Improving our knowledge on transport pollution and health

REDUCING HEALTH IMPACTS OF AIR POLLUTION CAUSED BY TRANSPORT IN EUROPE - AN INTEGRATED ASSESSMENT

R. Friedrich, J. Roos, C. Schieberle

IER University of Stuttgart

Germany

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The question:

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- **Measures that reduce GHG emissions influence emissions of air pollutants and vice versa**

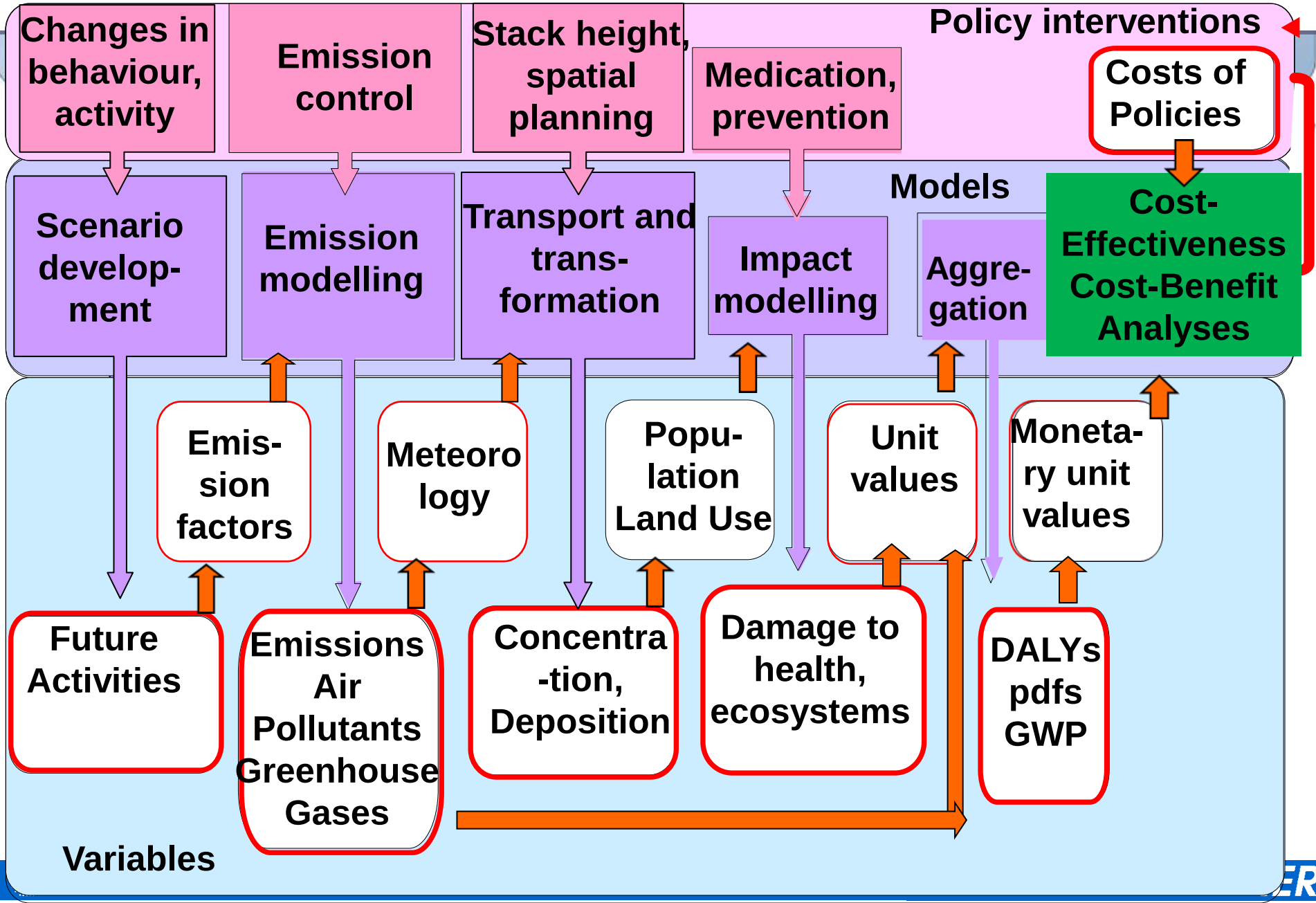
→ **development of integrated environmental strategies for air pollution control and climate protection**

- **Economic and social dimensions of sustainability**

→ **efficient strategies maximising benefits minus costs**

Efficient strategy (bundle of policies) for reducing simultaneously climate change and health impacts from air pollution

The Impact Pathway Approach



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New methods:

- **nontechnical measures**
- **Urban increment for PM10, PM2.5 and NO_2**
- **Concentration-response functions for NO_2**

Technical measures (e.g. particulate filters) already widely implemented (except maritime ships, brake and tyre wear, off-road transport, agriculture and animal breeding),

-> nontechnical measures, that change behaviour, become more and more important

-> estimation of changes of behaviour caused by policies (agent based modelling)

-> quantification of utility losses (rule of the half)

➢ Challenge: urban policies needs detailed analysis for **all** urban aggomerations in Europe

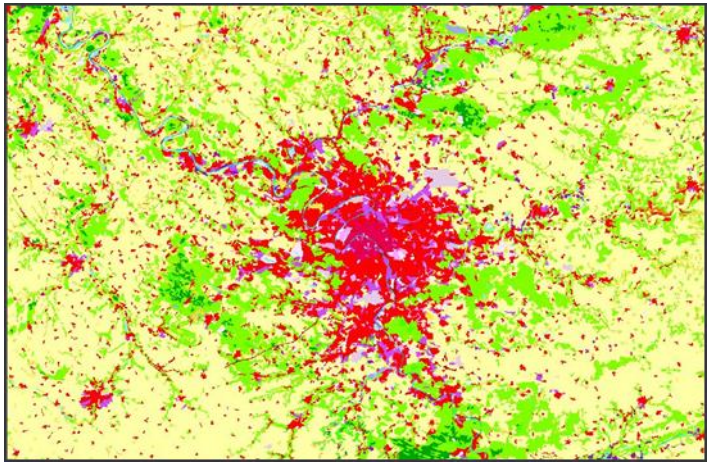
1) **Identification of urban agglomerations:**

