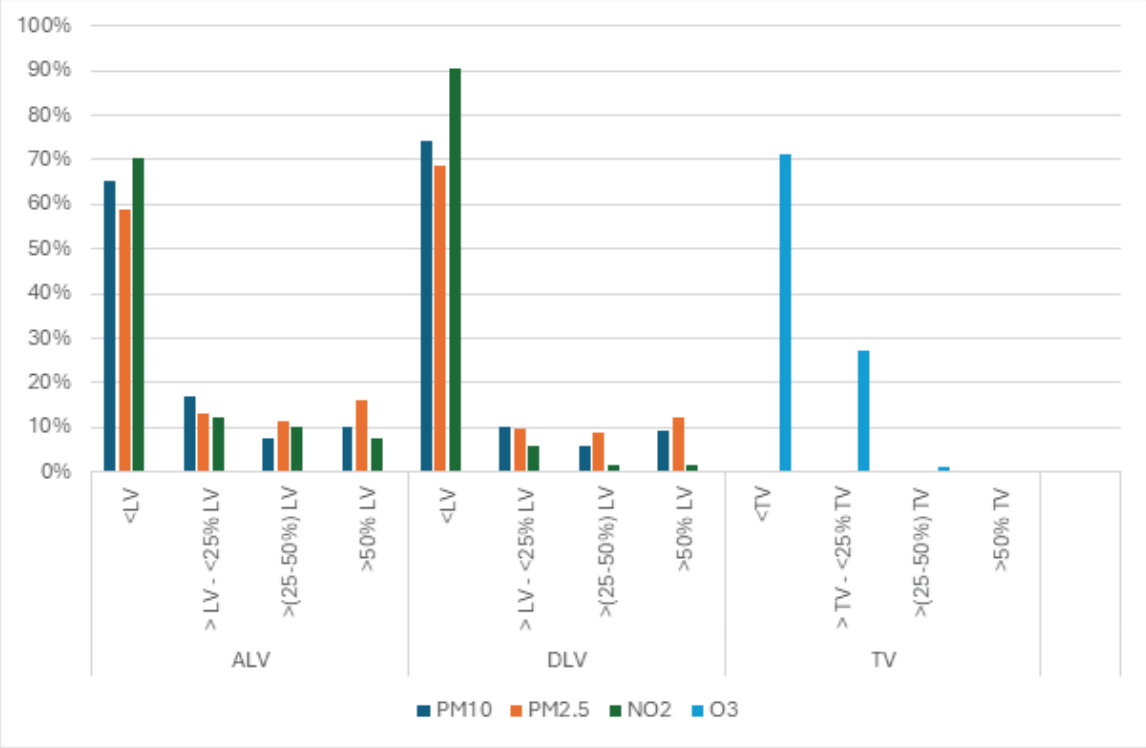

Figure A - 45 – Comparison of 2023 air quality data against 2030 air quality standards, indicating the percentage of stations already below the 2030 values and those within different concentration ranges above the 2030 values (for Annual Limit Values (ALV), Daily Limit Values (DLV) and Target Values (TV))

An alternative way of presenting the current performance against stricter future limit values as well as against WHO guideline levels is provided in the Figure below.

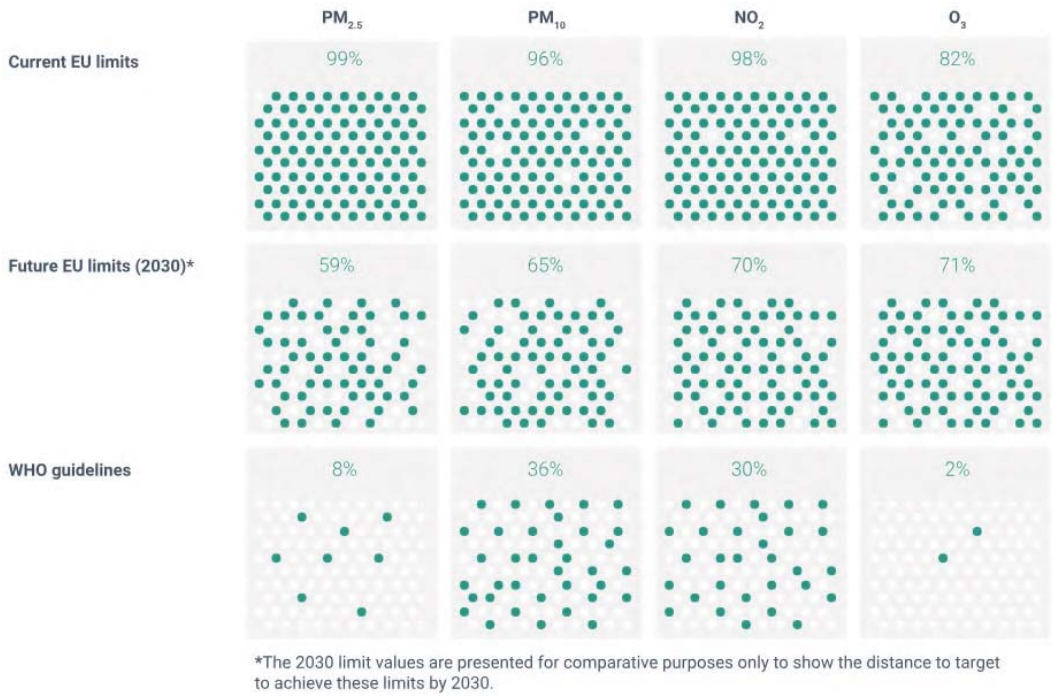

Figure A - 46 – Percentage of stations in 2023 with annual concentrations below applicable EU and WHO standards. Source: EEA Air quality status report 2025.

Under the AAQD, Member States' territory must be divided in zones. In order for a zone to be in compliance, all sampling points in that zone must report values respecting the designated standard. The proportion of zones already in compliance with the 2030 standards in 2023 is therefore lower than the proportion of sampling points already in compliance with the 2030 standards in 2023. However, as shown in the table below, the majority of zones were already in conformity with the 2030 standards for NO_2, PM_{10} and 0_3 in 2023. Compliance with the 2030 annual mean for $PM_{2.5}$ was however much lower in 2023, with less than 25% of zones already complying.

Table A - 61 – Proportion of zones in exceedance of air quality standards directed at the protection of human health for NO_2, PM_{10}, $PM_{2.5}$ and 0_3 in the years 2016 and 2023, as well as the proportion of zones above the stricter standards for 2030 in the year 2023

Pollutant	Proportion of zones in exceedance in the year 2016	Proportion of zones in exceedance in the year 2023	Proportion of zones above the stricter limit values for 2030 in the year 2023
annual mean for NO_2	119/610 (20%)	27/614 (4,4%)	277/614 (45%)
annual mean for PM_{10}	23/616 (3.8%)	4/620 (0,6%)	293/620 (47%)
daily mean for PM_{10}	96/616 (16%)	38/620 (6.1%)	165/620 (27%)
annual mean for $PM_{2.5}$	37/575 (6,4%)	3/599 (0,5%)	460/599(76%)
daily 8-hour mean for 0_3	156/542 (29%)	113/551 (21%)	175/551 (32%)

The 4th Clean Air Outlook provides projections of future air quality as well as population exposure to concentrations of $PM_{2.5}$ and NO_2, for 2030 and 2050, to gauge what is possible to achieve with current policies, including the ERCs applicable currently and from 2030 onwards. Below Figure shows annual mean concentrations of $PM_{2.5}$ calculated with the GAINS model for the period 2005 to 2050 for selected scenarios. Even under current policies ('baseline'), pollutant concentrations are expected to fall over time and, by 2030, very few areas in the EU are projected to exceed 20 µg/m^3 for $PM_{2.5}$. However, **large areas are still projected to have pollution concentration levels above the recommended WHO air quality guideline of 5 µg/m^3 in 2030** (and even in 2050).

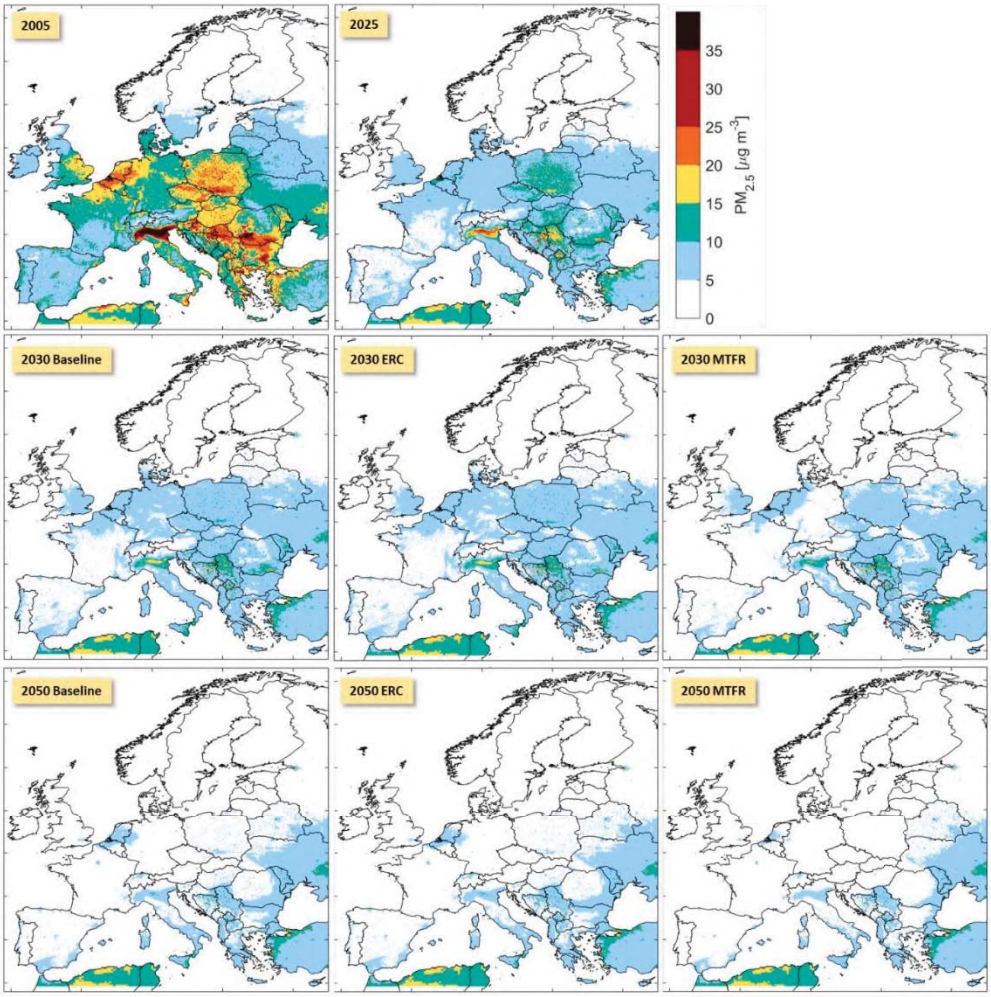

Figure A - 47 – Annual mean concentrations of $PM_{2.5}$ (including natural sources) for the baseline, the scenario assuming compliance with ERCs (within feasibility) and MTFR scenario (Source: IIASA et al., 2025)

Translating background concentration levels into impacts on the health of the EU population shows that the number of people living in areas with clean air is set to rise. The past improvements since 2005 are particularly remarkable. Looking at 2030, 14% of the EU population (just over 64 million) would, however, still be exposed to $PM_{2.5}$ concentrations above 10 µg/m^3 (i.e. the then applicable EU limit value) under baseline assumptions. In the scenario where Member States meet their 2030 ERCs under the NECD, that portion would reduce to just under 13% (or around 56 million). This shows that **while having the potential to bring air quality closer in line with revised air quality**

standards, compliance with ERCs is not sufficient for meeting air quality limits for $PM_{2.5}$ everywhere in the EU.

As seen from below figure, the outlook varies across Member States, though all are projected to see a steady improvement both in background concentrations and the share of population exposed to pollution. It also shows that **for some countries, the 'ERC' scenario provides more significant improvements than for others**, depending on current distance to ERC achievement.

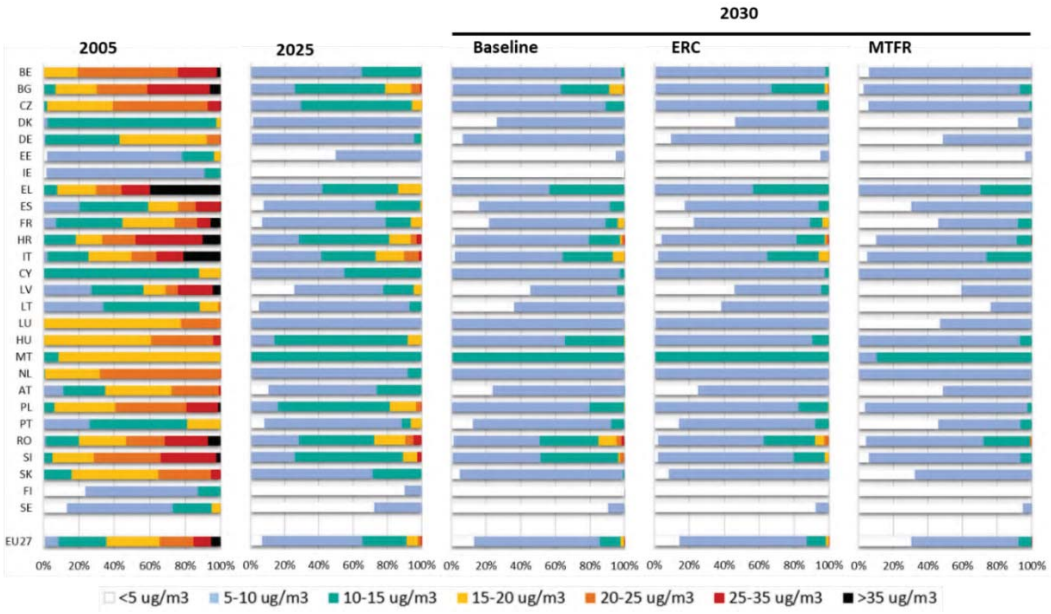

Figure A - 48 – EU-27 population exposed to different concentrations of $PM_{2.5}$. Source: IIASA et al. (2025). Note: 'ERC' is a scenario that assumes all Member States meet their emission reduction commitments. MTFR is the 'all technical measures' scenario

As regards NO_2, **most of the EU population** (97%) **lives in areas with NO_2 pollution levels below the current EU limit** of 40 µg/m^3, and nearly 60% live in areas below the WHO guideline limit of 10 µg/m^3 in 2025. By 2030, this share will increase to over 70%. Considering the revised annual limit value of 20 µg/m^3 that will apply as of 2030, 7% (or just over 32 million) of EU population are projected to remain exposed to pollution above that limit value. Achieving ERCs in all Member States would bring only very limited further reductions in exposure of the general population. By 2050, under all scenarios, well over 95% of the EU population is projected to live in areas where pollution remains below the WHO-recommended level for NO_2.

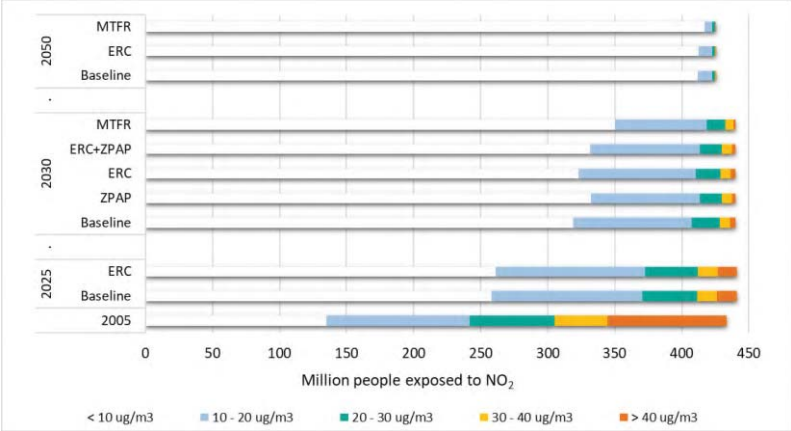

Figure A - 49 – Population in the EU exposed to different concentrations of NO_2 for selected key scenarios. Source: IIASA et al. (2025)

Ozone levels, for which the AAQD sets a target value, **have improved much less since 2005 and are projected to decrease to a very limited extent**, as seen in below Figure. The NECD only regulates some of the ozone precursors, i.e. NMVOC, but does not regulate methane, as discussed in other parts of this annex (in particular sections 4.5 and 5.3). Apart from human health impacts, elevated ground-level ozone also harms ecosystems and has direct economic consequences due to reduced forest productivity and crop losses.

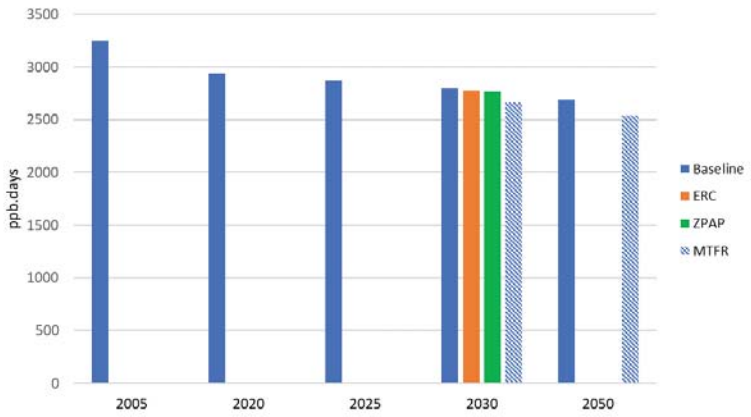

Figure A - 50 – Population-weighted SOMO35 indicator (ppb days) in the EU (Source: IIASA et al., 2025)

5.2.2 Progress in ratifying 2012 amended Gothenburg Protocol, and status of international framework since and in the future.

Another need the NECD was meant to address was to create coherence with the international framework regarding air pollution. To this end the emission reduction commitments agreed in the amended Gothenburg Protocol were transposed into EU law on the one hand, and, on the other, EU Member States were encouraged to ratify the amended Gothenburg Protocol. In addition, ratification of the Protocol also by other Parties to the Air Convention was meant to be promoted considering the transboundary nature of air pollution.

The amended Gothenburg Protocol has currently been ratified by 31 Parties. Of the EU Member States, all have accepted the Protocol, but Italy and Poland which are currently finalising their ratification. At the end of 2016, when the NECD entered into force, only

Sweden had ratified the amended Protocol. During the evaluation period of the NECD there has therefore been considerable ratification activity among EU Member States, however less so by non-EU Parties and non-Parties.

One of the major aims of the ongoing revision of the Gothenburg Protocol is to facilitate ratification of the protocol by current non-Parties. It is therefore expected that if appropriate allowances are made, more countries will sign up to the protocol. This process is independent from the NECD (which only addresses EU MS), but it is important that it is coherent with the enlargement processes in particular for countries in the Western Balkans and other candidate countries.

5.3 Does the scope of the NECD remain pertinent?

5.3.1 In terms of pollutants covered and not covered by emission reduction commitments (e.g. methane not included; condensable part of PM not specified)?

There is no evidence to suggest that any of the main pollutants addressed by emission reduction commitments would no longer be relevant, given their established impact on human health and the environment, as well as their transboundary nature. There is some evidence as well as some stakeholders suggesting that the scope of pollutants is too limited, or that current further pollutants should be added to the scope of pollutants for which the NECD sets emission reduction commitments.

Stakeholder were asked as part of the TSC whether the range of main pollutants is still relevant, with the majority agreeing. Dissenting opinions were expressed notably by NGOs, who in open comments suggested to add methane to the list of main pollutants for which the NECD sets ERCs, citing its dual role as a potent greenhouse gas and an important precursor to ground-level ozone. Some also highlighted black carbon and ultrafine particles as pollutants of growing concern that merit regulatory attention under the Directive.

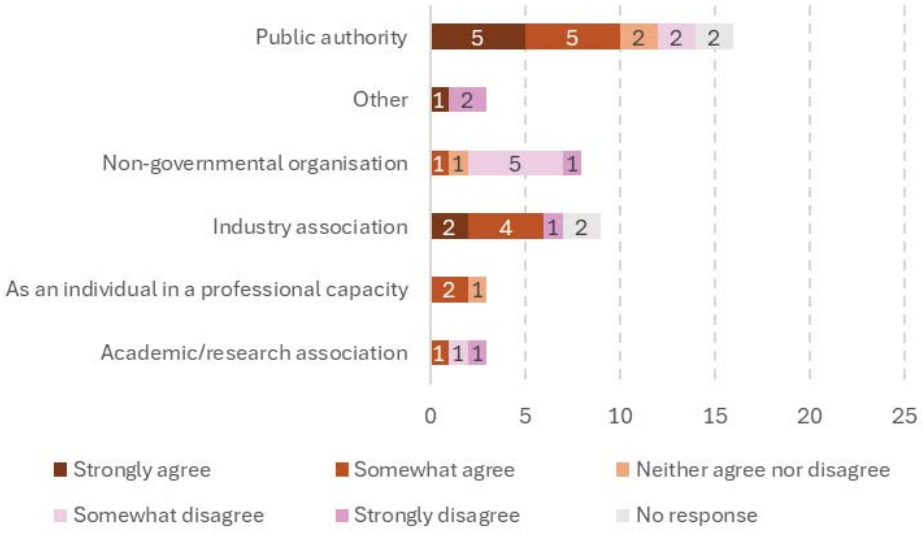

Figure A - 51 – Responses in TSC to the statement 'The range of air pollutants covered by emission reduction commitments is still appropriate'

5.3.1.1 Methane

Methane has gained significant political momentum since 2016 given its dual role as a relatively short-lived, but extremely potent GHG, as well as an ozone precursor, leading to the Global Methane Pledge to reduce global methane emissions by at least 30% from 2020 by 2030, launched by the European Union and the USA at COP26 in 2021. The main sources of EU emissions of methane have been addressed in Annex III section 4.6 above. Here some additional information is provided about the likely evolution of emissions from these sources in years to come. Based on Member States projections of their GHG emissions[391], the development of methane emissions from the three main sources in the EU by 2050, compared to current levels would be as follows:

- Methane emissions from the agriculture sector are projected to decrease by 3%;
- Methane emissions from the waste sector are projected to decrease by 52%;
- Methane emissions from the energy sector are projected to decrease by 8%.

This shows that the potential for further reductions varies substantially across sectors. In particular, it demonstrates a very limited additional reduction potential for **agriculture**, the source sector least addressed by existing regulation, as was seen in Annex III section 4.6. The Biomethane Action Plan, launched in May 2022 as part of the REPowerEU plan, could lead to additional reductions of emissions from manure management. The strategy aims at expanding the production of biomethane by promoting industrial partnerships, accelerating investments and reducing production costs.

Waste, on the other hand, is a sector addressed by a comprehensive set of policies, with the proposed EU targets for preventing food waste likely to drive further reductions in methane emissions. These sectoral trends are confirmed by modelling undertaken for the 4th Clean Air Outlook, which projects EU methane emissions to fall by 36% by 2050, driven by further action to decarbonise the economy and reduce emissions from waste management.

The impact assessment to the **energy**-sector Methane Regulation[392] provides estimations for future methane emission savings:

- For policy area 2, consisting of mitigating methane emissions inside the EU, 706, 377 and 317 kt of methane emission savings for respectively 2030, 2040 and 2050 compared to the baseline of no further EU action[393].
- For policy area 3, consisting of transparency requirements for importers, no CH_4 emission reductions were quantified due to a lack of relevant data. Instead, the

391 https://www.eea.europa.eu/en/analysis/maps-and-charts/eea-greenhouse-gas-projections-data-viewer-data-viewers

392 SWD(2021) 459 final.

393 To put this into perspective: According to Member States projections of GHG emissions, 2030 methane emissions in the energy industries would be 1 603 kt (2022 reported historic emissions are almost identical), so the projected saving of 706 kt would represent around 44% of 2030 projected emission levels (or of current, i.e. 2022, emissions).

impact assessment report used a sample of the largest exporting countries of oil and fossil gas to the EU, without linking oil and gas production specifically to EU consumption, and estimated CH_4 emissions savings to account for 25 513 kt at social and environmental optimal level of abatement in 2030.

While Member States report emissions of methane under **climate policy**, GHG targets set under EU climate law do not target specific gases and hence there are no specific incentives for Member States to target methane emissions specifically in their GHG reduction policies and measures.

During a survey conducted for work commissioned by DG ENV and prepared by Aether, CITEPA and Ricardo (2023)[394] stakeholders noted the following:

- 34% of stakeholders surveyed believed that annual emissions of methane should be included in the NECD reporting requirements.
- 46% of stakeholders surveyed believe that emissions can be taken from the existing regulation (i.e., EU/UNFCCC), but differences of scopes require consideration (cf. Column "additional assessment").
- 11% believe that emissions can be taken from the existing UNFCCC data, but that gridded emissions should be incorporated into air quality reporting requirements – although the modelling group of the Air Convention (MSC-West) have indicated that they would not require the reporting of gridded emissions to undertake their modelling studies.
- Stakeholders further stated possible uses of reported methane emissions for ozone modelling and air quality forecasting, incl. for formulating policies and measure.

The authors of the report point toward the existing IPCC Guidelines for CH_4 reporting, which could inform possible reporting also under the Gothenburg Protocol/NECD, without needing to add CH_4 guidelines in the EMEP/EEA Guidebook (to avoid duplication of effort). The authors further pointed out that due to differences of scope[395], in sources of emissions and possibly on geographical scope[396], possible CH_4 emissions in NFR format in the frame of Gothenburg Protocol/NECD would not be exactly the same data as from EU / UNFCCC GHG inventories and that resulting 'national totals' would differ between GHG and air pollutant reporting. But national inventory systems producing GHG inventory could in principle also report CH_4 in NFR format within the Gothenburg Protocol/NECD geographical scope without too much additional effort (the background

394 Analysis prepared by Aether, CITEPA and Ricardo, published as: European Commission: Directorate-General for Environment, *Analysis of and recommendations for the inventory reporting requirements under Directive (EU) 2016/2284 not linked to emission reduction commitments – Final report*, Publications Office of the European Union, 2023, https://data.europa.eu/doi/10.2779/035489.

395 The NFR code structure does not take account of emissions from LULUCF for example. The scope of emission sources also differs (emissions from national and international aviation are accounted for differently under NECD and Regulation (EU) No 525/2013) and Regulation (EU) No 2018/1999.

396 The definition of the geographical scope of some Member States may differ between the NECD/Gothenburg Protocol and EU/UNFCCC GHG inventory. For example, the latter can include overseas territories.

data for CH_4 is already available to be applied for reporting process for NECD frame / NFR format as other pollutants).

5.3.1.2 Condensable part of particulate matter

As indicated in the analysis of internal coherence (section 4.1 above), the NECD does not spell out how to handle the **condensable part of particulate matter emissions**. These are emissions initially in vapour form (inside or close to the stack) that transform into particulate matter when discharged into ambient air. It is important to include these emissions as they add to the low quality of the air we breathe[397]. It was not possible to do so in a systematic manner and for all emitting sectors in the past[398], but new findings[399] have improved data availability. This is particularly important for the domestic heating sector, where including condensable particulate matter could change, for some Member States, the extent of action needed to reduce real-life emissions. It could therefore also change the split of emissions reductions between economic sectors, increasing the relative share of domestic heating in emissions.

In recent years, the reporting of emissions with condensables has been improving. For several sectors, such as transport, condensables have long been included due to the established measurement methods and the availability of default emissions factors (provided in the EEA/EMEP Guidebook). However, in the case of residential combustion of solid fuels, which is typically a key source of primary $PM_{2.5}$ emissions, reporting has been more inconsistent. This stems from challenges like a lack of data, differences in the methods used etc. **In the 2023 version of the EEA/EMEP Guidebook, a set of emission factors including condensables was introduced**. As part of the development of the 4th Clean Air Outlook, IIASA consulted national inventories and Member States directly as regards the inclusion of condensables. According to IIASA et al. (2025), at the time of writing only five Member States remained that did not include the condensable part of PM emissions from residential solid fuel combustion in their inventories (Austria, Estonia, Germany, Lithuania and Luxembourg). Despite this progress, some inconsistencies in reporting still persist due to, for example, (i) use of different emission factor *Tiers* from the Guidebook, where Tier 1 default factors account only for fuel type and not for type of combustion device, (ii) lack of data about combustion type structure and its development over time, (iii) quality of data or assumptions how to estimate fuel use and combustion practices, etc. This is something that continues to be analysed, including in DG ENV funded work to improve certain elements in the EMEP/EEA Guidebook.

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397 In particular in domestic heating, condensable particulate matter emissions are estimated to represent about the same level as filterable emissions, the part most usually accounted for.

398 Emission inventories submitted by Member States have not always been fully comparable on this matter, due in particular to a lack of scientific consensus on methods to account for condensable PM from the heating sector (residential combustion emissions). This topic is also subject to discussions under the Air Convention (https://emep.int/publ/reports/2020/emep_mscw_technical_report_4_2020.pdf).

399 Set of consistent emission factors for the heating sector produced in a study for the Nordic Council of Ministers (Simpson et al.,2022, Revising $PM_{2.5}$ emissions from residential combustion, 2005-2019; Implications for air quality concentrations and trends, Nordic Council of Ministers).

Some of the discussion under the Air Convention have also looked into what an inclusion of condensables would mean for compliance prospects with emission reduction commitments. Some results from the 3rd and 4th Clean Air Outlooks, which have included in a systematic manner condensable emissions: In CAO3, inclusion of condensables was limited to sensitivity analysis. Given the increased inclusion of condensables in national inventories and the fact that the EMEP/EEA Guidebook now provides an emission factor including the condensable fraction, CAO4 included a consistent representation of the condensable part of particulate matter emissions in the *baseline* model set-up[400]. CAO3 results comparing baseline emissions with and without systematically including condensable PM in the model showed that there are **significant changes in a few Member States** (notably Austria and Germany). Comparing the impacts at a geographically disaggregated level reveals that **$PM_{2.5}$ concentrations change only marginally in most of Europe. However, it has a pronounced impact in some areas**, including some where residential heating has a major role (e.g. Finland and Estonia, where concentrations are overall low), and part of central Europe, e.g. Austria and Germany, that traditionally do not include condensable PM in their national data on $PM_{2.5}$ emissions. This is seen in a difference map below.

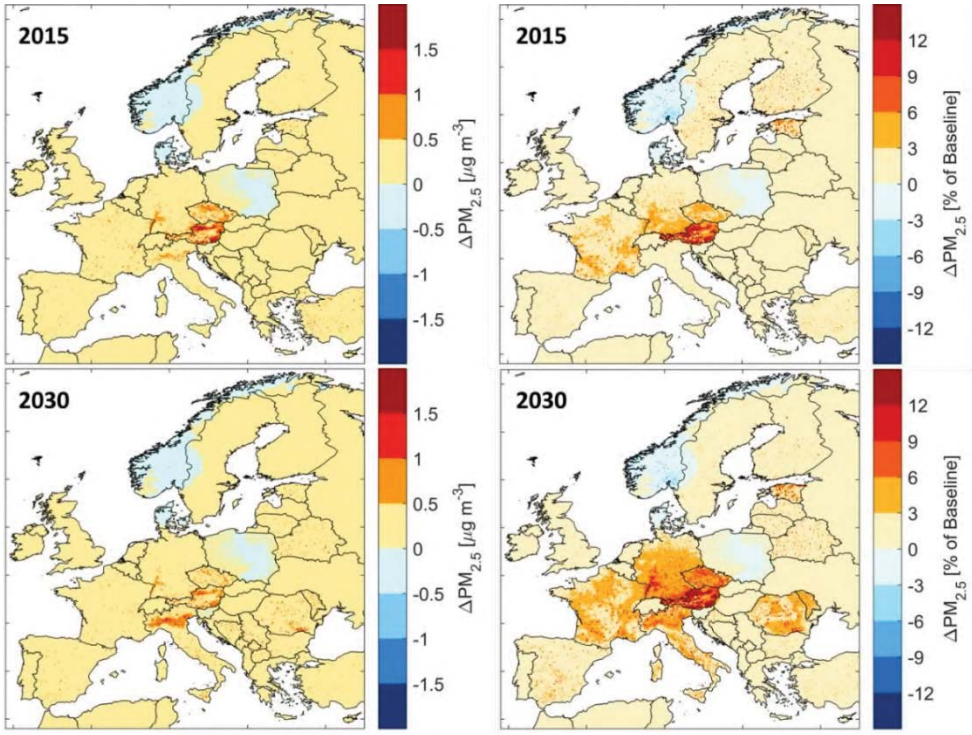

Figure A - 52 – Impact of including the harmonised set of PM emission factors (EF) with condensable fraction (the same set of emission factors for all countries) on calculation of $PM_{2.5}$ concentration in GAINS. Difference maps (GAINS with harmonised EFs minus GAINS standard EFs) showing absolute (left) and relative (right) difference for 2015 and 2030 baseline scenario (Source: CAO3 support study, IIASA, 2022).

In CAO3, these changes **did not affect any Member State's prospects of meeting their $PM_{2.5}$ emission reduction commitments**. Also in CAO4, changing the assumptions on

[400] IIASA et al (2025) tested alternative assumptions as part of the sensitivity analysis to see the effect of including filterable particulate matter only or including a set of higher emission factors that factor in bad combustion practices (which increase emissions further).

whether and how condensables are included barely changes the prospects of meeting the $PM_{2.5}$ emission reduction commitments[401]. This can be explained by the change in assumptions changing both base year, i.e. 2005 emission levels, as well as the ones in the target year. **However, the total volume of emissions reported does change depending on the emission factor used**. This is also seen at Member State disaggregated level, see more details available in IIASA et al (2025).

Concluding remarks

The **five main pollutants** for which the NECD sets ERCs **remain relevant.**

On **methane**: In line with what we argued above under 'coherence', evidence from modelling studies makes a strong case for tackling methane globally, along other precursors, in order to effectively reduce ozone levels. There remains thus an urgent need to address methane both given its role as a potent GHG gas and as a precursor for ozone – and it remains to be seen under which framework further action to reduce methane could be pursued most effectively.

On **condensables**: There has been considerable progress in this area. Despite the continued lack of a fully consistent approach to incorporate the condensable part of particulate matter emissions in the small combustion sector across Member States, more and more Member States now do include condensables in their inventories. This has been supported by advances of methodologies available in the EEA/EMEP Guidebook. Condensables are now also reflected in a consistent manner in the GAINS model used for the modelling underpinning the revision of the Gothenburg Protocol. It is therefore considered appropriate in any future revision of the NECD to explicitly reflect condensables both when setting cost-effective ERCs and in Member State inventories (and those also in compliance checks).

5.3.2 In terms of pollutants and type of data covered by reporting obligations, but for which no reduction commitment has been established?

Work commissioned by DG ENV and prepared by Aether, CITEPA and Ricardo (2023) has analysed the relevance of the range of the 'non-ERC' pollutants, i.e. pollutants covered by reporting obligations, i.e.:

- Annual inventories for black carbon (BC) '*if available*', PM_{10}, carbon monoxide (CO), heavy metals (Cadmium, Mercury, Lead), and persistent organic pollutants (POPs);
- Four-yearly reporting of emissions for large points sources (LPS) and gridded data;

[401] This masks some changes in the margin of compliance, which changes in different directions across Member States. This includes cases where the inclusion of high emission factors improves the margin of compliance.

– Optional reporting of annual inventories for other heavy metals (Arsenic, Chromium, Copper, Nickel, Selenium and Zink and their compounds) and total suspended particles.

This work was based on literature reviews, including evidence collected in the revised 2021 WHO air quality guidelines and analysis by the project team, as well as a survey and interviews of users (i.e. policy makers, modellers) and compilers (i.e. inventory compilers) of the emissions data. An analysis of reporting requirements under other EU legislation or international agreements formed part of the analysis, to see whether there would be overlaps. When considering reporting of new or emerging pollutants, some (qualitative) assessment was added as regards data availability, and estimated burden associated with reporting. Several conclusions have emerged from this work, which are summarised in below table and corroborated with stakeholder feedback received during the evaluation consultations, while noting that rather few responses were received on related questions during the latter.

Table A - 62 – Findings and stakeholder views on reporting of emissions of air pollutant beyond the five main ones (based on Table 5-1 in the report prepared by Aether, CITEPA and Ricardo for DG ENV, as well as consultations conducted for the NECD evaluation – last column)

	**Reporting of new or emerging pollutants** Pollutants which emissions are currently not reported under NECD and that could be considered for future reporting requirements: • The strongest consensus appears to be related to the potential upgrading of **black carbon** as a *mandatory* reporting requirement as well as the potential addition of **organic carbon**. • The reporting of **methane**, which is already reported under EU and international climate change regulation but has an important role as an ozone precursor. • The reporting of **ultrafine particles** and additional contaminants such as additional heavy metals and **PFAS**. In addition to the above, formaldehyde and butadiene, both ozone precursors, were analysed as part of the study but without there being a clear case for inclusion to the scope of the NECD.	**NECD evaluation TSC** 1 academic association commented that pollutants reported are relevant but the knowledge base on which the emissions are reported is sometimes weak, especially for heavy metals and POPs. Also, some new PM components (e.g. **elemental carbon/black carbon, organic carbon, ultrafine particles**) could be considered to be added as (mandatory) pollutants given their expected impacts on human health. 6 NGOs and one "other" stakeholder commented that **methane** should be added.

