International Institute for Applied Systems Analysis
IIASA www.iiasa.ac.at

science for global insight

Modelling PM2.5 health impact indicators in Europe: Health effects and legal compliance

VIIAS Symposium
Rome, June 4. 2-05

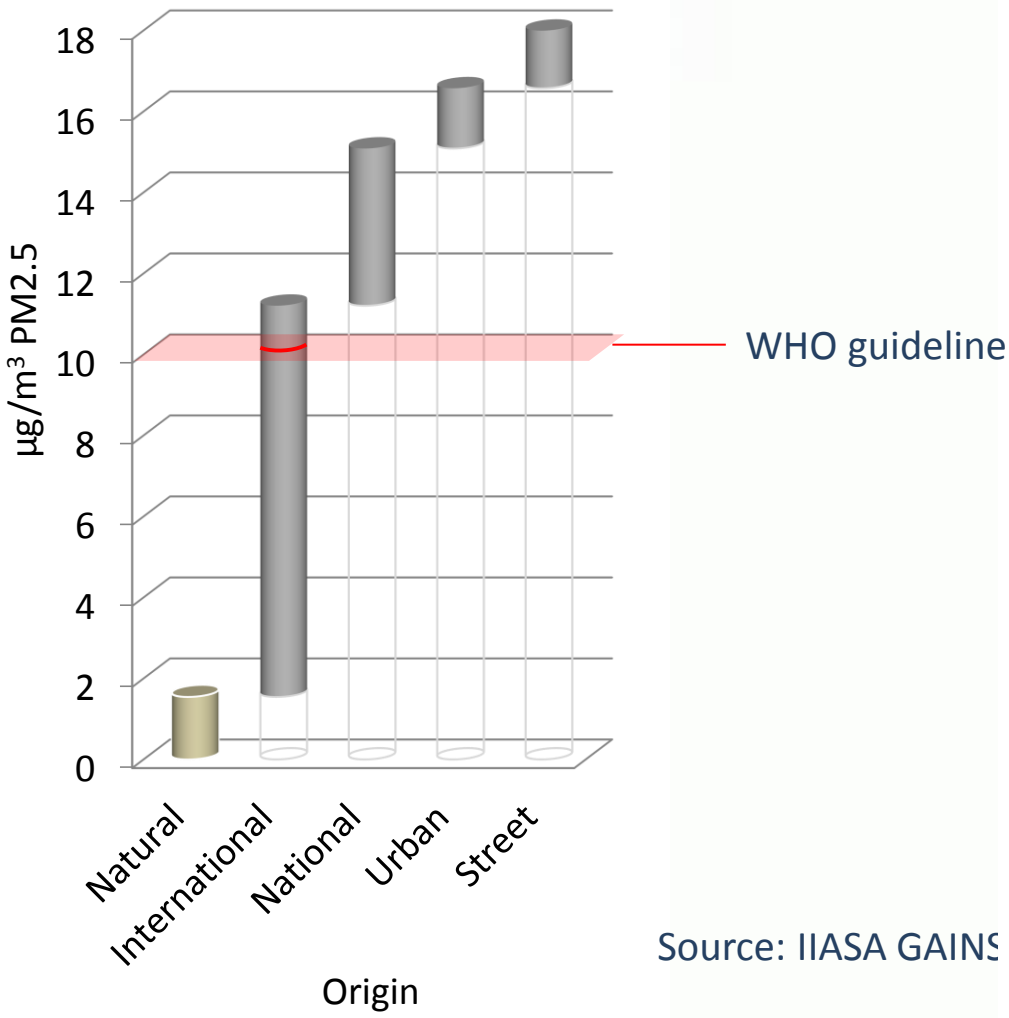
Markus Amann
Program Director IIASA

Context

- Wide-spread exceedance of air quality limit values for PM2.5 and NO_2 in the EU
- WHO review points out significant health impacts of PM2.5; e.g., 10 times more premature deaths from air pollution than from traffic accidents
- Understanding of NO_2 impacts is evolving
- EU Clean Air Policy package:
  - Commission proposal 2013 with national emission ceilings
  - Currently negotiated by EU institutions

