From Science to Policy. Some experiences from the European Commission's Joint Research Centre

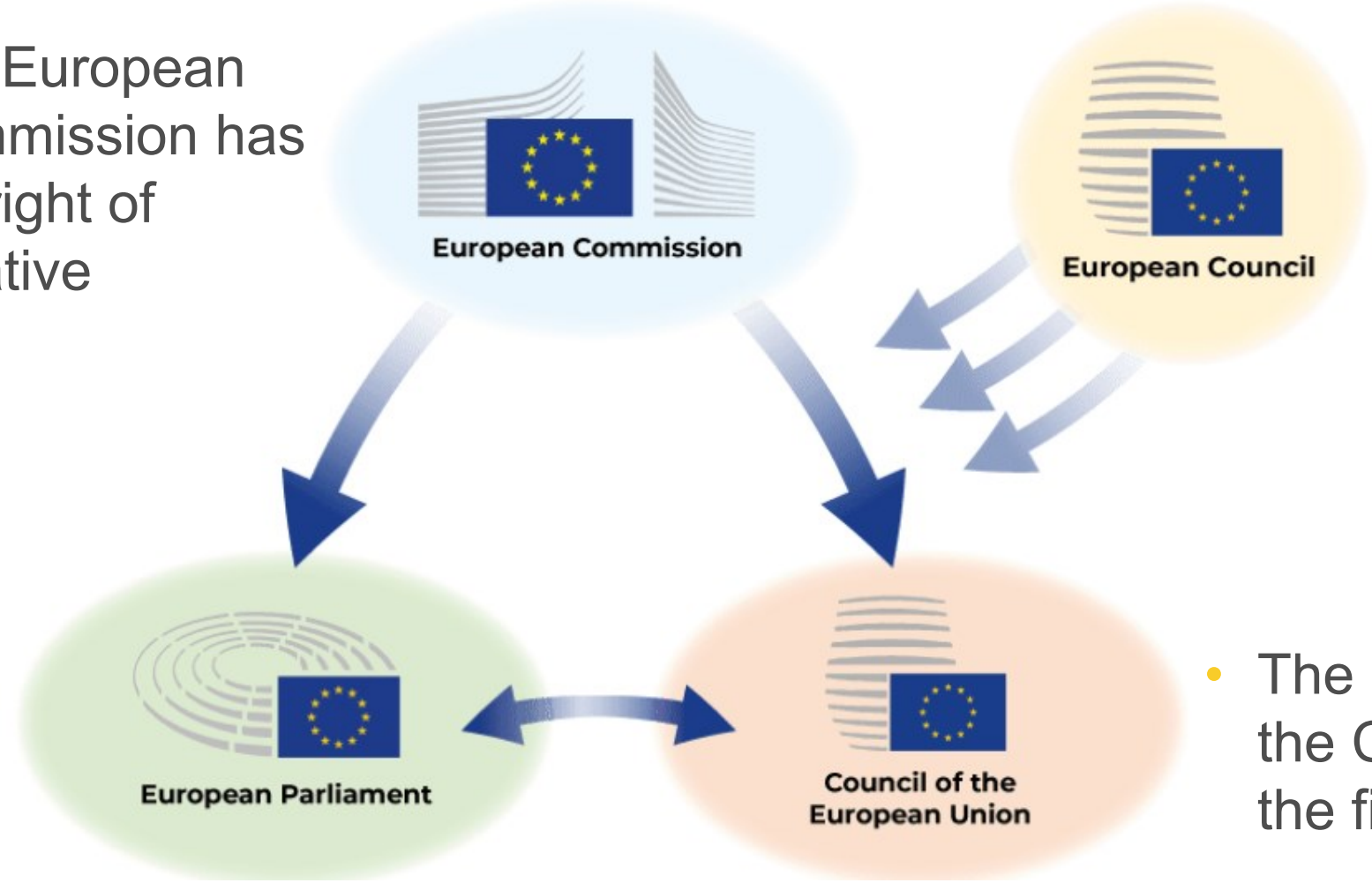
Fabio Monforti-Ferrario, Editor-in-Chief, Joint Research Centre

Summer school "Physics for a better planet" – Bologna, July 11th, 2025

European Commission

The functioning of the European Union

- The European Commission has the right of initiative



- The European Council gives general political lines

- The European Parliament and the Council of the EU have the final (co-decided) word

European Commission

Competences of the European Union

Exclusive competences:

customs, competition, monetary policy (Euro area),..

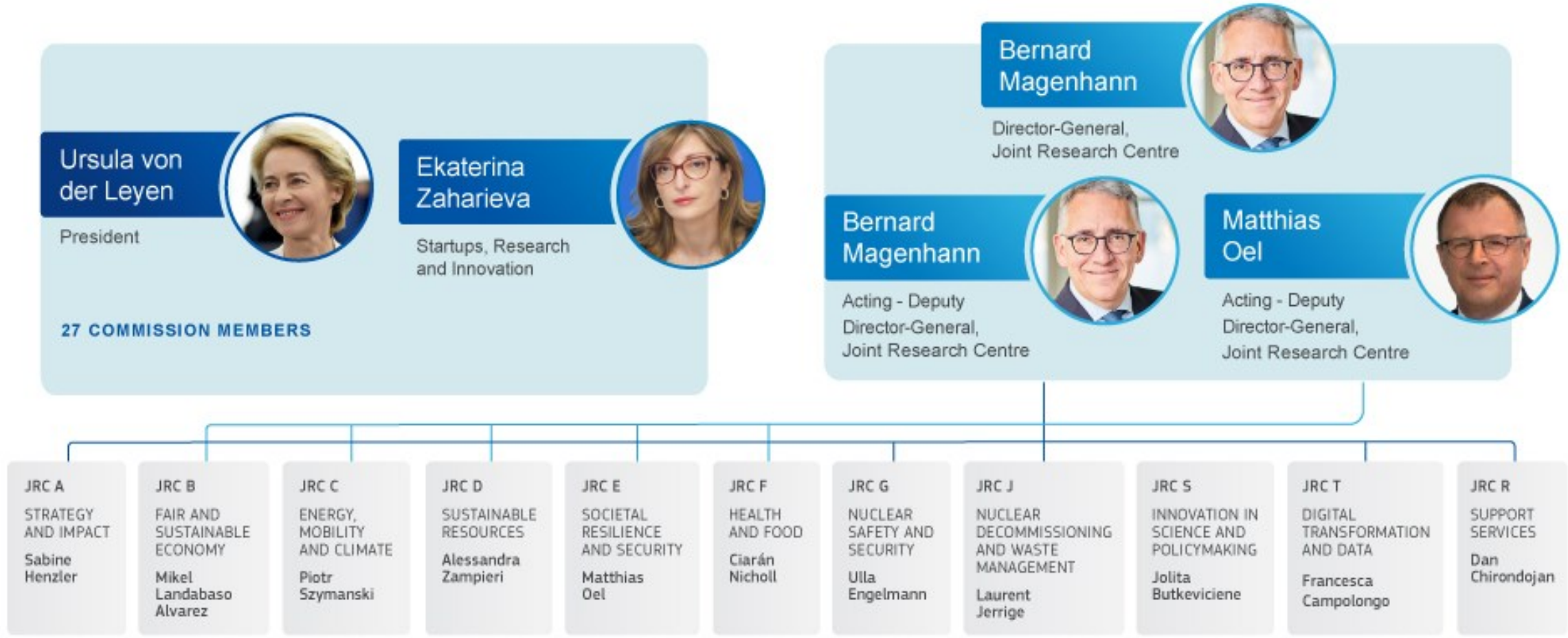
Shared competences:

Energy, environment, agriculture, internal market, transport, research, …

Support, coordination and supplement:

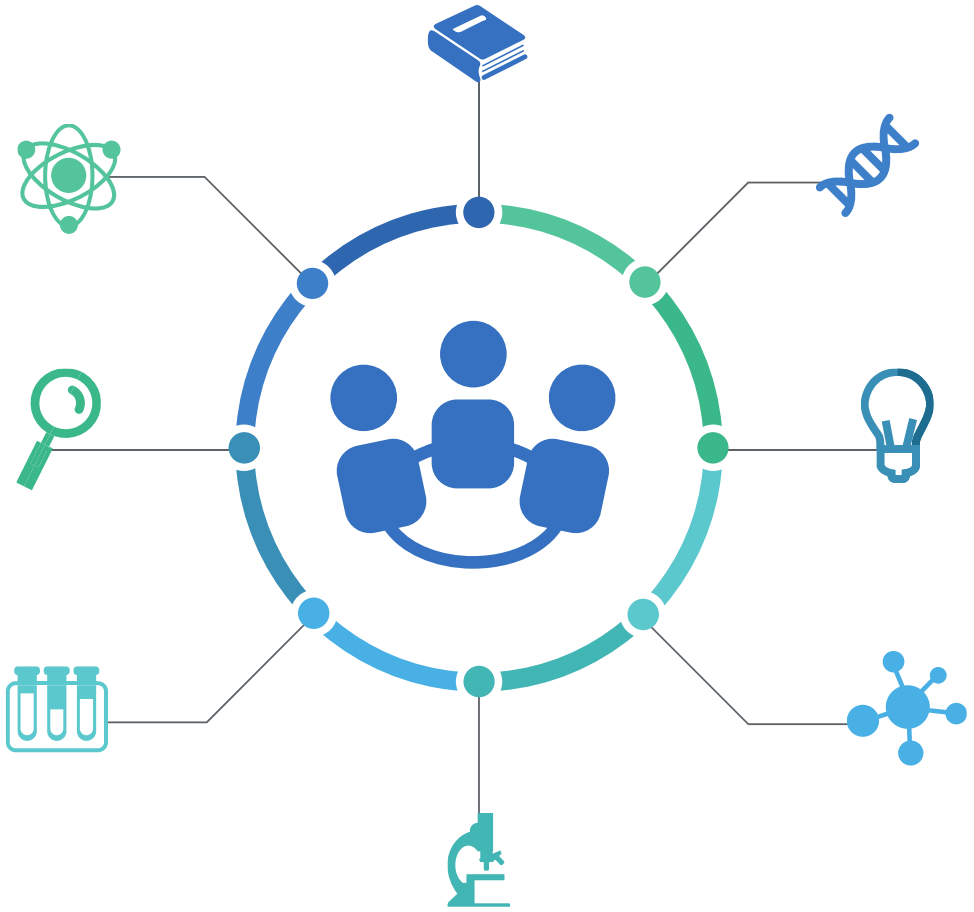
Public health, industry, culture, tourism,.

