ADDRESSING AIR QUALITY CO-BENEFITS OF PLANNED MITIGATION ACTIONS IN THE FRAME OF THE COVENANT OF MAYORS INITIATIVE

Fabio Monforti-Ferrario, Luana Valentini, Marta Giulia Baldi, Enrico Pisoni

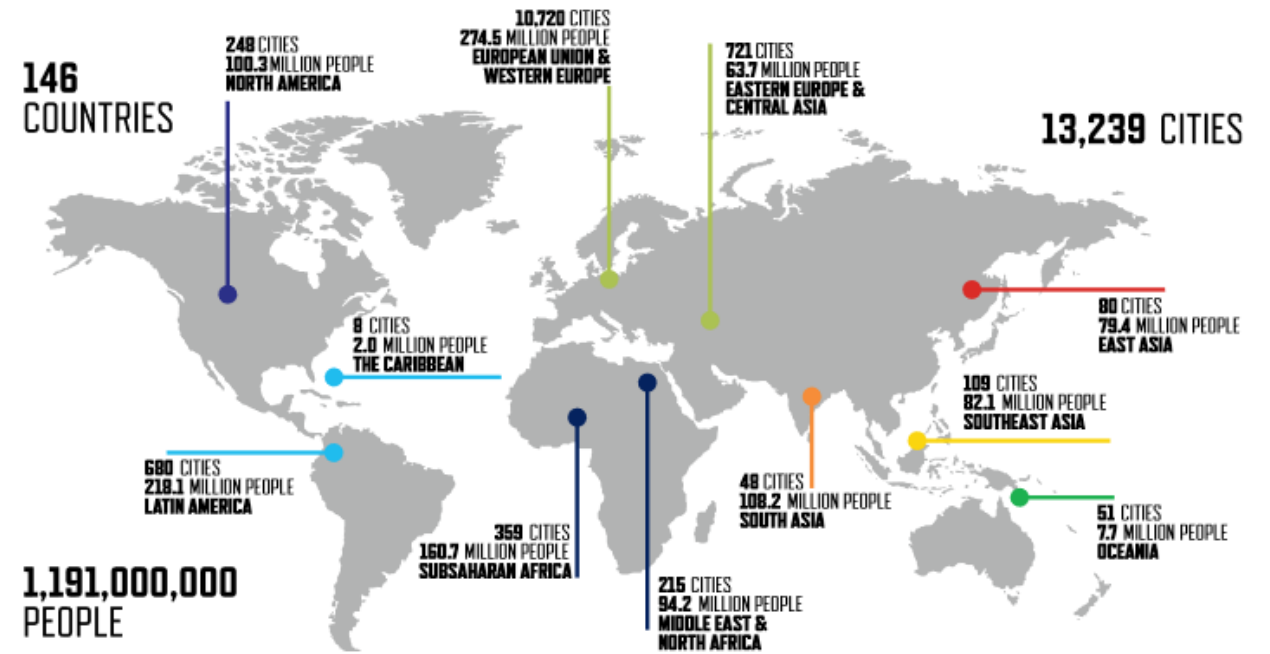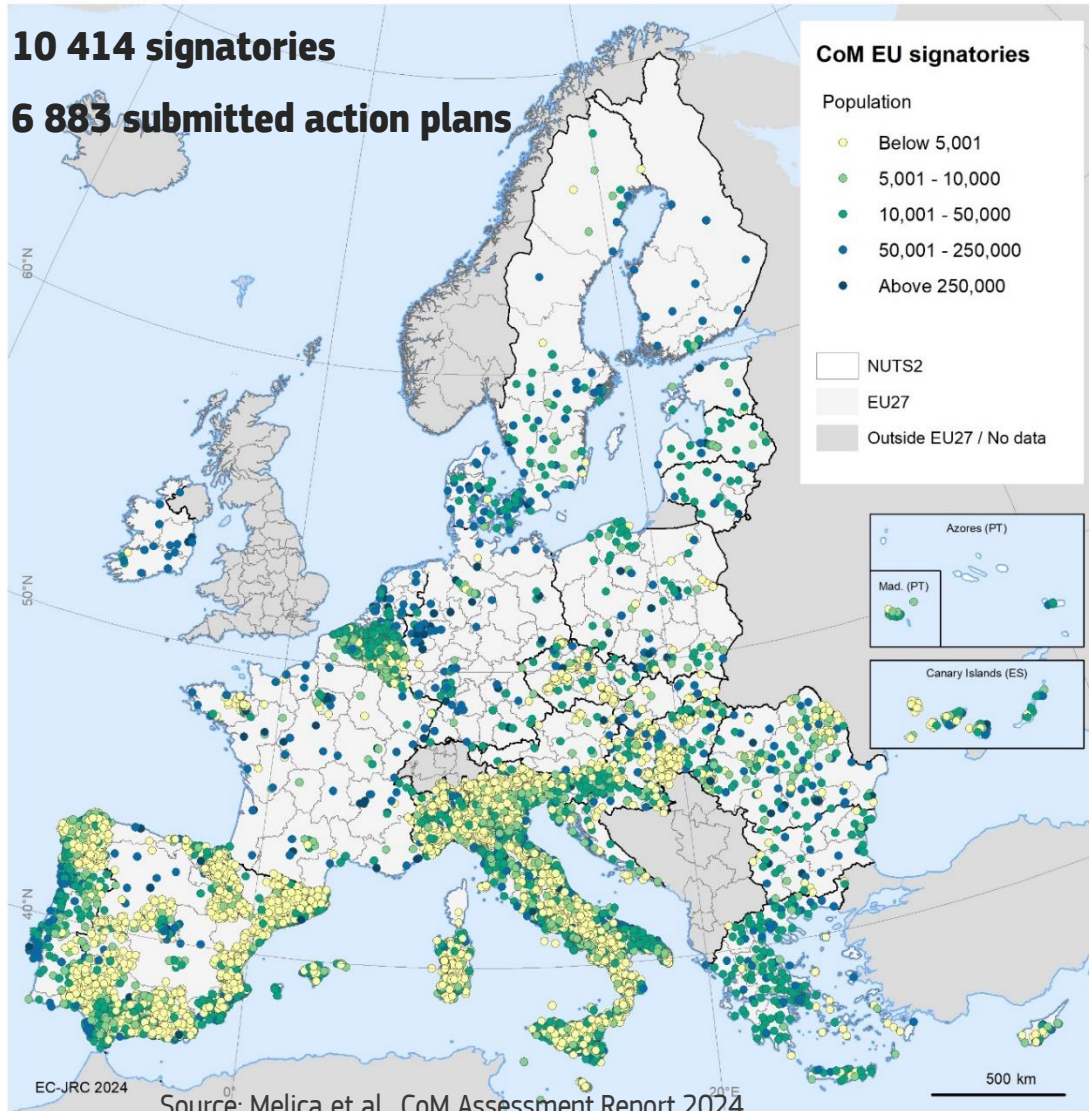European Commission – Joint Research Centre