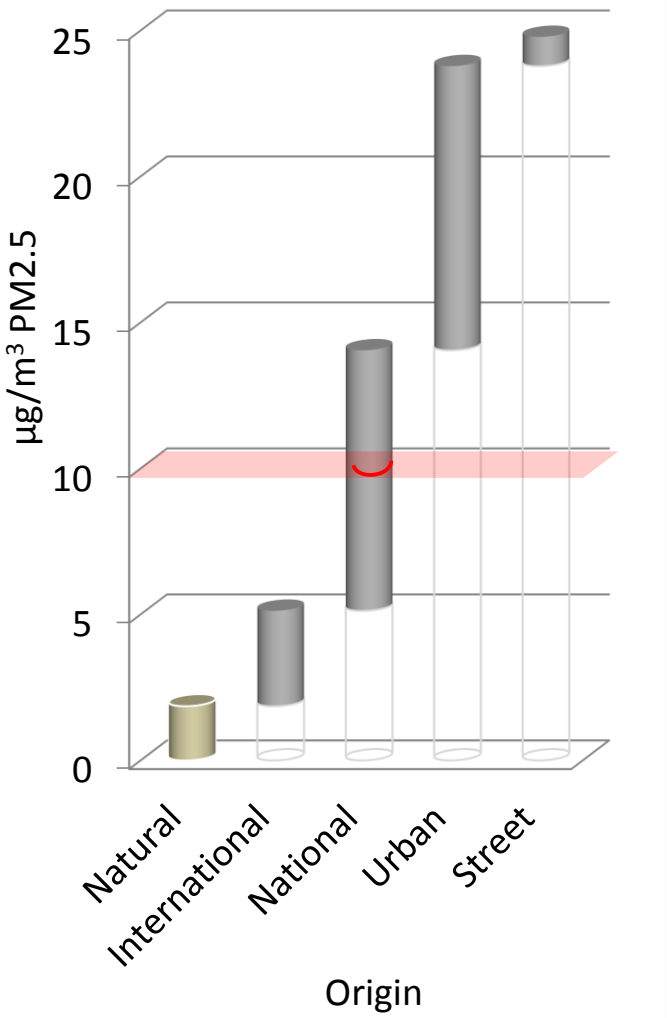
Origin of PM2.5 - 2009

Netherlands
average of the urban AIRBASE stations



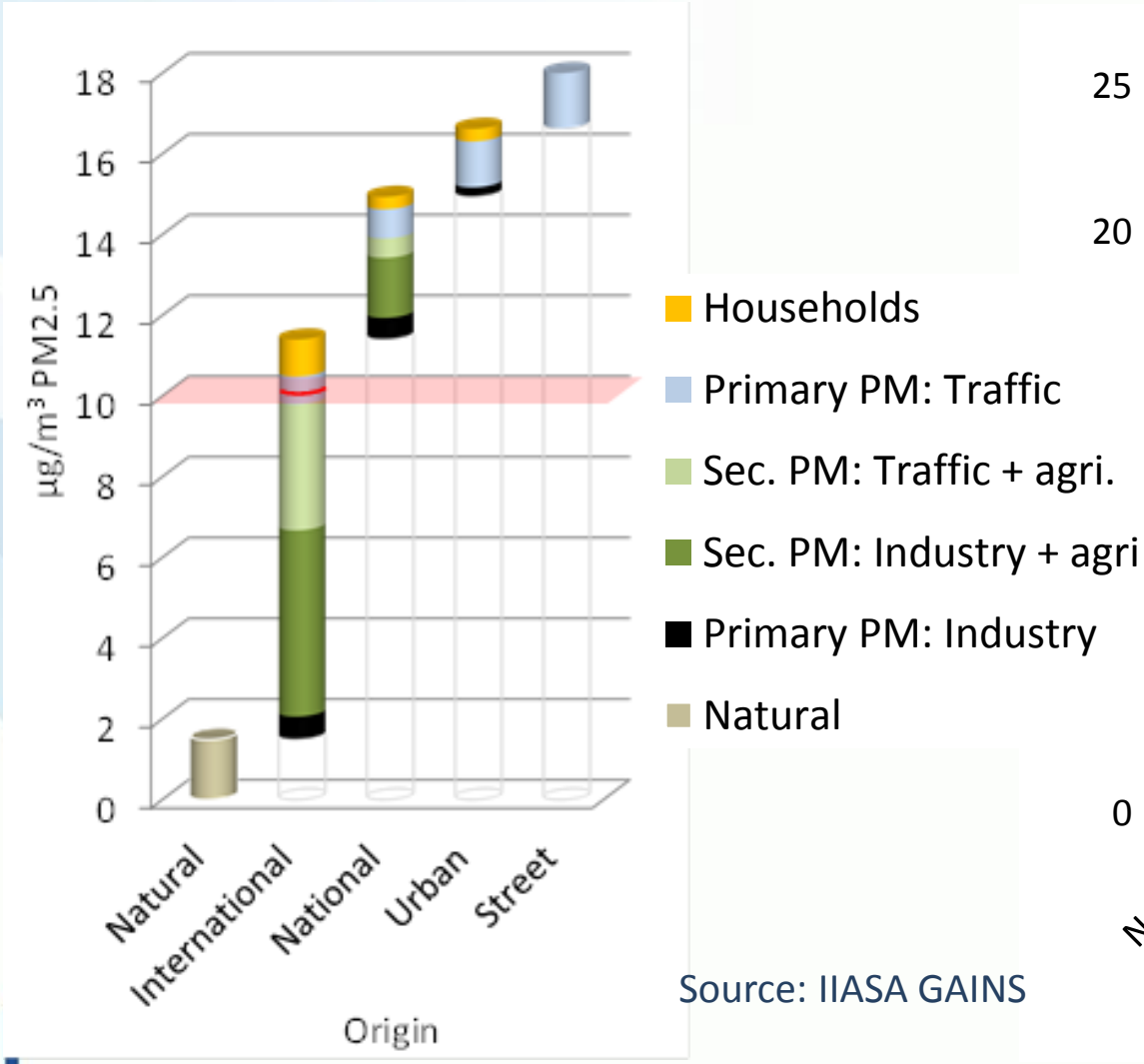
Source: IIASA GAINS

Lyon, Centre Ville

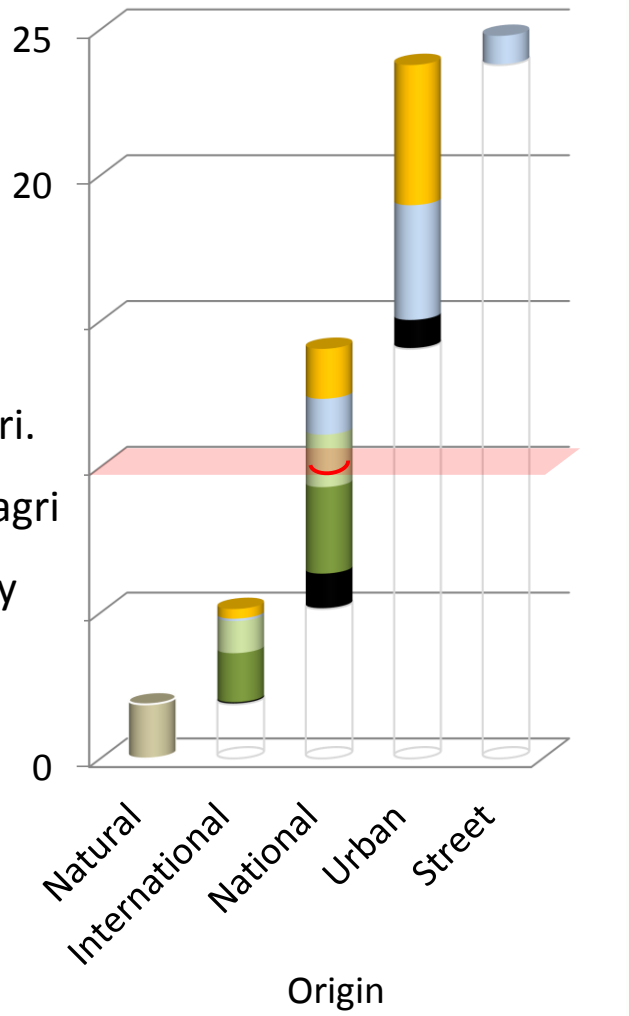


Origin of PM2.5 - 2009

Netherlands
average of the urban AIRBASE stations



Lyon, Centre Ville

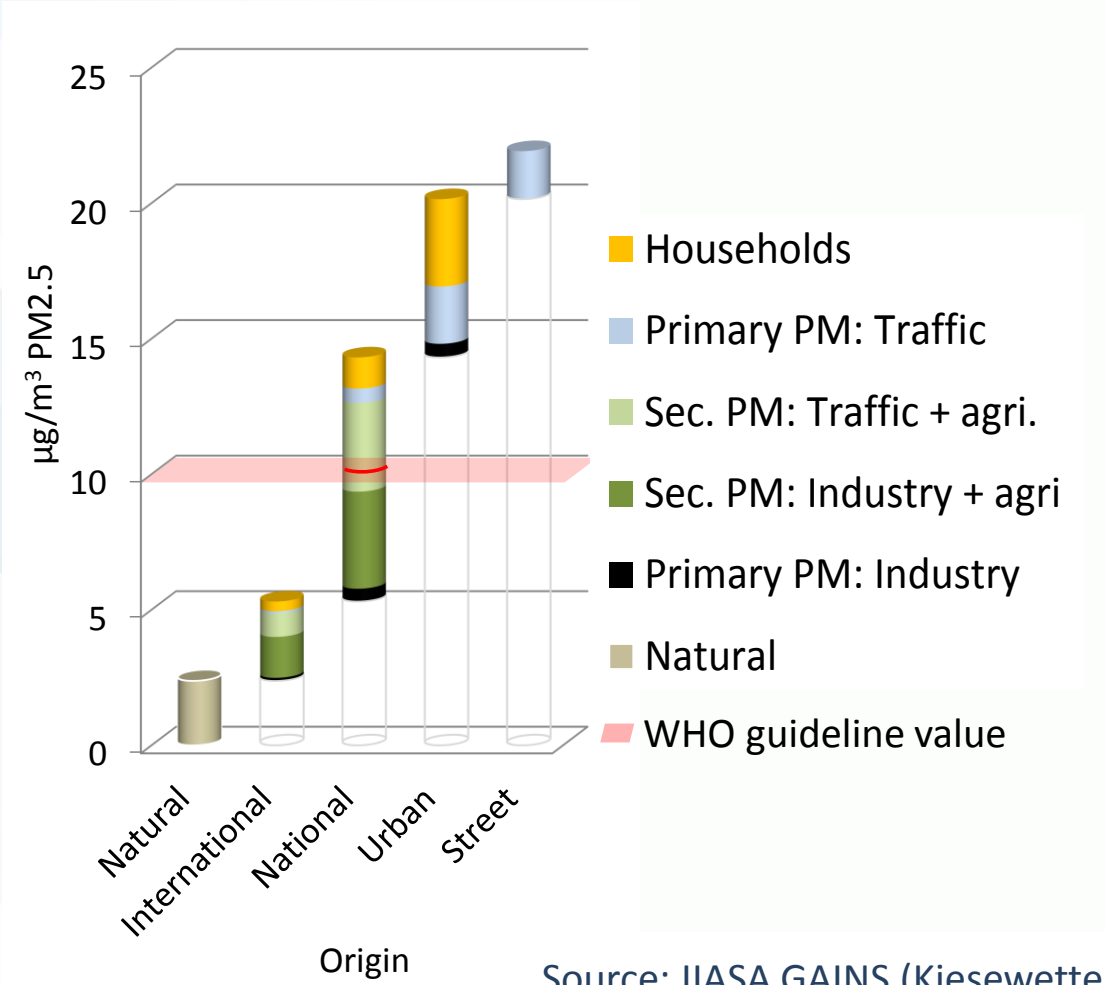


Source: IIASA GAINS