The Joint Research Centre within the European Commission

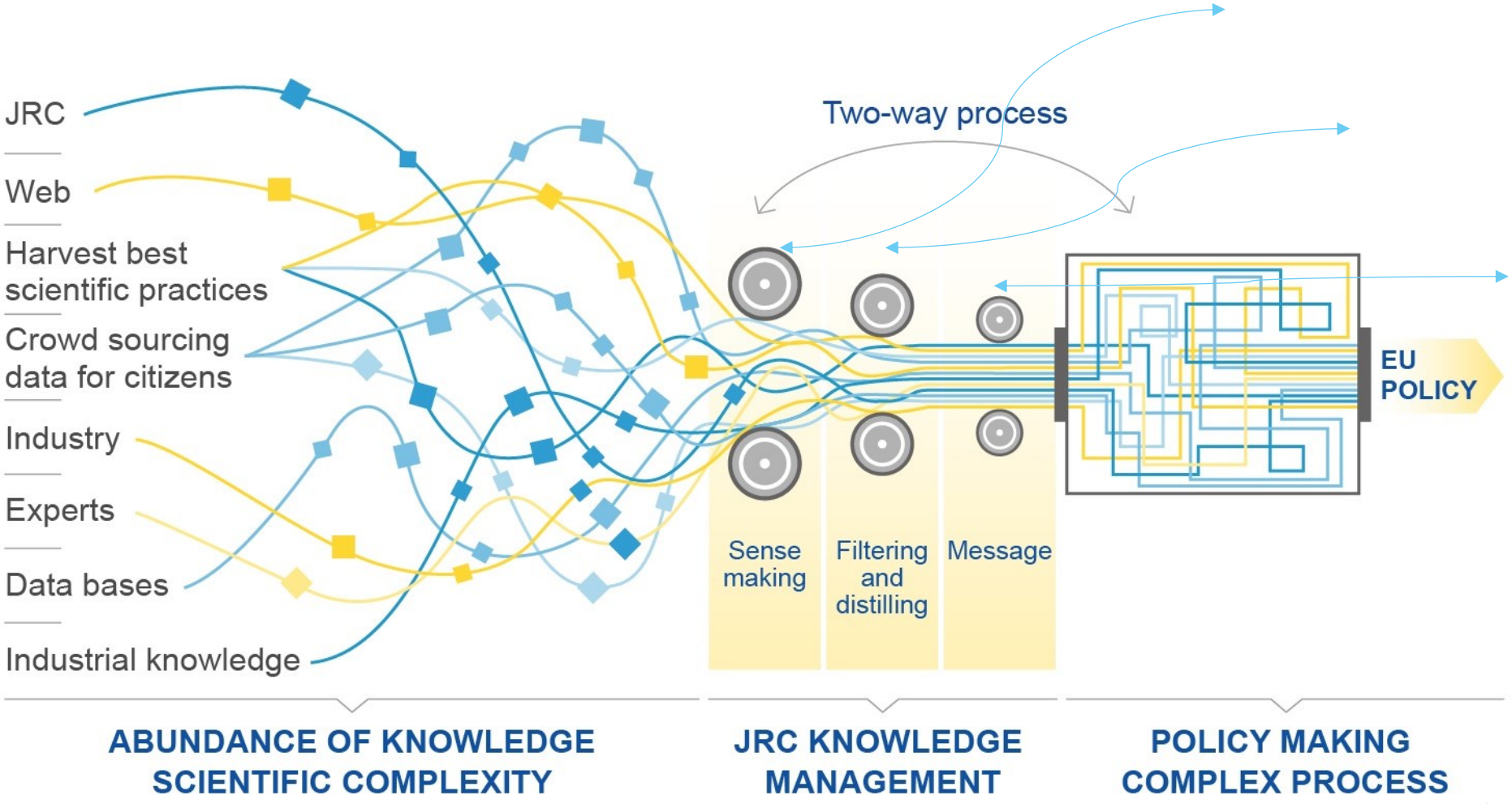


European Commission

The need for evidence to inform policy



Dealing with the information overload

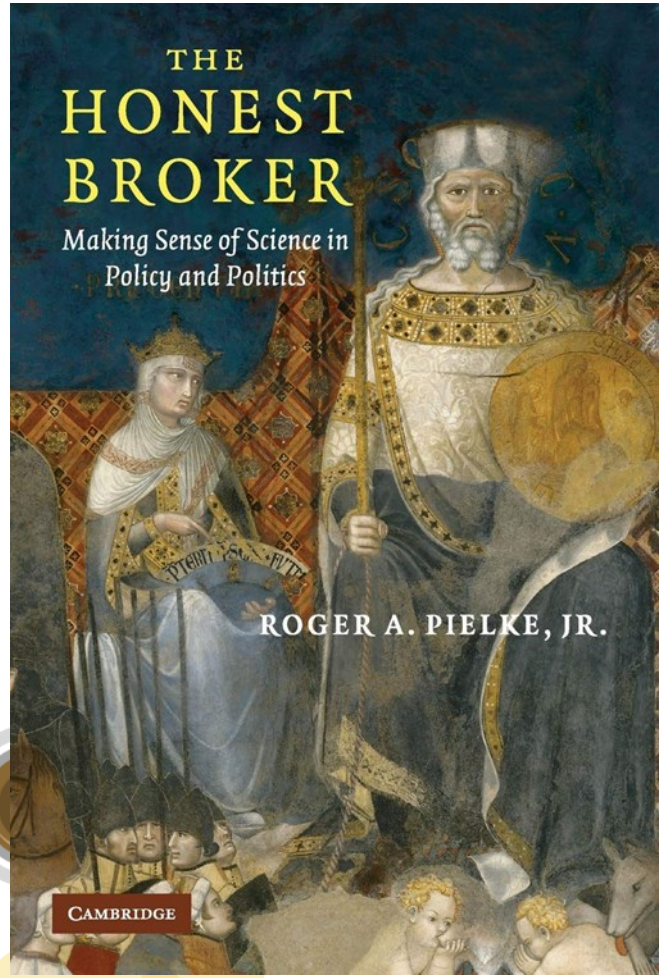


European Commission

JRC role

- **Independent** of private, commercial or national interests

- Works for more than **40 European Commission policy departments**



European Commission

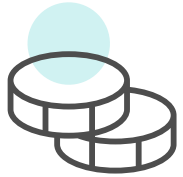
JRC sites

Headquarters in **Brussels** and research facilities located in **5 EU Countries:**

- Belgium (Geel)
- Germany (Karlsruhe)
- Italy (Ispra)
- The Netherlands (Petten)
- Spain (Seville)

European Commission

JRC – Facts and figures



About EUR 600 million
annual budget of which
about EUR 100 million
in contracts for third parties

3000+ open data sets

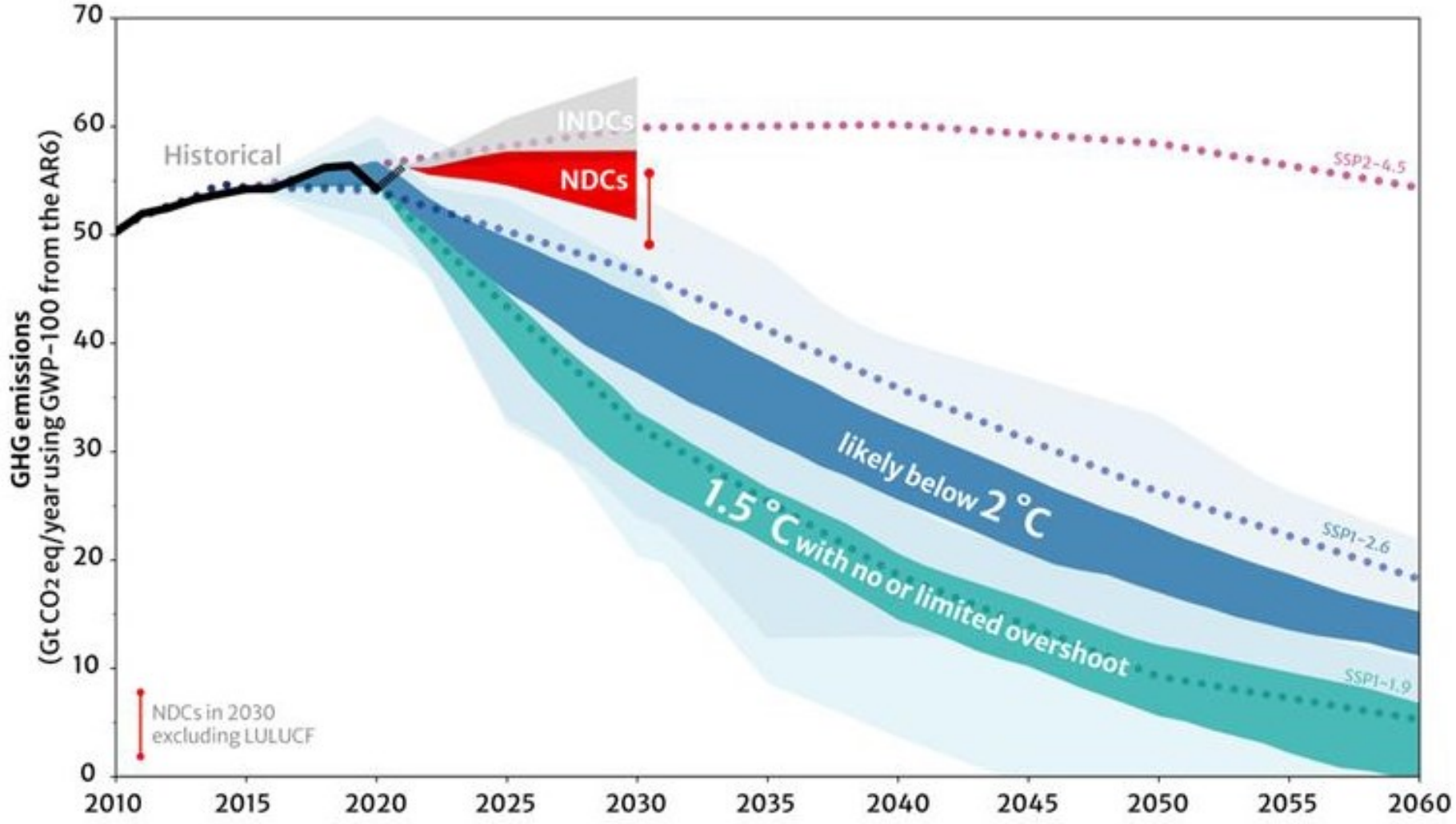
>100 economic,
bio-physical and nuclear models

>60 physical
research infrastructures

About 2.700 staff

Climate

GHG emissions – are we doing enough?



European Commission

Emission gap reports (UNEP) – in crescendo

2017 There is an urgent need for accelerated short-term action and enhanced longer-term national ambition […] **practical and cost-effective options are available** to make this possible

2020 Current NDCs remain **seriously inadequate** to achieve the climate goals of the Paris Agreement and would lead to a temperature increase of at least 3C by the end of the century.

2022 The world is still falling short of the Paris climate goals,with no credible pathway to 1.5°C in place. Only an urgent system-wide transformation can avoid **an accelerating climate disaster**.

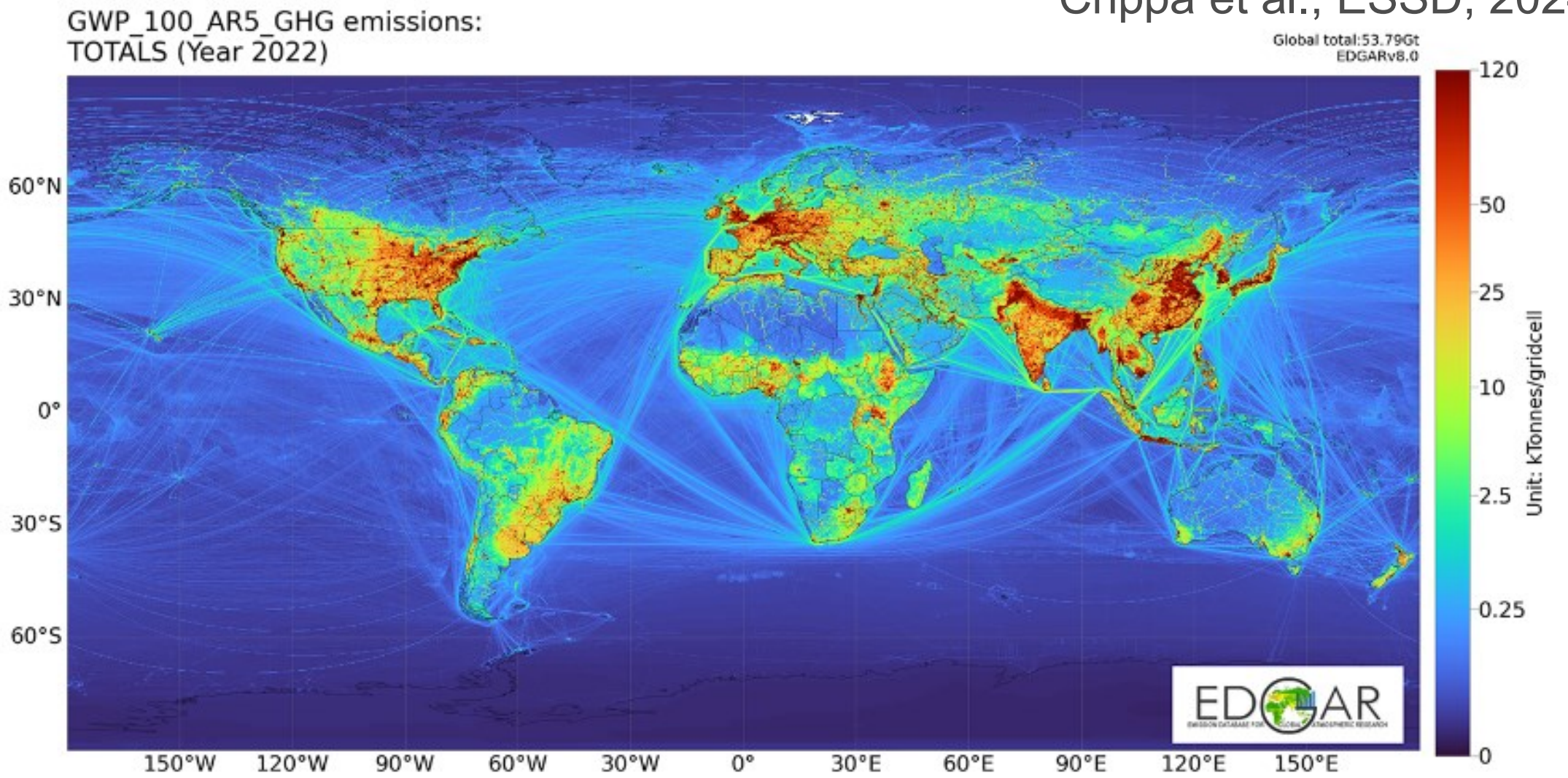
2024

No more hot air … please!

