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Applied Systems Analysis  
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science for global insight

# Cost-effectiveness analyses for the EU Clean Air Policy Package

Task Force on Health  
17<sup>th</sup> Session, Bonn, May 14-15, 2014

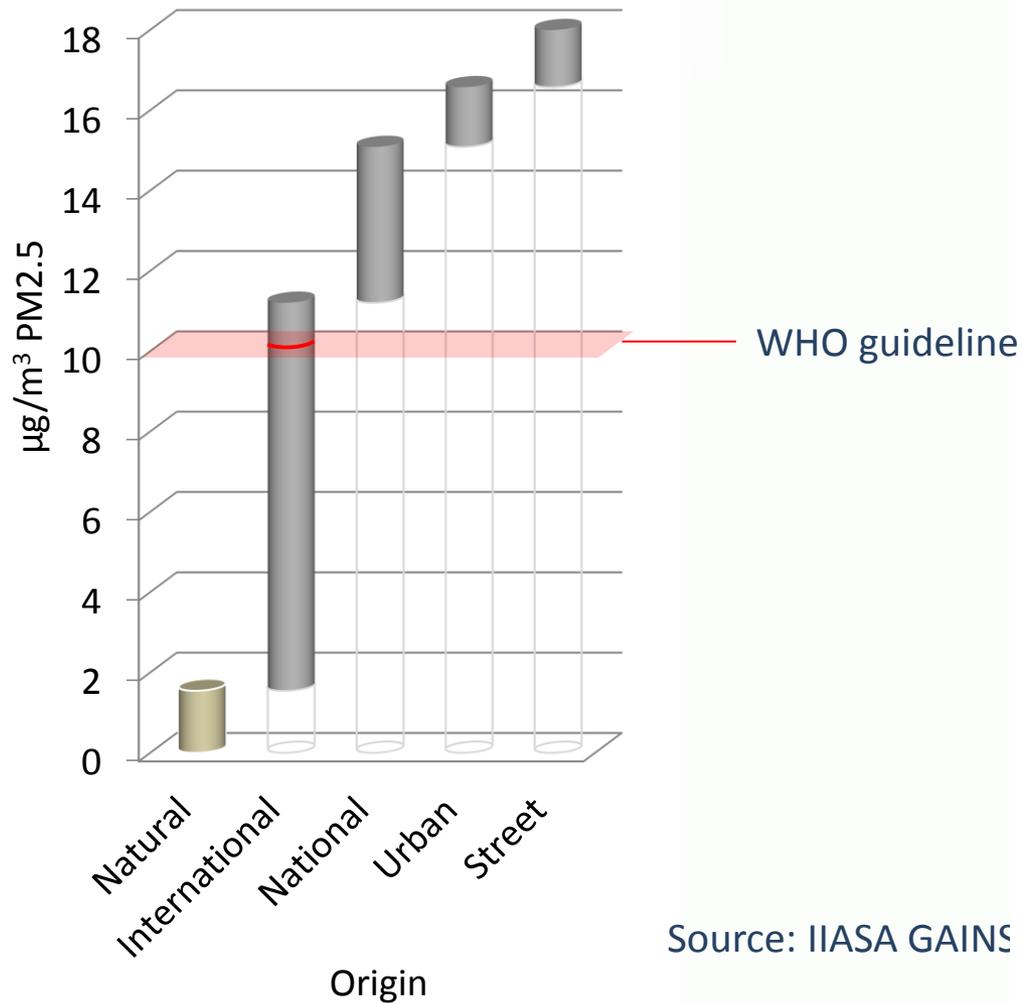
Markus Amann



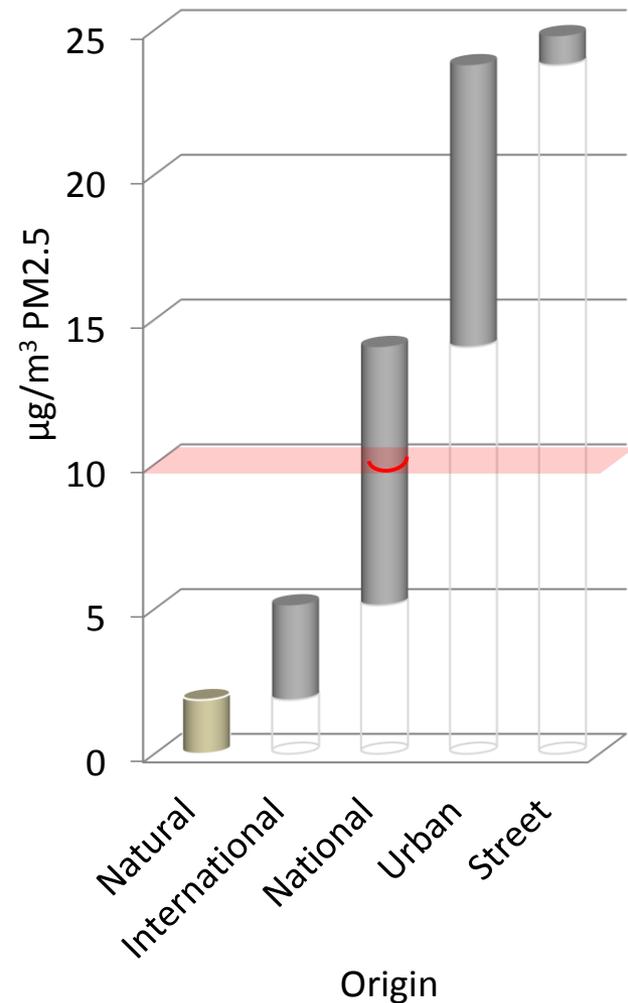
IIASA, International Institute for Applied Systems Analysis