	**Reporting of pollutants deemed of little use** • **Heavy metals** and **POPs** are often considered of little use because the data is thought to be unnecessary or not used by modellers and users of national emissions data. However, it is important to note that in most cases, there are likely to be smaller groups of experts that do work with such data within their specific roles. • **TSP** is identified as a pollutant that could be further evaluated for removal from NECD reporting requirements. • Importantly, inventory compilers have indicated that **removing several pollutants would not significantly reduce the resources needed for reporting** – while this reason could have been thought as being the main driver for suggesting a change.	**NECD evaluation TSC** 1 public authority commented - additional **heavy metals** could be excluded from reporting.
	**Role of gridded data** • Findings in relation to gridded data reporting under the NECD focused on a wish to **improve the *accuracy*, *consistency* and *completeness* of reporting** across Member States for it to be more regularly and confidently utilised by the modellers and users of national emissions data. • Further disaggregating the datasets spatially and temporally could assist some modellers and users with their need to produce fine scale emissions models. • Options for improving data storing and publishing were also identified.	**NECD evaluation TSC** The majority agreed that reporting of gridded data had improved the information and data available around air pollution and its impacts. 1 academic association and 1 public authority: More frequent submission of gridded data would help modelling of air pollutant concentrations. 3 public authority, 2 businesses, 1 academic association suggested reporting gridded data carries some unnecessary costs.
	**Role of LPS data** • Findings in relation to LPS data reporting under the NECD focused on a wish to **improve the *frequency* and *transparency* of reporting** for it to be more regularly and confidently utilised by the modellers and users of national emissions data. • The **role of LPS data submitted under NECD reporting was questioned by stakeholders,** particularly against the more frequently updated E-PRTR data. • Views for both **improving or entirely removing LPS data reporting** requirements were therefore identified.	**NECD evaluation TSC** The majority agreed that reporting of LPS data had improved the information and data available around air pollution and its impacts. 1 academic association and one public authority: More frequent submission LPS data would help modelling of air pollutant concentrations. 3 public authority, 2 businesses, 1 academic association suggested reporting LPS data carries some unnecessary costs.

Concluding remarks

Several conclusions emerge from the analysis of pollutants and type of data that the NECD requires to report as part of national inventories, without setting ERCs.

Several pollutants could be **considered for future inclusion** to the reporting requirements under the NECD (i.e. reporting of emissions as part of national inventories, without these pollutants being subject to ERCs): potential upgrading of **black carbon** as a *mandatory* reporting requirement as well as the potential addition of **organic carbon**; **methane**, which

is already reported under EU and international climate change regulation but has an important role as an ozone precursor; and **ultrafine particles** and additional contaminants such as additional heavy metals and PFAS. The impact of the use of **pesticides** for air pollution is something that remains to be watched.

Several pollutants are **potential candidates for future exclusion** from the scope of the NECD, because the data is thought to be unnecessary or not used by modellers and users of national emissions data: **Heavy metals** and **POPs**, as well as **TSP**. However, it is important to note that in most cases, there are likely to be smaller groups of experts that do work with such data within their specific roles. Any impacts of exclusion would thus need to be impact assessed.

There seems to be a continued relevance of reporting **gridded data** under the NECD, however, its accuracy merits improvement.

Finally, **LPS** (large point source) data is considered a **potential candidate for future exclusion** from the scope of the NECD, given that it largely overlaps with data reported under the European Industrial Emissions Portal. However, such an exclusion needs to be **considered carefully since EU Member States would still need to report these data under the Gothenburg Protocol**.

5.3.3 In terms of sources of emissions accounted for, for complying with the emission reduction commitments (e.g. not covering certain agricultural emissions; aviation beyond landing and take-off, or international maritime traffic)?

The NECD (in Article 4(3)) excludes certain sources of emissions for the purpose of assessing compliance with emission reduction commitments. These include:

- aircraft emissions beyond the landing and take-off cycle, i.e. aviation cruise emissions;
- emissions from international maritime traffic[402];
- emissions of NO_x and NMVOC from activities falling under the Nomenclature for Reporting (NFR) categories 3B (manure management) and 3D (agricultural soils).

While Member States report estimates for these sources of emissions in their emission inventories, they are not part of the 'national total for compliance', which is the basis for compliance checks with ERCs under the NECD. The fact that Member States report estimates allows for analysing the significance of these sources and how they have developed over time, as well as for analysing the robustness of the emission estimates. Such analysis is provided below for each of the three sources listed above, with additional detail available in chapters 4 to 6 of the support study to this evaluation.

[402] Article 4(3) also excludes emissions from national maritime traffic to and from the EU's outermost regions. This is justified given their specific situation and in particular their remote location and therefore the analysis here does not further address this exclusion from the scope of the NECD.

5.3.3.1 Exclusion of aviation cruise emissions

Emissions for categories 1A3ai(ii) International aviation cruise (civil) and 1A3aii(ii) Domestic aviation cruise (civil)[403] are both reported as memo items and are not included in the national total for compliance or the national total (for scientific purposes). NO_x is the pollutant of greatest relevance here: emissions from cruise aviation were 10.6% of total EU NO_x emissions (based on 'national total for compliance') in 2022. For SO_2, this share was 2.3%, for $PM_{2.5}$ it was 0.4% and for NMVOC it was 0.2% (ammonia emissions are negligible). There is considerable variation across Member States (see support study chapter 5 for detailed data tables).

Methodologies for estimating emissions from these sources are available in the EMEP/EEA Guidebook and they have been available in numerous previous versions of it and were thus already well established when the NECD came into force. As a result, Member States would have had sufficient time to develop good quality emission estimates, using suitably detailed methodologies. In fact, the support study found that there is almost no difference in the methodologies used by Member States for international and domestic aviation cruise and LTO. This is because they share a common methodology in the EMEP/EEA Guidebook, common sources are used for relevant input datasets, and typically national inventory compliers prioritise improvements and the detail used in these emission calculations in a consistent way. Member States use Tier 1, Tier 2 and Tier 3 methodologies, with Tier 3 being the most common. When compared to other sources across the scope of a national emissions inventory, there is a high percentage of countries using Tier 3 methodologies. This suggests that **exclusion from the national total for compliance has not impacted on Member States' efforts to develop the detail and accuracy of the emission estimates**.

Reasons for exclusion and whether these remain valid

When the scope of the current NECD was being discussed, it was recognised that emissions during the cruise phase of a flight (above 3,000 ft altitude) were not sufficiently close to the surface to warrant inclusion in the national total for compliance, i.e. they would not significantly influence ground level ambient concentrations of air pollutants, or of ozone. However, emissions from the cruise phase of both domestic and international flights, should be reported as memo items, so that the information is available to air quality modellers should they wish to include these sources in their studies.

The approach of excluding this source from the national total for compliance was a continuation of the approach used in the 2001 NECD, and it is fully aligned with the reporting requirements of the Air Convention. The reporting differs from the reporting of greenhouse gas emissions under the United Framework Convention on Climate Change (UNFCCC), but this has been a long-established difference in approach, which is justified as unlike for air pollutants, the impact of a unit of greenhouse gas emitted is the same, wherever it takes place.

[403] As defined in the NFR reporting format, used for reporting to both the NECD and the Air Convention.

The support study summarises recent **evidence to assess whether this reason for exclusion – limited impact on ground-level concentrations – remains valid**, in particular in light of the increase in aviation's share of total emissions of certain pollutants over the last decade. The analysis identified several relevant studies, focusing on the impact on ground-level NO_2, $PM_{2.5}$ and ozone.

A 2022 report by the ICAO found that, although ground-based and LTO emissions are the main cause of localised air quality problems around airports, cruise NOx emissions can be recirculated to ground level and increase background concentrations of ozone and $PM_{2.5}$ over large areas. Cruise NOx emissions are estimated to be (globally) the dominant aircraft source of ground-level ozone and $PM_{2.5}$.

However, a 2018 modelling study[404] found that aviation emissions contributed 1.9% and 0.5% of total O_3 and $PM_{2.5}$ concentrations respectively at the surface, which is small compared with other sectors.

A 2023 modelling study by Concawe[405] compared the contribution of aviation to air pollutant concentrations at several airports, in nearby cities, and on average across Europe. The study found that:

- Over the six airports modelled, the average contributions from aviation to the concentration of NO_2, SO_2 and $PM_{2.5}$ were 38%, 45% and 6% respectively. The study did not differentiate between LTO and cruise emissions, but in the immediate vicinity of airports LTO emissions are likely to dominate.
- By contrast, in the nearby city centres the average contributions from aviation to the concentration of NO_2, SO_2 and $PM_{2.5}$ were 2.5%, 1.8% and 0.5% respectively. For one large airport, it was found that the relative contribution of aviation falls by 63% for every 2.8 km increase in distance from the airport towards the city centre, due to reduction in aviation emissions and increase in other emission sources.
- Over the whole European domain (including sea areas) the average contributions from aviation to the concentration of NO_2, SO_2 and $PM_{2.5}$ were only 0.5%, 0.03% and 0.14% respectively.

In conclusion, some research suggests that whilst - on average over large areas - cruise emissions could contribute more to ground-level background ozone and $PM_{2.5}$ emissions than LTO emissions, **the contribution of aviation as a whole to average background air pollution remains very small**. **It is therefore likely that that local impacts around airports remain the only large contribution of aviation to ground-level air pollution**.

However, one caveat is that relatively few relevant studies were found from the literature search undertaken, so this conclusion can only be made tentatively, and this aspect of relevance should be kept under consideration in future.

404 https://pmc.ncbi.nlm.nih.gov/articles/PMC5920554/

405 Also referred to in the European Aviation Environmental Report 2025 by the European Aviation Safety Agency (EASA).

Out of the few respondents to the related question in the **targeted stakeholder consultation**, four respondents indicated that they believed the reasons for exclusion were still valid and five respondents believed that they are no longer valid. However, all of the additional comments received, and the responses from national inventory compilers interviewed, tended to either be neutral or agree that the original reasons for exclusion (low impact on ground-level receptors) still apply.

The impact of including international shipping on national totals and their trend over time

To further assess the continued relevance of the exclusion, it is worth looking at the impact of including aviation cruise on Member States national total emission estimates. Emissions from aviation cruise have increased, in contrast to reduced national compliance totals of the corresponding pollutants.

Including **NH_3, NMVOC and $PM_{2.5}$** emissions from aviation cruise in compliance totals would have a **very insignificant impact** on the trend in compliance total. NH_3 emissions are only reported by two Member States (AT and DE) and NMVOC and $PM_{2.5}$ emissions in absolute terms are small compared to the NECD compliance totals. The trend for these pollutants in national total for compliance - were aviation cruise included - flattens by only approximately 0.1%, despite the large difference in trend in NMVOC and $PM_{2.5}$ emissions from aviation cruise compared with the national totals for compliance, at the EU 27 level.

For **SO_2**, at the EU27 level there is again **relatively little impact**, with the trend in the compliance total between 2005 and 2022 flattening by 0.3% (from -81.5% to -81.2%) if aviation cruise is included. At the country level, the change in trend is less than 1% for most countries, but the trend would change considerably for Luxembourg (from -83% currently to -68% if aviation cruise were included).

For **NO_x**, the impact on the EU27 level trend over 2005-2022 is **larger than for other pollutants, but still small in absolute terms**. The trend in the compliance total changes by 2.9% from -52.8% currently to -49.9% if aviation cruise is included. As with SO_2 the impact varies by Member State, but to a lesser degree; in most countries the trend flattens by at least 1%, though again Luxembourg is an outlier (from -81% currently to -70% including aviation cruise) due to the relatively small size of the ground-based emissions.

The extent to which these sources could be controlled by policies and measures

The "international" nature of aviation emissions and particular of the cruise component means that it is usually challenging for the EU or national governments to unilaterally act to control emissions or even to assign them to a particular Member State. Measures driven by climate action which reduce demand for flights, reduce fuel consumption per flight or involve fuel switching to alternative fuels can also have co-benefits for air pollution mitigation. There are also a few examples of national level interventions.

International aviation emissions within the European Economic Area (EEA) are covered by the **EU Emissions Trading Scheme** (ETS). Under this, airlines receive tradeable allowances covering a certain level of emissions from their flights per year. Although

offsetting is one option to meet allowances, it nonetheless adds to incentives to minimise fuel consumption. The global market-based Carbon Offsetting and Reduction Scheme for International Aviation[406] (**CORSIA**) is similar in nature but expands the geographical scope of flights included.

The **ReFuelEU** Aviation Regulation promotes the gradual supply and uptake of Sustainable Aviation Fuel (SAF) at Union Airports (2% share of SAF at Union Airports from 2025 up to 70% share of SAF in 2050). The EASA European Aviation Environmental Report 2025 summarises the wide range of different fuels under the term SAF including biofuels, synthetic fuels produced from various feedstocks, and hydrogen. The impact of SAF on air pollution depends on the specific type of fuel and air pollutant. Hydrogen has the potential to eliminate primary PM, SO_2 and NMVOC emissions, although NOx emissions would remain. Other hydrocarbon-based fuels (biofuels, synthetic fuels) would have less of an impact, but research projects such as AVIATOR and RAPTOR have shown that certain types of SAF have lower sulphur and aromatic content than fossil jet fuel, so SO_2, NMVOC and PM emissions would be reduced.

The EASA report also outlines European research and development activities related to air pollution, comprising a string of **Horizon Europe research and innovation activities**[407] focus on better understanding and significantly reducing all aviation-related LTO and cruise air pollutants. Furthermore, the European Commission has established the **Alliance for Zero Emission Aircraft** (AZEA) to prepare the aviation ecosystem for the entry into service of hydrogen and electric aircraft, which will eliminate or significantly reduce all aviation-related air pollutants.

Concluding remarks

While there are only few scientific studies on this question, recent evidence seems to confirm that the impact of aviation cruise emissions on ground-level concentrations of air pollutants and of ozone is limited. Furthermore, including cruise emissions within scope would make negligible to small differences for the trend in EU emission reductions over time, and hence for compliance with ERCs across the EU, while recognising some more pronounced impacts for a few Member States. This means that **the current exclusion should be still considered relevant**, though given the limited recent evidence on the impact of cruise emissions on ground-level air pollutant concentrations, this **should be kept under review**.

5.3.3.2 Exclusion of international maritime transport emissions

This section considers the relevance of the NECD in relation to international maritime navigation (shipping). This is defined as a journey taking place at sea, departing in one country and calling at the next port in a different country. Emissions from this source are

406 https://www.icao.int/environmental-protection/CORSIA/pages/default.aspx
407 https://research-innovation-community.ec.europa.eu/events/icGIke5cMVCM3scpfmT8d/overview

reported as a memo item as 1A3di(i) International maritime navigation[408], which is not included in the national total for compliance or the national total (for scientific purposes).

Shipping/marine source categories that are included in the national total for compliance include: 1A3di(ii) International inland waterways[409], 1A3dii National navigation (shipping), and 1A4ciii National fishing.

The approach of excluding international shipping from the national total for compliance but including it in reporting is fully aligned with the Gothenburg Protocol.

Methodologies for estimating emissions from international shipping were included in numerous historical versions of the EMEP/EEA Guidebook[410]. So, methodologies for estimating these emissions are not a new addition or represent significantly different methodologies/approaches respectively to when the NECD came into force. As a result, Member States would have had sufficient time to develop good quality emission estimates, using suitably detailed methodologies, although it is appreciated that some of these sources are particularly challenging to estimate accurately. Indeed, the analysis found there is a low proportion of Member States that are using more accurate and complex Tier 2 or Tier 3 methodologies to estimate emissions for international maritime navigation. Half of all Member States either use a Tier 1 methodology or use a methodology that is unclearly documented in their IIR.

Reasons for exclusion and whether these remain valid

The key reasons for excluding international shipping sources from the assessment of compliance with ERCs were as follows:

- It was considered that emissions from international maritime shipping were not sufficiently close to receptors to warrant inclusion in the national total for compliance. Similarly, it was noted that emissions from both "national" shipping and international shipping in *inland waterways* should be included due to the closer proximity to both coastal and inland receptors.
- The existence of the International Convention for the Prevention of Pollution from Ships (MARPOL) provided a mechanism by which air pollutant emissions from international shipping could be controlled. So, inclusion within the scope of the NECD was not considered a priority.
- The approach of excluding this source from the national total for compliance was a continuation of the approach used in the 2001 NECD and has the advantage of being aligned with the reporting requirements of the Air Convention. This approach

[408] As defined in the NFR reporting format, used for reporting to both the NECD and the Air Convention.

[409] Hence a component of international shipping activities, taking place on inland waterways, is included in both the national total for compliance and the national total (for scientific purposes).

[410] Although defining international shipping in inland waterways as a component that is included in national totals was only included in the most recent iteration of the NFR categorisation. Analysis and stakeholder engagement undertaken in the context of the support study suggests that some Member States are not able to resolve emissions from 1A3di(i) International maritime navigation and 1A3di(ii) International inland waterways, which potentially leads to inconsistencies in the figures reported across countries.

also aligns with that used for reporting greenhouse gas emissions under the United Nations Framework Convention on Climate Change (UNFCCC), although the UNFCCC classifies emissions from international shipping in inland waterways as "international" and they are therefore not included in national totals.

Ensuring alignment with other international legislation has been a sensible approach. However, there would also have been logic in requiring the source to be split into more detail, allowing more relevant inclusion/exclusion in national totals and consistency with the approach used in aviation (i.e. close to ports / coast vs a "cruise" component[411]).

It is also worth revisiting the impact of shipping on air quality in the light of more recent studies, given the reduction in land-based source of some pollutants (in particular NO_x) over the last decade or so. The EU Horizon 2020 "SCIPPER" project (Shipping Contributions to Inland Pollution Push for the Enforcement of Regulations) is a key recent study on the impact of shipping on air quality in Europe. Among other things, this project included modelling of the contribution of shipping to air pollution exposure in different coastal regions across Europe (and in China for comparison), and in a selection of major ports. Regarding impacts on coastal regions, the SCIPPER project found that:

- Based on a comparison of 5 different models, in the Mediterranean, air pollution concentrations are heavily influenced by shipping in only a few coastal areas (coasts of southern Spain, the island of Sicily, and partly also the Greek coasts), with lower impacts in the Northern Mediterranean. In general, models showed a shipping contribution of 5-10% of ambient NO_2 concentrations, and 10-15% of $PM_{2.5}$ concentrations in coastal areas of the Mediterranean. Close to shipping lanes, ozone concentrations are reduced by shipping (due to interactions with NOx), but around 3-6% additional ozone if formed further away from shipping lanes, due to shipping emissions.

- Results for the North Sea and Baltic Sea region show that in general, shipping impacts on NO_2 concentrations are concentrated within 100km of shipping lanes. Within the lanes in the North Sea and Baltic Sea, shipping accounts for 80% of NO_2 concentration. Based on modelling of 2015 emissions, the shipping contribution to NO_2 concentration is 30-40% in the coastal zones of the Netherlands and Belgium. More than 100km from coasts, the contribution is much lower, at less than 5%.

- Particulate matter (PM) shows shallower spatial gradients (i.e. less concentrated around shipping lanes) due to a longer atmospheric lifetime. Some of the PM is secondary PM formed over land by reaction of NOx and SOx emitted by shipping, with NH_3 emitted from agriculture. The regions with the highest shipping contribution to $PM_{2.5}$ concentrations are the Netherlands, Northern Germany,

411 Vessels undertaking national navigation journeys, depending on the coastal geography, may spend part of their voyage far enough from land that their emissions have little impact on receptors. Equally, all international voyages starting or ending in a particular country include phases at berth ("hotelling") and manoeuvring in ports where emissions are occurring close to shore.

Denmark and Southern Sweden, at about 8-10%. Further from coasts the contribution is still 5% in many areas.

- The percentage contribution of shipping to ambient concentrations is influenced by the significance of other sources of emissions.

A 2023 report by Concawe modelled the impact of shipping on air quality in 19 European ports and port cities. It found that across the 19 port cities modelled, the average contribution of shipping to NO_2, SO_2 and $PM_{2.5}$ concentrations was 22%, 18% and 8% respectively (though it is not clear from these results what the relative contributions of domestic and international shipping is to this share).

In summary, it seems that **international shipping may, in fact, be responsible for a significant fraction of concentrations of some pollutants on land**. The impact is concentrated in ports and coastal areas near to shipping lanes for NO_2 but are more widespread for $PM_{2.5}$. Moreover, even coastal impacts are important for human exposure, given that almost 40% of the European population lives within 50km of the sea[412].

In response to the **targeted stakeholder consultation**, six respondents indicated that they believed reasons for exclusion of this source were no longer valid, related to the impact shipping has on air quality. Comments supporting these responses indicated that international maritime emissions are now known to be essential for tropospheric ozone pollution, and that abatement of shipping emissions has not been as strong as in other sectors, so emissions need to be better taken into account. However, three other respondents responded that reasons for exclusion are still valid, and four were undecided, with the main themes in supporting comments related to difficulties of allocation of emissions and national policies.

The impact of including international shipping on national totals and their trend over time

At the EU 27 level, the magnitude of emissions from international maritime shipping in 2022 compared to the national total for compliance was greatest for **NO_x** and **SO_2**, with 27.5% and 18.7% respectively, much lower for **$PM_{2.5}$** with 5.5%, and very small for **NMVOC** with 0.8% (ammonia emissions are insignificant).

Underlying the EU27 level figures is substantial variation across Member States, partly explained by geography and the presence of major ports in a country (with no emissions in landlocked Member States), and by the presence or absence of other significant emissions sources.

For most countries and pollutants, reported emissions from international maritime shipping in 2022 were considerably greater than those from national navigation and international inland waterways combined. These results show that for many countries with significant maritime activity, international maritime shipping is a substantial emission source. Hence, had these emissions been included in the national total for compliance, then:

412 https://south.euneighbours.eu/publication/european-maritime-transport-environmental-report-2021/

- The distribution of NO_x and SO_2 emissions across Member States would have been substantially different.
- Trends in emissions would have been substantially influenced by trends in international shipping emissions.

Whilst the NECD compliance total for all pollutants and all Member States has reduced between 2005 and 2022, for international maritime navigation there is a mixed picture, with increasing and decreasing trends observed across Member States. Decreases in **SO_2** emissions were the largest over the time period, likely due to introduction of the North Sea and Baltic Sea Sulphur emission control areas (SECAs) as well as the reduction in IMO global sulphur fuel content limits (more detail below). Where increases have been reported, this primarily relates to increased shipping activity.

At the EU27 level, the impact of including international maritime navigation in compliance totals is relatively small. For **NO_x**, the trend between 2005 and 2022 is flattened slightly from -52.8% to -48.3%. For **$PM_{2.5}$** and **SO_2**, the trend is steepened by 1.8 and 0.2 percentage points respectively, reflecting overall slightly greater emissions reductions in international shipping than in other sectors over the period. For **NMVOC** the impact is negligible. The impact varies across Member States, with some more pronounced impact at the level of certain Member States, notably for SO_2, where the impact is to steepen the trend by over 10 percentage points for some (LV, SE, DE, DK and NL); as well as for NO_x, where for some there is a considerable flattening of the trend by over 10 percentage points (PT, NL, CY, EL) and up to 31 percentage points (EE, where the trend changes from -49% currently to -18% if this source is included).

These results show that while at EU level, the impact of including international maritime navigation in compliance totals is relatively small, **for NO_x, exclusion of international maritime navigation does have a significant impact on the trends in the national total for compliance** and may therefore reduce the efficacy of the NECD to act as a driver for emissions reduction from this source.

The extent to which these sources could be controlled by policies and measures

There are some opportunities for national and EU-level policies to influence shipping emissions, but due to the global nature of shipping and vessel ownership, they are less direct than for other sectors. Member States have very little influence on vessels transiting near to the coast but not calling at a port, except through participation in international negotiations. The main impact of **national or sub-national policies and measures** would be on at-berth emissions from ships calling at ports, through provision of shore power or lower waiting times. Provision of alternative fuelling infrastructure or financial incentives for lower-emitting engines can have wider impacts by influencing the composition of the fleet calling at ports.

At the **international level**, the International Maritime Organisation's (IMO) International Convention for the Prevention of Pollution from Ships (**MARPOL**) Annex VI[413] includes several mechanisms to reduce air pollution from ships of all flags, regardless of whether they are calling at European ports or simply transiting:

- Regulation 13 defines engine NO_x emissions standards for new vessels, which include increasingly stringent type-approval emission limits over time (termed IMO Tier I to Tier III) for new diesel-engine vessels, vessels undergoing major renovations, or retrofit requirements for very large vessels.
- The "global sulphur cap" decreases sulphur limits for fuel oil over time, the most recent of which was a 0.5% by mass cap introduced in January 2020.
- Sulphur and NO_x emission control areas (ECAs) have been established in some European waterways (e.g. the Baltic Sea and North Sea including the English Channel, with a Mediterranean SECA coming into force in 2025), which require compliance with IMO Tier III NO_x standards and a maximum of 0.1% fuel sulphur content. The Northeast Atlantic may also become a SO_x and NO_x ECA as of 2027 pending the outcome of negotiations at IMO during 2025-6, which would lead to the control of NO_x from international shipping in all EU waters except in the Mediterranean and Black Sea.

Such international measures have been found to be effective in reducing the air pollution intensity of shipping, despite continued growth in traffic in recent years. Remote monitoring of exhaust gas plumes by the European Maritime Safety Agency (EMSA) between 2021 and 2023 has shown that fuel sulphur content limits both within and outside of SECAs are generally being respected[414].

In addition, the IMO's 2023 strategy to reduce GHG emissions from shipping[415] includes mandatory measures for improvement in energy efficiency over time (for example through the energy efficiency design index – EEDI). Increasing energy efficiency – all else being equal - will also tend to reduce the air pollution intensity of shipping.

At the **EU level**, there are over-arching directives which have an influence on national air pollution policies and measures relevant to shipping, climate-related legislation having an impact on shipping air pollution emissions, and specific air quality legislation related to shipping.

- Where shipping is a major contributor to local air quality issues, the air quality standards set in the **Ambient Air Quality Directive** may be a major policy driver for the introduction of national or port-level measures to address emissions in and near to ports.
- The **Sulphur Directive** (EU) 2016/802 transposes global IMO limits on fuel sulphur content limits, but in addition limits sulphur content of marine fuel to 0.1%

413 https://www.imo.org/en/KnowledgeCentre/ConferencesMeetings/pages/Marpol.aspx
414 https://www.eea.europa.eu/en/analysis/publications/maritime-transport-2025
415 https://www.imo.org/en/OurWork/Environment/Pages/IMO-Strategy-on-reduction-of-GHG-emissions-from-ships.aspx

by mass or ships at berth in EU ports, regardless of their flag; and obliges Member States to enforce this and make available fuels that meet this limit.

- The **Fit-for-55 package** introduced a set of drivers to decarbonise the maritime sector[416]:
  - Extending the EU emissions trading scheme (EU-ETS) to the maritime sector;
  - The Alternative fuels infrastructure Regulation (AFIR) which introduces mandatory targets for provision of shore-side electricity and refuelling points at ports; and
  - The FuelEU Maritime Regulation requiring ships to make use of shore-side electricity or zero emission technologies if electricity is available at the port, or low-carbon fuels whilst in port if possible.
- Finally, the **Port Services Regulation** (Regulation 2017/352) explicitly allows ports to differentiate their port infrastructure charges in order to promote a more efficient use of the port infrastructure, short sea shipping or a high environmental performance, energy efficiency or carbon efficiency of transport operations.

From studying the NECD policies and measures (PaMs) database[417], there are a range of **national and port-level PaMs** planned or in force currently. These focus on the provision / incentivisation of shore power to reduce emissions at berth, alternative fuel infrastructure (mainly LNG), engagement in international cooperative measures such as sulphur and NO_x emission control areas, measures to increase logistical efficiency, and tax / tariff differentiation based on emissions.

Some respondents to the **targeted stakeholder consultation**, targeted engagement with Member States and national inventory compilers interviewed, thought that the **reason for exclusion** of international shipping from compliance totals related to national responsibility for emissions and mitigation **still applied**. It was argued that it is practically difficult to attribute responsibility for international maritime shipping emissions due to their transboundary nature, and reliance on fuel sales statistics (which are not easy to reconcile with the location emissions occur). There was also doubt about the ability of national policies - the vehicle through which the NECD ERCs actually have an impact on air quality - to effectively make a difference to emissions. EU-level or international policies were seen as being more appropriate. One national inventory compiler interviewed thought that introducing strict national policies unilaterally would simply cause ships to use ports in other countries for bunkering, so was doubtful of the overall impact that would have. Of

[416] The combined effect of climate-related measures will be to incentivise decreased fuel use, use of low-carbon fuels, and use of shore-side electrical power. Energy efficiency improvements and shore-side power usage have clear air pollution co-benefits. The air pollution benefits of low-carbon fuels are less certain, depending on the fuel, mode of use (e.g., combustion versus fuel cell) and abatement measures fitted.

[417] https://sdi.eea.europa.eu/data/0ce35066-7977-4473-ab8c-e4908006e45e

those respondents who thought the reasons for exclusion were no longer valid, all of the supporting comments provided related to the impact of international shipping on air quality

Concluding remarks

Excluding emissions from international maritime transport from the scope of compliance assessments under the NECD has been a sensible approach to ensure alignment with the Air Convention. However, there would also have been logic in requiring the source to be split into more detail, allowing more relevant inclusion/exclusion in national totals and consistency with the approach used in aviation (i.e. close to ports / coast vs a "cruise" component[418]).

Recent literature suggests that, in fact, shipping emissions as a whole (of which international shipping is a major component) has a significant impact on concentrations of some pollutants in coastal areas, even outside of port areas[419].

This having been said, shipping emissions are addressed by a number of international and EU level legislation, several of which are driven by climate action needs. These are complemented by some targeted measures at national level. Due to the global nature of shipping and vessel ownership, the effectiveness of national and EU level measures may be more limited. At the international level, IMO's MARPOL Convention includes several mechanisms to reduce air pollution from ships of all flags, regardless of whether they are calling at European ports or simply transiting, including through increasingly stringent global sulphur caps and sulphur and NO_x emission control areas ECAs).

Therefore, while **there could be grounds for continuing the exclusion**, the increasing relevance of maritime shipping emissions for pollutant concentrations in ports and coastal areas means that **it merits to be kept under close scrutiny,** including on whether international maritime shipping emissions close to ports and coastal areas should be reported and added to the national total for compliance.

5.3.3.3 Exclusion of NO_x and NMVOC emissions from agricultural activities

This section considers the relevance of the NECD in relation to NO_x and NMVOC emissions from 3B Manure Management and 3D Agricultural Soils[420]. While regularly reported, these sources of emissions are excluded from the assessment of compliance with ERCs under the NECD ('national total for compliance'). Unlike the two transport sources considered above, they are, however, counted within the national total (for scientific purposes) of emission inventories.

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418 Vessels undertaking national navigation journeys, depending on the coastal geography, may spend part of their voyage far enough from land that their emissions have little impact on receptors. Equally, all international voyages starting or ending in a particular country include phases at berth ("hotelling") and manoeuvring in ports where emissions are occurring close to shore.

419 Based on the review of Member State inventories presented in the support study (section 6.2), for the EU27 as a whole, international maritime shipping in 2022 contributed 60% of NMVOC, 85% of NOx, 83% of PM2.5 and 92% of SOx emissions from all kinds of shipping.

420 As defined in the NFR reporting format, used for reporting to both the NECD and the Air Convention.

The category 3B Manure Management contains several more detailed sources relating to manure management linked to different livestock. The category 3D Agricultural Soils contains several more detailed sources as listed below, which also include crop production:

3D Crop production and agricultural Soils			
3Da1	Inorganic N-fertilisers (includes also urea application)	**3Db**	Indirect emissions from managed soils
3Da2a	Animal manure applied to soils	**3Dc**	Farm-level agricultural operations including storage, handling and transport of agricultural products
3Da2b	Sewage sludge applied to soils	**3Dd**	Off-farm storage, handling and transport of bulk agricultural products
3Da2c	Other organic fertilisers applied to soils (including compost)	**3De**	Cultivated crops
3Da3	Urine and dung deposited by grazing animals	**3Df**	Use of pesticides
3Da4	Crop residues applied to soils		

Unlike for the other two sources above, the **exclusion from the compliance totals under NECD does not follow from the Air Convention**. Under the Gothenburg Protocol, NO_x and NMVOC emissions from 3B Manure Management and 3D Agricultural soils are included in compliance assessments.

Methodologies for these source/pollutant combinations were included in the 2013 EMEP/EEA Guidebook (and even earlier versions of the EMEP/EEA Guidebook for NO_x emissions) and underwent only minor revisions for the 2016 version of the EMEP/EEA Guidebook. Methodologies for estimating these emissions were thus not new additions, or significantly different methodologies/approaches, when the NECD came into force. As a result, Member States would have had sufficient time to develop good quality emission estimates, using suitably detailed methodologies.

Reasons for exclusion and whether these remain valid

The key reasons[421] for excluding NO_x and NMVOC from manure management and agricultural soils from the assessment of compliance with national ERCs were that:

- NO_x and NMVOC emissions from 3B Manure Management and 3D Agricultural Soils were considered to be high in uncertainty, and especially for NMVOC emissions from both source categories and NO_x emissions from agricultural soils. Therefore, emission estimates for these sources would be of poor quality. Whilst emission estimates should still be reported in the emissions inventory, inclusion in the national total for compliance was considered inappropriate.
- It was recognised that NMVOC emissions from 3B Manure Management have a different chemical speciation to e.g. combustion and solvent emission sources and have a smaller photochemical ozone creation potential (POCP). As a result, whilst

[421] The list includes arguments put forward during the negotiations of the NECD, complemented by observations from engagement with Member State stakeholders that were present at the time.

emissions from manure management might be relatively high compared to other sources on a mass basis, they would make smaller contributions to ozone formation. Given that the main aim of achieving NMVOC emission reduction commitments would be to reduce ozone formation, but that compliance would be assessed on a mass basis, including these NMVOC emissions would be unhelpful, and potentially misleading.

- It is also noted that these sources were not included in the GAINS analysis that was used as the basis to negotiate the 2030 ERCs for the NECD and to negotiate the 2020 ERCs for the Gothenburg Protocol as amended in 2012, and that overall, there was little knowledge on available cost-effective measures to control NO_x and NMVOC emissions from these sources at the time.

The reason given for the exclusion of these sources from the NECD compliance total is that they are high in uncertainty. However, this reasoning was not applied across all emission sources in a consistent way - there are sources which are even higher in uncertainty than NO_x and NMVOC from 3B Manure Management and 3D Agricultural Soils and were still included. It would have been more logical to review all emission sources included in the NECD inventories in a consistent way for inclusion/exclusion from the compliance total. It is also noted that these excluded sources/methodologies were not "new" or significantly revised when the NECD was being drafted.

As regards the lower ozone creation potential of NMVOC emitted from the agricultural sector compared to e.g. combustion sources, it is possible to address such concern by using a different metric for NMVOC emissions reporting that reflects the difference in ozone creation potential (i.e. a POCP weighted mass). While this would introduce some uncertainty to emission estimates, it could focus mitigation efforts on reducing emissions from the sources making the largest contributions to ozone formation.

Finally, the GAINS model now includes agricultural NO_x and NMVOC emissions, so any future ERCs including these emissions sources could be derived from an integrated assessment modelling where these are taken into account[422].

The results from the **targeted stakeholder consultation** indicate that there are more stakeholders who do not think that reasons for exclusion of these sources from the NECD compliance totals are still valid than do – although the results are not unanimous. For NO_x emissions from manure management, seven respondents believed reasons for exclusion were no longer valid, whilst only four believed that they were still valid. Similarly for NOx emissions from agricultural soils, seven believed that the reasons were still valid and only three disagreed. The results were slightly more mixed for NMVOC, with six respondents suggesting that reasons for exclusion were no longer valid for both manure management

[422] In fact, both CAO3 and CAO4 have performed analysis to see what difference the inclusion of NMVOC and NO_x emissions from agriculture would make for projected compliance with NMVOC and NO_x ERCs for 2030. As expected, the number of Member States projected to be non-compliant on 2030 would significantly increase (in CAO4, from 2 to 8 Member States for NO_x, and from 3 to 6 Member States for NMVOC). However, it is recognised that 2030 ERCs were set based on cost optimisation that did not reflect the abatement costs linked to these emission sources. In other words, reflecting them would have led to a different level of ERCs.

and agricultural soils, and four believing that they were still valid. One respondent cited the inclusion of these sources within Gothenburg Protocol compliance totals as a reason for including these sources within NECD compliance totals, whereas another expressed concerns about the high uncertainty levels. One national inventory compiler interviewed expressed the view that although they agreed with the original reasons for exclusion for these sources, they believe that improvements in methodologies means that exclusion is no longer necessary.

The impact of including emissions in national compliance totals and their trend over time

3B Manure Management

When expressed as a percentage of the national compliance total, **NMVOC** emissions from manure management are highly variable across Member States but are generally large. For example, there are 10 Member States where the emission is 30% or more of the national total for compliance. So, if this source had been included in the national total for compliance, then:

- The distribution of NMVOC emissions for compliance purposes across Member States would have been substantially different.
- Trends in emissions for compliance purposes would have been substantially influenced by trends in NMVOC emissions from manure management, and importantly,
- The national total for compliance would have included a large source which was both high in uncertainty and was also very different to other sources in terms of its photochemical ozone creation potential.

NO_x emissions from 3B Manure Management are also highly variable across the Member States in terms of the percentage contribution that they would have made to the national total for compliance, should they have been included. However, they are considerably smaller than NMVOC in terms of the contribution that they would have made to the national total for compliance, with only two Member States exceeding 2%. As a result, inclusion would not have had a particularly large impact on the national compliance totals.