With **a massive gap between rhetoric and reality**, countries draft new climate commitments

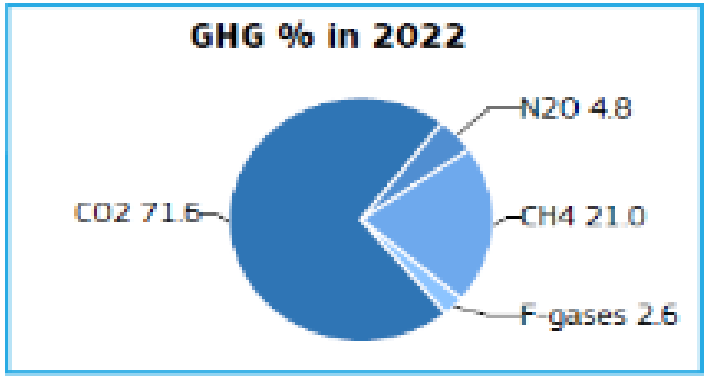
EDGAR – Global GHG Emission Database

Crippa et al., ESSD, 2024



Global emissions of GHG

major sectors



Slide Courtesy of E. Vignati

EDGAR

Negotiations UNFCCC

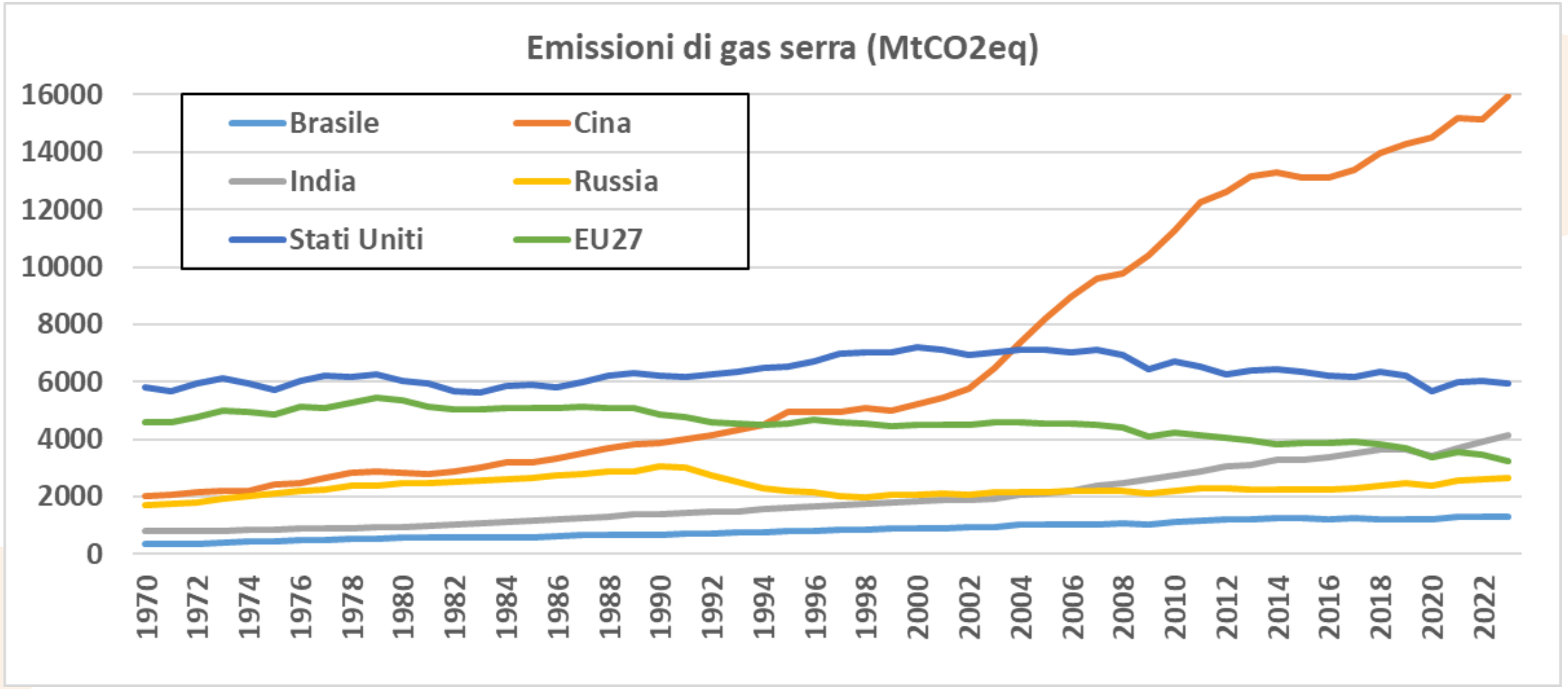
Kyoto Protocol

Paris Agreement

Sars-Cov2

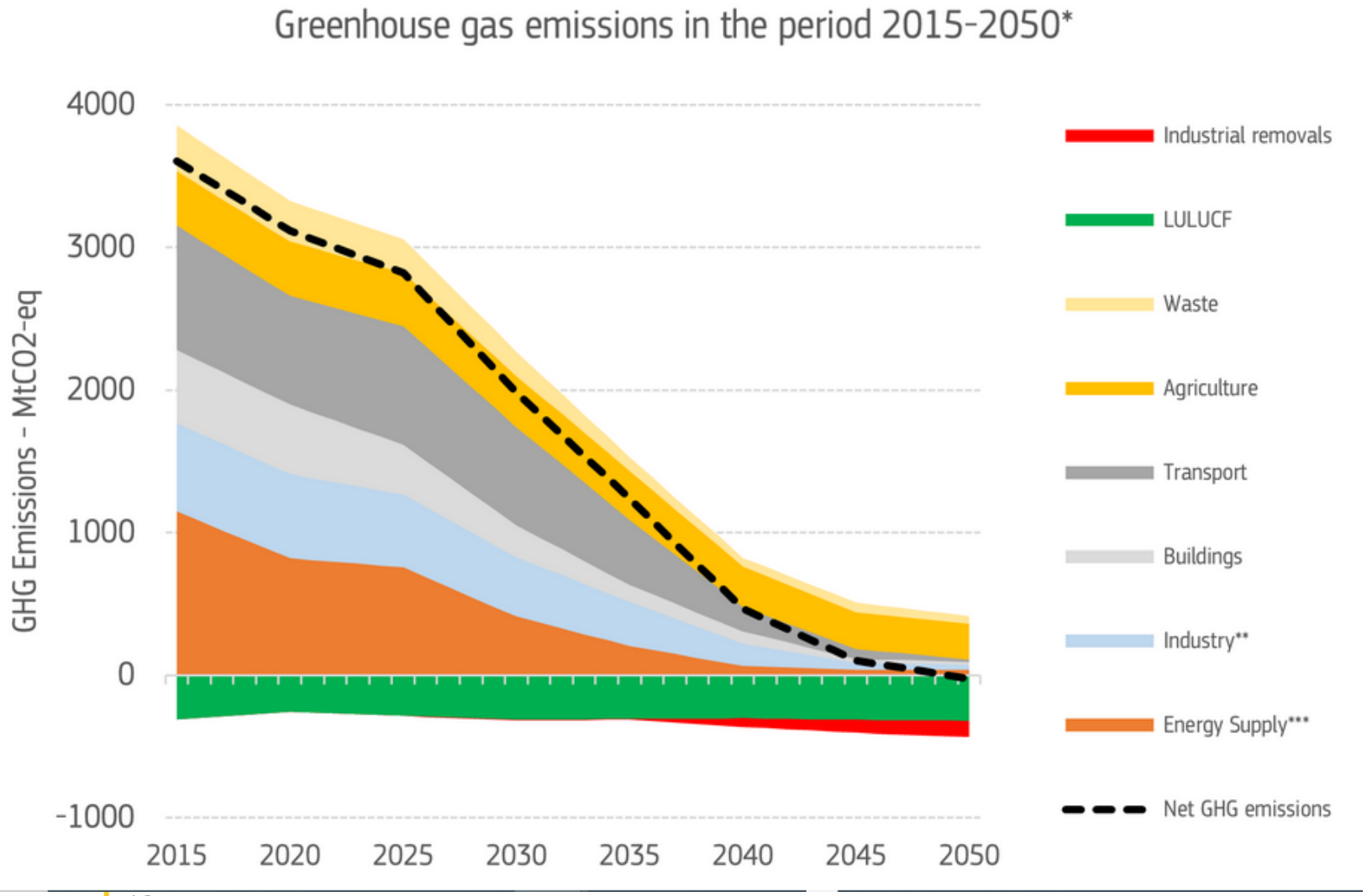
European Commission

GHG emissions – “the big six”



European Commission

EU GHG emissions – targets and scenarios



1990: 4877 MtCO2eq

2023: -33.9%

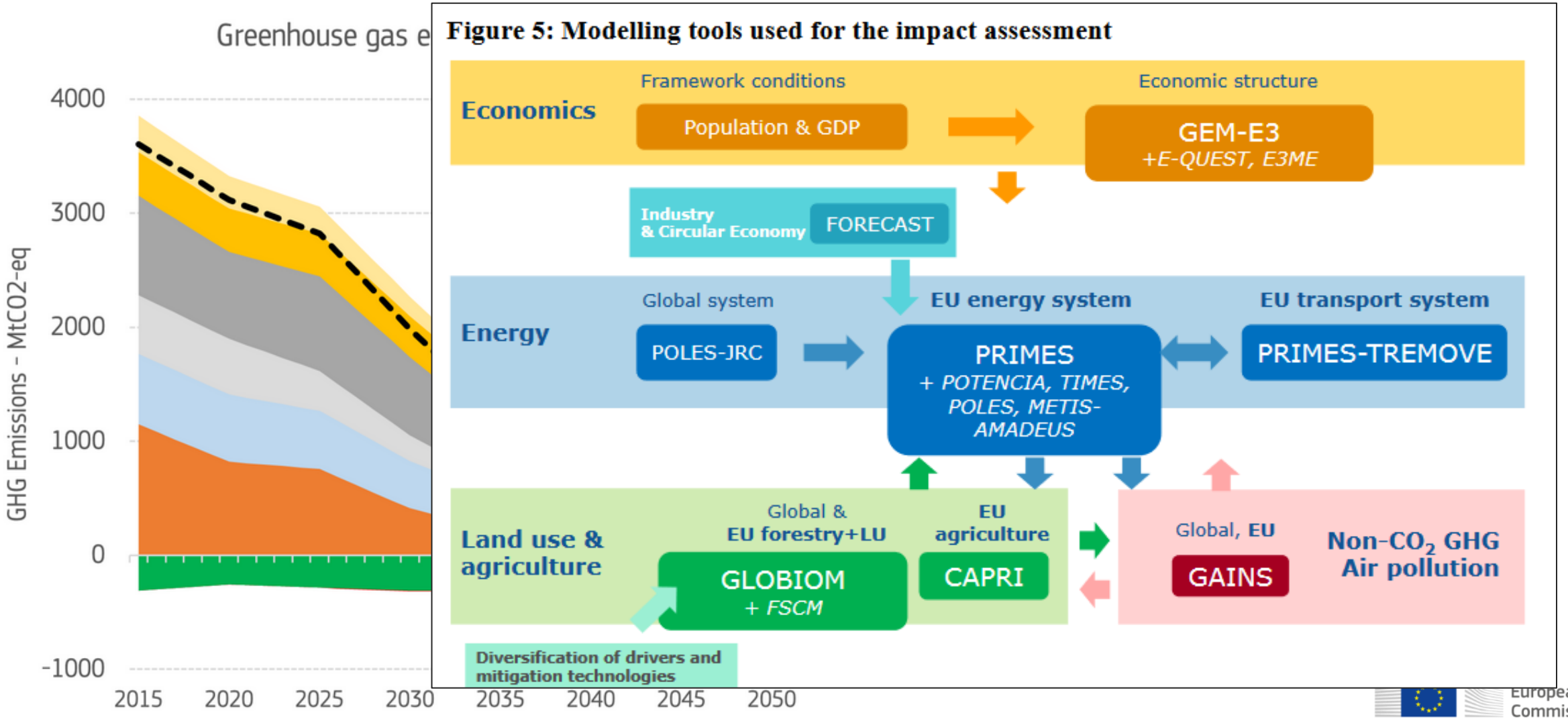
2030: -55%

2040: -90%

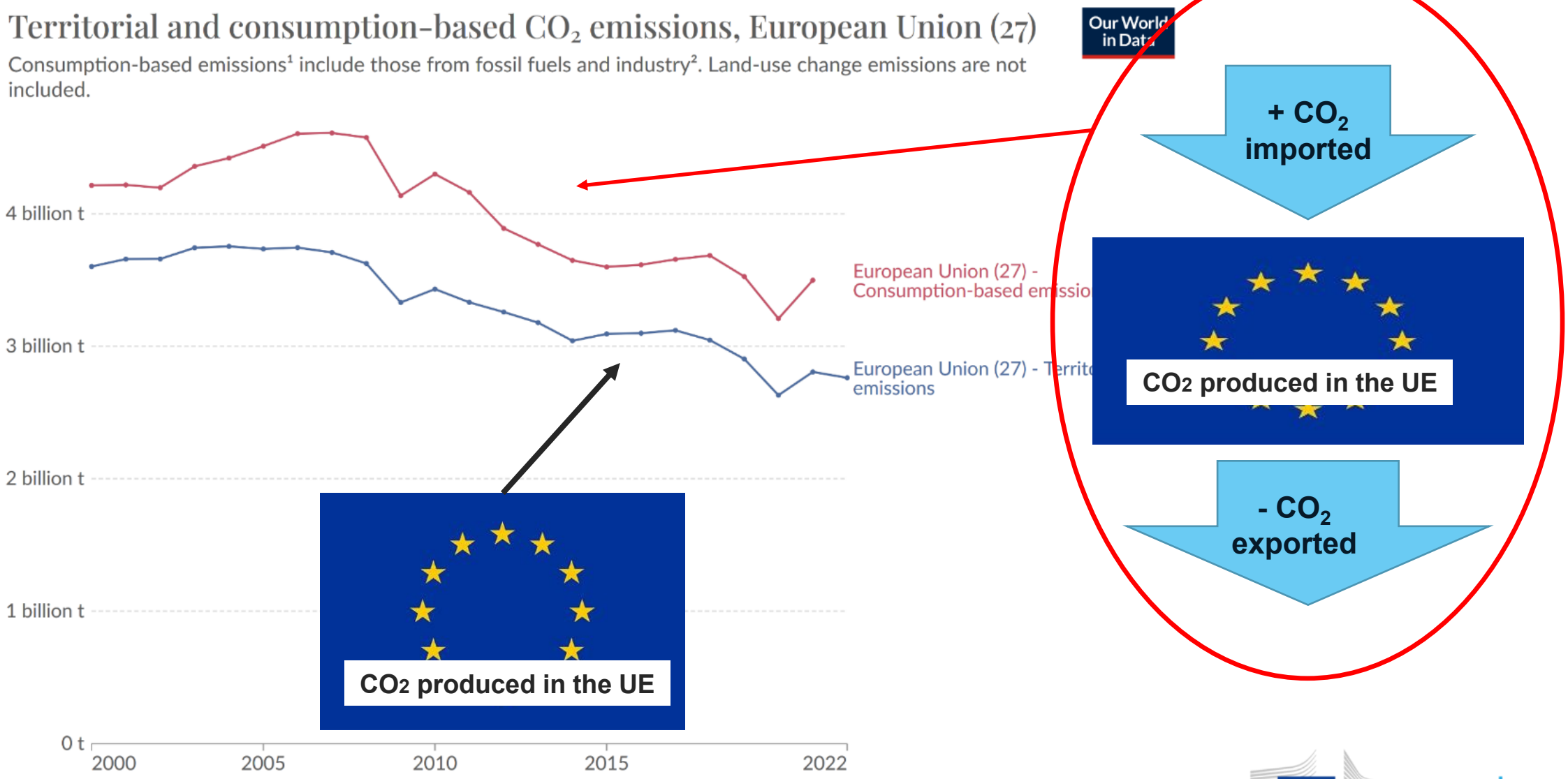
2050: net zero

European Commission

EU GHG emissions – behind the scenarios



Production vs. consumption based



Data source: Global Carbon Budget (2023)

