EU clean air policy : Opportunities for enhanced cooperation with CAMS

ECMWF Annual Seminar 2025
9 April 2025

Clean Air & Urban Policy Unit

Directorate-General Environment

European Commission

How does EU clean air policy work?

SETTING OBJECTIVES FOR GOOD AIR QUALITY

Ambient Air Quality (AAQ) Directives

Maximum concentrations of
air polluting substances
($PM_{2.5}$, PM_{10}, NO_2, O_3, SO_2, CO, C_6H_6, BaP, As, Cd, Ni, Pb)

REDUCING EMISSIONS OF POLLUTANTS

National Emission reduction Commitments Directive

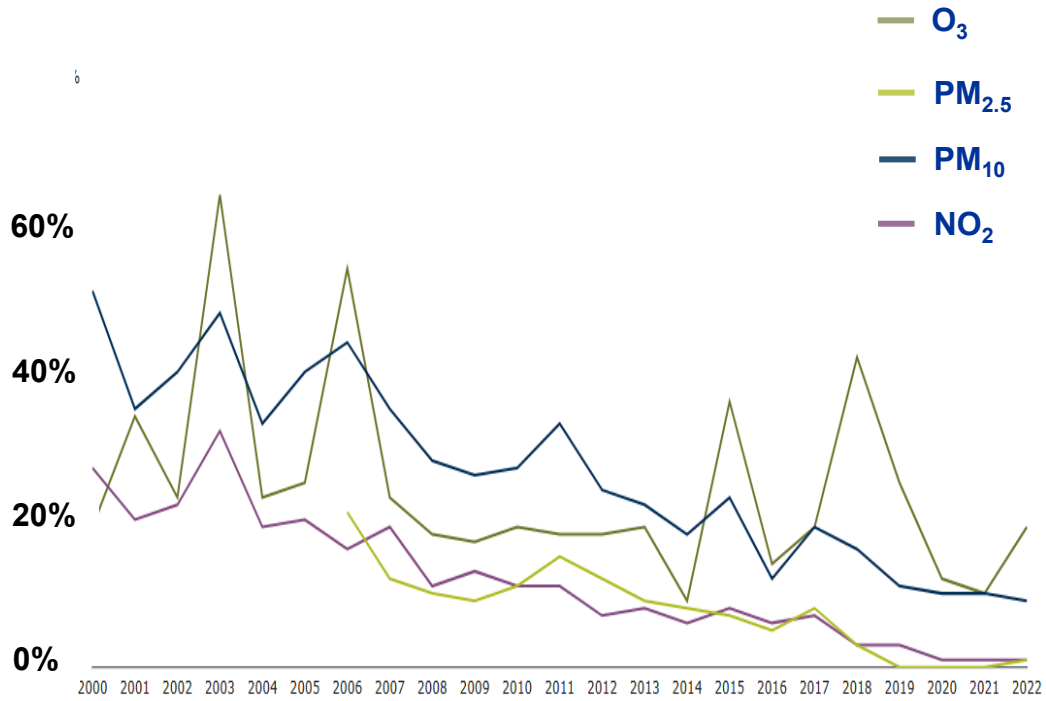
National emission totals
(SO_2, NO_x, NMVOC, $PM_{2.5}$, NH_3)

Source-specific emission standards

- IE Directive
- MCP Directive
- Eco-design Directive
- Energy efficiency
- Euro and fuel standards

Clean air policy works … but …

Urban population exposed to air pollutant concentrations above selected EU air quality standards, EU-27 (2000-2022)



Health impacts: air pollution continues to be the number one environmental cause of health impacts

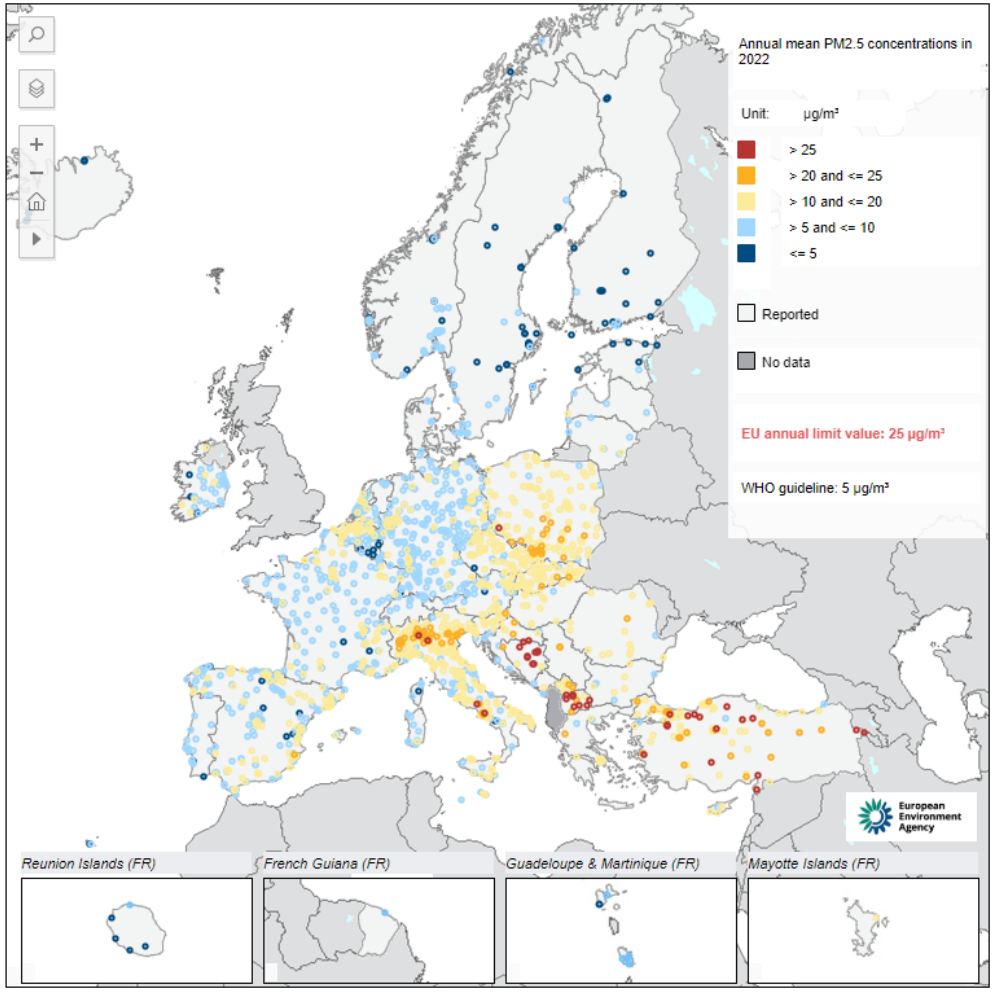
Social impacts: poor air quality disproportionally affects vulnerable groups – incl. children, elderly

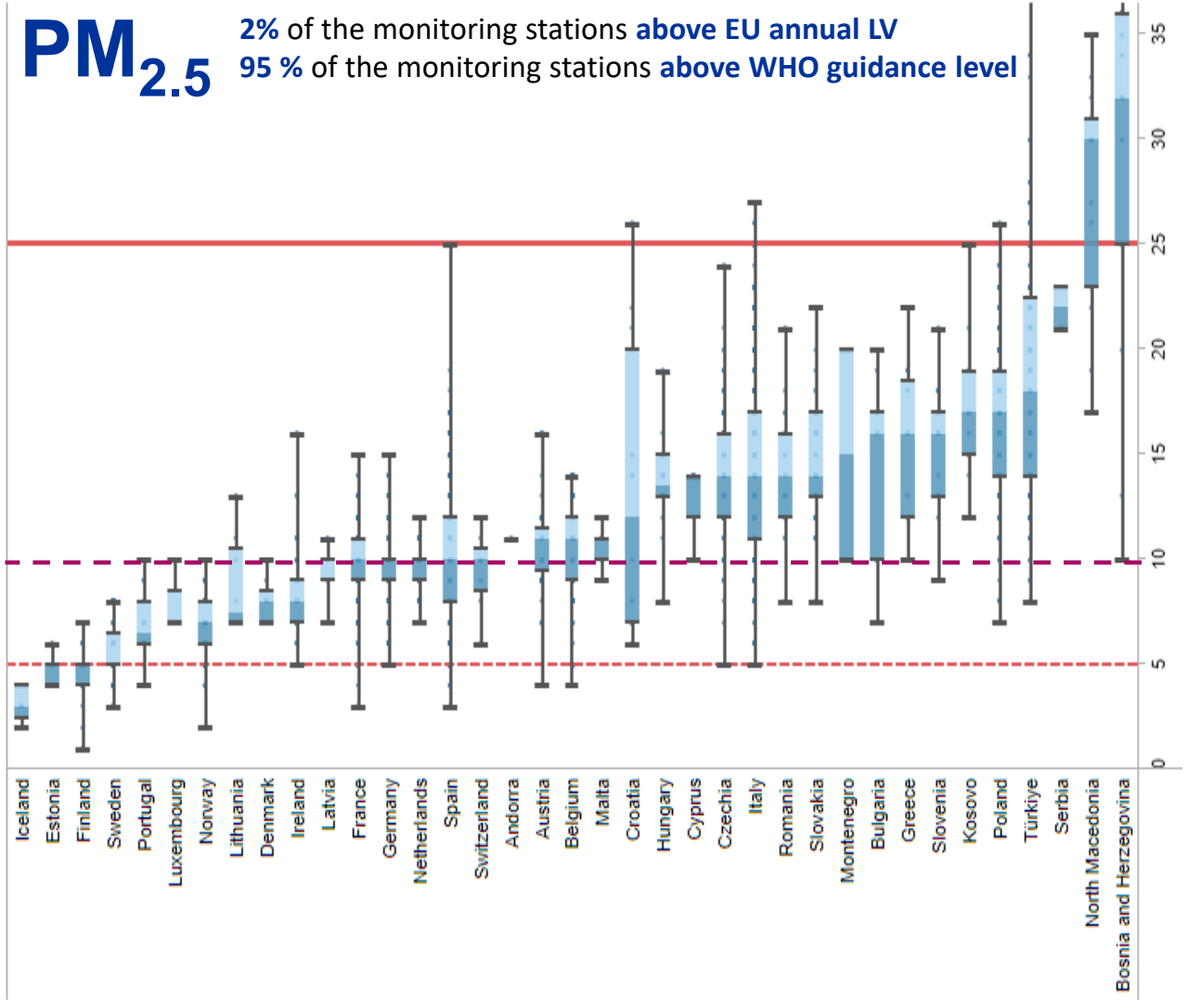
Environmental impacts: eutrophication (74%) and acidification (5 %) of ecosystem area affected

