

# Multi-level policies for air quality: Implications of national and sub-national emission reduction scenarios on population exposure

Joint Research Centre

Air and Climate Unit  
Directorate C

Energy, Transport and Climate

Emanuela Peduzzi  
Enrico Pisoni  
Philippe Thunis



# Air quality policy in Europe



European  
Commission

## Policies

### National Emission Ceiling Directive

Sets national emission targets and requires member states to develop National Air Pollution Control Programmes

### Source Specific Emission Standards

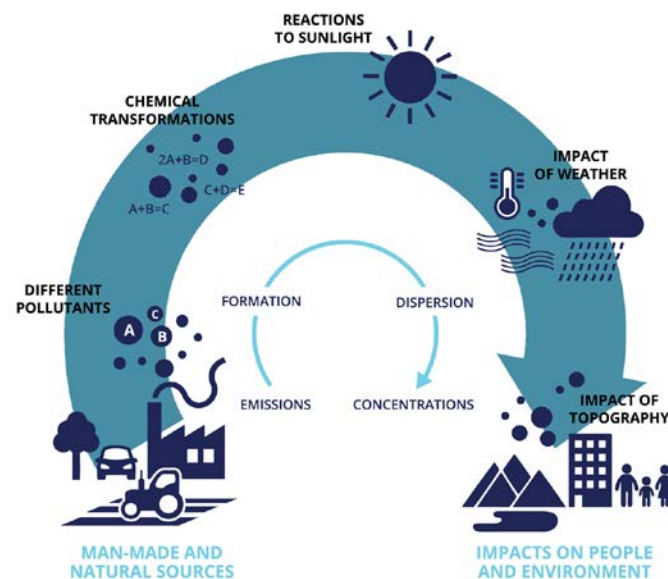
from vehicle and ship emissions to energy and industry

### Air Quality Directive

Sets the air quality standards and requires member states to adopt air quality plans to limit exceedances



Emissions



Source: European Environment Agency



Concentrations

# Air quality policy in Europe



## Policies

### National Emission Ceiling Directive

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### Source Specific Emission Standards

from vehicle and ship emissions to energy and industry

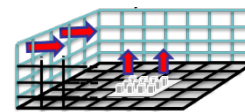
**Air Quality Directive**  
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## Emissions

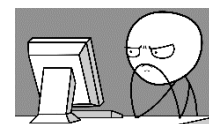


## Integrated Assessment Models (IAMs)

### Full Air Quality Model Simulations



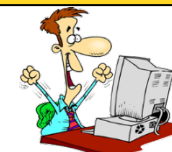
days to simulate 1 year



### Simplified air quality model



minutes to simulate 1 year



## Concentrations

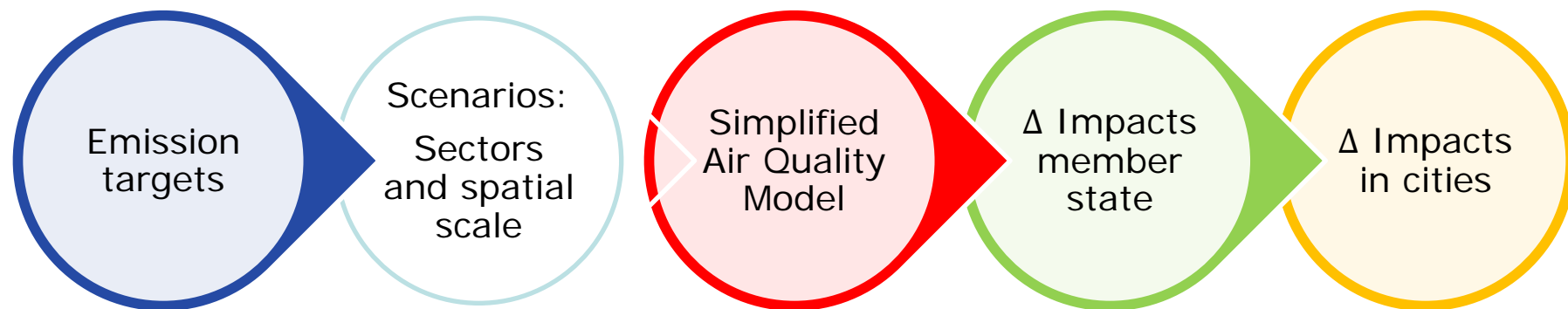


# The impact of spatial scales and sectors



Asses the **impact on exposure** of measures applied at different scales:

- Urban areas vs rest of the country
- Member state level
- Specific sectors



# A spatially flexible source receptor model



Simplified  
Air Quality  
Model

**SHERPA:**   
 Screening for High  
 Emission Reduction  
 Potentials on Air quality  
*Spatially flexible*  
 source receptors relationship

$$\Delta C_{j,p} = \sum_i^N \alpha_{j,p} \cdot (1 + d_{i,j})^{-\omega_{j,p}} \cdot \Delta E_{i,p}$$

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Research article

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

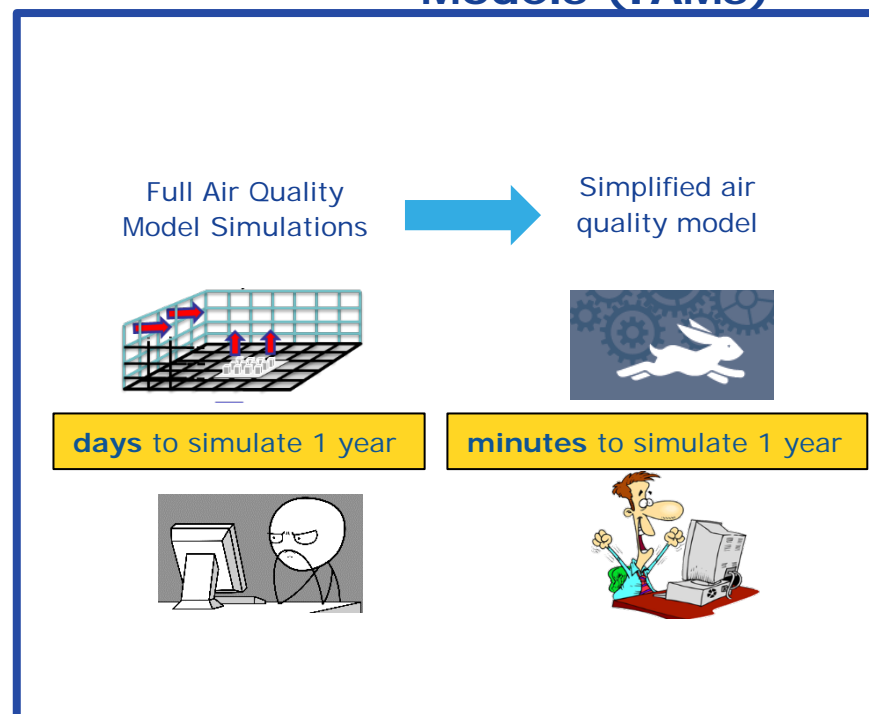
P. Thunis <sup>a,\*</sup>, B. Degraeuwe <sup>a</sup>, E. Pisoni <sup>a</sup>, F. Ferrari <sup>b</sup>, A. Clappier <sup>c</sup>