OurWorldInData.org/co2-and-greenhouse-gas-emissions | CC BY

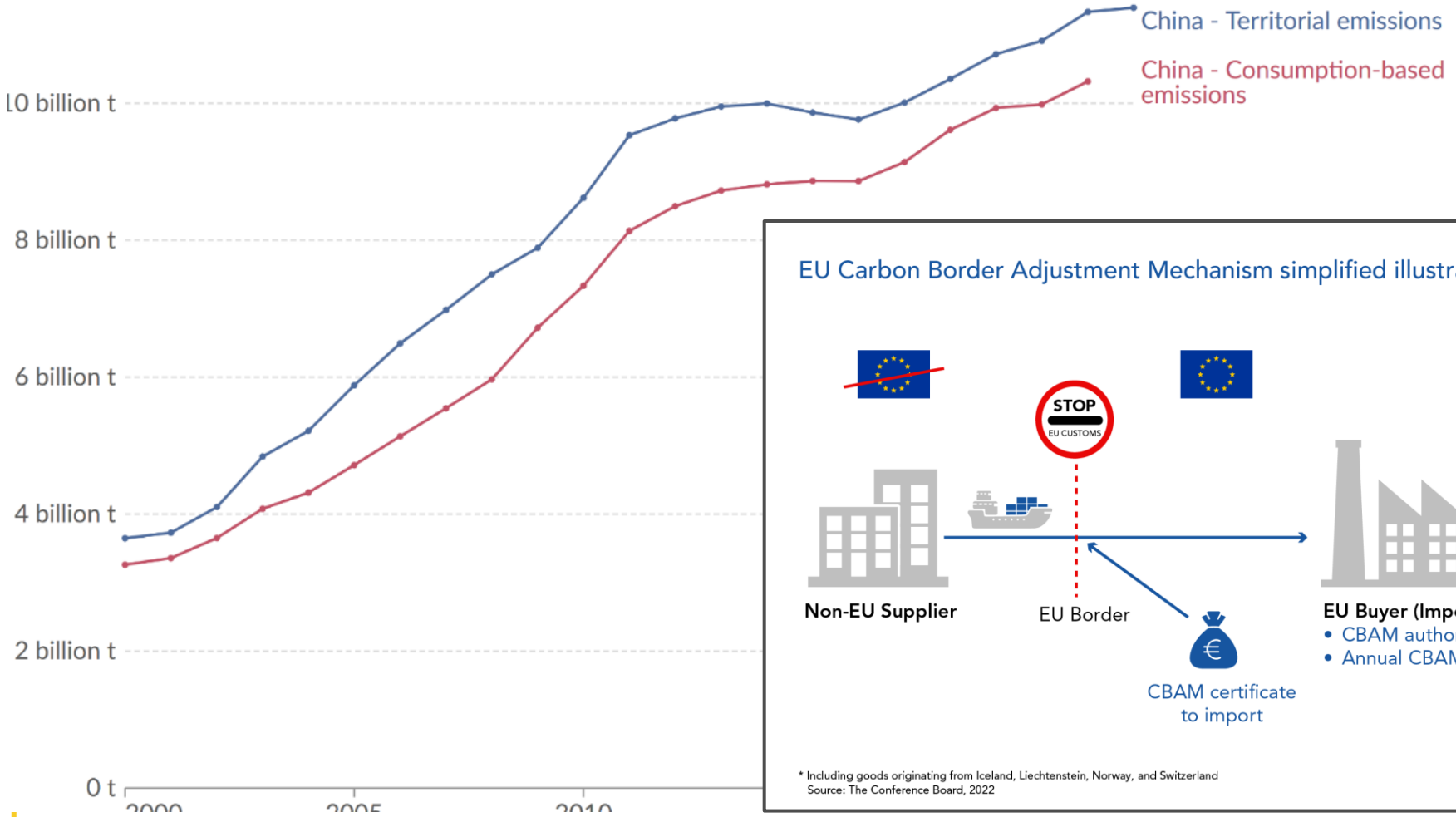
European Commission

Carbon leakage

Territorial and consumption-based CO_2 emissions, China

Consumption-based emissions[1] include those from fossil fuels and industry[2]. Land-use change emissions are not included.

Our World in Data



Proper application of CBAM

Figure 7. GHG emission intensity for CN codes 7211 13 00, 7211 14 00, 7211 19 00 - Hot-rolled flat products of non-alloy steel.

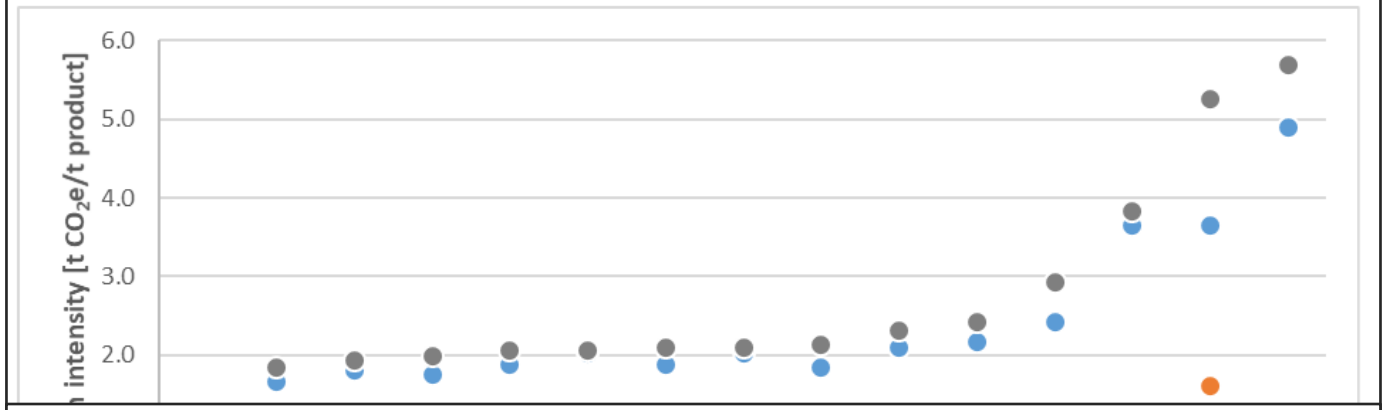
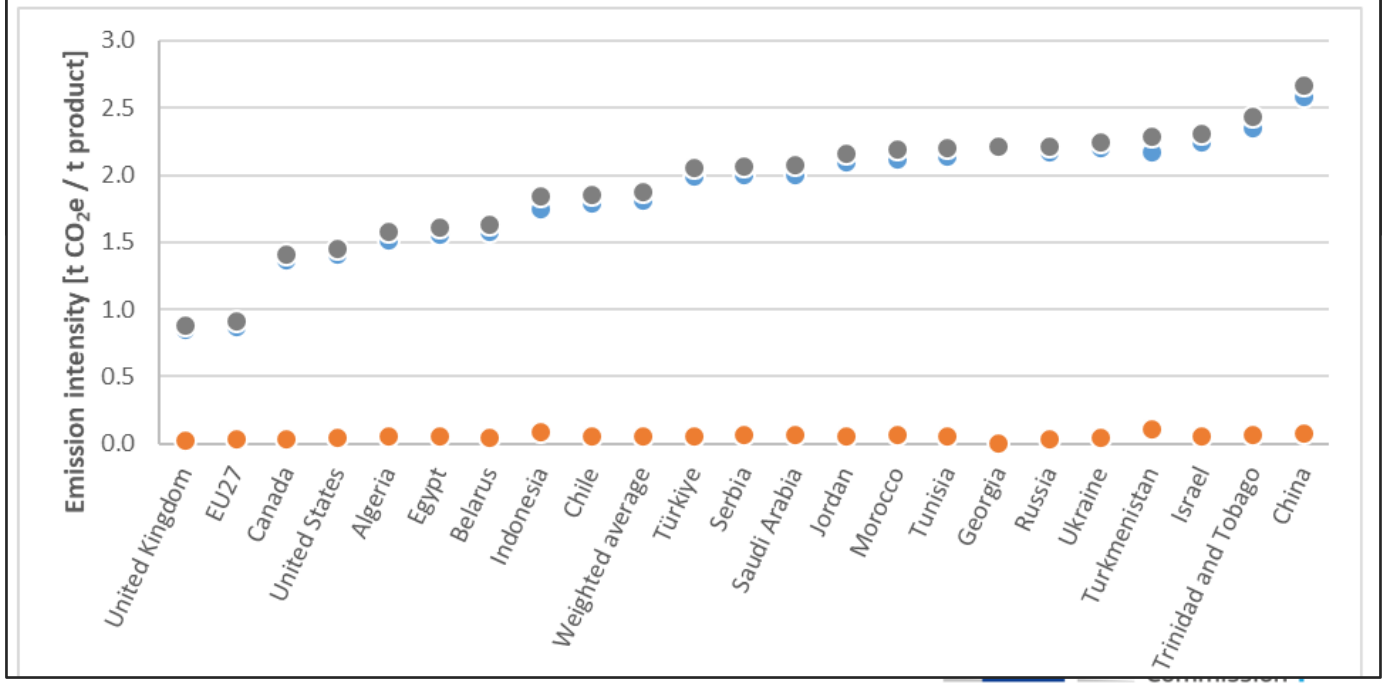
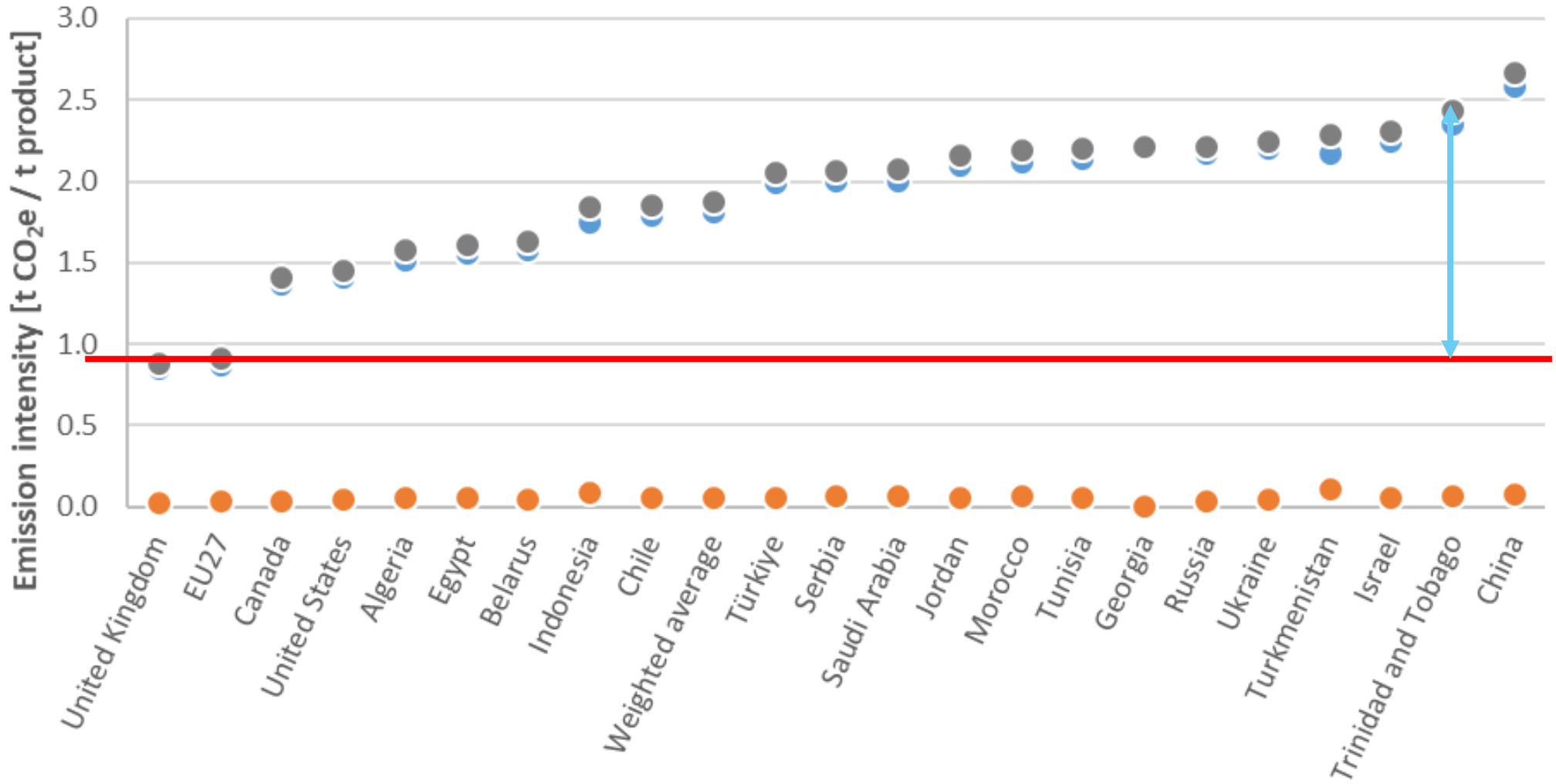


Figure 25. GHG emission intensity for CN code 2834 21 00 – Nitrates of potassium.