Origin of PM2.5 in Italy

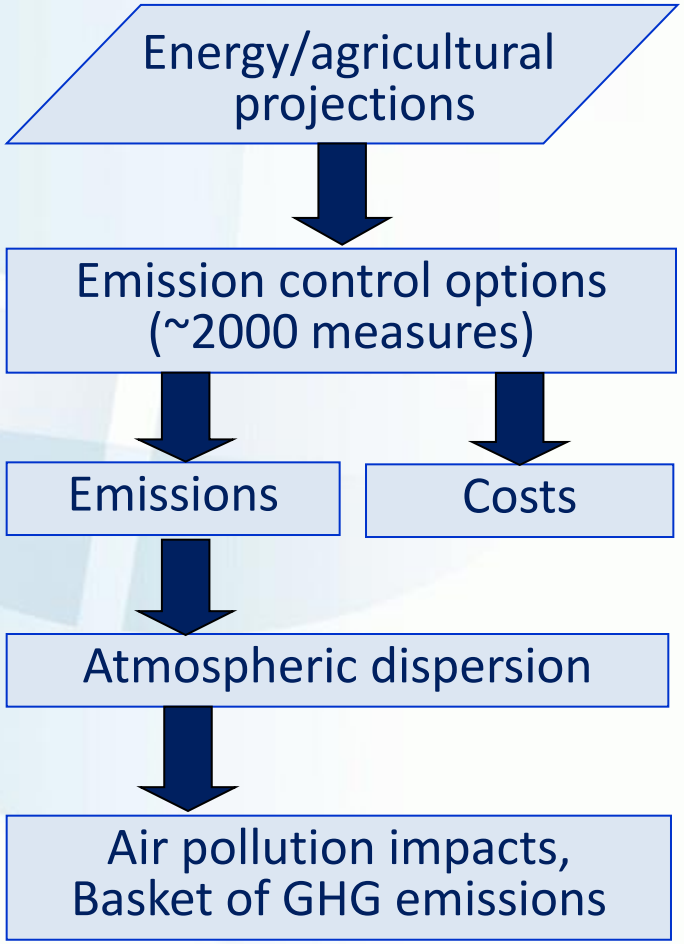
Average of 70 urban AIRBASE stations modelled in GAINS

2009



Source: IIASA GAINS (Kiesewetter et al., 2014)

IIASA's GAINS systems approach to identify cost-effective international emission reduction strategies

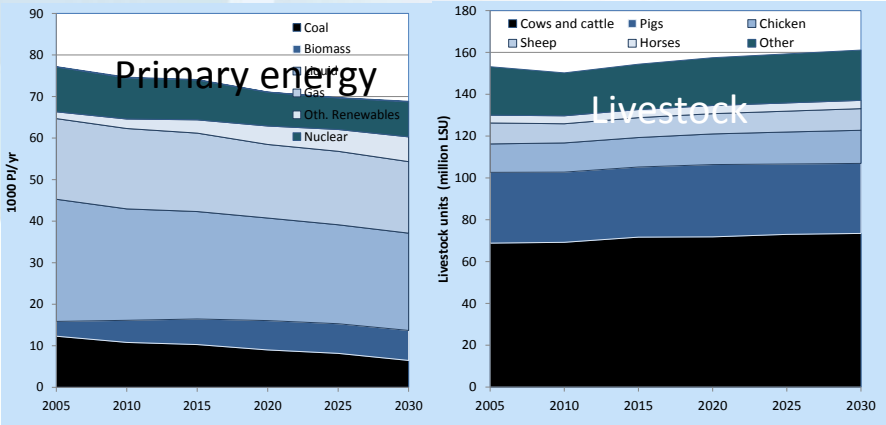


Baseline assumptions

Future economic development

Assumptions for Commission proposal:

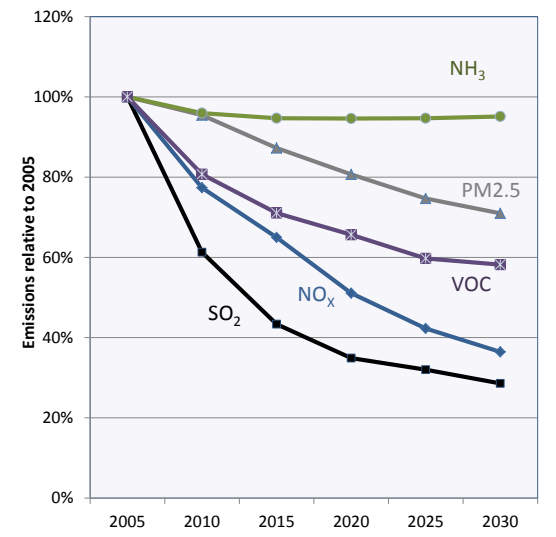
- Economic growth: +40% in 2030
- Energy: PRIMES 2013 Reference
- Agriculture: CAPRI 2013 Scenario



Baseline emissions EU-28

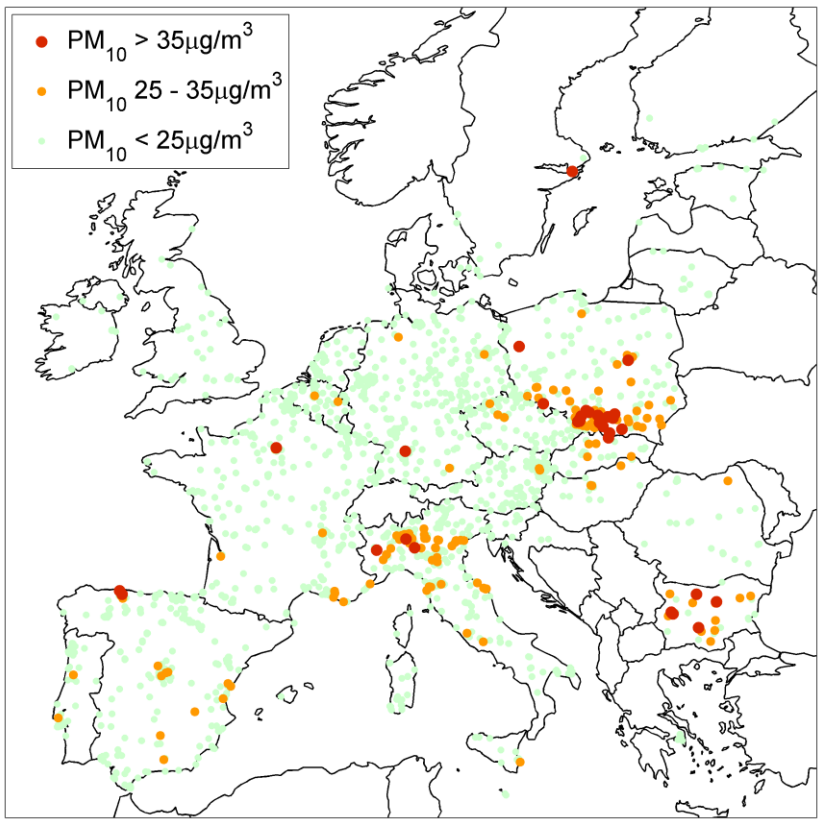
Implementation of current legislation according to plan

(Euro-6c from 2017)