Economic impacts: air pollution causes annual costs at €231-853 billion (bn) in health impacts, €8 bn in lost workdays, €4-12 bn in ecosystems damage, €10-11 bn in crop yield loss, €19 bn in forest damage, €1 bn in damage to buildings.

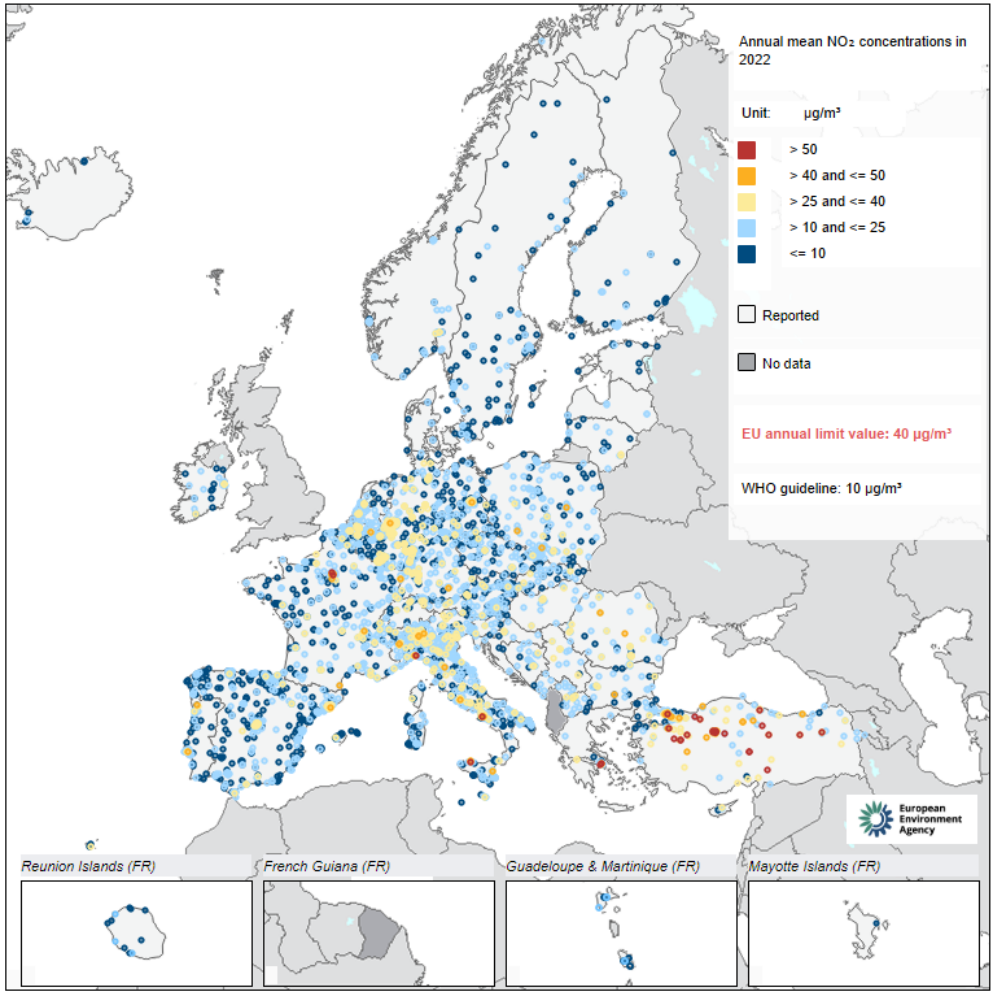
Source: EEA Air Quality in Europe (2024) & https://www.eea.europa.eu/en/analysis/indicators/exceedance-of-air-quality-standards

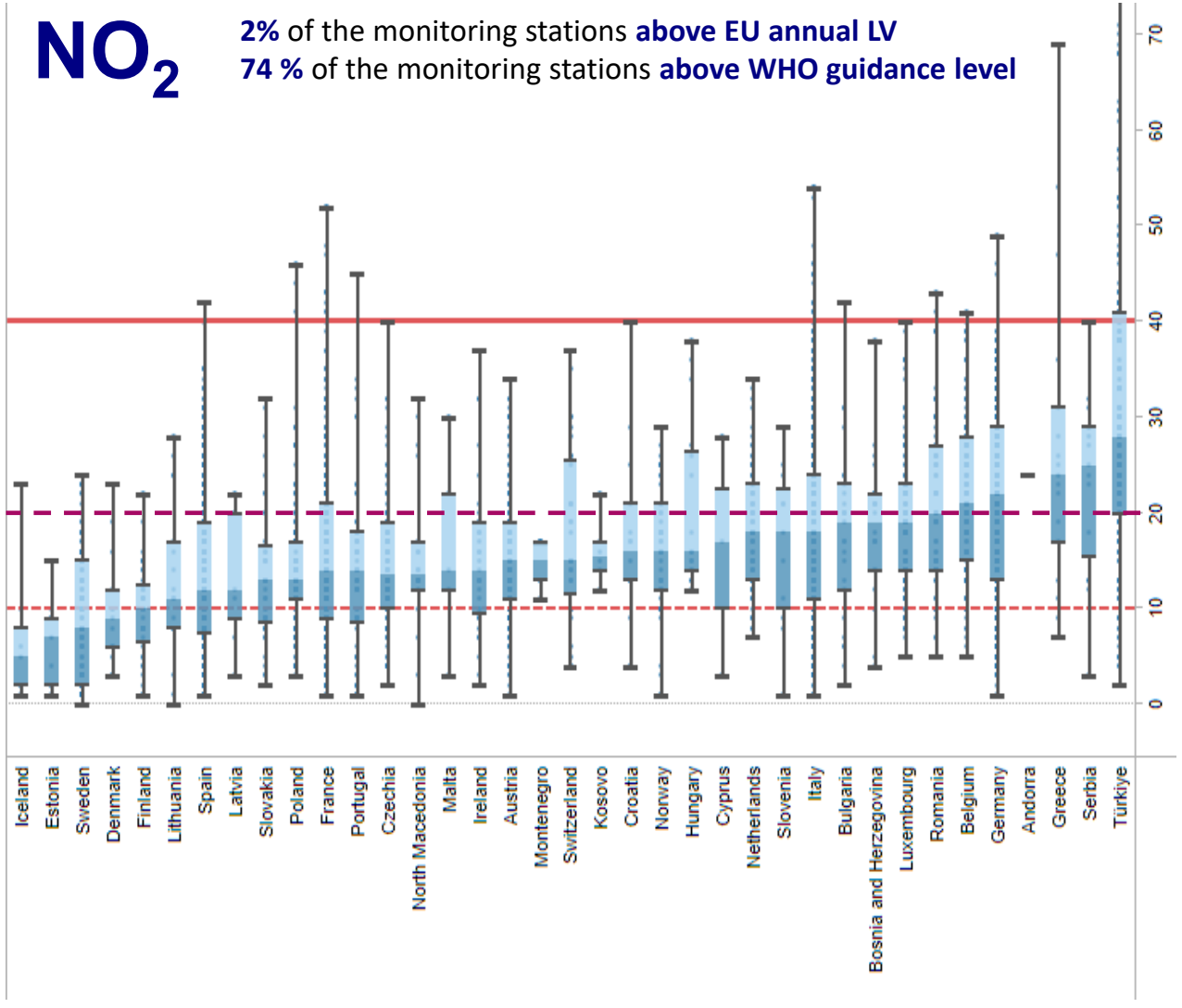
Where is air pollution (still) a problem? (2022)





Where is air pollution (still) a problem? (2022)





Ambient Air Quality Directive

Revision

“The Commission will draw on the lessons learnt from the evaluation of the current air quality legislation.