Urban morphological zones based on CORINE land cover classes and population maps

Results:

Categorization based on number of inhabitants:

- **892 zones having 50,000+**
- **416 zones having 100,000+**
- **75 zones having 500,000+**



Urban Increment

For each stability class:

$$C_{i\ urban} = \varpi_i + \phi_i \frac{E_{iUE}}{A_{UE} \cdot u_{avg}} + \gamma\, C_{i\ rural}$$

where

C_i urban = Urban increment of pollutant i.

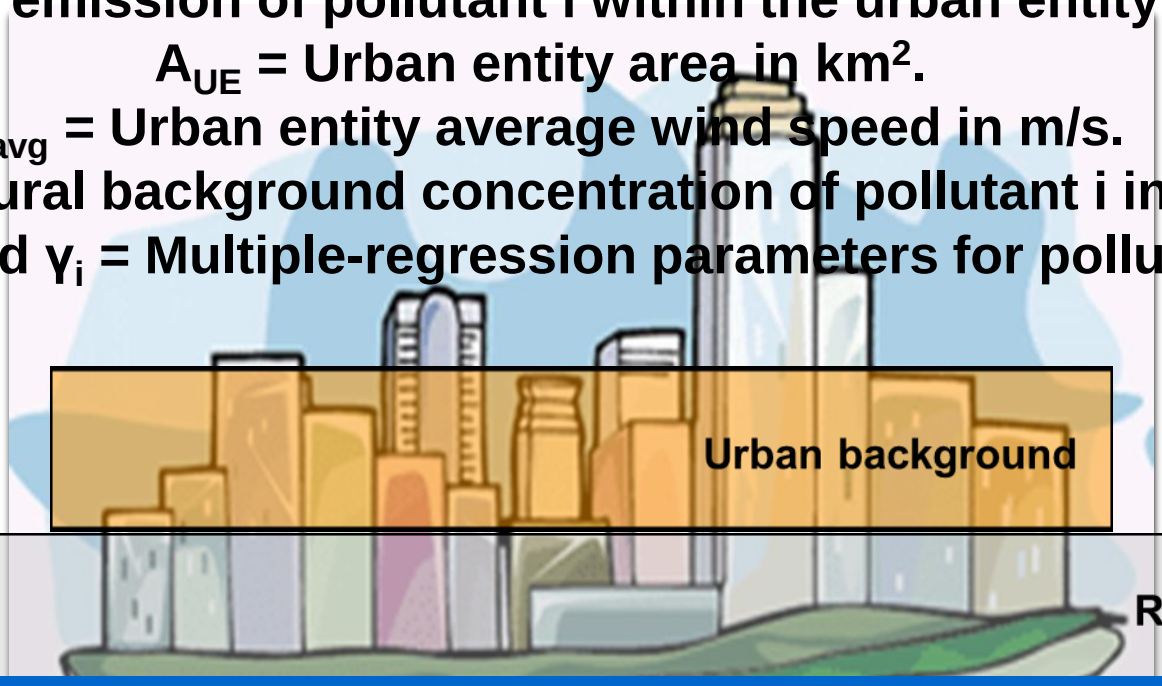
E_{iUE} = Total emission of pollutant i within the urban entity in tons.

A_{UE} = Urban entity area in km².

u_{avg} = Urban entity average wind speed in m/s.

$C_{i\ rural}$ = Rural background concentration of pollutant i in µg/m³

ω_i, φ_i, and γ_i = Multiple-regression parameters for pollutant i.



Torras Ortiz (2013),
Moussiopoulos 2014

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New concentrations-response relationships from the WHO HRAPIE report

WHO 2013: Health risks of air pollution in Europe – HRAPIE project Recommendations for concentration-response functions for cost-benefit analysis of particulate matter, ozone and nitrogen dioxide

Pollutant	Relative Risk (95% C.I.) All cause natural mortality >30 years
PM2.5 (per 10 µg/m3)	1.062 (1.04-1.083)
NO2 (per 10 µg/m3) above 20 µg/m3	1,055 (1,03-1,080) up to 33% overlap

Transport measures

Urban areas:

- Enhanced use of bicycles (15-30%)
- Enhanced use of public transport (30-35%)
- Car pooling
- Promotion of e-cars 2,5%
- Traffic management
- Low emission zones ≥ EURO 5
- Ban of HDT through traffic
- City toll (-15%)
- Parking management
- Hybrid buses (10% share)
- Freight consolidation center
- E&I city concept

Non-urban roads:

- 110 km/h on motorways
- 80 km/h on rural roads

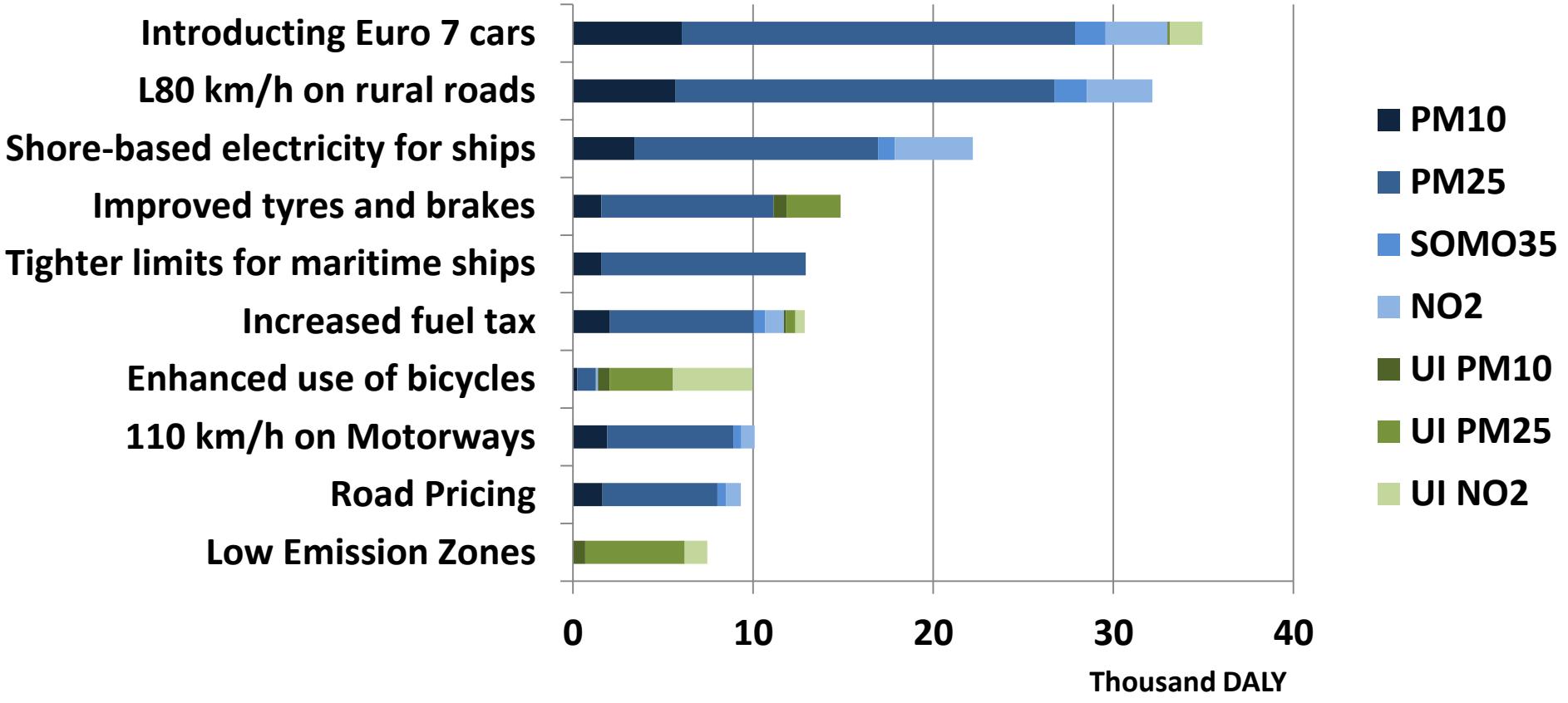
All roads:

- Road pricing 1,5 cent/km
- Increased fuel tax +20%
- Introducing Euro 7 (NOx red.)
- Improved tyres and brakes
- 10% share of bio-fuels
- Promotion of CNG cars (10%)

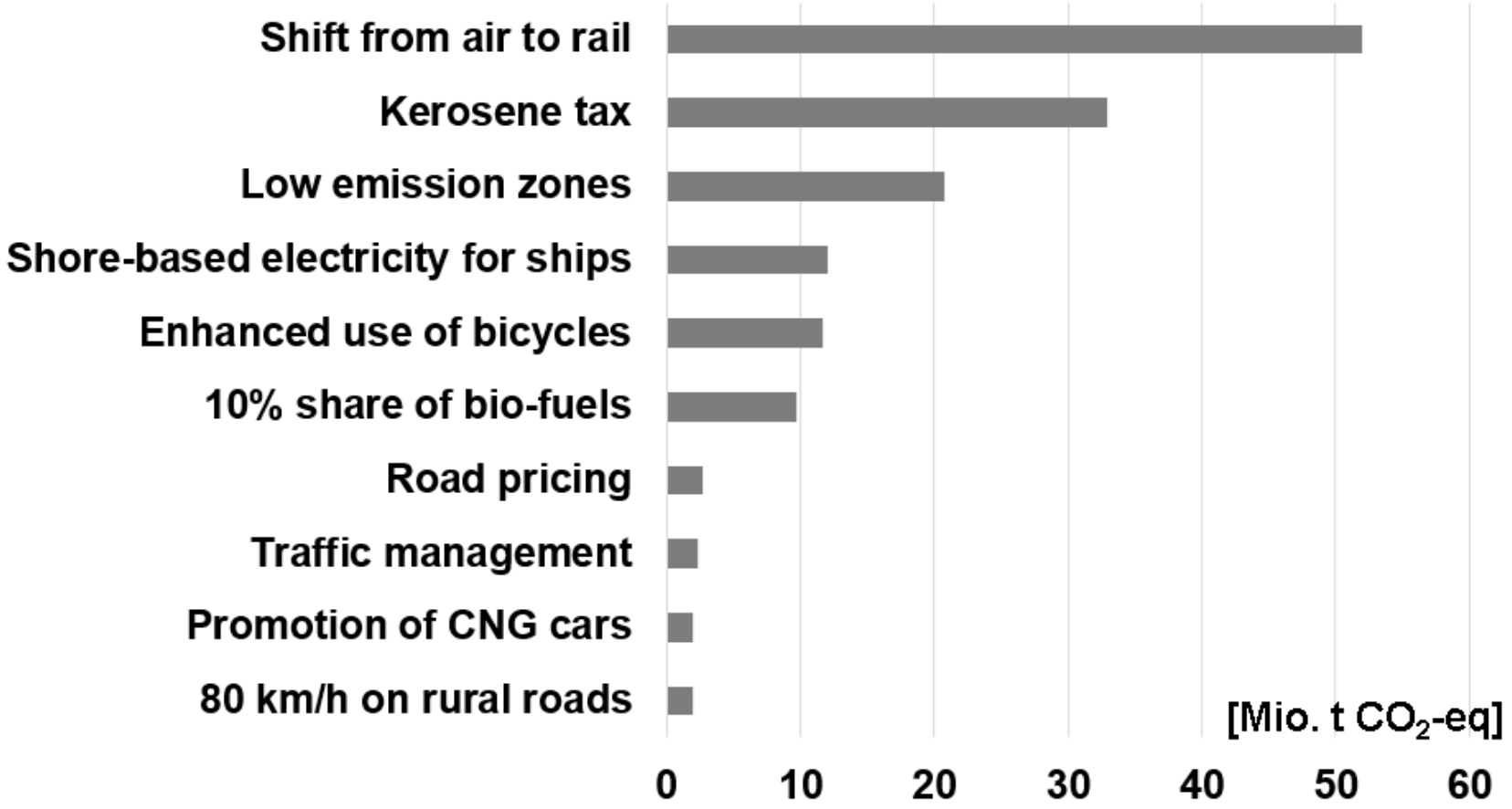
Off-road:

