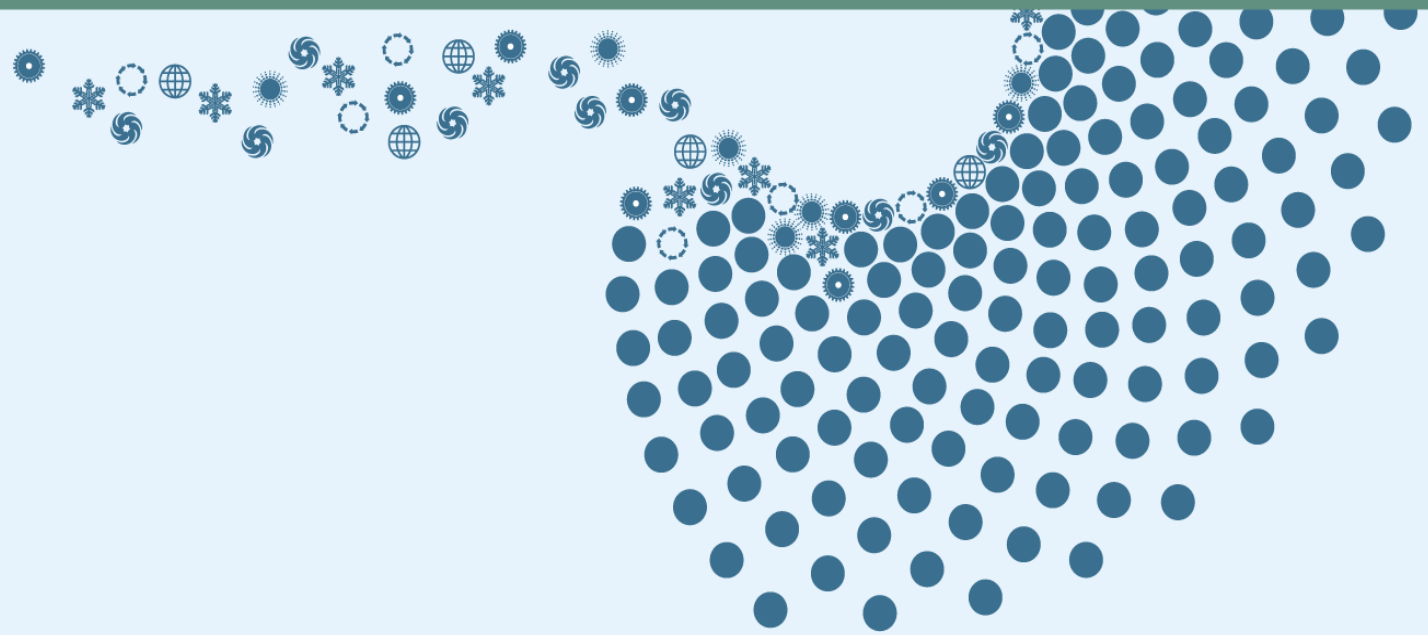
Statens forurensningstilsyn
Norwegian Pollution Control Authority

Vigdis Vestreng, Climate and Energy Section, Norwegian Pollution Control Authority

European road transport emissions linked to policy development



18th International Emission Inventory Conference. Comprehensive Inventories - Leveraging Technology and Resources. Baltimore, Maryland, 14-17 April 2009

