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The Third Clean Air Outlook

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1. INTRODUCTION

Air pollution has decreased over the last decades in the EU, as a result of EU clean air legislation and joint action taken by the EU and national, regional and local authorities. Yet air quality remains a serious concern for European citizens[1].

The EU's approach to improving air quality involves taking action in three areas (or 'pillars'). The first is the ambient air quality standards set out in the Ambient Air Quality Directives[2]. The second is to set national emission reduction obligations under the National Emission reduction Commitments Directive (NEC Directive)[3] for the main transboundary air pollutants[4]. The third is to set emission standards at EU level, laid down in legislation, for key sources of pollution, from vehicle and ship emissions to energy and industry, as well as eco-design requirements for boilers and stoves.

All three pillars evolve to adapt to new policy and scientific developments. In particular, following the mandate under the European Green Deal and the EU's ambition to reach zero pollution for a toxic-free environment, the Commission recently **proposed to revise the Ambient Air Quality Directives**[5]. The proposal puts the EU on a path to achieve zero pollution for air at the latest by 2050 and sets interim 2030 ambient air quality standards aligned more closely with the updated air quality guidelines issued by the World Health Organization (WHO) for key air pollutants[6].

As regards the **NEC Directive**, **compliance checks** are carried out against the national emission reduction commitments for 2020-2029 for the five most harmful transboundary air pollutants. The first compliance check took place in 2022, after Member States submitted national inventories with data on their 2020 pollutant emissions. This revealed that **much more action is needed in 14 Member States**, **in particular to reduce ammonia emissions from the agricultural sector**[7].

As regards addressing emissions at source, the Commission presented recently a proposal for a new, more stringent Euro 7 emission standard for new motor vehicles. Earlier this year, it also proposed revising the Industrial Emissions Directive[8]. The Commission has reviewed the national strategic plans for the new common agricultural policy for 2023-

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1 https://europa.eu/eurobarometer/surveys/detail/2660

2 Directive 2004/107/EC relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air - and - Directive 2008/50/EC on ambient air quality and cleaner air for Europe.

3 Directive (EU) 2016/2284 on the reduction of national emissions of certain atmospheric pollutants.

4 Sulphur dioxides (SO_2), nitrogen oxides (NO_x), ammonia (NH_3), non-methane volatile organic compounds (NMVOC) and fine particulate matter ($PM_{2.5}$).

5 COM(2022) 542.

6 WHO (2021) WHO Global Air Quality Guidelines.

7 https://environment.ec.europa.eu/topics/air/reducing-emissions-air-pollutants/emissions-inventories_en#review-of-national-emission-inventories

8 COM (2022) 586 (Euro 7) and COM(2022) 156 (revised Industrial Emissions Directive). These (as other Commission proposals referred to in this report) are subject to discussions between the Council and the European Parliament and therefore subject to changes.

2027 and the proposed schemes which offer the possibility to support investments towards ammonia reduction.

This third edition of the Clean Air Outlook assesses the prospects of achieving the objectives of the NEC Directive for 2030 and beyond, in terms of reducing emissions of air pollutants and subsequent impacts on air quality, health, ecosystems and the economy. This analysis builds on and complements the work carried out on the impact assessment underpinning the revision of the Ambient Air Quality Directives[9]. It incorporates the EU's climate targets under the Fit for 55 initiative, in line with the 2021 Commission proposals to move to a 55% reduction in greenhouse gas (GHG) emissions by 2030[10]. The Third Clean Air Outlook also sheds light on the implications of the current energy crisis on air quality and air pollution.

The Third Clean Air Outlook directly contributes to the **Zero Pollution Monitoring and Outlook report**[11] by analysing the prospect of achieving the two clean air related zero pollution action plan[12] targets. These are to reduce, by 2030 in the EU, by more than 55% the health impacts of air pollution (expressed as premature deaths), and by 25% the ecosystems where air pollution threatens biodiversity (compared to 2005 levels).

Finally, and in preparation for the **review of the NEC Directive by 2025**[13], the Third Clean Air Outlook analyses several aspects that could be covered by that review. In particular, it looks at the effect on compliance of integrating a more comprehensive range of emissions that are currently not accounted for in the NEC compliance checks but that have a clear impact on air quality. This includes condensable particulate matter and certain emission sources in agriculture. The report also highlights the co-benefits of reducing methane emissions, which are both air pollutants and a potent greenhouse gas.

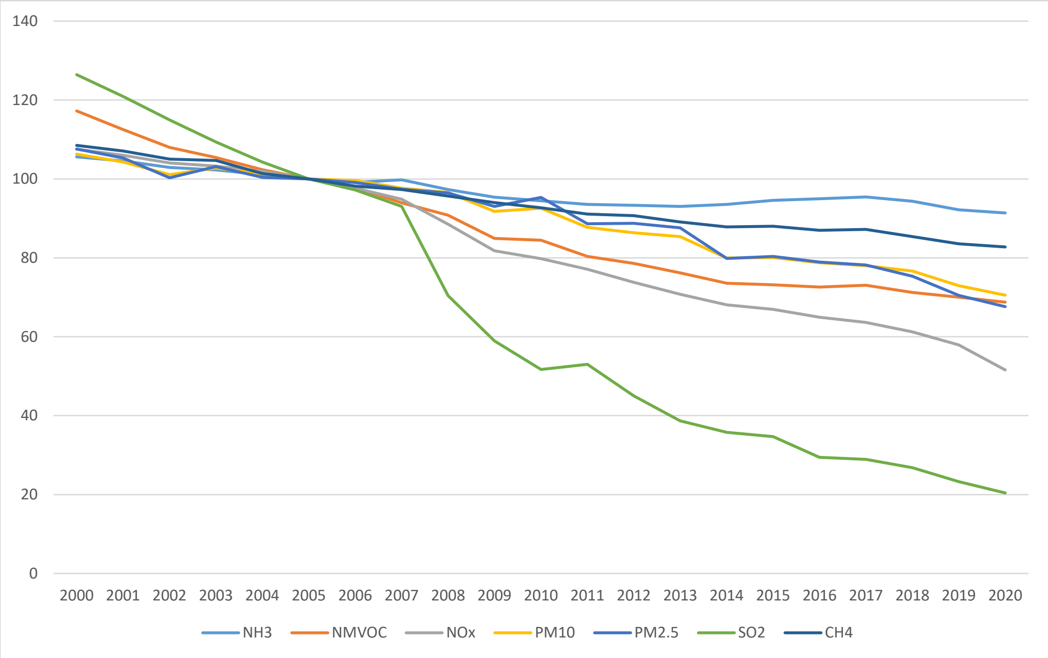
2. STATE OF AIR POLLUTANT EMISSIONS AND AIR QUALITY AND PROGRESS ON COMPLIANCE

2.1. Current air pollutant emissions and air quality situation

Over the years, the EU has reduced emissions of the main air pollutants, though at very different paces depending on the type of pollutants. Emissions of **ammonia** (NH_3), for which 94% of emissions are generated by the agricultural sector, **remain worryingly flat** and have even increased in recent years in some Member States.

9 SWD/2022/545 final.
10 https://ec.europa.eu/clima/eu-action/european-green-deal/delivering-european-green-deal_en
11 COM(2022) 674.
12 COM (2021) 400 final.
13 As per the Directive Article 13.