<sup>a</sup> European Commission, Directorate for Energy, Transport and Climate, Ispas, Italy

<sup>b</sup> TerraRisk Int, Via M. Galvani 132 20125 Milan, Italy

<sup>c</sup> Université de Strasbourg, Laboratoire Image Ville Environnement, Strasbourg, France

## Integrated Assessment Models (IAMs)



<http://aqm.jrc.ec.europa.eu/sherpa.aspx>

# Emission targets impact assessment

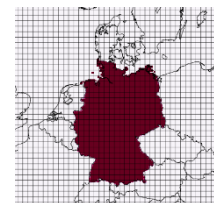


Germany (DE)  
**PPM target = -39%**  
 (from 2005 to 2030)

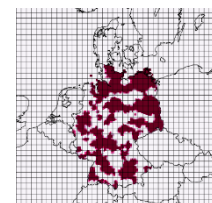


Precursor emissions  
 reductions targets

Member state level  
 Uniform reductions



Urban areas\*



\***Functional Urban Areas:**  
 they identify the **urban hinterlands**  
 including **city cores** and  
**commuting zones** [EU-OECD]

Exposure



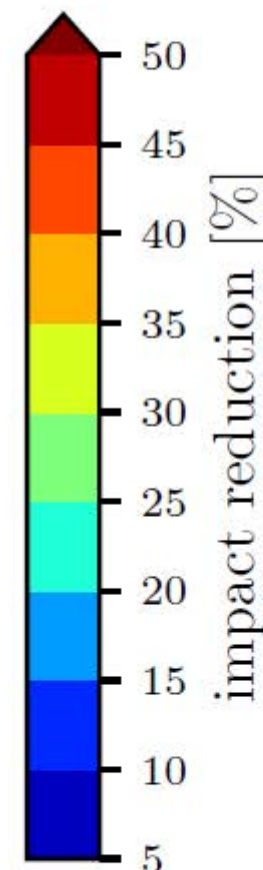
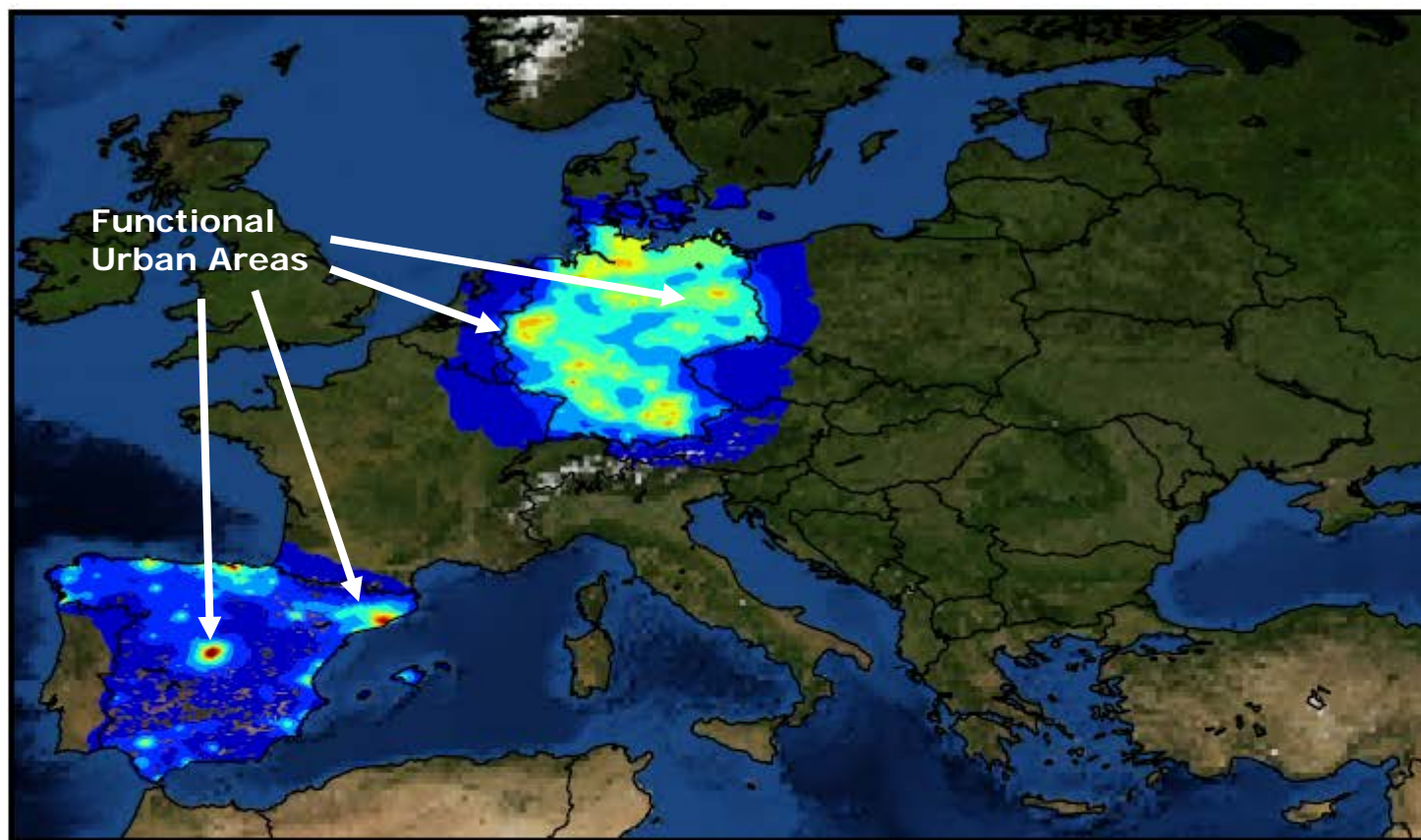
# NEC targets: priority to urban areas



## Precursors reduction: NEC Directive 2030 targets

Urban areas are important! In Spain emissions and population concentrated in relatively small areas

