

21st Century Air Quality Global Progress and Challenges

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Air Pollution is one of the most significant Local, National, Regional and Global Environmental and Health Challenges



<https://www.abc.net.au/news/2020-01-13/victorian-fires-cause-poor-air-quality-in-melbourne-geelong/11861964>

Global Air Pollution

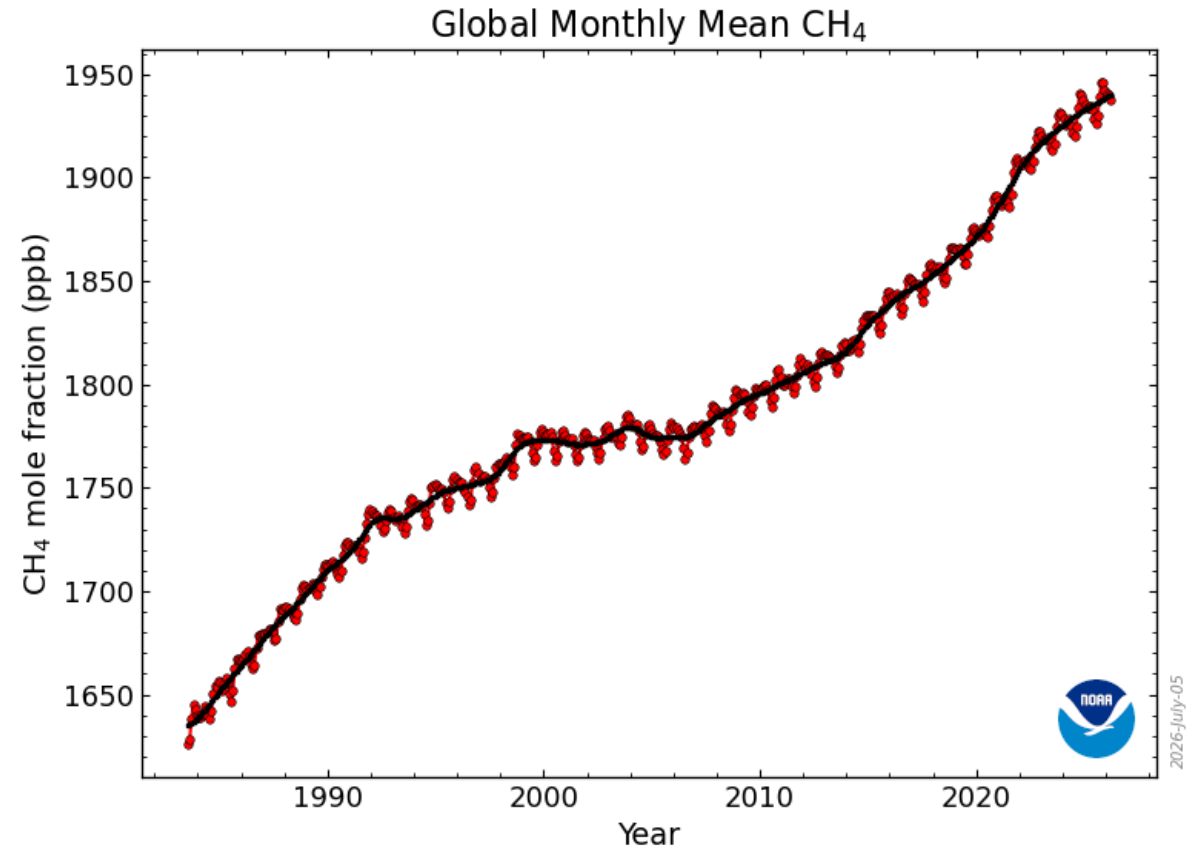
- Almost 99% of the world's population breathe air that exceeds WHO guidelines
- Low and Middle income countries suffer from the highest exposures, while in many high-income countries - concentrations decreasing
- 7.9 million deaths attributed to air pollution in 2023
- Ground-level ozone damages vegetation and reduces biodiversity. In 2020, critical levels for the protection of forests were exceeded in 59% of the total forest area of the 32 EEA member countries.
- Damaging levels of nitrogen deposition were found in 75% of the total ecosystem of the 27 EU Member States in 2020, a reduction of 12% since 2005.

Local, Regional, Global Issues

PM10, PM2.5 and ozone - problems in many airsheds and globally

Recent focus on methane - short lived climate pollutant - contributing to ground-level ozone concentrations but also as a greenhouse gas contributing to global warming.

NO_x and NH₃ – particularly in Europe

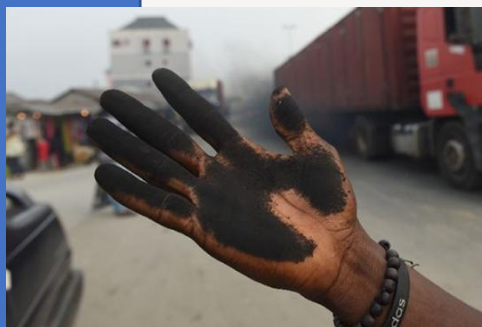


NOAA globally-averaged, monthly mean atmospheric methane abundance determined from marine surface sites. Values for the last year are preliminary