3D Agricultural Soils

The magnitude of emissions from 3D Agricultural Soils, expressed as a percentage of the compliance total, was around 8.6% for NMVOC and 14.1% for NO_x across the EU in 2022. This varies considerably across the Member States. **NO_x** emissions as a percentage of the compliance total varies between 4% (MT) and 56% (IE). For **NMVOC** the variation is even larger, with a variation between 0.2% (SK) and 32% (FR). This large difference could relate partly to differences in reporting methodology and Member States using more or less

complex methods (higher or lower 'Tier') for estimating their emissions[423]. However, the differences are also due to the relative size of emissions from other sectors, such as solvent use in industry. For NOx, the methods used to estimate emissions from 3D Agricultural Soils are much less varied, with a Tier 1 method being used by most Member States.

The conclusions for emissions of both pollutants from 3D agricultural soils are therefore similar to those for NMVOC from 3B manure management, i.e. **that had this source been included in national totals for compliance, it would have substantially affected the distribution of emissions for compliance purposes across Member States** and that the national total for compliance would have included a large source high in uncertainty.

Impact on trends in emission totals

At the EU level, emissions of NMVOC and NOx from 3B and 3D have shown modest declines since 2005, and for NMVOC from 3D a small increase (Table X). This reflects partly the difficulty of controlling emissions from these sources but may also reflect the lack of availability of guidance and methods to capture the impact of abatement measures. The reduction in the national totals for compliance under the NECD for both pollutants over the same period has been more significant (-53% and -40% for NMVOC and NO_x, respectively, at the EU level).

Including emissions from 3B and 3D into compliance totals would flatten the trend at EU level – that is, achieved reductions since 2005 would be less substantial, with -49.5% and -34.6% for NOx and NMVOC, respectively (see column CLRTAP compliance total). The impact would be slightly greater for NMVOC than for NO_x, because overall the NMVOC emissions from these sources are larger compared with the compliance total than the NO_x emissions.

There is significant variation across Member States. For the majority of Member States, in-/exclusion makes relatively little difference to the trend for either NO_x or NMVOC, but for Ireland and the Netherlands in particular, the trend in NMVOC emissions when the sources are included is considerably flatter (compare the 4th and 5th columns of below table; -8% versus -39% for IE, and -2% versus -24% for NL), because agriculture makes up a large fraction of NMVOC emissions in those two countries.

Table A - 63 – Percentage change from 2005 to 2022 in Member State emissions of NMVOC and NO_x from 3B Manure management and 3D Agricultural Soils, as well as of related compliance totals (Source: Table 4-3 of the support study)

Member State	NMVOC				NOx			
	3B Manure Management	3D Agriculture Soils	NECD compliance total	CLRTAP compliance total	3B Manure Management	3D Agriculture Soils	NECD compliance total	CLRTAP compliance total
AT	-1.8%	-19.3%	-43.3%	-35.1%	-3.9%	-1.4%	-56.2%	-53.8%

[423] The Tier 1 method for estimating NMVOC emissions from manure management only includes emissions from housing and is all allocated to 3B Manure Management, whereas the Tier 2 method also includes emissions from manure application and grazing, which is allocated to 3D.

Member State	NMVOC				NOx			
	3B Manure Management	3D Agriculture Soils	NECD compliance total	CLRTAP compliance total	3B Manure Management	3D Agriculture Soils	NECD compliance total	CLRTAP compliance total
BE	4.2%	-6.5%	-49.1%	-37.5%	11.8%	-11.9%	-61.7%	-58.9%
BG	-25.0%	24.0%	-25.6%	-24.7%	-44.6%	60.7%	-52.8%	-46.2%
CY	6.9%	-60.4%	-55.6%	-47.7%	-4.6%	5.1%	-48.0%	-45.3%
CZ	12.0%	-2.4%	-27.8%	-24.6%	-6.8%	0.3%	-51.8%	-48.9%
DE	-7.5%	-2.8%	-36.0%	-30.0%	-16.0%	-16.0%	-43.1%	-41.1%
DK	6.0%	9.5%	-38.7%	-33.0%	-2.3%	2.3%	-63.8%	-57.8%
EE	16.9%	-4.6%	-26.6%	-21.4%	-24.0%	61.9%	-48.7%	-44.5%
ES	6.3%	-1.8%	-31.1%	-25.7%	-12.7%	5.3%	-59.1%	-55.5%
FI	-8.8%	-27.3%	-53.4%	-48.7%	-14.0%	-4.2%	-54.8%	-52.4%
FR	-5.3%	8.6%	-53.1%	-53.1%	-15.9%	-17.8%	-61.2%	-56.7%
GR	-19.2%	-10.7%	-61.3%	-59.0%	3.8%	-19.3%	-53.4%	-51.8%
HR	-12.4%	-3.8%	-49.4%	-46.2%	-28.1%	-25.9%	-46.6%	-45.4%
HU	-9.9%	-2.8%	-40.7%	-35.7%	-9.8%	15.0%	-49.6%	-43.7%
IE	1.2%	1.4%	-38.5%	-7.9%	0.2%	4.4%	-55.9%	-44.1%
IT	-10.4%	-6.7%	-40.9%	-37.7%	-15.4%	-26.2%	-52.9%	-51.7%
LT	-15.4%	-4.6%	-25.4%	-22.7%	19.0%	27.1%	-28.8%	-22.2%
LU	23.6%	-0.8%	-44.6%	-32.1%	0.3%	-20.4%	-81.1%	-81.0%
LV	-13.0%	-8.2%	-40.3%	-36.1%	-38.6%	60.4%	-35.5%	-29.9%
MT	-7.3%	-9.0%	-37.0%	-33.4%	-8.5%	19.9%	-52.5%	-51.4%
NL	50.7%	-0.8%	-24.3%	-1.6%	17.9%	-11.8%	-59.0%	-54.8%
PL	5.9%	48.6%	-27.6%	-22.6%	-5.7%	2.6%	-40.8%	-37.5%
PT	17.7%	10.8%	-26.1%	-23.2%	30.4%	-14.8%	-54.6%	-53.2%
RO	-31.2%	-20.2%	-34.4%	-32.8%	-30.6%	20.2%	-43.4%	-39.0%
SE	-10.3%	-5.5%	-39.7%	-35.0%	-35.7%	9.9%	-45.7%	-42.4%
SI	0.6%	-9.8%	-45.6%	-40.3%	-12.0%	-4.7%	-55.7%	-53.5%
SK	-37.8%	-15.2%	-39.1%	-39.0%	-30.6%	2.8%	-52.0%	-48.8%
EU27	-3.0%	1.6%	-39.8%	-34.6%	-9.9%	-6.8%	-52.8%	-49.5%

Note: Colour coding has been applied to highlight the variation across Member States (increases = red, decreases = blue, and small changes = white).

In terms of more detailed source categories and to understand what is driving above trends it is worth noting that the largest sources:

- within 3B Manure Management are dairy cattle and non-dairy cattle for both NMVOC and NO_x;

— within 3D Agricultural Soils are inorganic N-fertilisers (followed by animal manure applied to soils) for NO_x, and cultivated crops and animal manure applied to soils for NMVOC.

The extent to which these sources could be controlled by policies and measures

NO_x emissions

There is ample evidence and guidance available on agricultural practices that would reduce NO_x emissions, along with emissions of other nitrogen species, such as NH_3 and N_2O[424]. This includes reducing the quantity of nitrogen excreted by livestock or applied to soils, but also other measures, as summarised in the support study. A challenge is that current methods employed by Member States to estimate NO_x emissions from these sources do not capture the effect of several of the available abatement measures. This would require Member States to adapt more detailed methodologies rather than Tier 1 to capture the relevant impacts of emission control policies and measures.

There are no specific **EU policies** targeting NOx emissions from manure management or agricultural soils in particular. However, reductions in NOx emissions will naturally emerge from policies aimed at reducing emissions of other nitrogen compounds, which means that several EU-level policies have relevance:

— Some measures to control nitrate loss taken under the **Nitrates Directive** will have co-benefits for NOx emissions, such as establishing nitrate vulnerable zones and nitrate action programmes (NAPs) within these zones.

— The **Common Agriculture Policy** supports NO_x emissions mitigation through conditionality of direct payments (pillar 1) to farmers, the statutory management requirements of which include the Nitrates Directive. In addition, under the new (2023-2027) CAP some eco-schemes of relevance to NOx emissions have been introduced (e.g. nutrient management plans, use of innovative approaches, precision crop farming and improved manure management and storage). Some rural development interventions concern reduction of air pollution in farming are also relevant to reducing NOx emissions[425].

— The **revised Industrial Emissions Directive** is the basis for permitting of large intensive pig and poultry rearing installations. Whilst limits for NO_x emissions specifically are not defined, the BAT conclusions for nutritional management, manure storage and land spreading of manure to reduce emissions of ammonia and other nitrogen losses are nonetheless relevant.

— The **Effort Sharing Regulation** likely has had and will have an indirect effect on NO_x emissions from agriculture, through co-benefits of national measures put in place to reduce N_2O and methane emissions from agriculture (e.g. regulation of livestock numbers and livestock diets, reduction in nitrogen fertiliser usage).

424 Including by the UNECE Task Force on Reactive Nitrogen (TFRN).

425 Chapter 3 of the support study as well as Annex III section 5.3.4 provides more detail on CAP related measures.

On the international level, the **Air Convention** includes NO_x emissions from manure management and agricultural soils in compliance totals, which could in theory lead to national action. However, this has not led to specific policy development for these sources, because other sources of NO_x have been a priority historically, and unlike the NECD, the Air Convention lacks strong enforcement mechanisms in case of non-compliance.

NMVOC emissions

The potential to control NMVOC emissions from manure management is less well established. While most practices for controlling NH_3 emissions from manure management also act to reduce emissions of NMVOC, there is minimal guidance in the EMEP/EEA Guidebook to support Member States with their quantification of the impacts of policies and measures.

Controlling NMVOC emissions from agricultural soils (which includes standing crops) is particularly challenging. NMVOC emissions arise directly from the crop vegetation and also at harvest time. But, as the emissions are not a direct consequence of fertiliser application and the associated application technique, there are very limited practical options for mitigating NMVOC emissions.

In **EU policies**, NMVOC emissions are covered specifically by the **revised Industrial Emissions Directive,** which includes specific BAT conclusions for minimising odour (which consists of NMVOC to a large extent) from intensive livestock facilities. The measures applicable to housing, manure storage an application align largely with those for reducing ammonia emissions.

In addition, the other EU-level policies which impact on the production, storage and spreading of livestock manure (CAP, Nitrates Directive, ESR) with an aim of reducing the quantity of ammonia and/or methane emitted will also likely have co-benefits for NMVOC emission reduction.

As with NO_x emissions, in theory the inclusion of the agricultural NMVOC emission sources under the **Air Convention** could provide a stimulus for national policy creation, although this has not been a focus to date.

Responses to a question in the **targeted stakeholder consultation** asking, '*To what extent has exclusion of these sources from compliance assessment under the NECD affected the relevance and effectiveness of national polices in controlling emissions from these sources?*' were **mixed**:

	High impact	Moderate impact	No impact
NOx manure management	4	3	5
NMVOC manure management	4	3	5
NOx agricultural soils	4	4	4

NMVOC agricultural soils	4	3	5

Several themes emerged from more detailed responses obtained. Two national inventory compilers interviewed commented that exclusion of NO_x from agricultural soils from compliance assessment meant that there is no political will to address this source specifically, as the NECD is the strongest driver. At the same time, they both expressed **concern about the burden on farmers**, especially given the lack of specific mitigation options for these sources[426]. Several survey respondents and interviewees pointed to **limited technical options** for specifically controlling these emissions, and that their inclusion would make it more difficult to attain the ERCs. One respondent pointed out that models have seen improvements over time and now include agricultural NO_x and NMVOC emissions", and that the improved GAINS model is currently used for scenario analysis to inform the Gothenburg Protocol revision process. Therefore, it **now should be possible using GAINS to calculate ERCs which include these sources in an accurate way**.

Concluding remarks

The analysis above and with more detail provided in the support study has shown that some of the excluded agricultural emission sources are relatively large and would substantially change the relative contributions from source sectors to the national compliance totals. In some countries where the contribution of these emission sources is particularly large (e.g. NMVOC emissions for Ireland and the Netherlands), inclusion would cause a substantial flattening of emission trends over time.

Some of these sources are difficult, or particularly expensive, to control (e.g. NMVOC from standing crops). However, it is reasonable to question whether this is a valid reason for excluding sources from the compliance total, as the costs of abatement would be taken into account in the integrated assessment modelling studies used when setting emission reduction targets and ambition levels more generally[427].

Excluding sources from the national total for compliance on the basis that they were particularly uncertain was a reasonable consideration, but this approach was not applied consistently across all other emission sources. There are some limitations to existing methods available in the EMEP/EEA Guidebook, but this could be addressed as part of ongoing efforts to improve the Guidebook. As for other sources, Member States can also

[426] The support study notes that mitigation of these emissions may be achieved as co-benefits of sustainable nitrogen management to control NH_3 and N_2O emissions (for which there are already many policies in place), so there may be no need to introduce specific policies

[427] As explained in the main part chapter 2 and in more detail in Annex VI chapter 1 ('How were ERCs established?'), emission reduction commitments are set through integrated assessment modelling that takes into account the costs of abatement for different pollutants. As explained above in this section, integrated assessment models are now capable of including agricultural NO_x and NMVOC emissions, so any future ERCs including these emission sources could be informed by integrated assessment modelling taking these sources into account.

pro-actively develop more accurate country-specific methods, which would reflect the impact of mitigation measures in their inventories.

The **targeted stakeholder consultation** indicates that there are more stakeholders who do not think that reasons for exclusion of these sources from the NECD compliance totals are still valid than do – although the results are not unanimous and are based on a very low number of respondents to the related question.

Unlike for the two other excluded sources assessed above – i.e. certain shipping and aviation emissions – **the exclusion of the agricultural emission source 3B and 3D creates an inconsistency in approach between the NECD and the Gothenburg Protocol**, where these sources are included for purposes of compliance checks. While the GAINS model, which was used for modelling cost-effective ERCs for both the 2012 Gothenburg Protocol and the 2016 NECD revision, did not include these sources at the time, this has changed, and a further developed model version now underpins the modelling to inform the ongoing revision of the Gothenburg Protocol.

All in all, **this evaluation considers that the exclusion is not relevant**[428]. It is therefore appropriate to consider inclusion of these sources in the NECD in the future, i.e. beyond 2030, following the approach under the Gothenburg Protocol revision.

5.3.4 In terms of the list of emission reduction measures quoted in Annex III on agricultural measures, including the split between mandatory and optional measures?

As the NECD sets out specific emission reduction measures for the agriculture sector in Annex III Part 2[429], the question arises whether these are still relevant in light of the current regulatory landscape, evolution of the farming sector in the EU, developments in abatement techniques and guidance on abating emissions at international level. To this end, next to assessing their uptake described in section 2.2.5, the support study to the evaluation considered their relevance to modern farming systems, their effectiveness, overlaps with other legislation and discussions in the Air Convention.

It was found that in general the measures are relevant to modern farming systems. In some cases, e.g. regarding measure A4bi, they are more applicable to specific types of farms than others, e.g. new vs. existing farms. Furthermore, the relevance of measures, for example measure A1 on the establishment of a national advisory code of good agricultural practice to control ammonia emissions, depends to a large degree on national implementation, as also highlighted by stakeholders in the **targeted stakeholder consultation**.

Generally, based on a review of relevant literature, requirements under related legislation (Nitrates Directive, IED) and expert knowledge, the support study also found that the **measures have been effective**, ranging from moderate to high in abatement of ammonia

428 The Commission's 2013 proposal for a revised NECD did not propose such exclusion.
429 For the list of measures, see section 2.2.5.

emissions. In some cases, wording permits a broad range of options for implementation which vary in effectiveness and can therefore include less effective techniques. For example, measure A4bii encompasses low emission storage systems including options with abatement efficiency ranging from 40-100%. Therefore, the measure can be implemented in ways that could be more effective than others. This leeway, however, leaves room to adapt measures to Member State-specific or local circumstances. Again, in some cases, it is not the measure that determines the effectiveness, but rather the practical implementation – and in such cases there is insufficient information on how Member States have implemented individual measures to assess their relevance or effectiveness. This finding regards establishing a national advisory code of good agricultural practice to control ammonia emissions (A1), a national nitrogen budget (A2), or a national advisory code of good agricultural practice for the proper management of harvest residue (B2).

Table A-64 on the assessment of relevance of measures in the support study provides a comprehensive **overview of Annex III Part 2 measures**, their implementation, relevance for farming systems and effectiveness in abating air pollution.

Mandatory measures have been widely implemented. Measures A1 on a national advisory code of good agricultural practice and A3 on the prohibition of ammonium carbonate fertilisers are still considered relevant in light of regulatory, technical and scientific developments by stakeholders who responded to the **targeted stakeholder consultation** (23 respondents, 96% of responses; and 20 respondents, 95%, of responses respectively). The relevance of measure A1 could be strengthened through more regular updates and consideration of local conditions as pointed out by public authorities, as well as more ambition forwarded by NGOs.

For **optional measures** the uptake differs across Member States. Despite the varied uptake of measure A2 on the establishment of a national **nitrogen budget** (not applied in 11 Member States and partially in 5), this measure was nevertheless considered relevant by stakeholders (18 respondents; 78%) during the TSC, with strong support from public authorities. This suggests that low uptake is not necessarily an indication of a lack of relevance but may be due to other reasons such as the absence of data in this case as highlighted by a stakeholder.

The support study also found that there are a number of measures which are not currently covered in Annex III Part 2 with benefits for ammonia reduction. However, these measures are not necessarily more effective, only additional to the measures in the Annex. Very few examples were given of additional measures by respondents to the consultation. One such example is the review and update of technical and technological solutions for the design and operation of farm animal housing. Most of the other examples could be mapped to those already included in Annex III Part 2.

Relevance was also assessed from the angle of **overlaps with other legislation**, notably the Nitrates Directive and the IED. It was found that some measures fully or partially overlap with these Directives. For example, the requirement to establish a national advisory code of good agricultural practice (measure A1) partially overlaps with certain

elements of the Nitrates Directive Code of Good Agricultural Practice (CoGAP). Measure A3(c) (replacement of inorganic fertilisers by organic fertilisers, and, where inorganic fertilisers continue to be applied, take into account N and P requirements of the crop or grassland and existing nutrient content/use of other fertilisers) overlaps with numerous elements of Nitrate Action Programmes (NAPs), e.g. fertilisation planning and soil sampling. Many of the optional measures under A4 for mitigation of ammonia emissions from manure storage and spreading and animal housing are also covered by the Nitrates Directive or partially by the IED for larger pig and poultry farms. However, requirements under these Directives are applicable only to certain farm types (either based on location in nitrate vulnerable zones according to the Nitrates Directive – though this applies to around 70% of the agricultural area – or based on farm type/size, i.e. only pig and poultry farms above certain thresholds under the IED). The difference in scope as well as the fact that most of the concerned Annex III Part 2 measures are optional justifies these (partial) overlaps of measures. Member States can provide guidance to farmers in the context of the national codes of good agricultural practice to ensure that the implementation of the mentioned Directives at national level promotes coherent and complementary action on reducing ammonia emissions.

Section 5.1.2.2 has already showed that the **UNECE Framework Code of for Good Agricultural Practice for Reducing Ammonia Emissions** and the UNECE Ammonia Guidance Document remain relevant. There is however potential to update Annex III Part 2 measures based on the forthcoming revision of these documents.

Table A - 64 – Assessment of the relevance of measures in Annex III Part 2 of the NECD (Source: Table 3-19 of support study)

Measure	Current implementation of the NEC Directive measures	Is it established under other legislation?	Is measure relevant to current farming systems?	Is the measure effective?	Magnitude of effect[430]
A1. Member States shall establish a national advisory code of good agricultural practice to control ammonia emissions, taking into account the UNECE Framework Code for Good Agricultural Practice for Reducing Ammonia Emissions of 2014, covering at least the following items:	21 Member States fully implemented. Remaining Member States are in process of implementing final aspects of the CoGAP.	Annex II of the Nitrates Directive (ND) outlines the requirements for guidelines that can be established at national or regional level (CoGAP). While there are overlaps between the measures contained in CoGAPs and the national advisory codes of good agricultural practice under the NEC Directive, the two have different purposes with CoGAPs designed to protect water quality from pollution caused by nitrates from agricultural sources.	See analysis of sub-measures in rows below.	The requirement is to have the measures (a) to (f) below within the CoGAP. It is not possible to determine effectiveness of a CoGAP, only measures implemented in practice. This is reflected below.	n/a
(a) nitrogen management, taking into account the whole nitrogen cycle;	18 Member States implemented. 2 implemented partially. Information not found for 7.	The measure is not mandatory under the ND at EU level but could be required by Member States or regions in their Nitrate Action Programme. The ND CoGAP may also include "the establishment of fertiliser plans on a farm-by-farm basis and	Yes.	See measures A3(c) and A4(a)(i) which relate to this measure in practice.	↓↓

[430] UNECE (2021) Guidance document on integrated sustainable nitrogen management. The magnitude of effect provides a qualitative indication concerning the effectiveness of measures in reducing losses of each nitrogen form, including NH_3. Downward arrows indicate a reduction in losses: ↓ small to medium effect; ↓↓ medium to large effect.

Measure	Current implementation of the NEC Directive measures	Is it established under other legislation?	Is measure relevant to current farming systems?	Is the measure effective?	Magnitude of effect[430]
		the keeping of records on fertiliser use".			
(b) livestock feeding strategies;	17 Member States implemented. 4 implemented partially. Information not found for 6.	The IED sets out BAT on livestock feeding for large pig and poultry farms above certain capacity thresholds	Yes.	See measure A4(d) for an assessment of the measure in practice.	↓↓
(c) low-emission manure spreading techniques;	16 Member States implemented 3 implemented partially. Information not found for 7.	The ND CoGAP should include "procedures for the land application, including rate and uniformity of spreading, of both chemical fertiliser and livestock manure, that will maintain nutrient losses to water at an acceptable level". The BATC for intensive rearing of poultry and pigs include techniques for reducing emissions from manure spreading.	Yes.	See measures A4(a)(iii) and A4(a)(iv) for an assessment of the measure in practice.	↓↓
(d) low-emission manure storage systems;	17 Member States implemented. 2 implemented partially. Information not found for 7.	The ND CoGAP should include "the capacity and construction of storage vessels for livestock manures, including measures to prevent water pollution by run-off and seepage… of liquids containing livestock manures and effluents from stored plant materials such as silage".	Yes.	See measure A4(b)(ii) for an assessment of the measure in practice.	↓↓

Measure	Current implementation of the NEC Directive measures	Is it established under other legislation?	Is measure relevant to current farming systems?	Is the measure effective?	Magnitude of effect[430]
		IRPP BATC include techniques for reducing emissions from manure storage			
(e) low-emission animal housing systems;	16 Member States implemented. 4 implemented partially. Information not found for 6.	IRPP BATC include techniques for reducing emissions from animal housing systems	Yes.	See measure A4(c) for an assessment of the measure in practice.	↓↓
(f) possibilities for limiting ammonia emissions from the use of mineral fertilisers.	17 Member States implemented. 2 implemented partially. Information not found for 7.	No.	Yes.	See measure A3(c) for an assessment of the measure in practice.	↓↓
A2. Member States may establish a national nitrogen budget to monitor the changes in overall losses of reactive nitrogen from agriculture, including ammonia, nitrous oxide, ammonium, nitrates and nitrites, based on the principles set out in the UNECE Guidance Document on Nitrogen Budgets.	10 Member States applied. 11 not applied. 5 applied partially. Information not found for 1.	No.	Yes - at a national scale, less relevance at farm level.	This is a national scale measure, and it is difficult to determine the effectiveness of a national nitrogen budget as a measure to reduce emissions. When prescribed at farm level this measure is an effective tool for allowing planned use of nitrogen based on needs.	n/a
A3. Member States shall prohibit the use of ammonium carbonate fertilisers and may reduce ammonia	25 Member States implemented.	Prohibition of the use of ammonium carbonate implemented as a NAP measure by 2 member states. In other	Yes.	Ammonium carbonate-based fertilisers readily breakdown in the environment to release ammonia, a property which	↓↓

Measure	Current implementation of the NEC Directive measures	Is it established under other legislation?	Is measure relevant to current farming systems?	Is the measure effective?	Magnitude of effect[430]
emissions from inorganic fertilisers by using the following approaches:	2 implemented partially.	Member States the prohibition is covered by rules implementing the NECD.		has seen their use banned (or being banned) in various parts of the world. [431,432,433]	
(a) replacing urea-based fertilisers by ammonium nitrate-based fertilisers;	10 Member States applied. 4 not applied. 5 applied partially. Information not found for 8.	No.	Yes.	As the rapid hydrolysis of urea-based fertilisers leads to high NH_3 losses[444] replacement with those based on ammonium nitrate will be beneficial. Ammonium nitrate generates 90 % fewer ammonia emissions per unit of nitrogen than urea.[434,444]	↓↓
(b) where urea-based fertilisers continue to be applied, using methods that have been shown to reduce ammonia emissions by at least 30 % compared with the use of the reference method, as specified	17 Member States applied. 2 not applied. 3 applied partially. Information not found for 5.	No.	Yes.	Various techniques are available for NH_3 emission reduction following urea-based fertiliser spreading[444], including sub-surface injection (80%-90%)[435], rapid incorporation (50%-80%), surface spreading with	↓↓

431 Tzilivakis, J., Green, A., Warner, D.J. & Lewis, .A. (2020) Identification of approaches and measures in action programmes under Directive 91/676/EEC. Final report: Annex D: Risk characterisation of all Nitrate Action Programmes. Report prepared for Directorate-General Environment, European Commission, for project ENV.D.1/SER/2018/0017 by the Agriculture and Environment Research Unit (AERU), University of Hertfordshire, United Kingdom.

432 Brondi, M., Eisa, M. Bortoletto-Santos, R., Drapanauskaite, D., Reddington, T., Williams, C., Ribeiro, C. & Baltrusaitis, J. (2023). Recovering, Stabilizing, and Reusing Nitrogen and Carbon from Nutrient-Containing Liquid Waste as Ammonium Carbonate Fertiliser. *Agriculture*, 13: 909. DOI: 10.3390/agriculture13040909.

433 House of Commons Environmental Audit Committee. (2018). *UK Progress on Reducing Nitrate Pollution*. House of Commons, London. Available at (Accessed 18 November 2024).

434 Yara. (2017). *Reducing Ammonia Emissions from Agriculture.* Yara International ASA, Oslo.

435 Sommer S.G., Schjoerringm J.K. & Denmead, O.T. (2004). Ammonia emission from mineral fertilisers and fertilized crops. *Advances in Agronomy*, 82: 557-622. DOI: 10.1016/S0065-2113(03)82008-4.

Measure	Current implementation of the NEC Directive measures	Is it established under other legislation?	Is measure relevant to current farming systems?	Is the measure effective?	Magnitude of effect[430]
in the Ammonia Guidance Document;				irrigation (40%-70%), urease inhibitors (40%-70%)[436] and polymer coatings (≈30%), although effectiveness will be dependent on the precise system used.	
(c) promoting the replacement of inorganic fertilisers by organic fertilisers and, where inorganic fertilisers continue to be applied, spreading them in line with the foreseeable requirements of the receiving crop or grassland with respect to nitrogen and phosphorus, also taking into account the existing nutrient content in the soil and nutrients from other fertilisers.	21 Member States applied. 1 applied partially. Information not found for 5.	"Where inorganic fertilisers continue to be applied, spreading them in line with the foreseeable requirements of the receiving crop or grassland…", covered by multiple ND NAP measures, e.g. fertilisation planning, soil sampling and foliar analysis.	Yes.	The N release rate of organic fertilisers is usually slower than that of synthetic fertilisers, potentially increasing N use efficiency and reducing NH_3 volatilization.[437],[438],[439]	↓↓
A4. Member States may reduce ammonia emissions from livestock	24 Member States applied.	See assessment of sub-measures.	See assessment of sub-measures.	See assessment of sub-measures.	n/a

[436] Lichiheb, N., Myles, L., Personne, E., Heuer, M., Buban, M., Nelson, A.J., Koloutsou-Vakakis, S., Rood, M.J., Joo, E., Miller, J. & Bernacchi, C. (2019). Implementation of the effect of urease inhibitor on ammonia emissions following urea-based fertiliser application at a Zea mays field in central Illinois: A study with SURFATM-NH3 model. *Agricultural and Forest Meteorology*, 269-270: 78-87. DOI: 10.1016/j.agrformet.2019.02.005.

[437] Niu, J., Saeed, Q., Wang, W., Zhang, R., Liu, L., Lv, F., Xu, J., Han, Y., Zhang, P., Hu, C., Xu, H., Sun, B., Yang, X & Zhang, S. (2024). Manure replacing synthetic fertiliser improves crop yield sustainability and reduces carbon footprint under winter wheat–summer maize cropping system. *Journal of Environmental Management*, 358: 120936: DOI: 10.1016/j.jenvman.2024.120936.

[438] Ren, F., Sun, N., Misselbrook, T., Wu, L., Xu, M., Zhang, F. & Xu, W. (2022). Responses of crop productivity and reactive nitrogen losses to the application of animal manure to China's main crops: A meta-analysis. *Science of the Total Environment*, 850: 158064. DOI: 10.1016/j.scitotenv.2022.158064.

[439] Wei, Z., Ying, H., Guo, X., Zhuang, M., Cui, Z., & Zhang, F. (2020). Substitution of Mineral Fertilizer with Organic Fertilizer in Maize Systems: A Meta-Analysis of Reduced Nitrogen and Carbon Emissions. *Agronomy*, *10*(8), 1149. https://doi.org/10.3390/agronomy10081149.

Measure	Current implementation of the NEC Directive measures	Is it established under other legislation?	Is measure relevant to current farming systems?	Is the measure effective?	Magnitude of effect[430]
manure by using the following approaches:	3 applied partially.				
(a) reducing emissions from slurry and solid manure application to arable land and grassland, by using methods that reduce emissions by at least 30 % compared with the reference method described in the Ammonia Guidance Document and on the following conditions:	22 Member States applied. 5 applied partially.	Some member states have ND NAP measures covering application techniques that are permitted (or prohibited), sometimes under specific circumstances, but not explicitly for a 30% reduction in ammonia emissions Certain sub-measures are included in IRPP BATC (See analysis of sub-measures)	Yes.	A number of options exist with a range of likely levels of effectiveness, some of which are discussed below. However, others too have been shown to reduce NH_3 losses by the required 30% in some situations (e.g. slurry acidification and/or separation) but may have variable levels of effectiveness dependent on soil type and weather conditions[440,441] (for example).	n/a
(i) only spreading manures and slurries in line with the foreseeable nutrient requirement of the receiving crop or grassland with respect to nitrogen and phosphorous, also taking into account the existing nutrient	13 Member States applied. 1 not applied. 7 applied partially.	Covered by multiple ND NAP measures, e.g. fertilisation planning, soil sampling and foliar analysis. Covered by multiple IED measures, e.g. BAT 20(d).	Yes.	Variable - although reductions in NH_3 losses are expected[442].	↓↓

[440] Fangueiro, D., Pereira, J., Bichana, A., Surgy, S., Cabral, F. & Coutinho, J. (2015). Effects of cattle-slurry treatment by acidification and separation on nitrogen dynamics and global warming potential after surface application to an acidic soil. *Journal of Environmental Management*, 162: 1-8. DOI: 10.1016/j.jenvman.2015.07.032.

[441] Nyameasem, J.K., Zutz, M., Kluß, C., ten Huf, M., Essich, C., Buchen-Tschiskale, C., Ruser, R., Flessa, H., Olfs, H.-W., Taube, F. & Reinsch, T. (2022). Impact of cattle slurry application methods on ammonia losses and grassland nitrogen use efficiency. *Environmental Pollution*, 315: 120302. DOI: 10.1016/j.envpol.2022.120302.

[442] Newell Price, J.P., Harris, D., Taylor, M., Williams, J.R., Anthony, S.G., Duethmann, D., Gooday, R.D., Lord, E.I., Chambers, B.J., Chadwick, D.R. & Misselbrook, T.H. (2011). *An Inventory of Mitigation Methods and Guide to their Effects on Diffuse Water Pollution, Greenhouse Gas Emissions and Ammonia Emissions from Agriculture: User Guide (DEFRA Project WQ0106).* Defra, London.

Measure	Current implementation of the NEC Directive measures	Is it established under other legislation?	Is measure relevant to current farming systems?	Is the measure effective?	Magnitude of effect[430]
content in the soil and the nutrients from other fertilisers;	Information not found for 6.				
(ii) not spreading manures and slurries when the receiving land is water saturated, flooded, frozen or snow covered;	16 Member states have applied. 4 applied partially. Information not found for 7.	Covered by multiple ND NAP measures, e.g. climate and soil conditions that prohibit the use of fertilisers. Covered by multiple IED measures, e.g. BAT 20(c).	Yes.	NH_3 losses from surface applied manures / slurries may be limited by cooler conditions[443].	↓
(iii) applying slurries spread to grassland using a trailing hose, trailing shoe or through shallow or deep injection;	16 Member States have applied. 6 applied partially. Information not found for 4. Not applicable for 1 (no grassland).	For ND, some Members States have ND NAP measures that specify application techniques for slurry, but not universally, often for specific circumstances. Measures are included in IRPP BATC	Yes.	Estimates of NH_3 loss reductions vary considerably but are generally in the range 30%-35% (trailing hose) to >90% (deep injection)[442,444].	↓↓
(iv) incorporating manures and slurries spread to arable land within the soil within four hours of spreading;	10 Member States applied. 13 applied partially, often to incorporate	For ND, some Member States have ND NAP measures that specify incorporation times. Some are 4 hours or less, and some will vary with specific circumstances.	Yes.	May reduce NH_3 losses by 85%-90% (based on 1 hour)[443] but effectiveness may reduce significantly with even short delays[444,445].	↓↓

[443] Lupis, S.G., Davis, J.G. & Embertson, N. (2012). Fact Sheet No. 1.631D: Best Management Practices for Reducing Ammonia Emissions - Manure Application. Colorado State University, Fort Collins, CO.

[444] Bittman, S., Dedina, M., Howard C.M., Oenema, O. & Sutton, M.A., (eds). (2014). *Options for Ammonia Mitigation: Guidance from the UNECE Task Force on Reactive Nitrogen.* Centre for Ecology and Hydrology, Edinburgh, UK.

[445] Webb, J., Pain, B., Bittman, S. & Morgan, J. (2010). The impacts of manure application methods on emissions of ammonia, nitrous oxide and on crop response - A review. Agriculture, Ecosystems and Environment, 137(1-2): 39-46. DOI: 10.1016/j.agee.2010.01.001.

Measure	Current implementation of the NEC Directive measures	Is it established under other legislation?	Is measure relevant to current farming systems?	Is the measure effective?	Magnitude of effect[430]
	by 24 or 12 hours (not 4). 3 not applied. Information not found for 1.	For IED, some measures specify incorporation times. Some are 6 hours or less (e.g. BAT 21).			
(b) reducing emissions from manure storage outside of animal houses, by using the following approaches:	21 Member States applied. 6 applied partially.	See analysis of sub-measures.	See analysis of sub-measures.	See analysis of sub-measures.	n/a
(i) for slurry stores constructed after 1 January 2022, using low emission storage systems or techniques which have been shown to reduce ammonia emissions by at least 60 % compared with the reference method described in the Ammonia Guidance Document, and for existing slurry stores at least 40 %;	16 Member States applied. 7 applied partially. 2 not applied. Information not found for 2.	For ND, some Member States have ND NAP measures covering the design and construction of manure stores, but not explicitly for a 60% reduction in ammonia emissions. For IED, some measures stipulate design and construction requirements for some elements of stores, but not explicitly for a 60% reduction in ammonia emissions.	Yes - although some systems require (e.g. replacing lagoons with tanks/silos) or are best suited to (e.g. tight-fitting covers) new builds, others (e.g. floating covers) are applicable to existing slurry stores. Therefore, NH_3 reducing storage options are available for most farming systems, although the choice will be dependent on a number	Forms of low NH_3 emission slurry storage system vary considerably in their effectiveness from ≈40% (natural crust development and low technology" floating covers (e.g., chopped straw, etc.) to 100% (storage bags)[444, ,446, 447].	↓↓

[446] Kupper, T., Häni, C., Neftel, A., Kincaid, C., Bühler, M., Amon, B. & VanderZaag, A. (2020). Ammonia and greenhouse gas emissions from slurry storage - A review. *Agriculture, Ecosystems & Environment*, 300: 106963. DOI: 10.1016/j.agee.2020.106963.

[447] Santonja et al (2017) Best Available Techniques (BAT) Reference Document for the Intensive Rearing of Poultry or Pigs.

Measure	Current implementation of the NEC Directive measures	Is it established under other legislation?	Is measure relevant to current farming systems?	Is the measure effective?	Magnitude of effect[430]
			of factors (e.g. slurry composition and wider slurry management systems)[444] and cost.		
(ii) covering stores for solid manure;	13 Member states applied. 6 applied partially. 4 not applied. Information not found for 4.	Overlaps with IED, e.g. BAT 16(b).	Yes - applicable to all farms with a need to store manure.	Covering solid manure heaps has been shown to be capable of significantly reducing NH_3 losses (particularly if combined with compaction - e.g. 90%)[448], although the magnitude of the reduction is highly variable (e.g. 14%-89%)[447] being dependent on broader manure management practices and conditions.	↓↓
(iii) ensuring farms have sufficient manure storage capacity to spread manure only during periods that are suitable for crop growth;	18 Member States applied. 1 not applied. 2 applied partially. Information not found for 6.	This is a core ND NAP measure implemented by all member states. Also overlaps with IED, e.g. BAT 15(d).	Yes - applicable to all farms with a need to store manure.	The use of N balancing (i.e. ensuring that N inputs take into account the needs of the growing crop) are a well-established means of increasing N use efficiency, but there is less information available in relation to its effectiveness in terms of NH_3 loss reduction[444].	↓ - Storage ↓↓ - Covered storage

[448] Chadwick, D.R. (2005). Emissions of ammonia, nitrous oxide and methane from cattle manure heaps: effect of compaction and covering. *Atmospheric Environment*, 39(4): 787-799. DOI: 10.1016/j.atmosenv.2004.10.012.