Most effective reductions



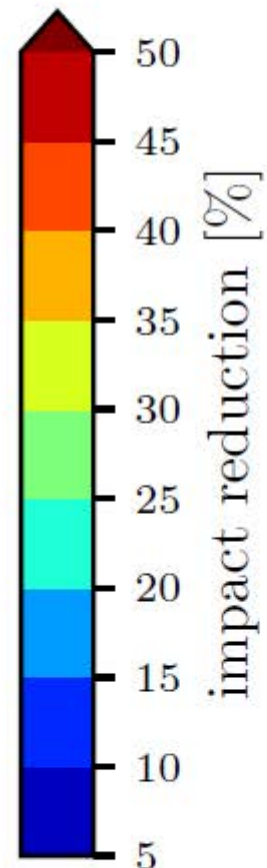
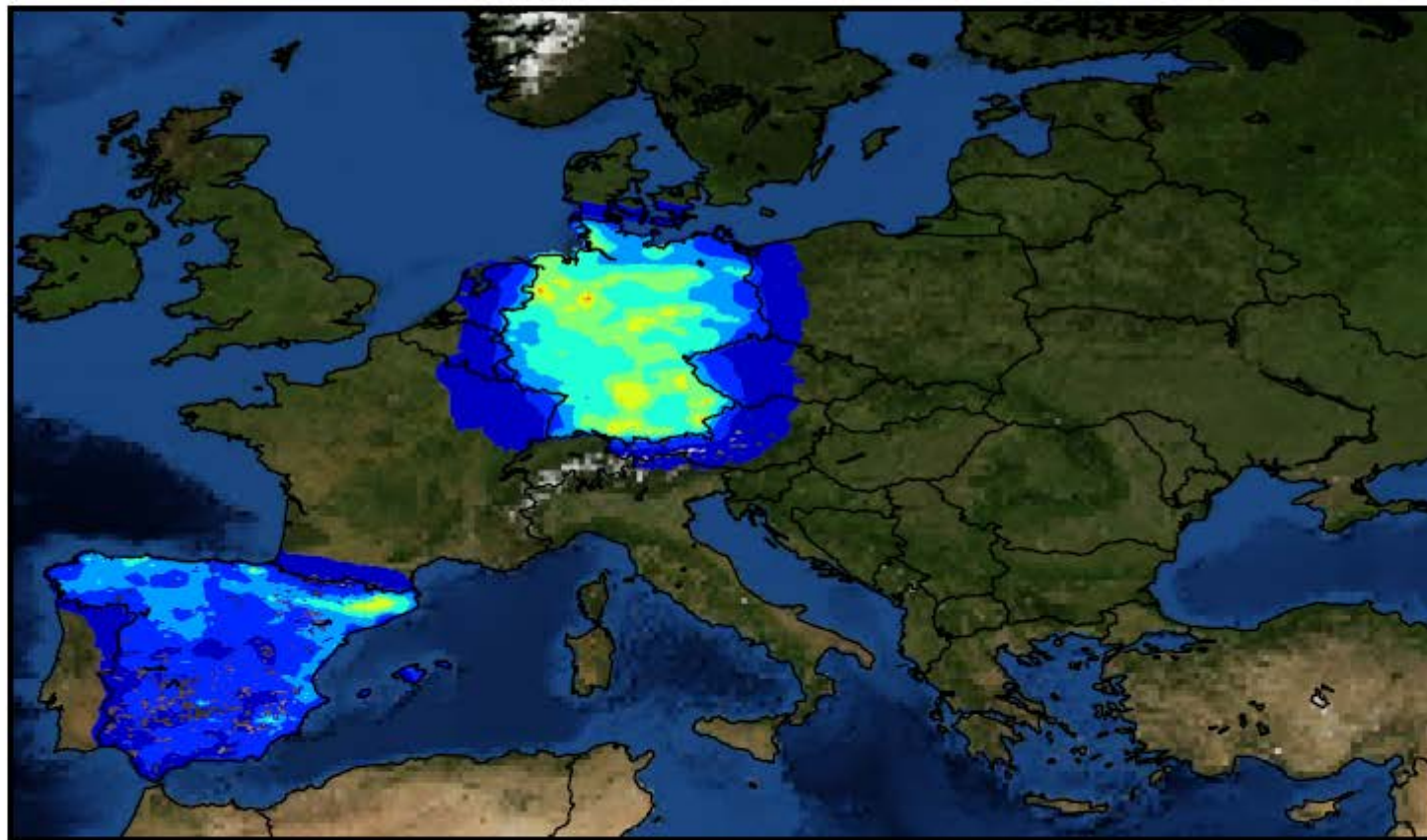
# NEC targets: priority to non urban areas



## Precursors reduction: NEC Directive 2030 targets

The same total emission reductions as in the previous slide!

Least effective  
reductions



-> What are the country averaged results?