It will also propose to strengthen provisions on monitoring, modelling and air quality plans to help local authorities achieve cleaner air.

The Commission will notably propose to revise air quality standards to align them more closely with the World Health Organization recommendations.”

#EUGreenDeal

Communication on the European Green Deal
(COM/2019/640 final)

Path towards revision – drivers & obstacles

Revised Directive

Official Journal
of the European Union

EN
L series

2024/2881

20.11.2024

DIRECTIVE (EU) 2024/2881 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

of 23 October 2024

on ambient air quality and cleaner air for Europe

(recast)

The Ambient Air Quality Directive recast

Directive 2008/50/EC

on ambient air quality and cleaner air for Europe

As amended by **Commission Directive (EU) 2015/1480**

Directive 2004/107/EC

relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air

As amended by **Commission Directive (EU) 2015/1480**

Directive (EU) 2024/2881

on ambient air quality and cleaner air for Europe (recast)

Member States need to transpose this by **11 Dec 2026**

Which policy options were considered?

For example for $PM_{2.5}$

AMBITION LEVEL

\-

EU standards today / baseline

Policy option I-3 I-3

Policy option I-2 I-2

Policy option I-1 I-1

WHO – Air Quality guidelines and interim targets for $PM_{2.5}$ (annual mean)

Annual mean level	$PM_{2.5}$ (µg/m3)	Mortality
Interim target 1	35	+ 24 % above guideline level
Interim target 2	25	+ 16 % above guideline level
Interim target 3	15	+ 8 % above guideline level
Interim target 4	10	+ 4 % above guideline level
AQ guideline level	5	mortality at guideline level

How did different policy options compare?

All three options assessed would render **significant health and environment benefits**, which outweigh the implementation costs by 2030 – albeit to varying degrees.

Table 17 – A Comparison of policy options on level of alignment with the WHO Air Quality Guidelines (2030)

		Baseline	Policy Option I-3	Policy Option I-2	Policy Option I-1
Air Quality standard	**$PM_{2.5}$**	**25 µg/m3**	**15 µg/m3**	**10 µg/m3**	**5 µg/m3**
	NO_2	40 µg/m3	30 µg/m3	20 µg/m3	10 µg/m3
Exposed > WHO levels	**$PM_{2.5}$**	**333 million**	**267 million**	**243 million**	**226 million**
	NO_2	52 million	46 million	44 million	42 million
Is the standard achievable with available measures? [a]		**For >99%** of $PM_{2.5}$ sampling points	**For 99%** of $PM_{2.5}$ sampling points	**For 94%** of $PM_{2.5}$ sampling points	**For 29%** of $PM_{2.5}$ sampling points
Key economic impacts					
Mitigation costs	**Central**	**0**	**€3.3 bn**	**€5.6 bn**	**€7.0 bn**
	If corrected for 'border cell effect' [b]	0	€1.0 bn	€5.1 bn	€7.0 bn
Gross benefits	**Low** [c]	**0**	**€32.4 bn**	**€41.8 bn**	**€45.0 bn**
	High [d]	0	€93.8 bn	€121.4 bn	€130.8 bn
Net benefits	**Low** [c]	**0**	**€29.0 bn**	**€36.2 bn**	**€37.9 bn**
	High [d]	0	€90.4 bn	€115.7 bn	€123.6 bn
Benefit-cost ratio	**Low** [c]	**-**	**10:1**	**7.5:1**	**6:1**
	High [d]	-	28:1	21:1	19:1
Net GDP impact		**+ /- 0%**	**+ 0.26 %**	**+ 0.38 %**	**+ 0.44 %**
Key health impacts [e]					
Annual premature mortality	**Due to $PM_{2.5}$**	**56 100**	**38% less**	**49% less**	**53% less**
	Due to NO_2	4 050	12% less	16% less	20% less

Key criteria:

- **Achievability**
- **Mitigation costs**
- **Gross benefits**
- **Benefit vs Cost**
- **Health impact**

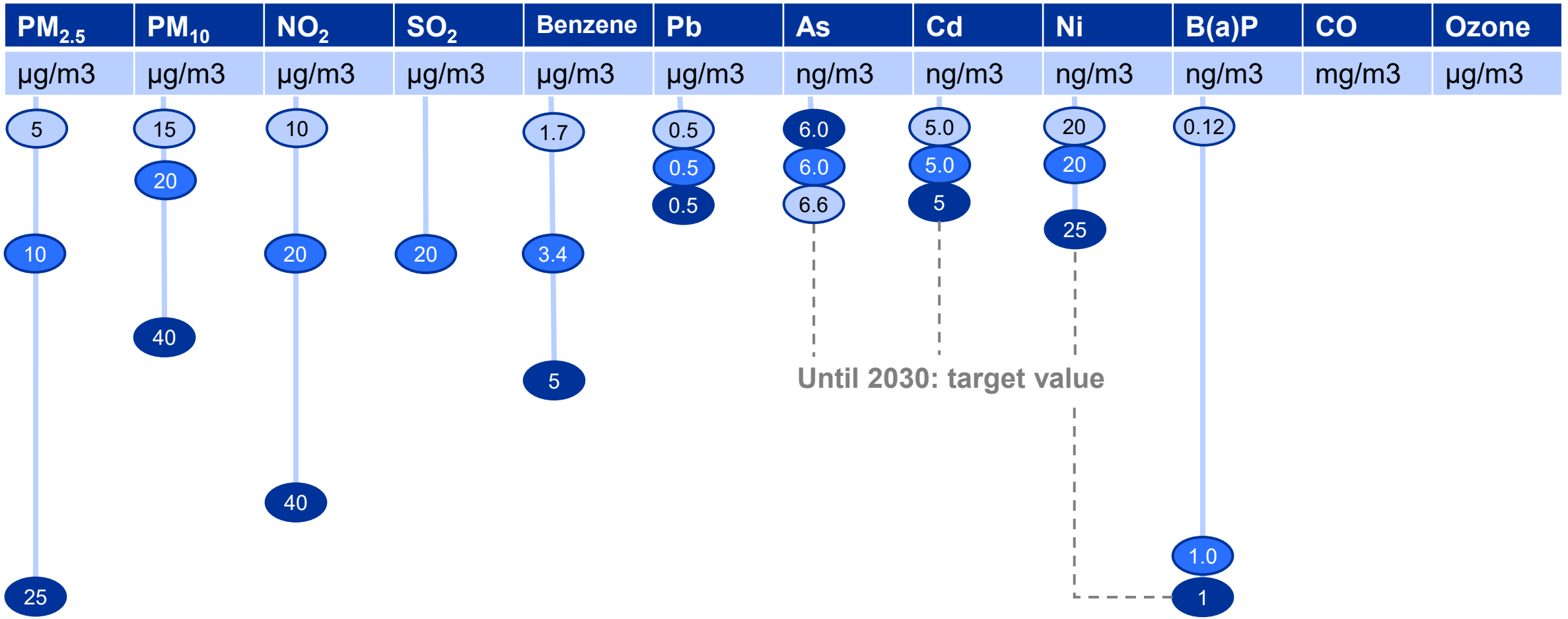
I-3 I-2 I-1

What's new (1 of 4)