- Tighter limits for inland ships (NO_x)
- Tighter limits for sea-going vessels (0,25%S, NO_x)
- Shore-based electricity for ships
- Kerosene tax
- Shift from air to rail < 500 km

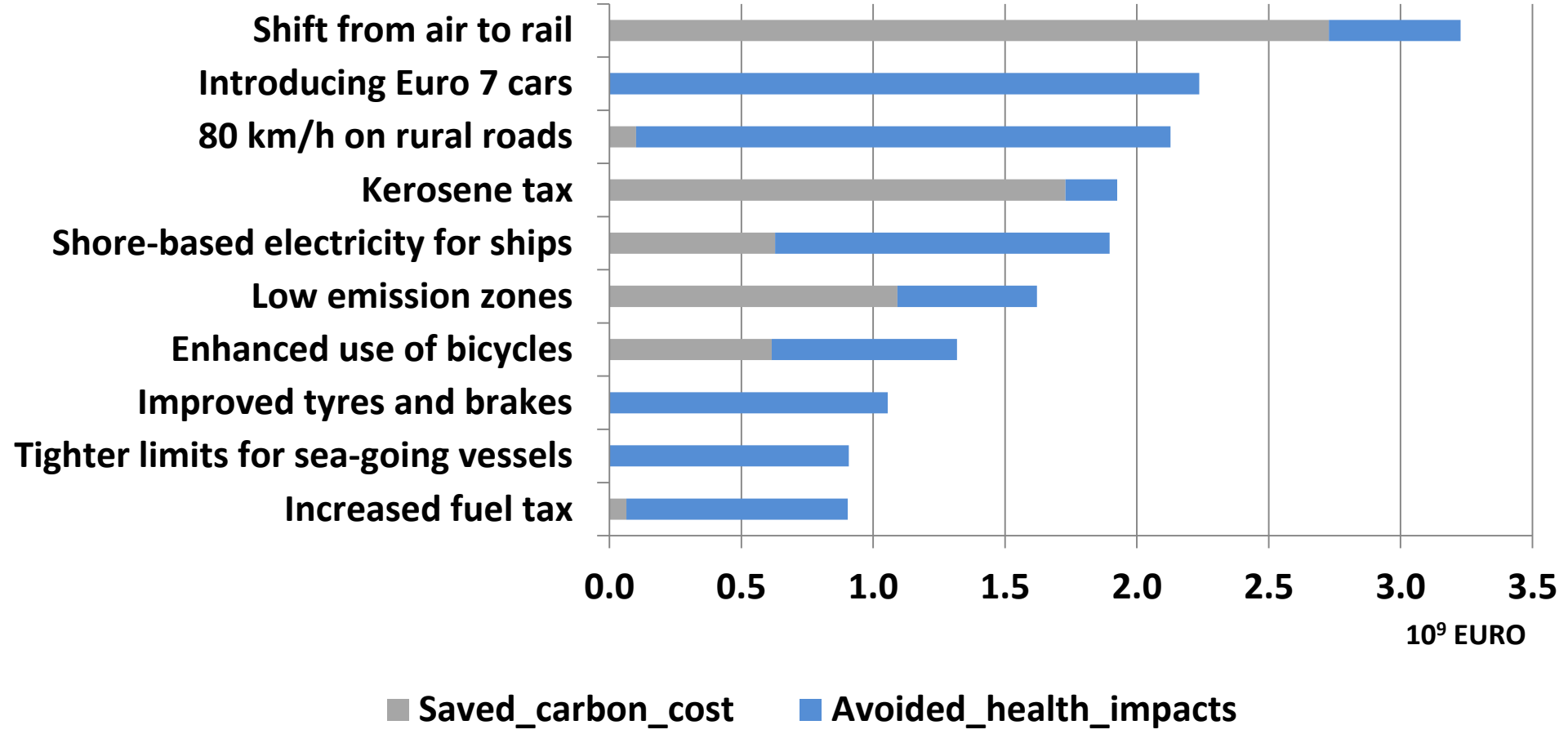
Top 10 of most effective measures: health impacts caused by air pollution