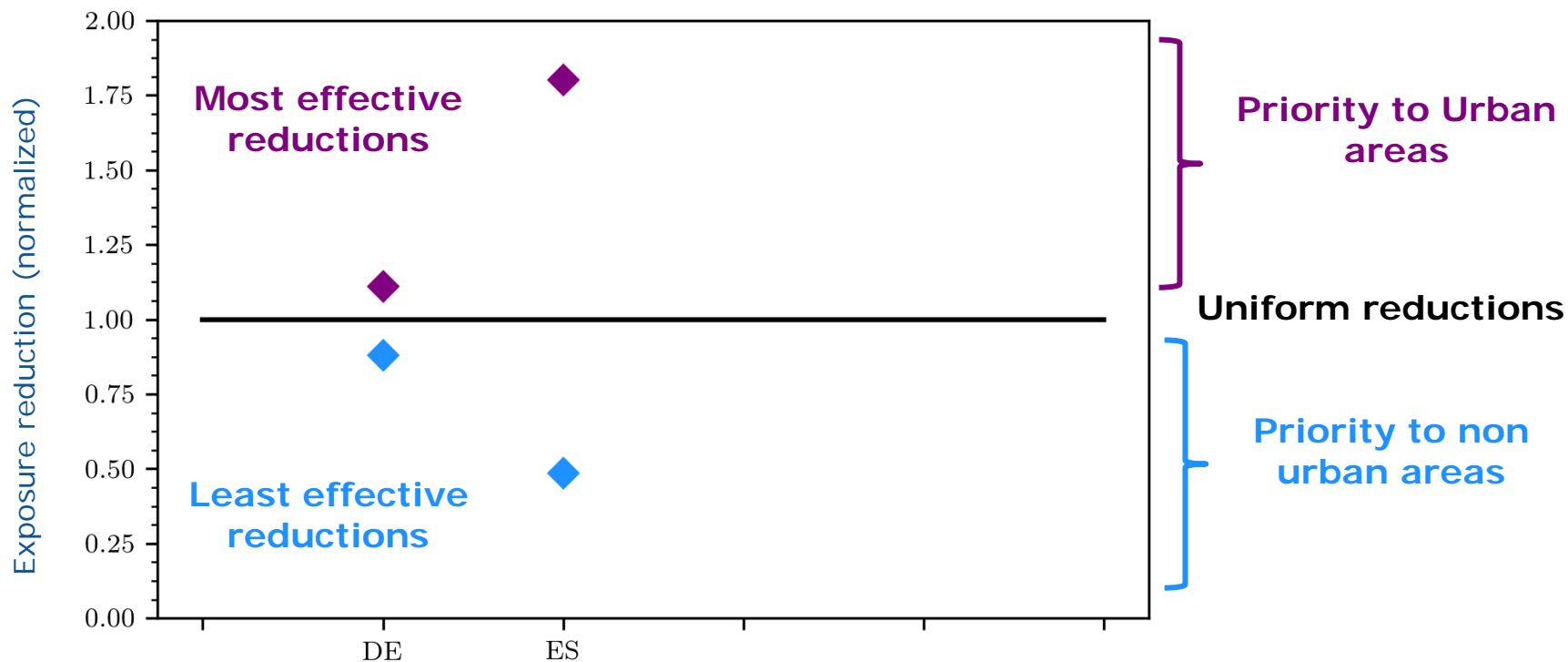
# Country averaged impacts



Large differences!

Spain -> 67% of population living in 12.3% of the area

Germany -> 74% of population living in 54 % of the area



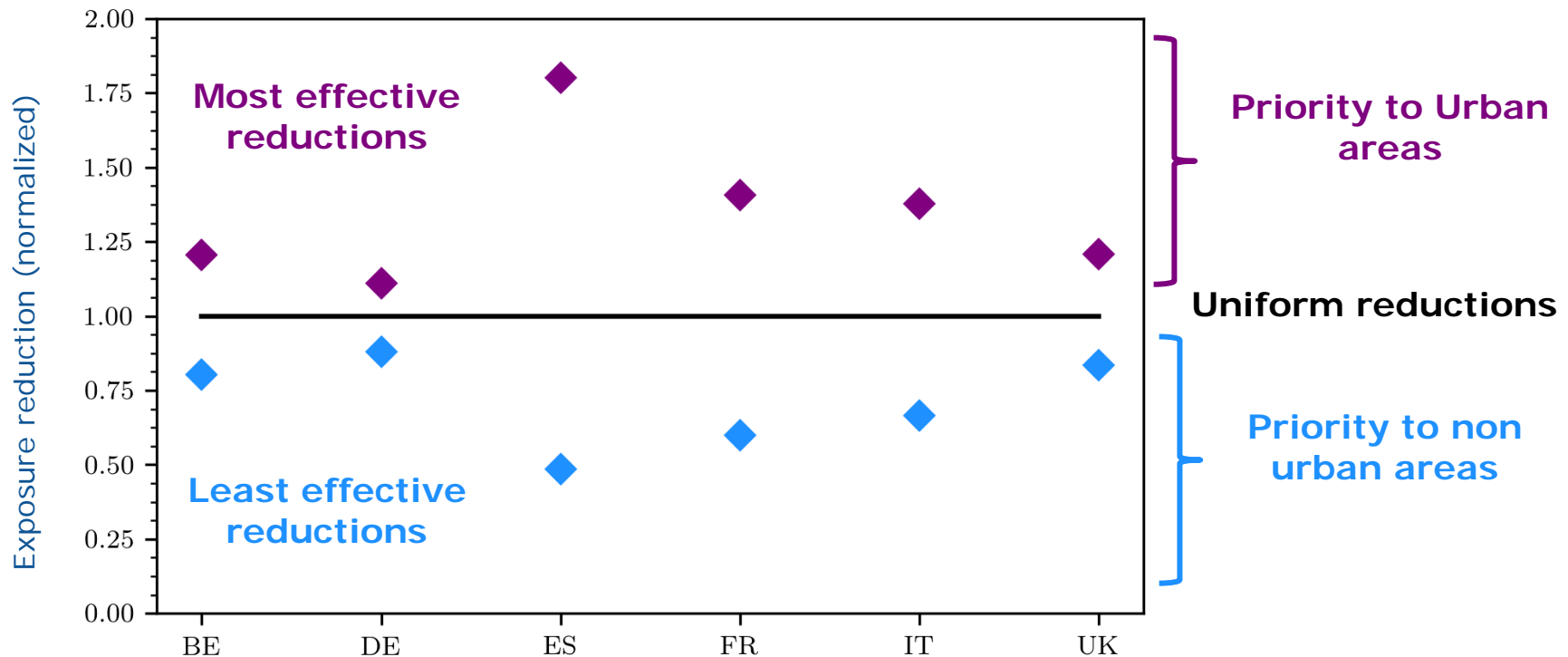
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Large differences!