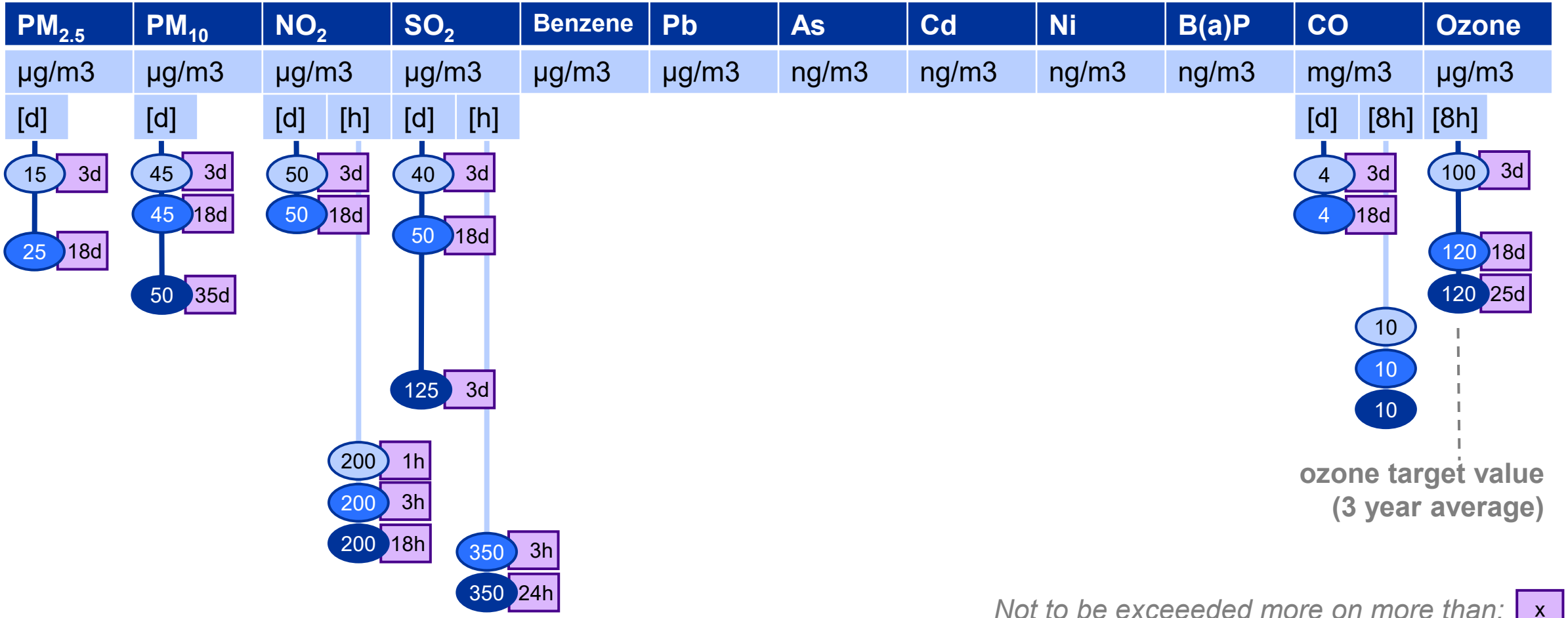
Environment & health

- **Zero pollution objective** at the latest by 2050
- Intermediate **2030 EU air quality standards**
- **Postponement** of deadlines possible (climate and orographic, domestic heating, projections)
- New metrics & **average exposure obligations**

Air quality standards (annual)



Air quality standards (short term)



Postponement of attainment deadline

Where, in a given zone, conformity with the limit values for $PM_{10,}$ $PM_{2,5}$, NO_2, benzene or benzo(a)pyrene **cannot be achieved by the deadline (2030)**, Member States may postpone that deadline for that particular zone provided that specified conditions set are met:

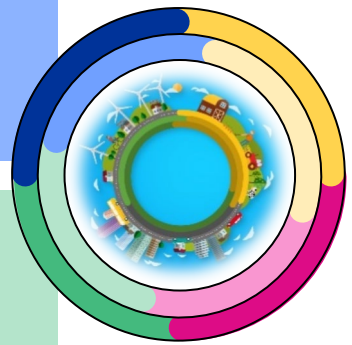
- *up to **1 January 2040**, if justified by site-specific dispersion characteristics, orographic boundary conditions, adverse climatic conditions, transboundary contributions, or where the necessary reductions can only be achieved by replacing a considerable fraction of the existing domestic heating systems that are the source of pollution causing exceedances; or*
- *up to **1 January 2035**, if justified by projections that demonstrate that even taking into account the expected impact of effective air pollution measures identified in the air quality roadmap, the limit values cannot be attained by the attainment deadline.*

In order to postpone an attainment deadline, Member States need to *inter alia* establish an **air quality roadmap** by 31 Dec 2028 for the zone(s) in question, supplemented by information on abatement measures, and demonstrate how exceedance periods above the limit values will be kept as short as possible. This is to be underpinned by air quality projections.

What's new (2 of 4)

Environment & health

- **Zero pollution objective** at the latest by 2050
- Intermediate **2030 EU air quality standards**
- **Postponement** of deadlines possible (climate and orographic, domestic heating, projections)
- New metrics & **average exposure obligations**



Governance & enforcement

- **Regular review mechanism**
- Air quality plans to be **more effective**
- **Improved enforceability**: new provisions on access to justice, compensation and penalties
- More **transboundary cooperation** on air quality

Air quality plans & roadmaps

AIR QUALITY PLAN

WHEN IS IT NEEDED?

There is an exceedance of limit of target value after attainment deadline
or
if average exposure reduction obligation (AERO) is not attained.

WITH WHAT OBJECTIVE?

To keep the exceedance period as short as possible.

AIR QUALITY ROADMAP

WHEN IS IT NEEDED?

There is an exceedance of 2030 limit or target values in the period from 2026 to 2029.

WITH WHAT OBJECTIVE?

To attain the limit or target values by the attainment deadline.

Air quality plans & roadmaps

AIR QUALITY PLAN

AIR QUALITY ROADMAP

Year **N**: exceedance

Year **N + 1**: exceedance reported

Year **N + 2**: max. time to set up plan / roadmap

Year **N + 4**:
max. time to end exceedance

Exceedance to end by
attainment deadline

Exception: not applicable to ozone target value (Art. 19(2) and AERO (Art. 19(4))

For limit and target values: 2030 (or later in case of postponement under Art. 18.)
Yearly obligation as of 2030 for AERO

Year **N + 5**: if exceedance: update plan / roadmap

Year **N + 7**: max. time to update plan / roadmap

What's new (3 of 4)

Environment & health

- **Zero pollution objective** at the latest by 2050
- Intermediate **2030 EU air quality standards**
- **Postponement** of deadlines possible (climate and orographic, domestic heating, projections)
- New metrics & **average exposure obligations**

Governance & enforcement

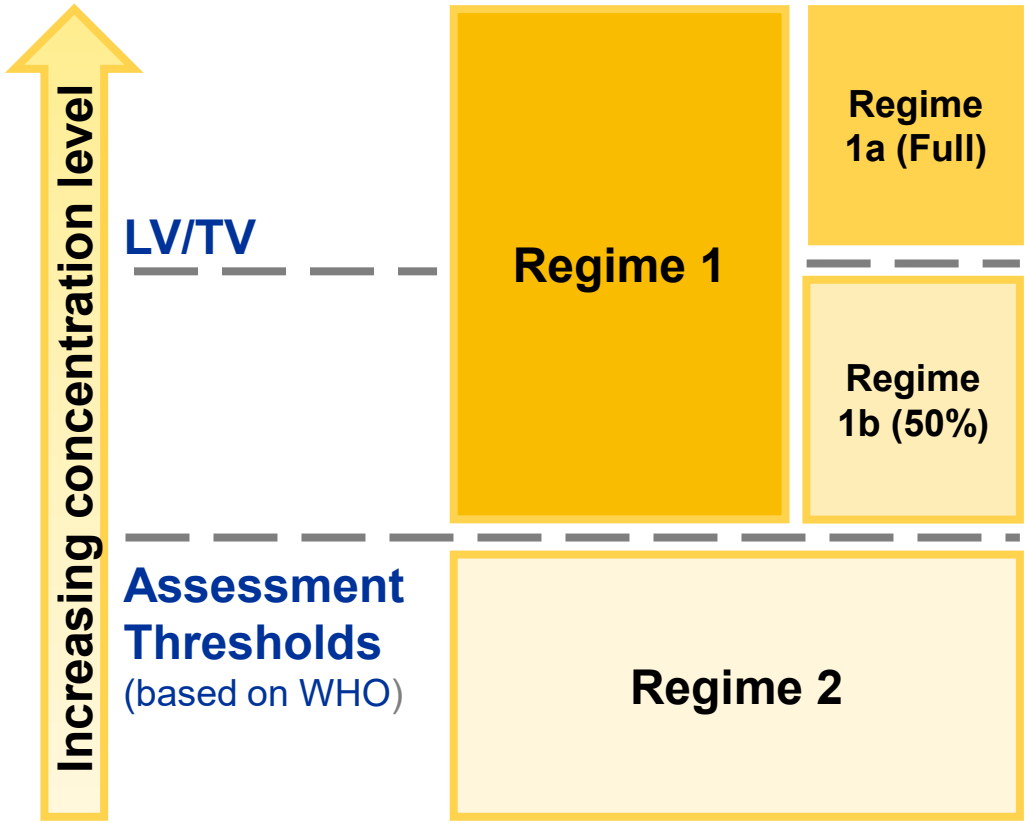
- **Regular review mechanism**
- Air quality plans to be **more effective**
- **Improved enforceability**: new provisions on access to justice, compensation and penalties
- More **transboundary cooperation** on air quality

Monitoring & assessment

- Refined approach to **air quality monitoring,** increased use of **air quality modelling**
- Additional information on representativeness of **sampling points**, better inform air quality action
- Monitoring **pollutants of emerging concern** (e.g. ultrafine particles, black carbon, ammonia)

Assessment regimes & criteria

Refined **monitoring and assessment regimes**, with stronger role for modelling and additional requirements to assure monitoring continuity and spatial representativeness.