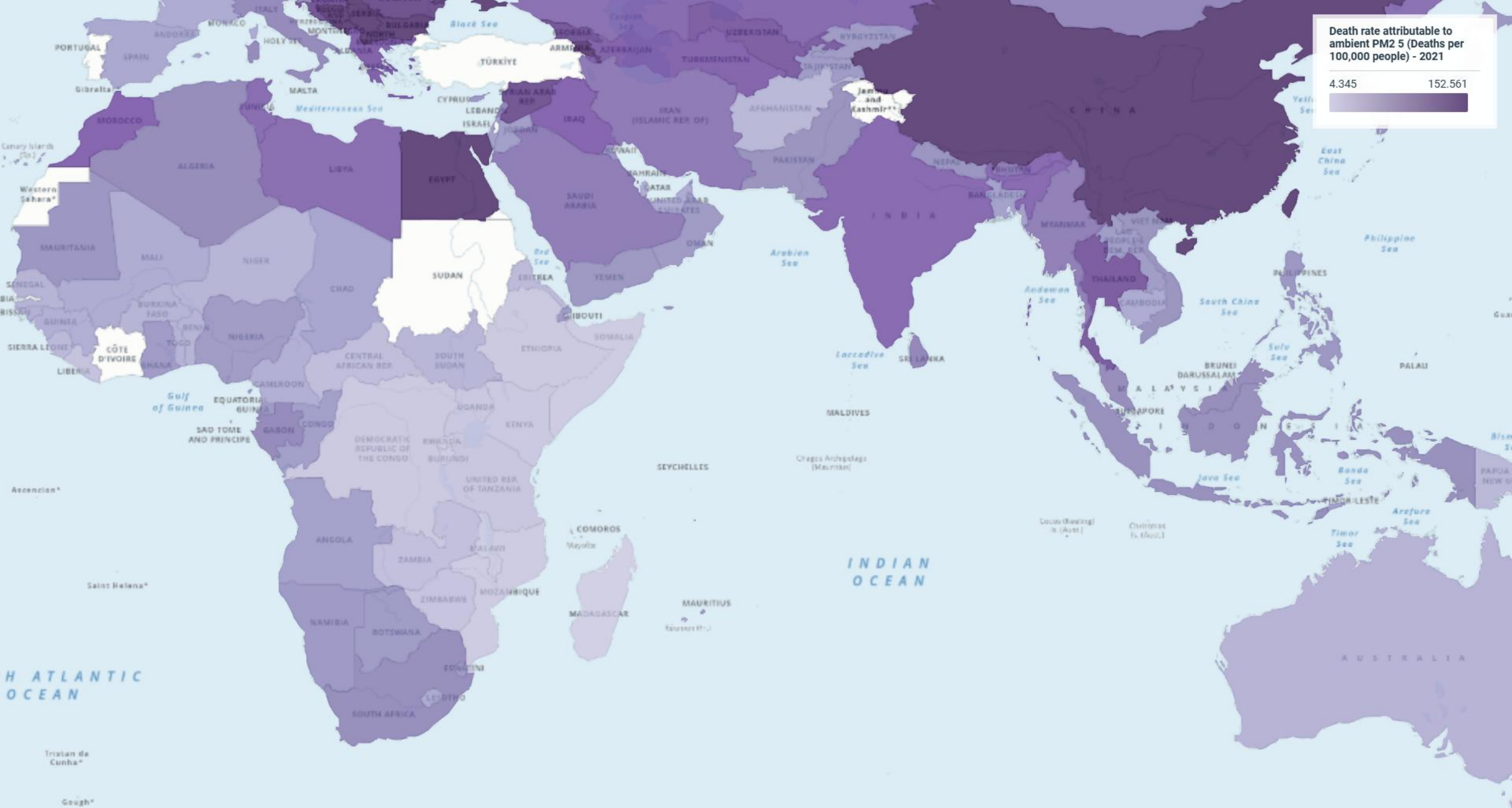
SHORT-LIVED CLIMATE POLLUTANTS

Response to mitigation efforts

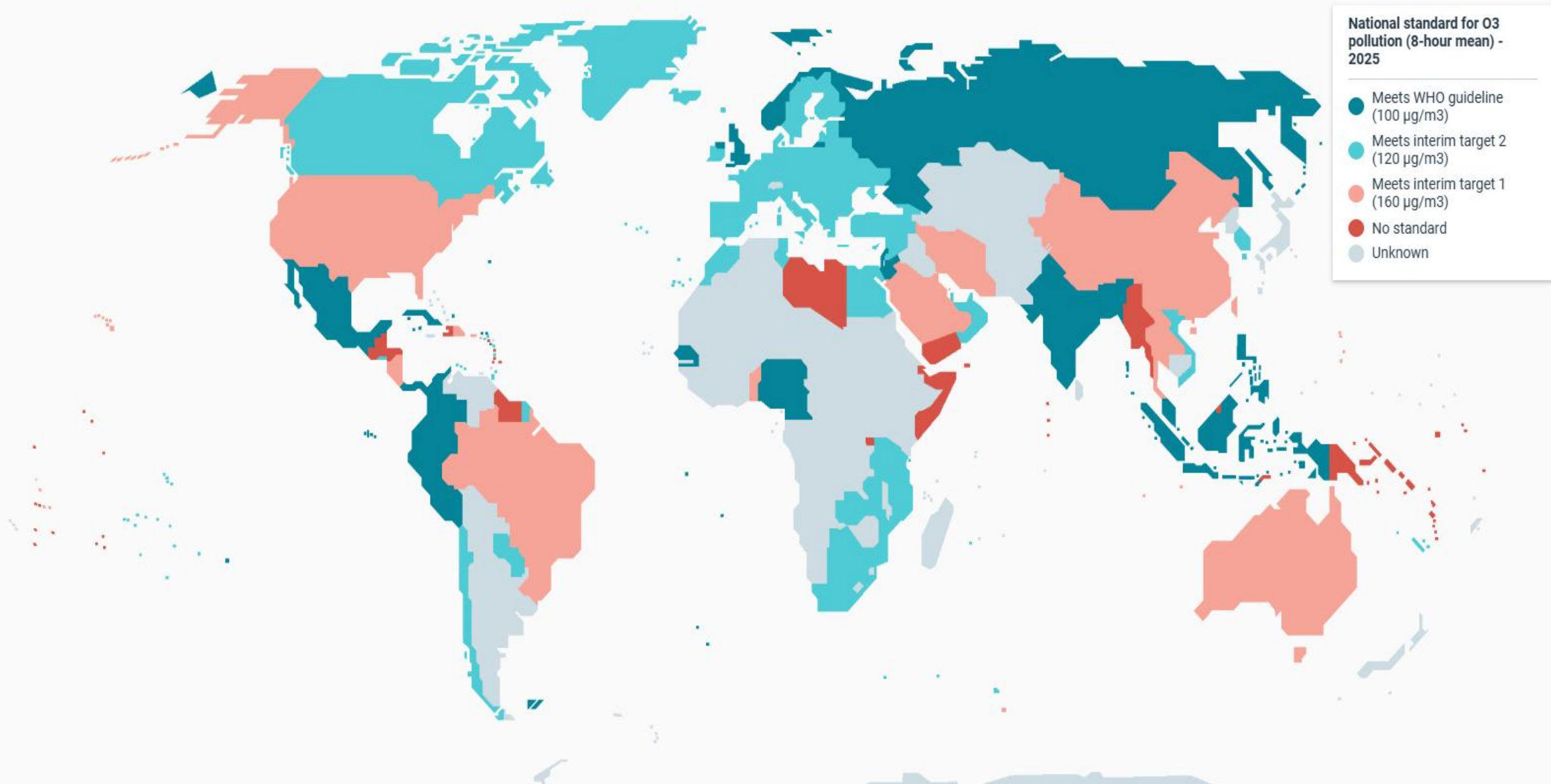
<https://www.ccacoalition.org/en/content/short-lived-climate-pollutants-slcps>