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

CoM EU signatories

Population

- ○ Below 5,001
- ● 5,001 - 10,000
- ● 10,001 - 50,000
- ● 50,001 - 250,000
- ● Above 250,000

☐ NUTS2
☐ EU27
☐ Outside EU27 / No data

Azores (PT)

Mad. (PT)

Canary Islands (ES)

EC-JRC 2024

500 km

Source: Melica et al., CoM Assessment Report 2024

146 COUNTRIES

1,191,000,000 PEOPLE

13,239 CITIES

248 CITIES
100.3 MILLION PEOPLE
NORTH AMERICA

10,720 CITIES
274.5 MILLION PEOPLE
EUROPEAN UNION & WESTERN EUROPE

721 CITIES
63.7 MILLION PEOPLE
EASTERN EUROPE & CENTRAL ASIA

80 CITIES
79.4 MILLION PEOPLE
EAST ASIA

8 CITIES
2.0 MILLION PEOPLE
THE CARIBBEAN

109 CITIES
82.1 MILLION PEOPLE
SOUTHEAST ASIA

680 CITIES
218.1 MILLION PEOPLE
LATIN AMERICA

48 CITIES
108.2 MILLION PEOPLE
SOUTH ASIA

51 CITIES
7.7 MILLION PEOPLE
OCEANIA

359 CITIES
160.7 MILLION PEOPLE
SUBSAHARAN AFRICA

215 CITIES
94.2 MILLION PEOPLE
MIDDLE EAST & NORTH AFRICA

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Pillars and Commitments

Mitigation

Adaptation

Access to Energy

Mitigation:

Reducing Greenhouse Gas (GHG) emissions and accelerating the decarbonisation of the territories.

Adaptation:

Increasing resilience and strengthening the capacity to adapt to unavoidable climate change impacts.

Access to Energy:

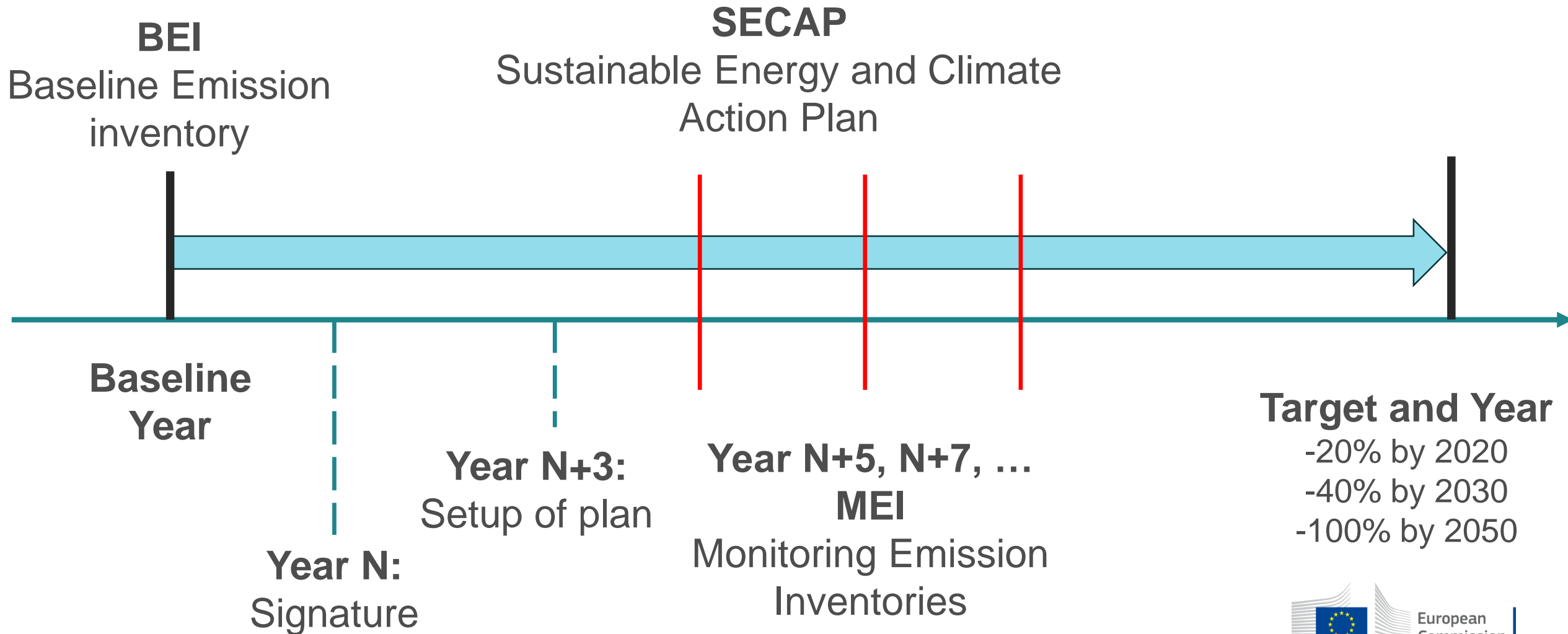Allowing the citizens to access secure, sustainable and affordable energy.