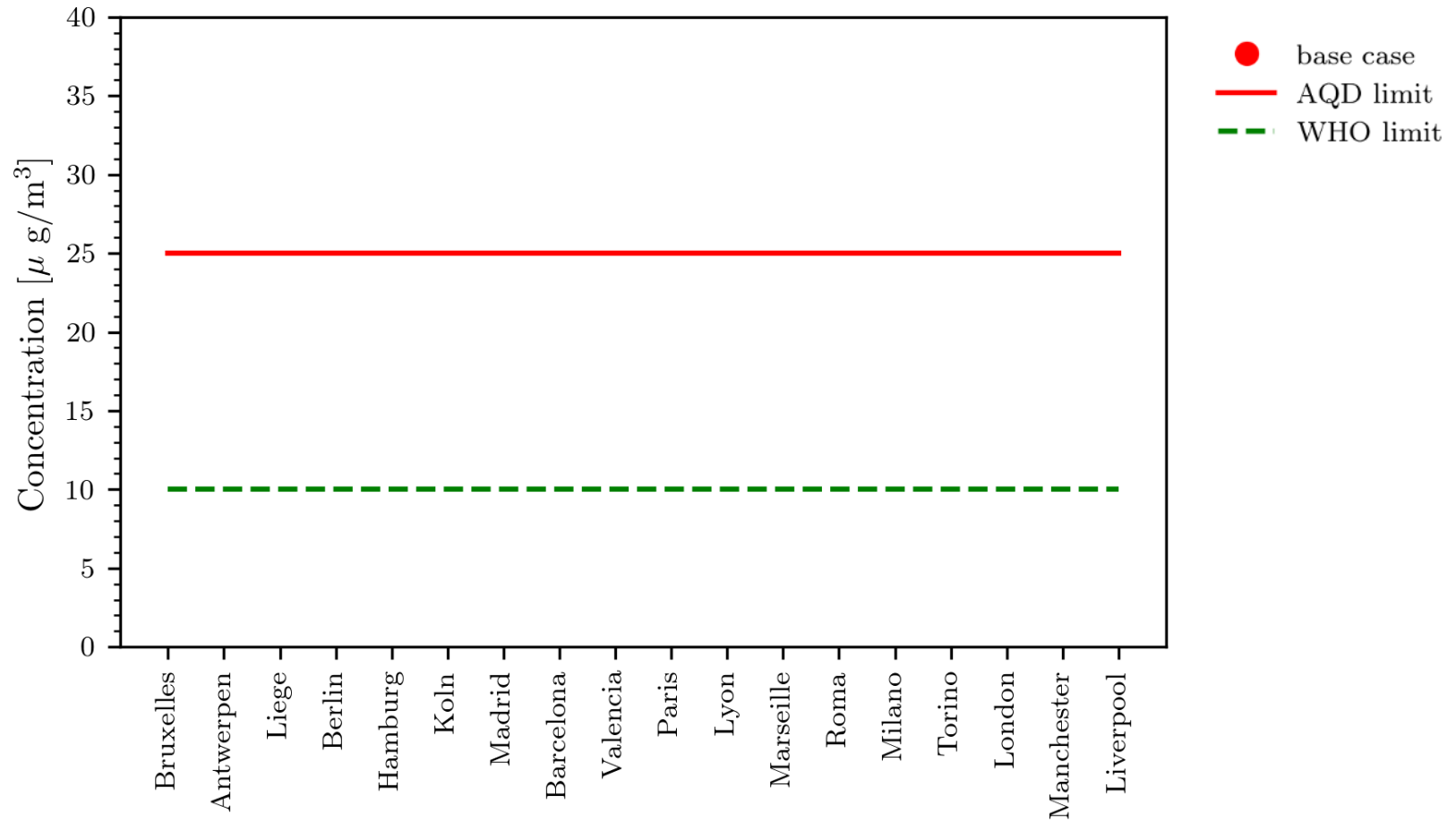
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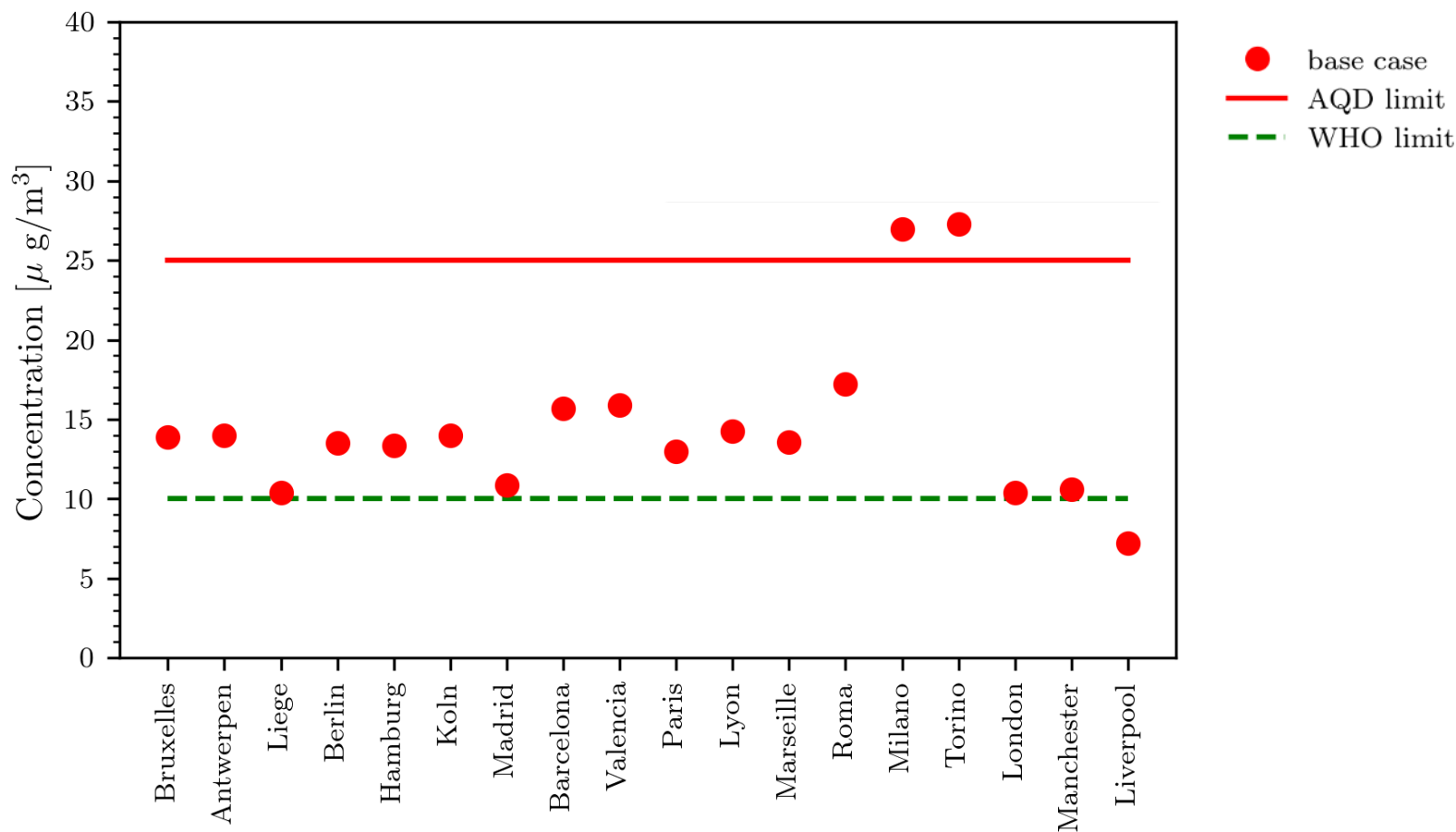


-> What about the effect on cities within a country?