Figure 1: Trend in EU-27 emissions, 2000-2020 (% of 2005 levels)



Source: European Environment Agency

Despite an overall decrease in air pollution, the levels of health and ecosystem impacts from pollution remain problematic. In 2020, **most people living in urban areas in the EU were exposed to air pollution at levels that damage their health**[14]. The European Environment Agency (EEA) estimates that air pollution is the single largest environmental health risk in Europe and it is one that disproportionately affects sensitive and vulnerable social groups[15]. As such, addressing air pollution is also a matter of fairness and equality. Approximately 238 000 premature deaths are attributable to fine particulate matter in the EU, 49 000 to nitrogen dioxide and 24 000 to acute exposure to ozone (these numbers, based on observed rather than modelled air quality data, stems from an updated methodology developed by the EEA)[16]. The EEA also estimated that in 2018, over 65% of the ecosystem area in the EU had levels of pollution that exceeded the critical load for eutrophication[17].

2.2. Progress towards compliance

After reviewing the 2020 emission inventories submitted by Member States in 2022[18], the Commission concluded that **14 Member States did not comply with the set reduction commitments for at least one pollutant**. In 11 of these Member States, ammonia is one of the pollutants emitted in excess. Countries must develop national air pollution control programmes (NAPCP) and update them at least every four years, as

[14] https://www.eea.europa.eu/publications/air-quality-in-europe-2021/air-quality-status-briefing-2021

[15] EEA Report No 22/2018.

[16] EEA (2022) Health impact of air pollution in Europe 2022. This estimate is based on air pollution concentration *monitoring* and only includes premature deaths attributable to air pollution above WHO air quality guidelines level, unlike other estimates in Section 4 stemming from *modelling* results in Klimont et al., “Support to the development of the third Clean Air Outlook”, IIASA, 2022 [IIASA 2022], and which reflect all impacts (including below WHO guidelines level), to remain consistent with previous Clean Air Outlook analysis.

[17] EEA Report No 9/2020.

[18] Emission inventories are reported with a two-year time lag, hence compliance checks against the 2020-29 obligations took place for the first time in 2022.

they are the key governance instrument to achieve the NEC Directive's reduction commitments. All Member States that submitted their first NAPCP by the 2019 reporting deadline must report an updated plan in 2023, presenting measures to reduce their emissions. Member States for which the first NAPCP or latest data indicate that they will not meet the set reduction commitments must also update their emission reduction measures.

The 2020 emission data submitted by Member States in 2022 also highlight that several Member States need to achieve a **dramatic reduction in the emissions** of several pollutants in order **to fulfil their more ambitious emission reduction commitments for 2030** onwards. The EEA analysis[19] shows that 7 and 8 Member States need their $PM_{2.5}$ and NO_x emissions to fall by more than 30% between 2020 and 2030. For NMVOC and ammonia emissions, 10 and 11 Member States need to reduce their emissions by over 10% by 2030. Again, this means that they must put in place additional, more stringent and effective policies and measures.

As regards the Ambient Air Quality Directives, as of October 2022, there were **28 ongoing infringement cases** opened due to exceedances of air quality standards in 18 Member States. Proceedings before both the Court of Justice of the EU and national courts confirm that in many cases, air quality plans were inadequate and/or insufficient measures were adopted to reduce air pollution.

2.3. Links between the proposal to revise the Ambient Air Quality Directives and continued implementation of the NEC Directive

Following up on the European Green Deal commitment, on 26 October 2022 the Commission presented a proposal to revise the Ambient Air Quality Directives. The aim was to progressively achieve full alignment of the EU air quality standards with WHO recommendations, improve the regulatory framework and strengthen the provisions on monitoring, modelling and air quality plans. The revision builds on the lessons learnt from the 2019 evaluation ('fitness check') of the Ambient Air Quality Directives.

As regards the link to the NEC Directive, the proposal includes monitoring pollutants of emerging concern, including ammonia, at 'monitoring supersites' in urban and rural background locations. Monitoring at urban locations will be complementary to ecosystem monitoring of ammonia under the NEC Directive, whereas monitoring at rural locations can coincide with the monitoring established as per Article 9 of the NEC Directive. The proposal also streamlines and simplifies the monitoring requirements for ozone. The revision aims to increase the effectiveness of air quality plans, including by requiring air quality plans to be drawn up before air quality standards enter into force, in cases where these standards are exceeded prior to 2030, and by mandating regular updates of air quality plans if they do not achieve compliance. These changes will foster forward-looking air quality planning, which can thus be coordinated more effectively with national air pollution control programmes (NAPCPs). Reporting of ecosystems impacts and of NAPCPs under the NEC Directive can support competent authorities in identifying the origin of pollution, which is an important requirement for effective air quality plans.

[19] https://www.eea.europa.eu/publications/national-emission-reduction-commitments-directive-2022; these figures are based on Member States' data and not on the data checked and reviewed by the Commission afterwards.

Once implemented, this proposal will reinforce the need for Member States to reduce further their emissions of air pollutants in order to meet the new and more ambitious air quality standards. It will also contribute to effective implementation of the NEC Directive obligations. The impacts of more ambitious air quality standards on air pollutant emissions and on health, ecosystems and their economic consequences have been analysed in the impact assessment underpinning the proposal to revise the Ambient Air Quality Directives. The Third Clean Air Outlook builds on this analysis and complements it by adding some more recent modelling and policy developments (see Annex) and projecting situations under multiple potential scenarios for the future.

3. IMPLEMENTATION OF THE NEC DIRECTIVE

3.1. Changes in relevant legislation and policy context

In July 2021, the Commission adopted the **Fit for 55** package of legislative proposals to increase the EU's climate ambition. It increased the target to reduce greenhouse gas emissions to at least 55% below 1990 levels by 2030. This is consistent with the EU's headline goal to become climate-neutral by 2050. The measures in the Fit for 55 proposals will bring co-benefits for air quality by reducing emissions of key air pollutants ($PM_{2.5}$, NO_x and SO_2), compared to the situation with previously agreed climate and energy policy (which was the basis of the Second Clean Air Outlook).[20]

As regards transport, the proposal for a **Euro 7 emission standard** tackles emissions from tailpipes as well as from brakes and tyres for new light- and heavy-duty vehicles. The proposed **revised CO_2 standards** for cars will ban the sale of combustion-engine cars and vans as of 2035[21]. Other measures in the transport sector, more linked to behavioural change and action at local level, could not be reflected in the model.

Finally, new proposed rules under the **Industrial Emissions Directive (IED)** will strengthen the links with innovation and industrial transformation, tighten the rules on permit conditions and on setting emission limit values, and enhance enforcement whilst increasing the level of public information, participation and access to justice. They extend the installations covered to extractive industry, battery giga-factories and to large cattle farms, as well as to more pigs and poultry farms (representing altogether 13% of non-subsistence farms in the EU, which are responsible for 60% of ammonia and 43% of methane emissions from EU livestock). The baseline of this Third Clean Air Outlook thus includes elements of the IED proposal concerning the proposed extension to cover more livestock farms[22].

[20] Results for the 'MIX' scenario in the impact assessment on the 2030 Climate Target Plan (SWD(2020) 176 final) show that the package would reduce emissions of $PM_{2.5}$, NO_x and SO_2 by 4%, 7%, and 17% respectively in 2030 as compared to the situation with previously agreed climate and energy policy.

[21] COM/2021/556 final; Council and Parliament reached a provisional political agreement in October 2022.

[22] The sensitivity analysis carried out for the impact assessment underpinning the revision of the Ambient Air Quality Directives has integrated further aspects of the IED revision proposal by assuming in 2030 a 20% decrease of $PM_{2.5}$, SO_2 and NO_x emissions from industrial installations falling into the remit of the revised IED, compared to their 2030 emission levels in the core baseline. The results are rather stable and lead to only very small changes in $PM_{2.5}$ and NO_x concentration levels. The most positively affected pollutant is by far SO_2, with total EU emissions projected to fall by 10% in 2030 compared to the baseline, but this would not change the already good projected compliance with the NEC Directive reduction commitments for this pollutant.