What about air quality?

To what extent measures taken by cities in the GCoM also impact the air quality?

Are cities aware of co-benefits and trade-offs?

Is it possible to exploit the GCoM momentum to increase such an awareness to the benefit of a more integrated air pollution and climate mitigation management?

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The Signatories timetable

BEI
Baseline Emission inventory

SECAP
Sustainable Energy and Climate Action Plan

Baseline Year

Year N:
Signature

Year N+3:
Setup of plan

Year N+5, N+7, …
MEI
Monitoring Emission Inventories

Target and Year
-20% by 2020
-40% by 2030
-100% by 2050

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Baseline years
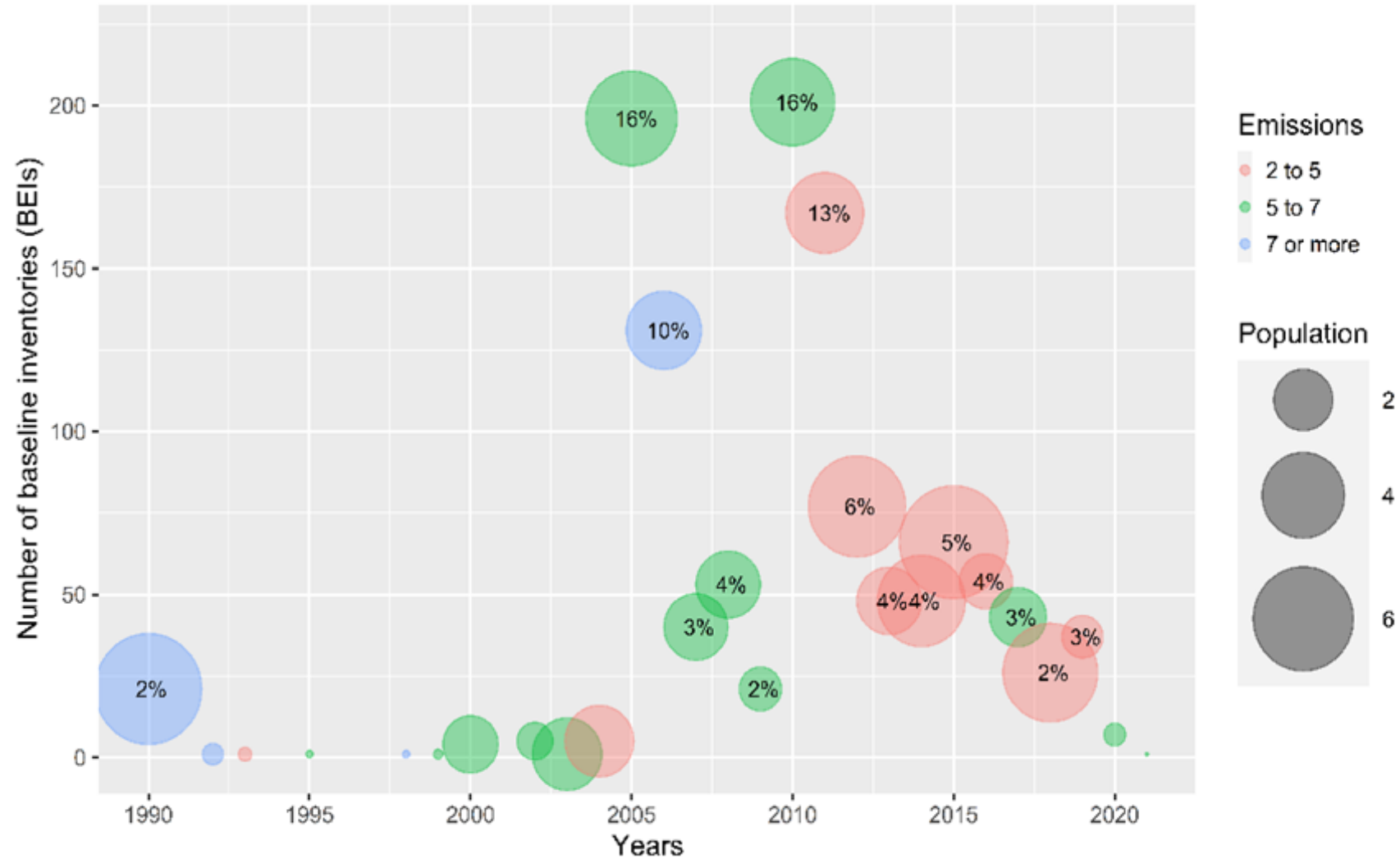
How to calculate emissions - GHG

Local governments can estimate their GHG emissions by multiplying activity data by an appropriate emission factor.

