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science for global insight

Experience on air pollution prevention and control of Europe

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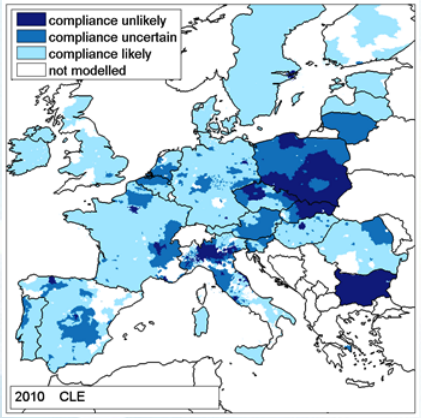
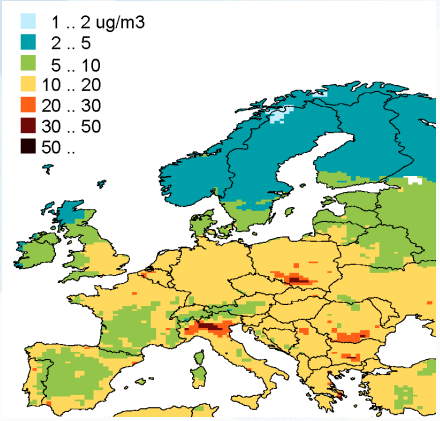
Despite significant emission reductions in the past, PM remains the most serious AQ problem in Europe

Violation of PM10
air quality limit value



PM2.5 concentrations in 2005



- Wide-spread violation of PM10 limit value (35 exceedances/yr of 50 µg/m^3 (24-hrs))
- 93% of population above WHO guideline (10 µg/m^3 annual PM2.5)
- PM remains death factor #11 in Europe (GBD)
- 8.5 months loss in statistical life expectancy due to PM2.5
- 300 million years of life lost
- Monetized health damage:
  400 – 1000 billion €/yr
- Further control of PM is one of the most cost-effective public health interventions

The EU has established a comprehensive legislative framework for PM control along three lines

- Ambient Air Quality Standards (to be achieved everywhere):
  - PM10 (24 hrs): 50 µg/m^3, 35 exceedances allowed
  - PM10 (1 year): 50 µg/m^3
  - PM2.5 (1 year): 25 µg/m^3 (Target value as of 2010, binding limit value as of 2015)

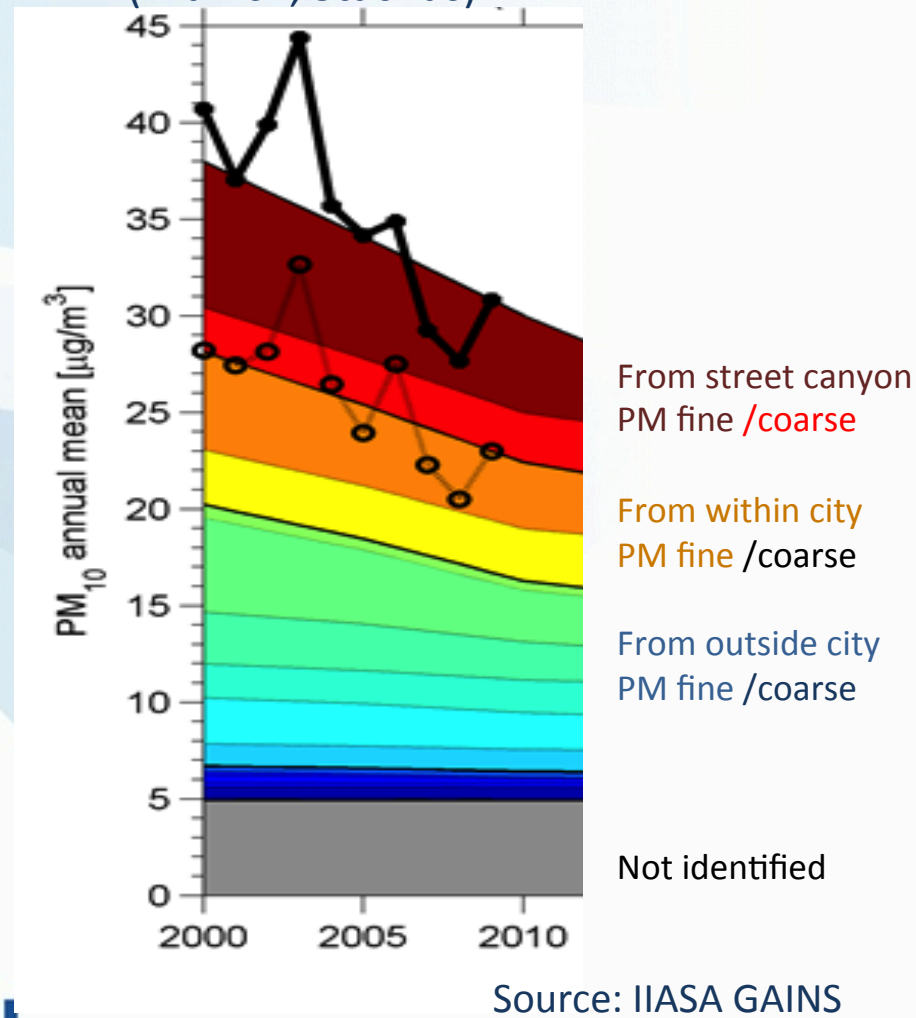
- Source-specific emission standards for TSP, SO_2, NO_x, VOC, for stationary and mobile sources

- National emission ceilings for PM2.5, SO_2, NO_x, VOC, NH_3

The European Commission initiates court cases for non-compliance

Where are the points for most (cost-)effective policy interventions?