# Origin of PM2.5 - 2009

Netherlands  
average of the urban AIRBASE stations



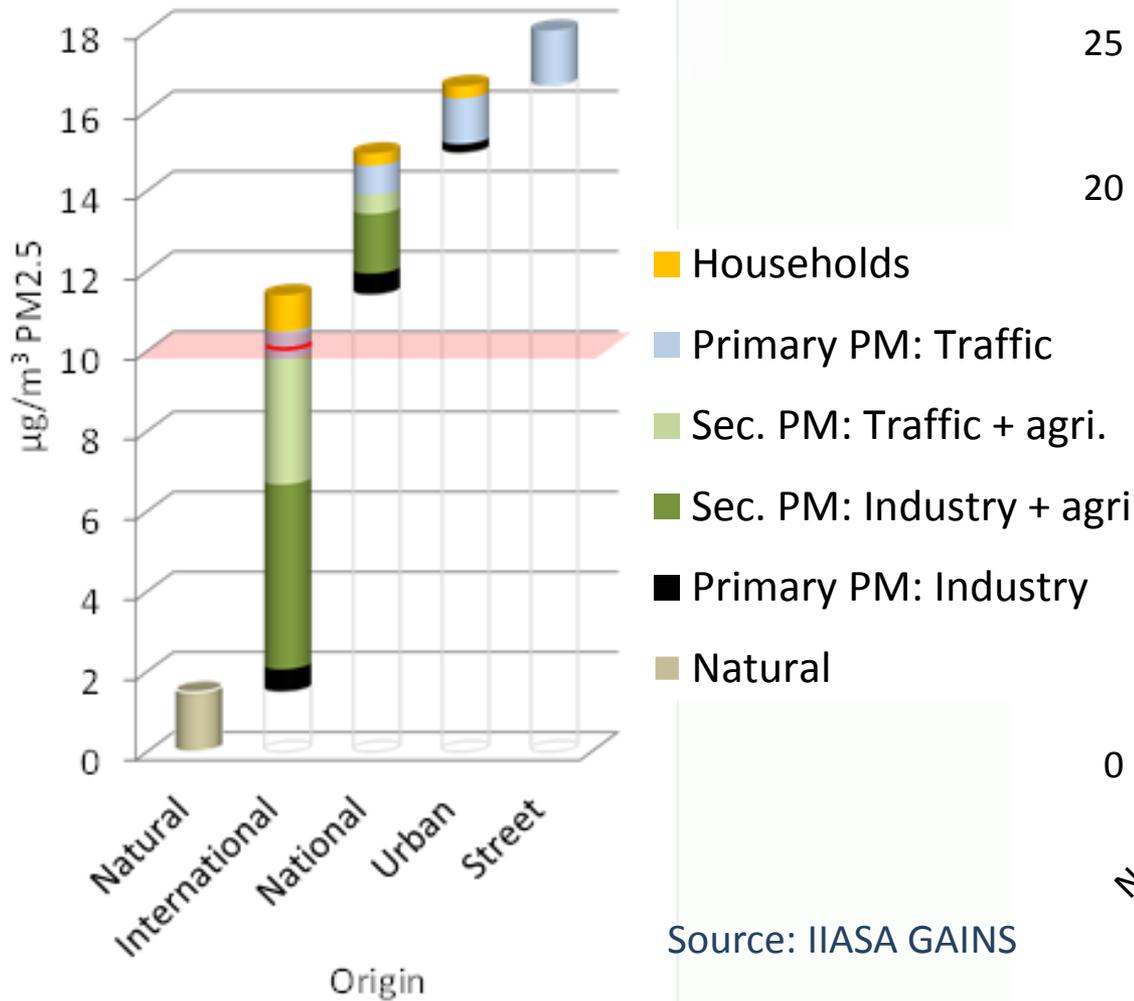
Lyon, Centre Ville



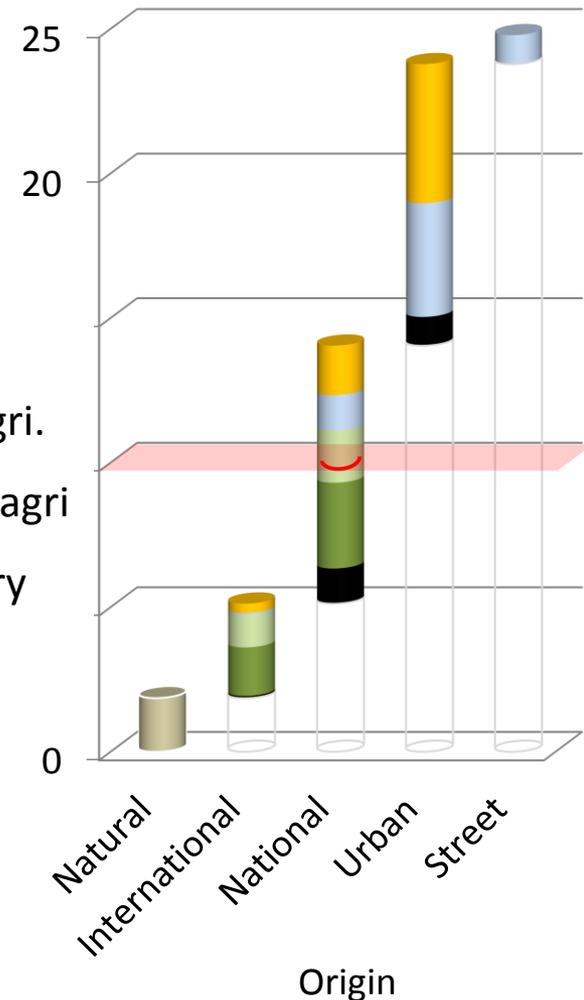
# Origin of PM2.5 - 2009

Netherlands

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Lyon, Centre Ville

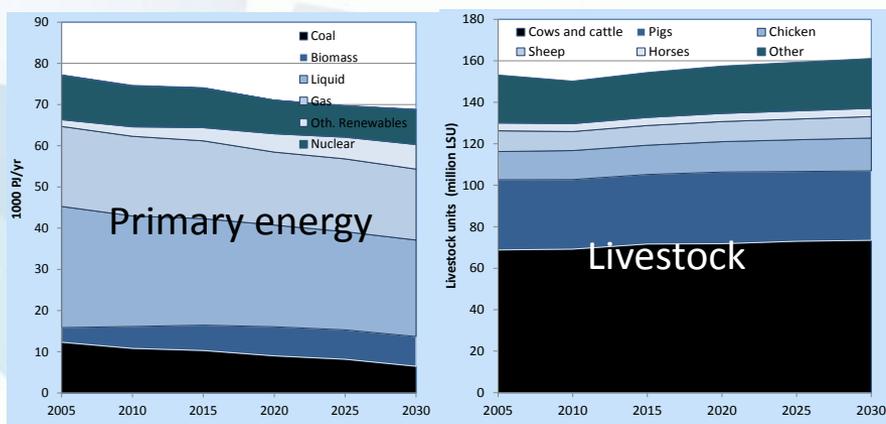


# Baseline assumptions

## Future economic development

Assumptions for Commission proposal:

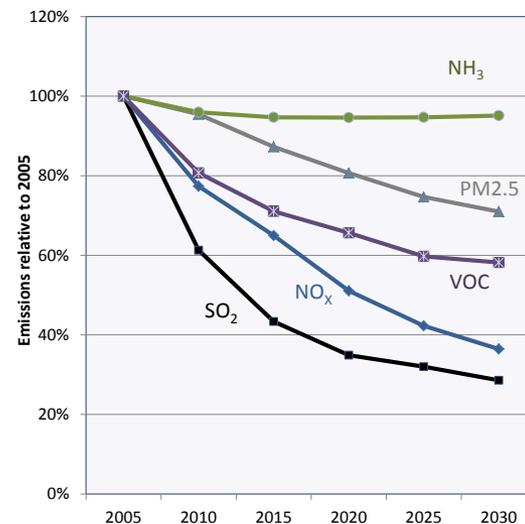
- Energy: PRIMES 2013 Reference
- Agriculture: CAPRI 2013 Scenario



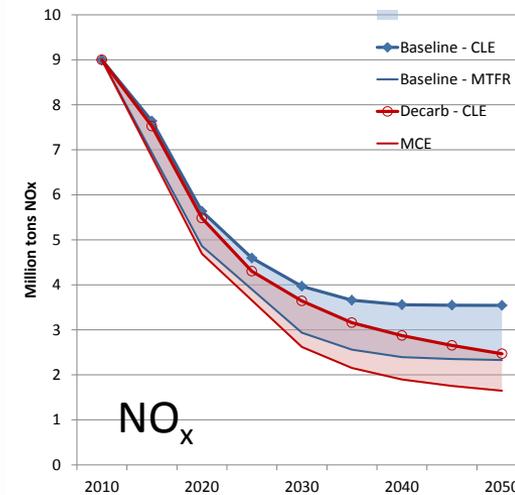
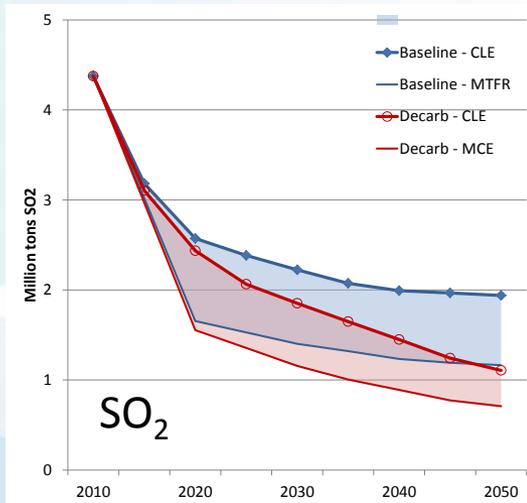
(also basis for Commission proposal for 2014 Energy & Climate Package, but without the proposed climate targets)

## Baseline emissions EU-28

Implementation of current legislation according to plan (Euro-6c from 2017)