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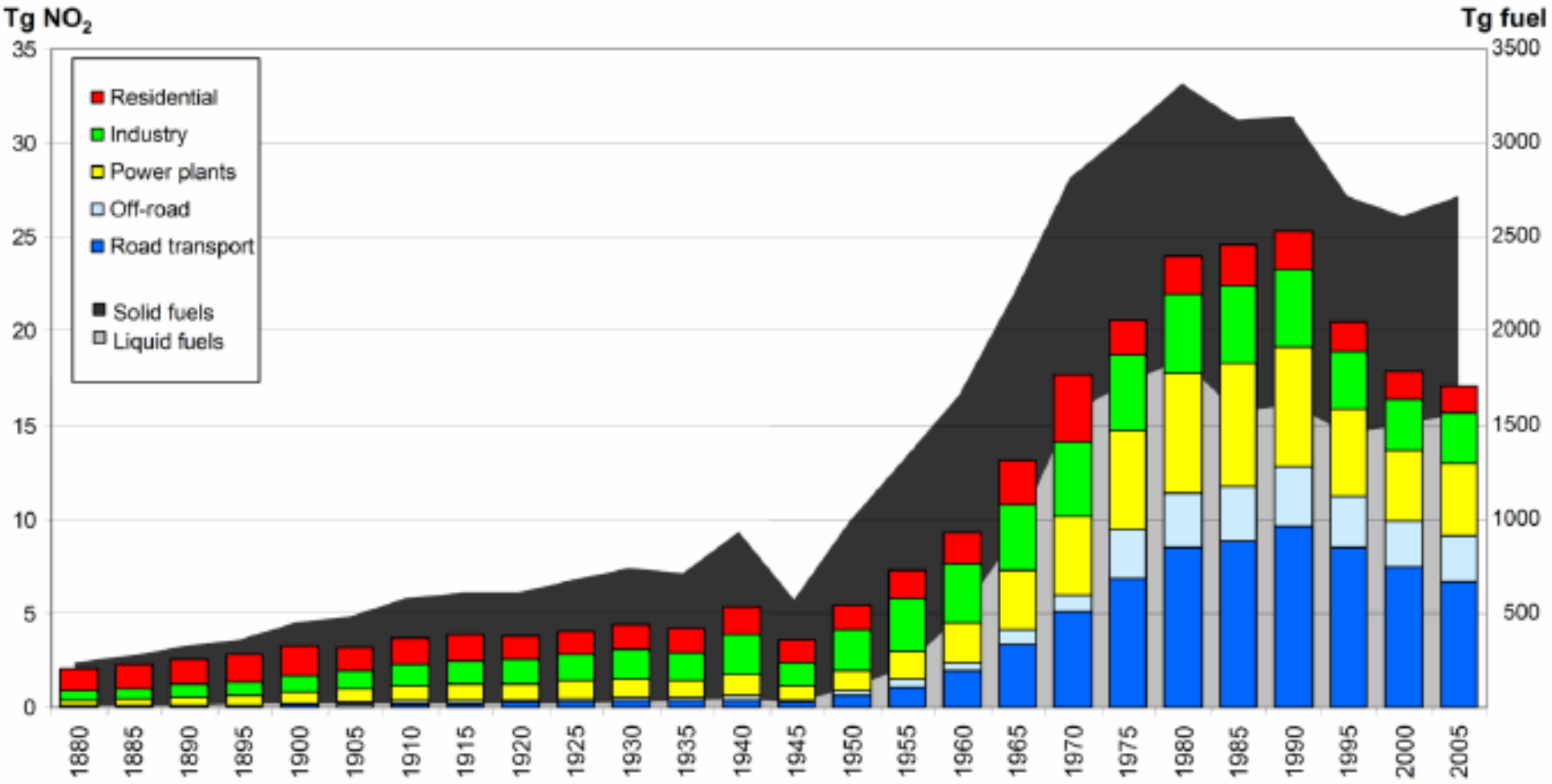
Overview

- Background
- Data sources & quality
- Results
- Conclusions
- Future perspectives

sft: The importance of road transport



Vestreng et al., ACP 2009

Instruments

UN and EC regulations

- 1958 ECE-R15
- 1988 NOx Protocol
- 1999 Multi-effect Protocol
- 2001 NEC Directive
- 1988/2001 LCP Directive
- 1997 Non-road mobile machinery Directive
- 2000 Waste Incineration Directive
- EURO Standards (post 1992 onwards)