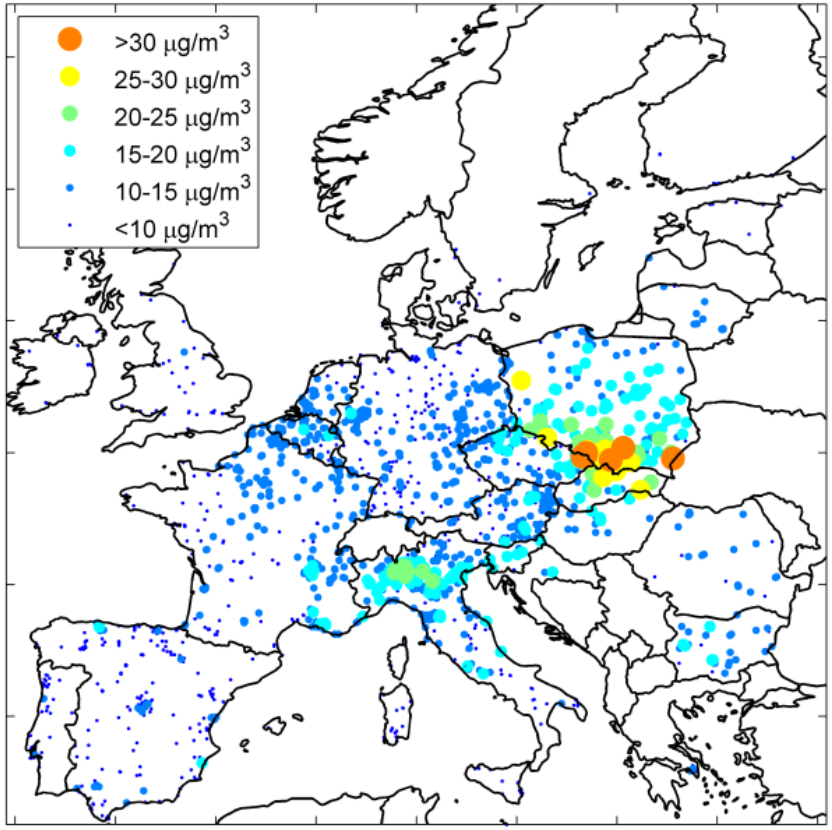


Estimated compliance with AQ limit values 2030 with Current Legislation

PM10

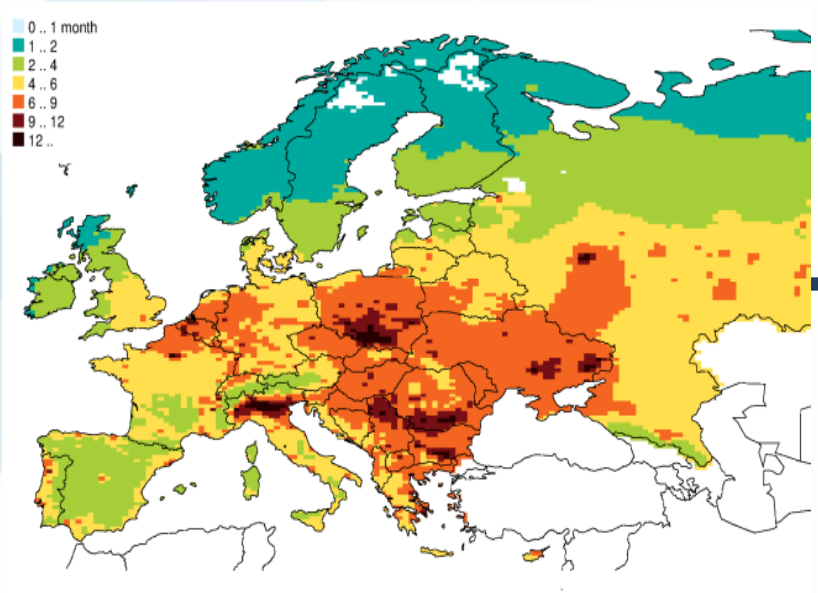


PM2.5

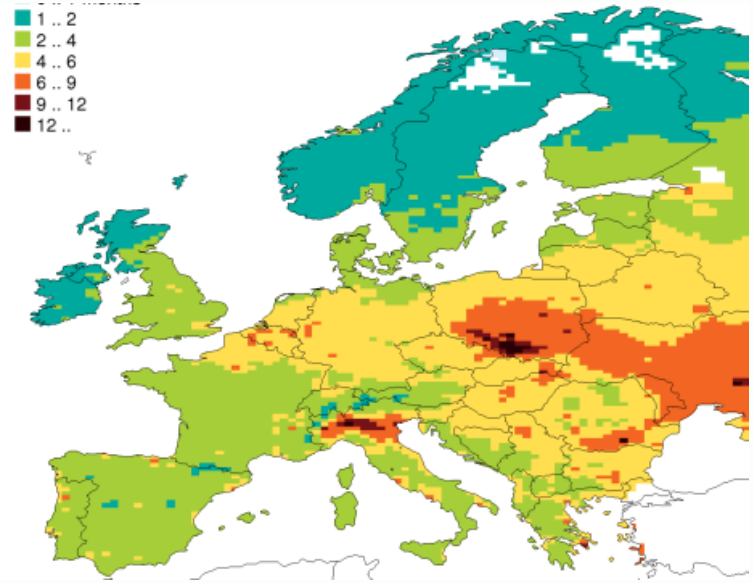


Health impacts of PM2.5
Loss of statistical life expectancy

Following WHO methodology

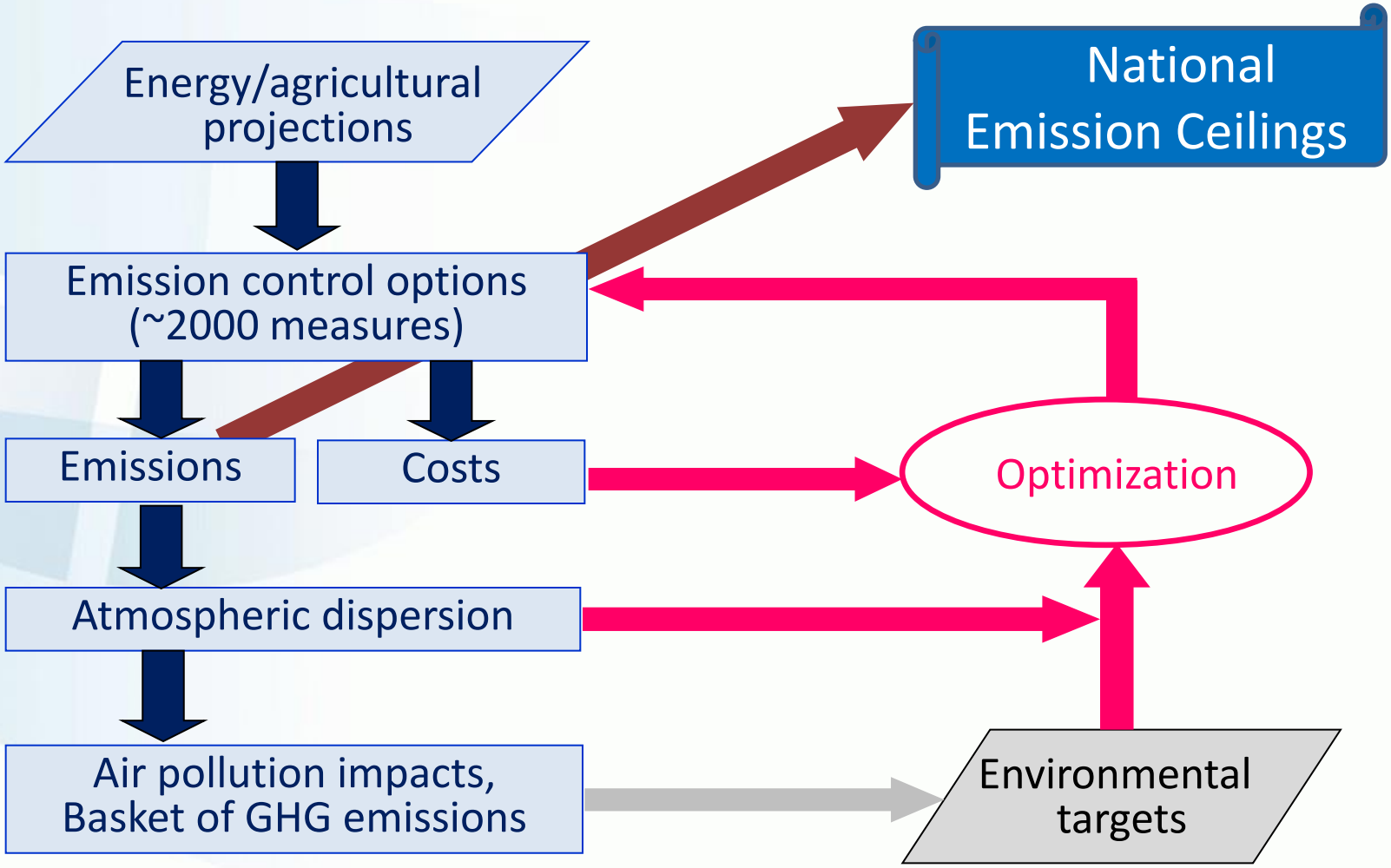


2010: 8.5 months life shortening

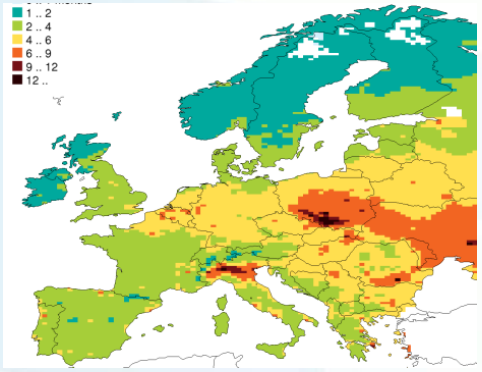


2030: 5.5 months

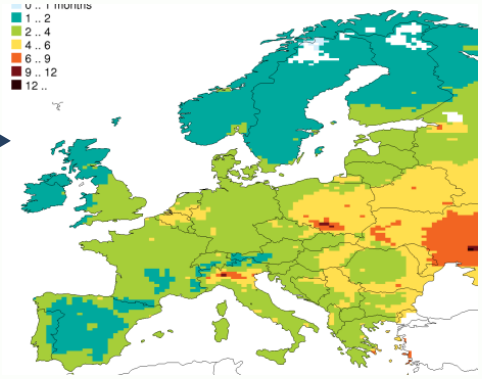
IIASA's GAINS systems approach to identify cost-effective international emission reduction strategies