Proper application of CBAM

Figure 25. GHG emission intensity for CN code 2834 21 00 – Nitrates of potassium.



Clean technologies

Technology Readiness Level (TRL)

Table 2 presents the current TRL of wind energy technologies. Floating wind covers a large range of TRLs, with spar-buoy and semi-submersible designs already achieving TRL 8-9, while the concrete barge design currently stands at TRL 7-8, and tension-leg platform, at TRL 6. Airborne wind energy is at TRL 3-5.

Table 2. Current TRL of wind energy technologies.

	TRL (Technology Readiness Level)								
Sub-Technology	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Onshore wind								■	■
Bottom-fixed offshore wind								■	■
Floating offshore wind						■	■	■	■
Airborne wind energy			■	■	■				

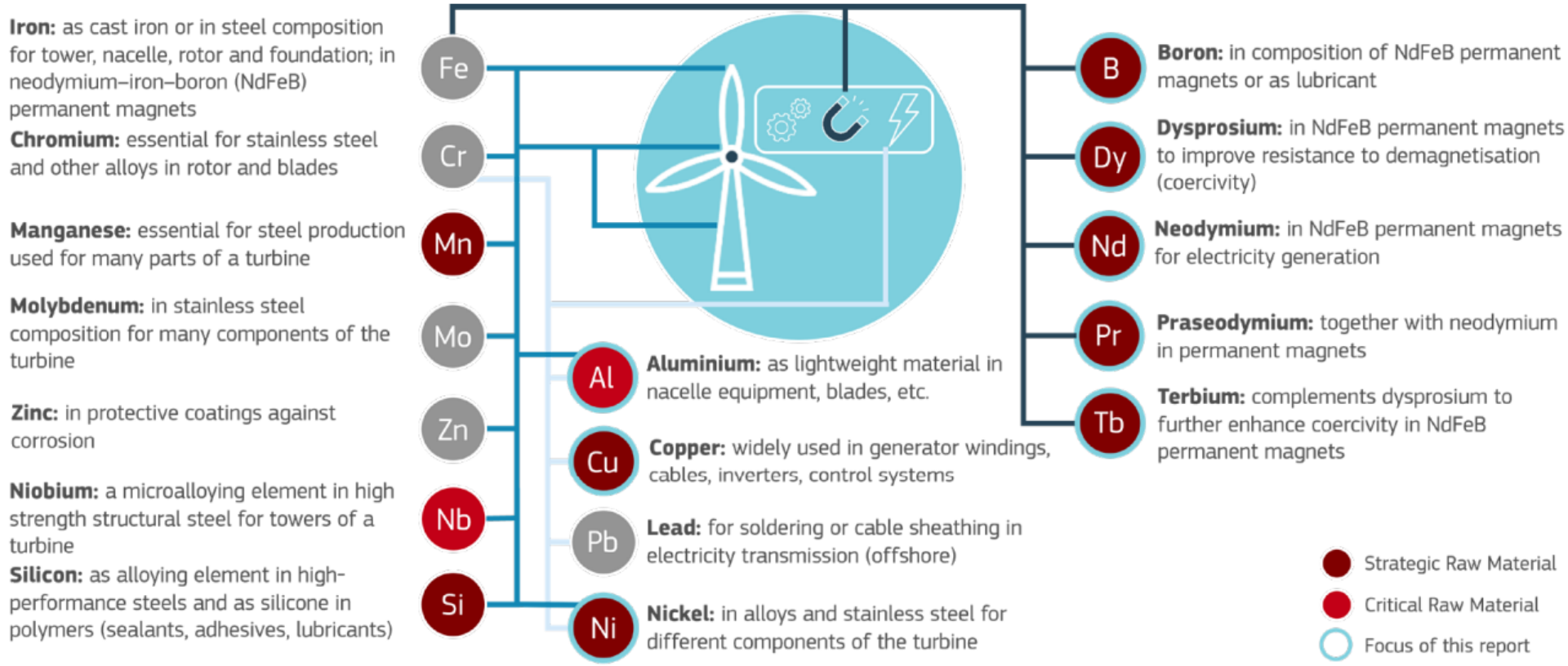
Source: JRC analysis, 2024.

Wind energy in the European Union, 2024

Critical Raw Materials

"The clean energy transition is essentially a materials transition".

Figure 2. Selection of raw materials used in wind turbines and their function



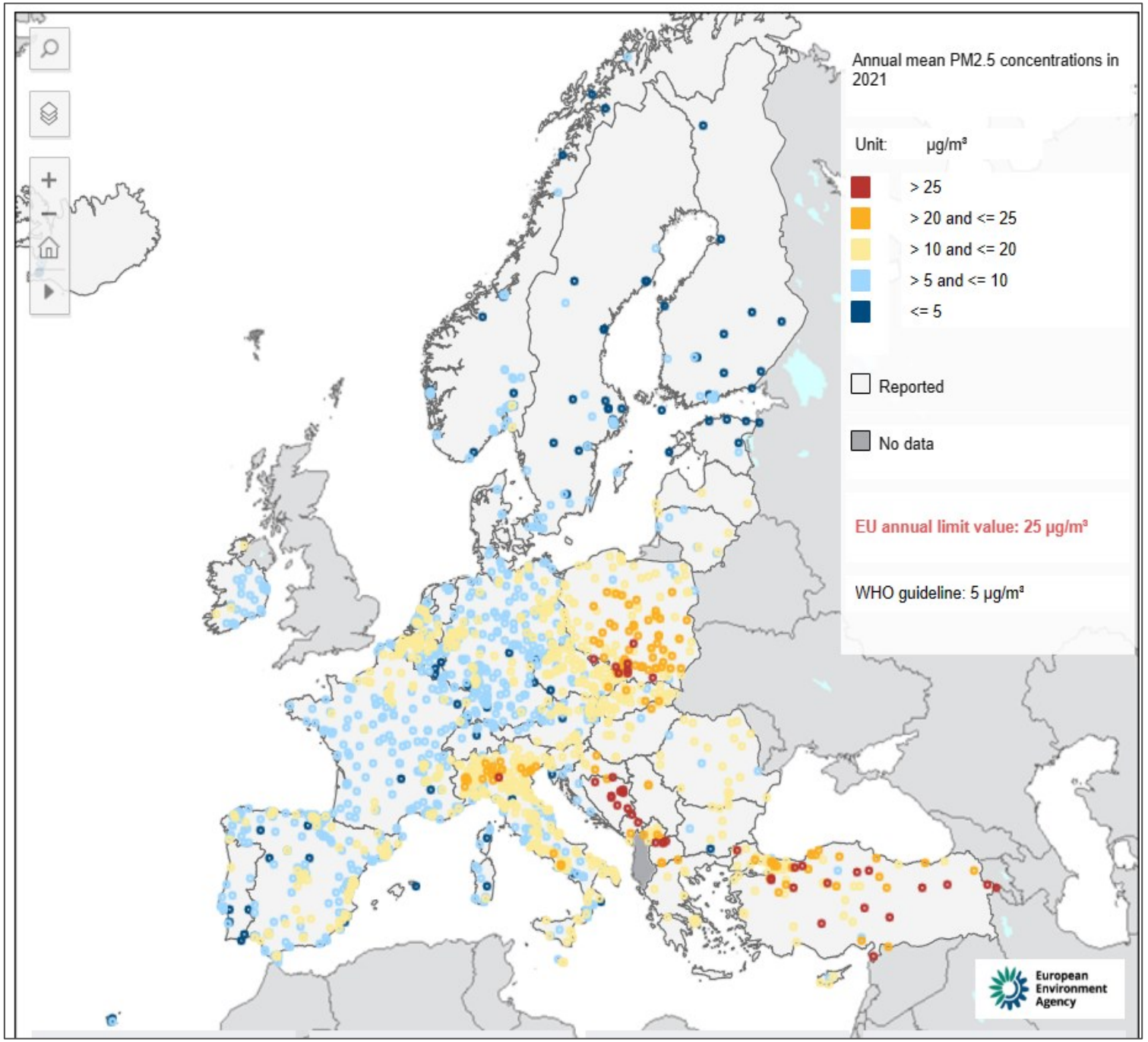
[Deep dive on critical raw materials for wind turbines in the EU]

European Commission

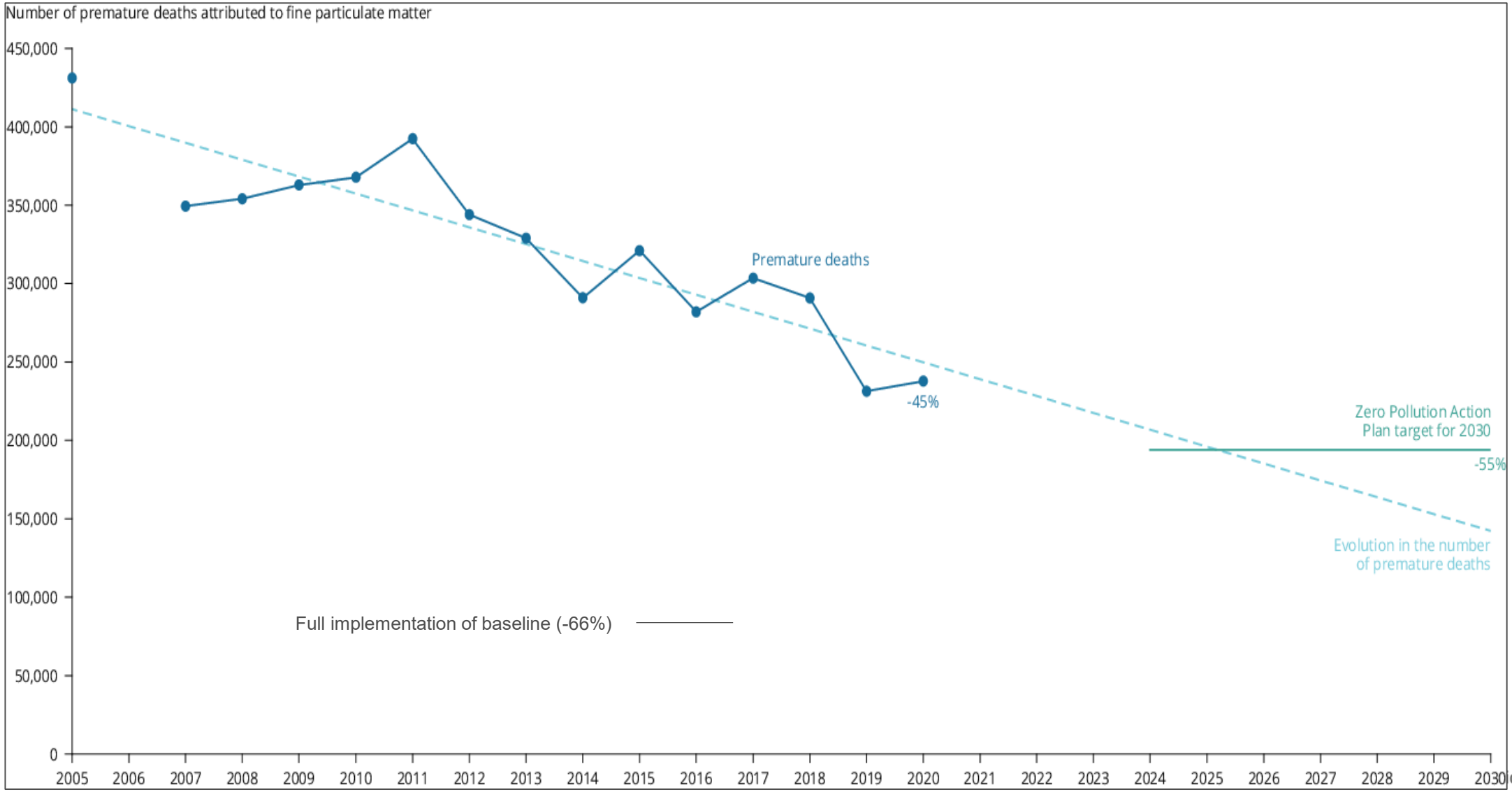
Air Quality

PM 2.5

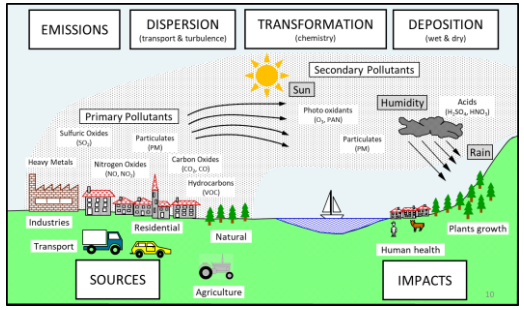
Share of the EU urban population exposed to air pollutant concentrations above the WHO guidelines (5 μm^{-3}) in 2021 (EEA, 2023)