Activity Data	✖	**GHG Emission factors**	=	**GHG Emissions**
Activity data (AD) quantifies the human activity occurring in the territory of the local authority		Emission factors (EF) quantifies the emissions of CO_2 emitted per unit of activity (IPCC, LCA, national/regional)		total amount of GHG emitted [tCO_2]

Examples of AD are :
- Charcoal for cooking;
- Electricity consumed;
- Diesel used in transportation;
- Amount of waste sent to landfill

It is strongly recommended to used **data relevant to the local territory**

Examples of EF are :
- CO_2 emitted per unit of charcoal;
- CO_2 emitted per unit of electricity;
- CO_2 emitted per unit of diesel;
- amount of CH4 emitted per tonne of waste sent to landfill

converted into *CO_2 equivalents by multiplying GWP*

Total amount of GHG emissions:
- GHG emissions due to charcoal;
- GHG emissions due to electricity;
- GHG emissions due to diesel;
- GHG emissions due to waste production

The Activity Data

CATEGORY	ELEC-TRICITY	HEAT/ COLD	FOSSIL FUELS								RENEWABLE ENERGIES					TOTAL
			Natural gas	Liquid gas	Heating oil	Diesel	Gaso-line	Lignite	Coal	Other fossil fuels	Plant oil	Biofuel	Other biomass	Solar thermal	Geo-thermal	
BUILDINGS, EQUIPMENT/FACILITIES AND INDUSTRIES																
Municipal buildings, equipment/facilities																
Tertiary (non municipal) buildings, equipment/facilities																
Residential buildings																
Municipal public lighting																
Industries (excluding industries involved in the EU Emission trading scheme – ETS)																
Subtotal buildings, equipments/facilities and industries																
TRANSPORT																
Municipal fleet																
Public transport																
Private commercial transport																
Subtotal transport																
TOTAL																
MUNICIPAL PURCHASES OF CERTIFIED GREEN ELECTRICITY (IF ANY) (MWh)																

A. FINAL ENERGY CONSUMPTION (MWh)

The GHG Emission Factors

Covenant of Mayors for Climate and Energy: Greenhouse gas emission factors for local emission inventories

Covenant of Mayors collection - 2024 datasets

Bastos, J. Monforti-Ferrario, F. and Melica, G.

2024

EUR 31825 EN
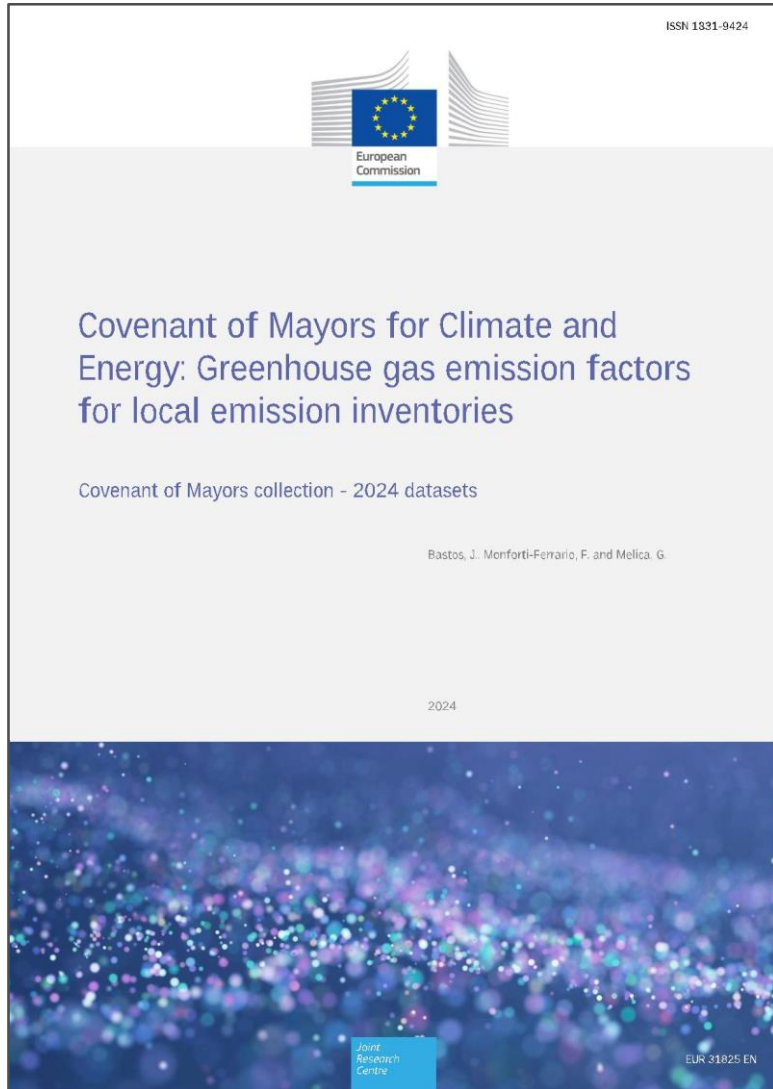
Table 4. Updated CoM EFs for local energy use of non-renewable energy sources (NRES)

Energy source SECAP category	IPCC category	Activity-based approach		LC approach [1]
		CO_2 (t CO_2/MWh)	GHG (t CO_2-eq/MWh)	GHG (t CO_2-eq/MWh)
Natural gas	Natural gas	0.202	0.202	0.261
Liquid gas	Liquefied petroleum gases	0.227	0.227	0.311
	Natural gas liquids	0.231	0.232	0.339
Heating oil	Gas/diesel oil	0.267	0.268	0.340
Diesel	Gas/diesel oil	0.267	0.268	0.349
Gasoline	Motor gasoline	0.249	0.250	0.333
Lignite	Lignite	0.364	0.365	0.373
Coal	Anthracite	0.354	0.355	0.404
	Other bituminous coal	0.341	0.342	0.392
	Sub-bituminous coal	0.346	0.348	0.416
Other	Peat	0.382	0.383	0.388
	Municipal waste (non-biomass fraction)	0.330	0.337	0.346

How to calculate emissions – pollutants

Local governments can estimate their GHG **and air pollutants** emissions by multiplying activity data by an appropriate emission factor.