Emission standards for road transport in Europe post-1992

Emission Standard	Impl. Year (1)	NO_x (g/km) or (g/kWh)	NO_x (Gg/PJ)	Main technology improvements over preceding step
Gasoline PCs and LDVs (g/km)				
Euro 1	1992	0.62 (2)	0.25	Closed-loop TWC (3)
Euro 2	1996	0.35 (2)	0.14	Faster light-off
Euro 3	2000	0.15	0.06	Faster light-off and twin lambda control
Euro 4	2005	0.08	0.03	Faster light-off and improved lambda control
Euro 5 & 6	2010-2015	0.06	0.02	Improved aftertreatment materials, deNOx for direct injection vehicles
Diesel PCs and LDVs (g/km)				
Euro 1	1992	0.90 (2)	0.44	Improved combustion
Euro 2	1996	0.67 (2)	0.32	Oxidation catalyst
Euro 3	2000	0.50	0.24	Two oxidation catalysts, high pressure injection
Euro 4	2005	0.25	0.12	Precise injection and pressure control
Euro 5	2010	0.18	0.09	Diesel particle filters
Euro 6	2010	0.08	0.04	deNOx, presumably SCR (3)
HDVs (g/kWh)				
Euro I	1992	8.0	0.84	Improved combustion
Euro II	1996	7.0	0.74	Electronic engine control
Euro III	2000	5.0	0.56	High pressure injection
Euro IV	2005	3.5	0.40	EGR, precise injection control
Euro V	2008	2.0	0.25	Cooled EGR (3) or SCR
Euro VI	2014	0.4	0.05	Presumably SCR+DPF (3), Draft proposal

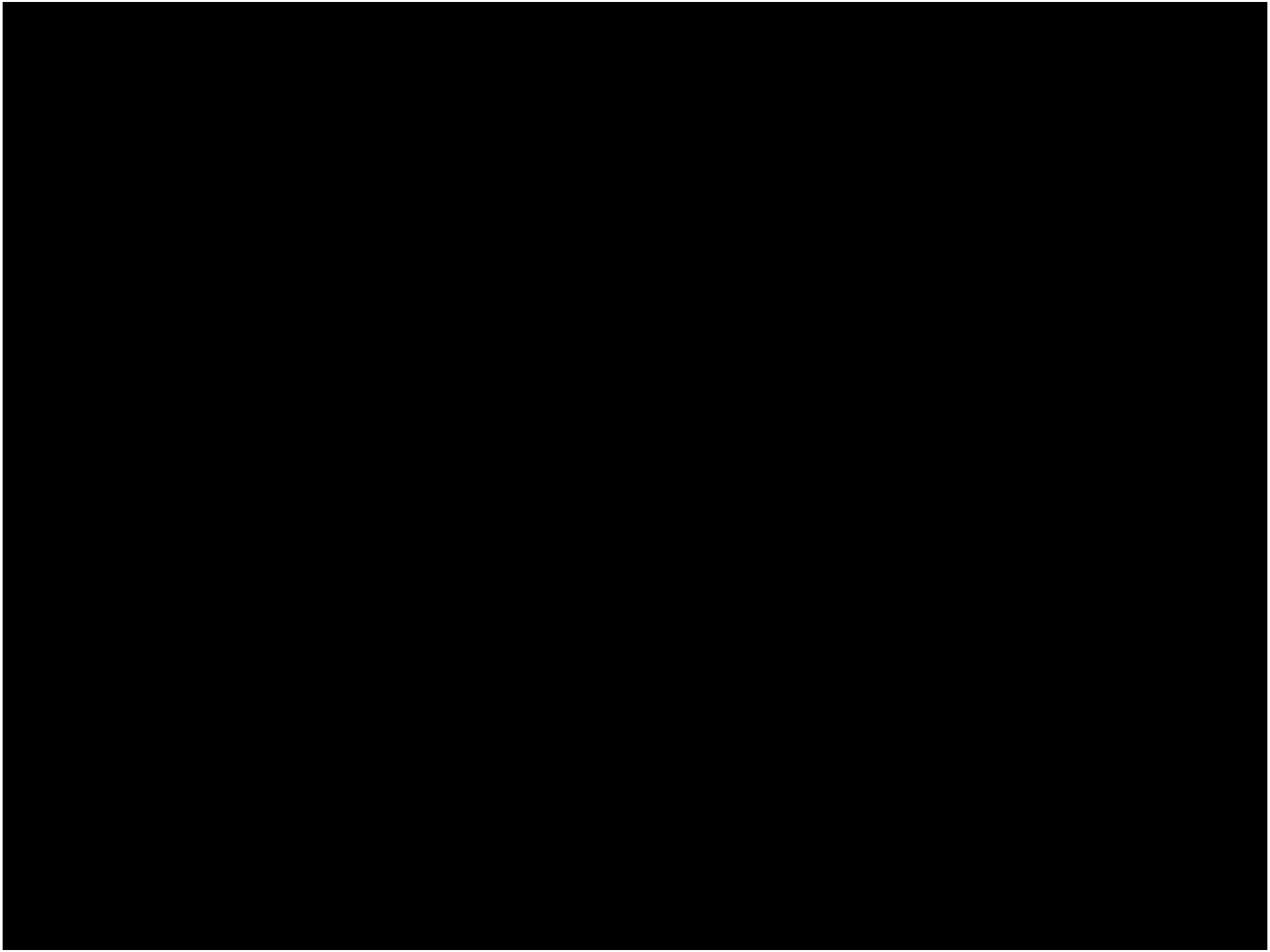
1. For LDVs and HDVs. For LDVs, the implementation date is roughly one year later than PCs to allow for calibration of new technology.