3.2. Prospects for achieving the emission reduction commitments in the NEC Directive for 2030 and beyond

According to the results of the Third Clean Air Outlook, **only five Member States**[23] **are on course to achieve in 2030 all their emission reduction commitments**, under current national measures and EU legislation and provided the above legislative proposals by the Commission are adopted and implemented (this is the 'baseline' policy scenario[24]). All other Member States need to take additional measures to fulfil their obligations. This is particularly the case for **ammonia emissions**, for which **20 Member States need to increase action to reduce their emissions by 2030**. Table 1 shows the Member States projected to miss their emission reduction commitments per pollutant. These forward-looking modelling results confirm the trend observed in the data analysed by EEA (see Section 2.2).

Looking at the modelling for emission levels in 2025 and at whether Member States are on a linear trajectory[25] to reach their more ambitious reduction commitments for 2030, only seven Member States[26] are projected to be on course to reduce adequately all five pollutants. Action must be taken very quickly by the remaining Member States, in particular to reduce ammonia emissions as **19 Member States are not projected to be on a linear trajectory in 2025**.

The compliance prospects improve under the scenario that the EU population gradually shifts to a **flexitarian diet**[27]. This is in particular good for ammonia emissions, with nine additional Member States on course to meet the reduction commitments in 2030 compared to the baseline, reaching 16 Member States in compliance[28]. Under the scenario with **more stringent EU-wide air quality standards** for $PM_{2.5}$ at 10 µg/m^3 in line with the Commission's proposal ('stricter air quality standards' scenario), a further two Member States would meet the commitment to reduce ammonia emissions (reaching 18 Member States), and it would improve compliance prospects for NMVOC and $PM_{2.5}$. Using all available technical measures[29] would enable all Member States to meet their 2030 commitments, except for one for NO_x.

23 EE, EL, IT, FI, SE.

24 For a description of all scenarios mentioned in this report, see Section 3 of IIASA (2022). All results presented here stem from the GAINS model (https://gains.iiasa.ac.at/gains)

25 According to Article 4(2) of the NEC Directive, the indicative levels of the 2025 emissions are determined by a linear reduction trajectory established between the emission levels defined by the emission reduction commitments for 2020 and the emission levels defined by the emission reduction commitments for 2030. The assessment is hence made against a maximum allowed emission level that is the average of the maximum allowed levels resulting from the 2020-29 and 2030 emission reduction commitments.

26 BE, EL, HR, IT, MT, NL FI.

27 Based on a scenario developed by JRC for implementation in the CAPRI model, assuming the adoption of a diet based on total human energy requirements of 2500 kcal/day (after waste) as laid out in the 'EAT-Lancet Commission' proposal (Willet et al., Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems, *The Lancet* Vol. 393(10170), 2019). The transition to a flexitarian diet is implemented in the GAINS model as of 2020 and increases progressively toward full implementation in 2050.

28 AT, BG, HR, CY, CZ, DE, HU, IE, LT, LU, RO remain projected to miss their reduction commitments.

29 Maximum technically feasible reduction scenario, referred to as 'all technical measures'.

Table 1: Member States projected to miss their emission reduction commitments

Scenario	Year	NH_3	NMVOC	NOx	$PM_{2.5}$	SO_2
Baseline	2025	BG, CZ, DK, DE, EE, IE, ES, FR, CY, LV, LT, LU, HU, AT, PL, PT, RO, SK, SE	LT	LV, LT	HU, RO, SI	-
Baseline	2030	BE, BG, CZ, DK, DE, IE, ES, FR, HR, CY, LV, LT, LU, HU, NL, AT, PL, PT, RO, SK	ES, LT, HU, SI	MT	DK, ES, HU, SI	-
Stricter air quality standards	2030	CZ, DK, DE, IE, CY, LV, LT, LU, AT	-	MT	-	-
All technical measures	2030	-	-	MT	-	-

Source: Own compilation based on IIASA (2022) modelling results.
Note: For 2025, the assessment is carried out against the linear reduction trajectory, as explained in Footnote 25. '-' means all Member States are projected to meet the targets.

3.3. Impacts of improving the range of emissions covered on achieving the commitments under the NEC Directive

The modelling underpinning this edition of the Clean Air Outlook incorporates new features that aim to bring the results closer to real-life conditions[30].

In particular, the modelling can now incorporate in a systematic manner **condensable particulate matter emissions** for all key sectors. 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[31]. It was not possible to do so in a systematic manner and for all emitting sectors in the past[32], but new findings[33] 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.

When comparing baseline emissions with and without systematically including condensable PM in the model[34], 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

30 For a description of the modelling framework and assessment of all impacts mentioned in this report, see IIASA (2022).

31 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. See IIASA report (annex) for details.

32 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 subject to discussions under the Air Convention (https://emep.int/publ/reports/2020/emep_mscw_technical_report_4_2020.pdf).

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

34 This has been subject to consultations with Member States.

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[35]. But these changes **do not affect any Member State's prospects of meeting their $PM_{2.5}$ emission reduction commitments**.

Another improvement to the modelling of real-world emissions is to include **NO_X and NMVOC emissions from agriculture**. These emissions are currently excluded from the compliance checks under the NEC Directive[36] due to the lack of sufficiently reliable data when the commitments were set. More recent data now allow this information to be incorporated into models[37]. This changes the projected compliance status in several Member States. When including **NO_X emissions** from agriculture, the prospects of compliance with 2030 reduction commitments under the baseline worsen, from only one Member State (MT) off course to meet the commitment to seven (CZ, DK, HU, IE, LT, MT, RO). When including **NMVOC emissions** from agriculture, 2030 non-compliance prospects under the baseline for 2030 worsen from four Member States (HU, LT, SI, ES) to eight Member States (CZ, FR, HU, IE, LT, LU, SI, ES). This demonstrates that additional action is needed in several Member States to unlock the full potential of mitigation. In the scenario assuming the recently proposed stricter air quality standards, the NEC Directive compliance prospects are less severely impacted by including these agricultural emission sources.

These results related to the better representation of condensable PM and of agricultural emissions could feed into the review of the NEC Directive due by 2025.

4. PROSPECTS FOR ATTAINING ZERO POLLUTION OBJECTIVES RELATED TO AIR

4.1. The EU's 2030 clean air targets in the zero pollution action plan

The zero pollution action plan includes two EU-level targets for 2030 related to clean air:

1) reduce by more than 55% the health impacts (expressed as premature deaths) of air pollution compared to 2005 figures;
2) reduce by 25% the EU ecosystem area where air pollution threatens biodiversity, expressed as ecosystem areas above 'critical loads' of nitrogen deposition (compared to 2005 figures).

Under the baseline scenario, the EU would broadly meet the **zero pollution target to reduce the health impacts**, with an estimated 66% reduction in the number of premature deaths between 2005 and 2030. However, it would meet the **ecosystems target only in 2040**[38], and achieve only a 20% reduction in areas at risk between 2005 and 2030.

35 IIASA (2022) include difference maps comparing $PM_{2.5}$ concentrations in 2015 estimated in the GAINS model in the standard setup and using the new consistent set of emission factors from Simpson et al. (2022). These show that there are also areas where modelled concentrations decrease slightly when using the consistent set of emission factors.

36 Article 4(3)(d) of the NEC Directive.

37 The assumptions for including NO_x and NMVOC emissions from agricultural into GAINS were discussed during the consultation with Member States.