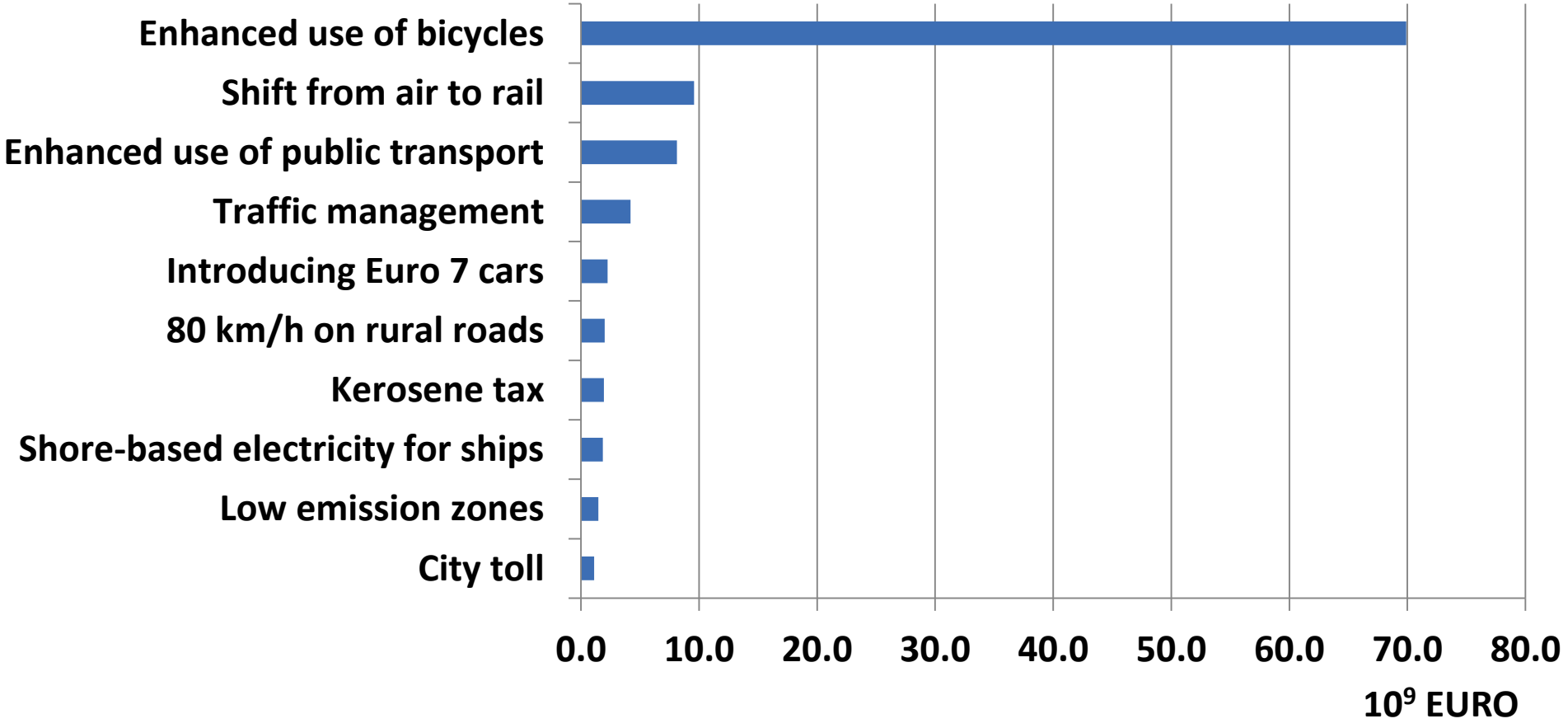
Top 10 of most effective measures: greenhouse gas reduction



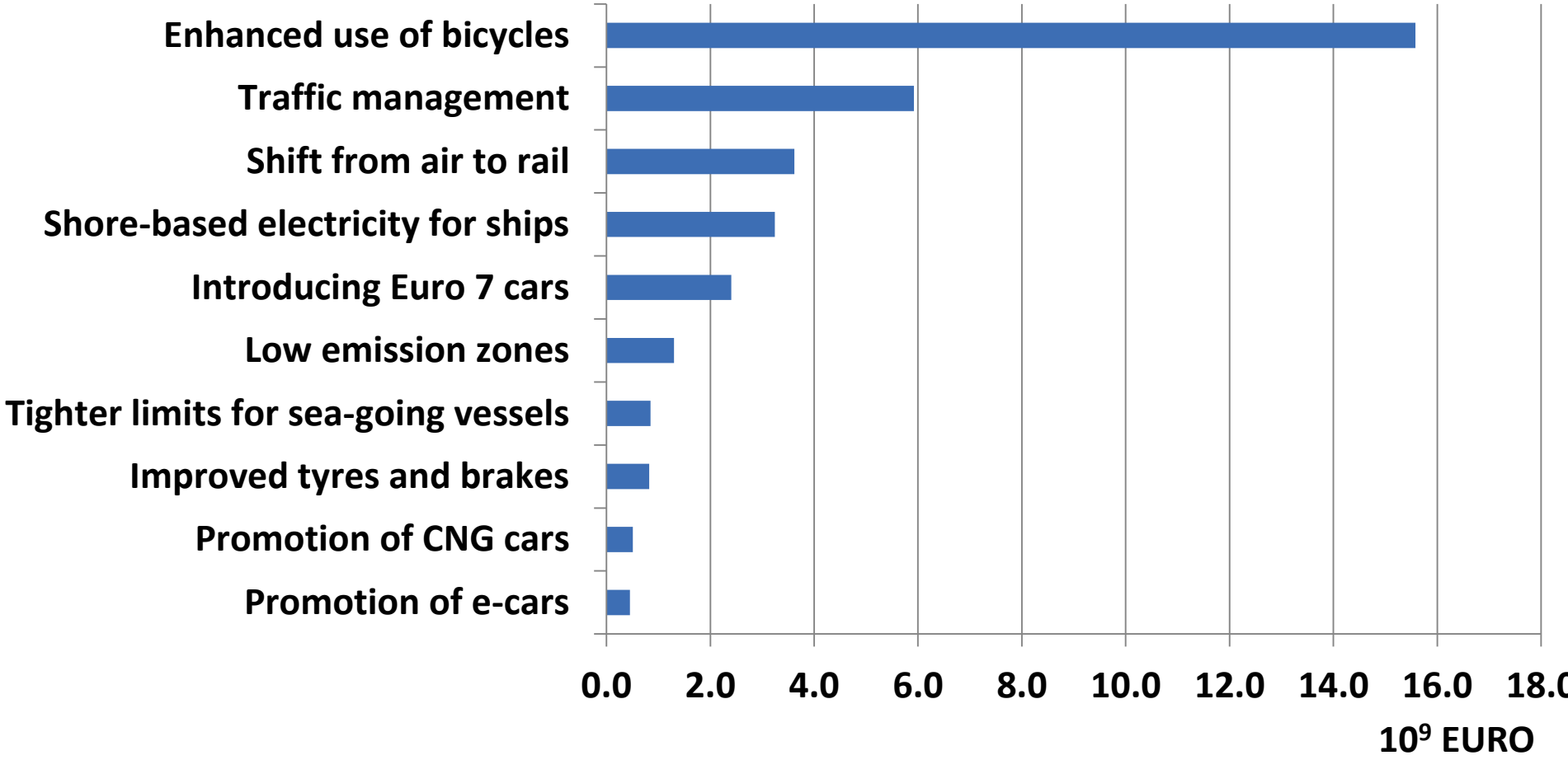
Top 10 of most effective measures: air pollution and climate protection