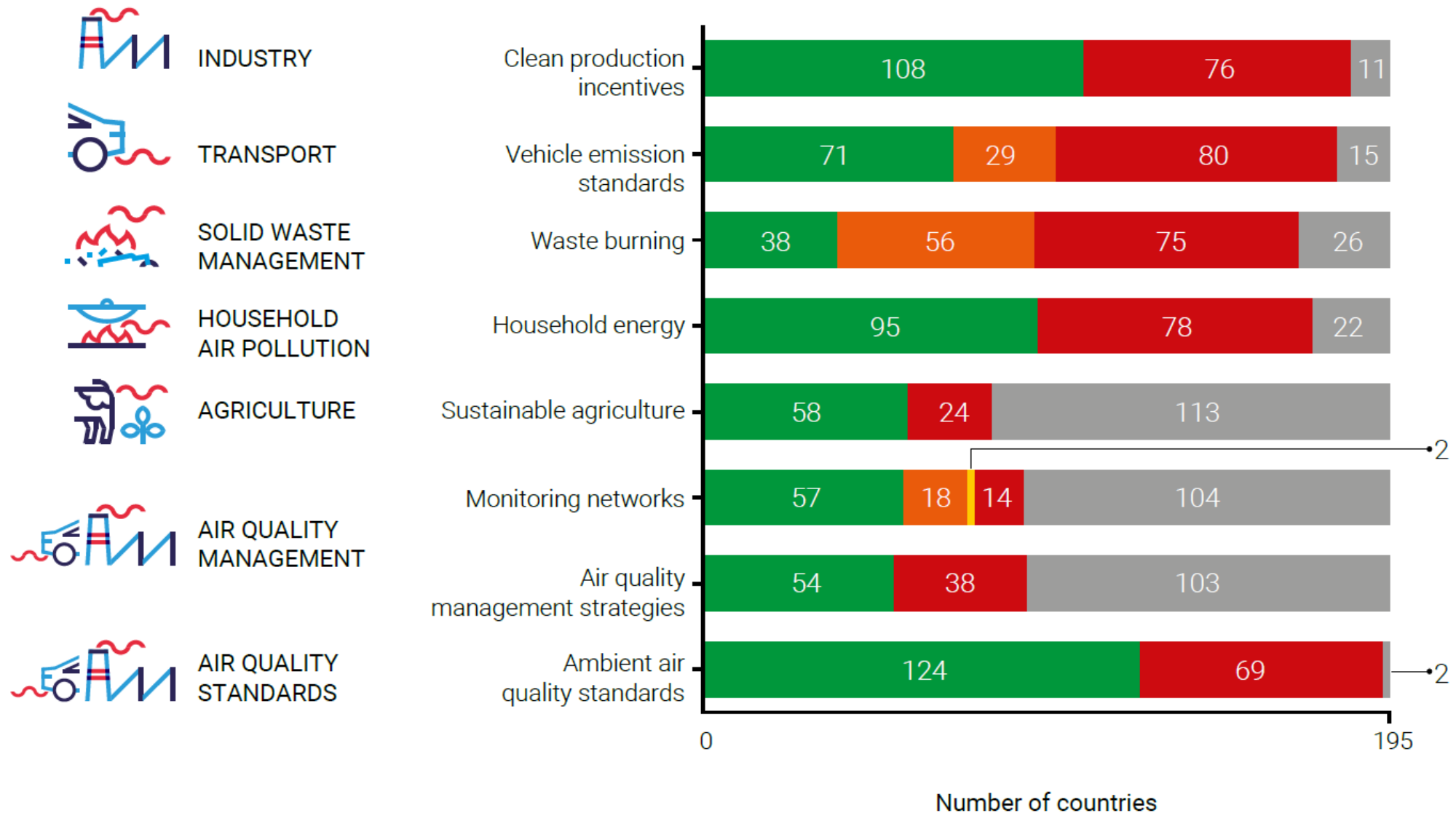
SUBSTANCE	 ANTHROPOGENIC SOURCES	LIFETIME IN ATMOSPHERE	LOCAL REGIONAL GLOBAL 		
			IMPACTS/MITIGATION		
BLACK CARBON (BC)	    	DAYS			
METHANE (CH ₄)	    	12 YEARS			
TROPOSPHERIC OZONE (O ₃)	     	WEEKS			
HYDROFLUORO-CARBONS (HFCs)	     	15 YEARS (WEIGHTED BY USAGE)			



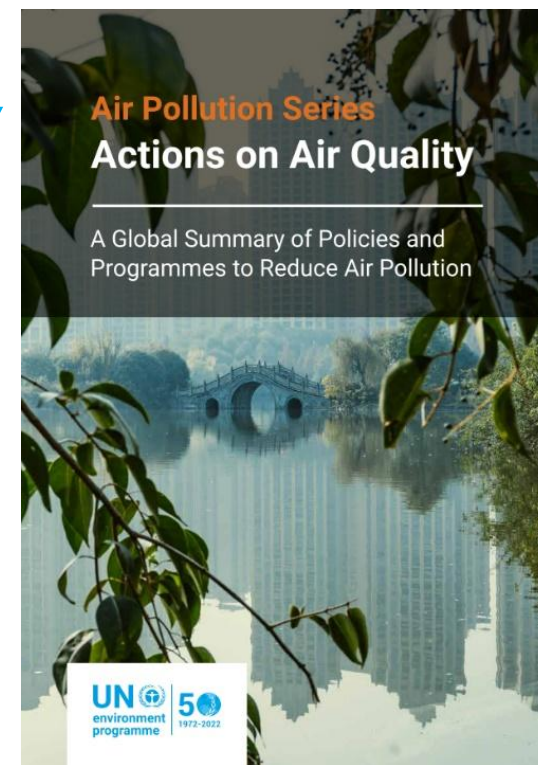
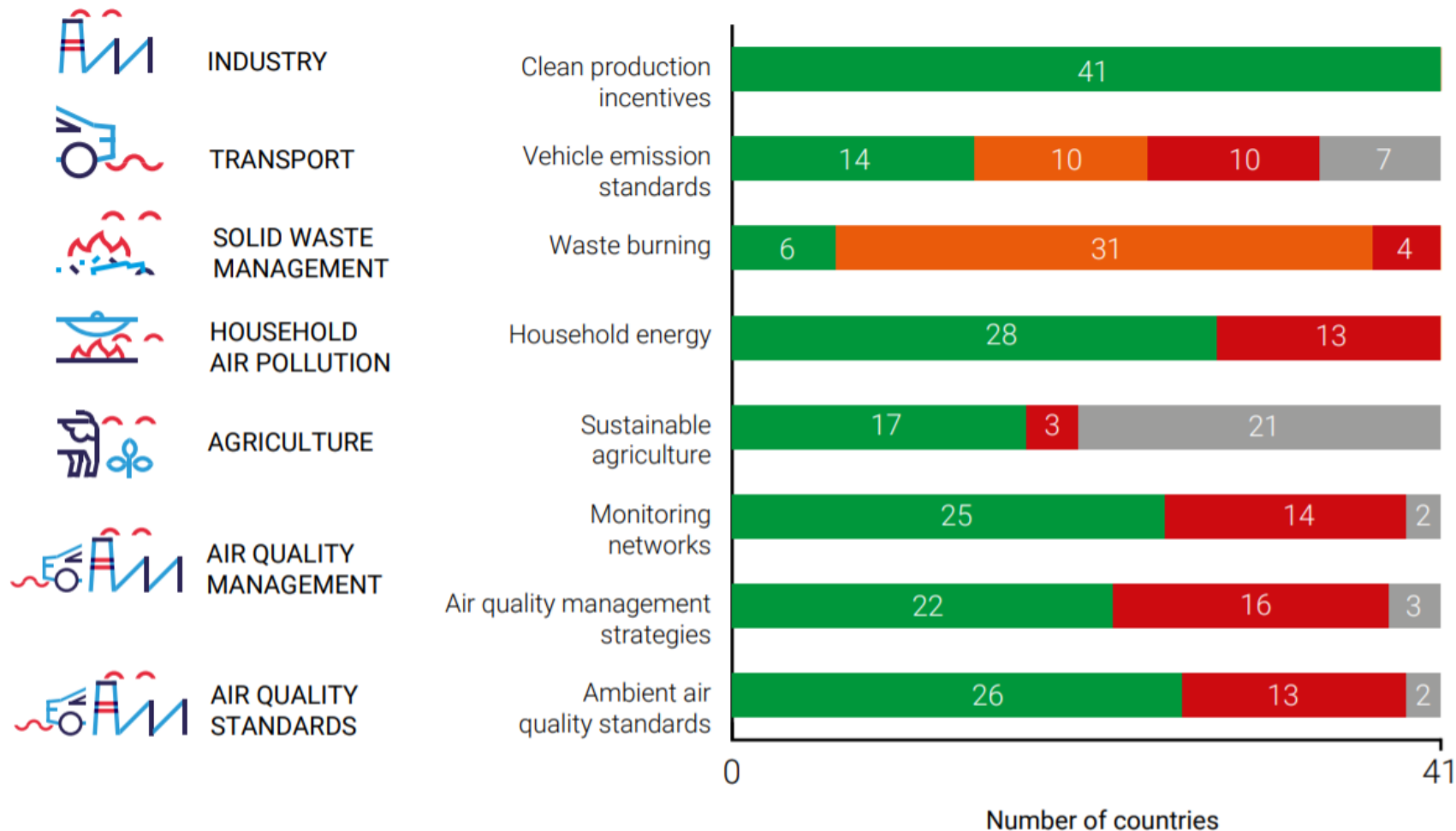
<https://wesr.unep.org/data-analysis>