Regime 1a - *fixed sampling points shall be used; may be supplemented by indicative measurements/modelling to assess air quality. From 2 yrs after adoption of IA modelling: indicative or modelling shall be used. Modelling at least every 5 yrs.*

Regime 1b - *fixed sampling points shall be used; but can be reduced by up to 50% under conditions (i.e. if there is sufficient modelling and/or indicative measurements, same number of indicative as fixed replaced).*

Regime 2 - *modelling applications, indicative measurements, objective-estimation techniques or a combination shall be sufficient for assessment of AQ.*

Monitoring supersites & ultrafine particles

Monitoring stations at urban background and rural background locations with **multiple sampling points** to gather long-term data on several pollutants – including pollutants of emerging concern such as UFP, black carbon or ammonia, and others.

>> at **urban background locations:** at least 1 per 10 million inhabitants.

>> at **rural background locations**: if territory > 10.000 km², then at least 1 per 100.000 km².

For a comprehensive list of pollutants to be measured or recommended to be measured at monitoring supersites, see **Annex VII**.

In addition: For **ultrafine particles**, at least one sampling point per 5 million inhabitants will have to be established at a location where high concentrations are likely to occur – e.g. influenced by sources from air, water or road transport (such as airports, ports, roads), industrial sites or domestic heating (Annex VII).

Recognition of Earth Observation & CAMS

(13) Where applicable, modelling applications should be applied to enable point data to be interpreted in terms of geographical distribution of concentration of pollutants, which can help to detect breaches of air quality standards, and to inform air quality plans and air quality roadmaps and the placement of sampling points. In addition to the requirements for air quality monitoring laid down in this Directive, for monitoring purposes, Member States are encouraged to exploit information products and supplementary tools, such as by regular evaluation and quality assessment reports or policy online applications, provided by the Earth Observation component of the Union Space Programme, in particular the Copernicus Atmosphere Monitoring Service.

What's new (4 of 4)

Environment & health

- **Zero pollution objective** at the latest by 2050
- Intermediate **2030 EU air quality standards**
- **Postponement** of deadlines possible (climate and orographic, domestic heating, projections)
- New metrics & **average exposure obligations**

Monitoring & assessment

- Refined approach to **air quality monitoring,** increased use of **air quality modelling**
- Additional information on representativeness of **sampling points**, better inform air quality action
- Monitoring **pollutants of emerging concern** (e.g. ultrafine particles, black carbon, ammonia)

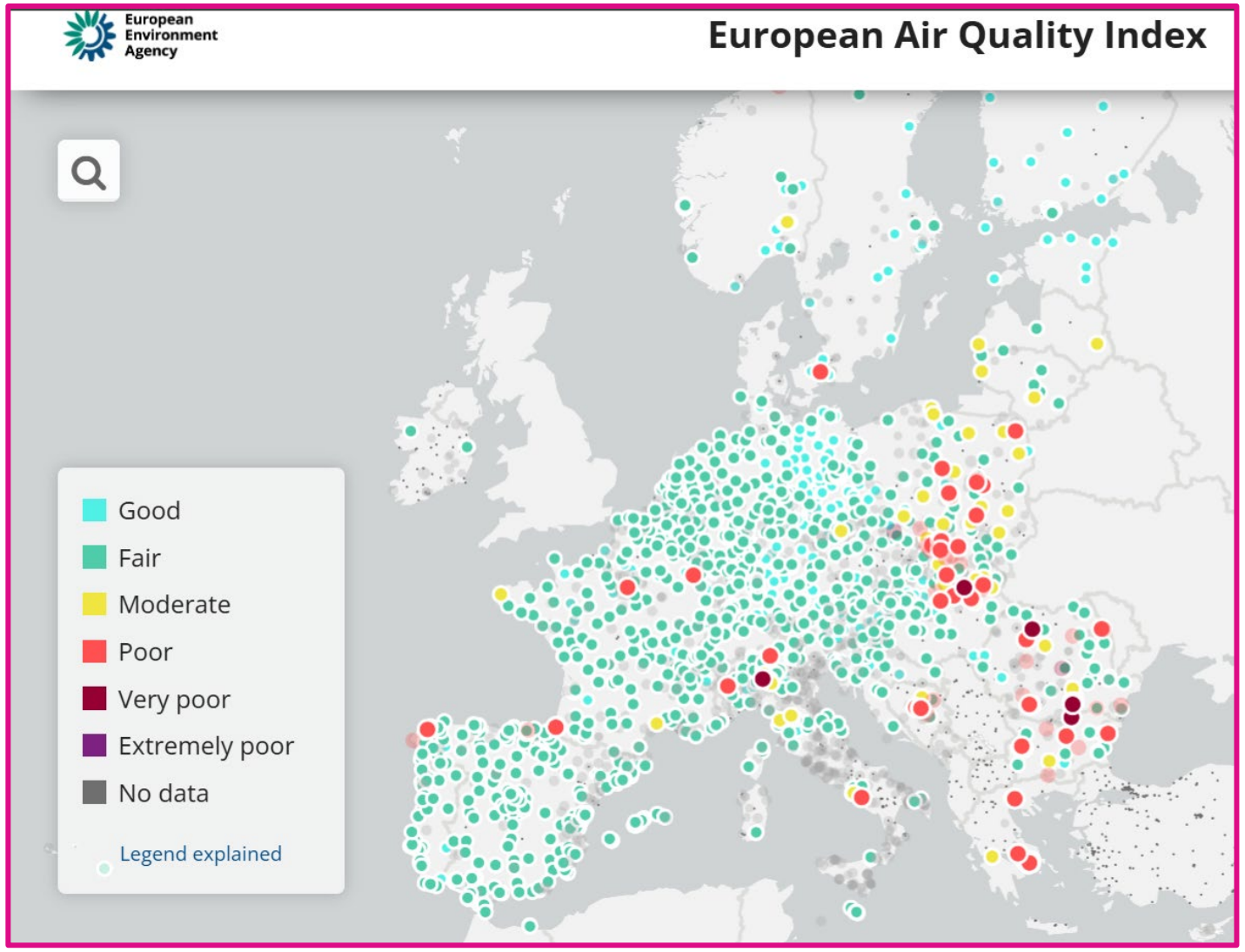
Governance & enforcement

- **Regular review mechanism**
- Air quality plans to be **more effective**
- **Improved enforceability**: new provisions on access to justice, compensation and penalties
- More **transboundary cooperation** on air quality

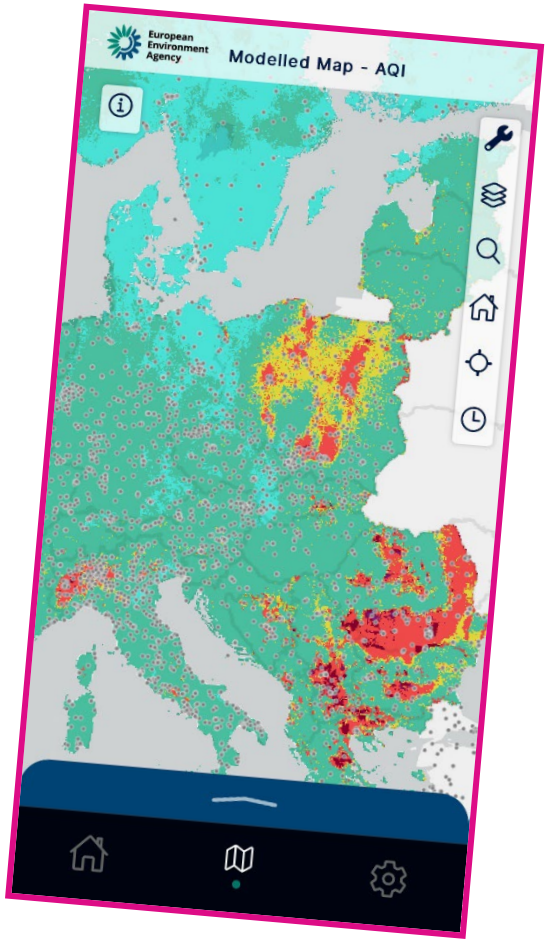
Information & communication

- More **up-to-date air quality information**
- Requirements for **air quality indices** to provide hourly reporting of available air quality data
- **Informing the public** about possible health impacts and provide recommendations

Air Quality Index



- $PM_{2.5}$
- PM_{10}
- NO_2
- SO_2
- Ozone



Screenshot of 28 Jan 2025 – 18:00
www.eea.europa.eu/en/analysis/maps-and-charts/index

CAMS relevance to the Directive

- Use of CAMS information to quantify **contributions of natural sources** to air pollution. Several Member States already use CAMS products for identifying contributions of natural sources to air pollutant concentrations as regards exceedances in the context of the AAQD
- Use of CAMS information to quantify **contributions to background air pollution**. This will require a collaborative effort with FAIRMODE, and with the relevant research networks (including EMEP and ACTRIS) to strengthen the validation procedures.
- Use of CAMS information to identify **transboundary contributions to air pollution**.
- Use of CAMS forecasting information, including as input to the **EEA Air Quality Index.**
- Use of CAMS **downscaling activities:** for example, as regards health risk assessments and in the Copernicus Health Hub or as input to EEA/JRC environmental health services.
- Use of CAMS information to **support air quality plans**, including source allocation services and scenario development.