38 When analysing the effect of moving towards a flexitarian diet in the EU (leading to reductions in ammonia emissions), the target would be reached by 2035.

Meeting the new air quality standards would enable the EU to achieve this target in 2030 and would deliver both health and biodiversity benefits.

4.1.1. *Health-related target and overall health impacts across scenarios*

Background concentration of air pollutants and population exposure

In the baseline scenario, pollutant concentrations already fall over time and, by 2030, no areas in the EU are projected to exceed 20 $\mu g/m^3$ for $PM_{2.5}$. However, large areas are projected to have pollution concentration levels above the currently recommended WHO air quality guideline of 5 $\mu g/m^3$ in 2030 and even in 2050.

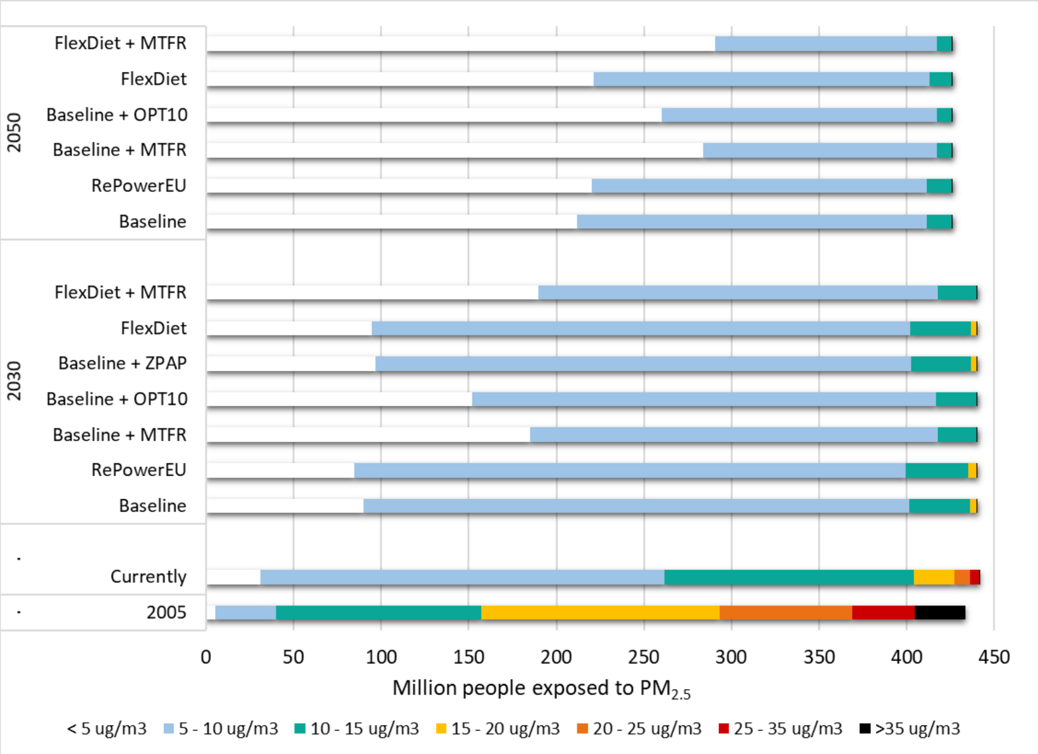
Translating background concentration levels into impacts on the health of the EU population shows that the number of people benefiting from clean air is set to rise considerably (Figure 2)[39]. While this would be a significant improvement, **further policy commitment is needed to limit the negative health impacts** from exposure above the 2021 WHO guidelines **also for the (roughly) remaining half of the EU population**.

With an EU-wide shift to a **flexitarian diet,** some benefits are expected in terms of reduced $PM_{2.5}$ exposure due to the reduction in emissions of ammonia, which contributes to the formation of secondary PM. Compared to the baseline, the number of people projected to benefit from clean air in line with WHO guidelines would increase by around 5-7 million in 2030 and by about 10 million in 2050.

The results vary for individual countries, though all are projected to see a steady improvement both in background concentrations and related population exposure (as further discussed in IIASA, 2022).

[39] These results are largely consistent with the AAQD impact assessment.

Figure 2: EU-27 population exposed to different concentrations of $PM_{2.5}$



Source: IIASA (2022)

Note: OPT10 indicates the 'stricter air quality standards' scenario (as in the Commission proposal for the revision of the Ambient Air Quality Directives), MTFR is the 'all technical measures' scenario, ZPAP is the scenario that optimises for the achievement of the ecosystem-related zero pollution target, FlexDiet indicates the flexitarian diet scenario.

Currently, just over 50% of the EU population live in areas with NO_2 pollution levels below the WHO guidelines of 10 µg/m^3. By 2030, this is projected to exceed 75% in all scenarios, reaching just over 80% if all technical measures are implemented. By 2050, under all scenarios, over 95% of the EU population is projected to live in areas where pollution remains below the recommended NO_2 WHO level.

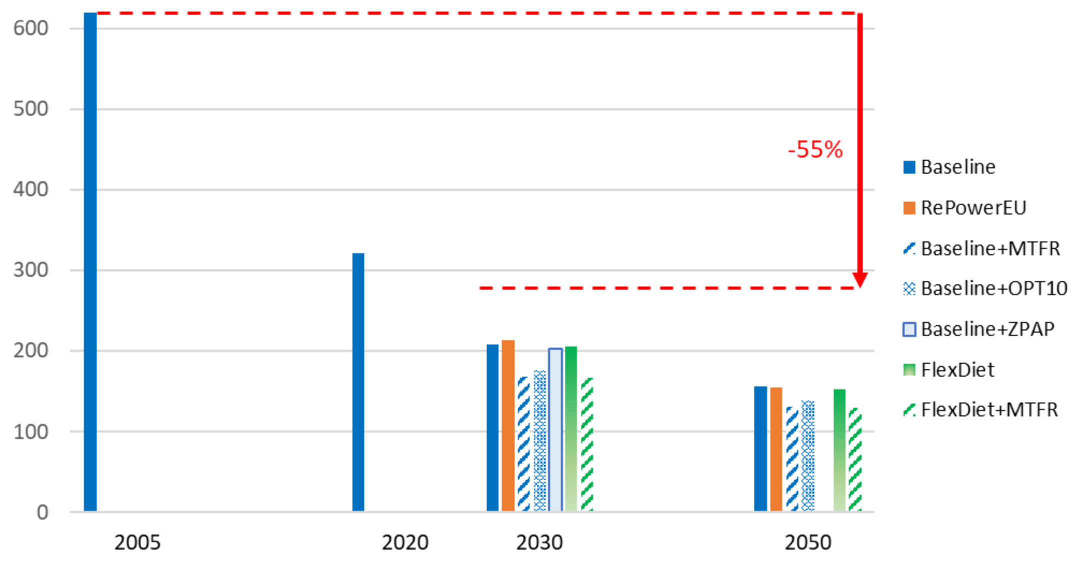
<u>Premature deaths and achieving the zero pollution target</u>

Premature deaths[40] due to **$PM_{2.5}$** exposure are projected to fall by about 60-75%, compared to 2005 figures, across all scenarios (including the baseline) in 2030 and 2050. Premature deaths will fall faster if stricter air quality standards are met and all technical measures taken[41]. Provided all policies included in the baseline have the intended results, **the EU is set to achieve the zero pollution health target** by a comfortable margin in 2030. The scenario under which the EU population would shift to a **flexitarian diet** would lead to a further estimated reduction of 2 000 premature deaths per year in 2030.