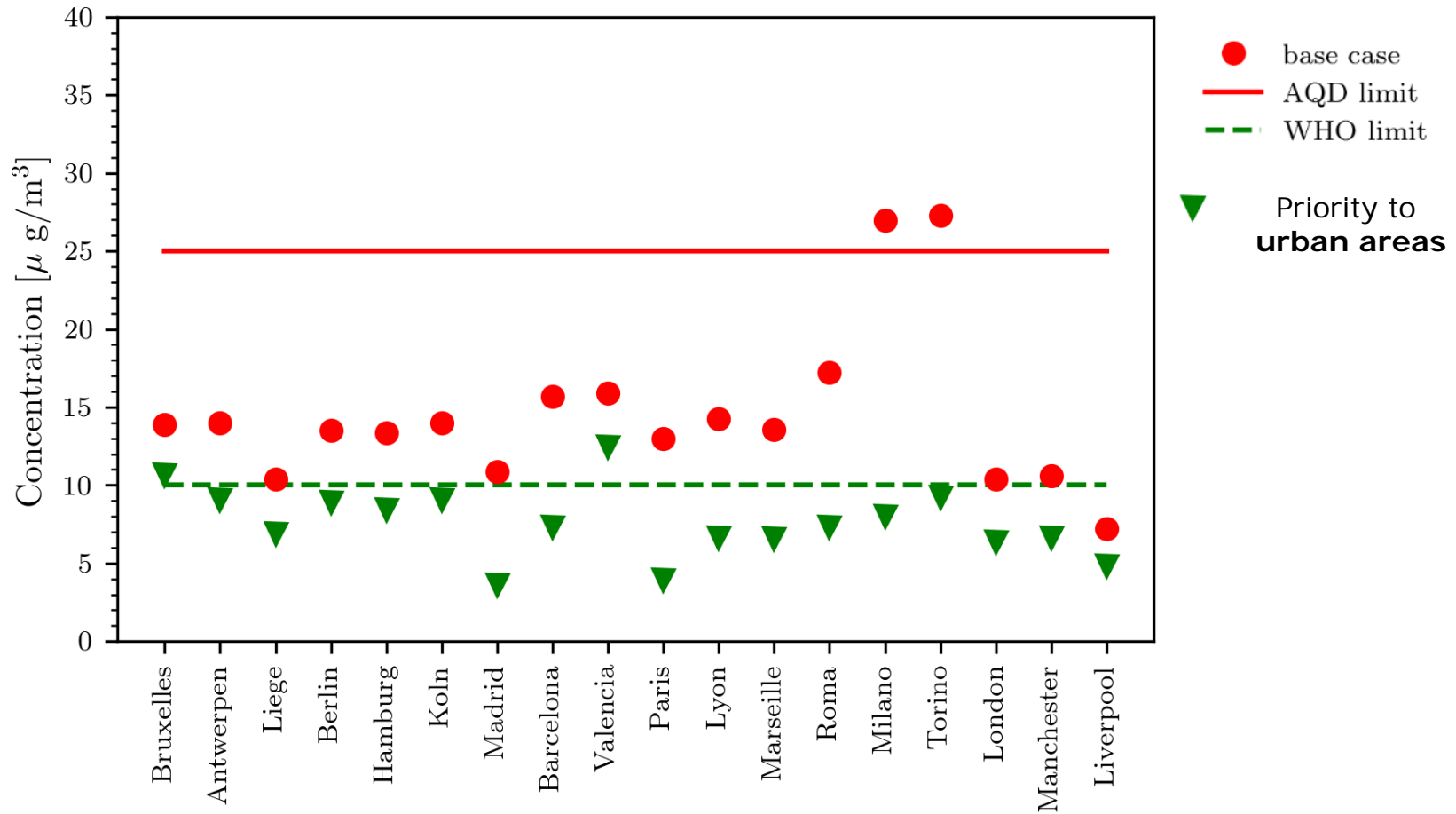
# Impact on cities: urban background



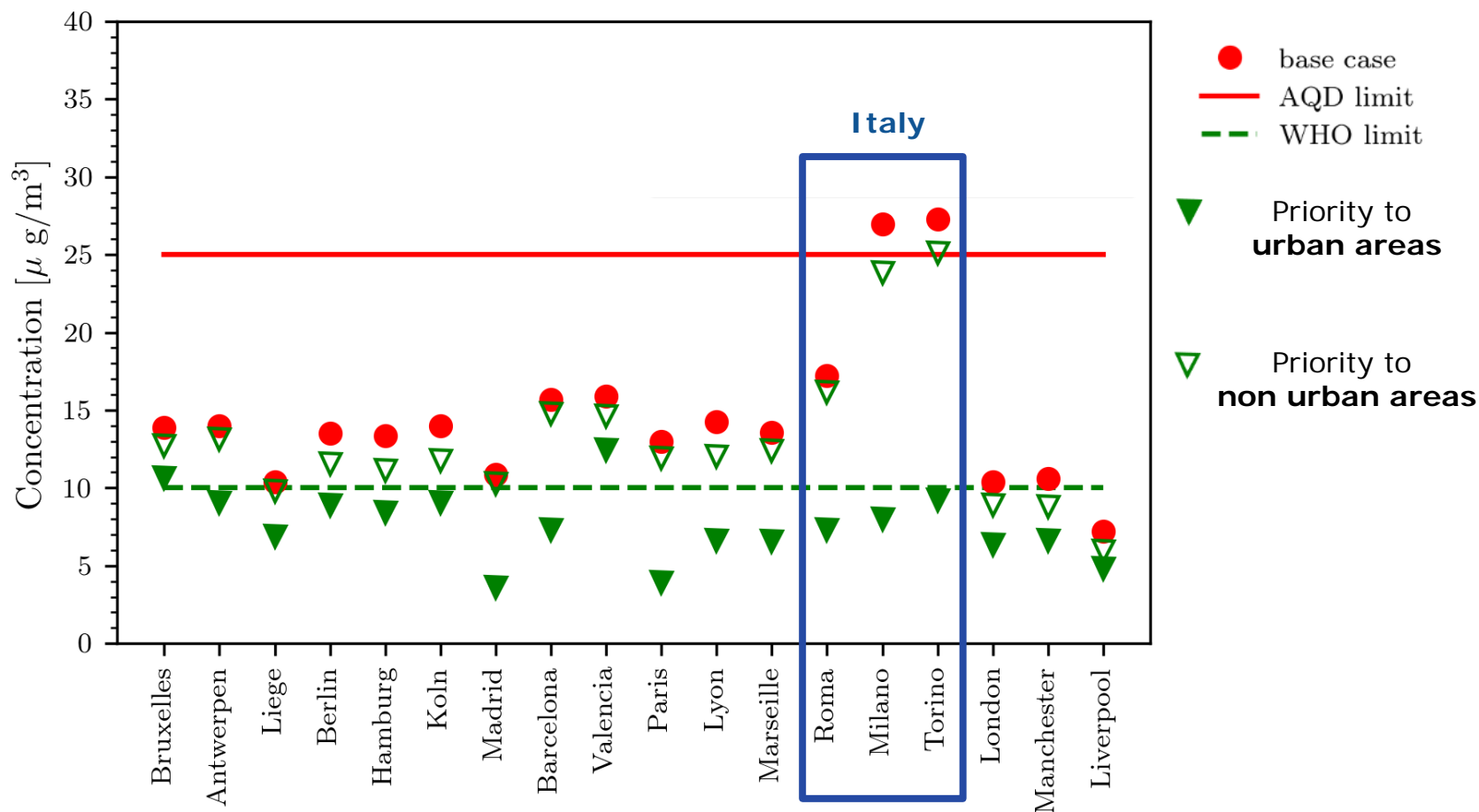
# Impact on cities: urban background



# Impact on cities: urban background



# Impact on cities: urban background



Again: reductions in urban areas are important to reduce exposure!