Measure	Current implementation of the NEC Directive measures	Is it established under other legislation?	Is measure relevant to current farming systems?	Is the measure effective?	Magnitude of effect[430]
(c) reducing emissions from animal housing, by using systems which have been shown to reduce ammonia emissions by at least 20 % compared with the reference method described in the Ammonia Guidance Document;	15 Member States applied. 7 applied partially. 4 not applied. Information not found for 1.	For IED, but not explicitly for a 20% reduction in ammonia emissions	Yes - a number of options for NH_3 loss reduction exist for all housed livestock types.	A range of physical (e.g. slatted floors for improved excreta control) and management (e.g. frequent manure removal) based techniques for reducing NH_3 losses from animal housing exist (incl. increasing grazing time – which results in an overall reduction) with the potential to reduce losses by 20% (optimal climatization) to 90% (chemical scrubbers)[444].	↓↓
(d) reducing emissions from manure, by using low protein feeding strategies which have been shown to reduce ammonia emissions by at least 10 % compared with the reference method described in the Ammonia Guidance Document.	14 Member States applied. 5 applied partially. 2 not applied. Information not found for 5.	Overlaps with IED	Yes - widely applicable within the constraints of animal dietary requirements.	Reductions in dietary crude protein significantly reduce N excretion, with the potential to reduce NH_3 losses at all stages of manure management (e.g. by 5%-15%)[444].	↓↓
B1. Without prejudice to Annex II on cross-compliance of Regulation (EU) No 1306/2013 of the European Parliament and of the Council (1), Member States may ban open field burning of agricultural harvest residue and	24 Member States implemented.	The burning of crop residues has been either banned or strongly discouraged in many European countries, not least through Cross Compliance.[449].	Yes.	A ban ensures emissions from burning of crop residues are avoided which include releases of air pollutants covered by the NECD, including NH_3 , NO_x,	Not reviewed

[449] European Commission. (2023). Approved 28 CAP Strategic Plans (2023-2027): Summary Overview for 27 Member States - Facts and Figures. European Commission, Brussels.

Measure	Current implementation of the NEC Directive measures	Is it established under other legislation?	Is measure relevant to current farming systems?	Is the measure effective?	Magnitude of effect[430]
waste and forest residue. Member States shall monitor and enforce the implementation of any ban implemented in accordance with the first subparagraph. Any exemptions to such a ban shall be limited to preventive programmes to avoid uncontrolled wildfires, to control pest or to protect biodiversity.	1 implemented partially (scheduled for 2025). 2 not implemented.			SO_2 and fine particulate matter ($PM_{2.5}$)[450]	
B2. Member States may establish a national advisory code of good agricultural practices for the proper management of harvest residue, on the basis of the following approaches:	13 Member States applied. 11 not applied. 3 applied partially.	See analysis of sub-measures	See analysis of sub-measures.	The requirement is to establish a CoGAP. It is not possible therefore, to determine effectiveness directly as this will be a function of the individual measures contained (see below).	Not reviewed
(a) improvement of soil structure through incorporation of harvest residue;	10 Member States applied. 3 applied partially. 6 not applied. Information not found for 8.	A few member states have ND NAP measures that stipulate how crop residues should be managed including incorporation (burial) under some circumstances, albeit not explicitly for soil structure reasons.	Yes.	The incorporation of harvest residues has been shown to significantly reduce NH4 losses whilst increasing soil organic matter content and structure. Improved soil structure can reduce dust to varying degrees. The variations in PM2.5 impacts as a result of improved soil structure is dependent upon	Not reviewed

[450] Abdurrahman, M.I., Chaki, S. & Saini, G. (2020). Stubble burning: Effects on health & environment, regulations and management practices. *Environmental Advances*, 2: 100011. DOI: 10.1016/j.envadv.2020.100011.

Measure	Current implementation of the NEC Directive measures	Is it established under other legislation?	Is measure relevant to current farming systems?	Is the measure effective?	Magnitude of effect[430]
				specific meteorological parameters and the amount of rainfall [451]	
(b) improved techniques for incorporation of harvest residue;	9 Member States applied. 2 applied partially. 7 not applied. Information not found for 9.	As above.	Yes.	Different techniques for incorporation / mixing have been shown to result in different degrees of NH_3 loss reduction. For example, some studies have found ploughing in of sugar beet tops to reduce losses by 81% whilst soil mixing reduced them by 63%, with other studies revealing similar benefits for other crops. [452] No till farming is among techniques employed by farmers to improve the incorporation of harvest residue. No till farming reduces dust emissions. Studies have shown reductions of up to 97% in windblown dust particulate matter with no-till practices.[453]	Not reviewed

[451] Piccoli, I., Sartori, F., Polese, R. & Berti, A. (2020). Crop yield after 5 decades of contrasting residue management. *Nutrient Cycling in Agroecosystems*, 117(2): 231-241. DOI: 10.1007/s10705-020-10067-9.

[452] de Ruijter, F.J. & Huijsmans, J.F.M. (2012). Ammonia Emission from Crop Residues - Quantification of Ammonia Volatilization Based on Crop Residue Properties. Wageningen UR, Wageningen, The Netherlands. Dămătîrcă et al (2023) Residue incorporation and organic fertilisation improve carbon and nitrogen turnover and stabilisation in maize monocropping. Agriculture, Ecosystems and Environment Vol 342.

[453] Pokharel et al (2023) Health burden associated with tillage related PM2.5 pollution in the US and mitigation strategies. Science of the Total Environment. Volume 903.

Measure	Current implementation of the NEC Directive measures	Is it established under other legislation?	Is measure relevant to current farming systems?	Is the measure effective?	Magnitude of effect[430]
(c) alternative use of harvest residue;	9 Member States applied 3 applied partially 6 not applied. Information not found for 9.	No.	Yes.	Harvesting and withdrawal of the crop residues (e.g. for animal feed or direct / indirect fuel production) decreases the soil N surplus (especially short term), although crop residue removal may also decrease soil organic matter content and N storage.[444]	Not reviewed
(d) improvement of the nutrient status and soil structure through incorporation of manure as required for optimal plant growth, thereby avoiding burning of manure (farmyard manure, deep-straw bedding).	12 Member States applied. 2 applied partially 5 not applied. Information not found for 9.	No.	Yes.	The burning of manures of all sorts (incl. poultry manure) potentially releases a number of air pollutants covered by the NECD, including NMVOCs, NH_3 , NOx, SO_2 and fine particulate matter ($PM_{2.5}$).[454,455,456]	
C. In taking the measures outlined in Sections A and B, Member States shall ensure that impacts on small and micro farms are fully taken into account. Member States may, for instance, exempt small and micro farms from those measures where	16 Member States implemented. 3 implemented partially. 1 not implemented.	No. However, IED only applies to large pig and poultry farms above certain capacity thresholds.	Yes.	n/a	n/a

[454] Havukainen, J., Väisänen, S., Rantala, T., Saunila, M. & Ukko, J. (2020). Environmental impacts of manure management based on life cycle assessment approach. *Journal of Cleaner Production*, 264: 121576. DOI: 10.1016/j.jclepro.2020.121576.

[455] Mudway, I.S., Duggan, S.T., Venkataraman, C., Habib, G., Kelly, F.J. & Grigg, J. (2005). Combustion of dried animal dung as biofuel results in the generation of highly redox active fine particulates. *Part. Fibre. Toxicol.*, 2: 6. DOI: 10.1186/1743-8977-2-6.

[456] Leinonen, I & Williams, A. (2013). Environmental Impacts of Poultry Production When Using Poultry Manure as a Fuel on Broiler Farms - Project Report for BHSL, April 2013. (Accessed 20 November 2024).

Measure	Current implementation of the NEC Directive measures	Is it established under other legislation?	Is measure relevant to current farming systems?	Is the measure effective?	Magnitude of effect[430]
possible and appropriate in view of the applicable reduction commitments.	No information for 7 Member States.				

6 DETAILED ANALYSIS OF THE "EU ADDED VALUE" EVALUATION CRITERION

This section addresses two evaluation questions to determine the EU added value of the NECD:

- To what extent is the initial subsidiarity analysis still valid?
- Do needs and objectives addressed by the NECD continue to require action at EU level?

While analysing these questions, we consider to whom the intervention made a difference, and whether the NECD contributed to reductions in air pollutants in a fair and equitable way.

6.1 Subsidiarity analysis

Obligations stemming from the NECD, like all requirements linked to EU legislation, should be subject to the principle of subsidiarity, which is fundamental to the functioning of the EU. The principle provides that the EU may only intervene if it is able to act more effectively than Member States at their respective national or local levels. The NECD sets national emission reduction commitments per pollutant for each Member States in Annex II. It also follows a staged approach by setting emission commitments to be achieved for the period 2020-2029 and more ambitious ones as from 2030. However, as indicated in the 2013 impact assessment of the NECD, it largely leaves the choice of the means to achieve those commitments to the Member States. **The approach described in the impact assessment remains to date, and the analysis performed therefore remain valid**.

6.2 Significance of transboundary pollution

In most Member States, domestic sources are the main sources of pollution, however, the analysis in the support study to the 4th Clean Air Outlook (IIASA et al., 2025) confirms that **in most Member States, a significant share of $PM_{2.5}$ background concentration is generated in other Member States**. According to GAINS calculations, in 2020 the share of population-weighted $PM_{2.5}$ background concentrations originating from outside sources (EU and non-EU) ranged from 29% to 92%. For the majority of Member States, this share was in the range of 40 to 70%. This reflects the transboundary nature of air pollution, which justifies taking action at EU level as air pollution generated in one Member State may have negative impacts beyond a Member State's borders.

At the same time, the analysis also shows that **the role of sources outside the EU has increased over time**, with their importance varying from country to country and dependent on their geographical location. Two examples are provided below, to showcase different cases of a centrally located Member State (Germany) as opposed to one that is influenced to a considerable extent by non-EU sources of pollution (Bulgaria). The corresponding figures for all Member States are available in the CAO4 support study (IIASA et al., 2025).

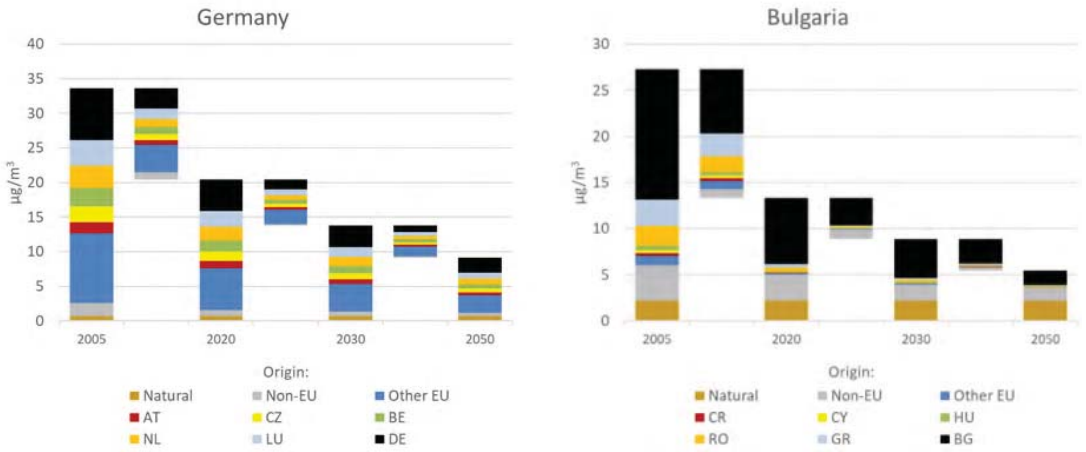


Figure A - 53 – Origins of ambient background concentrations of $PM_{2.5}$ (population-weighted) in DE and BG in the period 2005 to 2050 and the contribution to the changes during respective periods.

Amongst **stakeholders** responding to both OPC and TSC there was strong agreement that transboundary pollution remains a significant source of air pollution across EU Member States. This confirms the widely held view that air pollutants are not confined by national borders and therefore require coordinated cross-border policy responses. In line with this, there was also broad consensus that EU-level legislation is necessary to effectively reduce emissions of the pollutants covered by the NECD.

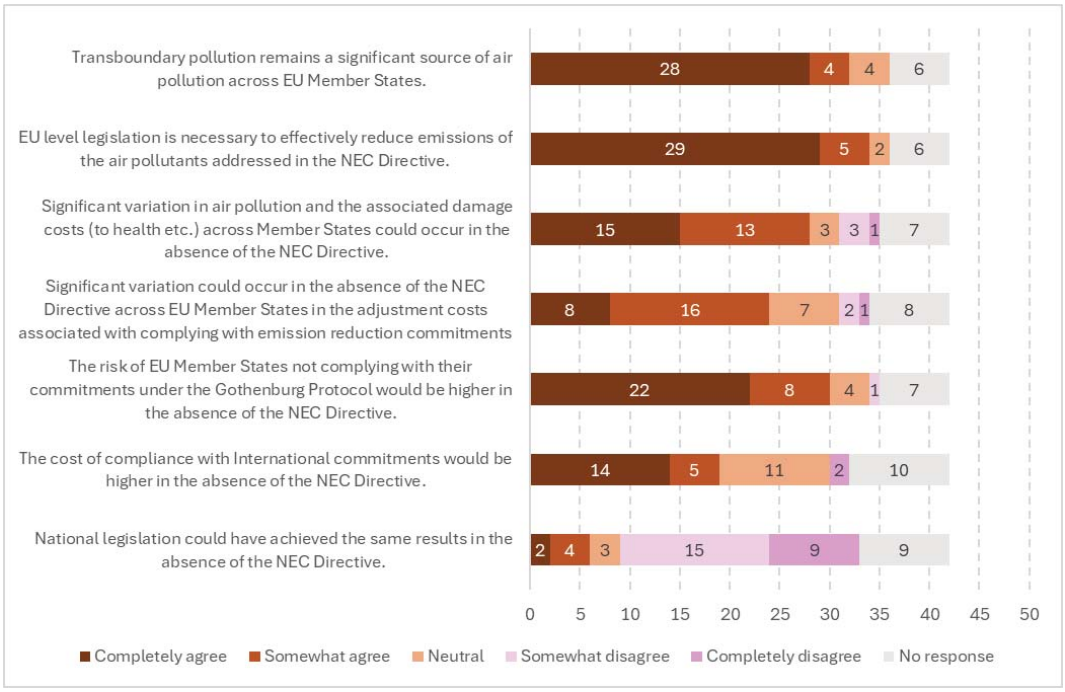


Figure A - 54 – Summary of the responses to the TSC to EU added value related sub-questions.

6.3 Level of protection achieved relative to action at Member State level and relative to a situation where only the Gothenburg Protocol exists (no NECD)

Due to the transboundary character of air pollution, protection from air pollution at national level is limited to national competences. Neither national legislation nor national

jurisdiction can be employed effectively against pollution that has its origin in another country.

A system of an international agreement such as the Air Convention also proves less effective than action at EU level, even if it sets reduction commitments for an entire region. In the hypothetical situation where the emission reduction would rely solely on the commitments taken by Member States in the Gothenburg Protocol the level of compliance is bound to be significantly less, since the Gothenburg Protocol lacks the strong enforcement mechanisms which are available under EU law. As seen in other parts of the analysis (section 2.1 of this annex), the Commission has taken swift action to enforce the NECD in cases of non-compliance with emission reduction commitments. The ability to infringe Member States under EU law therefore allows for achieving a higher level of protection than in the above-described hypothetical situation of Gothenburg Protocol only. Furthermore, it is not certain that all Member State would ratify the Protocol, or would not ratify it at the same time, which would create further inequalities.

There was agreement amongst **stakeholders** across both consultations that the absence of the NECD would likely lead to non-compliance with international commitments, particularly under the Gothenburg Protocol.

6.4 Fairness and equity in reduction in air pollution and costs of abatement across EU Member States in the absence of NECD (qualitative assessment)

While EU clean air policy is based on the principle that citizens across the EU have the same right to clean air – hence uniform air quality standards applying throughout the EU, looking at air quality concentration maps shows that large disparities remain across Europe, as well as within a given Member State, with a clear rural-urban divide. EEA analysis on income-related environmental inequalities between regions associated with air pollution in Europe has pointed out differences between wealthier and less well-off regions: '*despite improving trends in air pollution for both the richest and poorest regions of the European Union over the 2007-2022 period, inequalities remain with $PM_{2.5}$ concentrations consistently higher by around one third in the poorest regions*'[457].

Despite such remaining disparities, the effectiveness analysis above showed that overall, remarkable improvements in air quality were achieved over the evaluation period, which have benefitted Member States across the EU, including some that started from much lower levels of air quality.

While emission reduction commitments set in the NECD are differentiated according to Member States, it is worth recalling that they were set based on a cost-minimisation

[457] Earlier EEA analysis (report 22/2018) has looked into 'Unequal exposure and unequal impacts' finding that '*uneven distribution of the impacts of air pollution, noise and extreme temperatures on the health of Europeans closely reflects the socio- demographic differences within our society*' and that '*in many European countries, such disproportionate exposure occurs in urban areas*'. It further finds that regions that are both relatively poorer and suffering from higher PM pollution '*are located mainly in eastern and south-eastern Europe*'. However, '*the link between socio-economic status and exposure to PM is also present at a finer-scale, local level*'.

approach to meet an EU wide health target on reducing premature deaths related to air pollution (specifically, $PM_{2.5}$). This approach took into account the cost-effective reduction potential in each Member State, in order to meet the EU wide health objective at lowest possible cost.

Stakeholders responding to both the OPC and TSC have predominantly expressed concern that significant disparities in air pollution levels and associated costs – including health impacts – would likely arise in the absence of the NECD.

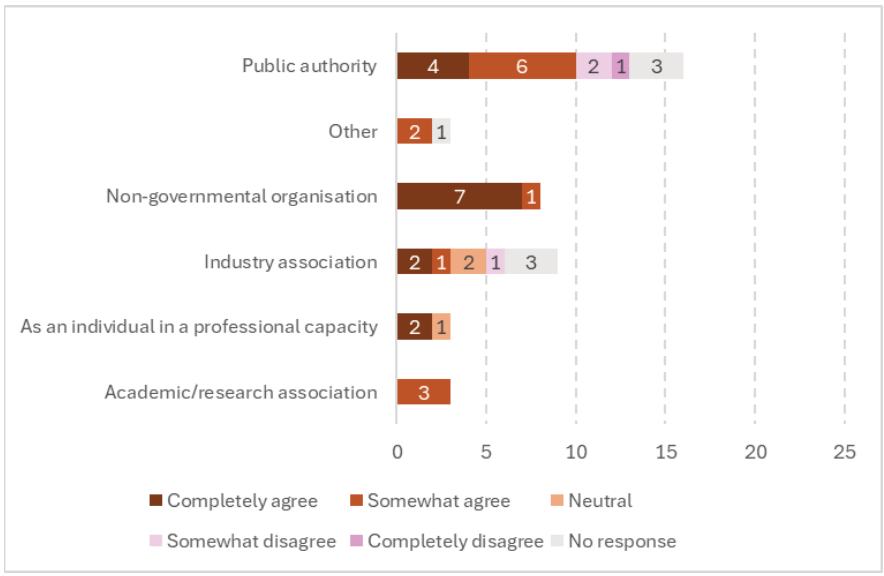


Figure A - 55 – TSC replies to statement 'Significant variation in air pollution and the associated damage costs (to health etc.) across Member States could occur in the absence of the NECD'

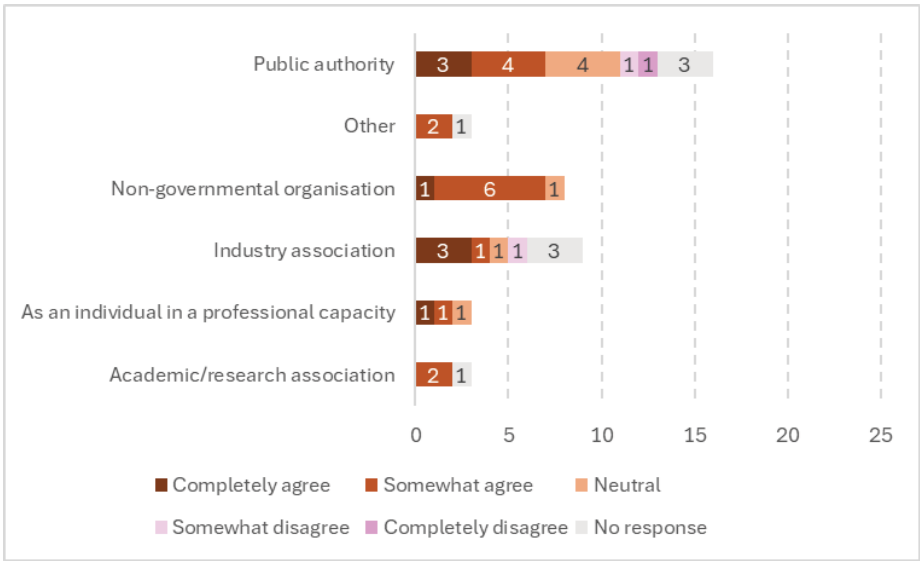


Figure A - 56 – TSC replies to statement 'Significant variation could occur in the absence of the NECD across EU Member States in the adjustment costs associated with complying with emission reduction commitments'

Given it was amongst the objectives of the NECD to increase funding in line with clean air objectives (Article 7 – see also Annex III section 4.4), it is worth considering whether this funding went to the parts of the EU where air quality is worse. EU funding is a key lever to reduce costs related to mitigating pollution, especially for Member States that rely to a large extent on EU funding for implementing environmental policy measures. There are **significant differences between Member States in their allocations to investments contributing to the clean air targets.** The difference in absolute amounts is partly explained by differences in the size of national allocations under e.g. Cohesion Policy and RRF. The variations in percentages of clean air allocations across the Member States are also due to the needs for compliance with policy objectives, and to priorities set by Member States and their regions. As an example, for Cohesion Policy, the contribution to clean air ranges from 6% (Ireland) to 18% (Poland and Hungary)[458].

Bruegel in a report on clean air and how much Europe pays for it[459] analysed whether EU funding is allocated across the EU in line with regional needs. The Figure below shows higher clean air funding rates for Eastern European and the Baltic countries. While the RRF significantly increased the funding in these areas, it also did so in Western European countries including France, Italy, Portugal and Spain. Bruegel also concluded based on regression analysis that there is '*significant correlation between the funds that were allocated in each financial period (i.e. 2014-2020 and 2021-2027), and the burden of air pollution in the previous years, measured in mortality rates, in economic cost, or in air pollution levels. While these relationships do not imply causality, notably because there might be confounding factors, such as GDP per capita or the share of low-income households, it nonetheless suggests that EU funding was indeed allocated to the countries that needed it most.*'

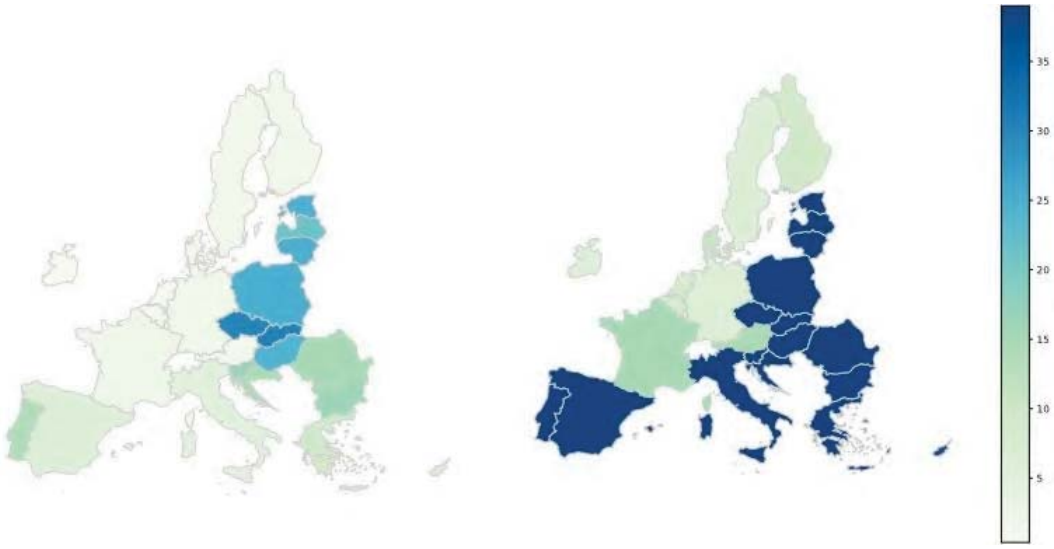


Figure A - 57 – Clean air funding across member states in € millions per 100,000 inhabitants for the two considered periods 2014-2020 (left) and 2021-2027 (right). Source: Bruegel (2024). Note: the data for the 2014/2020 and the 2021/2027 periods include the funding from the cohesion fund and the RRF.

458 https://cohesiondata.ec.europa.eu/stories/s/21-27-Clean-air-tracking/ff8w-rrvm

459 Mejino-López, J and Oliu-Barton, M (2024) 'How much does Europe pay for clean air?' Working Paper 15/2024, Bruegel.

6.5 Conclusions on EU added value

The above analysis shows that:

- The initial subsidiarity analysis remains valid. By setting national emission reduction commitments for each Member States following a staged approach while leaving a substantial margin to the Member States in deciding how to best achieve the prescribed commitments, the NECD is in line with the principles of subsidiarity and proportionality.
- Transboundary pollution continues to be a significant source of pollution in most EU Member States, with a significant share of $PM_{2.5}$ background concentration generated in other Member States, and this is projected to remain the case. At the same time, the role of sources outside the EU has been increasing (particularly for Member States sharing borders with non-EU countries).
- Due to the transboundary character of air pollution, protection from air pollution at national level is limited to national competences. Neither national legislation nor national jurisdiction can be employed effectively against pollution that has its origin in another country. A system of an international agreement such as the Air Convention also proves less effective than action at EU level, even if it sets reduction commitments for an entire region. This is because the Gothenburg Protocol lacks the strong enforcement mechanisms which are available under EU law.
- Large disparities in air quality remain across the EU, as well as within a given Member State, with a clear rural-urban divide. Despite such remaining disparities, the effectiveness analysis under this evaluation showed that overall, remarkable improvements in air quality were achieved over the evaluation period, which have benefitted Member States across the EU, including some that started from much lower levels of air quality. EU funding may have played a significant role in that, as analysis has shown that EU funding has benefitted most EU regions with higher levels of pollution.

ANNEX IV. OVERVIEW OF BENEFITS AND COSTS, SIMPLIFICATION AND BURDEN REDUCTION

Table 1. Overview of costs and benefits identified in the evaluation

		Citizens/Consumers		Businesses		Administrations	
		Quantitative	Comment	Quantitative	Comment	Quantitative	Comment
Direct – Administrative costs	Recurrent	Not applicable.	No evidence to suggest any administrative burden is passed to citizens or consumers.	Data provided businesses is used in inventory compilation (and other obligations). Illustrative, ballpark estimates suggest **recurrent costs could be up to around €100 000 per annum per each Member State (range €1 190 - €417 000)**	No monetary estimation identified directly by stakeholders – estimates made on very limited data provided using assumptions. Competent authorities predominantly use data already available under other legislation (in particular IED and IEPR), and NECD obligations interact with those of other legislation and commitments (in particular inventories and GP). Estimate takes a 50:50 split in these cases, unless specific indications on the split of costs between instruments.	**Member State competent authorities:** €1.1m (range 0.06m - €4.9m) per Member State per annum (recurrent) **European Commission**: €1.7m per annum (recurrent) **EEA:** €0.23m per annum (recurrent)	A significant proportion of the costs are not attributable to the NECD alone. For emissions inventories and reporting, almost all activities also fulfil the obligations of the GP under the Air Convention. Furthermore, for many Member States it was impossible to disaggregate administrative effort between compilation of air pollutant and GHG inventories. This was also the case, but to a lesser extent, for ecosystems reporting and NAPCP development.
Direct compliance costs - Adjustment costs	One-off and recurrent	Not quantified precisely. Using CAO4 outputs, total discounted costs of additional emissions controls from all policies affecting air pollutants	Evidence (including from stakeholders) suggests citizens may have faced some of the costs of meeting ERCs, but less than businesses and authorities.	Not quantified precisely. Using CAO4 outputs, total discounted costs of additional emissions controls from all policies affecting air pollutants delivered over	Evidence (including from stakeholders) suggests businesses may have faced a significant proportion of the costs of meeting ERCs, and more so than citizens and authorities.	Not quantified.	Modelling studies did not model adjustment costs to administrations. Evidence (including from stakeholders) suggests administrations may have

Table 1. Overview of costs and benefits identified in the evaluation							
		Citizens/Consumers		Businesses		Administrations	
		Quantitative	Comment	Quantitative	Comment	Quantitative	Comment
		delivered over evaluation period (2016-2025) of **€92 billion, of which part will fall on citizens. The proportion of costs could not be quantified.**	Examples of costs faced directly will include for improved boilers or stoves, or fuel switch to cleaner alternatives. A part of this switch is also covered by funding/ financial incentives. It is important to note that there is no possibility to split the effects of different EU and national policies on pollutants and costs. As a consequence, estimates cover the effect of all policies having an effect on the level of air pollutants. **The figures therefore represent an over-estimation.**	evaluation period (2016-2025) of **€92 billion, of which a significant (but not quantifiable) part will fall on businesses.**	Analysis suggests the sectors on which most costs fall are 'agriculture', followed by 'other energy intensive' sectors, refineries and electricity supply. Examples of costs faced directly will include: developing vehicles compliant with improved Euro standards, implementing process improvements and end-of-pipe techniques in industry, implementation of manure management, housing improvements and other measures in agriculture. A part of this cost was offset through EU and national funding. It is important to note that there is no possibility to split the effects of different EU and national policies on pollutants and costs. As a consequence, estimates cover the effect of all policies having an effect on the level of air pollutants. **The figures therefore represent an over-estimation.**		faced a significant proportion of the costs of meeting ERCs, and more so than citizens but less than businesses. Authorities do not present a significant emissions source and hence do not directly face large adjustment costs. However, authorities may share the burden though funding and support offered to households and businesses to implement emissions controls. Information from funding trackers suggest the level of funding channelled to air quality improvement measures has been significant. The EU budget is spending €171.4 billion (bn) over the period 2021-25 to the clean air objective (or €34.3 bn per annum over the period). This is in addition to €46.4 bn reported over the 2014-20 spending period as reported by the

Table 1. Overview of costs and benefits identified in the evaluation							
		Citizens/Consumers		Businesses		Administrations	
		Quantitative	Comment	Quantitative	Comment	Quantitative	Comment
							Commission (or €6.6 bn per annum). Abatement cost and funding figures cannot be compared due to methodological issues.
Indirect costs – employment, consumption and supply chain	One-off and recurrent	Before taking into account benefits, CAO1 estimated that abatement costs to meet ERCs would result in the loss of around 1 000 jobs EU-wide and a reduction in household consumption of between 0.004% and 0.008% in 2030.	Changes in household consumption arise as costs of abatement are passed through by businesses in the form of higher prices (of e.g. electricity or other products from sectors that incur abatement costs). CAO4 did not model effects on employment and consumption. No data is available on whether the reductions anticipated in the IA happened or not.	Before taking into account benefits, CAO1 estimated that abatement costs of meeting ERCs would result in GDP reduction of between 0.002% and 0.005%, with most significant effects in agriculture (0.08% reduction in output), Coal, oil & gas', ferrous and non-ferrous metals and consumer goods industries (all reducing output by 0.01%) in 2030. Under pessimistic assumptions regarding benefits, CAO4 modelled **overall negative impact on GDP of 0.002%,** with the livestock, crop and fossil fuel sectors were all estimated to incur a net cost in 2030.	Supply chain effects for businesses occur as those directly affected pass costs through the supply chain.	n/a	n/a
Direct benefit – human health	One-off and recurrent	Using CAO4 analysis, total **discounted benefits over the evaluation period (2016-2025) are of €372 billion (VOLY) or €1 180 billion (VSL)**		Not quantified separately.	Human health improvements will deliver productivity benefits for businesses through reduced absenteeism (e.g. through reduction in workdays lost) and presenteeism (i.e.	See businesses.	See businesses.

Table 1. Overview of costs and benefits identified in the evaluation							
		Citizens/Consumers		Businesses		Administrations	
		Quantitative	Comment	Quantitative	Comment	Quantitative	Comment
					reduction in illness and improved productivity when at work). Estimates suggest an economic gain from improved productivity of 0.80% per 1 $\mu g/m^3$ decrease in the concentration of fine particulate matter (Dechezleprêtre et al. 2019).		
Direct benefit – environ-mental health	One-off and recurrent	CAO1 estimated societal environmental health benefit of €507 m per annum in 2030 to meet ERCs, over the baseline (forest carbon sequestration, reduction in ecosystems and material damage). CAO4 estimated total monetised environmental benefits of €430 m – 870 m per annum in 2030 to meet ERCs, over the baseline (adjusted to 2025 prices).	Does not capture changes in GHG emissions and hence likely underestimates effects. No quantification available that pertains only to the evaluation period.	CAO1 estimated environmental health benefit of €128 m per annum in 2030 to meet ERCs, over the baseline, likely to accrue to businesses through reduced damage to crops and commercial timber production. CAO4 estimated total monetised environmental benefits of €430 m – 870 m per annum in 2030 to meet ERCs, over the baseline (adjusted to 2025 prices), of which part will relate to crops and commercial timber production.	Does not capture changes in GHG emissions and hence likely underestimates effects.	See citizens.	See citizens.
Direct benefit – macro-	One-off and recurrent	After taking into account benefits of reduction in workdays lost and improved	CAO4 did not model effects on employment and consumption.	After taking into account benefits of reduction in workdays lost and improved	-	n/a	n/a

Table 1. Overview of costs and benefits identified in the evaluation							
		Citizens/Consumers		Businesses		Administrations	
		Quantitative	Comment	Quantitative	Comment	Quantitative	Comment
economic benefits		crop yield, CAO1 estimated that meeting ERCs would result in around 30 000 to 39 000 additional jobs and an increase in household consumption of between 0.006% and 0.007% in 2030, over the baseline.		crop yield, CAO1 estimated that meeting ERCs would result in GDP increase of 0.006% (only sector seeing net reduction is agriculture with net output loss of 0.05%) in 2030, over the baseline. Under CAO4, taking more optimistic assumptions regarding the size of the benefits, overall net effect on GDP over the baseline was estimated to be positive 0.053% to meet ERCs, with the crop and fossil fuel sectors observe a net benefit. The net effect on livestock sector remained negative across all sensitivities modelled, but in all cases the net impact was less than 0.15% net cost in 2030.		

Caveats:

- *Attribution of costs to NECD is not possible given interaction with other policies as measures which deliver emissions reductions are driven by a range of interacting policies (of which NECD is one) and external factors. Instead, the estimated costs focus on the adoption of emissions controls either relative to the baseline in a given year or the baseline modelled for 2015. All emissions controls taken up are likely to be in some way influenced by the NECD, but not all, hence these estimates somewhat overstate the cost attributable to the NECD.*
- *Key studies have been undertaken to estimate the costs of emissions controls (namely the IA and CAO series). However, cost estimates made are outputs of forward-looking modelling studies, not actual cost data collected. Each CAO involves a back-casting of costs to historic years (including 2005 and 2015, the latter closest to the implementation year of the NECD) and is informed by a detailed review of EU policies and the most recent Member State NAPCPs, to align as far as possible the starting point for the modelling with abatement measures taken up in practice. However, this is not a perfect exercise as consistent and complete information is not always available, and the construction of the scenario in GAINS is limited to deploying the techniques defined within the model. Furthermore, evidence of actual costs associated with policies and measures to deliver emissions controls is extremely limited.*

- *Estimates vary between studies depending on definition of the baseline. Across the CAO series an increasing amount of efforts to abate emissions is captured in the baseline, making it increasingly difficult to gain insight as to the 'effects of the NECD', as this will be captured somewhat in the net impact of scenario versus the baseline, but also in the baseline itself.*
- *Impacts faced by households, businesses and administrations will depend on policies and measures put in place to deliver emissions reductions at national and EU level. This distribution has not been robustly quantified.*

TABLE 2 ***PART I - Simplification and burden reduction (savings already achieved)*** *Report any simplification, burden reduction and cost savings **achieved already** by the intervention evaluated, including the points of comparison/ where available (e.g. REFIT savings predicted in the IA or other sources).*	
Savings achieved	
Type: N/A	Not quantified. No evidence has been found identifying savings delivered by the NECD. For Member State Competent Authorities, the Directive introduced new obligations which have introduced additional costs, such as the development of NAPCPs, which are likely to outweigh any savings. At the same time, during the implementation of the Directive, several steps were taken to ease and simplify reporting processes: • Definition NAPCP common format • Commission Guidance on NAPCPs to aid competent authorities in compiling the information • Electronic reporting of PaMs – the EEA PaM tool • Commission guidance on ecosystem site selection / monitoring • Template for ecosystem monitoring that has been revised after 1st reporting round involving MS • Delegated act to amend Directive and ensure continued alignment with reporting under the Air Convention • Templates developed for applying for specific flexibilities (Art 5(2) and 5(3)) • DG JRC AgrEEE tool helping to compile sections of the inventories related to the agricultural sector The effect of these elements on the costs of reporting could not be quantified.