[40] The health impacts of air pollution extend beyond mortality and include morbidity. The impacts have been analysed and are monetised in order to assess the economic impacts as well as the benefits of lower air pollution (see Section 4.2).

[41] This result holds independent of the assumptions about population development (whether static, as reported here, or dynamic) and health impacts assumptions used.

Figure 3: Cases of premature deaths attributable to the exposure to total $PM_{2.5}$ concentrations in the EU27, in thousand cases per year



Source: IIASA (2022)
Note: The marked 55% refers to the Zero Pollution target.

In absolute numbers[42], while this projection shows that significant improvements should be achieved over the baseline scenario, it still means an estimated 200 000 **premature deaths due to $PM_{2.5}$** exposure in 2030. More stringent air quality standards would reduce this to 177 000 in 2030, with further reductions obtained by taking all technical measures[43].

In addition to these, exposure to **NO_2** is projected to cause some 60 000 premature deaths in the baseline in 2030, with little variation across scenarios, though this would be halved by 2050. Exposure to **ground-level ozone** is projected to cause around 50 000 premature deaths in the baseline in 2030.

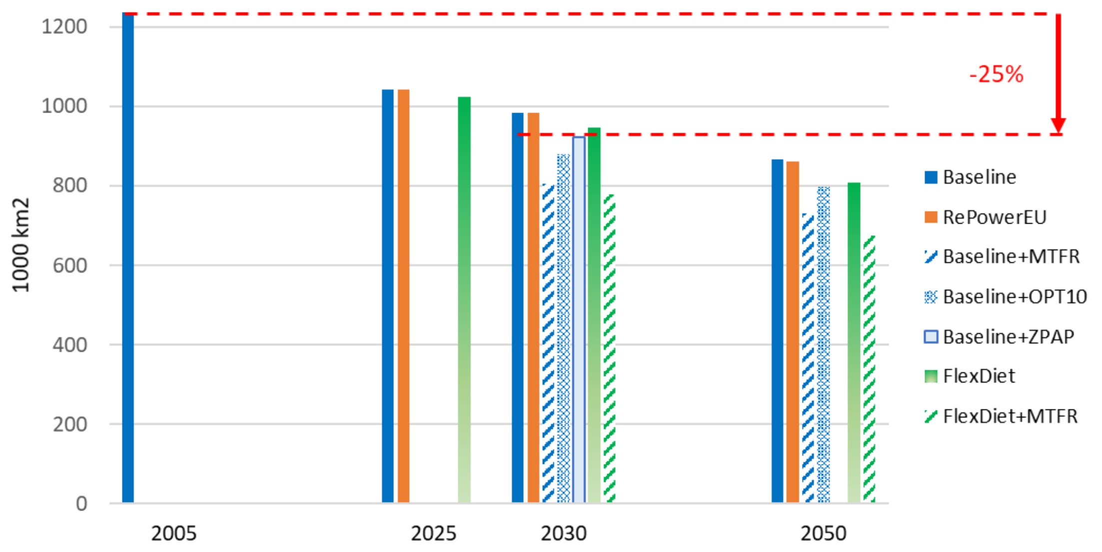
4.1.2. Ecosystem-related target and overall ecosystem impacts

Air pollution affects **ecosystem health** through acidification, eutrophication and ozone impacts. Modelling results[44] show a significant improvement over time as regards **acidification**: under the baseline scenario, by 2030, less than 3% of the ecosystem area in the EU would suffer from acid deposition exceeding critical loads, compared to 15% in 2005. This demonstrates the benefits of the significant decrease in SO_2 emissions that has already been achieved over the past decades. These benefits would be even greater if stricter air quality standards are set, all technical measures are taken, or the EU population shifts to a flexitarian diet.

[42] Using the same methodological approach as in the Second Clean Air Outlook, which was the basis for setting the zero pollution targets.
[43] These numbers differ from the numbers presented in the impact assessment underpinning the revision of the Ambient Air Quality Directives (see Annex 1).
[44] Based on a 2022 Critical Load database (Coordination Centre for Effects of the Working Group on Effects under the UNECE Air Convention) and the most recent source receptor coefficients implemented in the GAINS model (see IIASA, 2022).

However, when looking at the **eutrophication** impacts of air pollution[45], the situation is less positive. This is linked to the current projection that the EU will not achieve the zero pollution ecosystem target under baseline policies only. In this scenario, 68% of the EU ecosystem area would still suffer from eutrophication in 2030 (compared to 86% in 2005). Under the same baseline conditions, **protected areas would continue to be highly affected in 2030**, with 59% of Natura 2000 areas suffering from eutrophication. If stricter air quality standards are set or all technical measures are taken, the share of the EU ecosystem suffering from eutrophication would fall to 61% and 56% respectively, and to 51% and 46% in Natura 2000 areas by 2030.

Figure 4: Ecosystem area in the EU-27 where the critical loads for eutrophication are exceeded



Source: IIASA (2022)
Note: The marked 25% indicates the zero pollution target.

To address this eutrophication challenge, achieve the ecosystem zero pollution target and the NEC ammonia emission reduction commitments, and to help implement the Nature Restoration Law, Member States will need to put in place additional **measures to limit ammonia emissions** from the agricultural sector, as ammonia is the air pollutant with the greatest impact on ecosystems. The optimal set of measures to reach the zero pollution target relates to more efficient management and application of manure from cattle, pigs and poultry and of mineral fertilisers to reduce ammonia emissions.

These well-established measures (reflected in the NEC Directive either as compulsory or voluntary measures)[46] would also **significantly increase the prospects of fulfilling the NEC Directive ammonia emission reduction commitments**, with fewer Member States projected to miss the reduction commitments in 2030 (from 20 to 7). Member States are therefore strongly encouraged to step up implementation of these measures by:

– adopting national legislation to make certain agricultural practices binding;
– promoting these practices through communication and awareness-raising campaigns, including through farm advice under the new common agricultural policy.

[45] Assessed as area of ecosystems where nitrogen deposition exceeds the critical loads.
[46] Annex III, part 2.

Member States should also consider taking other measures to improve nutrient management and avoid nutrient losses leading to air, water and soil pollution, taking an integrated approach to nitrogen, notably from agriculture. This is in line with the Farm to Fork Strategy, the Nitrates Directive and the forthcoming integrated nutrient management action plan.

4.2. Economic impacts

The economic impacts of air pollution are numerous. The vast majority of impacts are not reflected in market prices, in particular the **direct health effects**[47] of pollution but damage to ecosystems (including agricultural areas and forests) and materials from air pollution also generates costs. There are also indirect impacts of air pollution, including some macroeconomic consequences reflected in market prices. The costs of air pollution abatement measures should therefore be weighed against the benefits these measures bring to society, by attributing a monetary value to these benefits[48].

Under the baseline scenario, the **health damages** caused by air pollution levels above WHO guidelines[49] are estimated to range from EUR 114 to 384 billion per year in 2030. They are estimated to fall to between EUR 44 to 169 billion by 2050[50], as population exposure to air pollution decreases. Under the scenarios with stricter air quality standards or all technical measures taken, health damages are projected to fall by at least 30% compared to the baseline, both for the 2030 and 2050 timeframes. Combining all available technical measures with the change in diet would reduce the health damages to the lowest value.

The economic cost of **ecosystem damages** due to air pollution[51] ranges from EUR 3.6 to 10.8 billion in 2030. This is projected to fall only marginally to EUR 3.1 to 9.2 billion by 2050, reflecting the only modest reduction in Natura 2000 areas subject to eutrophication under the baseline. However, the situation would improve significantly if more ambitious clean air policies are pursued. The cost of **damages to crops and to forests** are estimated at EUR 8.9 and 8.7 billion in 2030 respectively under the baseline, only marginally decreasing under more ambitious clean air scenarios. Indeed, these ecosystems are mostly affected by ozone, which is only indirectly reduced in the scenarios envisaged.