Where is the world in taking action to improve air quality?



ASIA PACIFIC: PROGRESS TOWARDS ADOPTION OF KEY ACTIONS THAT CAN SIGNIFICANTLY IMPROVE AIR QUALITY



Indicates how many countries have adopted these policies (green), are on their way to adopting them (orange) or have yet to adopt or implement them (red). Grey indicates that no data were available.

Solutions Exist and actions are being taken



AGRICULTURAL CROP RESIDUE MANAGEMENT

Case study: Thailand's open burning controls

Enabling / Success Factors: Growing awareness of pollution sources/impacts. Complementing burning bans with other use options with involvement of farmers, alternative off-site use of crop residues, technologies that plough residues on fields



VEHICLE INSPECTION AND MAINTENANCE

Case study: Tokyo's (Japan) diesel control strategy

Enabling / Success Factors: Centralized I&M systems, developed through multi-agency collaboration. Self-funding mechanism for regular audits at test centres

Solutions Exist

Electric Mobility Demonstration Projects (UNEP/BMU-IKI)

PHILIPPINES

- Supporting urban electric freight launched in Nov 2019 with PhilPost and Pasig City (with TAILG)
- Supporting more demonstration projects and setting up charging network in Pasig City with EC Solutions plus

VIETNAM

- Supporting standards and regulations and demonstration projects on electric 2-wheelers for personal use and for urban freight (with Honda)

THAILAND

- Supporting development of standards and regulations on electric 2&3 wheelers
- Demonstration project to support electric motorcycle taxi/ electric motorcycle deliveries