Top 10 of most efficient measures (utility losses not considered)



Top 10 of most efficient measures (including utility losses)



Transport measures

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Non-urban roads:

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All roads:

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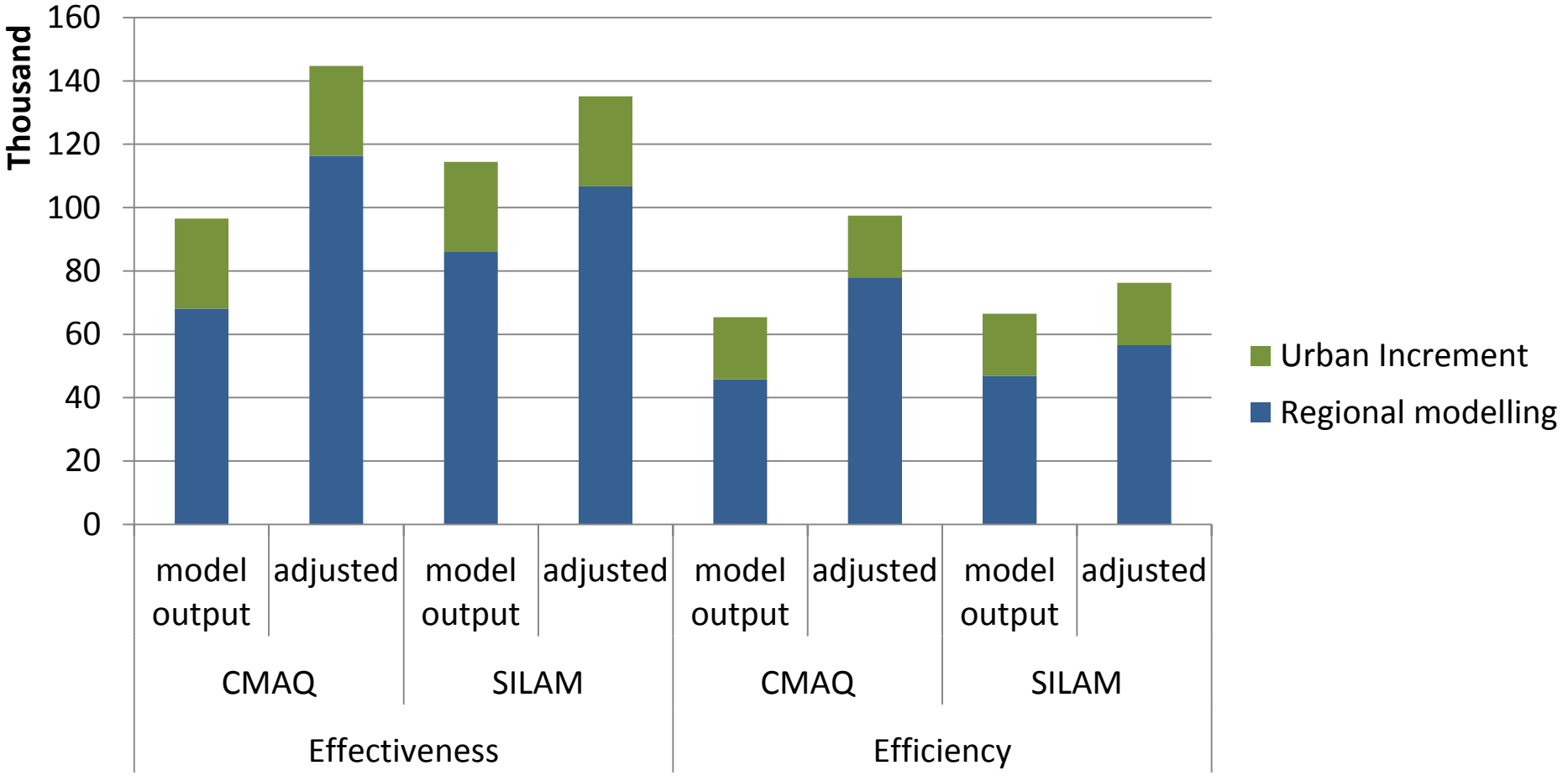
Avoided health impact in DALYs 2020

Reduction by efficiency scenario 1,5 to 2 %, effectiveness scenario 2,5 to 3%



Summary

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Methodology and tools for carrying out integrated assessments (esp. cost-benefit- analyses) of environmental policies developed:

- **simultaneous assessment of air pollution control and climate protection**
- **includes bias correction for PM10/PM2.5 concentrations,**
- **EU wide implementation of urban measures**
- **urban increment modeling**
- **assessment of non-technical measures incl. quantification of utility and time losses**
- **Concentration-response functions for NO_2**