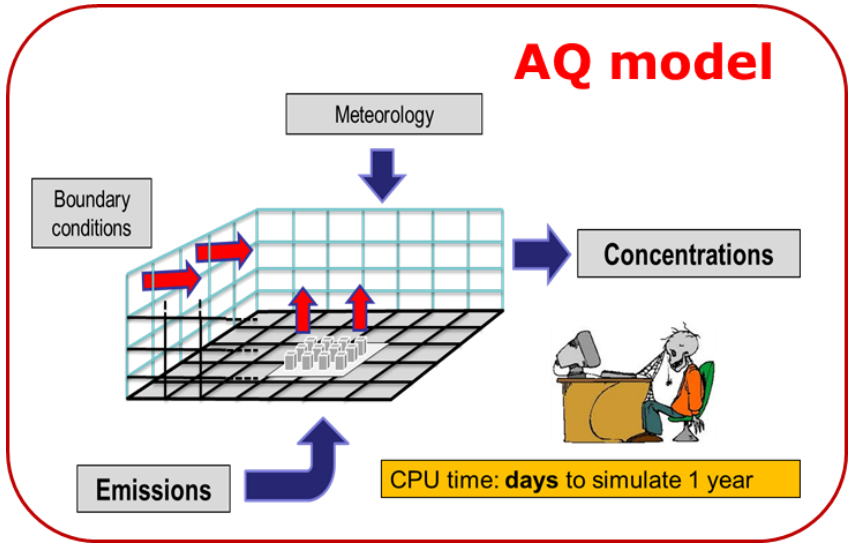


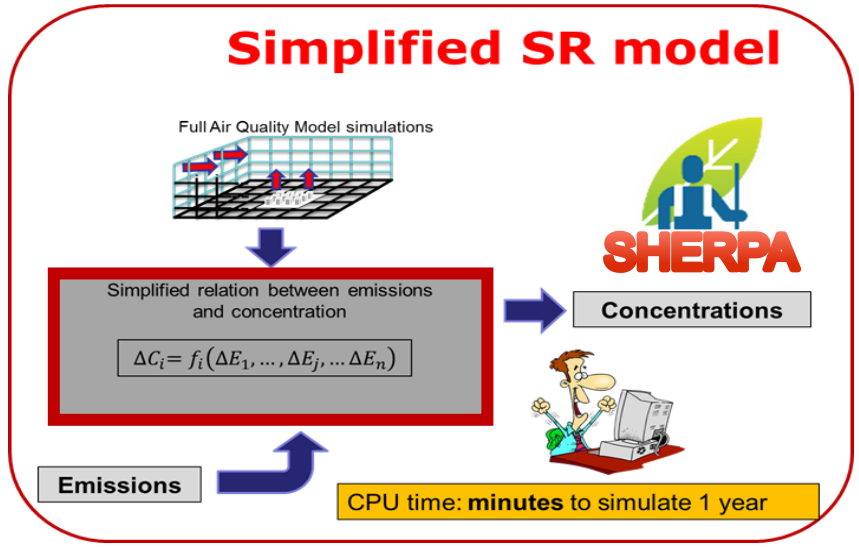
Decreasing trend, work still to be done



How: from real world to models







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Research article

On the design and assessment of regional air quality plans: The SHERPA approach

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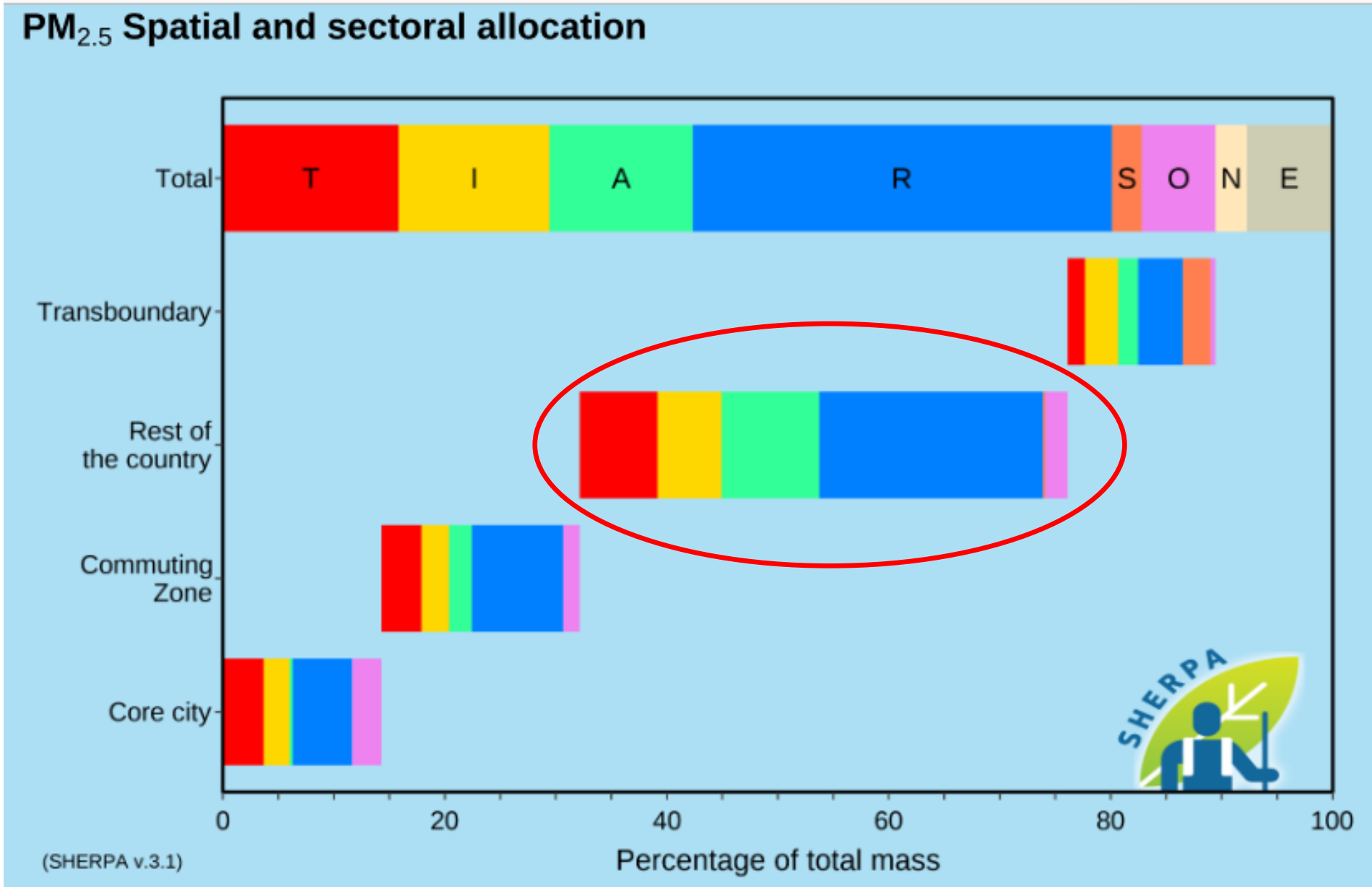
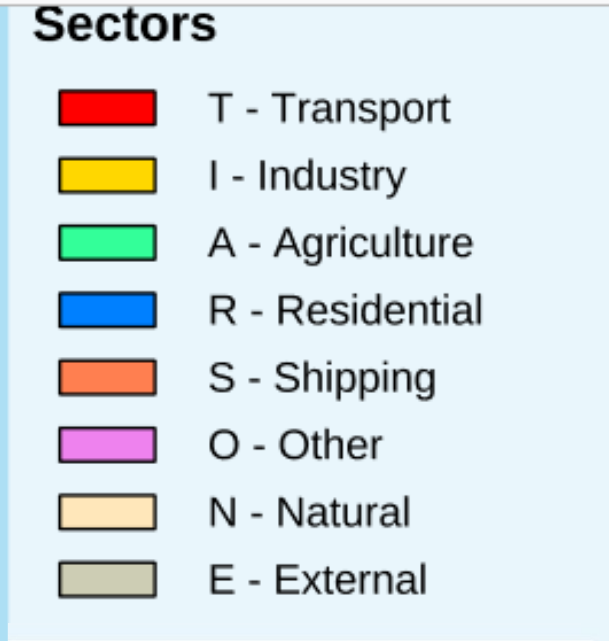
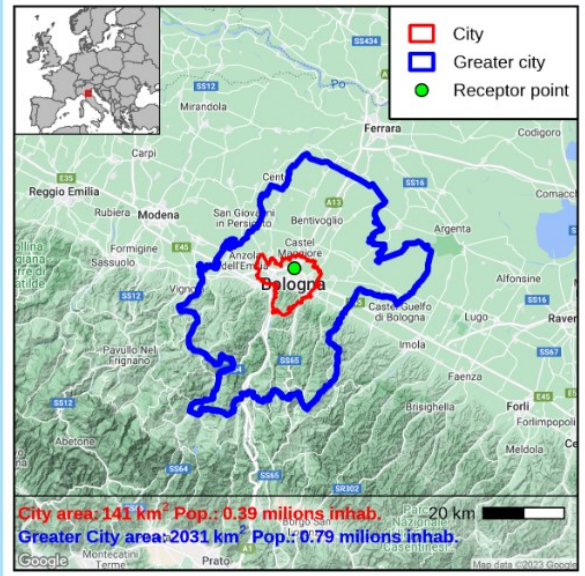
[a] European Commission, Directorate for Energy, Transport and Climate, Ispra, Italy
[b] TerrAria srl, Via M. Gioia 132 20125 Milan, Italy
[c] Université de Strasbourg, Laboratoire Image Ville Environnement, Strasbourg, France