What do we expect from revised Directive?

Health benefits: Reduce **annual mortality** (premature deaths) linked to air pollution by 50% more than without this policy and related measures [(1)] and reduce **related morbidity** (illnesses) by 50% more than without this policy and measures.

Social benefits: Stricter limit values particularly protect sensitive populations and vulnerable groups; Directive requires additional health impact information.

Environmental benefits: Decreases in **eutrophication (-22%)** and **acidification (-63%)** of ecosystems; less crop losses and damage to forests.

Economic benefits: Benefits far outweigh the costs, with annual total gross **benefits estimated at €42 bn** (and up to €121 bn depending on the valuation method) in 2030, compared to measures that costs less than €6 bn annually.

[(1)] Note that these estimates refer only to health impacts above the WHO Air Quality Guideline levels. However, air pollution below these levels can also impact human health.

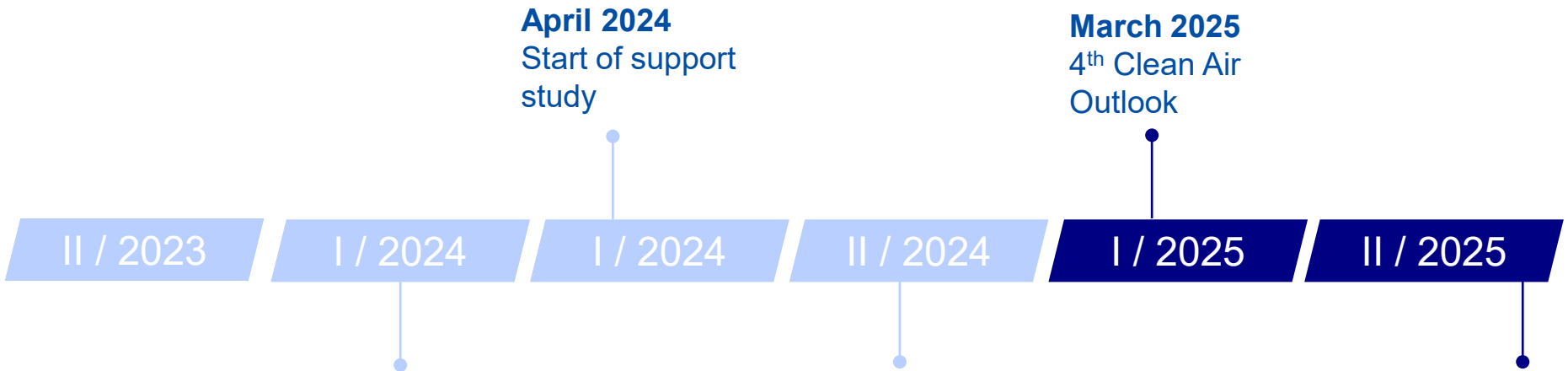
National Emission reduction Commitments (NEC) Directive

Implementation, Evaluation, Fourth Clean Air Outlook

NECD – implementation

- Defines specific **national emission reduction commitments** for each MS for **SO_2, NO_x, NMVOC, NH_3 and $PM_{2.5}$** for 2020-2029 and for 2030 onwards
- Member States need to report yearly **emission inventories** and to develop and update regularly **National Air Pollution Control Programmes** (NAPCP)
- Implementation on-going, but shortcomings – especially as regards emission inventories and reduction commitments – still in several Member States

NECD evaluation – indicative timeline



April 2024
Start of support study

March 2025
4th Clean Air Outlook

15 February – 14 March
Call for evidence on the Have your say portal

30 July
2nd NECD implementation report

3 September-26 November:
Open public consultation
Targeted consultation

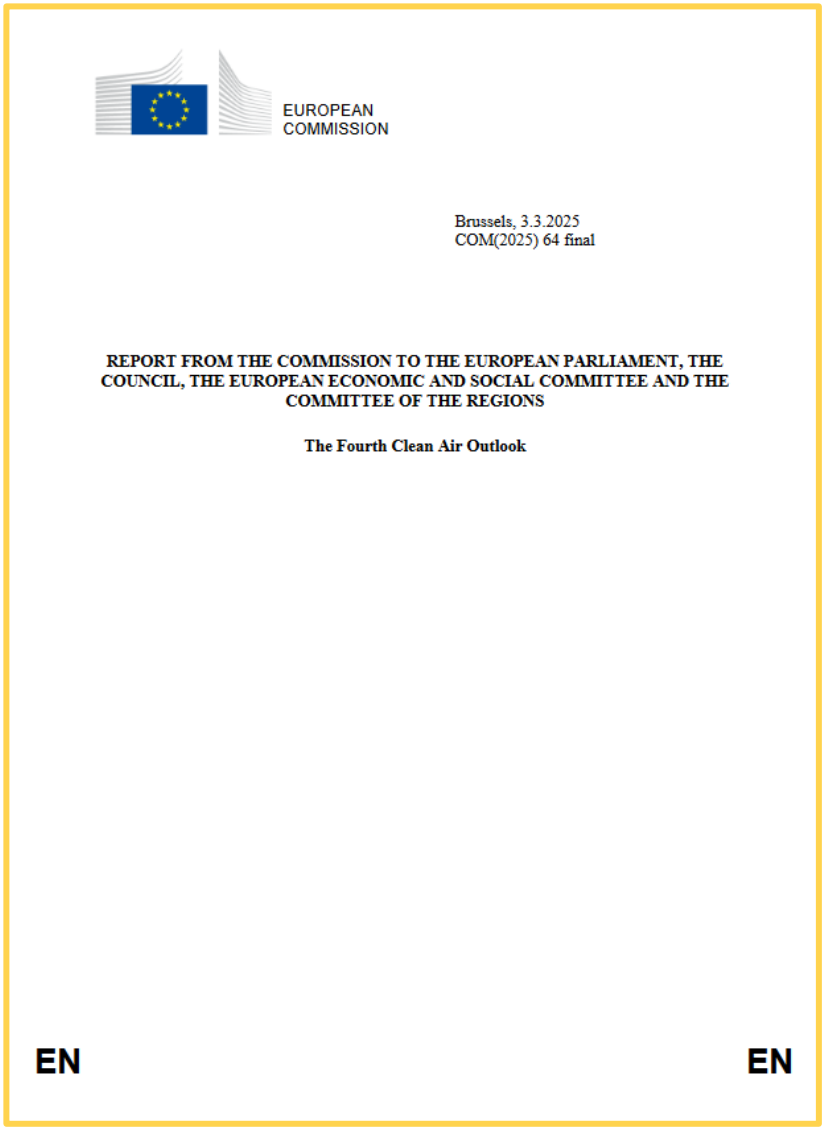
14 October
Stakeholder workshop

Planned adoption
of the Staff Working Document in December 2025

1-2 December
Clean Air Forum

Fourth Clean Air Outlook

- Regular modelling exercise, linked to NEC Directive 2016/2284, to provide consistent set of EU projections for the five main air pollutants and beyond
- Adopted on 3 March 2025: COM (2025) 64
- Support study by IIASA et al (link to OP publication)
- EUROPA page with all Clean Air Outlook reports: https://environment.ec.europa.eu/topics/air/clean-air-outlook_en
- Part of Zero pollution monitoring and outlook 2025