2. Regulations set a standard for the sum of HC and NOx emissions. The value quoted in the table is an inferred value based on typical HC/NOx split for the particular vehicle technology.

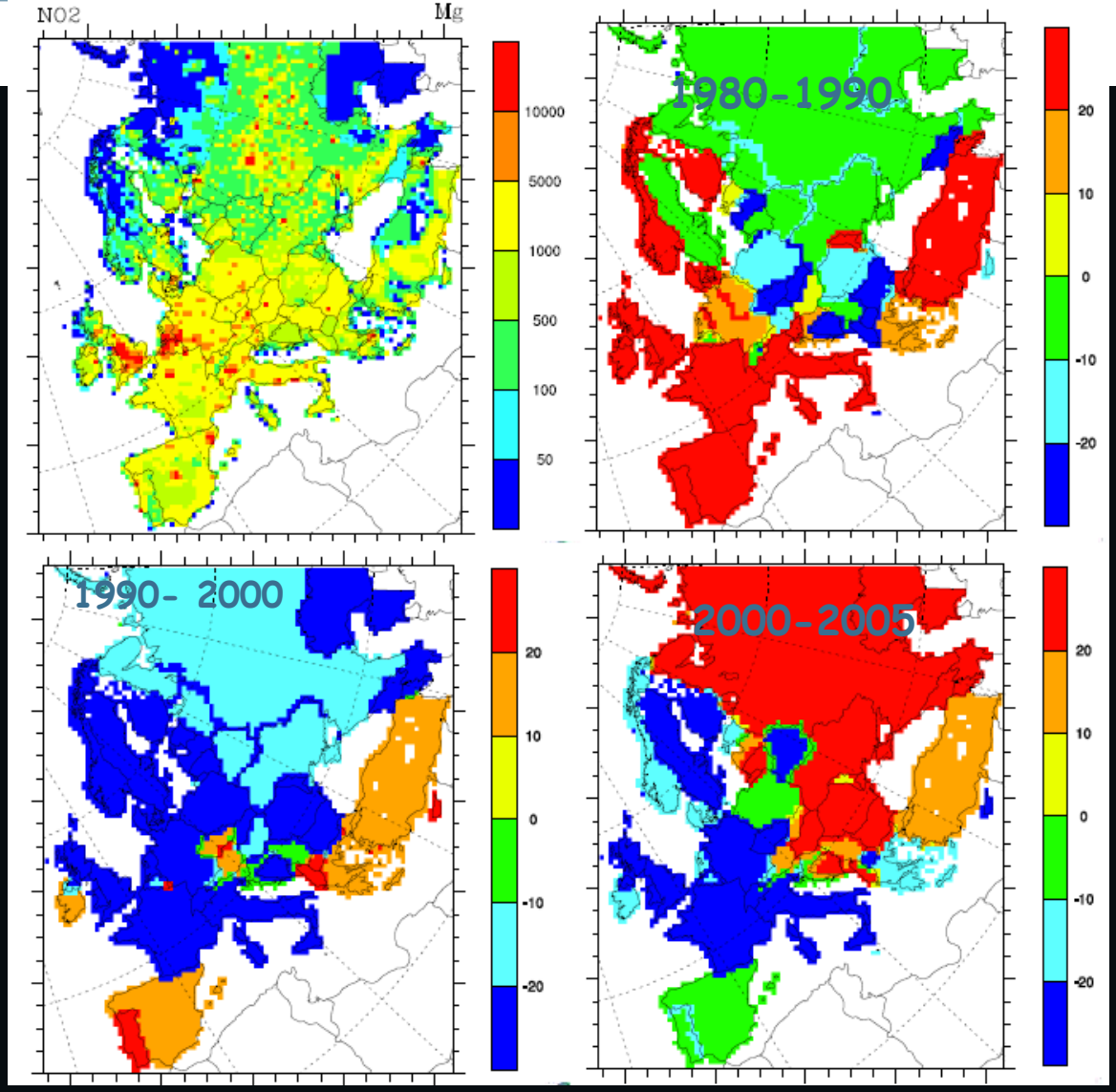
3. TWC: Three-way catalytic converter; SCR: Selective catalytic reduction; DPF: Diesel particle filter