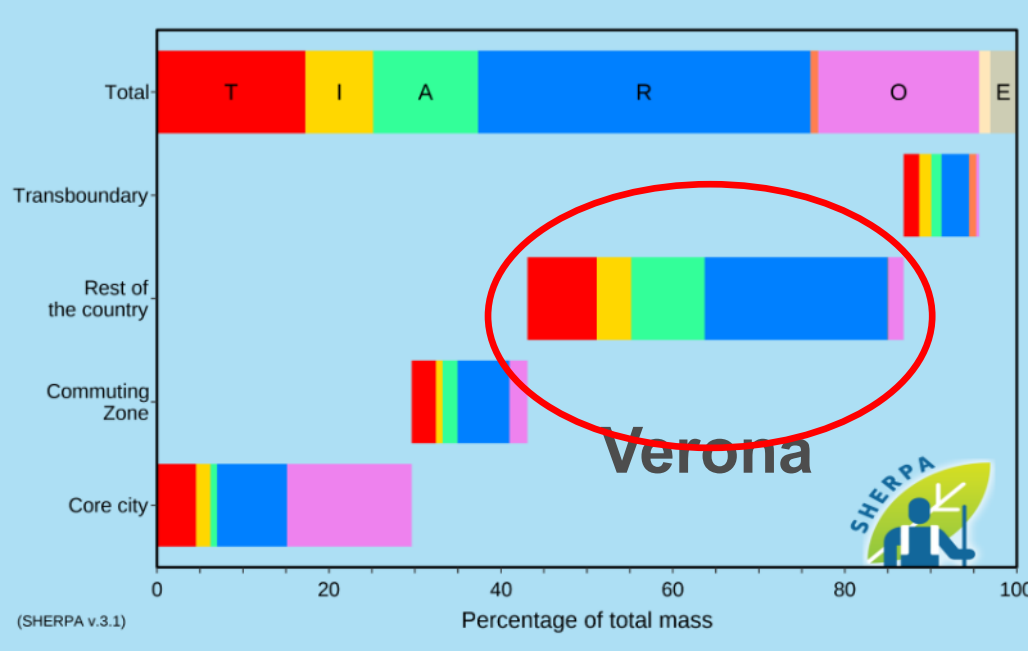
Focus on Bologna

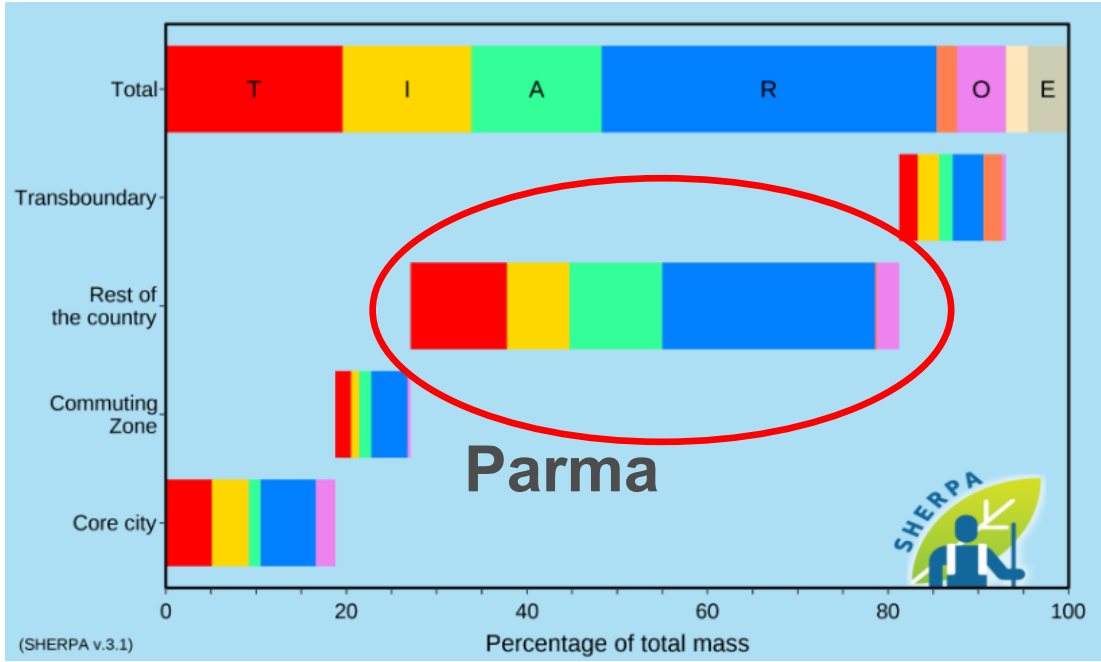


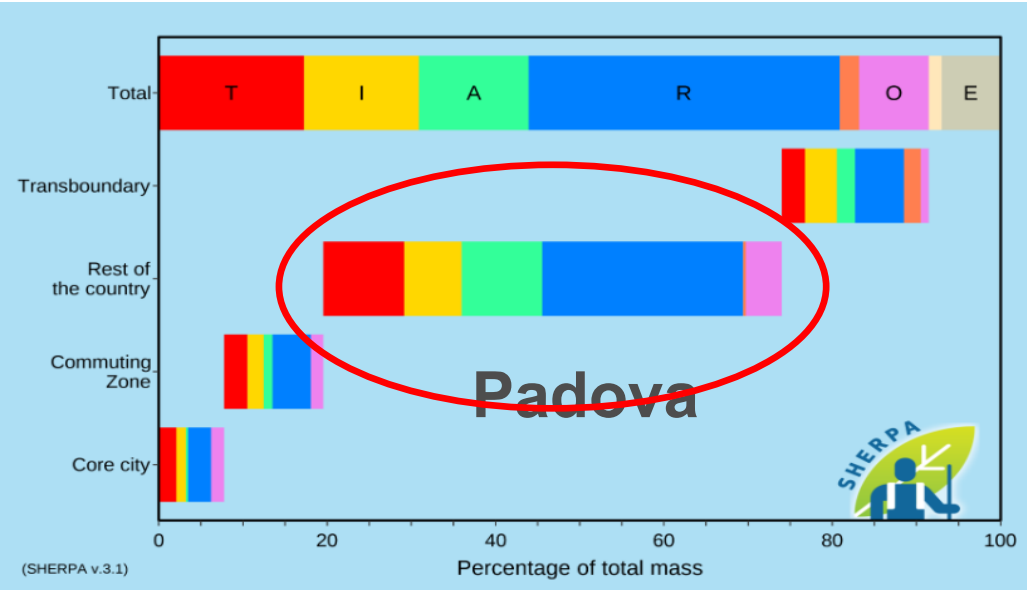


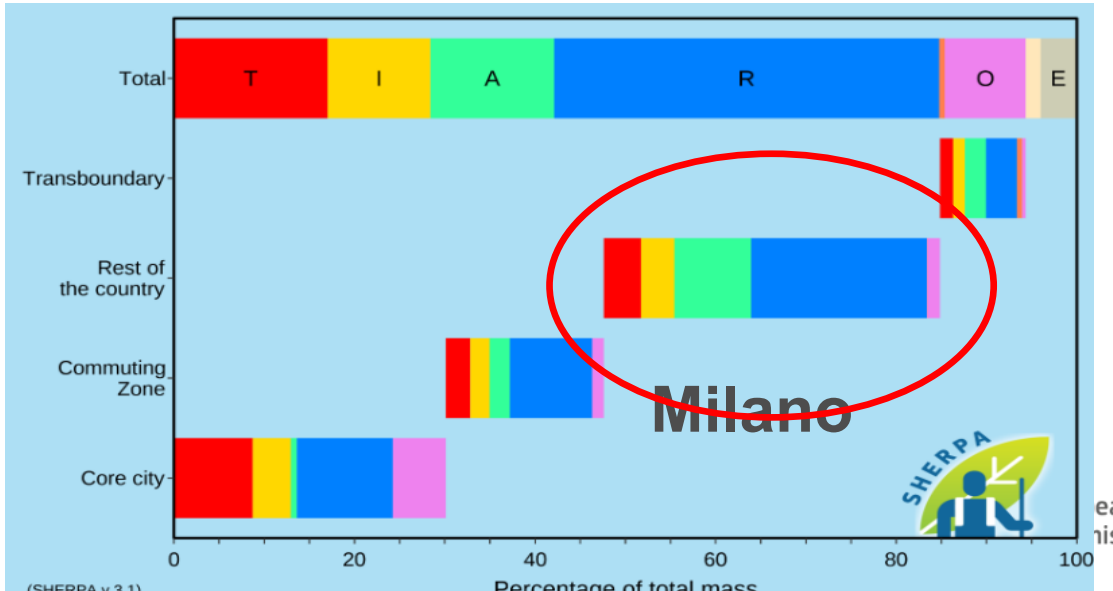


Po Valley as a “basin”









Policy consistency

The Global Covenant of Mayors

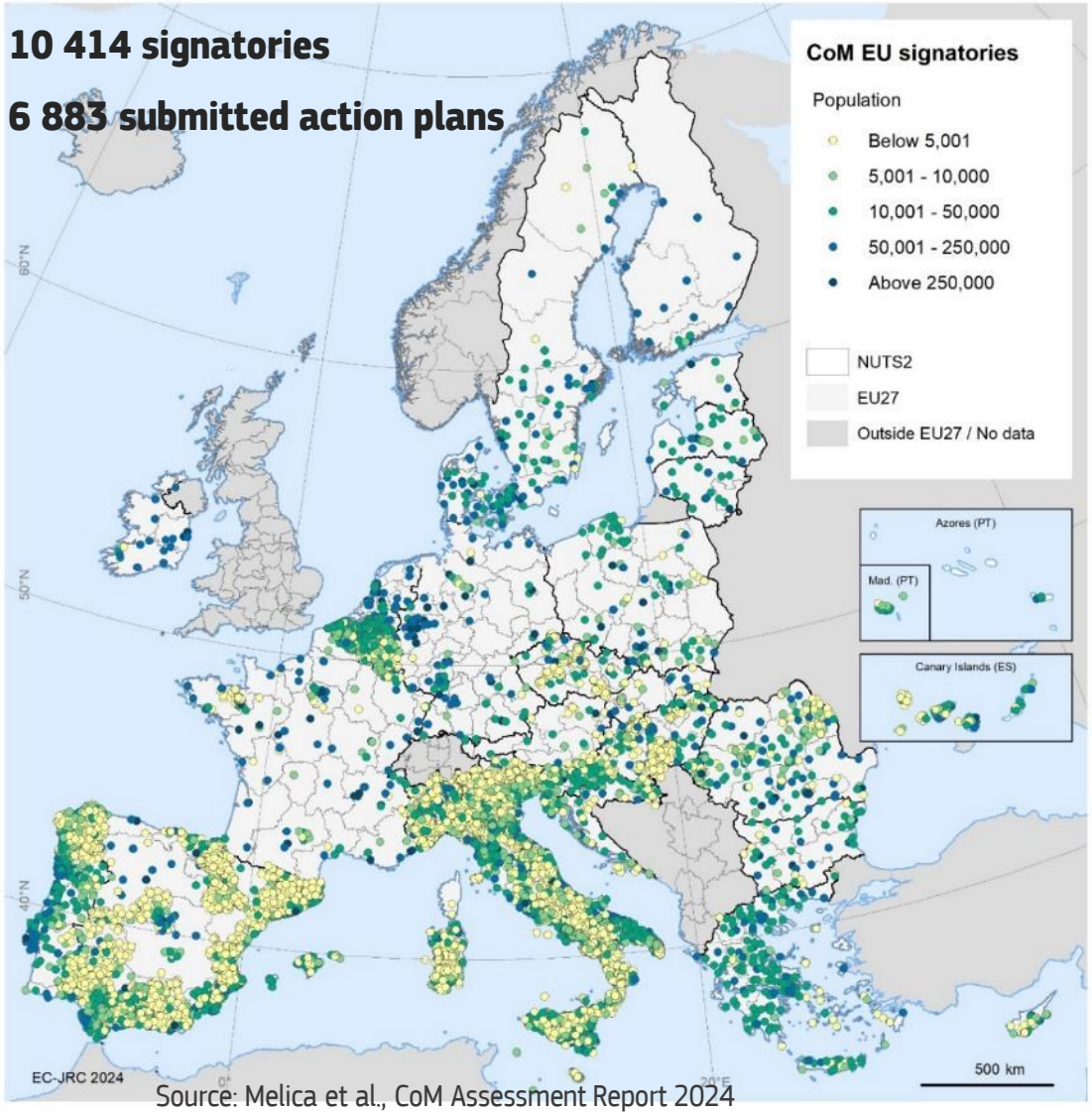
The Covenant of Mayors was launched in 2008 in Europe with the ambition to gather local governments **voluntarily committed to achieving and exceeding the EU climate and energy targets**.

The initiative expanded to other areas of the world and since 2016 the **Global Covenant of Mayors for Climate and Energy** is a worldwide initiative that invites cities and local governments to play a direct role in climate actions now involving more than **13 000 signatories,** representing **more than 1 billion people.**