PART II: II Potential simplification and burden reduction (savings)[460] *Identify further potential simplification and savings **that could be achieved** with a view to make the initiative more effective and efficient without prejudice to its policy objectives*[461]*.*				
	Businesses		Administrations	
	Quantitative	Comment	Quantitative	Comment
Reduction in the frequency of reporting (for emissions inventories – gridded and LPS data, projections) to focus on producing and submitting higher quality data.				
Type: Recurrent	No quantification available.	This could affect business, based on the conclusions in the summary table above,	25% of annual reporting cost for typical Member State of €749 000 =	Whilst opinion differs between Member States, potential savings could be high, particularly since the reporting obligations under these tasks have been identified as the costliest. However, **no evidence or data has been identified or provided to quantify these potential savings**.

[460] See a detailed summary in Annex III 3.5 and in chapter 4.1.4.3 of the Staff Working Document

[461] This assessment is without prejudice to a possible future Impact Assessment.

PART II: II <u>Potential</u> simplification and burden reduction (savings)[460] *Identify further potential simplification and savings **that could be achieved** with a view to make the initiative more effective and efficient without prejudice to its policy objectives*[461]*.*				
	Businesses		Administrations	
	Quantitative	Comment	Quantitative	Comment
		however significant savings are unlikely due to policy obligations beyond the NECD. No evidence or data has been provided to quantify the potential savings.	savings of up to €187 000 per Member State per year	**<u>Analysis assumes ballpark a proxy of -25% in terms of administrative saving under this simplification option per year.</u>** This is because significant man-time would be saved if preparation of some reports only had to occur at half the current frequency (e.g. this could concern the frequency of projections reporting, but not of inventories, where the yearly frequency is essential both for assessing compliance with the NECD and with the Air Convention and its protocols). At the EU-27 level, based on data received from Member States for this study, a potential yearly saving of €187 000 is estimated for Member States on average. However, this is likely to be offset by innovation / R&D related costs which are not quantified. These costs would relate to the 'higher quality data' point within the option. **<u>The effects of changes to the frequency of reporting would need to be assessed further.</u>** This is necessary both to ensure coherence with the Air Convention and its GP, and to ensure that elements are in place to reach the objectives of the NECD.
Simplification in the NAPCP reporting process, including a potential change to frequency				
Type: Recurrent	N/A	N/A	20% of annual NAPCP cost for typical Member State of €34 000 = savings of up to €7 000 per Member State per year	It is important to firstly state that there is no unanimous opinion related to either the problems or solutions associated with NAPCP reporting. However, the two key common suggestions are: (i) potential for reduced reporting frequency for Member States who have met ERCs, (ii) simplified processes for reporting (i.e. streamlined PaMs submission). We may estimate that this option would provide a potential annual administrative cost saving of ~20% primarily due to the adapted format for reporting. This could result in an annual saving, at the EU-27 level, of ~€7 000 for Member States on average. However, the key caveat here would be that the actual reduction potential would depend on how detailed – and how aligned with the template – each MS would report. As seen throughout Annex III section **Error! Reference source not found.**, the quality of, and price of developing, NAPCPs currently widely varies between Member States. A more in-depth analysis would be needed to understand the consequences of reducing the frequency of reporting in case of compliance with ERCs.

PART II: II <u>Potential</u> simplification and burden reduction (savings)[460] *Identify further potential simplification and savings **that could be achieved** with a view to make the initiative more effective and efficient without prejudice to its policy objectives*[461]*.*				
	Businesses		Administrations	
	Quantitative	Comment	Quantitative	Comment
Potential synergies to be identified between the NAPCP development process and NECPs under the Governance of the Energy Union and Climate Action Regulation, including better alignment of timeframes and phasing.				
Type: Recurrent	N/A	N/A	10% of annual NAPCP cost for typical Member State of €34 200 = savings of up to €3 420 per Member State per year	We can assume a potential minor administrative saving, if efficiency gains are realised between the reporting requirements. A closer alignment could make the process more streamlined (and enable greater consideration of each set of PaMs in the two plans). Stakeholder input suggested that introducing a single deadline would put a strain on the teams handling submissions. Further reflection would be needed on what would be the most efficient approach. This streamlining, if realised, could result in a yearly saving for Member State competent authorities of €3 420 on average (this estimate does not consider the effects of potential changes to timing).
Potential for closer alignment with requirements related to ecosystems monitoring, the Air Convention, and other EU obligations.				
Type: Recurrent	N/A	N/A	40% of annual ecosystems monitoring and reporting cost for typical Member State of €288 000 = savings of up to €115 000 per Member State per year	The area around which there was greatest consensus was that the current form of ecosystems reporting is ineffective, as it does not deliver comparable data. Heterogeneity also leads to difficulties in analysing the status of ecosystems at EU level. The suggestions included (1) less and better-quality reporting, and (2) alignment with the Air Convention's International Cooperative Programmes (ICPs). The widely different approaches applied in Member States make it impossible to quantify the effects of simplification opportunities with confidence; there are also many variables to consider. Looking at alignment with ICPs, this would enhance efficiency for Member States already active within ICPs but would represent an additional one-off cost for Member States that do not do so. We assume a potential administrative saving of 40%, assuming that all reporting is streamlined under the GP requirements, in the same template. This is based on Member State accounts of either not utilising the existing templates or taking a reasonable amount of effort to harmonise. This would, however, vary significantly at the Member State level, where some Member States could face significant one-off costs associated with reporting to the ICP under the GP, if they do not already. However, this study estimates that if these efficiency gains are realised, they could incur an annual €115 000 saving, on average, per Member State.

ANNEX V. STAKEHOLDERS CONSULTATION - SYNOPSIS REPORT

1 THE CONSULTATION STRATEGY

As part of the evaluation of Directive (EU) 2016/2284 on National Emission reduction Commitments (NECD), the European Commission developed a comprehensive consultation strategy aimed at gathering robust evidence on the Directive's performance across five key criteria: effectiveness, efficiency, relevance, coherence, and EU added value.

The consultation approach aimed at involving a variety of stakeholder groups to ensure the perspectives of all relevant actors were taken into account. Stakeholders identified for engagement included: the general public, public authorities within all EU Member States, civil society organisations, business representatives, the scientific community, EU institutions and agencies, international partners, and other relevant parties such as social partners and non-EU countries participating in the European Environment Information and Observation Network (Eionet)[462].

The table below summarises the stakeholder groups identified, and the consultation methods and strategies used for each stakeholder group.

Table A - 65 – Participation of stakeholder groups through different consultation tools

Stakeholder group	Consultation tools and approaches applied
General public	Call for evidence, open public consultation
Consumer organisation	Call for evidence, open public consultation
Companies/businesses	Call for evidence, open public consultation, targeted stakeholder consultation, stakeholder workshop
Trade union	Call for evidence, open public consultation, targeted stakeholder consultation, stakeholder workshop
Member State public authorities	Call for evidence, open public consultation, targeted stakeholder consultation, stakeholder workshop, additional questionnaire, bilateral follow-up emails and interviews, Member State Ambient Air Quality Expert Group
industry/business associations	Call for evidence, open public consultation, targeted stakeholder consultation, stakeholder workshop
Individuals in a professional capacity	Call for evidence, open public consultation, targeted stakeholder consultation, stakeholder workshop
NGOs, environmental organisations	Call for evidence, open public consultation, targeted stakeholder consultation, stakeholder workshop
Academic/research institutions	Call for evidence, open public consultation, targeted stakeholder consultation, stakeholder workshop
Other	Call for evidence, open public consultation, targeted stakeholder consultation, stakeholder workshop

462 https://www.eionet.europa.eu/

2 CONSULTATION ACTIVITIES

Overview of consultation activities

To capture diverse views and ensure both breadth and depth of input, the consultation strategy employed several complementary consultation tools and methods. The figure below shows the number of participants by consultation activity.

Figure A - 58 – Number of respondents per consultation activity

A **call for evidence** was launched early in the process, running from 15 February to 14 March 2024, on the European Commission's 'Have Your Say' web portal. The call described the context and requested feedback on the evaluation questions, developed based on the Better Regulation Guidelines. This provided the public with an opportunity to submit initial feedback on the functioning of the Directive. The call for evidence received contribution from 53 stakeholders: three academic/research institutions, twenty-three EU citizens, one trade union, twelve NGOs, ten business associations, three other organisations, and one company/business. The highest number of contributions came from Germany (9), followed by France (8), Slovakia (7), Belgium (6), and Czechia (5). Three responses were received from both the Netherlands and Poland. Denmark, Spain, Italy, and Finland each submitted two contributions, while Greece, Hungary, Sweden, and the United Kingdom each submitted one.

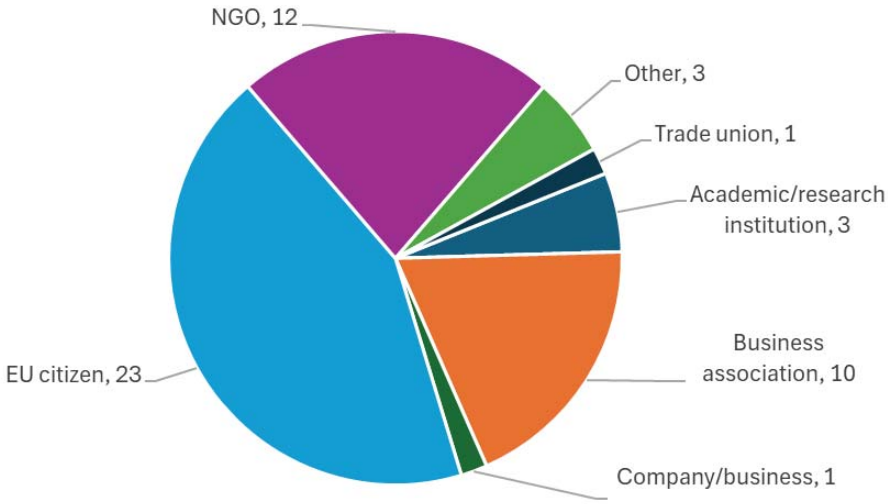


Figure A - 59 – Number of respondents for call for evidence, per stakeholder group

Two further replies to the call for evidence were sent separately from an environmental NGO and an association coming under the "other" category. They were not included into the statistics, but the content of their contributions is included in the summary.

Building on the call for evidence, a one-day **stakeholder workshop** was held in Brussels in a hybrid format on 14 October 2024. Topics covered in the workshop were (i) an overview of the NECD; (ii) an introduction to the methodology of the evaluation; (iii) the consultation process; (iv) sessions on each of the five evaluation questions; and (v) closing session and take-aways. One hundred and forty-four stakeholders registered for the workshop. The meeting served as a forum to discuss preliminary insights and to officially launch the open public consultation[463].

The **open public consultation** (OPC)[464] ran from 3 September 2024 to 26 November 2024 and was accessible online through the Commission's 'Have Your Say' portal. The questionnaire included both closed and open questions and was designed to gather views from the general public in all official EU languages. The OPC received 53 responses. The questionnaire was accessible in all official EU languages and open to anyone with an interest in the NECD. Respondents could participate either in a personal capacity or on behalf of an organisation. They also had the option to support their responses by uploading a position paper and any additional relevant documents.

An overview of the OPC participants per stakeholder group is shown in the figure below.

[463] The agenda, summary report and presentations are available on https://circabc.europa.eu/ui/group/cd69a4b9-1a68-4d6c-9c48-77c0399f225d/library/9fa66a2c-2868-45a4-90e3-a0a551f2bfea.

[464] European Commission, Public consultation https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/13968-National-Emission-Reduction-Commitments-Directive-evaluation/public-consultation_en.

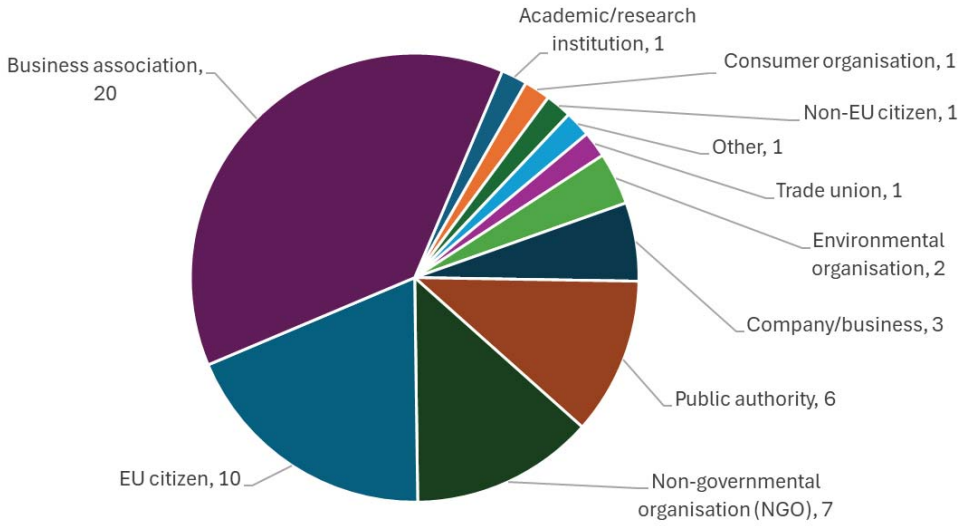


Figure A - 60 – Overview of OPC participants (N-53)

Although the OPC attracted input from a broad range of stakeholder types and sectors, the overall number of responses was relatively low. This limited sample size affects the degree to which the findings can be viewed as reflective of wider stakeholder or public perspectives. Some stakeholder groups such as academia, consumer organisations, trade unions, and environmental organisations were relatively underrepresented, while certain sectors and countries (for example Poland, Romania, Sweden, Greece, Bulgaria, Ireland, Lithuania, Slovenia, and Latvia) were not represented at all. As is typical with public consultations, participation was self-selecting, meaning that responses were more likely to come from individuals or organisations already involved in the topic, or those with strong views or particular interests. This factor also limits the representativeness of the results across the broader stakeholder community. Consequently, the findings should be interpreted with caution, bearing in mind the distribution of responses across different stakeholder categories.

Contributions were received from a range of EU Member States, with the highest numbers coming from Belgium (14), Germany (9), and France (5). This was followed by the Netherlands and Czechia with three responses each, and Italy, Finland, Croatia, and Portugal with two each. One response each arrived from Austria, Denmark, Hungary, Spain, and Slovakia. In addition, four contributions came from non-EU countries: two from the United Kingdom, and one each from Switzerland and Norway.

OPC participants uploaded a total of thirteen documents: five position papers were from NGOs, two position papers from business associations, two position papers from companies, one position paper was from a public authority, two documents were from one non-EU citizen, and one document was uploaded by a stakeholder who self-identified as ‘other’ (this organisation was the European Respiratory Society based in Switzerland).

These were **reviewed and analysed to extract key information**. The detailed analysis of position papers is provided in the 'OPC in-depth analysis'[465].

In parallel, a **targeted stakeholder consultation** (TSC) was conducted over the same period. The TSC ran from 3 September 2024 to 26 November 2024, administered via EU Survey. While the questionnaire was available in English only, respondents could submit their answers in any official EU language. This exercise was directed at stakeholders with deeper expertise in air quality and emissions policy, including Member State authorities, environmental and civil society groups, industry stakeholders, and members of the scientific research community. To ensure balanced representation, a pre-identified list of stakeholders covering a broad spectrum of interests and expertise was proactively invited to contribute. The consultation was also publicised through social media and invitations were distributed via Commission expert groups, too. An overview of participants in the TSC are shown in the figure below.

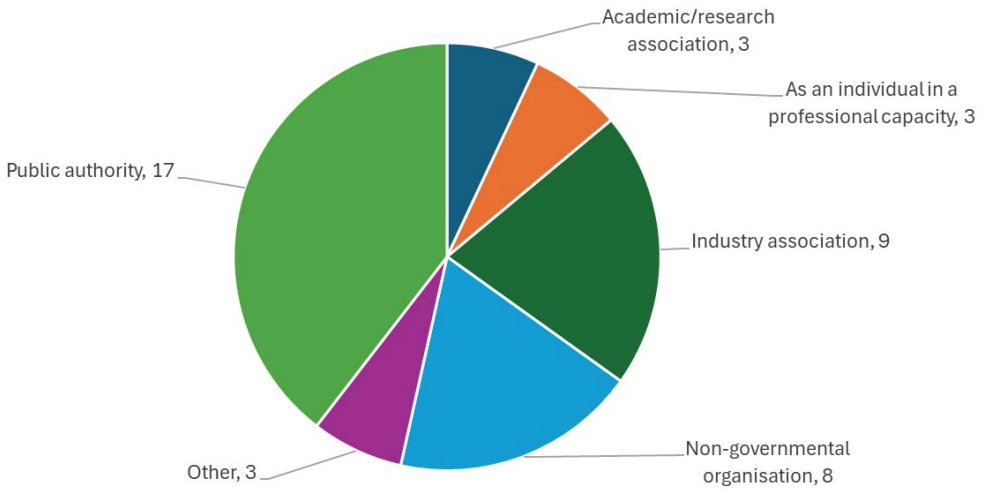


Figure A - 61 – Overview of TSC participants by stakeholder type and country (N=43)

As for the OPC, also the TSC received a low number of responses, hence interpretation of results requires caution. In order to try to increase the response rate, a reminder email was sent from the NECD functional mailbox on 22 November (four days before the closure of the consultation).

The highest number of respondents were from Germany (8) and Belgium (7), followed by France (4). The Netherlands, Sweden, and Ireland had three respondents each. Lithuania, Denmark, Italy, and Croatia had two respondents each, while Portugal, Malta, Czechia, Hungary, Finland, and Austria had one. Two non-EU respondents, one from the United Kingdom and other from the United States of America also contributed to the TSC.

A total of 16 position papers were submitted in response to the TSC: six by industry associations, four by NGOs, three by other stakeholders, two by public authorities and one

465 See Appendix 7 of the support study.

by an academic research association. These were also **reviewed and analysed to extract key information.**

As part of a targeted engagement of competent authorities, an **additional questionnaire** was sent to Member State authorities on 10 February 2025 to address information gaps on costs and benefits, areas for simplification of the NECD, coherence and relevance with respect to agriculture, and the Directive's relevance to certain emission sources. The questionnaire received 15 responses, with one response from each of the following countries: Belgium, Croatia, Denmark[466], Estonia, Finland, France, Germany, Greece, Hungary, the Netherlands, Portugal, Romania, the Slovak Republic, Spain, and Sweden. A series of **follow-up interviews** were conducted online between 26 February and 20 March 2025 with selected Member States in response to the additional questionnaire described above to fill in gaps or clarify responses. Four targeted interviews were conducted to elaborate responses in relation to the costs and benefits, in particular administrative burden imposed by the NECD obligations. These interviews were conducted with the main aim of clarifying data already submitted, and to ensure accuracy of interpretation. They also aimed to elaborate some of the answers provided in the additional questionnaire, in particular around administrative burden and the use of data and information collected from businesses. Interviews were conducted virtually in March 2025, each lasting 1 hour, with representatives from four Member State competent authorities (Estonia, Denmark, Luxembourg and Portugal).

Further evidence and insight was gathered through **interviews with national inventory compilers** and modellers around estimation of emissions from different sources. When interviewing national inventory compilers and modellers, there was a particular focus on the relevance of emissions from certain sources not included within compliance totals. Four interviews were conducted with national inventory compilers from the inventory teams in Denmark, Germany, France, and Croatia. Interviews were also conducted with an air pollution modeller from TNO (in the Netherlands) and an integrated assessment modeller from IIASA (Austria).

Additional targeted **engagement with businesses** was carried out to deepen the evidence and understanding on administrative burdens and abatement costs for businesses related to the implementation of the NECD. This engagement took the form of a short, structured set of questions, circulated on the 14 April 2025, to businesses or business associations who had participated in either the workshop, open public consultation or targeted stakeholder consultation (sample of over 50 stakeholders). This engagement received 9 further responses (two European-wide organisations, and from individual businesses or associations from Germany (2), Finland (1), Sweden (1), France (1), Belgium (1), and Denmark (1)), with 5 responses coming from associations representing agriculture or forestry sectors.

[466] Response via interview.

Further written contributions outside the above-mentioned consultation activities were received from FAIRMODE and Bayerischer Landtag who sent contributions during the consultation period. In addition, exchanges with the Ambient Air Quality Expert Group provided further opportunities to gather insights on the implementation of the Directive. Inputs received through these expert group meetings were formally documented in meeting minutes.

Awareness of the NECD

Both the OPC and TSC explored stakeholders' awareness of air pollution issues and their familiarity with the NECD and related implementation tools. The results show a generally high level of awareness among respondents across both consultations, particularly with regard to the pollutants covered by the Directive and their relevance at the EU and national levels. As mentioned in Section 2.1, the high level of awareness is to be expected given that participation was self-selecting, meaning that responses were more likely to come from individuals or organisations already involved in the topic, or those with strong views or particular interests.

When asked about their knowledge of specific aspects of the NECD, TSC respondents demonstrated a high level of familiarity overall. The strongest awareness was observed in relation to the national emission reduction commitments applicable from 2020 and 2030 onwards, as well as the reporting obligations under the Directive. Awareness was somewhat lower in relation to the flexibilities incorporated from the revised Gothenburg Protocol and the content of National Air Pollution Control Programmes (NAPCPs) of countries other than their own. These were the areas where a significant share of respondents reported only limited knowledge.

The OPC findings on Directive-related awareness align with those of the TSC, though levels of detailed knowledge appeared to vary more widely across OPC respondents. While many TSC respondents demonstrated a clear understanding of the NECD and its mechanisms, others showed less familiarity with more technical aspects such as ecosystem monitoring requirements and specific measures in Annex III of the Directive.

Taken together, the results of both consultations indicate that respondents — particularly those with a professional or organisational interest in air quality — are generally well informed about the NECD and the issues it seeks to address. However, awareness appears to be lower for certain technical provisions and for developments in other Member States, highlighting areas where communication and information-sharing could be strengthened.

3 ANALYTICAL METHODS

The TSC was designed and launched via the EUSurvey, while the call for evidence and the OPC were published on the 'Have your say' portal. The additional questionnaire addressing information gaps was distributed as a word document by email.

There were no campaigns, although two OPC respondents provided very similar replies. Eight respondents participated both in the OPC and TSC; of these, three also participated in the Call for Evidence.

Responses to multiple choice questions are presented through charts indicating the number of responses of each type, segmented by stakeholder groups. Thematic analysis was applied to responses to the call for evidence, to open text questions of the OPC and TSC and uploaded documents to identify common themes and patterns of meaning across stakeholder groups.

The results of the OPC and the TSC have been analysed together, as both exercises sought input on the same set of evaluation questions and were conducted in parallel. While the OPC was open to the general public and the TSC was aimed at stakeholders with more technical expertise, the type and distribution of respondents across both consultations showed notable similarities. In particular, there was a considerable overlap in the stakeholder categories represented, and no significant differences were observed in the overall patterns of responses. Analysing the two consultations jointly therefore allows for a more comprehensive and coherent interpretation of the feedback received.

4 RESULTS

The results presented here are a summary of stakeholder views per evaluation criterion resulting from the different consultation exercises conducted. They should not be confused with the conclusions of this evaluation, which are set out in the main part of this SWD (as well as in detail in its Annex III).

Effectiveness

The **effectiveness of the NECD was a central focus of stakeholder feedback** to the consultation activities. Respondents were invited to comment on the extent to which the Directive has contributed to reducing emissions of the five main pollutants, improving air quality, and ultimately mitigating risks to human health and the environment. The feedback from both the OPC and TSC suggests that the Directive has generally been effective in driving progress towards these objectives, although important challenges and limitations were also identified. The views on **impact of the NECD on air quality** for both OPC and TSC stakeholders is shown in the figure below.

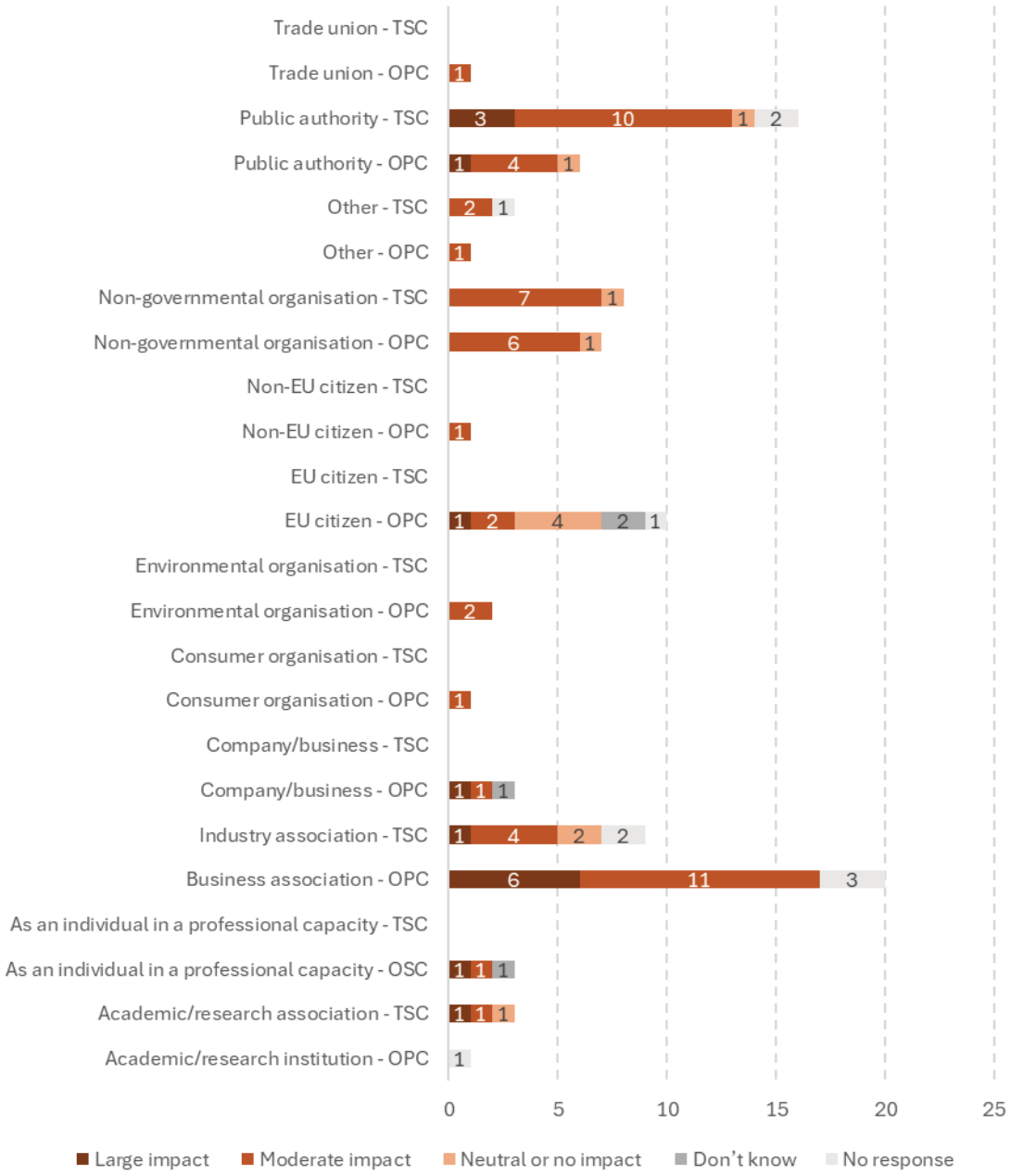


Figure A - 62 - To what extent has the NECD contributed to the achievement of better air quality, and a consequent reduction in risks for human health and the environment?

Across both the OPC and TSC, there was broad agreement that the NECD has played a positive role in **improving air quality in the EU**. In the OPC, over three-quarters of respondents considered the Directive to have contributed either moderately or significantly to better air quality and the reduction of associated health and environmental risks. Similarly, the TSC results showed an overwhelming consensus across all stakeholder groups that the Directive had contributed to improved air quality. While the majority view was positive, a small minority — most notably among NGOs, industry representatives and public authorities — expressed more neutral or sceptical views, suggesting that in some contexts the Directive's impact may have been limited or difficult to attribute.

In terms of **specific pollutants**, responses from both consultations indicated that the Directive has made the greatest perceived contribution to reductions in sulphur dioxide (SO_2) and nitrogen oxides (NO_x), with moderate to significant impact also reported for $PM_{2.5}$ and ammonia (NH_3). Stakeholders considered that the NECD has had a less significant impact on emissions of non-methane volatile organic compounds (NMVOCs), particularly amongst public authorities responding to the TSC. While the overall sentiment was that the Directive had helped reduce emissions across all five pollutants, a minority of respondents in both consultations believed that for certain pollutants—especially NMVOCs and NH_3—the impact had been minimal or insufficient.

The majority of respondents noted that a number of **other policies and strategies** had 'significantly reduced' or 'somewhat reduced emissions': AAQ Directives, IED, Euro vehicle emissions standards, Energy Efficiency Directive, Nitrates Directive, CO_2 standards for cars and vans and non-road mobile machinery.

Participants in both consultations were also invited to reflect on the reasons **why emission reduction commitments (ERCs) may not yet have been met in some Member States**. A range of interrelated factors were identified. Several respondents, especially within the TSC, pointed to structural challenges such as the high cost of abatement technologies, limited access to funding, weak enforcement mechanisms, and lack of political will. The agricultural sector was frequently cited as a particularly difficult area for emission reductions, with some stakeholders arguing that technical measures often do not deliver the expected results in practice, and that vested interests had undermined the ambition of national policies. Stakeholders also highlighted perceived inconsistencies between different policy instruments and competing objectives across sectors (e.g. climate versus air quality goals), which were seen to limit the effectiveness of the Directive's implementation.

Another key focus of the consultations was the role of the various **implementation tools and requirements set out in the NECD**, such as the development of NAPCPs, emission inventories and projections, and ecosystem monitoring and reporting. Responses to the OPC and TSC showed that these instruments are **generally viewed as valuable components of the Directive**. In particular, the development and submission of NAPCPs and the reporting of emission inventories were widely recognised as having contributed meaningfully to achieving the Directive's objectives. NAPCPs were seen as important planning tools that help Member States to identify and coordinate national measures, while the emission inventories were valued for their role in tracking progress and informing policy.

However, the consultations also revealed critical perspectives on the adequacy and implementation of these tools. Stakeholders in both the OPC and TSC expressed concerns about the varying quality and level of detail of NAPCPs submitted by Member States, with some noting that they had not always resulted in effective or timely action. Public consultation processes related to NAPCPs were also viewed as lacking in influence, with feedback rarely reflected in final programmes. The NAPCP template was criticised by

some public authorities for being overly technical, inflexible, and difficult to use for public engagement purposes. Meanwhile, ecosystem monitoring and reporting — although recognised as important in principle — was widely considered ineffective due to a lack of harmonisation across Member States, insufficient data integration, and limited policy relevance.

The TSC provided additional insight into **how the Directive's requirements have supported policymaking**. Most stakeholder groups felt that the data and information generated through reporting obligations — especially emission inventories and projections — had been used to improve national, regional or local policies. Ecosystem monitoring data were again seen as less impactful in shaping policy decisions, with many respondents highlighting the difficulty of attributing observed environmental changes solely to air pollution trends.

On the question of whether the NECD has facilitated greater **policy coordination**, the feedback was mixed. Respondents to the TSC generally felt that the Directive had done little to improve coordination between Member States, with only limited evidence of systematic transboundary consultation. Coordination between national and regional or local levels was viewed somewhat more positively, particularly by public authorities, but still with room for improvement. Stakeholders noted that while inter-ministerial coordination had often taken place during NAPCP development, these processes were not always sustained or deeply embedded.

In relation to **transboundary consultations**, the TSC revealed widespread concerns about inefficiencies in their application. While the Directive requires Member States to engage in consultations where appropriate, when preparing NAPCPs, stakeholders reported that such processes are rarely undertaken in a meaningful way. NGOs and public authorities alike suggested that transboundary consultation provisions are vague and inconsistently applied, leading to lost opportunities for regional coordination and information-sharing. Some respondents argued that making such consultations mandatory in cases of significant cross-border pollution could help improve both coherence and efficiency.

Lastly, views were gathered on the effectiveness of the **Directive's flexibilities under Articles 5(1) to 5(4)**. These include provisions allowing for inventory adjustments, derogations in the case of extreme weather events or unforeseen disruptions, and the possibility to compensate non-compliance with reductions in another pollutant. Across both consultations, stakeholders expressed concerns that these flexibilities may undermine the Directive's effectiveness by weakening incentives for emission reductions. NGOs in particular were critical of these provisions, arguing that they compromise the Directive's integrity and should be more strictly limited or removed. Some public authorities, while recognising their utility in certain circumstances, acknowledged that the use of flexibilities had introduced confusion or compliance challenges.

BOX 14. Key messages on effectiveness

- The NECD is widely seen as contributing to improved air quality across the EU
- The greatest perceived impact was on SO_2 and NO_x emissions, followed by $PM_{2.5}$. The Directive was viewed as less effective in reducing NMVOC and NH_3 emissions
- Low achievement of emissions reductions in agriculture, especially for NH_3, has limited overall effectiveness
- Lack of political will, high investment needs coupled with insufficient funding were cited as barriers to meeting emission reduction commitments
- Perception of specific instances of competing policy objectives (e.g. use of wood-burning stoves to reduce GHG emissions having a detrimental effect on $PM_{2.5}$) have hindered effectiveness of the Directive's implementation
- Reporting obligations have helped inform policy, especially for inventories and projections. National-regional coordination has improved somewhat but remains inconsistent.
- NAPCPs and emission inventories are seen as helpful tools but vary in quality and impact. But stakeholders found public consultation and transboundary consultation on NAPCPs to be superficial or ineffective and stated that it had limited impact on policy coordination.
- Ecosystem monitoring is broadly seen as important, but ineffective due to lack of harmonised methods and limited data use
- Flexibilities under Article 5 are viewed critically, particularly by NGOs, for weakening incentives to reduce emissions
- Stronger enforcement and better alignment with other EU policies could improve effectiveness

Efficiency

The **efficiency of the NECD** was examined through several consultation activities, with stakeholders invited to reflect on whether the resources invested into the implementation of the Directive — by Member States, businesses, citizens, the European Commission and other actors — have led to proportionate and cost-effective outcomes. Questions also addressed whether the reporting obligations and policy requirements under the Directive are reasonable and manageable, and whether the Directive's implementation has generated administrative burdens or inefficiencies.

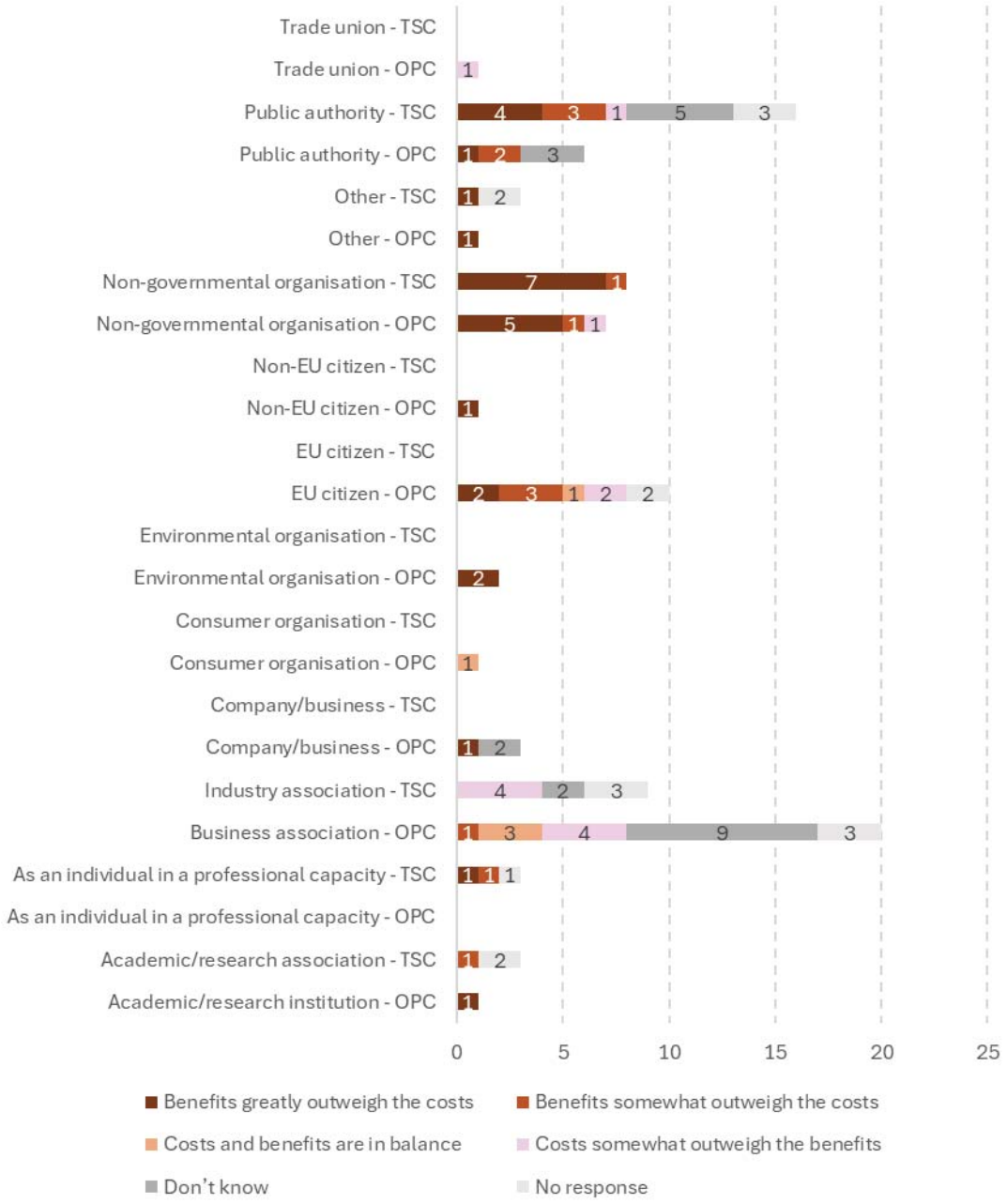


Figure A - 63 – Overall, how have the benefits of the NECD compared to the costs of its implementation to date?