Data sources

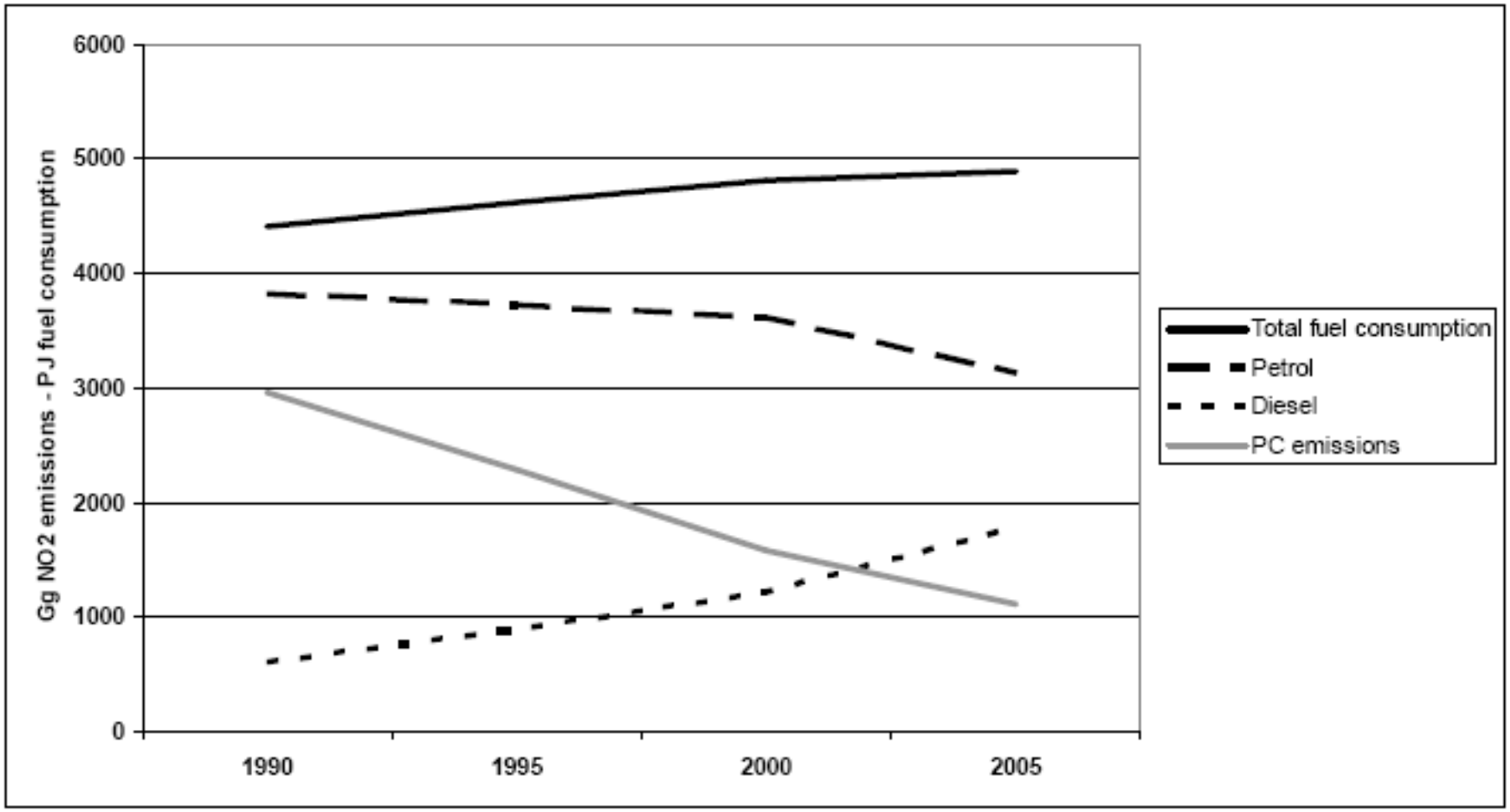
- WebDab (ceip.at)
- Gains (gains.iiasa.ac.at)
- Edgar (www.mnp.nl/edgar)