# Range of future SO<sub>2</sub> and NO<sub>x</sub> emissions



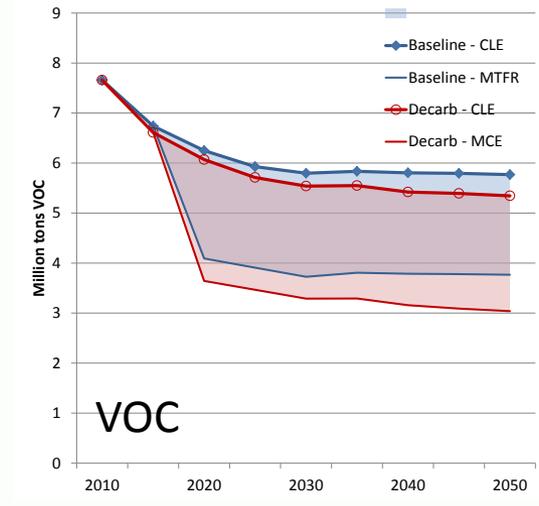
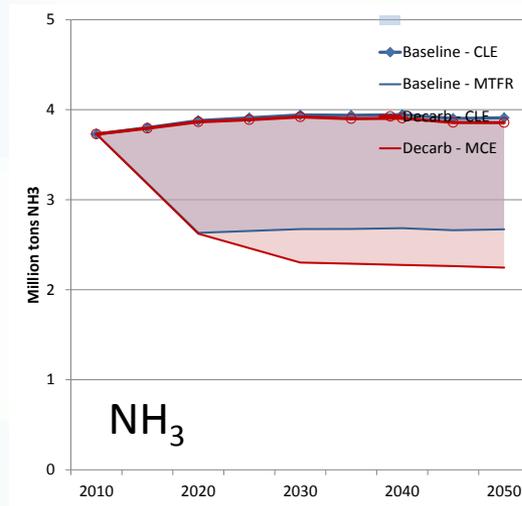
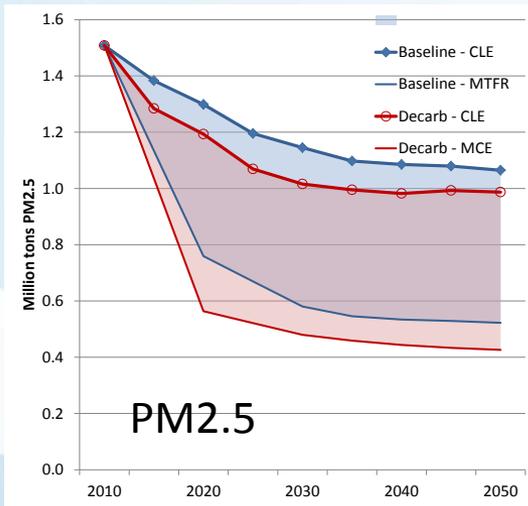
Blue: BAU baseline, Red: climate policy scenario

In the long run, further emission reductions of SO<sub>2</sub> and NO<sub>x</sub> from:

- further climate policies, and/or
- further air pollution controls.

The EU Climate policy proposal will lead to lower SO<sub>2</sub> and NO<sub>x</sub> emissions – not included in Clean Air proposal

# Range of future PM2.5, NH<sub>3</sub>, and VOC emissions



Blue: BAU baseline, Red: climate policy + healthy diet scenario

Climate policy will not greatly affect emissions of PM2.5, NH<sub>3</sub> and VOC

Future emissions will be determined by air pollution regulations

# GAINS HIA methodology for cost-effectiveness analysis

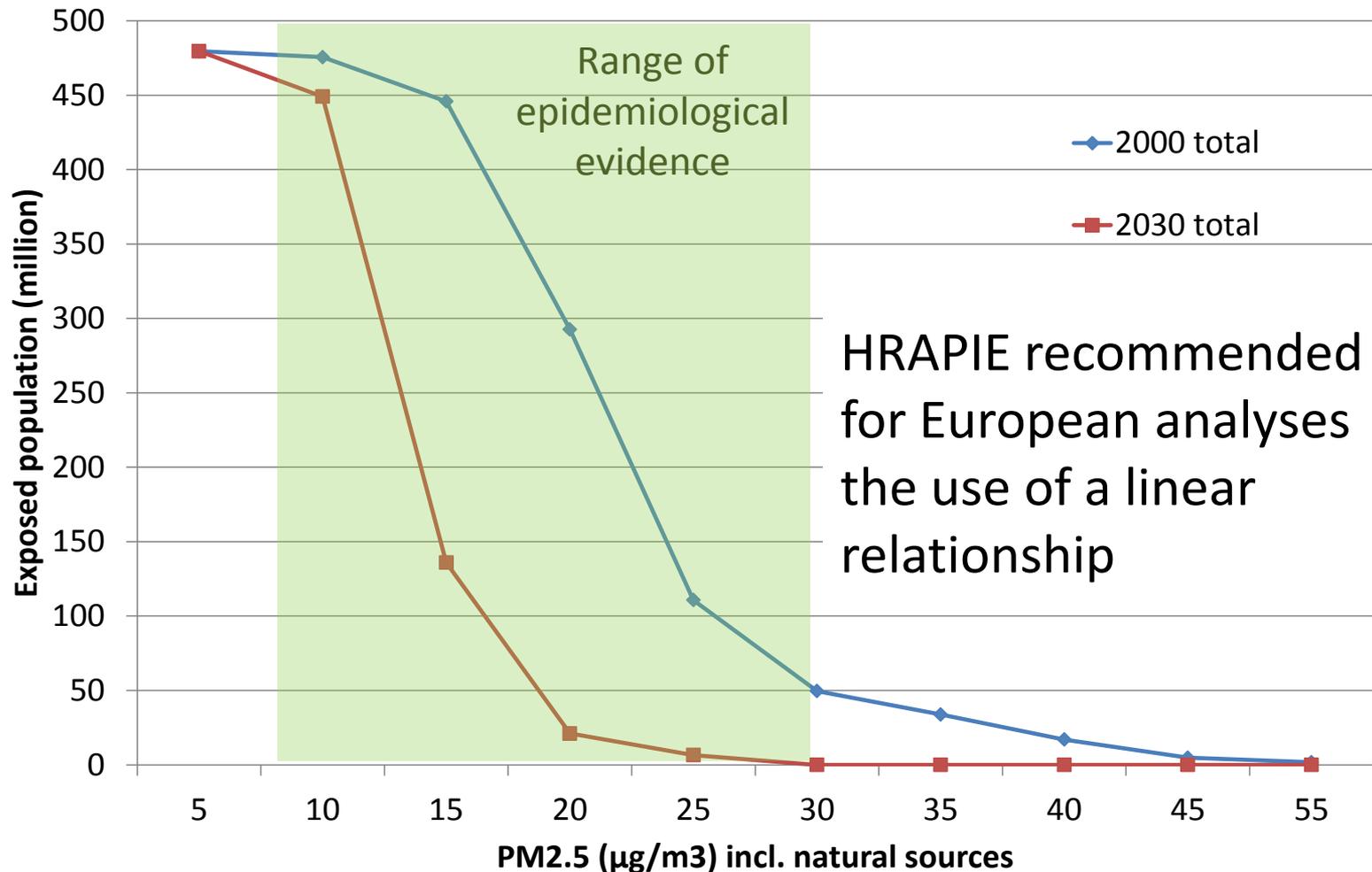
GAINS strictly follows the HRAPIE recommendations.