Many respondents acknowledged the societal and economic benefits from reduced emissions and improved air quality, such as lower health costs, increased productivity, and environmental protection. Some industry stakeholders also pointed to opportunities for innovation and competitiveness arising from investments in cleaner technologies, although they emphasised the need for accessible funding mechanisms and clearer implementation pathways.

Regarding costs and benefits associated with the NECDD, respondents considered that the most significant costs were abatement costs (emission reduction measures) falling on businesses. This was corroborated by the targeted engagement with businesses, where respondents noted the costs for businesses had been 'high', in particular for those in the

agriculture sector. Furthermore, given this is a sector predominantly represented by micro and small farms, respondents highlighted that costs had also fallen on SMEs, with some noting the impacts for SMEs were disproportionate. However, respondents also highlighted it was not possible to isolate the effects of the NECDD from other linked legislation, therefore part of these costs would not be triggered by the NECD. The most significant benefits delivered by the NECD were considered by respondents to be the protection of human health, and protection of the environment (ecosystems).

Through the targeted engagement of public authorities and related interviews, a couple of Member State authorities provided references where adjustment costs of achieving ERCs had been explored, but the majority noted that such information was not available.

Through the targeted engagement, quantitative information regarding the administrative costs for competent authorities was collected and used as a basis of estimations of burden[467]. Furthermore, competent authorities provided valuable insights around whether these costs could be solely attributed to the NECD, or whether the supporting activities also contributed to obligations under other legislation or commitments. Efforts to prepare inventories and projections was reported to almost completely be shared with meeting obligations under the Gothenburg Protocol and often had links with IED and GHG reporting. Activities to prepare NAPCPs reportedly links to other obligations, in particular preparation of National Energy and Climate Plans (NECPs), and there are synergies between ecosystems reporting and monitoring under other legislation, but the overlap in activities is less than that for inventories and projections and varies by Member State.

The targeted engagement also elaborated on the administrative burden placed on businesses. Competent Authorities reportedly collect data from businesses to help fulfil the obligations of the NECD, in particular inventories. That said, in the majority of cases, the data used is also gathered under other legislation (e.g. IED or IEPR), and where additional data is sought, this is often information that is already available in businesses, implying any additional administrative burden from the NECD is very small. This was corroborated through the targeted engagement of businesses, through which respondents highlighted that businesses are required to report information which will help fulfil the objectives of the NECD (in particular in the agriculture and refineries sectors), but that the associated burden cannot be attributed to the NECD alone.

Across all stakeholder engagement activities, a majority of respondents indicated that **the benefits of the NECD had outweighed the costs associated with its implementation**. Respondents frequently acknowledged the Directive's role in driving emission reductions and supporting public health and environmental protection, which they considered to be highly worthwhile goals. However, several contributors—particularly from public authorities and business associations —also noted that some of the Directive's mechanisms impose considerable administrative demands without always delivering proportional benefits.

[467] A detailed analysis of these outcomes is available in Annex III section 3.1.1.

Similar views were echoed in the TSC, where a majority of respondents, including public authorities (16), NGOs (8), and industry associations (9), supported the Directive's overall intent and framework.

Responses in the TSC highlighted **challenges in implementation that impact its efficiency**. Several public authority respondents observed that the Directive's requirements — while necessary — can be resource-intensive to fulfil, particularly for smaller administrations with limited capacity. For instance, the preparation and updating of NAPCPs was described by some respondents as a burdensome process, exacerbated by the need to coordinate with other planning frameworks, such as the NECPs. That said, the inconsistency in the timing of submission deadlines between NAPCPs and NECPs was seen by some as creating duplication of effort and unnecessary administrative strain.

Stakeholders also expressed mixed views on the **efficiency of the NAPCP template**. While some respondents recognised that a standardised format promotes consistency across Member States, many — particularly among public authorities — found the template to be overly technical, difficult to use, and ill-suited to communicating plans to non-expert audiences or engaging the public. The tabular format, in particular, was criticised for limiting the scope to describe progress in implementing measures or to adapt plans over time. Several respondents also noted that the current template lacks flexibility to reflect Member State-specific contexts and administrative systems.

The **reporting obligations** under the NECD **were generally seen as essential for tracking progress and enabling evidence-based policy**. Emission inventories and projections, in particular, were widely viewed as core components of the Directive and necessary for transparency and accountability. However, some concerns were raised — especially in the TSC — regarding the frequency and effort required to meet these obligations. While many respondents considered the reporting frequency to be broadly appropriate, some public authorities and NGOs argued that certain elements, such as spatially disaggregated data and ecosystem monitoring, could benefit from revised timelines to better balance effort and usefulness. For example, one respondent from academia and several public authorities noted that the infrequent or delayed reporting of ecosystem data reduces its policy relevance and undermines its utility.

Ecosystem monitoring and reporting were viewed as one of the less efficient aspects of the Directive. Although it was regarded as an important element in principle, many respondents across both consultations questioned the practical added value of this element, citing a lack of harmonisation between Member States, unclear guidance, and difficulties in integrating data into national policy processes. Several stakeholders noted that the design and implementation of ecosystem monitoring programmes often require substantial resources but yield limited actionable insights, especially where attribution of environmental change is complex or uncertain.

The TSC asked participants to comment on the extent to which other external factors (other than the wider EU Policy landscape) have influenced the cost of achieving the NECD's

objectives. While there was a relatively low response rate to this question, the factors that were considered to have most increased costs were the military aggression against Ukraine and change in energy markets, and dieselgate (public authorities, NGOs, and industry associations providing most of these responses). The factors that were considered to have most decreased costs were the UNFCCC (public authorities and NGOs providing most of these responses), Low Emission Zones (NGOs providing most of these responses), and the COVID-19 pandemic (public authorities and NGOs providing most of these responses).The importance of the interactions between the NECD and other legislation were reflected in the stakeholder engagement activities, including the response to the OPC. Although not commenting directly on costs, where a policy has reduced emissions, this logically implies that it has already reduced the costs of further emissions reductions to meet ERCs under the NECD.

BOX 15. Key messages on efficiency

- The NECD has placed costs on economic actors, with the most significant believed to be adjustment costs for Member States and businesses.
- NECD also carries administrative costs for competent authorities, which have been estimated through data provided. Although businesses do not face direct obligations, engagement highlighted that businesses provide data and information, mainly to support inventory compilation. However, data is often either already available or gathered for compliance with other policies (e.g. IED). Thus, any additional burden on businesses attributable to the NECD is likely to be very small.
- The benefits of the NECD are widely seen as justifying the effort and costs involved, due to its health and environmental benefits. In particular with respect to administrative burden, emission inventories and projections are seen as essential and efficient tools for policy and compliance tracking.
- Through the engagement, a number of ideas for simplification were identified. Some of the key ideas included:
    - NAPCP preparation is viewed as resource-intensive, especially due to misalignment with NECP timelines. The NAPCP template is considered overly technical, rigid and difficult to use for public engagement
    - Reporting on ecosystem impacts is perceived as inefficient due to low harmonisation and limited policy relevance in its current state
    - The frequency of some reporting obligations is seen as appropriate, but certain elements (such as spatially disaggregated data, and ecosystem monitoring) may benefit from revision
    - Lack of integration with CAP and NECPs leads to administrative inefficiencies and conflicting policy signals
    - Stakeholders call for better coordination, simplification of requirements, and more targeted implementation
- Improved policy coherence and enforcement could significantly enhance the Directive's efficiency.

Coherence

The coherence of the NECD was assessed across all stakeholder engagement activities, with a particular focus on how well the Directive aligns with other EU policies and instruments — especially within the broader framework of clean air legislation — and with international obligations such as those under the Gothenburg Protocol. Respondents were also asked to reflect on the consistency of the Directive's internal provisions and how they interact with policies in related areas, such as climate, energy, agriculture, and transport.

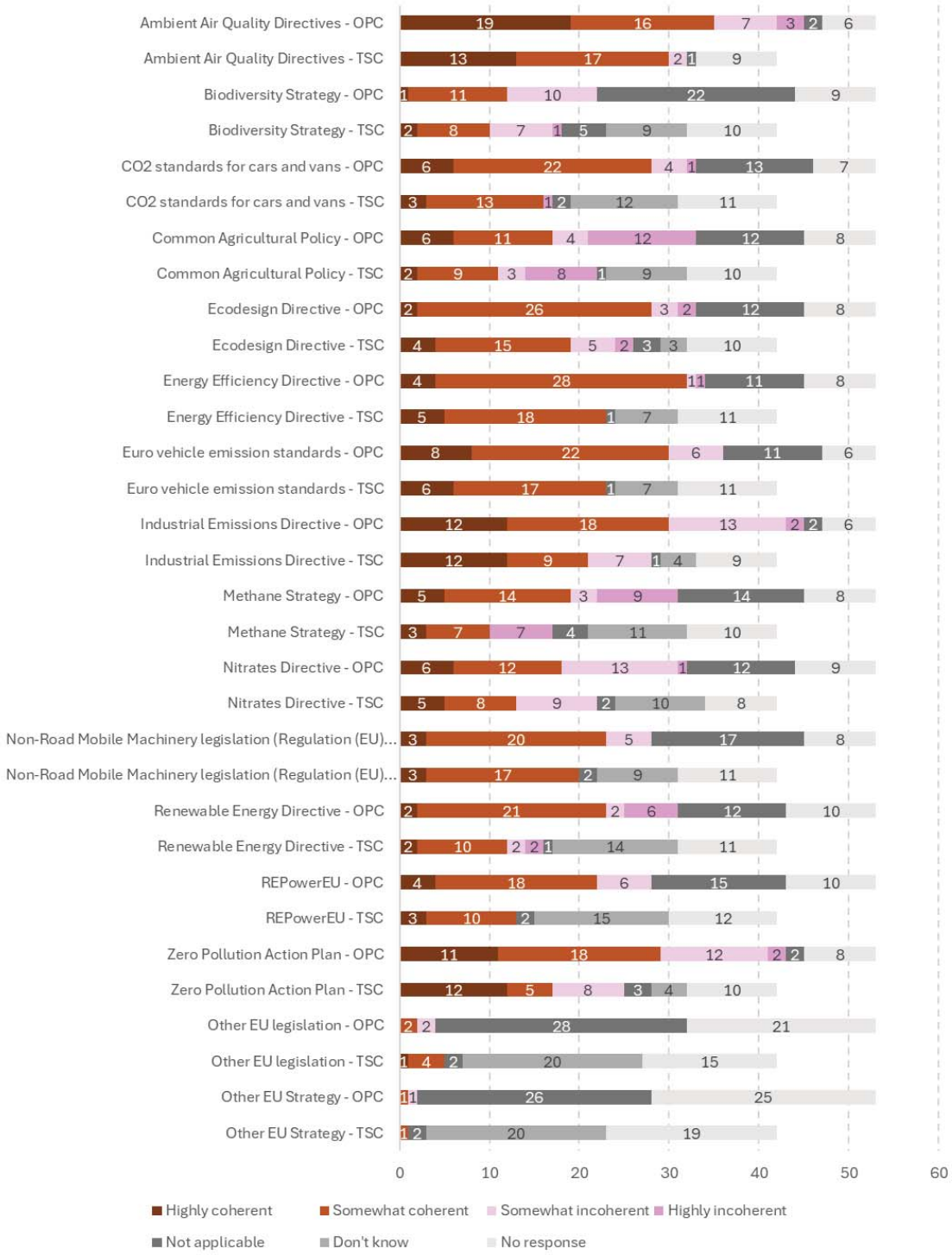


Figure A - 64 – To what extent do you think the NECD is coherent with these policies or initiatives?

Overall, respondents in both OPC and TSC recognised **the NECD as an integral part of the EU's clean air policy framework and largely considered it to be coherent with other legislation,** in particular the Ambient Air Quality Directives, the Industrial Emissions Directive, the Energy Efficiency Directive, the Euro vehicle emission standards, and the Zero Pollution Action Plan. However, many also highlighted practical challenges and inconsistencies in the Directive's interaction with sectoral policies and international commitments, which may hinder implementation or reduce its overall impact.

In terms of **synergies and overlaps with other EU policies**, a number of respondents pointed to a lack of coherence between the NECD and related policy frameworks, particularly in agriculture and climate. For example, TSC respondents (NGOs and public authorities) noted that agricultural policies under the Common Agricultural Policy (CAP) often do not align with NECD objectives, making it difficult for Member States to design and fund efficient measures to reduce ammonia emissions. Several stakeholders proposed that better integration of air quality considerations into the CAP and NECP processes could significantly improve policy efficiency and reduce administrative fragmentation.

A strong majority of respondents in the TSC agreed that **the NECD plays an important role in the EU's overall clean air strategy**. This view was shared across stakeholder groups including public authorities, NGOs, academia and industry associations. The Directive was seen as complementary to the Ambient Air Quality Directives (AAQDs), source-specific regulations such as the Industrial Emissions Directive (IED), and standards for vehicles and fuels. Respondents appreciated that the NECD targets emissions at source and provides a national-level framework for managing air pollutant emissions across sectors. Similar views emerged from the OPC, where the majority considered the NECD to be a key component of the EU's air quality policy and supportive of broader objectives such as health protection and environmental quality. Some respondents emphasised that the Directive's legally binding reduction commitments provide a necessary counterbalance to the more localised and concentration-focused approach of the AAQDs, thereby reinforcing consistency and accountability across Member States.

However, the consultations also revealed a number of concerns about coherence in practice. One recurring theme was the **insufficient alignment between the NECD and the CAP**. This issue was particularly emphasised in the TSC by NGOs and public authorities, who argued that while the NECD places a strong emphasis on reducing ammonia (NH_3) emissions, the CAP has not sufficiently supported the uptake of relevant measures. Some stakeholders noted that subsidies under the CAP may still encourage practices that are not aligned with air quality goals, such as intensive livestock farming or fertiliser use, thereby undermining the emission reduction objectives of the NECD.

Likewise, some specific **inconsistencies were observed in the interaction between the NECD and climate policies**. Respondents pointed out that measures designed to reduce greenhouse gas emissions—such as the promotion of biomass for residential heating—may inadvertently lead to increased emissions of particulate matter ($PM_{2.5}$), potentially undermining air quality objectives. These cross-policy trade-offs were viewed by several respondents as a significant challenge, suggesting that greater integration and coordination are needed between climate and air quality policies at both EU and national levels.

Another area of **perceived incoherence relates to the Directive's timing and administrative alignment with other policy instruments**. Several public authority respondents in the TSC noted that the timelines for submitting and updating NAPCPs do not align well with the NECPs. This temporal misalignment leads to administrative inefficiencies and limits opportunities to ensure that measures under both planning

instruments are mutually reinforcing. Some stakeholders suggested that aligning the review cycles of these two plans would improve coherence and reduce duplication of effort.

Respondents also commented on the **coherence of the NECD with the EU's international commitments under the Gothenburg Protocol**. Here, the views were generally positive: a majority of stakeholders felt that the NECD provides a coherent mechanism for implementing the emission reduction commitments under the Protocol. In the TSC, several public authorities, NGOs and industry representatives acknowledged that embedding the Gothenburg reduction commitments in EU law through the NECD helps ensure compliance, creates legal certainty, and facilitates enforcement. The inclusion of common reporting methodologies, such as those developed under the UNECE CLRTAP (e.g. EMEP/EEA guidelines), was also seen as promoting coherence and efficiency in monitoring and evaluation. Nonetheless, a few stakeholders expressed reservations about specific technical inconsistencies, such as differences in metrics or methodologies used across EU and international frameworks. For instance, in ecosystem monitoring, some respondents raised concerns about divergent approaches to assessing ozone damage on vegetation (e.g. AOT40 versus POD metrics), which may result in confusion or limit comparability across Member States.

At the operational level, respondents called for **more robust mechanisms to ensure that policies are implemented in a coherent manner across Member States**. For example, while the NECD requires transboundary consultations as part of the NAPCP process, these provisions were widely reported in the TSC to be weakly applied or inconsistently enforced. Several stakeholders highlighted that Member States rarely engage in meaningful cross-border dialogue, despite the transboundary nature of air pollution. This lack of coordination was seen as undermining the coherent application of the Directive and limiting its effectiveness.

Finally, respondents reflected on the **Directive's internal coherence**. Most agreed that the structure of the NECD is logically sound and that its core elements—emission reduction commitments, planning through NAPCPs, reporting obligations, and monitoring—are complementary. However, concerns were raised about the interaction between these elements and the Directive's flexibility provisions under Article 5. NGOs in particular argued that allowing adjustments, pollutant swapping, and exemptions under certain conditions introduces a degree of ambiguity that can weaken the coherence of the policy framework and reduce the incentive for sustained action.

BOX 16. Key messages on coherence

- The NECD is broadly perceived as coherent within the EU clean air policy landscape
- Some specific inconsistencies were observed in the interaction between the NECD and climate policies, specifically the promotion of biomass for residential heating.
- Improving alignment with agricultural, energy, and climate frameworks, enhancing the synchronisation of planning instruments, and reinforcing cross-border coordination and enforcement mechanisms would all contribute to a more coherent and effective implementation of the Directive going forward.

- The NECD is perceived as overall coherent with the Gothenburg Protocol.

Relevance

Through the various engagement activities stakeholders explored the relevance of the NECD, with stakeholders reflecting on whether the Directive continues to address pressing problems related to air pollution and whether its scope, objectives and design remain fit for purpose in light of evolving environmental, health and policy contexts.

There was consistency across all engagement activities and across all stakeholder types suggesting **strong support for the continued relevance of the NECD**. Stakeholders consistently recognised that air pollution remains a major environmental and public health issue in the European Union, and that the Directive plays a critical role in addressing it (See figure below).

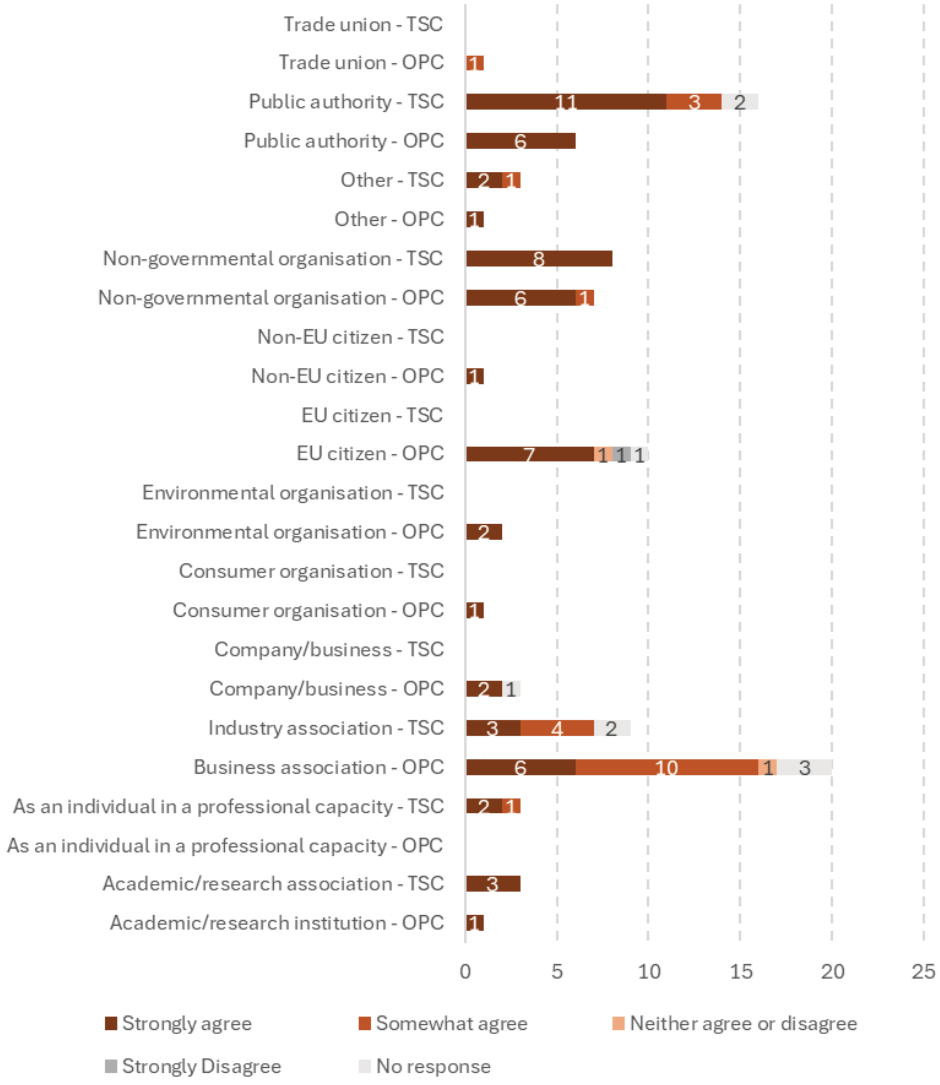


Figure A - 65 – Air pollution is still having a significant detrimental effect on human health and the environment in the EU

Nonetheless, several respondents called for a strengthening of the Directive's provisions and highlighted areas where its scope and mechanisms could be improved to better reflect current scientific knowledge, societal priorities and legislative developments.

When questioned directly through the OPC and TSC, stakeholders revealed broad consensus that **the NECD remains necessary**. In the OPC, the vast majority of respondents agreed that the pollutants targeted by the Directive —SO_2 , NO_x, NMVOCs, NH_3 and $PM_{2.5}$ — continue to pose significant risks to human health, ecosystems, and climate. Many respondents stressed that, despite notable improvements in air quality over the past two decades, emission levels of key pollutants remain too high in many areas, and that further action is needed to address persistent exceedances of air quality standards. This view was strongly echoed in the TSC, where stakeholders across all groups — including public authorities, NGOs, industry representatives, and academia — indicated that **the Directive addresses issues that are still highly relevant today**. Several respondents emphasised the importance of maintaining EU-level coordination on emission reductions, noting that transboundary pollution and shared environmental responsibilities make **national-level action alone insufficient**. The Directive's binding commitments and harmonised reporting obligations were viewed as essential features in ensuring accountability and driving progress across Member States.

While respondents affirmed the relevance of the Directive's core objectives, **many called for its scope and content to evolve in response to changing circumstances**. One key message — especially prominent among NGO respondents — was the need to **update the list of regulated pollutants**. In particular, several stakeholders advocated for the inclusion of methane (CH_4) as an additional pollutant, citing its dual role as a potent greenhouse gas and an important precursor to ground-level ozone, which continues to pose health and environmental risks across Europe. Some also highlighted black carbon and ultrafine particles as pollutants of growing concern that merit regulatory attention under the Directive.

Concerns were also raised about the **sufficiency of current emission reduction commitments (ERCs)**. While the Directive sets binding ERCs for the periods 2020–2029 and from 2030 onwards, many respondents questioned whether these are ambitious enough to align with other EU environmental and health objectives—particularly the zero-pollution ambition of the European Green Deal, the upcoming revisions to the AAQDs, and the long-term goal of achieving air quality levels that do not harm human health. Several NGOs and public authorities argued that more stringent targets are necessary to close the gap between emission reductions and ambient air quality improvements, particularly in urban and densely populated areas.

Another frequently cited issue was the **limited effectiveness of the Directive in the agricultural sector**, particularly regarding ammonia emissions. Numerous stakeholders expressed concern that the NECD has not been sufficiently successful in driving reductions in NH_3 , agriculture being the dominant source of these emissions. The voluntary or weakly enforced nature of many agricultural measures, as well as their limited integration

with the Common Agricultural Policy (CAP), was seen to undermine the Directive's relevance in this critical area. Respondents stressed the importance of strengthening the link between Annex III (agricultural measures) and CAP instruments to ensure more consistent implementation and support for emission reductions in the sector.

Several respondents also pointed to the need to **improve the Directive's capacity to respond to emerging scientific evidence and changing technological and economic conditions**. For example, some stakeholders called for more dynamic mechanisms for reviewing and adjusting ERCs in light of new data or modelling, as well as improved coordination with Member States' NAPCPs and NECPs. Others recommended enhancing the Directive's responsiveness to new findings on health impacts, such as the growing body of evidence linking long-term exposure to even low concentrations of pollutants with serious health effects.

The **NECD's design and approach were generally seen as broadly appropriate for its objectives**. Respondents to both the OPC and TSC supported its focus on national-level emission reduction commitments, noting that these allow for a degree of flexibility in implementation while ensuring collective progress across the EU. The Directive's emphasis on sector-neutral targets was considered a strength, allowing Member States to determine the most suitable mix of policies and measures based on national circumstances. However, some stakeholders warned that this flexibility must be balanced with more concrete implementation requirements—particularly in sectors like agriculture, where progress has been slow and uneven.

BOX 17. Key messages on relevance

- Air pollution remains a major health and environmental issue, and the Directive continues to address important problems. The NECD is widely seen as an essential part of the EU clean air framework
- The pollutants regulated under the Directive are still considered highly relevant. Several stakeholders called for the inclusion of additional pollutants, such as methane and black carbon
- Current emission reduction commitments may not be ambitious enough to meet the EU's zero pollution and health objectives
- Stakeholders stressed the need to strengthen ammonia reduction measures in the agricultural sector
- Respondents recommended aligning the Directive more closely with evolving scientific knowledge and technological developments. Several stakeholders called for more dynamic mechanisms to revise targets and improve responsiveness to new data
- The NECD was seen as important in maintaining a level playing field and ensuring consistent action across Member States
- Better integration with climate, energy and agricultural policies is needed to ensure the Directive remains relevant and effective

EU added value

Stakeholders explored the extent to which the NECD provides added value through EU-level action across the engagement activities — particularly in comparison to what could be achieved by Member States acting independently. The broad consensus across stakeholders affirmed that the Directive delivers clear EU added value by addressing a

transboundary issue, harmonising national efforts, and supporting collective progress towards shared environmental and health objectives.

Across both OPC and TSC, stakeholders consistently agreed that **air pollution is a cross-border problem that requires coordinated EU action** (see figure below). In the OPC, a large majority of respondents recognised that pollutants such as NO_x, $PM_{2.5}$ and NH_3 travel across national boundaries and cannot be effectively managed by individual countries alone. This view was echoed in the TSC, where public authorities, NGOs and industry stakeholders all emphasised that **EU-level legislation is essential to ensure a fair and consistent approach across Member States**.

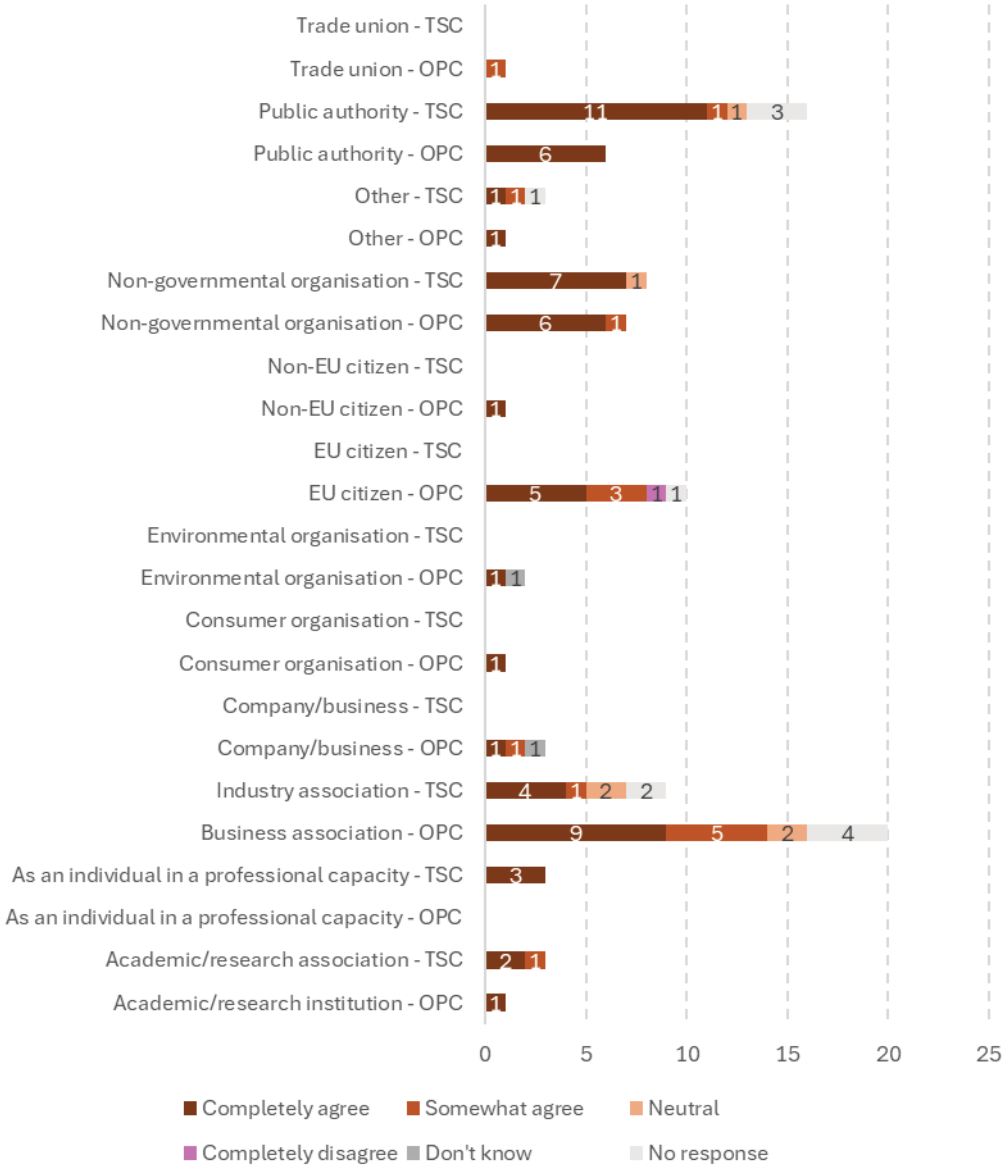


Figure A - 66 – To what extent do you agree or disagree with the following statement: transboundary pollution remains a significant source of air pollution across EU Member States

Many respondents also noted that the NECD creates a **level playing field by establishing binding, harmonised commitments for all Member States**. Without such commitments,

several stakeholders argued, there would be a risk of uneven ambition and fragmented national efforts, undermining both environmental outcomes and internal market fairness. The Directive's legal framework was seen as providing not only consistency, but also accountability and pressure for action in countries that might otherwise deprioritise air pollution control.

Stakeholders further highlighted the value of **common reporting standards and shared methodologies**, which help to ensure comparability, transparency and trust in national data. Several TSC respondents pointed to the EU's role in developing technical guidance and coordinating reporting processes, which facilitates monitoring and evaluation and reduces duplication of effort.

Another frequently mentioned benefit of EU-level action was the **support for capacity-building and knowledge exchange**. Respondents noted that EU institutions play a critical role in funding research, disseminating best practices, and fostering collaboration between Member States. This was considered particularly important for smaller Member States or those with limited technical capacity.

Although views on the effectiveness of specific provisions varied, there was broad agreement that the Directive's existence at EU level provides a **strong incentive for long-term investment and planning**, particularly in sectors where progress has been slower, such as agriculture and transport. Some respondents suggested that in the absence of EU legislation, many national administrations would lack the impetus or resources to undertake ambitious emission reduction efforts.

BOX 18. Key messages on EU added value

- Air pollution is a transboundary issue that requires coordinated EU-level action
- The Directive provides clear added value by harmonising national efforts across Member States. Binding EU-level commitments help ensure consistent ambition and accountability. Without EU legislation, national action on air pollution would likely be weaker and more uneven
- Common reporting standards and methodologies support transparency and comparability
- EU action creates a level playing field and avoids fragmentation of national policies
- The Directive incentivises long-term investment and planning in pollution reduction
- EU institutions play a key role in building capacity and facilitating knowledge exchange. Smaller or less-resourced Member States particularly benefit from EU coordination and support
- Stakeholders strongly support maintaining and strengthening EU-level involvement in emission reduction efforts

ANNEX VI. OVERVIEW OF THE NECD

1 THE NECD

The Directive (EU) 2016/2284 (NECD) sets national emission reduction commitments (ERCs) for the Member States' anthropogenic emissions of nitrogen oxides (NO_x), non-methane volatile organic compounds (NMVOC), sulphur dioxide (SO_2), ammonia (NH_3) and fine particulate matter ($PM_{2.5}$) into air. It also includes reporting of the emissions of further pollutants for monitoring purposes, partly on an optional basis. For example, emissions of carbon monoxide (CO), PM_{10} and of black carbon (if available) are mandatory to report, whilst Member States may optionally report on heavy metals (arsenic, chromium, copper, nickel, selenium and zinc) and total suspended particles.

These pollutants worsen air quality, leading to significant negative impacts on human health and the environment. For example, these pollutants are linked to asthma, heart disease and stroke; they damage vegetation and ecosystems and affect water and soil quality, thus also crops.

The NECD's objectives are to achieve levels of air quality that do not give rise to significant negative impacts on human health and the environment, and to contribute to the Union's long-term objective of achieving air quality in line with the World Health Organisation's air quality guidelines. The Directive implements the Gothenburg Protocol[468], to which most EU Member States and the EU itself are parties.

The NECD came into force on 31 December 2016 (replacing earlier legislation (Directive 2001/81/EC) and features:

- National commitments to reduce emissions of five main air pollutants (NO_x, NMVOC, SO_2, NH_3 and $PM_{2.5}$) for the period 2020-2029, and more ambitious reductions for 2030 and beyond, expressed as percentage of reduction relative to 2005 emission levels. This is a shift from the fixed emission ceilings expressed in kilotonnes per year in Directive 2001/81/EU;
- A requirement for Member States to produce and regularly update national air pollution control programmes (NAPCPs), demonstrating the policies and measures (PaMs) by which the emission reduction commitments would be achieved, including a series of both optional and mandatory measures to control emissions from agriculture;
- Member State reporting of:
    - Air pollutant emission inventories per sector (annually);
    - Emission projections, i.e. estimates on the future evolution of emissions (every two years);
    - Spatially disaggregated (i.e. per grid point) emissions inventories and large point sources (e.g. power plants) (every four years);

[468] Protocol to Abate Acidification, Eutrophication and Ground-level Ozone, United Nations Economic Commission for Europe (UNECE). Ratification from Italy and Poland outstanding.

- Updated NAPCPs (every four years, or more frequently in specified circumstances);
- Ecosystem impacts monitoring data (sites and data on a staggered four-year cycle).

Annex III, Part 2 of the NECD includes measures to reduce agricultural emissions, divided into three parts: ammonia control, fine particulate matter and black carbon reduction, and considerations for small farms. To control ammonia emissions, Member States must create an advisory code of good agricultural practice, covering nitrogen management, livestock feeding strategies, low-emission manure techniques, and limits on ammonia emissions from mineral fertilisers, including banning urea-based fertilisers. For fine particulate matter and black carbon, Member States may ban open field burning of agricultural and forest residue, with exceptions for preventing wildfires, pest control, or biodiversity protection. Additionally, they can develop practices to improve soil structure and nutrient status through the incorporation of harvest residue and manure. Measures must also consider the impact on small and micro farms, including exemptions where appropriate.

The table below summarises key requirements and provisions of the Directive. Acts, guidance and other documents complementing the Directive are included in italics.