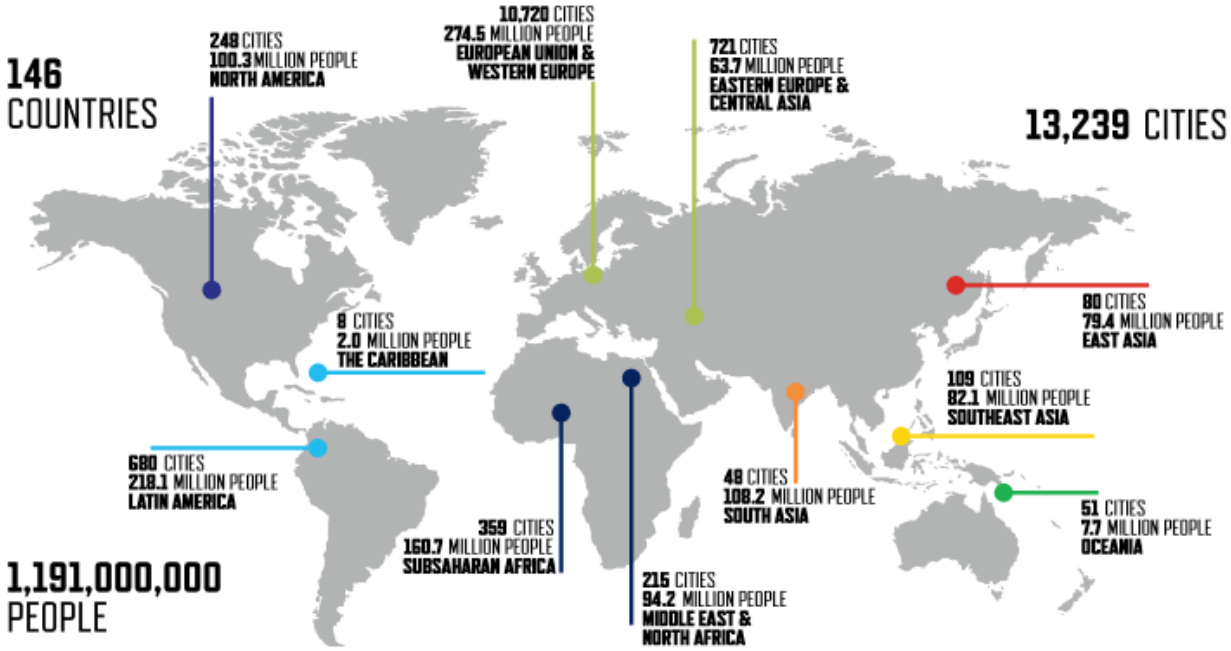
CoM – From EU to Global

10 414 signatories

6 883 submitted action plans



Source: Melica et al., CoM Assessment Report 2024



European Commission

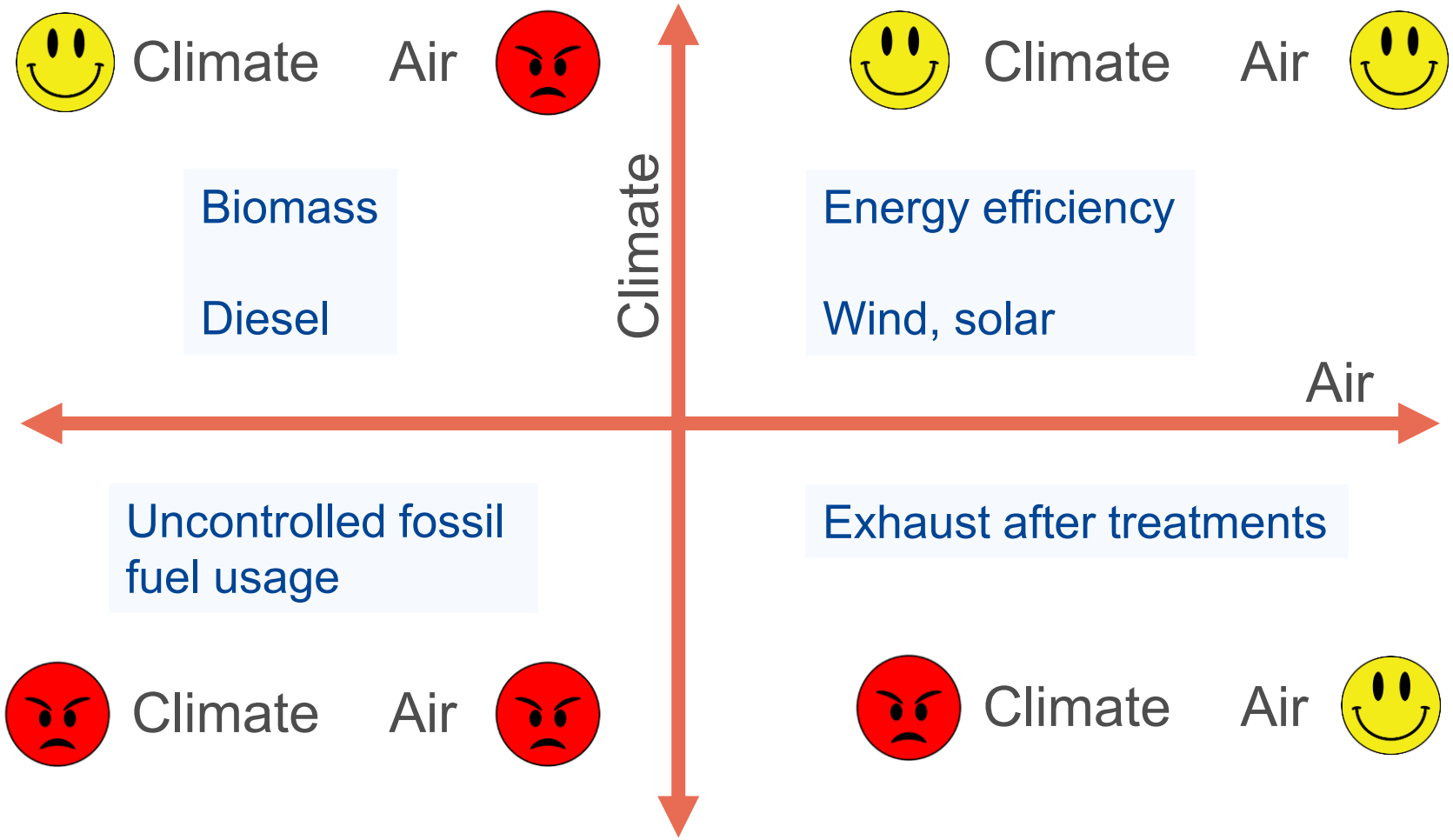
100 Neutral cities

In Italy:

- Bergamo,
- Bologna,
- Firenze,
- Milano,
- Padova,
- Parma,
- Prato,
- Roma
- Torino

European Commission

Air Quality & Climate Actions



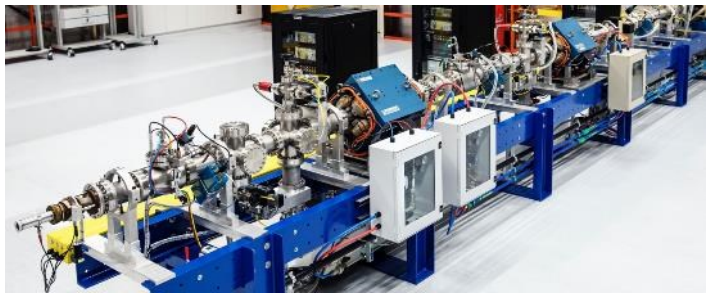
Adapted from: Air quality and climate--synergies and trade-offs, von Schneidemesser E. and P. Monks, Environ Sci. Process Impacts, 2013

Infrastructures

JRC facilities – some examples

Virtual tour at *https://visitors-centre.jrc.ec.europa.eu/en/media?type=8*

Neutron beams to explore the femtoscale (MONNET)



Food Contact Materials (EURL FCM)

Nanobiotechnology Laboratory

JRC neutron time-of-flight facility (GELINA)

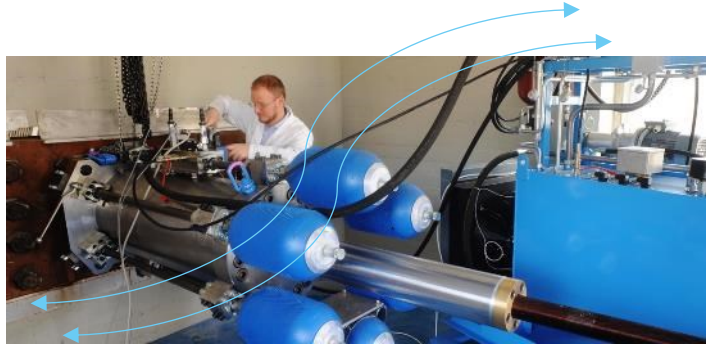
Reference Material Processing Hall

Water Laboratory

JRC facilities – some examples

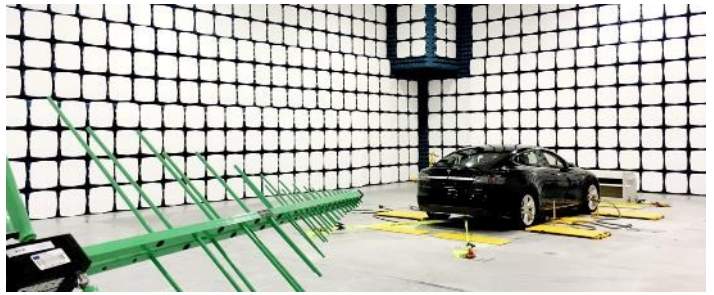
Virtual tour at *https://visitors-centre.jrc.ec.europa.eu/en/media?type=8*

European Laboratory for Structural Assessment (ELSA)



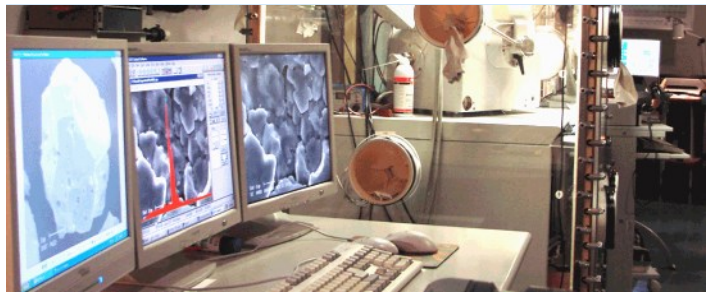
Hopkinson Bar facility (HOPLAB)

Vehicle Emission Laboratory (VELA)+ vehicle Market Surveillance Laboratory



European Interoperability Centre for Electric Vehicles and Smart Grids

Battery Testing Facility Laboratory



Nuclear Forensic Laboratory

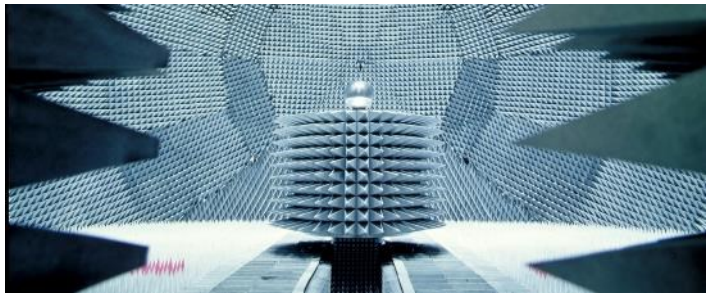
JRC facilities – some examples

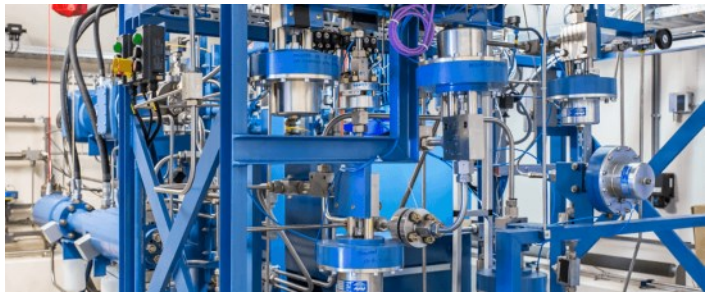
Virtual tour at *https://visitors-centre.jrc.ec.europa.eu/en/media?type=8*

JRC ultra low-background gamma-ray spectrometry facility (HADES)

European Solar Test Installation (ESTI)

European Microwave Signature Laboratory (EMSL)





Gas Testing Laboratory

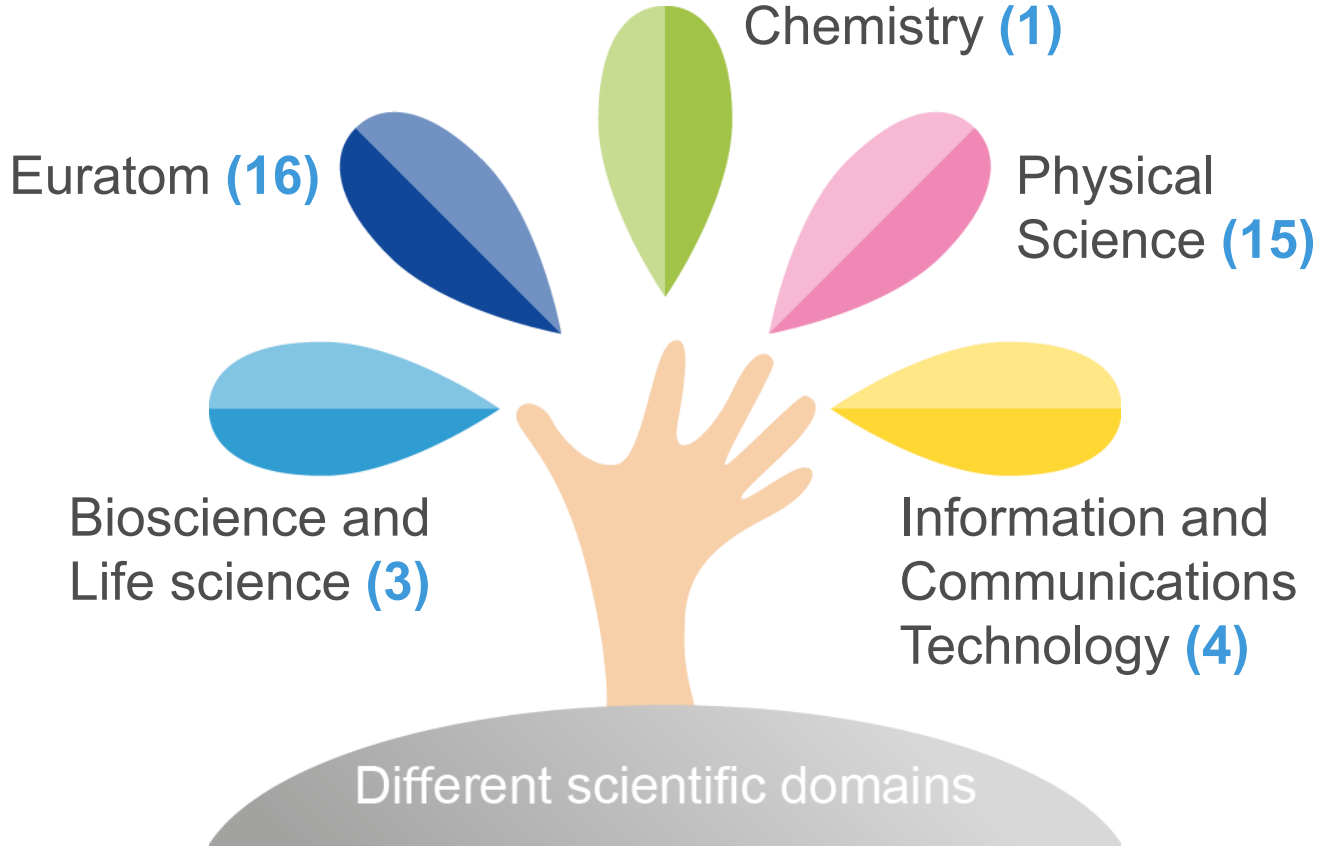
JRC radionuclide metrology laboratory (RADMET)

European Crisis Management Laboratory (ECML)

Open access to JRC Research Infrastructures

The JRC hosts **39 physical Research Infrastructures (RI)** with a potential of **opening to external users** (out of a total of **56**)

https://europa.eu/!CM63UK



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Check our vacancies

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Thank you

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