Activity Data	✖	CO2 Emission factors	=	GHG Emissions
Activity data (AD) quantifies the human activity occurring in the territory of the local authority		Emission factors (EF) quantifies the emissions of CO_2 emitted per unit of activity (IPCC, LCA, national/regional)		total amount of GHG emitted [tCO_2]
Activity Data	✖	Air Pollutants Emission factors	=	Air Pollutants Emissions
Activity data (AD) quantifies the human activity occurring in the territory of the local authority		Emission factors (EF) quantifies the emissions of NOx, PM, NH_3, SO_2, CO, NMVOC, BC, OC emitted per unit of activity (GAINS and EDGAR)		total amount of pollutants emitted [t]

No additional reporting!

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Co-Benefits and tradeoffs

Are CO_2 and air pollutants emissions both decreasing?

Are cities taking maximum possible advantage of synergies between CO_2 and pollution policies?

The Signatories timetable
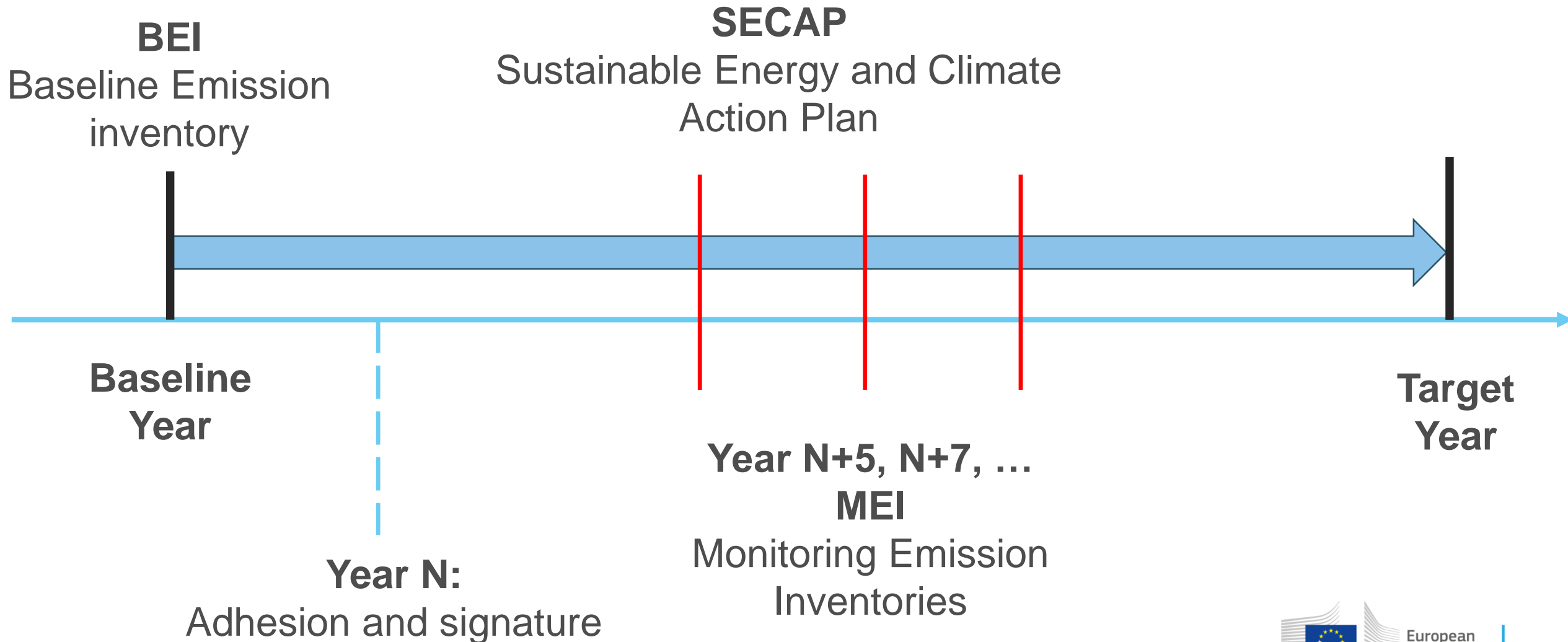
A retrospective view: BEI → MEI(s)
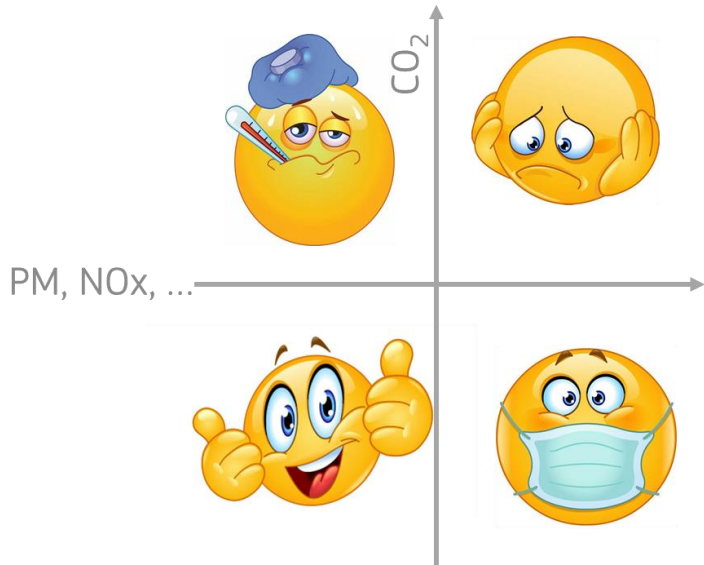
CO2 vs NOx Density Plot
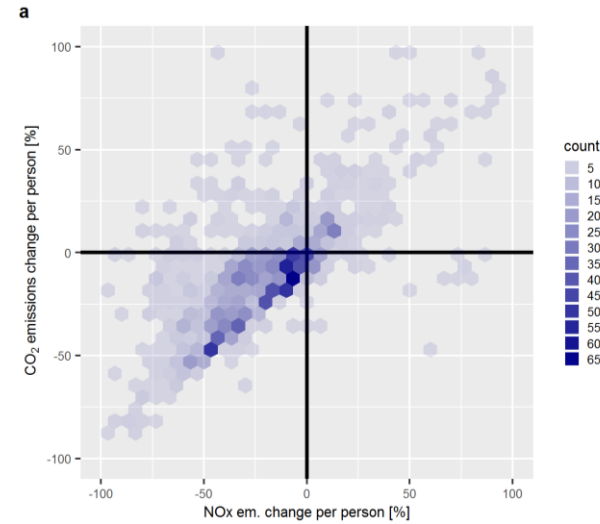
CO2 vs PM2.5 Density Plot
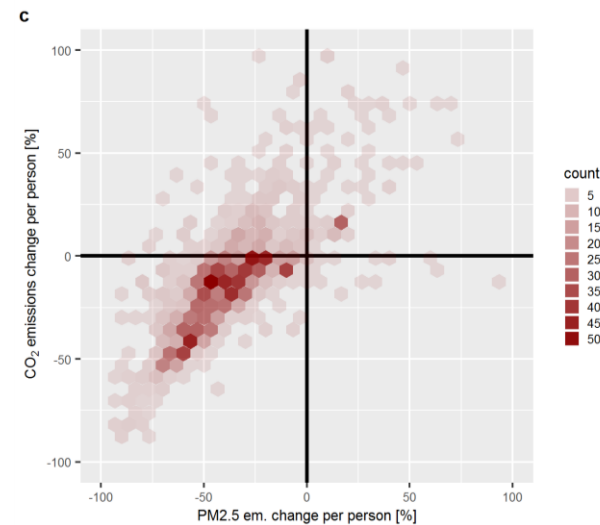
1653 cities