The target of the Thematic Strategy on Air Pollution for 2030



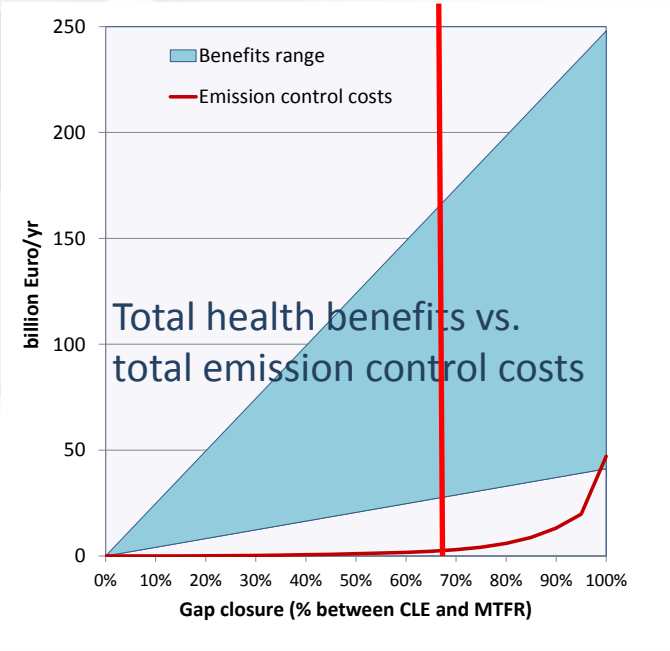
Loss in statistical life expectancy

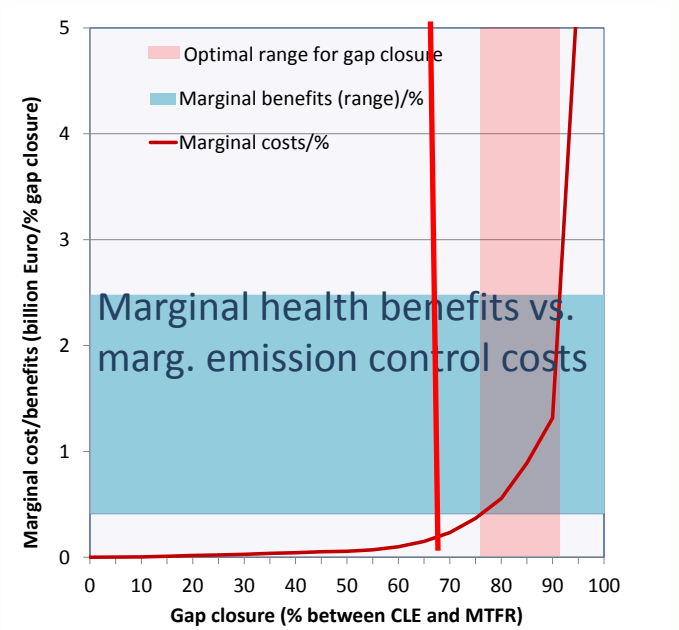


Current legislation 2030:
5 months life shortening

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

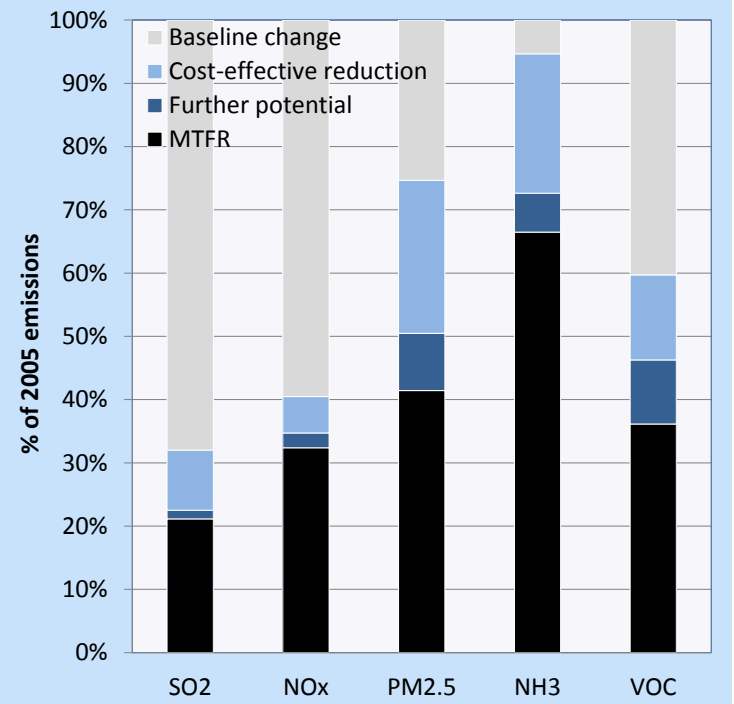
Maximum additional controls:
3.6 months life shortening