Approx 20-40% uptake of EVs in select countries

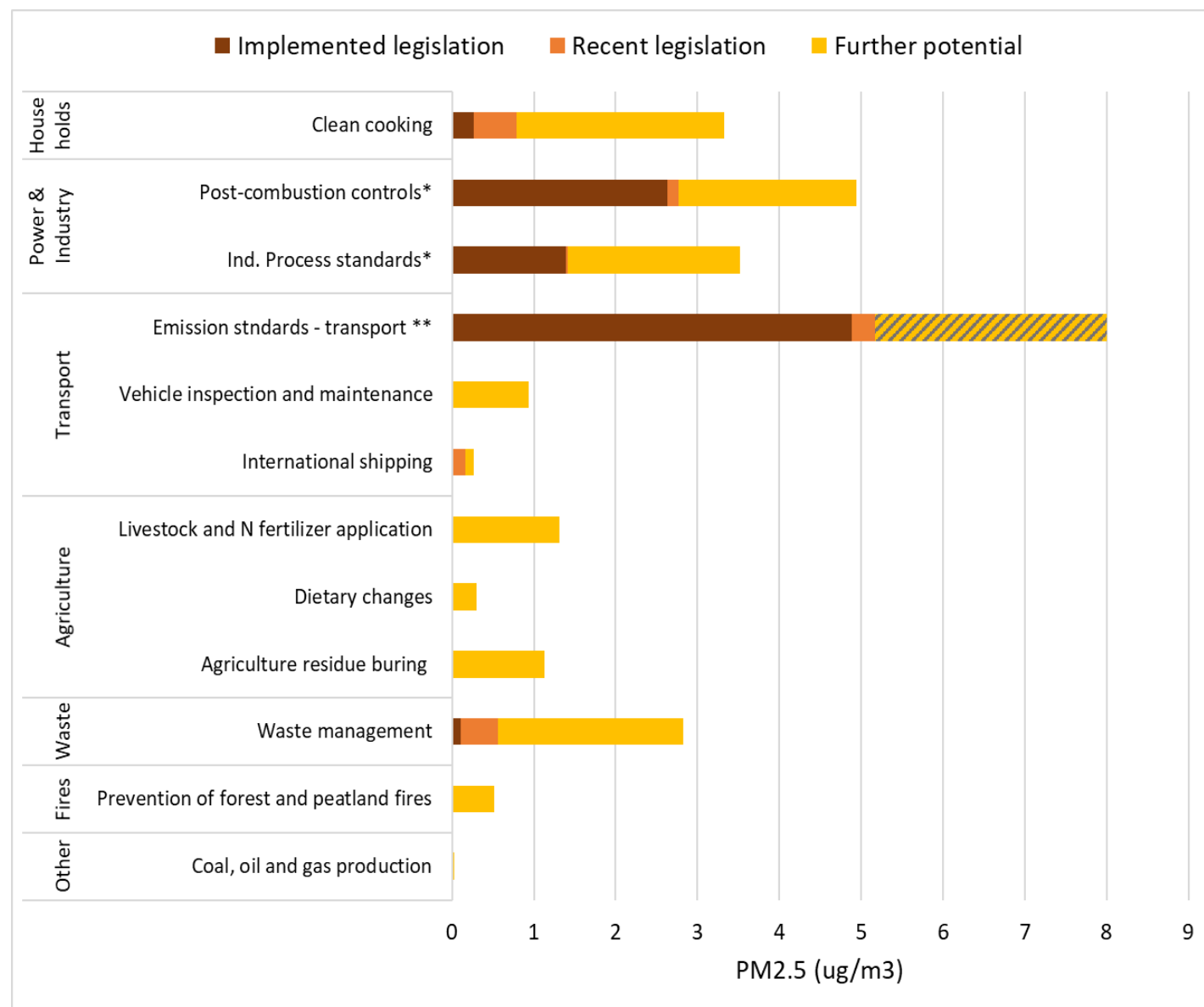


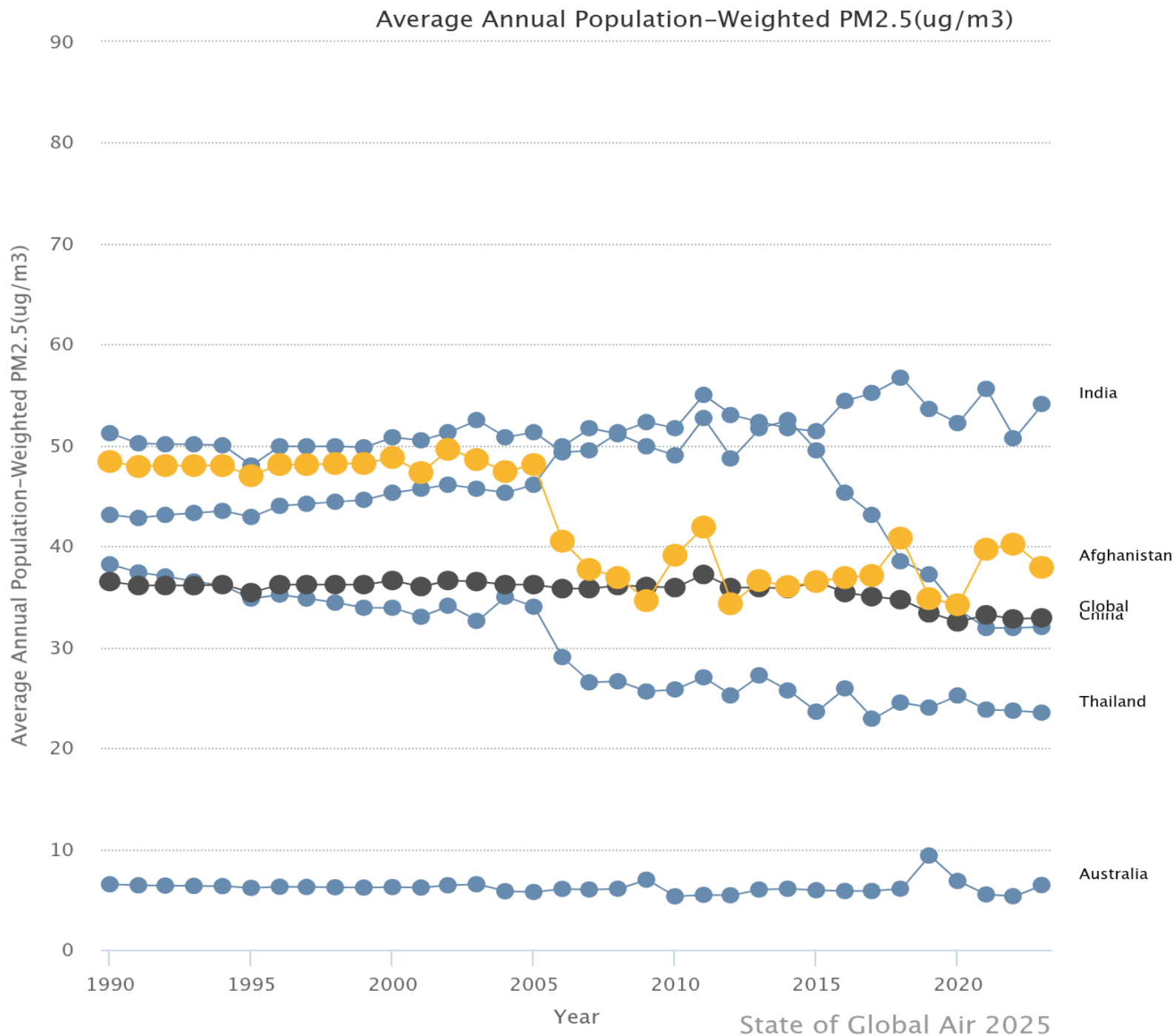
Source: UNEP CCAC

12 priority solutions in ASEAN by 2030

Nearly 40% (20-60% at the country level) of identified potential is associated with existing legislation – **implementing existing solutions is critical!**

 Indicates maximum potential for either introduction of Euro VI equivalent vehicle emission standards or rapid electrification of vehicle fleet