The economic cost of **damages to materials** due to air pollution is estimated to reach EUR 676 and 444 million in 2030 and 2050, respectively, under the baseline scenario.

Compared to current policies, the different scenarios are projected to generate different levels of non-market benefits and different levels of additional costs for the pollution abatement measures needed. Choosing the **more ambitious clean air scenarios** (setting stricter air quality standards, taking all technical measures or implementing the optimal

47 Mortality damages account for between 70% and 91% of aggregate value of health damages, the rest is due to morbidity impacts. The range reflects whether mortality is valued using the value of a life year or the value of statistical life.

48 For a description of the methodology underpinning the results in this section, see IIASA (2022).

49 Below the guideline levels, a larger share of pollution is due to natural sources.

50 The ranges reflect whether mortality is valued using the value of a life year or the value of statistical life; values are expressed per year, in 2015 prices.

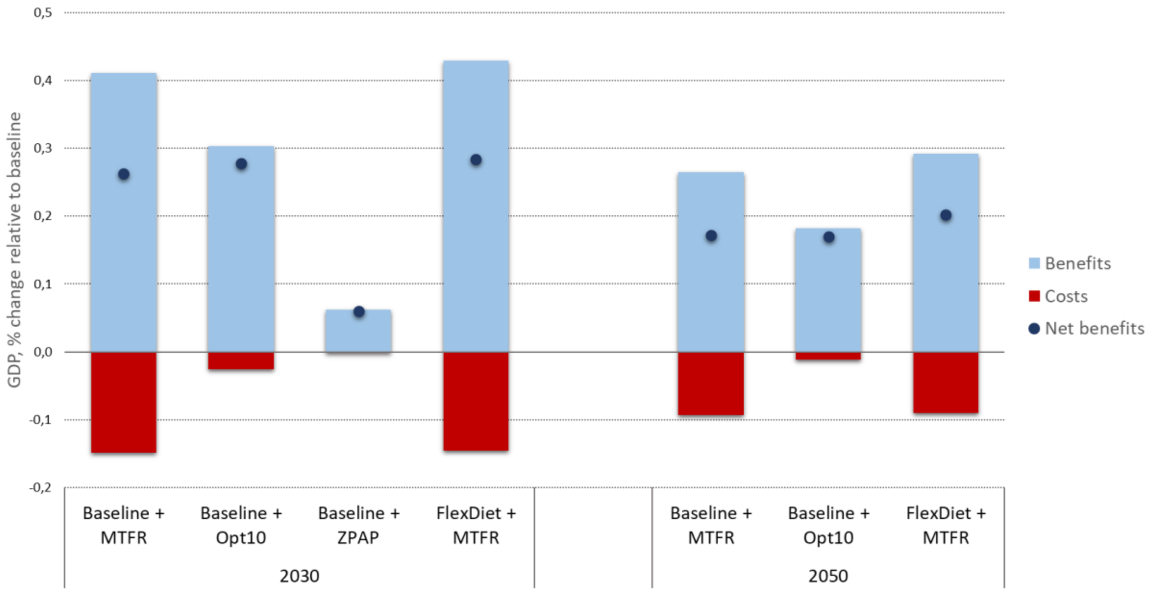
51 Those impacts are estimated through the loss of ecosystem services only in Natura 2000 areas due to eutrophication. They therefore underestimate total loss in ecosystem services.

measures to reach the zero pollution targets) **always brings net direct benefits** (benefits minus costs) compared to the baseline scenario[52].

Air pollution control measures and their positive effects on air quality also have wider **macroeconomic effects[53]** reflected in the market. Pollution abatement measures generate both a cost for some sectors and a business opportunity for others, while air quality has impacts on both labour and crop productivity and therefore on the economy as a whole. Based on recent assumptions on labour productivity effects[54], **all improved clean air scenarios increase EU GDP in 2030 by 0.26 to 0.28%** compared to the baseline scenario, showing the overriding positive economic effects of pollution abatement measures.

The sectoral distribution of effects shows that, in 2030, only the agricultural sector would have low-level negative impacts when all technical measures are taken (about 2% worse than under the baseline scenario, and especially in the livestock sector). Under the scenario with stricter air quality standards, the net effect on all sectors (including agriculture) is positive.

Figure 5: Macroeconomic market effects of clean air policy scenarios, in % change in EU GDP compared to the baseline scenario



Source: IIASA (2022) based on JRC modelling, based on OECD 2019 assumptions on labour productivity.

52 The existence of net benefits from abatement measures is robust across sensitivity cases (metrics for mortality valuation, air pollution exposure levels, etc.).

53 These effects have been computed by the European Commission Joint Research Centre using the GEM-E3 model (https://joint-research-centre.ec.europa.eu/gem-e3_en). For more details, see Section 4.4.5 of IIASA (2022).

54 Dechezleprêtre, A., Rivers, N., & Stadler, B. The economic cost of air pollution: Evidence from Europe. *OECD Economics Department Working Papers*, 2019.

5. THE CLEAN AIR IMPACTS OF THE RECENT GEOPOLITICAL EVENTS AND THE ENERGY CRISIS

Russia's unprovoked and unjustified military aggression against Ukraine led to a massive disruption on the European energy system, calling for immediate collective action. The Commission presented on 18 May 2022 its REPowerEU Plan[55] to end the EU's dependency on gas, oil and coal imports from Russia, building on the Fit for 55 proposals and in line with the climate neutrality objective of the European Green Deal. This plan tabled additional measures combining smart investments and reforms to rapidly save energy for households, businesses and industry, and to accelerate the clean energy transition including by proposing higher targets for renewable energy and energy efficiency for 2030[56].

As part of the Third Clean Air Outlook, the Commission has tested projections on the EU energy mix incorporating, on top of the measures included in the baseline scenario, the potential consequences of phasing out fossil fuels from Russia and the main REPowerEU measures announced at the time[57], to assess their impact on air pollution.

Later this year, the Commission also tabled emergency measures to further reduce energy consumption in the short term[58] and boost the necessary rapid development of renewable energy[59]. The above mentioned projections do not factor in those latest measures and potential rapid changes that could be triggered, in particular behavioural changes and acceleration of the deployment of renewable energy.

On the basis of these projections, of relevance for air quality are a projected reduction in overall EU energy use, a strong reduction in the use of natural gas, compensated by a massive increase in renewables and hydrogen. Compared to the baseline scenario, overall solid biomass consumption in this scenario is currently projected to stay fairly stable in 2030, with an over 40% decline in 2050. Boosting energy efficiency and spurring investment in non-combustible renewable energy sources would yield clean air co-benefits.

However, the current energy crisis is also expected to lead to prolonging some existing coal capacities, depending on the Member States' specific situation and their current energy mix, as well as the speed of the deployment of alternative energy sources. This temporary potential rebound in the use of coal has the opposite effect on clean air. Due to these projected changes in the EU's energy mix, and in the absence of further EU policy action to achieve clean air, the projections indicate that air quality would worsen for about 2% of the EU population in 2030 compared to the baseline scenario, and then improve slightly in terms of the share of the EU population benefiting from clean air by 2050, due to the accelerated rollout of clean energy production and lower use of solid biomass, oil and gas. All in all, compared to the baseline scenario, this alternative scenario is estimated to result in a slightly higher number of premature deaths in 2030, but then in a greater reduction by 2050, in line with the trends observed for the projected pollution concentration levels.