BEI + at least a MEI both complete and of good quality

88 millions people

Avg. size: 50k inh. (53 to 3millions)

Two sectors:

Transport and Residential

What about MY city?

A perspective view: BEI $\rightarrow$ SECAP $\rightarrow$ Target year

The SECAP provides a view on the future emissions.

Problem: The SECAP does not provide the same level of details than BEI (and MEIs) in terms of fuels.

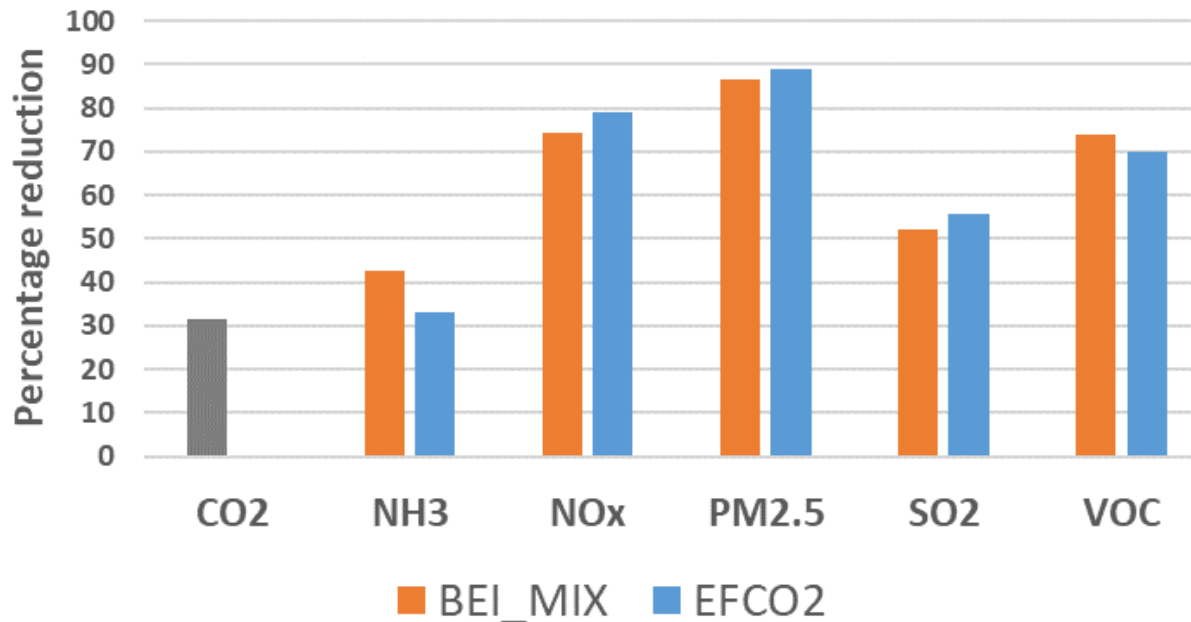**Unknown:** how is the fuel mix going to evolve in the future?