Summary

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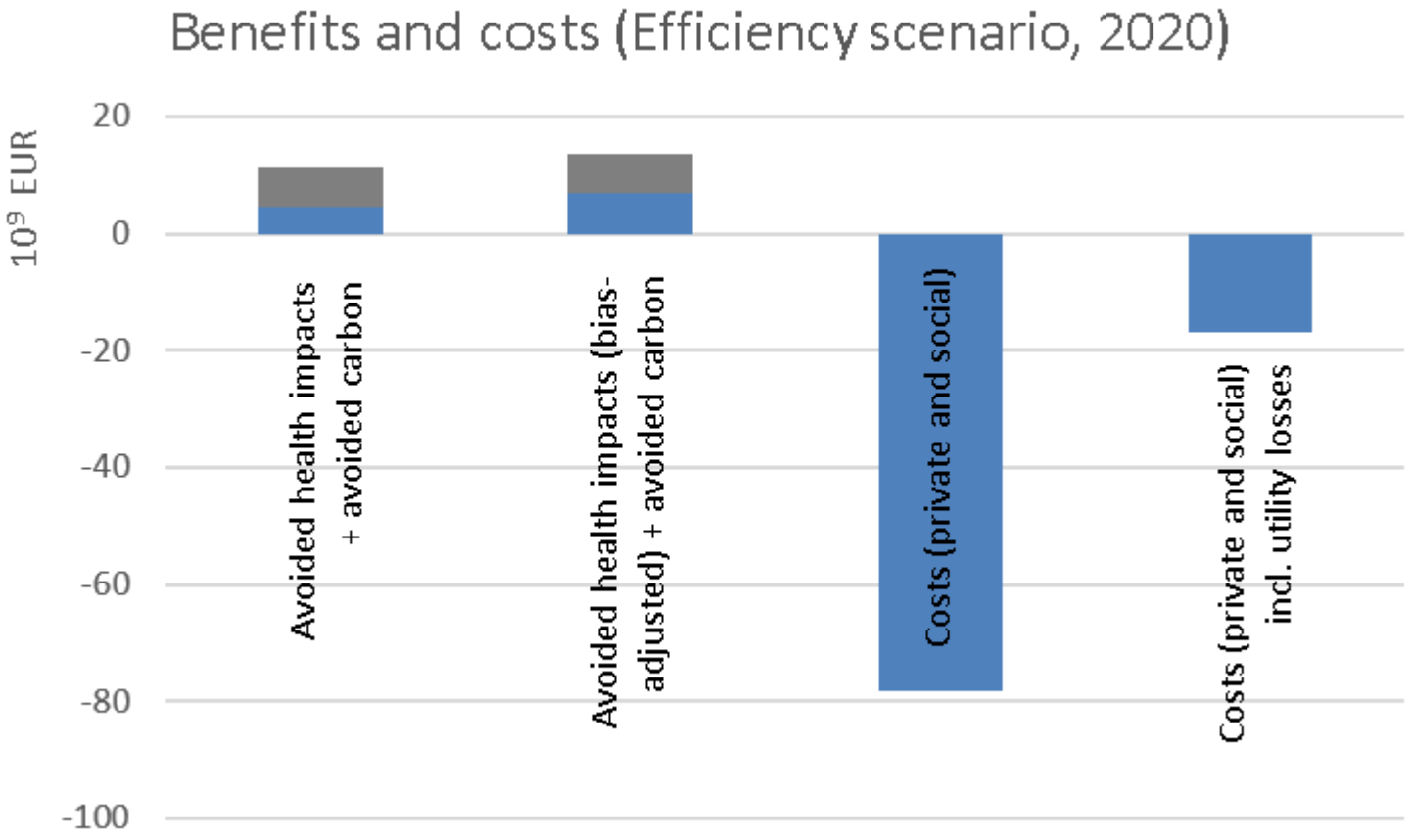
Most efficient transport policies for improving air quality and protecting climate:

- **more use of bicycles and e-bikes,**
- **traffic management,**
- **rail replacing air transport,**
- **shore based electricity and tighter emission limits for ships,**
- **tighter EURO limits (EURO 7)**
- **low emission zones in cities (≥ EURO V)**
- **improved tyres, brakes, road cover**
- **promotion of CNG and electric drive**

But: more effective and efficient policies in other sectors available, esp. in agriculture (less meat, filter in hog houses, optimized fertilizer application)

Impact assessment - CMAQ output (1/2)