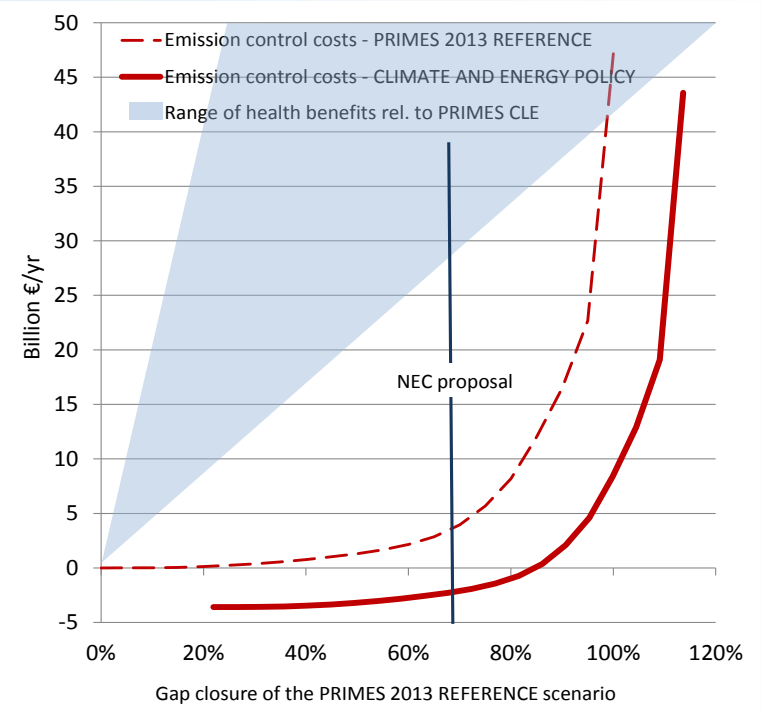


The Commission proposal for National Emission Ceilings (NECs) in 2030

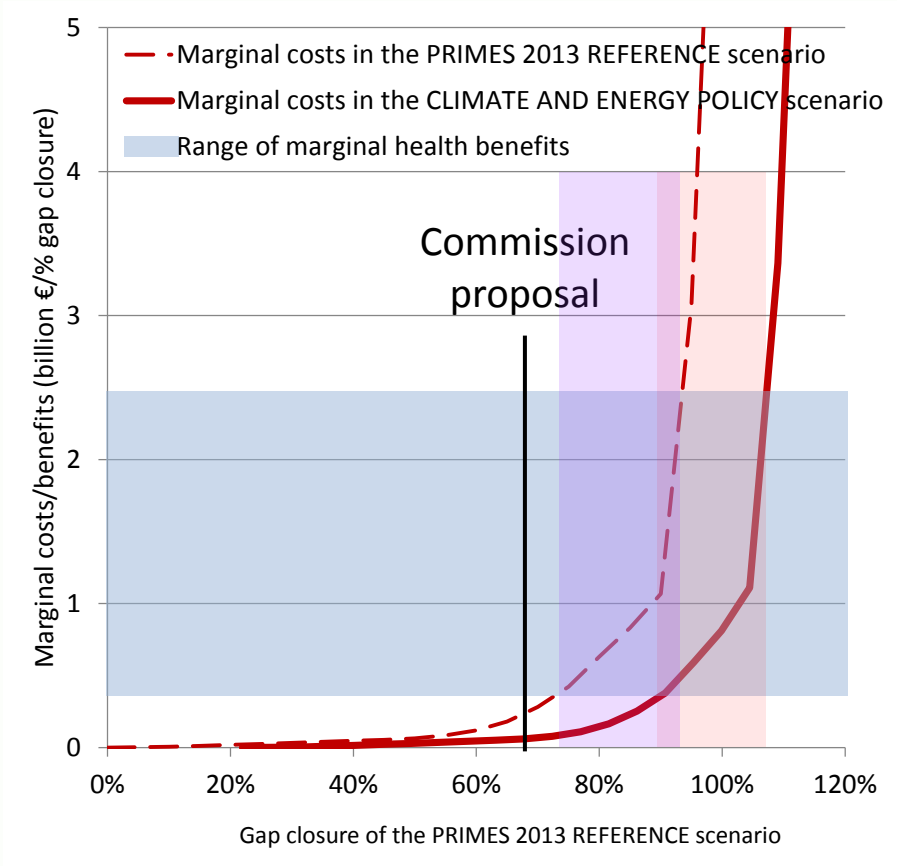
	EU-28 (relative to 2005)	EU-28 (in addition to Baseline)
SO_2	-81%	-8%
NO_x	-69%	-4%
PM2.5	-51%	-24%
NH_3	-27%	-20%
VOC	-50%	-9%
CH_4	-33%	-9%



Re-analysis for European Parliament: Climate policies do not only save lives, but also money for air pollution control

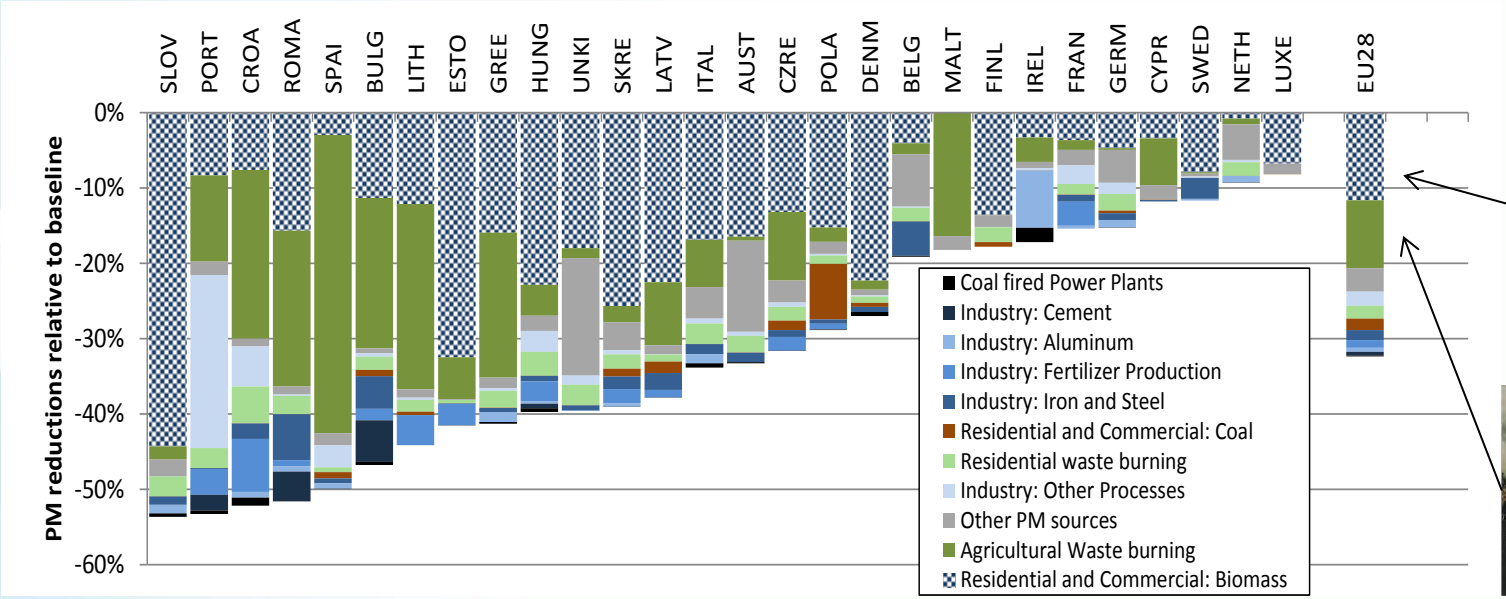


Reduction of premature mortality in 2030,
% of scope offered by further technical measures
in the scenario without further climate policies



Source: Amann et al. (2014) Europ. Parliament

Optimized emission reductions by sector: PM2.5



Key measures:

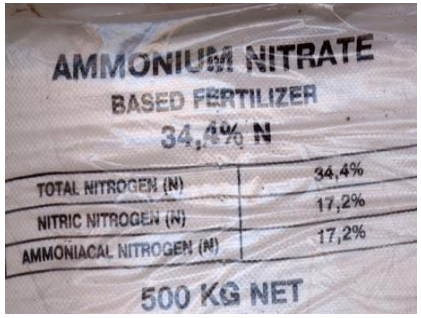
- Modern biomass stoves with lower emissions and higher energy efficiency
- (Enforcement of) ban of agricultural waste burning
- Stricter PM controls on some industrial processes