-> What about the effect of sectoral reductions?

# Prioritizing sectors

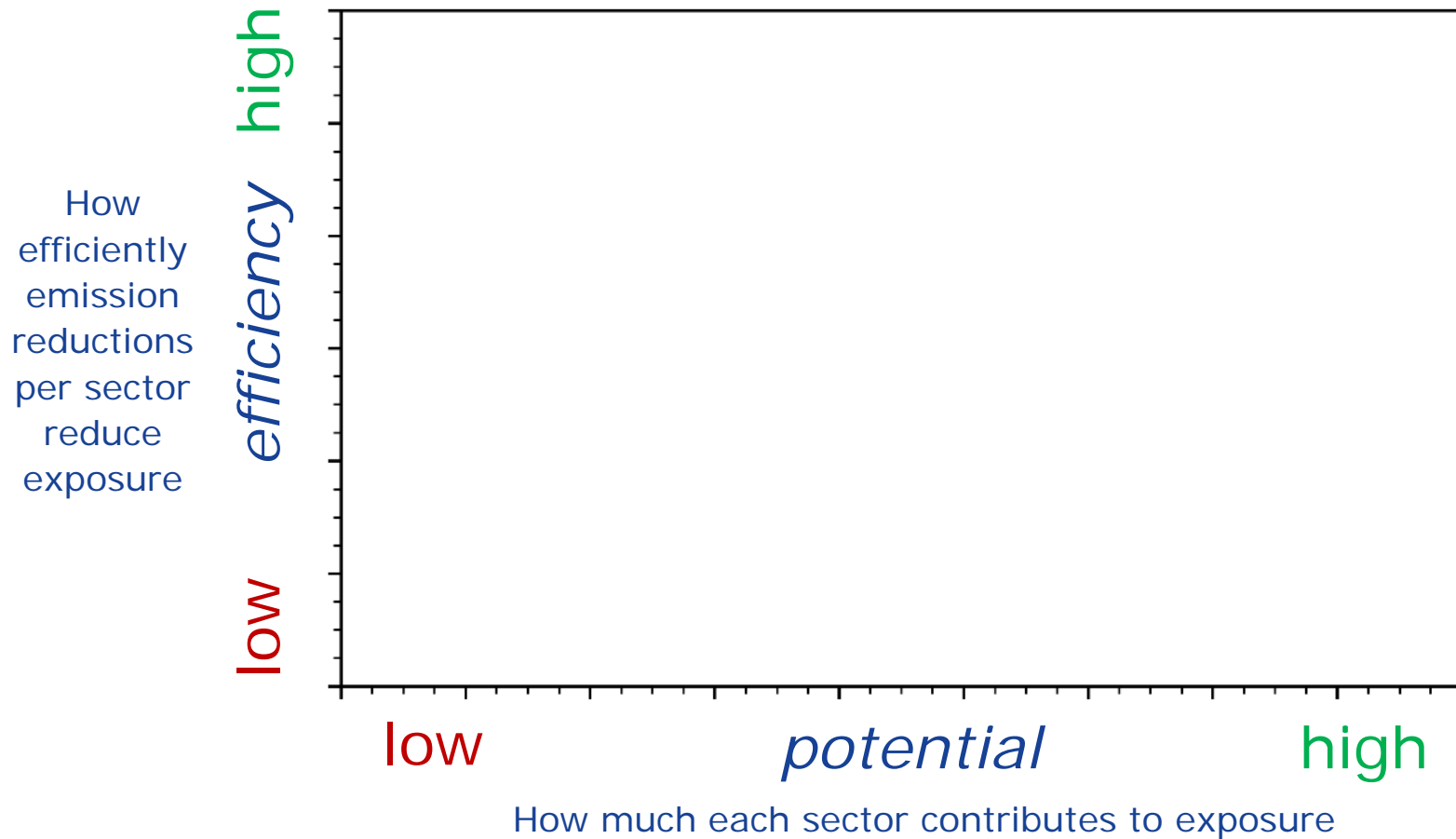


-> For example: Italy

PPM target: -40% by 2030

What is the most effective scenario?

And the least effective?