EUROPEAN
COMMISSION

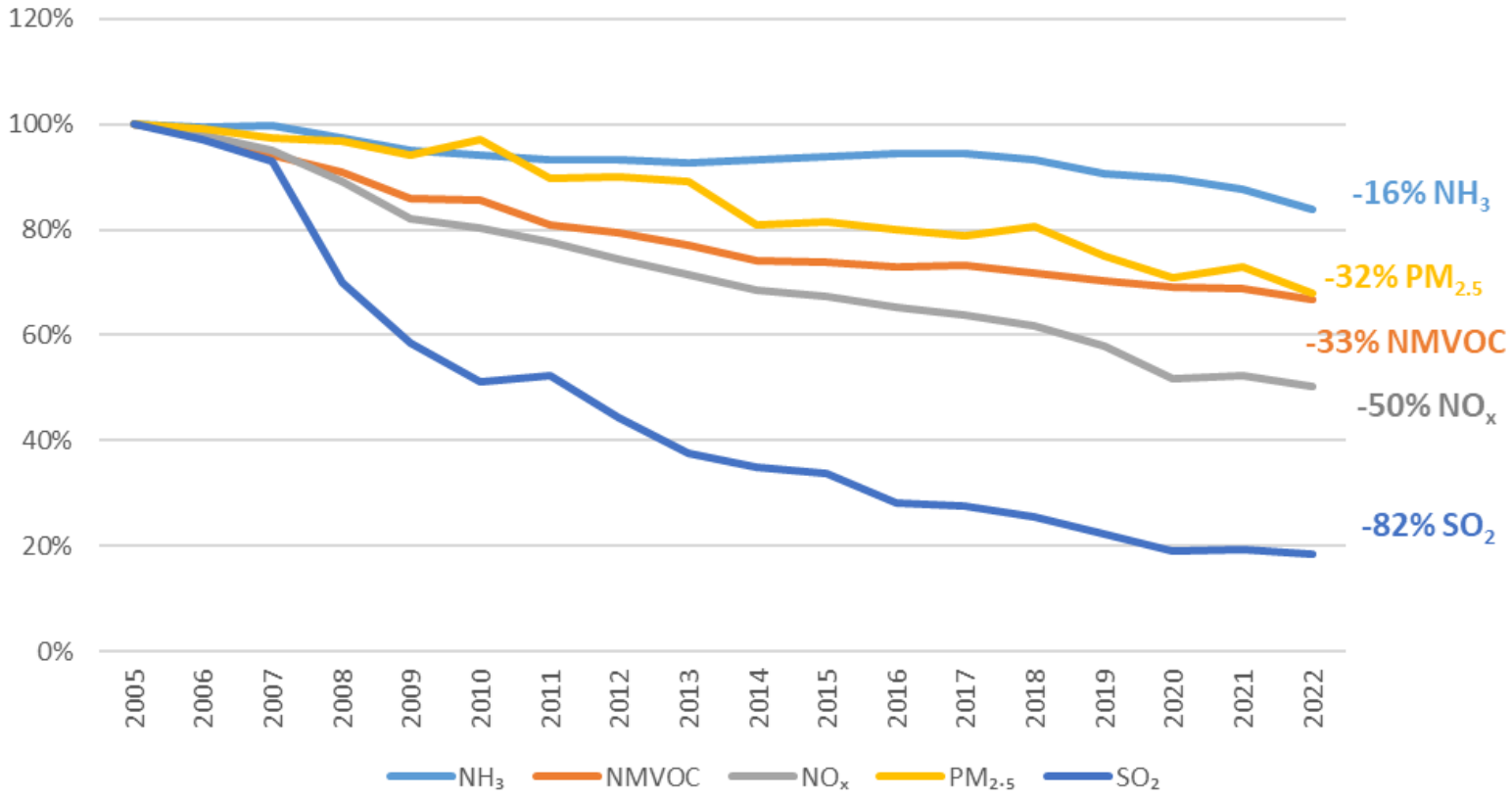
Brussels, 3.3.2025
COM(2025) 64 final

REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS

The Fourth Clean Air Outlook

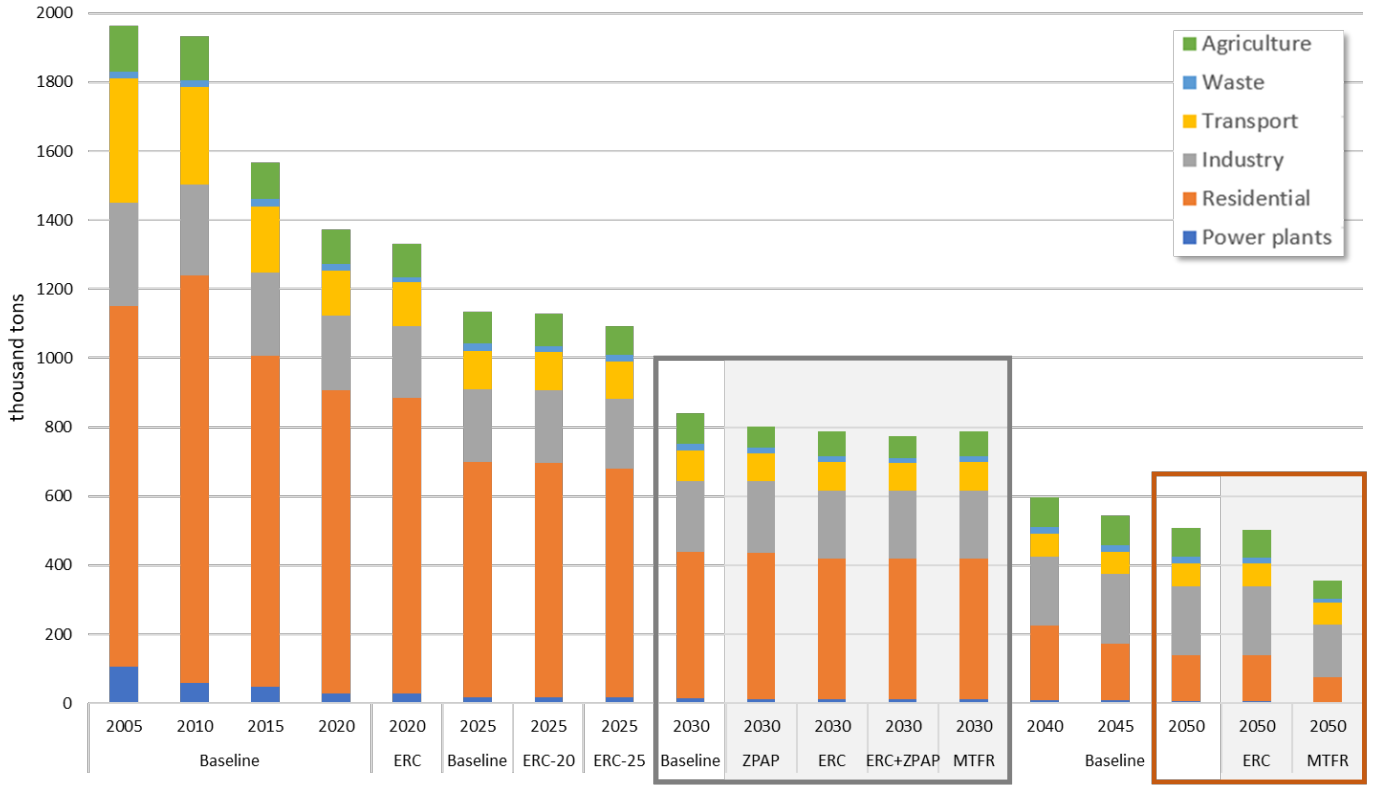
EN EN

Progress since 2005

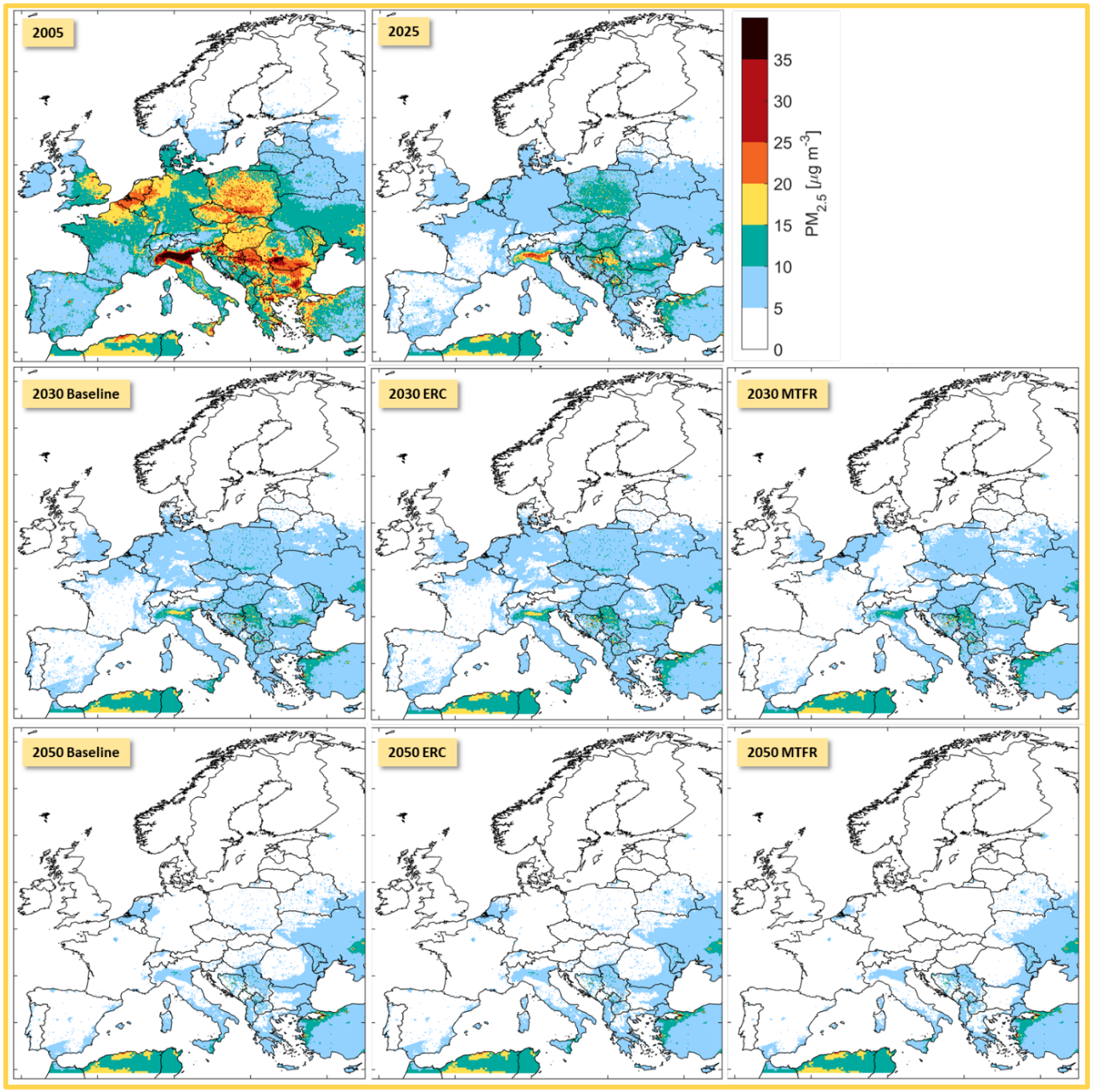


Source: European Environment Agency, based on Member States' air pollutant emission inventories