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:

€ 2.2 bn/yr
(0.008% of GDP)

Methane measures:

Cost savings € 2.4 - 4.0 bn/yr

Net costs:

Likely to be negative

Benefits:

Gains in statistical life expectancy from lower PM2.5:

4.4 months (-50% of 2005)

Monetized *health* benefits

€ 35 - 135 bn/yr

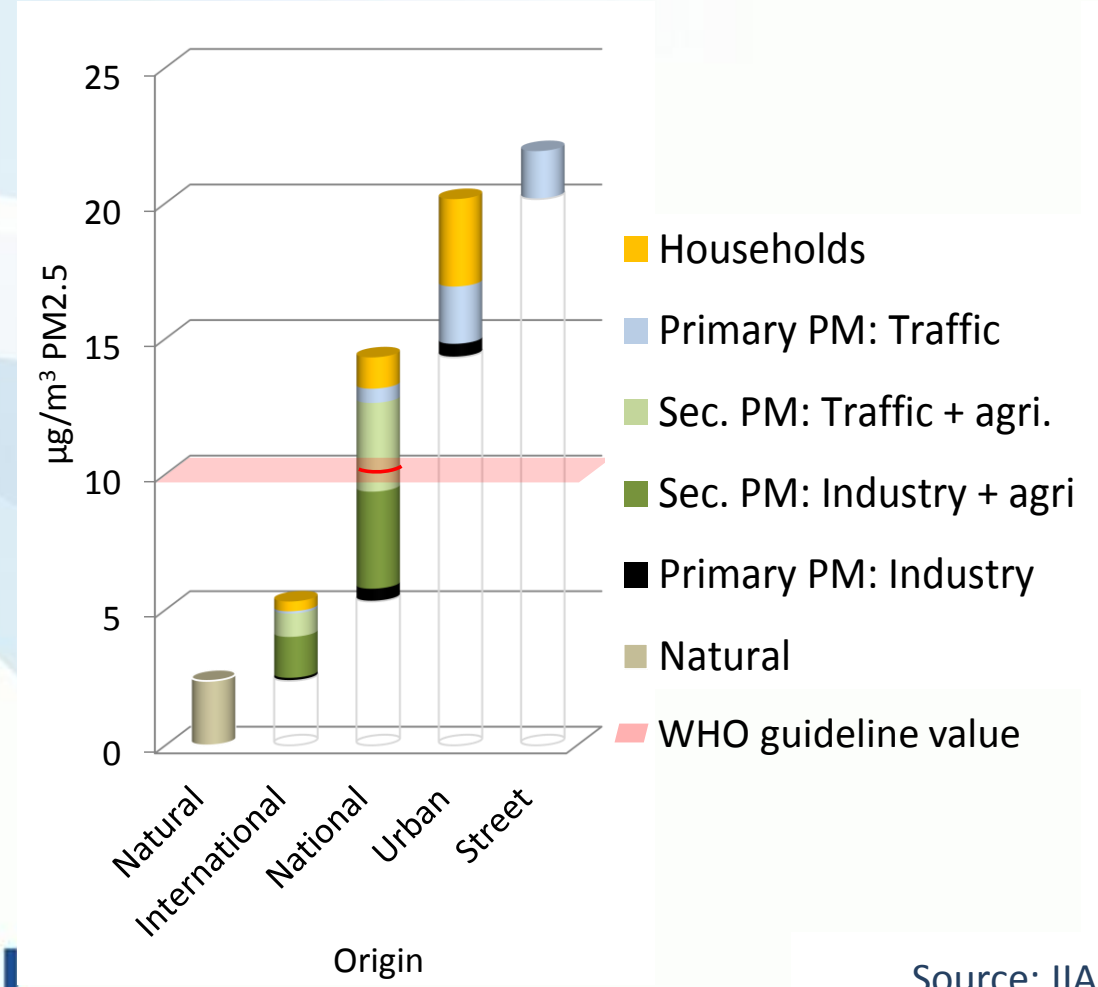
Additional Natura2000 areas protected against eutrophication:

150,000 km^2

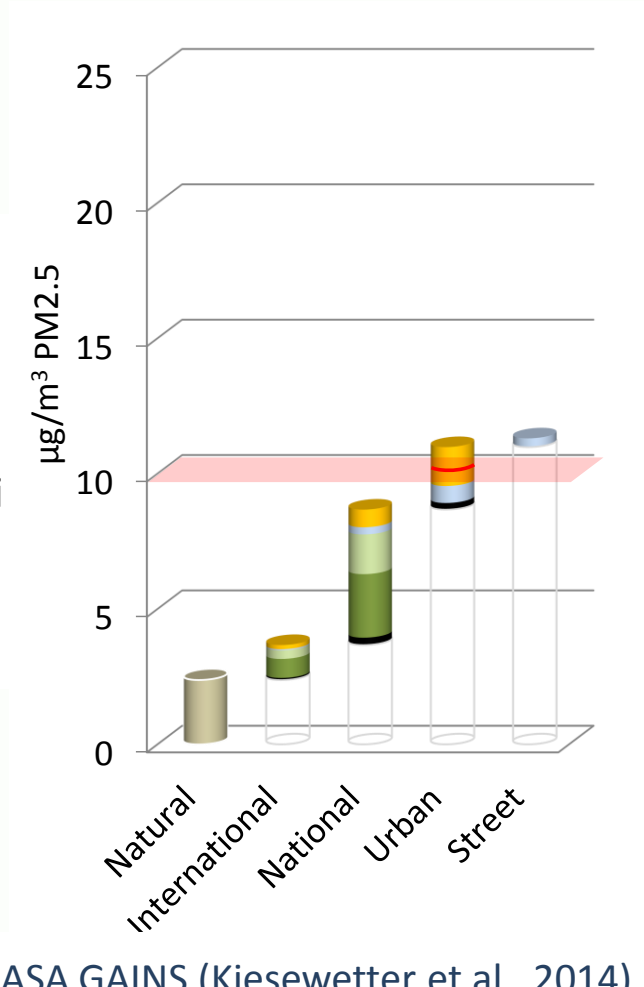
Origin of PM2.5 in Italy

Average of 70 urban AIRBASE stations modelled in GAINS

2009



2030 Commission proposal



Source: IIASA GAINS (Kiesewetter et al., 2014)

Conclusions

- Environmental health is the central entry point for the revision of the EU clean air policy
- International coordination of action is indispensable for effective improvements of population exposure
- The original Commission proposal for National Emission Ceilings has been revised recently, taking into account new statistical information from Member States
- Focus on solid fuel combustion in households and agricultural NH_3 emissions
- However, the proposed strategy will not meet the WHO guideline for PM2.5 everywhere