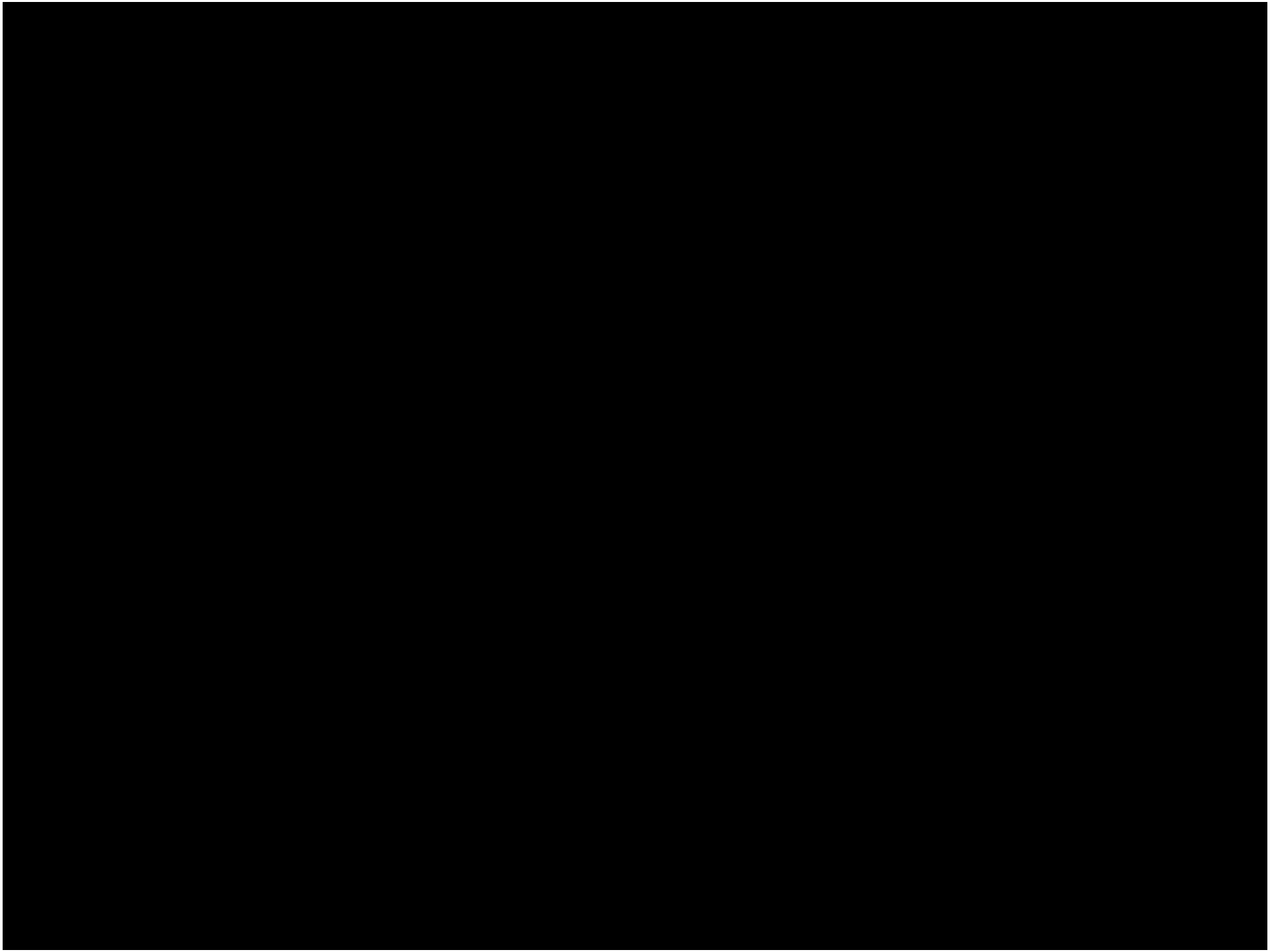


sft: Trends in road transport