Projected emissions of EU27 $PM_{2.5}$



Source: IIASA (2025) support study underpinning CAO4

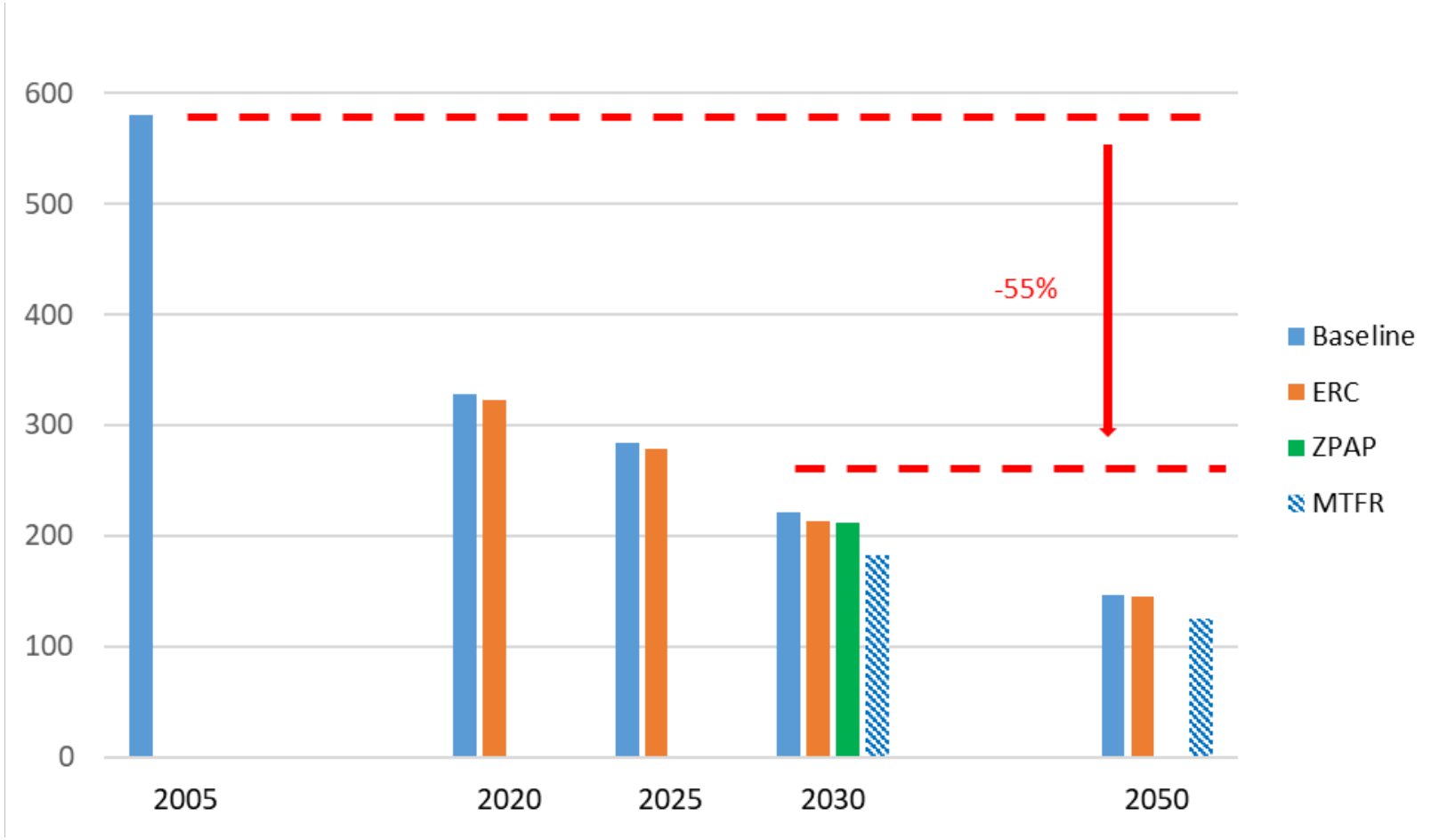


Implications for air quality

Notable improvements, yet, in 2030 and even in 2050, large areas remain exposed to levels above the WHO air quality guideline of 5 μg/m^3

Prospect of achieving the zero-pollution target of reducing health impacts of air pollution by 55%

EU is **on track** to meet ZPAP target: 62-68% reduction in premature deaths in 2030 compared to 2005 across the various modelled scenarios



CAMS relevance: future implementation of the NECD

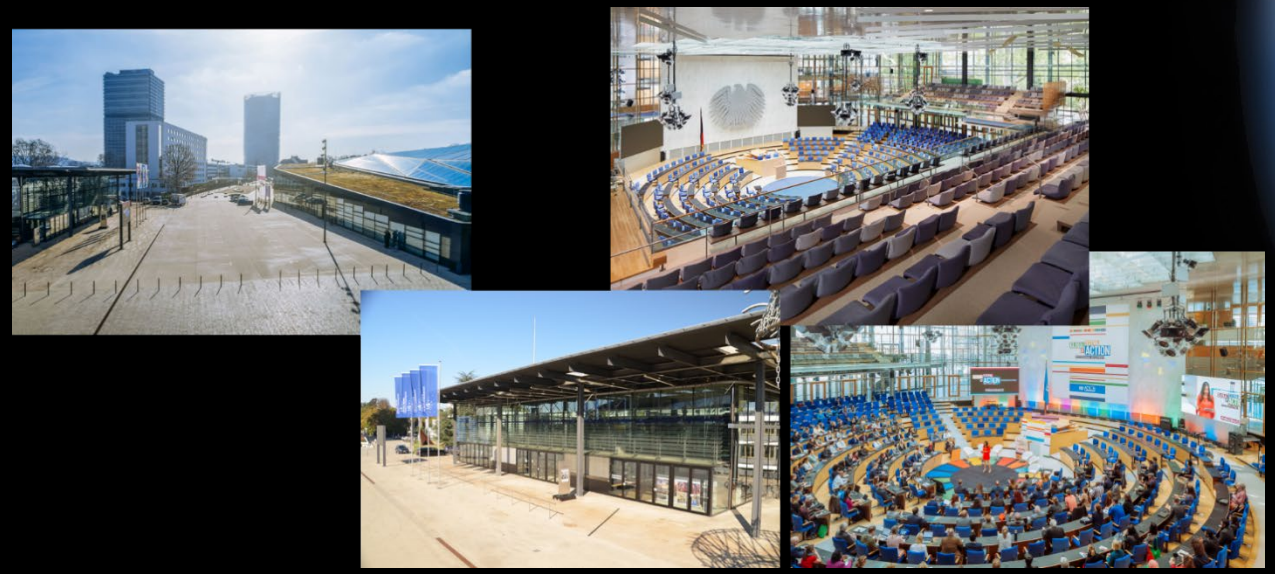
- Use of Copernicus C3S temperature data to account for exceptional meteorological conditions within one specific year in the flexibility mechanisms under the NECD reporting.
- Possible use of CAMS emissions and concentrations for national inventory and other reporting under the NECD.
- Possibilities for gap filling and QA/QC support on reported LCP industrial data, update of E-PRTR diffuse emissions and forecast of emissions.
- Possible use of inverse modelling to flag possible inconsistencies and gaps in the reported data.

Conclusion

- Potential for enhanced cooperation with CAMS on clean air policy
- Towards the 5th EU Clean Air Forum

European Commission
Clean Air & Urban Policy Unit

- **Co-organised by the European Commission and ECMWF/CAMS**
- **Will be held on the 1-2 December 2025 in at the Bonn World Conference Centre**



opernicus
Europe's eyes on Earth

Atmosphere Monitoring

PROGRAMME OF THE EUROPEAN UNION

opernicus
Europe's eyes on Earth

IMPLEMENTED BY ECMWF

Thank you

Contact us:

env-air@ec.europa.eu

European Commission