Progress -
but more
is needed

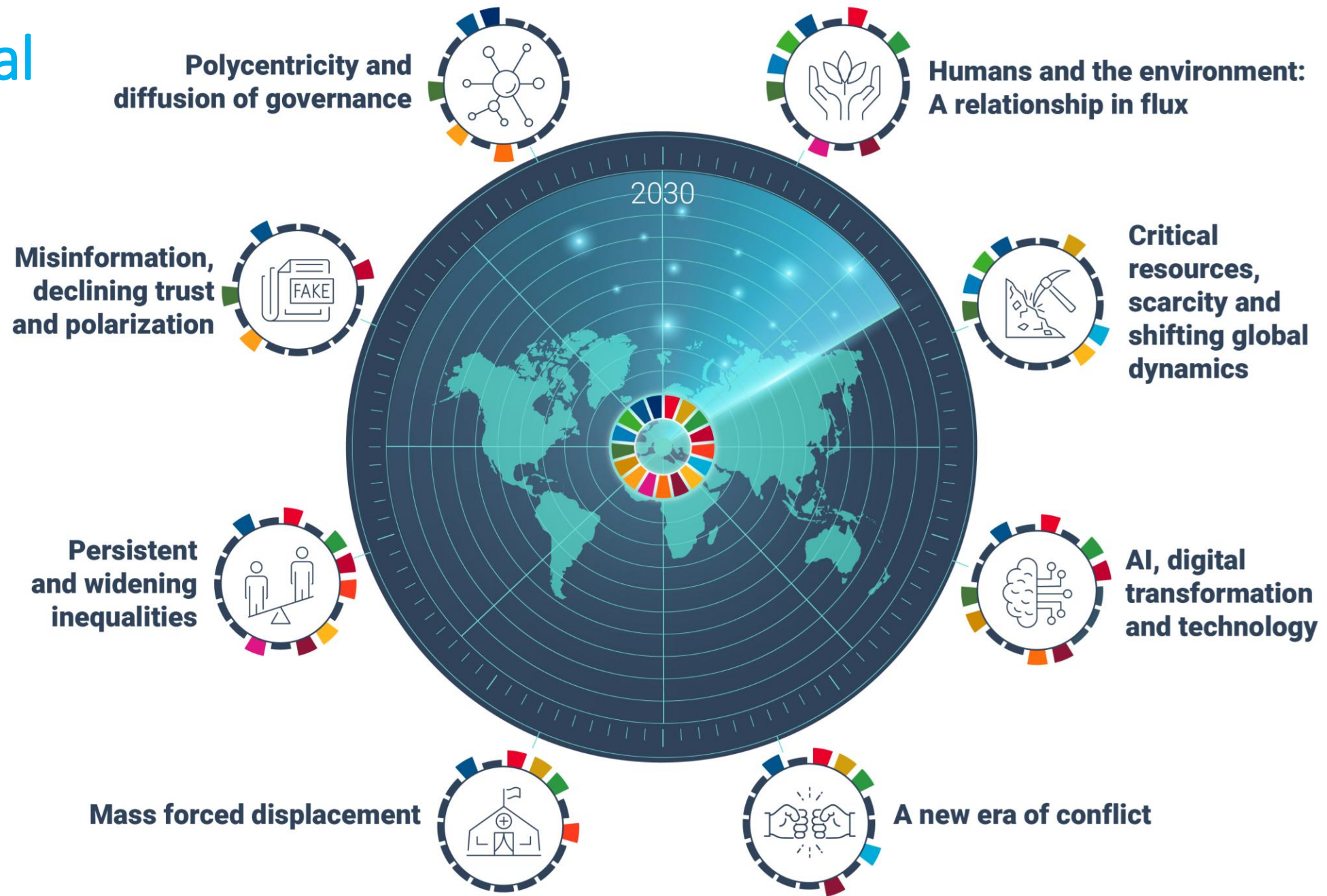
Global Context – Interconnected and increasingly complex Environmental Crises and Planetary Health



Planetary Crises: Interconnected challenges of **climate change**, **pollution & waste**, and **biodiversity loss & land degradation** – compounding threats to human well-being and ecosystems.

Planetary Health: The **interdependent health of human societies and Earth's natural systems** (e.g., geosphere, biosphere, cryosphere, hydrosphere, atmosphere) that sustain life and well-being.

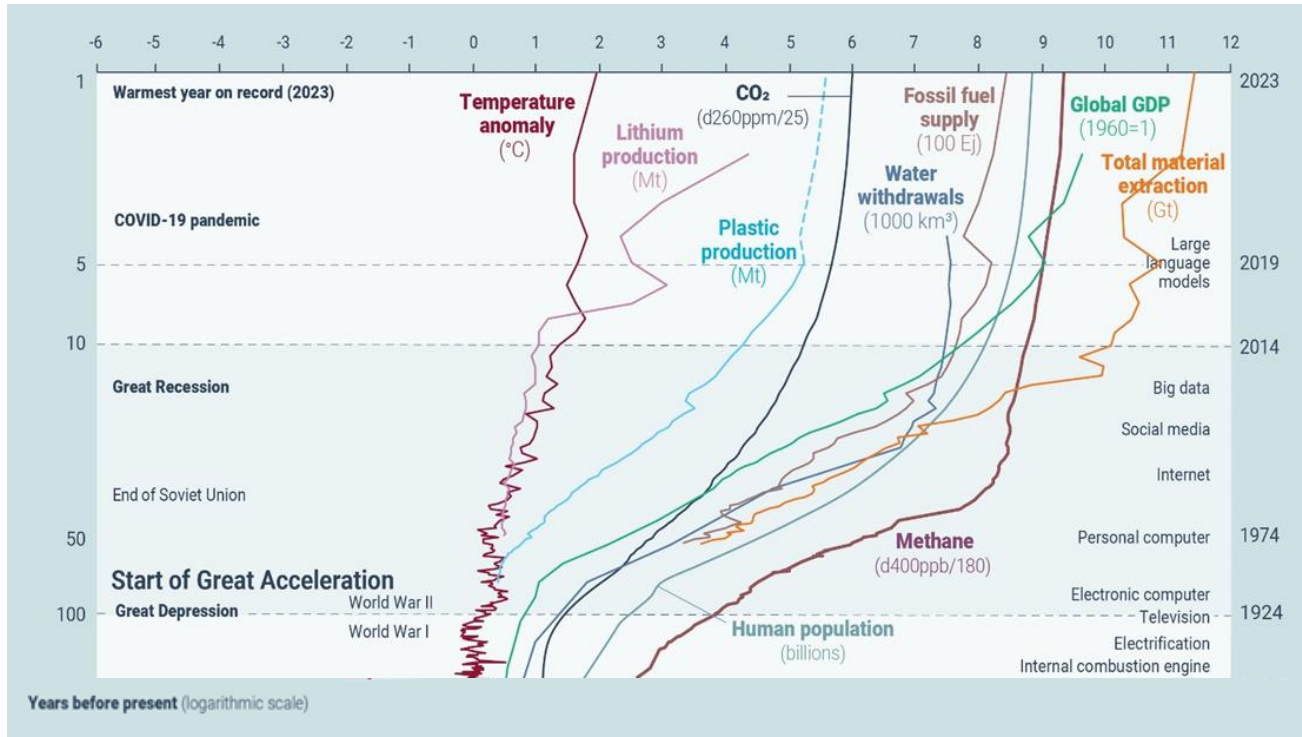
Critical Shifts





CRITICAL SHIFT

Humans and the environment: A relationship in flux



The Great Acceleration – human-driven social, technological and environmental changes have surged dramatically since the mid-20th century, representing the start of a major shift in our collective relationship to each other and to the Earth system.

- The human condition and the health of **our planet** are inextricably linked.
- **Accelerating climate crises:** record-breaking climate events surge in number, velocity and scale, wreaking havoc across the globe.
- By 2050, ~**25%** of the **global population of adults** will be exposed to chronic and acute dangerous heat extremes, putting up to 246M older people at risk—largely in Africa and Asia.
- Continuing **environmental degradation** and cascading shocks are pushing natural ecosystems and humans to limits.