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55 COM(2022) 230

56 The Commission proposed to increase the 2030 target for renewable energy to 45% and the energy efficiency target to 13%.

57 In COM (2022) 230 and SWD (2022) 230.

58 COM (2022) 360 and Council Regulation (EU) 2022/1369.

59 COM (2022) 591.

There are **geographical differences in these impacts** across the EU[60]. This **medium-term negative impact** would require the EU to take appropriate abatement measures to avoid undermining the achievement of clean air objectives and legal obligations. The cost of related health and material damages is slightly higher (3-4% for health and 14% for material) in 2030 under this case than in the baseline, but slightly lower by 2050.

As regards **NEC Directive compliance prospects**, the main pollutant to consider for changes in the energy mix is $PM_{2.5}$[61]. Compared to compliance prospects under current policies (Section 3.2), one additional Member State would be off the linear reduction trajectory in 2025 (DK), whereas the same four Member States as in the baseline scenario are projected to fall short of their reduction commitment for 2030 (DK, HU, SI, ES).

Overall, the REPowerEU plan was adopted in response to the need to drastically accelerate the clean energy transition and increase Europe's energy independence from unreliable suppliers and volatile fossil fuels, and this yields longer-term clean air benefits. However, in the short term, the projected increase in coal use to offset the phasing out of Russian gas, especially in some EU regions, would lead to **increased air pollution and hence higher health damages** than in the baseline scenario, leading to fewer clean air benefits too. However, the negative clean air impacts in the short term are not expected to have a negative effect on the prospects of meeting the 2030 zero pollution health target at EU level. The modelling shows that the EU will miss the ecosystem target, as under the baseline scenario, unless further measures are taken.

Given the current dynamics on energy markets as well as the associated changes to the regulatory framework, all these results should be considered indicative. Apart from potential future measures at EU level, there is considerable uncertainty as to how energy users across the Member States will react to changing energy prices. A surge in the use of cheaply available sources of energy (such as own collected wood of lower fuel quality) would lead to increased emissions of air pollutants. The need to switch to other more polluting sources of energy has already led to temporary derogations from emission standards, representing a risk of worsening air quality that needs to be assessed at national level in order to avoid jeopardising compliance with EU clean air legislation and prevent negative impacts on health and ecosystems. Rapid implementation of structural measures and unpredictable evolution of energy markets would instead further accelerate the clean energy transition and lead to an improvement of air quality.

6. INTERACTIONS WITH CLIMATE POLICY – FOCUS ON METHANE AND BLACK CARBON

To complement the assessment of air quality impacts of the measures to scale up the EU's climate ambition included in the baseline scenario (Fit for 55 package), in this Third Clean Air Outlook, the Commission analyses synergies between climate and clean air policies related to developments in short-lived climate forcers.

The NEC Directive recognises the link between air pollution on the one hand and methane and black carbon, two key short-lived climate forcers, on the other. Member States must report national emissions of black carbon when the data are available, and

[60] With Austria, Bulgaria, Poland and Romania most affected by higher pollutant concentrations. However, the estimated changes do not exceed an increase of 1.5 µg/m^3 of $PM_{2.5}$ concentration levels.

[61] SO_2 is also relevant but the compliance prospects are unchanged, given the large margins by which all Member States are projected to comply with their SO_2 reduction commitments.

currently all but two Member States do so. Building on the Commission Declaration on methane featuring at the end of the NEC Directive, the 'EU strategy to reduce methane emissions'[62] announced that the Commission will, as part of the NEC review due by 2025, explore the possible inclusion of methane among the regulated pollutants.

Indeed, methane is both a potent climate forcer and a precursor to ground-level ozone pollution, which was estimated to be responsible for 24 000 premature deaths in the EU in 2020[63]. Anthropogenic emissions of methane in the EU come principally from agriculture (54%), waste (27%) and energy (17%)[64].

Black carbon[65], or soot, forms part of fine particulate matter and contributes to the negative impacts on health and on the environment. It is formed from the incomplete combustion of fossil fuels and wood. By absorbing light and heat in the air, black carbon contributes to climate change. When deposited on ice and snow, black carbon reduces surface albedo[66], contributing to heating, particularly in Arctic regions of the EU.

Reducing emissions of methane and black carbon can therefore produce benefits both in terms of clean air and in terms of climate change mitigation, increasing the benefit-to-cost ratio of their abatement measure.

For these reasons, the modelling carried out for this report has analysed the evolution of black carbon and methane emissions under various scenarios. It shows that baseline **EU black carbon emissions would drop significantly (by 53%) between 2020 and 2030**, mostly due to the gradual roll-out of the eco-design requirements for domestic heating appliances, the drop in biomass and the strong reduction of coal use in this sector. A quarter of the achieved reduction comes from the transport sector, primarily as a result of advanced Euro standards including installation of efficient particulate filters.

Even greater reductions could be achieved (72% below the 2020 baseline level) if all technical measures were taken. Under the alternative energy scenario assessed in Section 5, emissions of black carbon are projected to increase slightly in 2030 (compared to the baseline scenario), due to the increased use of solid fuel (coal, biomass) in certain regions and Member States.

Likewise, under this report's baseline scenario, **EU methane emissions are projected to fall by 19% between 2020 and 2030**[67]. In 2050, the flexitarian scenario mentioned above would lead to a 11% reduction in the EU methane emissions compared to the baseline scenario.

However, as methane is transported on a hemispheric scale, it is vital to complement action at EU level with global action. In November 2021, the EU co-convened, together with the United States, the **Global Methane Pledge**[68], which has provided momentum to

62 COM(2020) 663 final.
63 EEA (2022)
64 Data from the EU inventory submission to the UNFCCC 27 May 2022 (including the land use sector).
65 Elements from this description are sourced from the Climate and Clean Air Coalition (https://www.ccacoalition.org).
66 The ability to reflect sunlight.
67 The EU Methane Action Plan (2022), under the Global Methane Pledge, estimates a reduction of methane emissions of about 23% between 2020 and 2030 in its policy scenario (https://www.ccacoalition.org/en/resources/national-methane-action-plans).
68 https://www.globalmethanepledge.org/

accelerate action. It puts forward a voluntary commitment to reduce global methane emissions by at least 30% from 2020 levels by 2030. In parallel, the UNECE Air Convention provides opportunities to explore synergies between the international clean air and climate frameworks. In particular, the review of its Gothenburg Protocol (see next section) has opened discussions on the role of methane as an ozone precursor and therefore a pollutant of relevance to clean air policies.

The stricter ozone concentration standards presented in the Commission proposal to revise the Ambient Air Quality Directives also emphasise the need to further reduce emissions of all ozone precursors, including methane, inside and outside of the EU.

7. TRANSBOUNDARY AND INTERNATIONAL DIMENSION

Air pollution in a given country comes from multiple sources, notably domestic emissions, emissions generated in neighbouring countries and natural sources. In most Member States, domestic sources are the main sources of pollution, and hence **cutting domestic emissions** is the priority to reduce air pollutant background concentration. The share of pollution from domestic sources is often higher in the largest Member States, where at least half of the action needed must be to reduce these sources.