For PM mortality:

- PM<sub>2.5</sub> exposure calculated at 7\*7 km resolution, including SOA
- All-cause mortality
- RR: 1.062/10  $\mu\text{g}\cdot\text{m}^{-3}$  based on ESCAPE (Hoek et al.)
- Linear relation between exposure and impacts
- Contributions from natural sources discounted

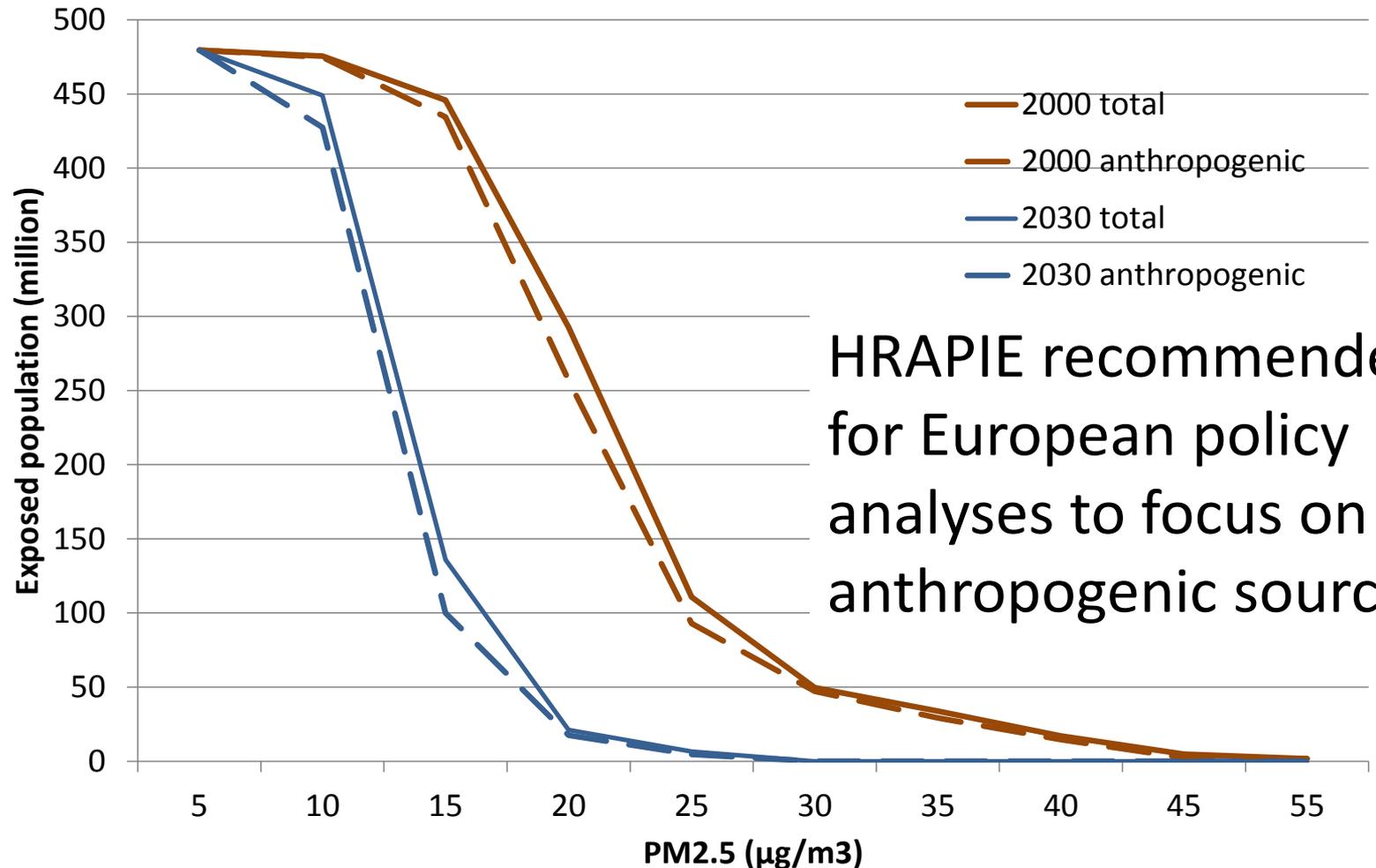
# Non-linear response function?