Source: UNEP, 2024 Navigating New Horizons

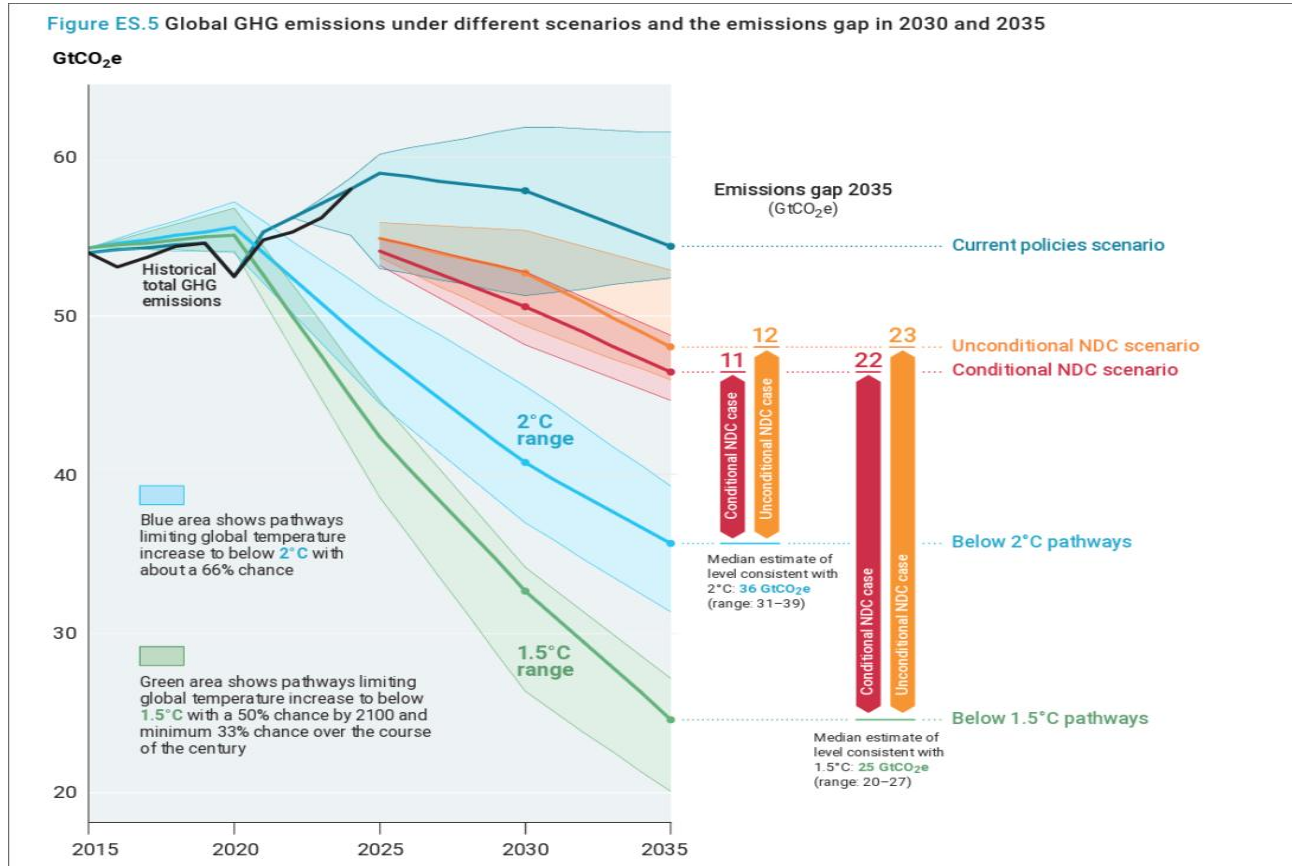
Climate change

Source: WMO (2024)State of the Global Climate 2024,



- 2024 was the warmest year on record
- The past ten years saw the warmest individual years with an average of between 1.34-1.41°C above pre industrial temperatures.
- Increased GHG emissions, surface temperatures, ocean heat and acidification, sea level rise, reduced Antarctic sea ice cover and glacier retreat.
- Increase in the number, frequency and scale of extreme weather events causing havoc around the globe
- Global Warming **will increase air pollution – wildfires, heat and PM**

The Emissions Gap Report 2025



Warming Projections: Full implementation of new NDCs projects 2.3–2.5°C warming, while current policies project 2.8°C.

Required Reductions: Annual emissions must fall 35% by 2035 for a 2°C pathway and 55% by 2035 for a 1.5°C pathway (relative to 2019 levels).

Pledge Submissions: Only about one-third of Paris Agreement parties submitted new NDCs containing 2035 targets by September 30, 2025

<https://www.unep.org/resources/emissions-gap-report-2025>

A photograph showing a cityscape with several large, billowing plumes of white smoke or steam rising from industrial or power plant areas. In the background, there are blue mountains under a clear sky. The smoke plumes are thick and extend across the middle of the frame.

75% of the Earth's land
surface has been
significantly altered by
human actions, including
85% of wetland areas.
(IPBES)

Nature in Crisis

- Our global food system is the primary driver of biodiversity loss with agriculture alone being the identified threat 24,000 of the 28,000 species at risk of extinction (Chatham House and UNEP)
- Agricultural expansion is said to account for 70% of the projected loss of terrestrial biodiversity. (CBD)
- Up to 37% activity in Ag sector estimated to contribute to global warming (IPCC Special report)





UN-HABITAT

Half of the **global population** lives in areas most affected by biodiversity loss, water stress, food insecurity, health risks, and climate change impacts (IPBES, 2024).

These interconnected Issues combined
with acceleration in critical shifts is
affecting both the nature of the issues
but the ability to
manage, maintain, respond to and
reduce environmental degradation



Existing, Emerging and Compounding Challenges

- Prediction – without policy intervention PM2.5 could increase by 2030 due to compounding events (Bento et al 2026)
- Short Lived Climate Pollutants continue to increase
- Waste and Plastic Pollution not being dealt with
- Nitrogen/ammonia
- Compounding and Cumulative Issues
 - Wildfires 99% funding spent on response
 - Conflicts - unabating
 - Heat - increasing
 - Acceleration of data centres, EVs - critical minerals demand
 - Acceleration space activity
 - Desertification



Plastic pollution is also an air pollution issue

- > 430 million tonnes of plastic annually (a figure expected to double by 2040), two-thirds of which are short-lived products that soon become waste
- Plastics – complex mixtures with many additives (stabilizers, fillers, plasticizers, colorants, flame retardants, curing agents)
- Plastics and Additives may degrade to form other chemicals and micro-plastics enabling environmental and human health exposure



Dandora Waste dump Kenya

- the largest waste dump in the world 30 acres
- significant air pollution issues local community; children and informal waste pickers