Two (extreme?) scenarios:
    a) The fuel mix of the BEI is not going to change.
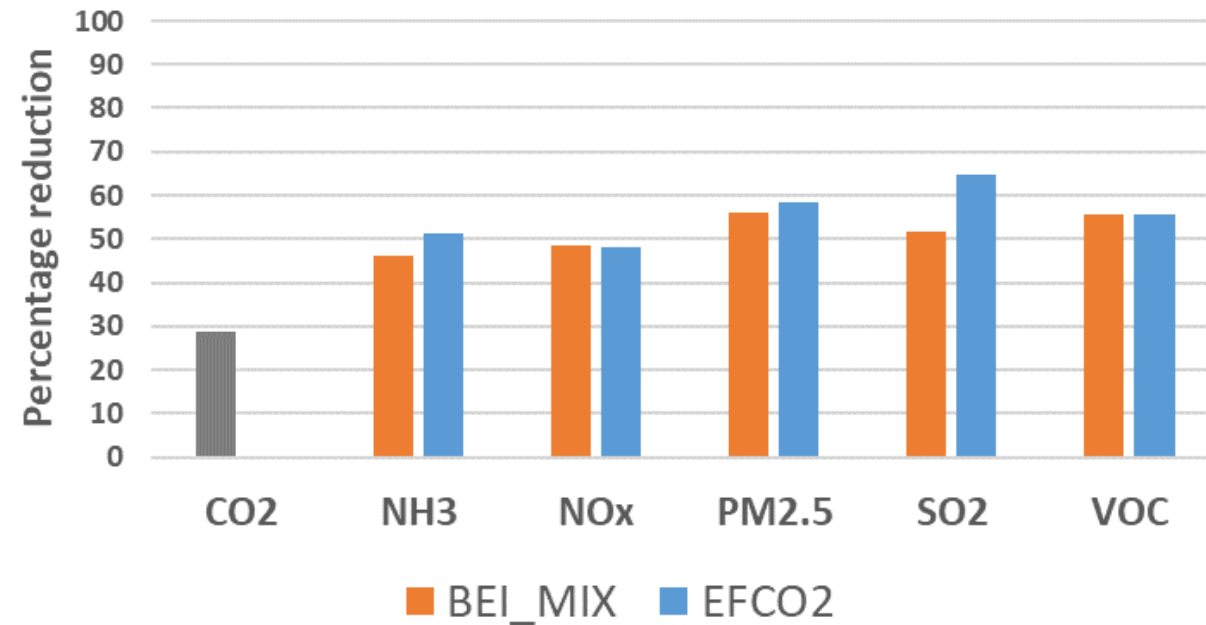   b) The highest CO_2 intensive fuels will be phase out first

Preliminary results

167 cities, targeting 2030, inhabitants > 50 000

Emission factors from GAINS (2005 – 2050)

Conclusions

- Air quality and climate mitigation policies **can** be tuned in order to maximize co-benefits and minimize trade-offs

- We are providing GCoM signatories tools to evaluate these aspects for their cities

- A "retrospective" tool has been already made available

- A further tool for "perspective" evaluations is being implemented

What's next?

- Creating a community of users

- Collecting feedback for improving the tools

- Disseminating interplay awareness and the use of the tools beyond the CoM (e.g. Climate Neutral and Smart Cities)

European Commission

Help yourself!

https://data.jrc.ec.europa.eu/collection/id-00354

Joint Research Centre Data Catalogue

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European Commission > EU Science Hub > JRC Data Catalogue > Collections > GCoM-MyCovenant