Table A - 66 – Summary of the NECD requirements

Article	Target group	Requirement/ provisions
4	Member States	Limit anthropogenic emissions of SO_2, NOx, NMVOC, NH_3 and $PM_{2.5}$ according to ERCs defined for 2020-2029 and from 2030 onwards, as set out in Annex II
5(1-4)	Member States	Possibility to use flexibilities to adjust national emission inventories. The conditions include: • applying improved emission inventory methods • exceptional weather conditions (e.g. exceptionally cold or dry weather) • compensating the non-compliance for an ERC going beyond cost-effective reduction with equivalent reduction of another pollutant • sudden and exceptional interruption or loss of capacity in power and/or heat supply or production system.
5(6, 8)	EC, assisted by EEA	Review the use of flexibilities and adopt related decisions, taking into account guidance documents developed under the UNECE Convention on long-range transboundary air pollution (CLRTAP)[469].
6 (1-4)	Member States	Draw up, adopt and implement national air pollution control programmes (NAPCPs). Programmes have to be updated every four years, policies and measures (PaMs) have to be updated within 18 months after national emission inventory or projections are submitted showing non-compliance or a risk of non-compliance. NAPCPs shall include reduction measures laid down as obligatory in Annex III Part 2 (agricultural measures) and may include the optional measures of the same annex. → *Where appropriate, use data and methodologies developed by the European Monitoring and Evaluation Programme (EMEP)*

[469] https://unece.org/convention-and-its-achievements

Article	Target group	Requirement/ provisions
6(5,6)	Member States	Consult the public and competent authorities Conduct transboundary consultations, where appropriate.
6(7)	EC	Facilitate elaboration and implementation of NAPCP, where appropriate through exchange of good practice.
6(9,10)	EC	Establish guidance for NAPCP and specify NAPCP format → *Contents of NAPCPs are regulated through Annex III and Commission Implementing Decision (EU) 2018/1522 laying down a common format for NAPCPs under Directive. The use of the format is mandatory.* → *Commission Guidance for the development of NAPCPs*
7	EC	Endeavour to facilitate access to existing EU funds (Horizon, Structural and Investment Funds, LIFE)[470]
8(1)	Member States	Prepare national emission inventories (annually). Obligatory for the five pollutants set out in Table A of Annex I; optional for pollutants set out in Table B of the same.
8(2)	Member States	Prepare projections every two years, spatially disaggregated national emission inventories and large point source inventories every four years.
8(3,4)	Member State	Prepare informative inventory reports (IIRs) (annually), including information on use of flexibilities, where applicable
8(6)	EC, assisted by EEA	Prepare annual Union-wide emission inventories and IIRs Every two years, prepare Union-wide emission projections Every four years, prepare spatially disaggregated Union-wide emission inventories and Union-wide large point source inventories
8(7)	EC	Empowered to adopt delegated acts on reporting → *Delegated Directive (EU) 2024/299 on the methodology for the reporting of projected emissions of certain atmospheric pollutants.*
9	Member States	Monitor negative impacts of air pollution upon ecosystems based on a network of monitoring sites representative of freshwater, natural and semi-natural habitats and forest ecosystem types. Optional monitoring indicators defined in Annex V. → *Commission Notice 2019/C 92/01 on ecosystem monitoring under Article 9 and Annex V of the NECD* → *May use methodologies laid down in the LRTAP Convention and its Manuals for the International Cooperative Programmes*[471]
10(1, 2, 4)	Member States	Reporting of to NAPCPs, Reporting of emission inventories (including spatially disaggregated and large point source ones), projections (reporting dates defined in Annex I) and informative inventory reports; → *Shall be consistent with reporting to the Secretariat of the LRTAP Convention* Reporting of location of monitoring sites and indicators used for monitoring ecosystems and monitoring data (Art. 9)

470 Further information on clean air funding

471 See the Working Group on Effects under the Air Convention, which includes references to the websites of the different International Cooperative Progammes that provide the respective manuals (e.g. ICP Forest manuals).

Article	Target group	Requirement/ provisions
10(1)	EC	Examine NAPCPs
10(3)	EC, assisted by EEA	Review inventory data and calculate technical corrections in consultation with Member States; if no agreement, adopt a decision laying down technical corrections.
11(1)	EC	Every four years, report to European Parliament and Council on the implementation of the Directive → *Report from the Commission to the European Parliament and the Council on the progress made on the implementation of the NECD, COM(2020) 266 final* → *Report from the Commission to the European Parliament and the Council on the progress made on the implementation of the NECD, COM(2024) 348 final*
12	EC	Set up a European Clean Air Forum to provide input for guidance and facilitate the coordinated implementation of EU legislation and policies related to improving air quality
13	EC	Review the Directive no later than 31 December 2025 (this evaluation). Present legislative proposals for emission reduction commitments for the period after 2030, if appropriate Assess impact of mercury, consider measures for reducing mercury emissions and, if appropriate, submit legislative proposal → *Regulation (EU) 2017/852 of the European Parliament and of the Council on mercury*
14(1)	Member States	Make available on a publicly accessible website NAPCPs and their updates, inventories, projections and IIRs
14(2,3)	EC	Make available on a publicly accessible website Union-wide emission inventories, projections and IIRs: – Union wide emission inventory (EU submission to CLRTAP) is available on the website of the Centre on Emission Inventories and Projections (CEIP); – IIR also available on EEA website, and inventories can be found in EEA datahub. – The Clean Air Outlook constitutes Union-wide projections, all editions are available on a dedicated sub-page on EUROPA. Publish on website: — assumptions considered for defining emission reduction commitments (TSAP16a and TSAP16b); — list of relevant Union source-based air pollution control legislation; — results of examination of NAPCPs
15	EC	Pursue bilateral and multilateral cooperation within international organisations (e.g. UNEP, UNECE, FAO, IMO, ICAO)
16	EC	Power to adopt delegated acts → *Report from the Commission to the European Parliament and the Council on the exercise of the power to adopt delegated acts conferred on the Commission pursuant to the NECD, COM(2021) 451 final*
17	EC and Member States	Commission to be assisted by the Ambient Air Quality Committee
18	Member States	Lay down rules on penalties applicable to infringements of national provisions

Enforcement and implementation support

As for all EU law, the European Commission monitors whether the NECD is applied correctly and on time, taking into account the transposition of the Directive and its amendments, compliance with ERCs and all reporting obligations. In case of failure to transpose or to comply with requirements, the Commission initiates an infringement procedure, which can lead to legal action before the Court of Justice. The status of compliance and related infringement procedures are described in Annex III section 2 (in section 2.1.6 for failure to comply with ERCs, 2.2 for failure to report NAPCPs or their updates, and in 2.3.1 for failure to report inventories or projections on time).

The Commission also provides assistance to Member States to implement EU law correctly, including by providing online information, guidance, capacity building, facilitating exchange between competent authorities and stakeholders, and organising expert group meetings. These mechanisms are in place under the NECD.

How were ERCs established?

ERCs were established for the period 2020 to 2029, meaning that they had to be attained by 2020 and maintained throughout the period; and for 2030 and beyond.

For the period 2020 to 2029, the NECD sets ERCs that are identical to those set in the revised Gothenburg Protocol to the Air Convention.

The ERCs for 2030 and onwards were based on integrated assessment modelling performed in the context of the impact assessment in view of reducing substantially the health and environmental impacts of air pollution based on a cost-effective combination of national emission reduction commitments. Specifically, ERCs were established taking into account:

- an overall health impact reduction by 2030 (compared with 2005) as close as possible to that of the Commission proposal for the Directive, which corresponded to 70% of the maximum feasible reduction, bringing the EU closer to reducing air pollution in line with WHO air quality guidelines applicable at the time[472],
- the estimated cost-effective reduction potential of each Member State contained in the Thematic Strategy on Air Pollution (TSAP) Report No 16 (TSAP 16a and TSAP 16b), and
- technical examination of the differences between national estimates and those in TSAP 16.

[472] Delivering further reductions in background pollution to enable levels of air quality that are closer to those recommended by the WHO and CLRTAP is stated amongst the NECD's objectives (Article 1(2)(a) of the NECD). The IA assessed a policy option to fully meet the WHO guideline values, but considered these not within reach before 2030 everywhere in the EU with measures and assumptions valid at the time.

In addition, the NECD sets an indicative emission level for 2025, based on a linear reduction trajectory between 2020-29 ERCs and 2030+ ERCs. The purpose of this is to serve as a "benchmark" to indicate whether Member States are on track towards achieving the 2030+ ERCs by 2030.

Tracking compliance – emission inventories

The core instrument for tracking Member State progress in meeting ERCs and the indicative 2025 emission levels is emission inventories. Inventories are used for both the NECD and the UNECE Air Convention's Gothenburg Protocol.

Inventories consist of emission estimates for a list of pollutants broken down by sectors and are produced using well established methodologies set out in EMEP Reporting Guidelines, the EMEP/EEA air pollutants emission inventory guidebook and further guidance material adopted under the Air Convention. These methodologies are regularly updated based on evolving scientific knowledge. For reporting on the agricultural sector, Member States may use the AgrEE tool, developed by DG JRC. Inventories are submitted yearly covering a time series from 1990 to the reporting year minus two (n-2), except for $PM_{2.5}$ inventories which date back to 2000.

The Commission, with the support of the EEA, reviews inventories to verify the transparency, accuracy, consistency, comparability and completeness of the emission inventories, and whether they have been prepared in accordance with approved methods. Where necessary, estimates are recalculated. Inventories also form the basis for compliance checks against the ERCs.

Compliance checks involve the calculation of the maximum level of emissions allowed: the ERC's percentage reduction is applied to the 2005 emissions for each pollutant. To be compliant, the reviewed emission total per pollutant may not exceed the maximum allowed emissions.

Member States may apply for flexibilities to be applied to inventories when it comes to compliance checking. Accepted flexibility applications are taken into account when reviewing inventories and compliance with the ERC. Member States may request to have flexibilities considered under the following conditions (see Art. 5 of the NECD):

- non-compliance due to applying improved emission inventory methods;
- exceptional weather conditions (exceptionally cold or dry weather) – to support the assessment of eligibility for this flexibility, the Copernicus Climate Change Service developed a tool to identify years when a Member State may have experienced an exceptionally cold winter or an exceptionally dry summer;
- compensating the non-compliance for an ERC going beyond cost-effective reduction with equivalent reduction of another pollutant;
- sudden and exceptional interruption or loss of capacity in power and/or heat supply or production system.

The Commission publishes the reviews of national emission inventories[473].

The figure below provides an overview of how the ERCs apply and how inventories inform compliance:

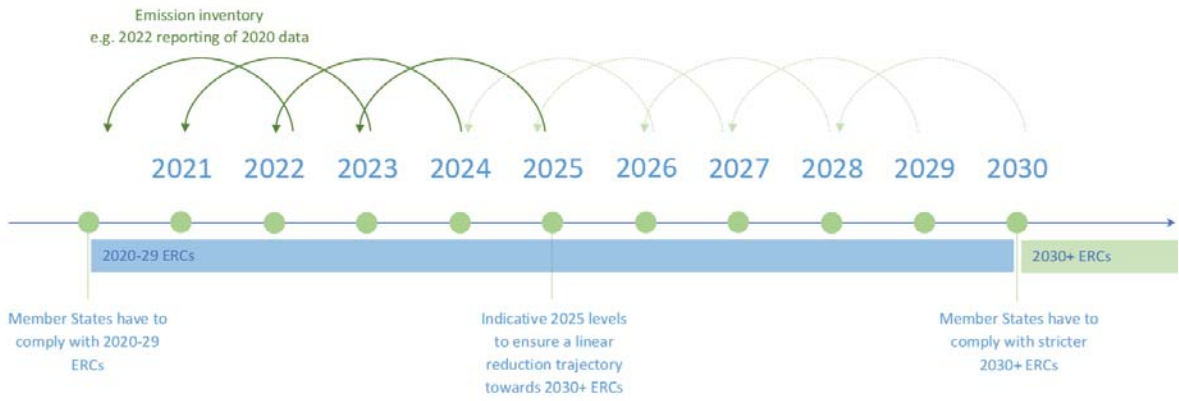


Figure A - 67 – ERCs defined in the NECD

The role of projections

Member States submit national emission projections every two years. These reflect the expected future evolution of air pollutant emissions and are used to evaluate whether Member States are on track to meet their ERCs and the indicative 2025 levels determined by the linear reduction trajectory towards 2030+ ERCs. Projections are also used in the Air Convention's Gothenburg Protocol for tracking compliance with the commitments under the Protocol. The Protocol requires to submit projections every four years.

As for inventories, the underlying methodology for preparing projections is the EMEP/EEA guidebook. Projections take into account:

- A 'with measures' (WM) scenario that represents the events or conditions most likely to occur with currently implemented or adopted Policies and Measures (PaMs). These are policies that are enshrined in national legislation in force, or in established voluntary agreements, or that have financial resources allocated or human resources mobilised. Adopted PaMs are those where an official government decision has been made and there is a clear commitment to proceed with implementation (EMEP/EEA guidebook definitions). The 'WM' scenario should also incorporate recently adopted EU legislation (e.g. source-based air pollution control), even if not implemented yet.
- A 'with additional measures' (WAM) scenario that includes projections of emissions that encompass the effects, in terms of air pollutant emission reductions, of PaMs included in the WM scenario, as well as PaMs that are planned (under discussion and have a realistic chance of being adopted and implemented in the future), at the time the projection is calculated.

[473] https://environment.ec.europa.eu/topics/air/reducing-emissions-air-pollutants/emissions-inventories_en

Thus, projections link up to the NAPCPs and PaMs, where the implemented/adopted and planned PaMs are identified and described.

The Commission, with the support of the EEA reviews Member State projections to ensure that they are as reliable as possible. The reviews are published[474].

2 ACTS AND GUIDANCE RELATED TO THE NECD

The Commission Delegated Directive (EU) 2024/299 on the methodology for the reporting of projected emissions of certain atmospheric pollutants amends the NECD and reflects the changes to the Guidelines for Reporting Emissions and Projections Data under the Convention on Long-Range Transboundary Air Pollution, revised in December 2022[475] as regards the reporting of emission projections. The amendment brought the approach of reporting projections under the NECD in line with the Air Convention's requirements to improve comparability and consistency. It introduced the use of the updated Annex IV to the Guidelines for Reporting Emissions and Projections Data under the Convention on Long-range Transboundary Air Pollution, which requires a greater level of detail when reporting projections than the requirements in the NECD had asked for so far.

Coherence between the NECD and the Air Convention (Gothenburg Protocol) is addressed by one of the evaluation questions and has been explored through stakeholder consultation.

Commission Implementing Decision (EU) 2018/1522 laid down a common format for NAPCPs. The aim of the Decision was to facilitate the drafting of programmes and their review (an obligation of the Commission according to Art. 10(1) of the NECD) and to provide for better comparability of the NAPCPs across Member States.

The Commission also issued **Guidance for the development of NAPCPs**. The aim of the guidance was to support Member States in developing the initial NAPCP, due by 1 April 2019. It addresses the format of the NAPCP, the monitoring of progress in its implementation, the consultations on the NAPCP and its dissemination. A toolkit to support consideration and selection of additional policies and measures to comply with emission reduction commitments is set out in the appendix to the guidance.

The **Commission Notice C(2019) 1328 on ecosystem monitoring** provides guidance on setting up and operating a network of monitoring sites that meets the requirements of Article 9 of the NECD.

This evaluation explores the usefulness of the common format and the two guidance documents, the extent to which they were used, and any inefficiencies related to their use.

474 https://environment.ec.europa.eu/topics/air/reducing-emissions-air-pollutants/national-air-pollution-control-programmes-and-projections_en

475 Guidelines for Reporting Emissions and Projections Data under the Convention on Long-range Transboundary Air Pollution of the Executive Body for the Convention on Long-range Transboundary Air Pollution (ECE/EB.AIR/125, Executive Body decisions 2013/3 and 2013/4), as amended at its 42nd session of 12-16 December 2022.

ANNEX VII. MAPPING OF MONITORING UNDER THE NECD WITH RESPECT TO ITS IMPACT ASSESSMENT

The impact assessment was supporting not only the proposal for the NECD, but also a Communication on a Clean Air Programme for Europe, a proposal for a Directive on the limitation of emissions of certain pollutants into the air from medium combustion plants (MCP Directive) and a proposal for a Council Decision on the acceptance of the Amendment to the 1999 Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution to Abate Acidification, Eutrophication and Ground-level Ozone.

The monitoring chapter of the impact assessment covered all these elements. The table below focuses on monitoring elements relevant to the NECD.

Table A - 67 – Mapping of monitoring between the NECD IA and as carried out during the evaluation period

Monitoring and evaluation elements in the impact assessment	Who	Related monitoring and evaluation activities	Was monitoring completed as projected?
Achievement of ambient air quality standards, according to AAQD and summarised in the yearly EEA air quality report	MS, EC, EEA	Monitoring according to the AAQD. This includes air quality measurements from stations, annual air quality statistics, data on air quality attainment status, information on Air Quality Plans and Air Quality Measures[476]. Yearly EEA briefings on Europe's air quality status[477]	Yes
Number of premature deaths due to PM health impacts in the EU	EC, EEA	Regular publications from the EEA on burden of disease status[478]	Yes
Number of premature deaths due to acute ozone exposure	EC, EEA	As above	Yes
Ecosystem area for which critical loads are exceeded (eutrophication) — Combined monitoring and modelling of nitrogen deposition to ecosystems — Direct monitoring of sensitive ecosystem impacts under the NECD	MS, EC, EEA	— Regular EEA briefing on the impacts of air pollution on ecosystems in Europe[479] — Monitoring of ecosystem impacts under the NECD (Member State reporting and analysis of reported data at EU level)	Yes
Ecosystem area for which critical loads are exceeded (acidification) — Combined monitoring and modelling of nitrogen/sulphur deposition to ecosystems — Direct monitoring of sensitive ecosystem impacts under the NECD	MS, EC, EEA	As above	Yes

476 For a detailed overview of data and methods, see the European Air Quality Portal.
477 The 2024 edition of the EEA briefing is available at the address https://www.eea.europa.eu/publications/europes-air-quality-status-2024.
478 *Harm to human health from air pollution in Europe: burden of disease status*, EEA, 2024.
479 *Impacts of air pollution on ecosystems in Europe*, EEA, 2024.

Monitoring and evaluation elements in the impact assessment	Who	Related monitoring and evaluation activities	Was monitoring completed as projected?
Uptake of available funds	EC	Monitoring of the uptake of EU funds to support the objectives of the NECD was put in place (Clean air tracking)	Yes
Progress towards EU and Member State ERCs for $PM_{2.5}$, SO_x, NO_x, NMVOC, NH_3 and CH_3 for 2020 and 2025-30	MS, EC	National emission inventories and projections, EC review of emission inventories and projections[480]	Yes[481]
Effect of the reduction of air pollutants on background concentrations of air pollutants (under AAQD)	EC	EEA tracks data on both air pollutant emissions (NECD data viewer) and the average exposure indicator (AEI) for $PM_{2.5}$, which assesses the general population's long-term exposure to $PM_{2.5}$ in urban areas and is based on a 3-year average measured at urban background stations.. As part of the Clean Air Outlook series the Commission regularly assesses different air pollution mitigation scenarios and their impact on ambient air concentrations	Yes
Implementation of the new NECD to be evaluated every five years and for the first time no later than 2020	EC	Current evaluation. Article 13 of the NECD requires a review no later than 31 December 2025	Yes

As the table shows, monitoring was carried out as intended in the impact assessment, with changes that are due to modifications introduced during the adoption of the NECD. In its conclusions, this evaluation will reflect on whether changes are needed to the monitoring regime.

[480] National emission inventories and projections are available on the Eionet Central Data Repository website. Results of the review of national emission inventories and projection reviews are available on the Europa webpage dedicated to the NECD.

[481] Changes to the monitoring regime are due to changes to the proposal during the co-legislation process. As a consequence, CH_4 is not part of the air pollutants covered by an ERC, therefore is not monitored in this context; and ERCs are defined for the 2020-2029 period and for 2030 and beyond, rather than for 2020 and 2025-2030. Beyond these changes, monitoring is performed as intended.

ANNEX VIII. INTERNATIONAL CONTEXT AND COMPETITIVENESS

Ambient air pollution is an issue at global level. 99% of people worldwide are exposed to unhealthy concentrations of air pollutants – thus, levels that exceed those recommended by the World Health Organisation. Some of the most damaging impacts occur in low- and middle-income countries. The economic cost related to disease and death burden, productivity loss and cognitive impacts is estimated at nearly 5% of global GDP[482] (4% of annual GDP in the EU[483]).

The chapters below provide an overview of global regulatory approaches and efforts of to reduce emissions in non-EU countries respectively to the EU efforts. The aim of the analysis is to help determine whether there are important asymmetries in the application of clean air policy in the EU and its main trading partners, with potential disadvantages for the international competitiveness of EU businesses.

The analysis focuses on the principal trading partners of the EU based on Eurostat data available at the time of writing this evaluation, reflecting a 2023 status. The principal partners for EU export of goods were Canada, USA and Mexico; Norway, Switzerland, Turkey, and the UK; China, South Korea and Japan. For the EU import of goods, principal partners were the USA; Norway, Switzerland, Turkey and the UK; China, India, Japan and the Russian Federation[484].

1 LEGAL REQUIREMENTS IN NON-EU COUNTRIES

The WHO developed an air quality standards database, which includes data on legal references for countries taking action to improve air quality. Similar data for legislation limiting air pollution at national level is not available, therefore we use this database as a proxy to show policy interventions in non-EU countries.

The map below shows the countries applying air quality standards and the limit values for annual mean concentrations for $PM_{2.5}$.

[482] The World Bank (2025) – Accelerating access to clean air for a livable planet.
[483] Juan Mejino López, Miquel Oliu-Barton (2024) – How much does Europe pay for clean air? Brueghel Working paper issue 15/2024.
[484] https://ec.europa.eu/eurostat/statistics-explained/index.php?title=International_trade_in_goods_by_partner; retrieved on 14/02/2025.

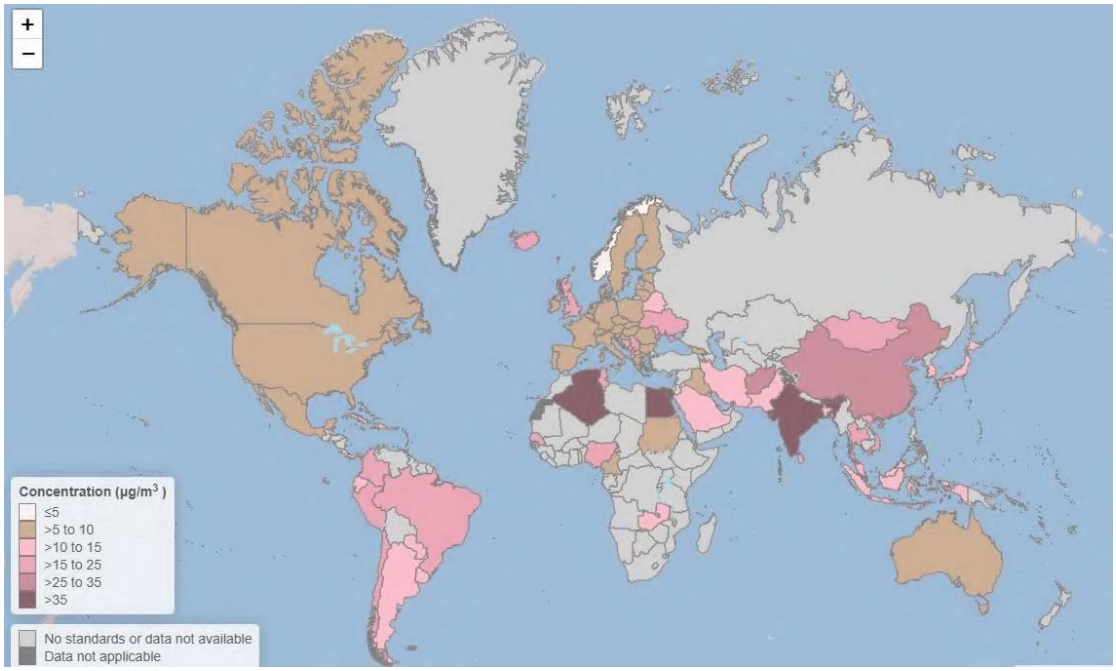


Figure A - 68 – World map of air quality standards for $PM_{2.5}$. Source: WHO Air quality standards database (accessed on 19/3/2025). For the EU, the annual limit values applicable as from 2030 under Directive (EU)2024/2881 were used.

A Brueghel report extracted information for a selection of countries from national policy documents, showing limit/target values[485]:

Table A - 68 – Comparison of air quality regulations in a selection of countries, proxied by $PM_{2.5}$ annual concentrations (ranked from looser to stricter limit/target values)

Country	**$PM_{2.5}$ annual concentration ($\mu g/m^3$)**
UK, except Scotland	20
China	15
Japan	15
Mexico	12
Singapore	12
EU (2024 AAQD, as of 2030)	10
Scotland	10
US	9
Canada	8.8
Australia	8
WHO 2021 guidelines	5

Looking at the list of standards laid down in legal documents as indicated in the WHO database, 67% of countries[486] in the world have introduced standards on air quality. The percentages per world region are shown in the figure below.

485 Juan Mejino López, Miquel Oliu-Barton (2024) – How much does Europe pay for clean air? Brueghel Working paper issue 15/2024, page 7.

486 Number of countries in the world and per region sourced from Worldometer (accessed on 19/3/2025). Kosovo was added to the list of countries in addition to the count on Worldometer.

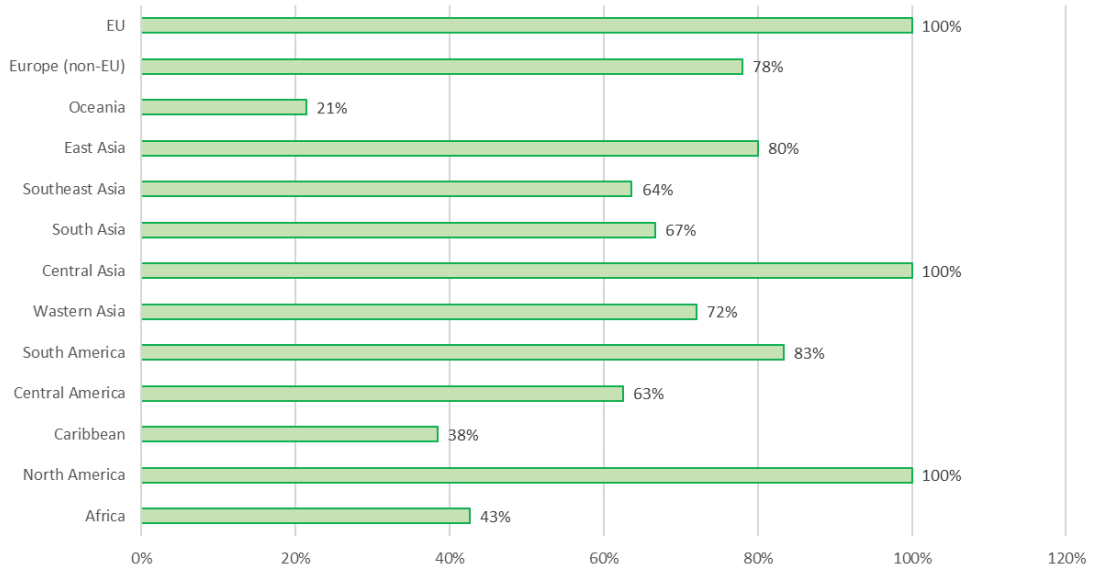


Figure A - 69 – % of countries that introduced legal standards for air quality, split per world region. Source: WHO Air quality standards database (accessed on 19/3/2025).

Legal standards are present in all world regions. The regions where the smallest number of countries introduced standards include Oceania, the Caribbean and Africa. In other world regions the share of countries introducing standards is above 50%. In North America, Central Asia and the EU all countries in the region introduced such standards.

Looking at the principal trading partners of the EU, the majority introduced legal standards. Exceptions are Turkey and the Russian Federation.

2 EMISSION REDUCTIONS IN NON-EU COUNTRIES

To put the results of clean air policy in the EU into an international context, we are providing below an overview of reductions of air pollutant emissions in the EU and non-EU countries. The focus is on principal trading partners of the EU.

The analysis relies on air pollutant inventories provided to the UNECE Air Convention and further elaborated through GAINS modelling. Both are coherent with approaches used in the NECD to quantify emissions. The GAINS model fuels the EU Clean Air Outlooks (CAOs).

Data is systematically gathered in non-EU countries that are also parties to the Gothenburg Protocol, namely Canada, Norway, Switzerland, the UK and the USA. The Centre for Integrated Assessment Modelling (CIAM)[487] of the UNECE Air Convention provides projections up till 2050. For some non-EU countries that are not parties to the Gothenburg Protocol, data is available through GAINS models (unpublished). These include the key trading partners of the EU. As the GAINS model is also at the basis of the EU CAOs, it is

487 https://iiasa.ac.at/policy/applications/centre-for-integrated-assessment-modelling-ciam

possible to compare EU data reflected in the CAOs and data for non-EU countries modelled through the GAINS and data available on the CIAM.

The figure below presents reductions in the emission of air pollutants between 2005 and 2025 for these countries, in comparison to the reductions obtained at EU level.

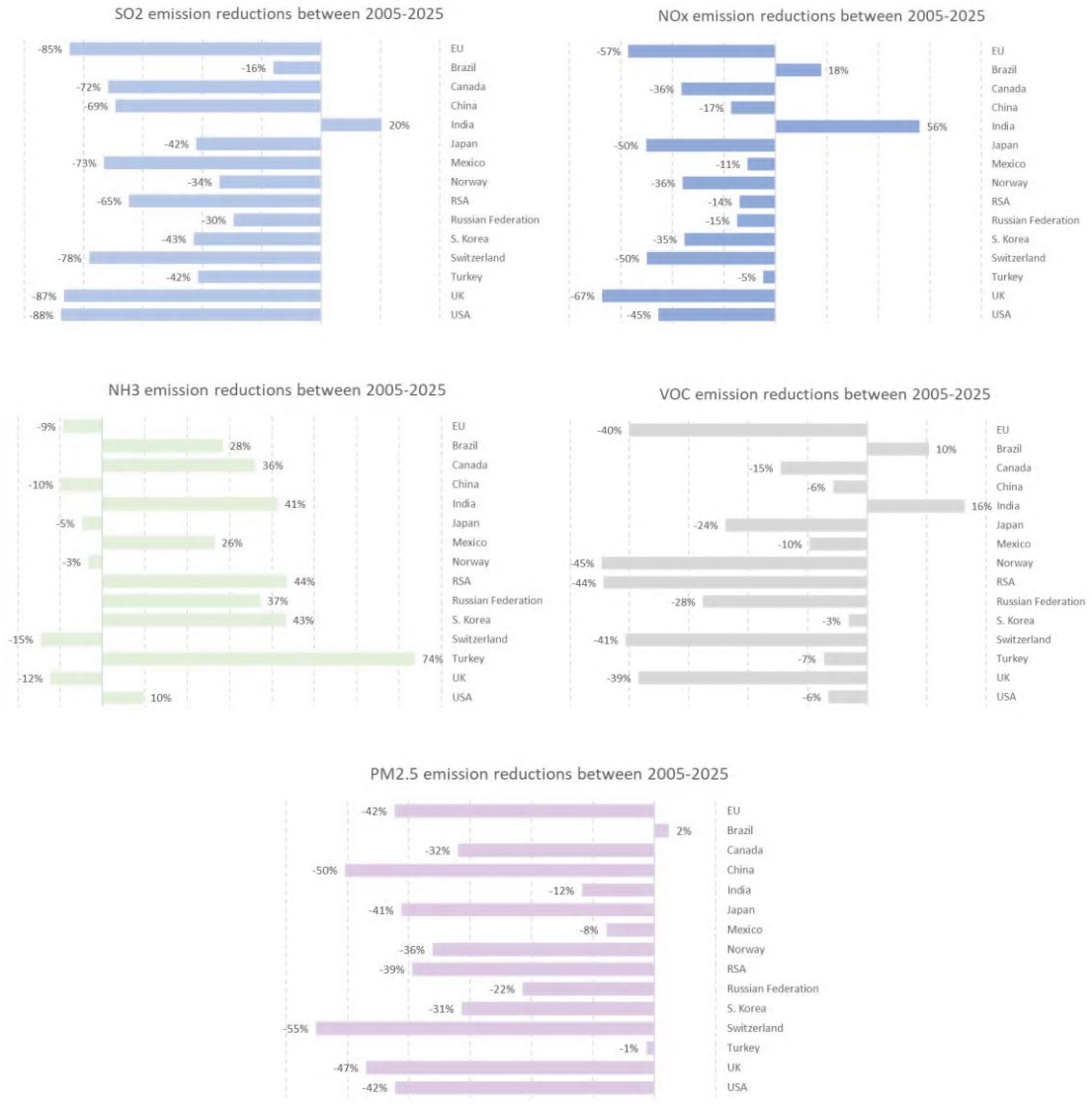


Figure A - 70 – Reductions of the five main air pollutants between 2005 and 2025 for the EU and selected non-EU countries. 2025 data are projected and data is only produced for 5-year intervals. Sources: CIAM and GAINS modelling, IIASA, 2025.

NH_3 emissions are a challenge across all the countries included in the analysis, with emissions growing in most of them. Out of those countries, Switzerland (-15%), the UK (-12%), China (-10%) and the EU (-9%) obtained the most decrease in these emissions. The highest increase can be observed in Turkey (74%).

For **$PM_{2.5}$**, efforts to decrease emissions are put in place in all countries. An increase can be observed in Brazil (2%), reductions are more limited in Turkey (-1%), Mexico (-8%)

and India (-8%). The rest of the countries included in the analysis decreased their emissions by a range between 32% (Canada) and 55% (Switzerland). The EU (-42%) sits alongside the jurisdictions obtaining higher reductions.

SO_2 emissions were considerably reduced in most countries. The highest reductions can be observed in the USA (-88%), the UK (-87%) and the EU (-85%). The graph shows limited reductions in Brazil (-16%) and an increase in emissions in India (20%).

NO_x and **VOC** emissions grew in India and Brazil. For NOx, the reduction percentages ranged between 5% (Turkey) and 67% (UK), with the EU showing a 52% of reduction. For VOC the same range is between 3% (South Korea) and 45% (Norway), with the EU reaching a 40% reduction.

Overall, the graph shows that the policies and measures introduced in the EU had a visible impact, with the EU reductions being among the highest for all pollutants. **Reduction rates obtained in the EU are often comparable to efforts in some other trading partners**, with reduction levels generally closest to China, Japan, Norway, Switzerland, the UK and the USA, depending on the pollutant.

The graphs below show the evolution of the emission of air pollutants in kiloton, including projections for the years 2025-2050.

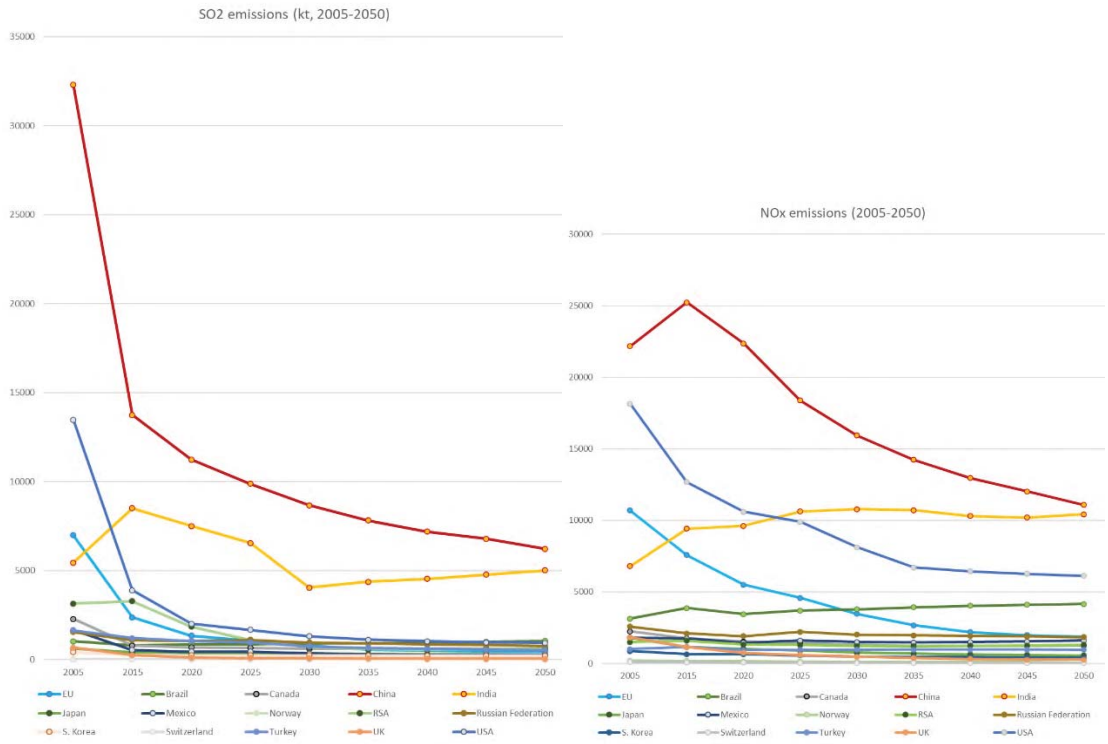
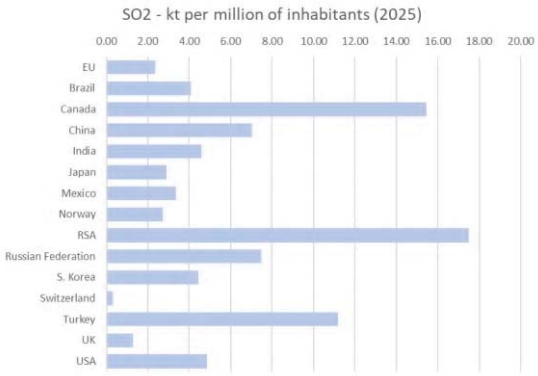


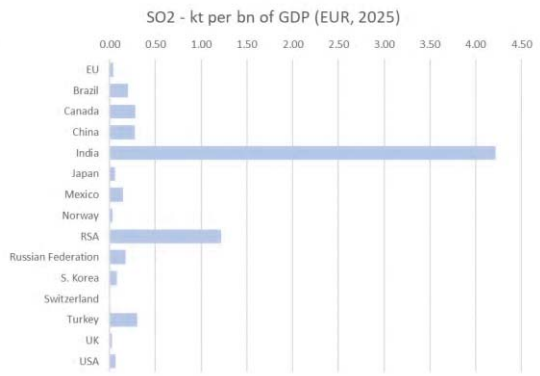
Figure A - 71 – Evolution of the five main air pollutants between 2005 and 2025 in selected countries in kilotonnes (kt). Sources: CIAM and GAINS modelling, IIASA, 2025

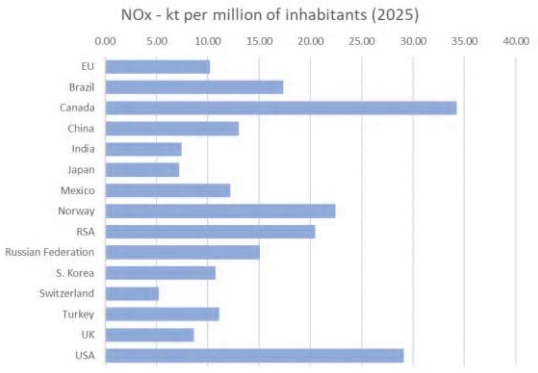
Air pollutant emissions are the highest in China and India. China is expected to reduce these significantly over the coming decades, whilst emissions in India are lower, but show an increasing trend.