Ghetto classics – jazz group

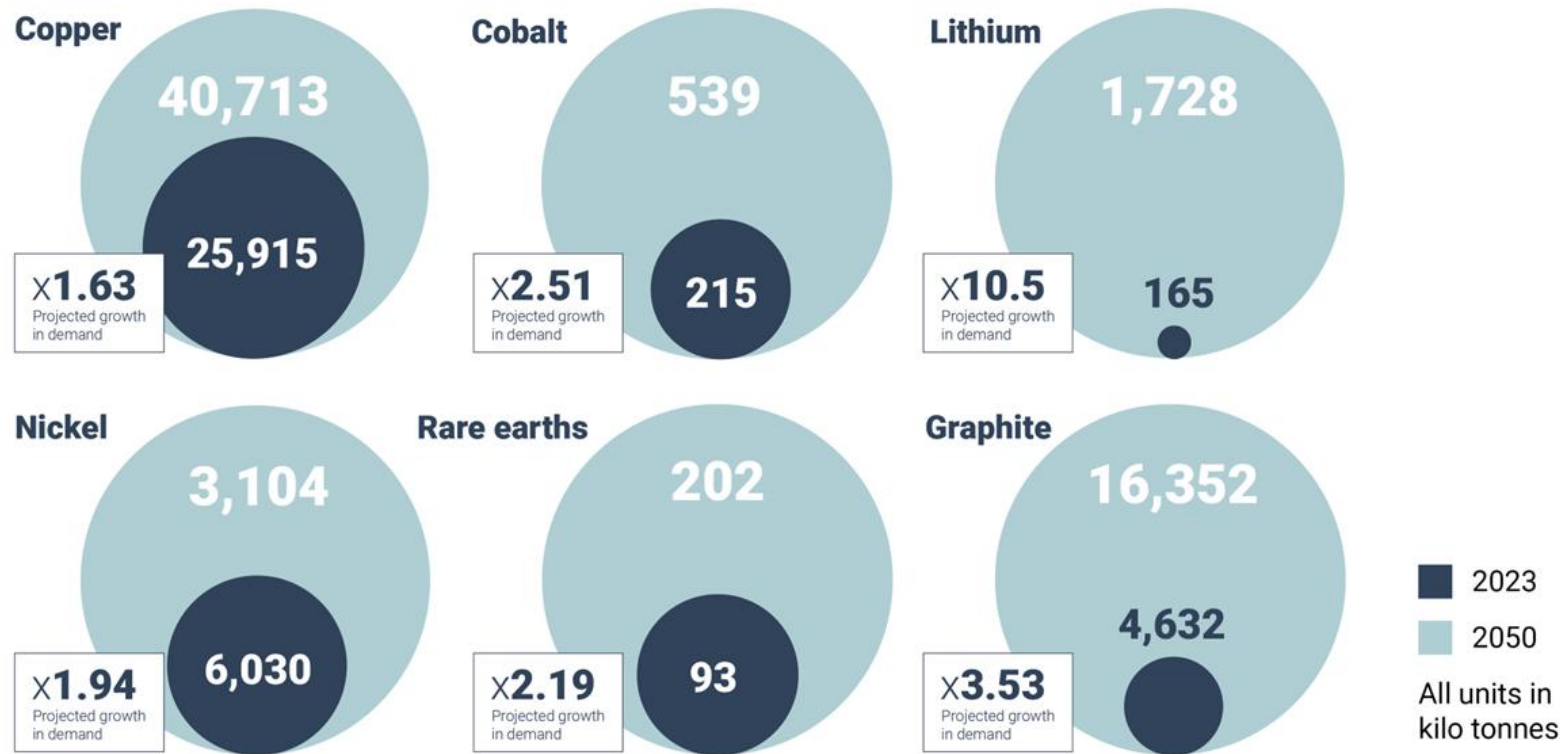


Photo by Duncan Moore/ UN Environment



CRITICAL SHIFT

Resources, scarcity and competition shifting global dynamics



Global transition to clean energy expected to create massive demand increase for critical minerals, especially those used in manufacturing batteries and electricity networks, key inputs in emerging technologies and markets

Projected growth in demand for critical minerals in 2050 to achieve net zero emissions

Source: IEA 2024

- As countries discover more sources for materials, **competition** and potential **confrontation** likely to increase.

Exponential Growth in the Space Sector

<https://www.unep.org/resources/emerging-issues/safeguarding-space-environmental-issues-risks-and-responsibilities>

- Many benefits of satellites, communication, exploration and science
- Potential impacts at all layers of the atmosphere – poorly characterised
- Launch emissions are increasing, emissions, fuels and materials, increased need for critical minerals and rare elements
- Emissions when vehicles travel through stratosphere
- Space debris around globe with large historical pieces of space junk
- Increased collisions creating more debris
- Re-entry emissions (metals) cause ozone depletion altered atmospheric chemistry and dynamics -ozone depletion
- Global observation and monitoring lacking
- Need comprehensive scientific assessment of range of issues.



Importance of addressing integration and co-benefits

Solution to traffic and air pollution: A livable city which considers health, transport, food, greening, walkability (ie 15 -20 minute neighbourhood) housing and city design, mobility



Photo CCAC

Solution to local burning: waste management which considers health, transport, employment.





United Nations Assembly

- UNEA – 193 countries Acts as a Global highest level decision making body. UNEP implements UNEA resolutions.
- UNEA 6 (2024) United Nations Environment Assembly
UNPE/EA.6/Res.10 - Promoting regional cooperation on air pollution to improve air quality globally; Directs UNEP establish a network connecting member states, international bodies, and experts to share experiences and tools and a knowledge platform.
- Many conventions addressing the topics outlined earlier

The Climate and Clean Air Coalition (CCAC)

- Voluntary partnership of over 200 governments, intergovernmental organizations, businesses, scientific institutions and civil society organizations
 - Committed to protecting the climate and improving air quality through actions to short-lived air pollutants: methane, black carbon, tropospheric ozone and HFCs, through a practical, measures-based approach.
 - Science and Management (AQx)
-
- UNEP - CCAC **Benefits of Action** report on addressing climate and air pollution together Sept 2026.

The UN Environment Programme's **International Methane Emissions Observatory (IMEO)** exists to provide open, reliable, and actionable data to the individuals with the agency to reduce methane emissions.

- Core implementing partner for the **Global Methane Pledge (>150 countries)** providing open, empirical data and transparency frameworks needed to help reach goal of cutting global methane emissions by at least 30% by 2030 from 2020 levels (estimated 0.2°C saving in temp increase and reductions in health and agricultural effects attributable to ozone by 2050).
- Science, monitoring (MARS), capacity building, eye on methane data platform (<https://www.unep.org/topics/energy/methane/imeo-methane-science-studies>)

Global Progress is evident - more is required

Solutions and policies exist - implementation needed

Integration and co benefits to be more deliberately assessed and costed

At a minimum - climate change and air pollution to be considered in tandem.

Thank You