COLLECTION

Global Covenant of Mayors - A complete collection of action plans and monitoring reports from MyCovenant reporting platform
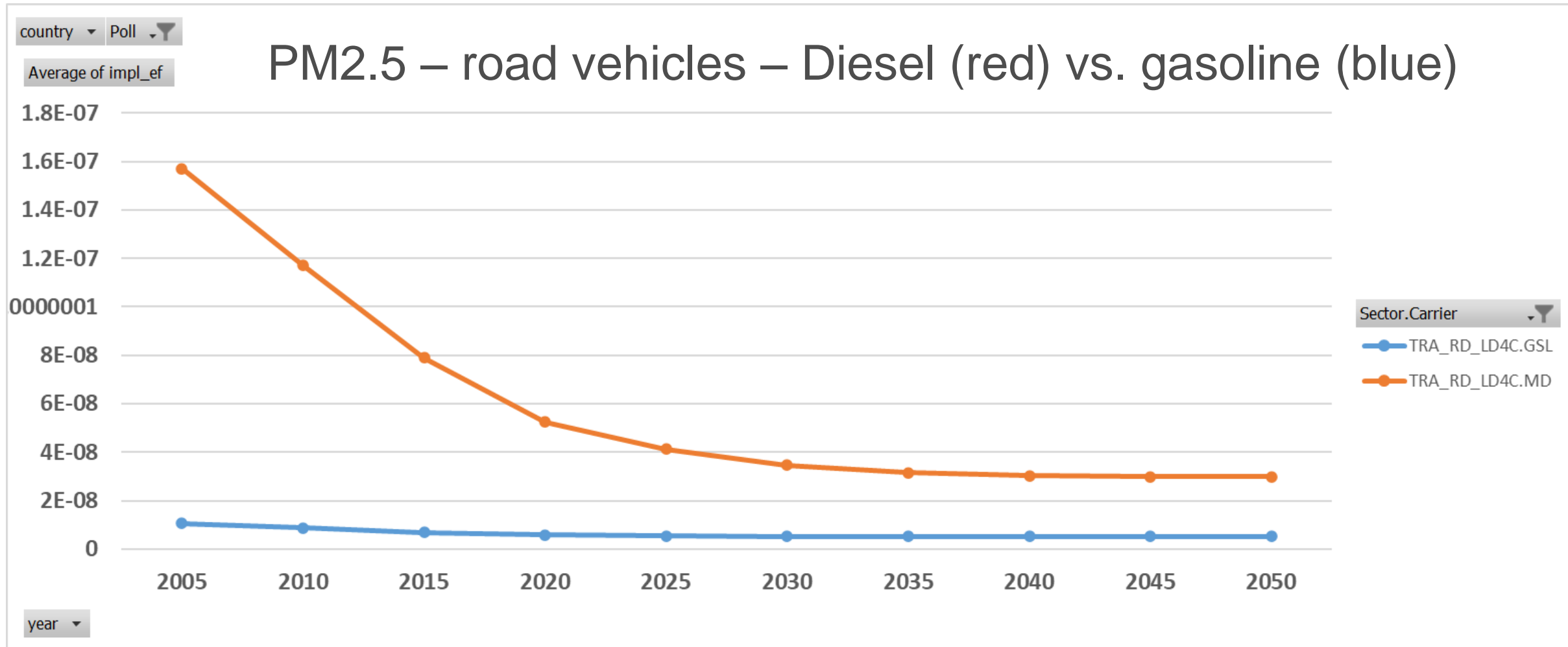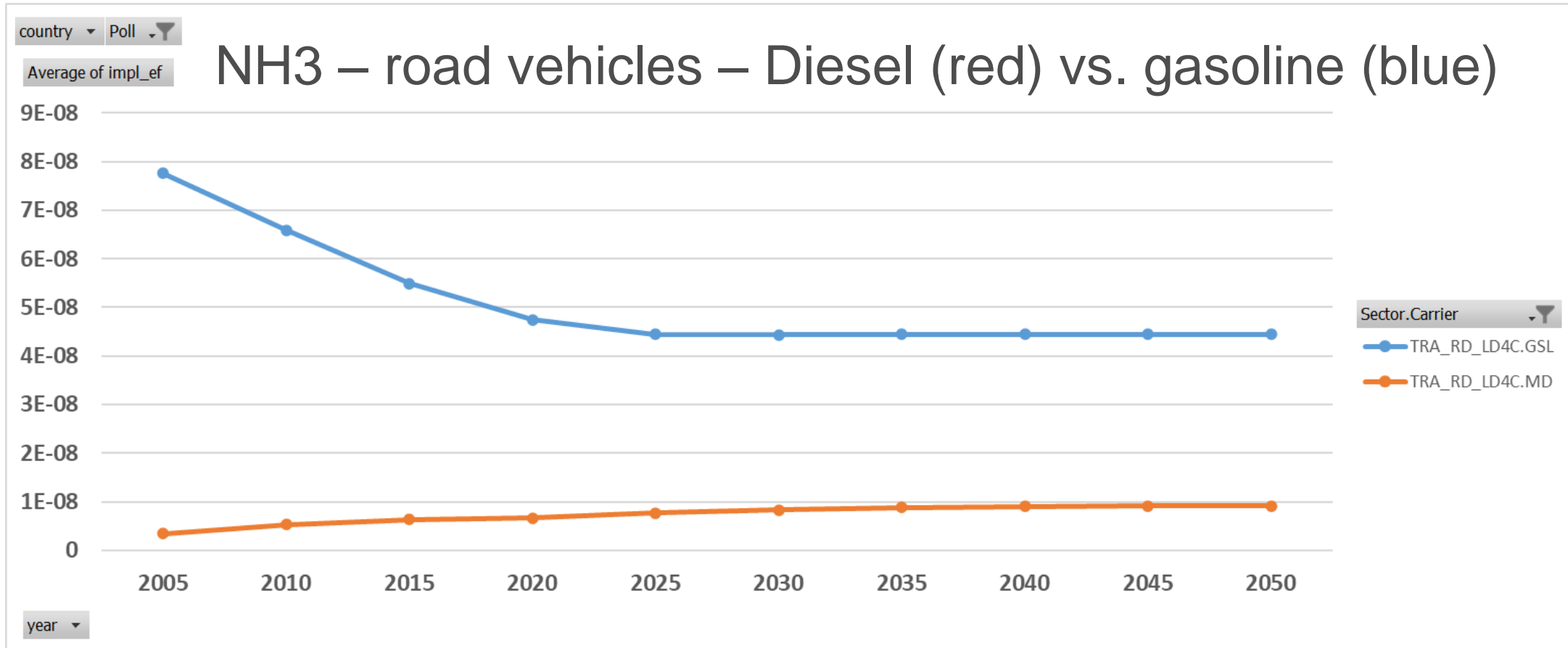
Acronym: GCoM-MyCovenant

Thank you.

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Some Emission factors (averages)

PM2.5 – road vehicles – Diesel (red) vs. gasoline (blue)

Some Emission factors (averages)

NH3 – road vehicles – Diesel (red) vs. gasoline (blue)

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Some Emission factors (averages)

PM2.5 – Residential– Gas (blue) vs. Diesel (red) vs. Wood (blue)