## Distribution of population exposure to PM2.5



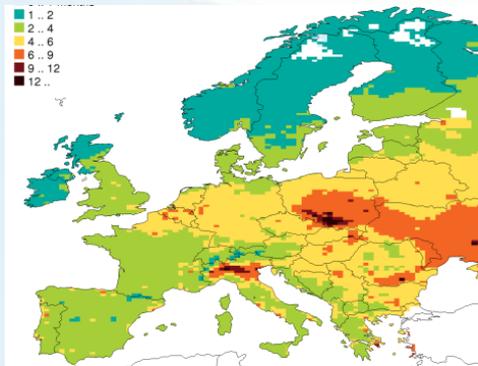
# Inclusion of PM from natural sources?

## Distribution of population exposure to PM2.5



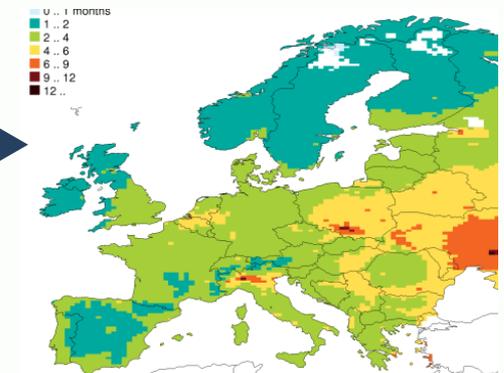
HRAPIE recommended  
for European policy  
analyses to focus on  
anthropogenic sources

# The target of the Thematic Strategy on Air Pollution for 2030



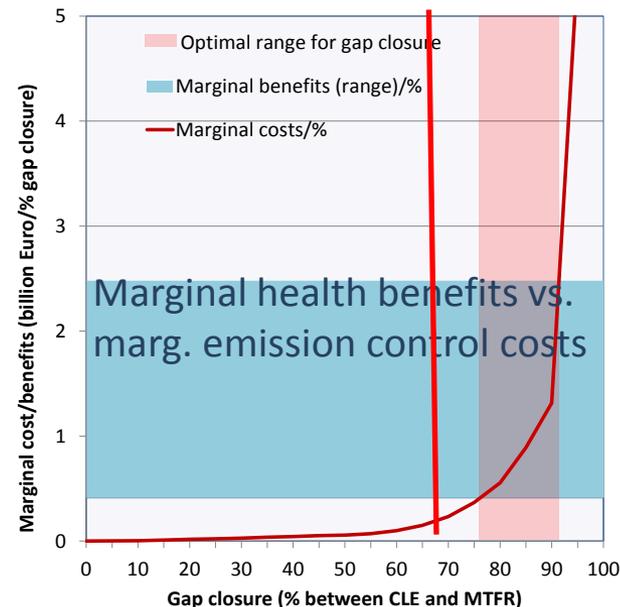
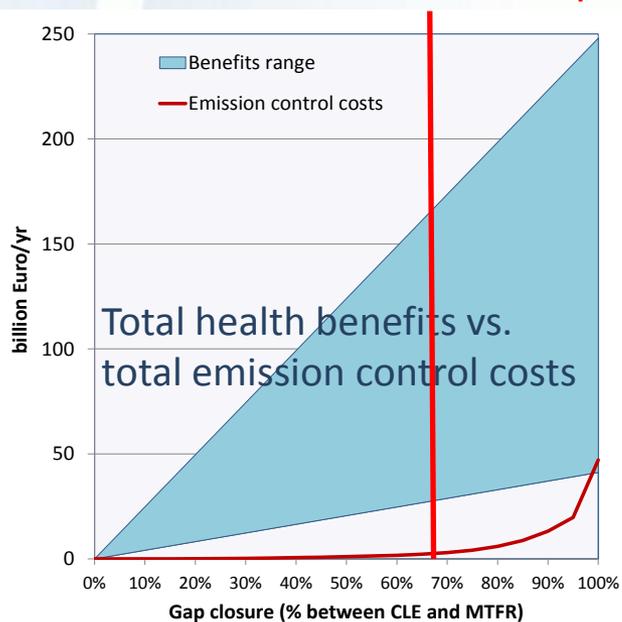
Current legislation 2030:  
5 months life shortening

Loss in statistical life expectancy



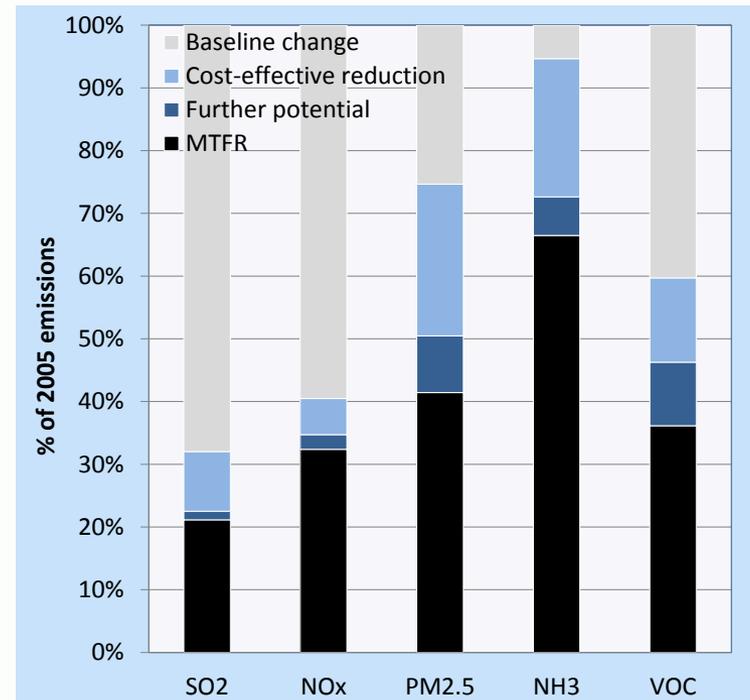
Maximum additional controls:  
3.6 months life shortening