Origin of PM in street canyons (Munich, Stachus)



Source: IIASA GAINS

- Even in street canyons, ~60% of PM10 comes from outside the city – and even more for PM2.5
- Large part of decline in last decade mainly due to decline in secondary precursor emissions (SO_2, NO_x)
- Even for urban air quality, a coordinated Europe-wide approach is required to
  - control inflow of pollution,
  - Impose new technology standards (e.g., for vehicles)

Which combination of measures is most effective?

The multi-pollutant/multi-effect framework

	PM (BC, OC)	SO_2	NO_x	VOC	NH_3	CO	CO_2	CH_4	N_2O	HFCs PFCs SF_6
Health impacts: PM (Loss in life expectancy)	√	√	√	√	√					
O_3 (Premature mortality)			√	√		√		√		
Vegetation damage: O_3 (AOT40/fluxes)			√	√		√		√		
Acidification (Excess of critical loads)		√	√		√					
Eutrophication (Excess of critical loads)			√		√					
Climate impacts: Long-term (GWP100)	(√)	(√)	(√)	(√)	(√)	(√)	√	√	√	√
Near-term forcing (in Europe and global mean forcing)	√	√	√	√	√	√	(√)	√	(√)	(√)
Black carbon deposition to the arctic	√									

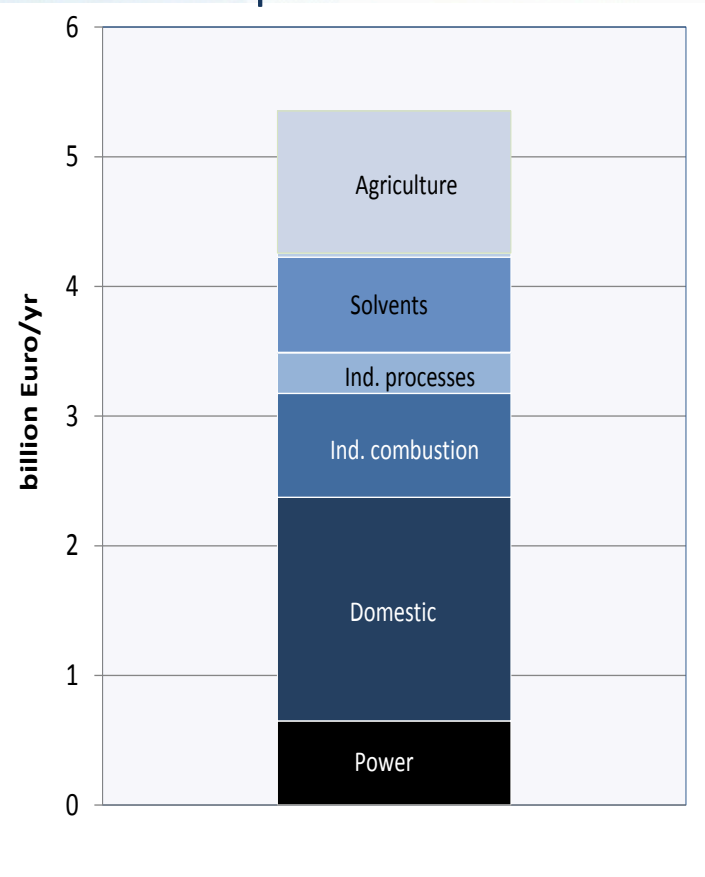
Source: IIASA GAINS

Ambient PM2.5 is formed from multiple pollutants, and control measures have multiple impacts on human health, vegetation and climate.

The EU Thematic Strategy on Air Pollution identifies national emission ceilings for SO_2, NO_x, PM2.5, NH_3 and VOC that achieve multiple air quality and climate targets at least costs.

Solid fuel stoves and agriculture offer now the largest potential for further PM reductions in Europe

Costs for the further measures proposed by the European Commission



- Current EU regulation has cut emissions from power plants, industry and mobile sources.
- To further reduce ambient PM, the new Commission proposal sees largest cost-effective potentials for emissions from
  - domestic heating (solid fuels),
  - agriculture (NH_3 as a PM precursor).

Conclusions

- PM2.5 is currently the most serious air quality problem in the EU
- Legislation has established three lines for control: (i) ambient standards, (ii) emission limit values, (iii) national emission ceilings
- Despite the anticipated decline in precursor emissions, there remains a large potential for cost-effective further measures for which benefits exceed costs
- New focus on PM emissions from solid fuel (wood/coal) combustion in households and NH_3 from agriculture
- GAINS provides an integrated management approach for the European Commission: multi-pollutant/multi-effect, multiple scale, cost-effectiveness