# Prioritizing sectors

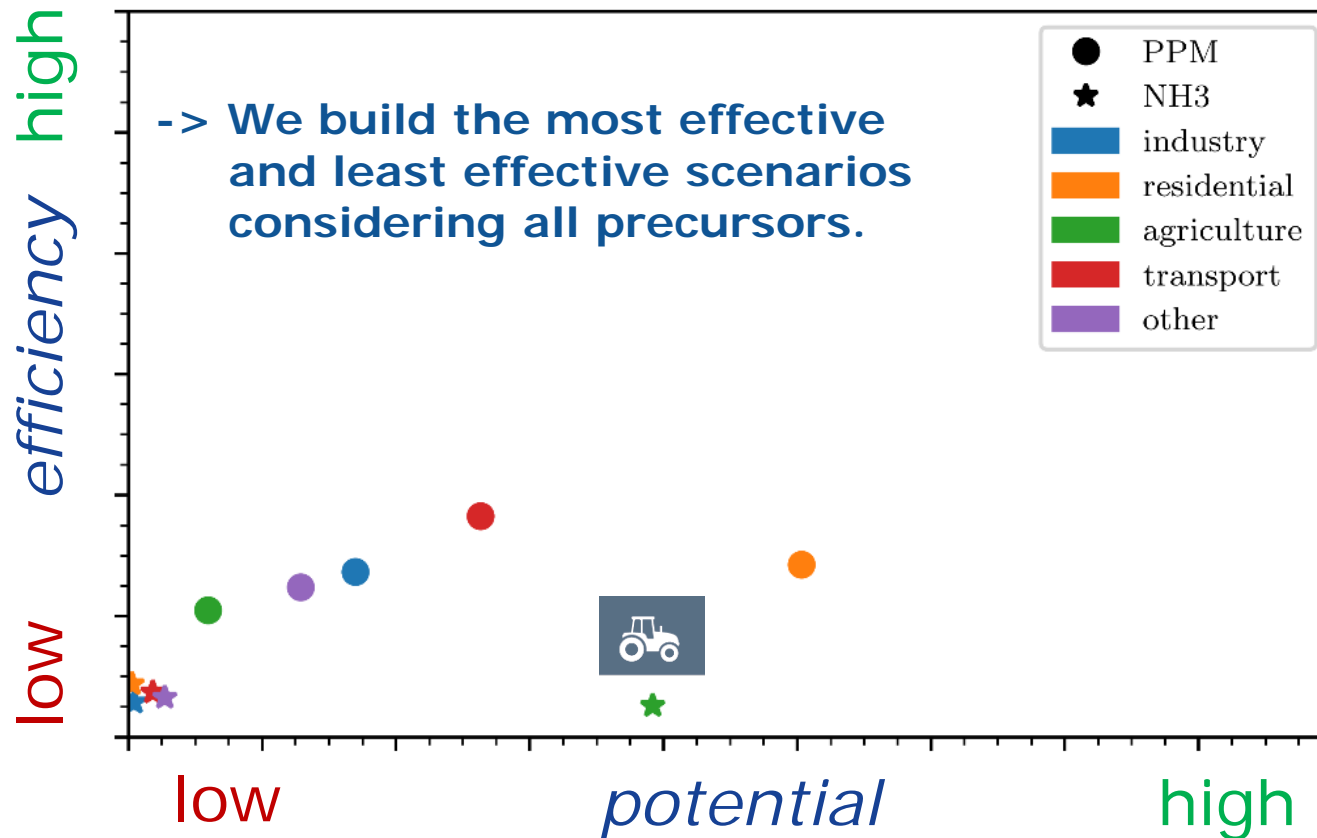


-> For example: Italy

NH3 target: -16% by 2030

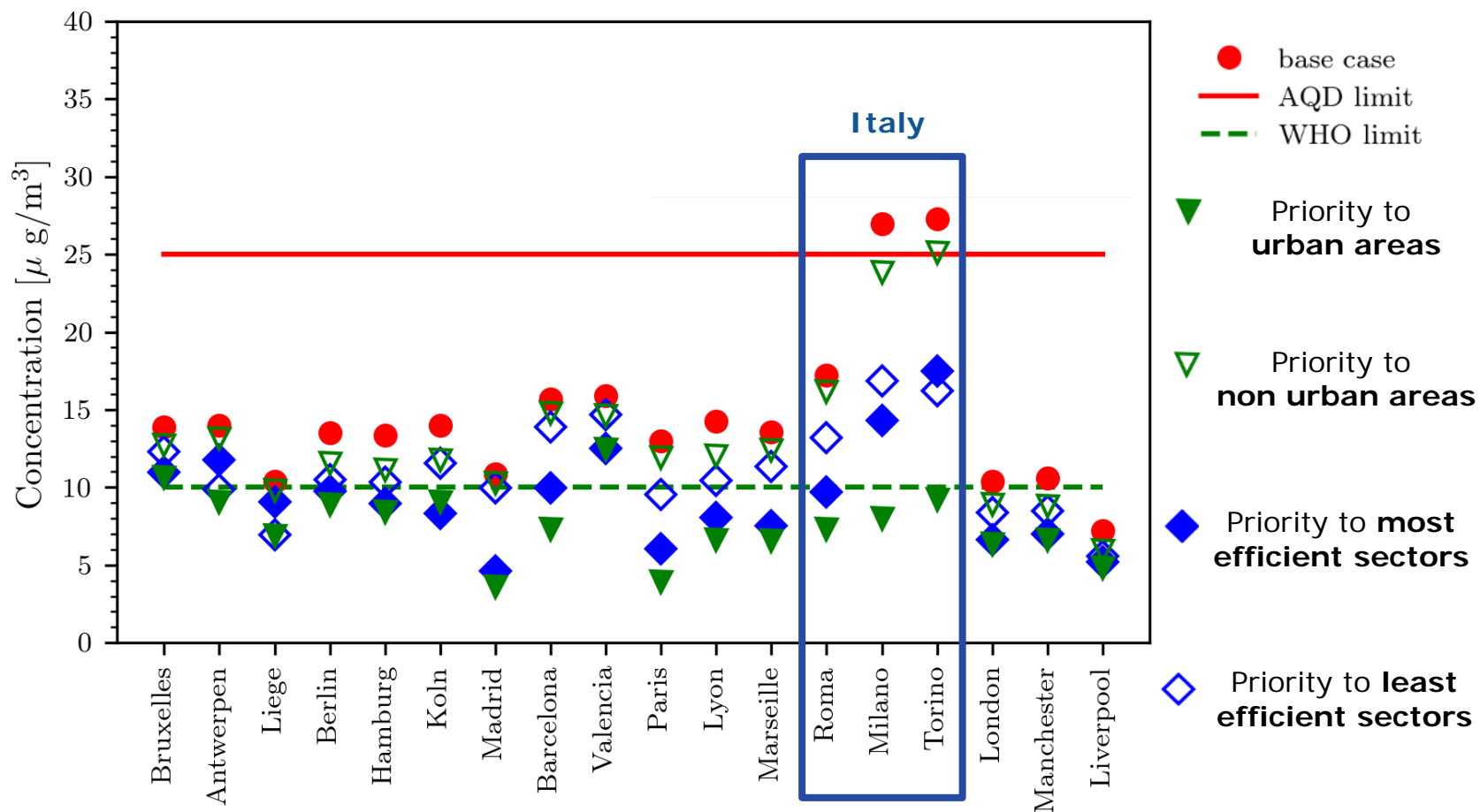
What is the most effective scenario?

And the least effective?





# Case study: emission reduction targets



The most efficient scenario at member state level may not be the most efficient one at the local level

# Conclusions



National Emission targets (as NEC) can be implemented in various ways:

- If the focus is on exposure, focus on urban areas reductions
- Sector priority matters!

It is important to:

- integrate national and subnational policies
  - comply with national emission reduction targets
  - address local air quality issues



Limitations:

- Uncertainty in the inventory, of the CTM model and of the SRRs. Only one meteorological year, resolution of the grid (~7km x 7km).
- Ideal scenarios, specific technologies have not been taken into consideration