Commission proposal:  
67% 'gap closure' in 2030:  
-50% health impacts  
compared to 2005



# The Commission proposal for National Emission Ceilings (NECs) in 2030

	EU-28 (relative to 2005)	EU-28 (in addition to Baseline)
SO <sub>2</sub>	-81%	-8%
NO <sub>x</sub>	-69%	-4%
PM2.5	-51%	-24%
NH <sub>3</sub>	-27%	-20%
VOC	-50%	-9%
CH <sub>4</sub>	-33%	-9%



# Key measures for achieving the proposed NECs in 2030: Agriculture

Improved storage of manure  
(e.g., closed tanks)  
+ anaerobic digestion at large farms



Improved application of manure on  
soil, e.g., trailing hose, slot injection  
(only at large farms)



Improved application of urea fertilizer  
or substitution by ammonium nitrate



# Costs and benefits of the additional measures

## Costs:

Air pollution control measures:

**€ 2.5 - 3.3 bn/yr**  
**(0.016% - 0.021% of GDP)**

Methane measures:

**Cost savings € 2.4 - 4.0 bn/yr**

Net costs:

**Between costs of € 0.9 bn/yr  
and savings of € -1.5 bn/yr  
(0.006% to -0.010% of GDP)**

## Benefits:

Gains in statistical life expectancy  
from lower PM2.5:

**4.4 months (-50% of 2005)**

Monetized *health* benefits

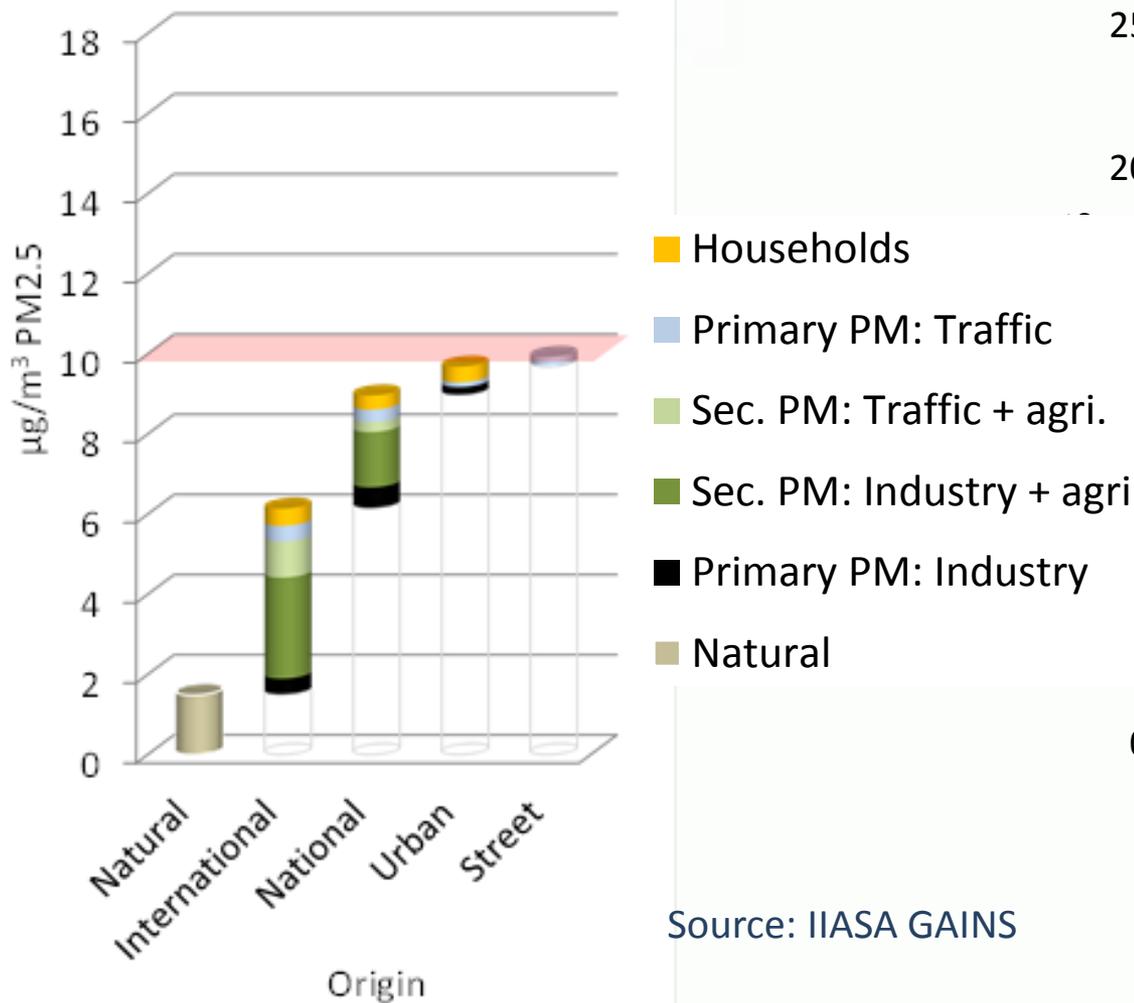
**€ 35 - 135 bn/yr**

Additional Natura2000 areas  
protected against eutrophication:

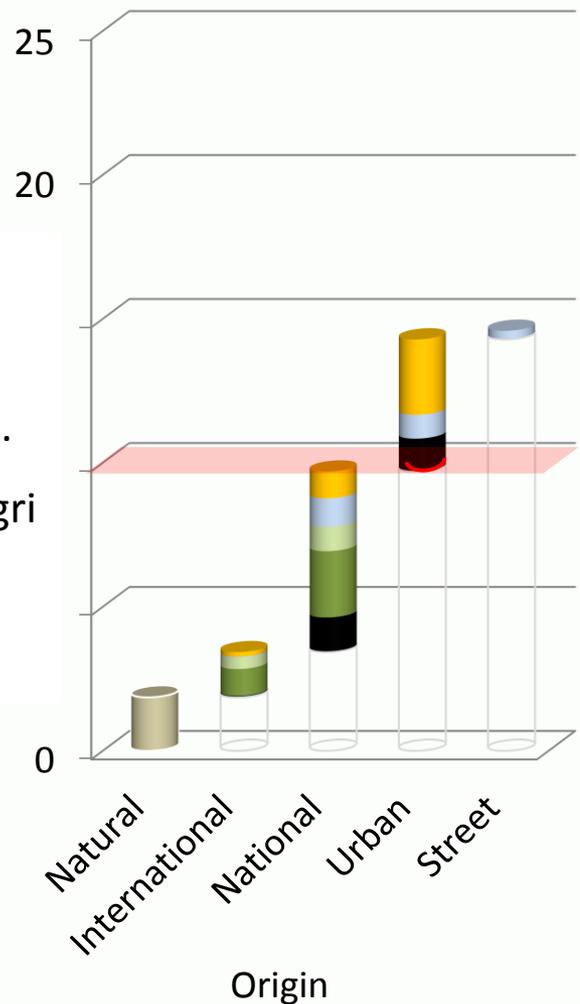
**150,000 km<sup>2</sup>**

# PM2.5 in 2030: Commission proposal

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average of the urban AIRBASE stations

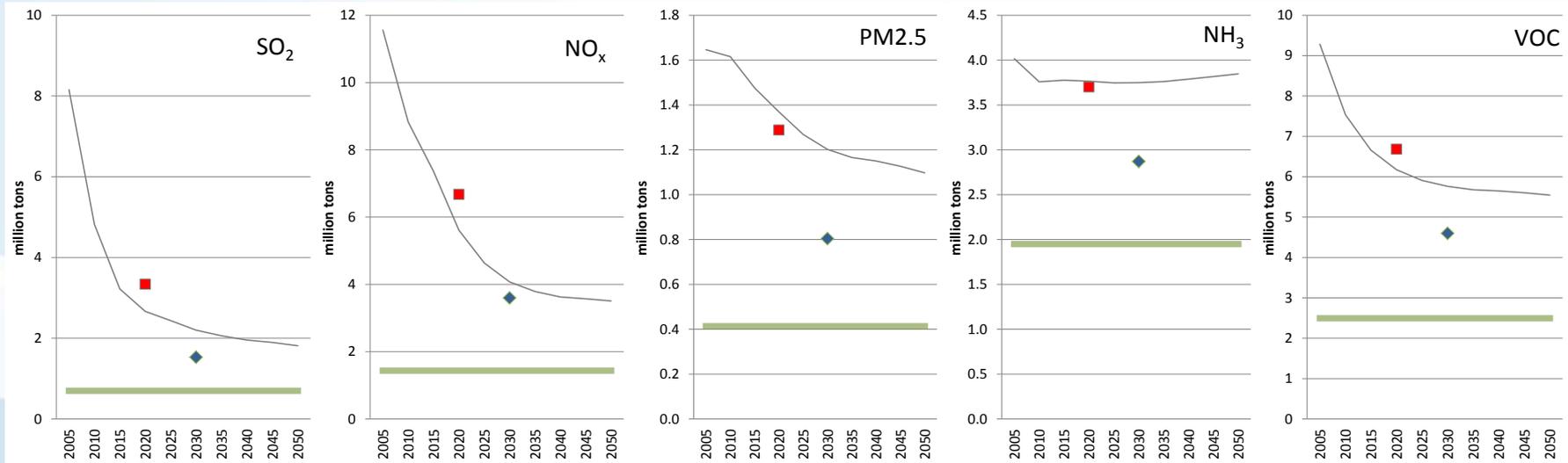


Lyon, Centre Ville



Source: IIASA GAINS

# Are we on track towards sustainability?



— Baseline with current legislation

■ Gothenburg ceilings

◆ Proposed NEC ceilings

■ Illustrative low emission set

While the proposed NECs are important milestones, long-term sustainability will require further policy interventions

# Conclusions

- The Commission proposal for the ‘Clean Air Policy Package’ suggests a concrete path for solving the remaining air quality problems in Europe, based on
  - solid scientific understanding, especially on health impacts,
  - economic efficiency, and
  - fully utilizing the potential from international cooperation.
- **Health impact information was most instrumental for reaching agreement on the ambition level of the proposal (i.e., the ‘70% gap closure’)**
- More info: <http://gains.iiasa.ac.at>