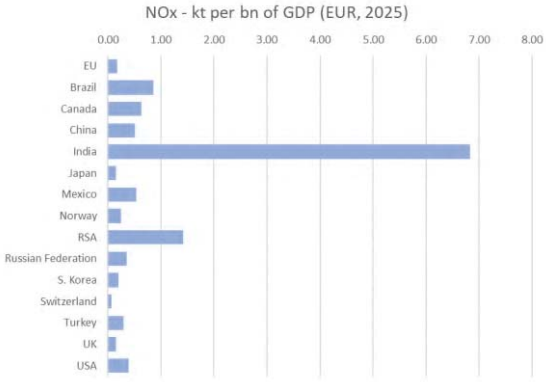
All countries included in the analysis are expected to reduce their SO_2 emissions further. For NO_x, VOC and $PM_{2.5}$ the majority of the countries are expected to reduce their emissions, with some increase noted for Brazil (NO_x, VOC), India ($PM_{2.5}$), the Republic of South Africa (NO_x, VOC) and Turkey (NO_x, VOC). Most countries are expected to increase their NH_3 emissions, with the exception of the EU and the UK. The lowest increase is expected for China, Japan and Switzerland and the highest increase (above 100%) for the Republic of South Africa.

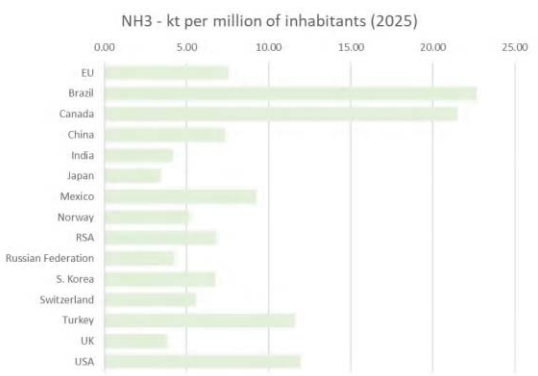
To understand better the levels of emissions, we have put them in relation of the population and GDP of the countries included in the analysis. Figures below displaying kilotonnes of emissions per million of inhabitants give an idea of the comparability of emissions across the countries included into the analysis. Figures showing kilotonnes of emissions per billion euro show the emission-intensity of GDP in the countries included into the analysis.

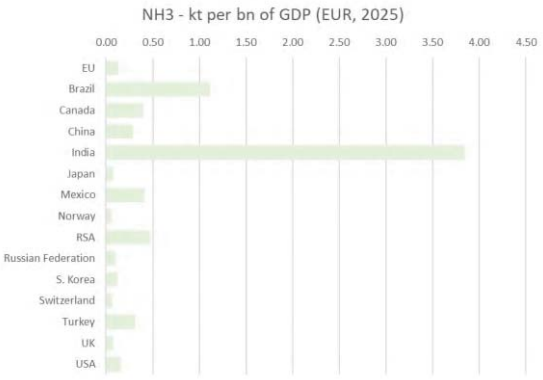

SO2 - kt per million of inhabitants (2025)
0.00 2.00 4.00 6.00 8.00 10.00 12.00 14.00 16.00 18.00 20.00
EU
Brazil
Canada
China
India
Japan
Mexico
Norway
RSA
Russian Federation
S. Korea
Switzerland
Turkey
UK
USA

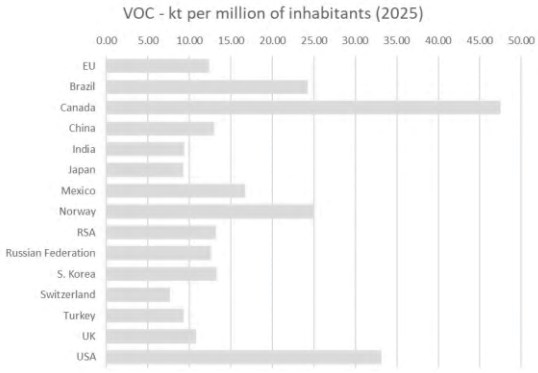

SO2 - kt per bn of GDP (EUR, 2025)
0.00 0.50 1.00 1.50 2.00 2.50 3.00 3.50 4.00 4.50
EU
Brazil
Canada
China
India
Japan
Mexico
Norway
RSA
Russian Federation
S. Korea
Switzerland
Turkey
UK
USA

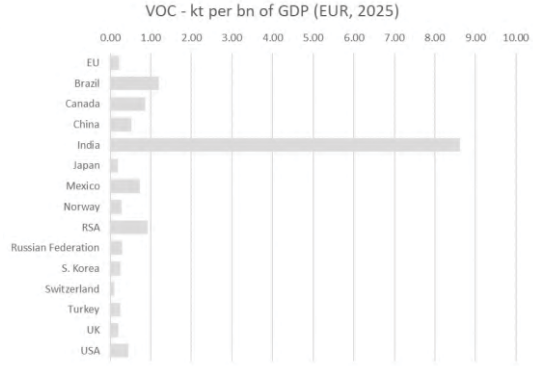

NOx - kt per million of inhabitants (2025)
0.00 5.00 10.00 15.00 20.00 25.00 30.00 35.00 40.00
EU
Brazil
Canada
China
India
Japan
Mexico
Norway
RSA
Russian Federation
S. Korea
Switzerland
Turkey
UK
USA


NOx - kt per bn of GDP (EUR, 2025)
0.00 1.00 2.00 3.00 4.00 5.00 6.00 7.00 8.00
EU
Brazil
Canada
China
India
Japan
Mexico
Norway
RSA
Russian Federation
S. Korea
Switzerland
Turkey
UK
USA


NH3 - kt per million of inhabitants (2025)
0.00 5.00 10.00 15.00 20.00 25.00
EU
Brazil
Canada
China
India
Japan
Mexico
Norway
RSA
Russian Federation
S. Korea
Switzerland
Turkey
UK
USA


NH3 - kt per bn of GDP (EUR, 2025)
0.00 0.50 1.00 1.50 2.00 2.50 3.00 3.50 4.00 4.50
EU
Brazil
Canada
China
India
Japan
Mexico
Norway
RSA
Russian Federation
S. Korea
Switzerland
Turkey
UK
USA


VOC - kt per million of inhabitants (2025)
0.00 5.00 10.00 15.00 20.00 25.00 30.00 35.00 40.00 45.00 50.00
EU
Brazil
Canada
China
India
Japan
Mexico
Norway
RSA
Russian Federation
S. Korea
Switzerland
Turkey
UK
USA


VOC - kt per bn of GDP (EUR, 2025)
0.00 1.00 2.00 3.00 4.00 5.00 6.00 7.00 8.00 9.00 10.00
EU
Brazil
Canada
China
India
Japan
Mexico
Norway
RSA
Russian Federation
S. Korea
Switzerland
Turkey
UK
USA

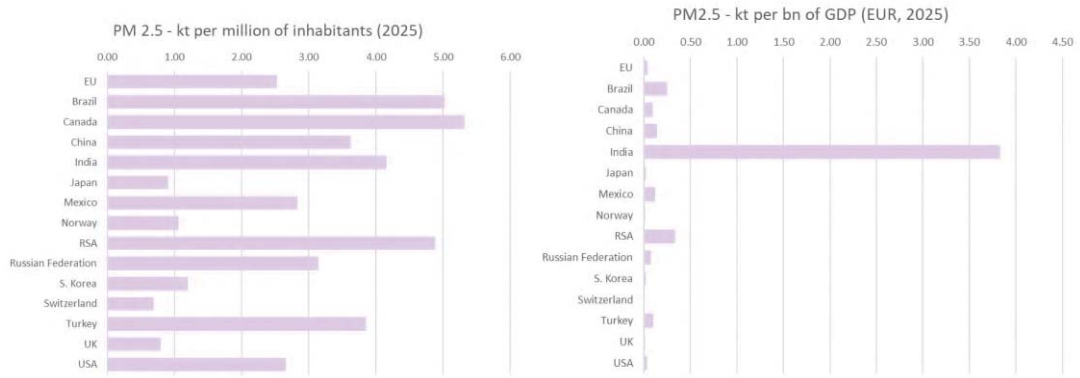


Figure A - 72 – Emissions of the five main air pollutants in the EU and major trading partners in 2025, shown per million of inhabitants and per EUR billion of GDP.

Air pollutant emissions per million of inhabitants show a more nuanced comparison between the levels of emissions in the countries included into the analysis. Emissions per population are the lowest in Switzerland, with the exception of NH_3, where the lowest value is observed in Japan. Emissions are the highest in Brazil (NH_3 and $PM_{2.5}$), Canada (high values across all pollutants), the Republic of South Africa (SO_2) and the USA (NO_x and VOC). The EU's emissions are below the average for SO_2, above but close to the average for NO_x and $PM_{2.5}$, and above the average for NH_3 and VOC.

Air pollutant emissions generated per billion euro of GDP are consistently the highest in India, and showing a considerably higher value than all other countries included into the analysis. The emission-intensity of the economy in the EU is generally at the lower end of this indicator, and is closest to Canada, Japan, South Korea, the UK and the USA, depending on the pollutant. This value is the lowest in Switzerland, except for NH_3, where the lowest value is observed in Norway.

It is possible that some of the air pollutant emissions in major trading partners are due to companies that relocated from the EU to third countries; however, this analysis did not find any evidence that EU clean air policy is driving relocation. In any case, this issue is best tackled at international level. The Air Convention highlights the need to assist countries in Eastern Europe, the Caucasus and Central Asia in the ratification and implementation of the Convention, and organises regular capacity building to this purpose[488]. Currently, no information is available on the contribution of EU funding to mitigating these effects. Statistics on spending under the Global Europe instrument register no contribution to climate mainstreaming in the 2021-2024 period, but is expected to reach a share of 25% between 2025-27[489]. If this share is realised, co-benefits are expected for clean air.

In conclusion, UNECE CIAM data show that comparable abatement is taking place in the EU, China, Japan, Norway, Switzerland, the UK and the USA, depending on the pollutant.

488 See UNECE (2024) - Addendum to the 2024-25 workplan for the implementation of the Convention.

489 https://commission.europa.eu/strategy-and-policy/eu-budget/performance-and-reporting/programme-performance-statements/neighbourhood-development-and-international-cooperation-instrument-global-europe-performance_en

Air pollutant emissions in absolute terms are the highest in China and India. China is expected to reduce these significantly over the coming decades, whilst emissions in India are lower, but show an increasing trend. Further reductions are expected over the coming decades for all pollutants in the majority of the countries included into the analysis, with the exception of NH_3, where the majority of the countries shows an increase.

When looking at emission of air pollutants per million of inhabitants in 2025, we see that the EU is situated in the mid-range, with only SO_2 emissions being below the average of the countries included into the analysis. Air pollutant-intensity of the GDP is at the lower end for the EU, with Canada, Japan, South Korea, the UK and the USA showing similar values, depending on the pollutant.

ANNEX IX. EXAMPLES OF MEMBER STATE APPROACHES TO REDUCE EMISSIONS

1 INTRODUCTION

The following examples provide insights into how three Member States with distinct agricultural sectors have put forward efforts to reduce ammonia emissions.

2 ADDRESSING AMMONIA EMISSIONS IN DENMARK

This example was selected to illustrate an approach that led to significant reductions in ammonia emissions since 2020.

Relevance of the issue

Based on 2022 inventory data, in Denmark 96.3% of ammonia emissions stem from agriculture. Around half of ammonia emissions comes from the handling of livestock manure in stables and warehouses (around 43%) and the other half from agricultural land in the form of distribution of fertiliser and manure and emissions from growing crops (around 53%)[490].

The primary agricultural sector accounts for 15% of Denmark's gross value added. Pigmeat and dairy are the most important sectors in terms of production value and represent 7% of the EU production of pigmeat and 4% of the production of raw milk. There are approximately 35 000 farms in Denmark, with an average physical size of 75ha[491]. These classify as large, with the EU average mean size of agricultural holdings being 17.4ha in the EU in 2020 and with only an estimated 18% of farms that were this size or larger[492]. Over 90% of utilised agricultural area is arable land characterised by intensive and specialised production[493].

The ERC of Denmark for 2020-29 is among the highest in the EU, committing to 24% reduction respectively to 2005 levels. The same percentage applies for the period 2030 and onwards.

Based on the initial policies and measures ('with measures' scenario), Denmark projects to be in compliance for 2025 with the 2020-29 ERCs and also for the ERCs of 2030 and beyond.

490 NAPCP of Denmark, 2023 update
491 EC (2025), At a glance: Denmark's CAP Strategic Plan.
492 EC(2022), Farms and farmland in the European Union – statistics.
493 https://ec.europa.eu/commission/presscorner/detail/fr/memo_14_2628

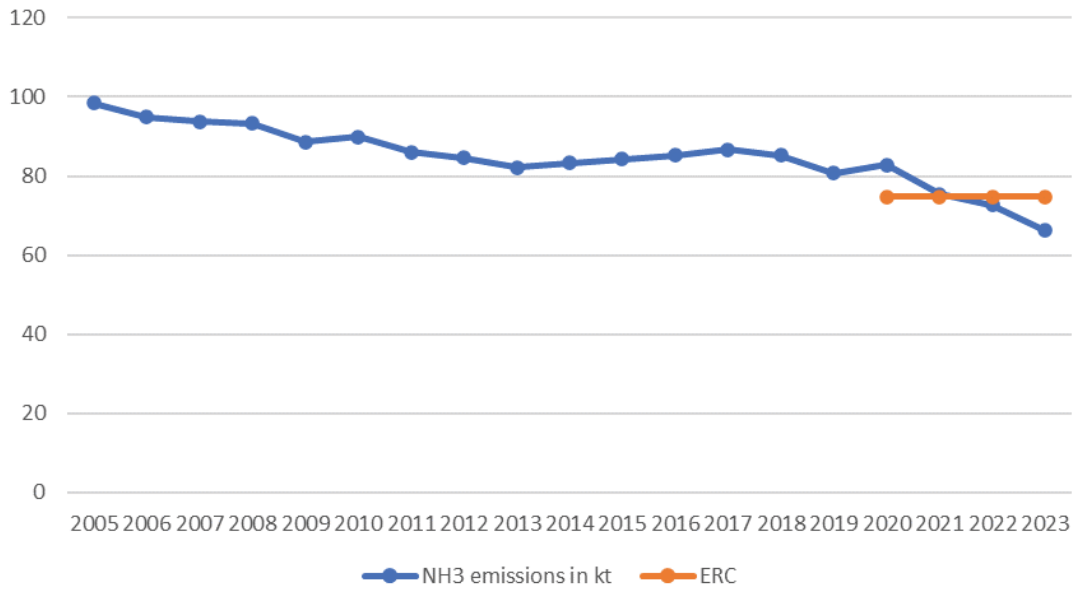


Figure A - 73 – NH_3 emissions in Denmark since 2005. NECD ERCs apply from 2020. Note: The figure is based on data submitted by Denmark in 2025 (from EEA data viewer 2025)

The 2020 and 2021 inventories (submitted in 2022 and 2023, respectively) showed a non-compliance with the ERC. The Commission opened an infringement case against Denmark for not respecting the ammonia ERC with a letter of formal notice dated 26 January 2023[494]. The infringement case is still open at the time of drafting this evaluation.

External circumstances specific to Denmark and influencing ammonia emissions were the temporary ban on keeping mink for fur production (2021-22), which resulted in lower production levels; and higher fertiliser prices due to the energy crisis of 2021, leading to a significant decrease in the consumption of fertilisers and related emissions.

Policies and measures

The foundation of acting on ammonia was the **implementation of BATs** linked to the IED for livestock farming starting with 2007[495] and amended in 2017. This also included additional requirements regarding deposition for nearby nitrogen-sensitive habitats. According to the Danish NAPCP, BATs, together with requirements related to deposition and a general requirement for reducing ammonia were the driving force for low-emission stables, feed optimisation and the use of environmental technologies for reducing ammonia emissions from stables.

A requirement for **protective cover** for slurry stores was in place since 1988 and requirements were introduced for fixed covers for solid manure since 2001 based on the Ammonia Action Plan. The same Plan introduced a ban on wide **spreading of manure** and a tightening of incorporation time when applying manure on unvegetated land to 6 hours. In 2011, requirements for incorporation in grass and brown earth was made general.

494 https://ec.europa.eu/commission/presscorner/detail/en/inf_23_142

495 Act on environmental approval for livestock (Act no 1572 of 20 December 2006), first entered into force on 1 January 2007 and amended by Act no 204 of 28 February 2017.

The 2019 amendment to the Livestock Manure Order strengthened the requirements for the use of fertilisers with particularly high emissions (sulphate of ammonia and urea).

A **voluntary agreement** for limiting the content of crude protein in feed for dairy cattle and pigs for fattening is in place since 2020.

No new measures were introduced in Denmark based on Annex III part 2 of the NECD. Most of the practices listed there were covered by pre-existing measures, with the exception of the voluntary establishment of a national advisory code for the management of harvest residue, which Denmark did not address.

These policies are all part of the "with measures" (WM) scenario. Given the non-compliance with the 2020-29 ERC, recommendations from the review of the NAPCP included the definition of additional PaMs. Denmark (in their NAPCP) justified not doing so by the fact that their 2021 inventory submission showed a NH_3 reduction of 23.9% compared to the 2005 baseline (the ERC is 24%). Therefore, they assumed that they would achieve their 2020-2029 ERC for ammonia in the following years. The consultant's 2023 NAPCP review concluded that Denmark was **at low risk of non-compliance** with their ERCs on NH_3. Denmark's emission inventories for 2022 and 2023 (submitted in 2024 and 2025, respectively), show compliance with the NH_3 ERC for 2020-2029 period. The 2022 inventory indicates a 3% compliance margin, whilst the 2023 inventory displays a 13% compliance margin.

In its PaMs[496], Denmark provided absolute cost figures for four measures out of the seven related to agriculture. The measures related to reducing greenhouse gases from agriculture with positive impact on ammonia emissions; the establishment of a committee on ammonia reducing measures; funding for improved animal housing through the EU fund for Rural Development; and improved management of manure. The combined cost of these four measures is EUR 63.8 million at 2019 prices, which represented 2.1% of the gross value added[497] of the Danish agricultural sector in 2019 and 0.02% of the 2019 Danish GDP.

Conclusions

Denmark started addressing ammonia emission from agriculture in 1987 and applied best practices early on. Between 1990 and 2020, total Danish ammonia emissions fell by around 46%. This was mainly due to a decrease in emissions from agricultural land.

The NECD sets a relatively ambitious ammonia reduction commitment of 24% for Denmark and Denmark put in place policies to address ammonia emissions. These included the use of IED BATs complemented with additional provisions, which is particularly relevant in Denmark, with 90% of the agricultural land dedicated to intensive production. Furthermore, requirements on the use of manure and its storage and voluntary agreements on animal feed were put in place.

496 EEA, NECD policies and measures database, 18/12/2024 version.
497 Eurostat, Gross value added of the agricultural industry – basic and producer prices, accessed on 25/3/2025.

Whilst inventories for 2020 and 2021 showed non-compliance with the 2020-29 ERC for ammonia, 2022 and 2023 inventories register compliance. Projected compliance for the ERCs of 2030 beyond also show compliance.

3 ADDRESSING AMMONIA EMISSIONS IN AUSTRIA

Relevance of the issue

Based on 2022 inventory data, in Austria 94% of ammonia emissions stem from agriculture. Half of ammonia emissions comes from the handling of livestock manure in stables and warehouses (49%), the next important source is spreading of manure on land (38%), the remainder is mostly due to mineral fertiliser application (11%)[498].

The agricultural sector of Austria is characterised by many (more than 110 000) small-scale farms (managing on average about 20ha of land), many of which located in mountainous areas with specific constraints on farming. 82 000 of farms have animal husbandry, with averages of 34 head of cattle, 112 pigs, 33 sheep and 12 goats per farm[499]. The primary sector accounts for 1.2% of the Austria' gross value added (GVA)[500].

The ERC of Austria for 2020-29 requires a reduction of 1% of NH_3 emissions compared to 2005 levels. A more ambitious commitment requiring a reduction of 12% applies for the period 2030 and onwards. Emissions of NH_3 decreased by 9% between 1990 and 2005. They have been influenced by changes in livestock numbers, as well as a change of housing systems in cattle rearing from tied housing to loose housing[501]. Between 2005 and 2017, NH_3 emissions increased by over 3%, with some ups and downs as shown in the Figure. Since 2017, emissions decreased by almost 9%, leading to an almost 6% reduction for 2005-2023 according to the Austrian emission inventory submitted in 2025. The first Austrian NAPCP (July 2019) projected non-compliance for the NH_3 ERC in 2030 under both 'with measures' and 'with additional measures' scenarios.

498 Presentation by Austrian Federal Agriculture and Environment Ministry 'Challenges in reducing ammonia emissions utilising CAP Strategic Plans in Austria' given at the September 2024 'TAIEX-EIR multi-country Flagship workshop on Air quality: Implementation of the National Emissions Commitment reductions Directive (NECD) to further mainstream air and broader pollution reduction in agricultural policy' [*henceforth*: 2024 TAIEX presentation AT].

499 2024 TAIEX presentation AT.

500 EC (2025) At a glance: Austria's CAP Strategic Plan.

501 Updated Austrian NAPCP

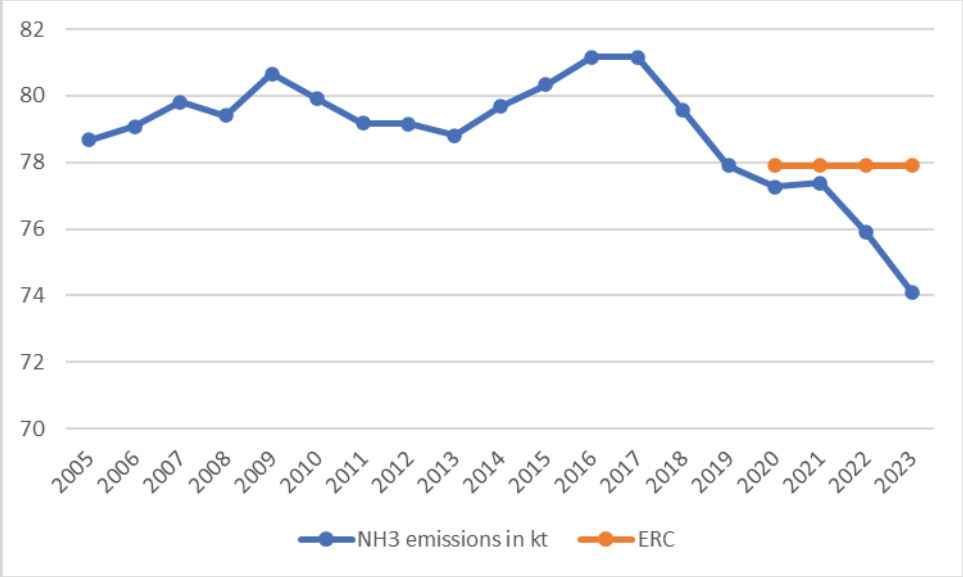


Figure A - 74 – NH_3 emissions in Austria since 2005. NECD ERCs apply from 2020. Note: The figure is based on data submitted by Austria in 2025 (from *EEA data viewer 2025*)

Unlike the figure above, which is based on the latest submission made in 2025[502], the 2020, 2021 and 2022 inventories (submitted in 2022, 2023 and 2024, respectively) showed a non-compliance with the ERC. The Commission opened an infringement case against Austria for not respecting the ammonia ERC with a letter of formal notice dated 26 January 2023[503]. Due to the continued non-compliance, the case was taken forward with a reasoned opinion issued in November 2023[504]. The infringement case is still open at the time of drafting this evaluation.

Policies and measures

Austria submitted an updated NAPCP in early 2024 (dated February 2024). According to the updated NAPCP, emission reduction measures implemented under the Austrian CAP funded agri-environment programme (ÖPUL) have curbed the increase in emissions. The financial volume of the Austrian CAP Strategic 2023-2027 amounts to 1,86 billion EUR/year[505]. Nevertheless, additional measures were considered necessary. As mentioned at the TAIEX event, estimating uptake of CAP linked voluntary measures is difficult to predict. Mandatory measures were therefore considered necessary to complement.

The updated NAPCP projects compliance with the NH_3 ERC 'with additional measures' by 2024. As seen above, already 2023 data (submitted in 2025) indicate compliance. The updated NAPCP describes several measures to forward to address NH_3 emission. The **ammonia reduction ordinance** entered into force in January 2023 and obliges farmers to **incorporate within 4 hours** fertilisers on agricultural land without soil cover (applies to

502 Emission inventories submitted each year by Member States always contain the full time series since 1990, as sometimes changes in methodologies for estimating emissions also change the historic emissions.

503 https://ec.europa.eu/commission/presscorner/detail/en/inf_23_142

504 https://ec.europa.eu/commission/presscorner/detail/en/inf_23_5380

505 2024 TAIEX presentation AT.

liquid and solid farm manure, digestate, undrained sewage sludge and unstabilised urea fertilizer). It also requires **covering manure storage** facilities (with different provisions for new and existing facilities). An evaluation of the regulation is foreseen by the end of 2026 at the latest. If necessary, further mandatory measures may be imposed, such as low emission techniques for spreading manure or a complete ban of urea fertilizers, to comply with the 2030 ERC[506].

Further measures are planned (for application in 2024, according to the updated NAPCP) and have been included in the 'with additional measures' scenario of the NAPCP:

- Optimised nitrogen fertilisation: e.g. forced application with trailing hose, trailing shoe and injector; digitalisation and precision farming;
- Further advancements in livestock farming: increasing the share of cattle grazing; better cleaning of cattle sheds; reducing the proportion of fully slatted floors for pigs; increasing the use of belt systems for manure removal for chickens;
- Animal waste treatment: increasing production of biogas from slurry; increasing slurry separation;
- Reduced protein diet: reducing the raw protein content in cattle and pig feed.

Prior to the adoption of the ammonia reduction ordinance, there was a long (> 2 years) process of **extensive discussions across relevant ministries but also involving key stakeholders**, e.g. the Chamber of Agriculture as well; as the Environmental Agency Austria. It also involved conducting studies to have a good and quantified understanding of feasibility and reduction potentials of different measures, as well as data surveys amongst livestock farms to have more accurate and detailed activity data[507].

Annex III part 2 of the NECD are largely implemented in Austria, with the exception of a national advisory code of good agricultural practices for the proper management of harvest residues. An initial national nitrogen budget is being prepared by the Federal Environment Agency (as stated in the updated NAPCP). Some of the optional measures are introduced or reinforced through the ammonia reduction ordinance.

Conclusions

Austria ERC for ammonia is to reduce emissions by 1% over 2020-29, and by 12% as of 2030. Austria's agricultural sector is characterised by a many small-scale farms, often operating in mountainous areas, many of which engage in animal husbandry. Emissions of ammonia have been on the rise since 2005 until 2017, with reductions achieved since then, and more accelerated reductions in recent years. Inventory data for 2020-2022 showed non-compliance with the ammonia ERC.

Austria has made extensive use of CAP support to promote ammonia reduction measures but considered that mandatory measures are needed to complement. To reach agreement

506 Austria's updated NAPCP and 2024 TAIEX presentation AT.
507 2024 TAIEX presentation AT.

on mandatory measures, extensive consultations across ministries and involving key stakeholder, including from the farming sector, were conducted, and detailed background knowledge on reduction measures and activity data was sourced. Austria adopted an ammonia reduction ordinance (entered into force in January 2023), which obliges rapid (within 4 hours) incorporation of fertilisers as well as covering of manure storage. Further measures were put forward to for application as of 2024.

The latest inventory submitted in 2025, containing emissions data for 2023 and earlier, indicates compliance with the ERC, with a reduction of close to 6% achieved since 2005. The updated Austrian NAPCP also projected compliance with the 2030 ERC based on additional measures.

4 ADDRESSING AMMONIA EMISSIONS IN IRELAND

This example was selected to illustrate an approach that led to reductions in ammonia emissions amidst recent growth in output from the agricultural sector.

Relevance of the issue

Agriculture accounts for over 99% of Ireland's NH_3 emissions in 2022, the main sources being manure management from cattle (40%), manure application (26%), nitrogen fertiliser application (14%) and depositions from grazing animals (11%)[508].

There are around 135 000 farms in Ireland, with an average farm size of around 33ha. Farms in Ireland have become increasingly specialised towards livestock production, particularly beef and dairy. The agri-food sector accounts for 4.3% of the country's economy (total GVA)[509].

The ERC of Ireland for 2020-29 requires a reduction of 1% of NH_3 emissions compared to 2005 levels. A more ambitious commitment requiring a reduction of 5% applies for the period 2030 and onwards. Emissions of NH_3 decreased between 2005 and 2011/2012, but then saw a rather steep increase until 2018, driven in large part by changes in milk production following the removal of EU milk quotas and strategies to develop and grow the sector in Ireland, going along with increases in cattle populations, dairy production and nitrogen fertiliser use[510]. NH_3 emissions subsequently increased by around 5% over 2005-2018. Since 2018, emissions decreased by over 10%, leading to a 6% reduction for 2005-2023, all based on the latest emission inventory submitted by Ireland in 2025.

508 NECD data viewer 2005-2022
509 EC (2025). At a Glance: Ireland's CAP Strategic Plan.
510 Irish 2021 NAPCP

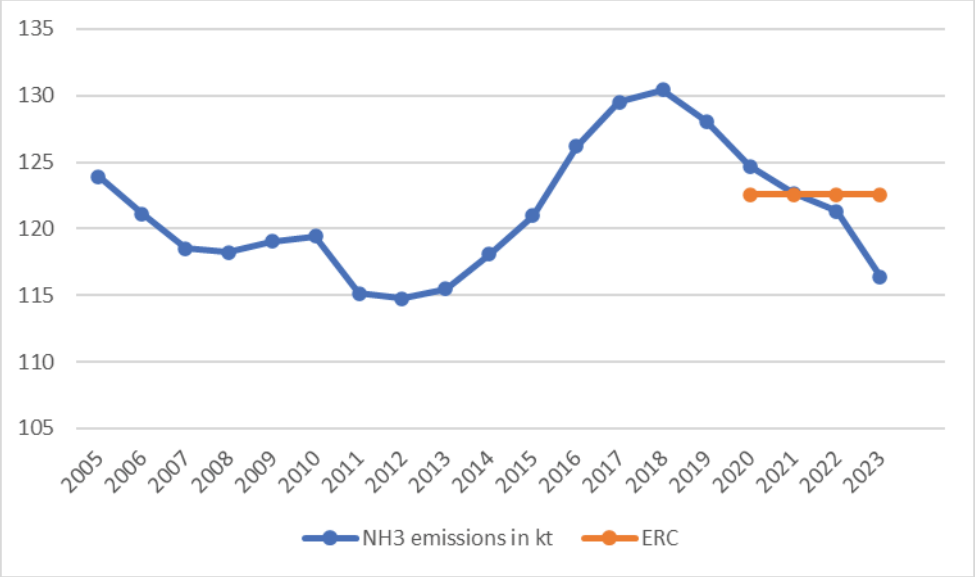


Figure A - 75 – NH_3 emissions in Ireland since 2005. NECD ERCs apply from 2020 Note: The figure is based on data submitted by Ireland in 2025 (from *EEA data viewer 2025*)

The 2020, 2021 and 2022 inventories (submitted in 2022, 2023 and 2024, respectively) showed a non-compliance with the ERC. The Commission opened an infringement case against Ireland for not respecting the ammonia ERC with a letter of formal notice dated 26 January 2023[511]. Due to the continued non-compliance, the case was taken forward with a reasoned opinion issued in November 2023[512]. The infringement case is still open at the time of drafting this evaluation.

Policies and measures

The implementation of measures improving farm efficiency and mitigating harmful emissions, notably low-emission slurry spreading (LESS) and the use of inhibited urea fertiliser, have led to some decoupling of the increased production from rising emissions[513]. However, continuation of existing measures would lead to further increases in NH3 emissions. The 'with additional measures' scenario of the 2021 NAPCP included measures such as increased uptake of LESS for pig and cattle manure as well as of inhibited urea products, reducing the crude protein content of pig feed and introducing clover into grass swards. Including these additional measures projected lower increases in emissions, but with ERCs still exceeded. Annex III part 2 of the NECD are largely implemented in Ireland, with the exception of a national nitrogen budget (voluntary measure) as well as of some inorganic fertiliser related measures.

511 https://ec.europa.eu/commission/presscorner/detail/en/inf_23_142
512 https://ec.europa.eu/commission/presscorner/detail/en/inf_23_5380
513 Irish 2021 NAPCP and Irish 2024 NAPCP

In the recent years, stabilisation of the national herd was achieved; dairy cows increased by 1.3%, but other cows were down by 4.5% and total sheep numbers decreased by 4.9%. Since 2018, the application of chemical nitrogen reduced by 30%[514].

In 2023, Ireland published a **Clean Air Strategy**, to help promote integrated clean air measures across transport, energy, residential heating and agriculture sectors. This national framework is hoped to assist Ireland in developing the necessary PaMs to support compliance with EU and international ambitions on air quality and air pollution and to facilitate integration with national climate policies.

In September 2023, Ireland submitted **additional measures targeting NH_3 emissions** in accordance with Article 6(4) of the NECD. These include increased reduction potential from further uptake of LESS, as well as a range of other measures addressing emissions from slurry and manure handling and chemical nitrogen use. In May 2024, Ireland submitted an updated NAPCP. The 'with additional measures' **projections in the 2024 NAPCP indicate compliance with the currently applicable NH_3 ERC as of 2023, and also project compliance in 2030 with the more ambitious ERC**. Both submissions list two further measures that are under consideration for the future, i.e. 1) further reduction in the crude protein in concentrates for grazing livestock, and 2) restriction on the use of unprotected/straight urea (solid/granular form) on both grassland and arable crops.

Selection of additional measures was based on economic cost and reduction capacity. Policy makers could rely on the marginal abatement cost curves (MACC) developed by Teagasc, the Agriculture and Food Development Authority, which quantifies potential to abate ammonia emissions up to 2030[515]. The ammonia MACC identifies 13 measures with associated reduction potential and costs/benefits. Measures such as using protected urea, changing the crude protein content in feed and introducing clover come in fact with negative economic costs. The MACC estimates an average abatement potential at approx. 15.26 kt at a cost of €10.86 million per year. Full implementation of the **using protected urea** and of **LESS** would achieve **80% of the total estimated mitigation potential**[516].

In implementing ammonia reduction measures, Irish authorities sought **synergies with nitrogen reduction measures** taken in accordance with requirements resulting from the **Nitrates Directive**. Ireland's 5th National Action Programme under the Nitrates Directive mandates the use of LESS; amongst other relevant measures[517]. Ireland also highlighted the eco-scheme and the Agri Climate Rural Environment Scheme (ACRES) under their CAP Strategic Plan to support implementation on the ground of LESS and other measures.

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514 Presentation by the Irish Department Agriculture, Food and the Marine on 'Irish policies and measures in relation to ammonia emissions', given at the September 2024 'TAIEX-EIR multi-country Flagship workshop on Air quality: Implementation of the National Emissions Commitment reductions Directive (NECD) to further mainstream air and broader pollution reduction in agricultural policy' [*henceforth*: 2024 TAIEX presentation IE].

515 https://www.teagasc.ie/media/website/publications/2020/NH3-Ammonia-MACC.pdf

516 Based on 2024 TAIEX presentation IE, which also clarifies that this assessment is based on the maximum technical abatement potential, something that is extremely challenging to achieve in practice.

517 Irish 2024 NAPCP

The latter comes with a budget of €1.5 billon over 2023-27 and has 55 000 participating farms across Ireland[518]. At the TAIEX event, the Irish representative reflected on obstacles to **engaging with farmers** and getting them on-board. In this context, they found that small, **farmer-led discussion rounds helped**.

Conclusions

Agriculture accounts for over 99% of Ireland's NH_3 emissions in 2022, the main sources being manure management and application as well as chemical fertiliser application. NH_3 emissions have seen a steep increase between 2011 and 2018, given an agricultural sector increasingly specialised towards livestock production, particularly beef and dairy, with removal of EU milk quotas leading to increased production. The NECD sets an ERC for of 1% for the current period, and 5% for 2030 and onwards. Inventory data for 2020-2022 showed non-compliance with the ammonia ERC.

The implementation of measures improving farm efficiency and mitigating harmful emissions, notably low-emission slurry spreading (LESS) and the use of inhibited urea fertiliser, have counteracted to some extent the rise of emissions from increased production. Ireland has intensified efforts in past years to increase uptake of these and other reduction measures. A marginal abatement cost curve for ammonia provided by Teagasc, the Agriculture and Food Development Authority, provided quantified reduction potential to abate ammonia emissions and associated costs and benefits and hence an evidence base to select measures.

CAP support is available under the 2023-27 CAP Strategic Plan and several measures are benefiting both commitments under the NECD and the Nitrates Directive. Irish authorities actively seek to ensure synergies between the two. Direct engagement with farmers has also been noted as a success factor. According to the Irish inventory submitted in 2025, 2022 and 2023 NH_3 emissions are below the maximum allowed level stipulated in the NECD.

[518] 2024 TAIEX presentation IE and https://capnetworkireland.eu/schemes/acres/.