At the same time, the analysis confirms that in most Member States, a significant contribution to $PM_{2.5}$ background concentration is generated in other Member States. This reflects the **transboundary nature of air pollution**, which justifies action at EU level, as air pollution of domestic origin has negative impacts beyond a Member State's borders[69]. Likewise, reducing air pollution in line with the NEC Directive's commitments would benefit other countries. In addition, the analysis shows that contributions to air pollutant background concentration also come from non-EU countries, at varying levels depending on the geographical situation of the Member States[70]. Over time and with increasing stringency of EU air pollution abatement scenarios, the share of pollution from within the EU is projected to fall (due to additional action within the EU), increasing the relative importance of non-EU sources. This underlines the need for the EU to **take stronger action bilaterally** (notably in the context of accession and neighbourhood policies, but also by building stronger international partnerships) **as well as in multilateral fora** such as the UNECE Air Convention.

The NEC Directive obligations are, at least to some degree, reflected at international level via the UNECE Air Convention and its amended Gothenburg Protocol. The number of countries having ratified this Protocol has increased over the last years, but **still very few ratifications are by non-EU Parties**. Among the EU Member States, seven[71] are still not yet Party to the amended Protocol but most are advancing in the ratification process.

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[69] Efficiency of transboundary pollutants monitoring can be considerably improved by means of the EU space data and services.

[70] Smaller and more isolated Member States would benefit most from reductions in non-EU neighbouring countries, as well as from lower emissions from international shipping (the latter especially in the case of islands).

[71] Austria, Belgium, Greece, Ireland, Italy, Hungary and Poland.

The **ongoing review of the amended Gothenburg Protocol** is of particular interest under the Air Convention work. The review is in its final stages and the Parties will decide how to take its conclusions forward.

8. CONCLUSION

The analysis conducted for the Third Clean Air Outlook has shown that emissions of air pollutants are projected to continue falling. This is good news for EU citizens and the EU economy and society. Over the past 20 years, the EU has achieved substantial reductions in the emissions of most of the five main pollutants regulated under the NEC Directive. Emissions of ammonia, however, are a worrying exception. Emissions have fallen only marginally, and 11 Member States did not achieve their ammonia emission reduction commitments in 2020.

For emissions of ammonia, the prospects of meeting the NEC Directive's emission reduction commitments remain bleak. These Member States must take **significant additional action to reduce ammonia emissions at source** by promoting good agricultural practices. As the analysis has also shown, a gradual shift to a flexitarian diet in the EU would improve the compliance prospects, as would a stronger push at Member State level to take related agricultural measures under the common agricultural policy[72]. Additional action is also needed to limit emissions of $PM_{2.5}$ and NMVOC, though for these two pollutants only four Member States are currently projected to miss their 2030 reduction commitments.

The Commission underscores that it is essential to meet the NEC Directive's commitments in full to reduce the negative health and environmental impacts of air pollution, in line with the EU's zero pollution ambition. With current and proposed policies, the EU is projected to meet the health-related zero pollution target, but it is not on track to meet the ecosystem-related target in 2030. This emphasises the need to take further measures to reduce ammonia emissions.

To ensure that the expected projections materialise, it is important to implement existing legislation in full[73]. Equally, **it is important that Parliament and Council swiftly adopt the more recent policy proposals made by the Commission** (and that formed part of the underlying assumptions for the Clean Air Outlook) **while maintaining the proposed ambition level**. This includes the proposals on vehicle emission standards, industrial emissions (including extending the scope of the Industrial Emissions Directive to cover large farms, projected to have a significant impact towards reducing ammonia emissions) and initiatives under the Fit for 55 and REPowerEU initiatives.

As regards the REPowerEU Plan, the analysis presented here shows that, while the accelerated roll-out of renewable energy (notably wind and solar) will bring long-term benefits, the rebound of coal use due to phasing out Russian gas is set to worsen air quality in the short term and requires some abatement measures (the same holds for

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72 Many Member States decided to address ammonia emissions in their CAP Strategic Plans and/or through national legislation.

73 Including through EU support, such as the Technical Support Instrument (https://ec.europa.eu/info/funding-tenders/find-funding/eu-funding-programmes/technical-support-instrument/technical-support-instrument-tsi_en) and EU funded Research and Innovation initiatives related to the prevention and remediation of air pollution (https://research-and-innovation.ec.europa.eu/document/c9d4c0b5-f85e-4599-986d-e6b2438229fc_en)

biomass). In this context, it will be very important to propose more stringent eco-design standards for solid fuel boilers and stoves during the ongoing revision. **The development of energy markets also merits close observation from a clean air perspective**, as increasing prices can lead consumers to switch to cheaper but more polluting fuels. The current situation has already led to temporary derogations from emission standards, the implications of which for air quality need to be assessed and monitored closely, including at national level.

Most importantly, more ambitious air quality standards as recently put forward by the Commission in its proposal to revise the Ambient Air Quality Directives would ease implementation of the NEC Directive. This would greatly improve the 2030 compliance prospects (though still too many Member States would be projected to miss their ammonia reduction commitments). It would also bring further reductions to the health and ecosystem impacts of air pollution and generate macroeconomic gains, in line with the analysis underpinning the proposed revision of the Ambient Air Quality standards.

ANNEX: MAIN METHODOLOGICAL DIFFERENCES WITH THE SECOND CLEAN AIR OUTLOOK AND WITH THE ANALYTICAL WORK UNDERPINNING THE REVISION OF THE AIR QUALITY DIRECTIVES

Updates since the Second Clean Air Outlook

- The baseline scenario reflects more recent adopted and proposed EU policies.
- Updated methodology for assessing health impacts. Based on more recent scientific evidence, it now includes some new morbidity impacts. A sensitivity analysis is carried out to reflect different slopes of the concentration response functions at low concentration levels.
- Updated methodology for valuing health impacts. The same monetised values are applied as in the Second Clean Air Outlook but only impacts above the WHO 2021 guidelines levels are taken into account in the monetisation part (the Second Clean Air Outlook monetised impacts at all levels). This enables the analysis to focus on the monetised estimation of the damages that are mostly due to the anthropogenic part of pollution. It also includes a few additional morbidity impacts.

Additional updates since the analytical work underpinning the revision of the Ambient Air Quality Directives

There are methodological differences due to the different timing of the modelling work for the two initiatives and different purposes. For the work underpinning the revision of the Directives, the focus was on relative changes *between scenarios* in the target years 2030 and 2050 with a focus also on local impacts, whereas the Clean Air Outlook also analyses changes *over time* and with a coarser geographical approach.

- Use of different models and of different population projections for some parts of the analysis. The Clean Air Outlook analysis relies primarily on the GAINS model, assuming a constant population to estimate health impacts, to apply the same methodological choices to assess the achievement of the zero pollution target as were used in the target setting. The work underpinning the revision of the Ambient Air Quality Directives uses, for pollutant concentration and related impacts, the uEMEP model with a higher geographical resolution.
- For the same reason, to assess the zero pollution target, it looks at the full health impacts from anthropogenic $PM_{2.5}$ emissions (whereas the impact assessment of the Ambient Air Quality Directives revision looks at the cases attributable to exposure above the WHO guideline level of 5 $\mu g/m^3$ but including natural sources).
- The baseline scenario includes the agricultural elements of the proposed revised Industrial Emission Directive.
- The baseline scenario has been adjusted following consultation with the Member States to better reflect national policies, measures and emission inventories.
- Use of updated atmospheric transfer coefficients, which may result in different spatial distribution patterns.
- Use of the 2021 updated database on critical loads for ecosystems provided by the Coordination Centre for Effects of the UNECE Air Convention.

– In addition to these methodological updates, further scenarios are analysed in the Third Clean Air Outlook, in particular reflecting the changes to the energy mix due to the war against Ukraine and the REPowerEU Plan and a shift to a flexitarian diet.

These differences in methodology can lead, in some cases, to different results between the Third Clean Air Outlook and the analysis underpinning the revision of the Ambient Air Quality Directives.