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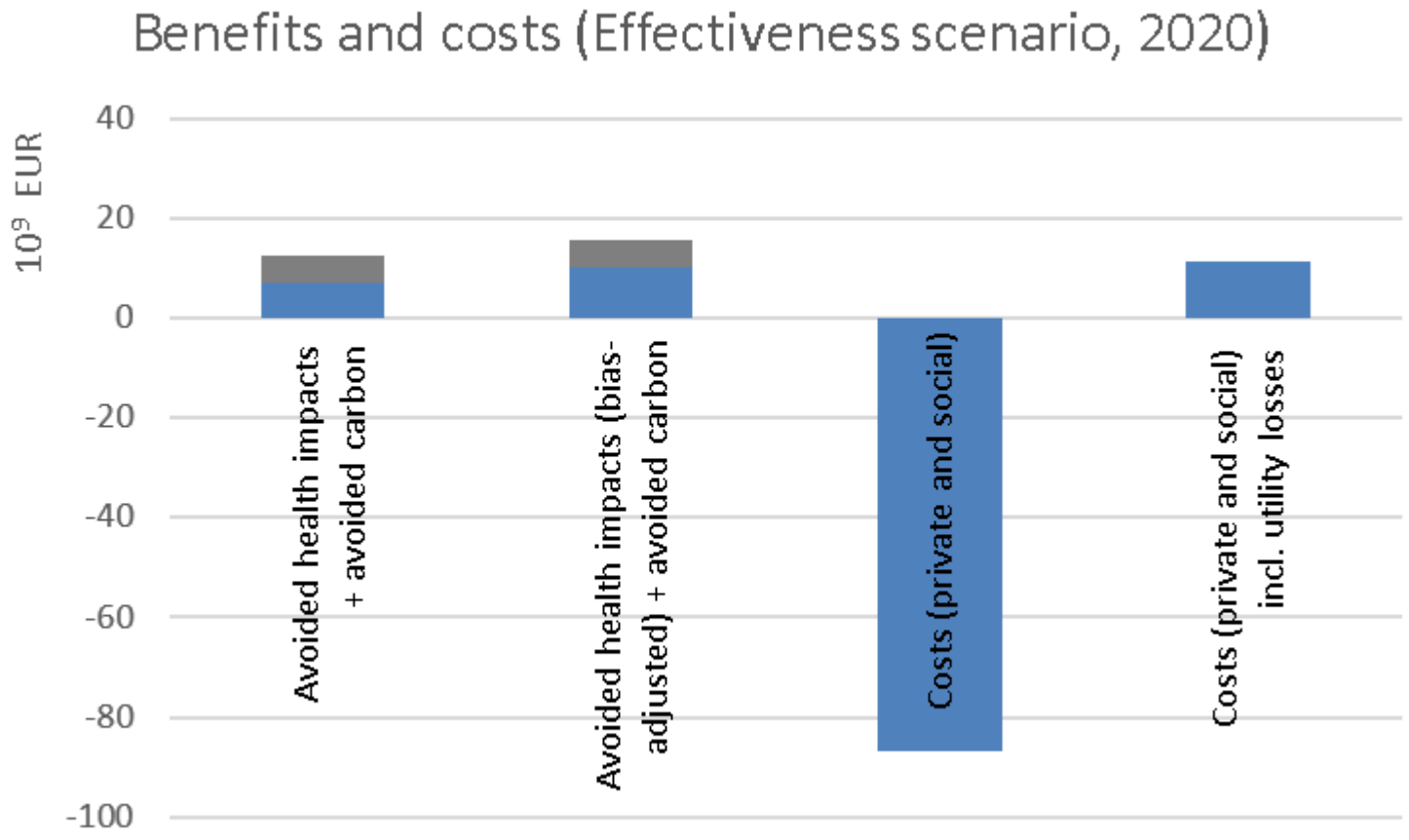
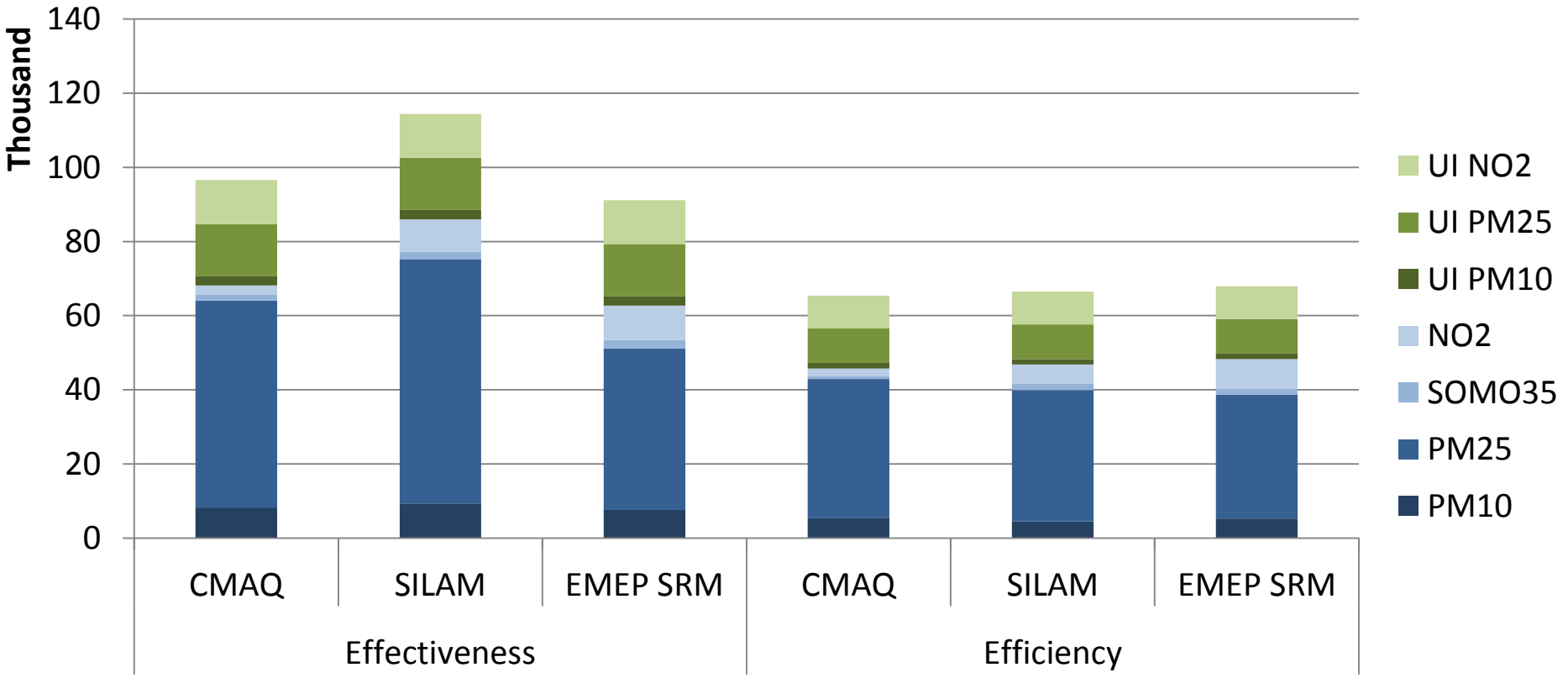


Model comparison: Avoided health damages in DALY, model output, 2020



Model comparison: Avoided health damages in DALY, adjusted values, 2020