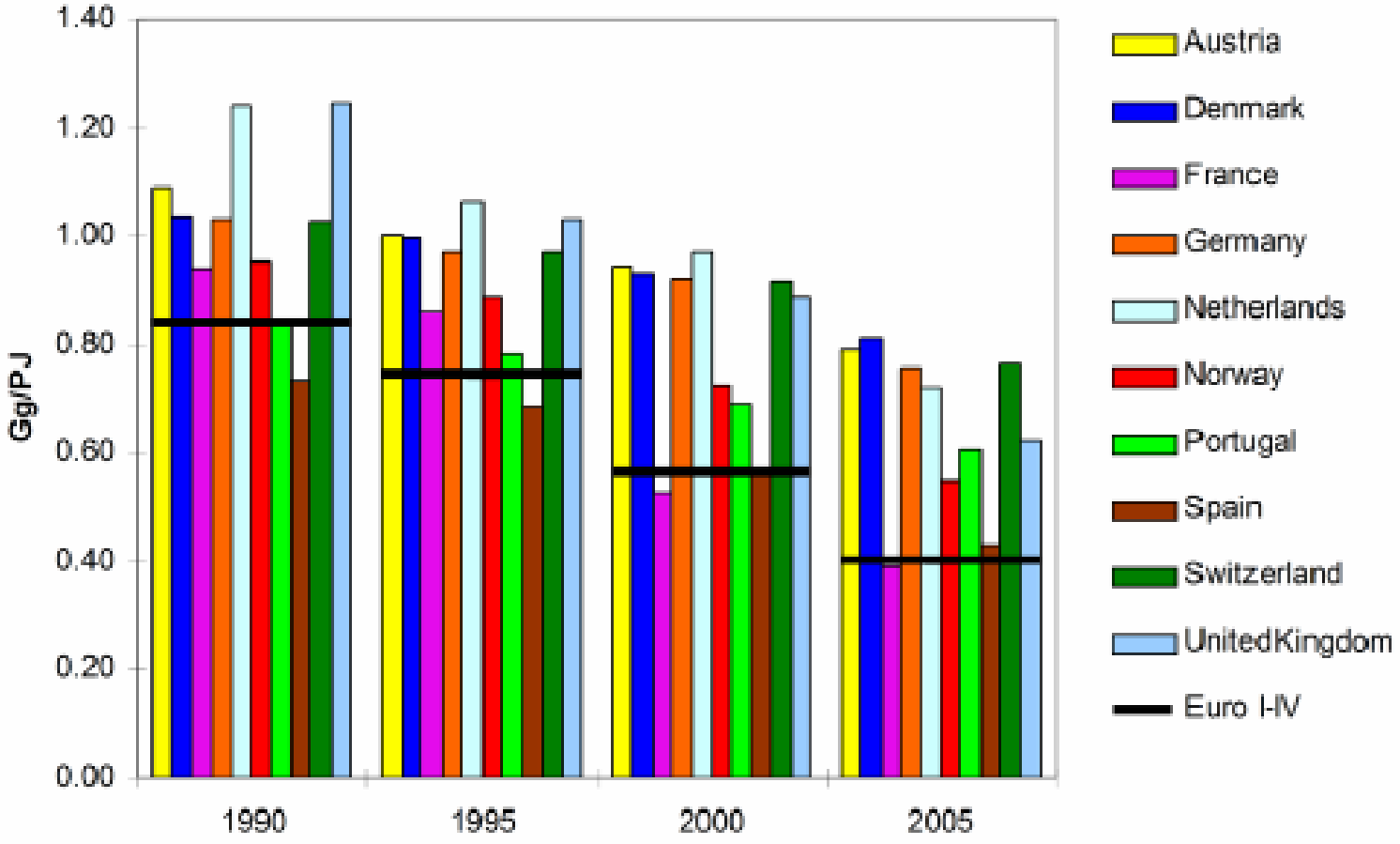
Effectiveness of policies: "Dieselization"





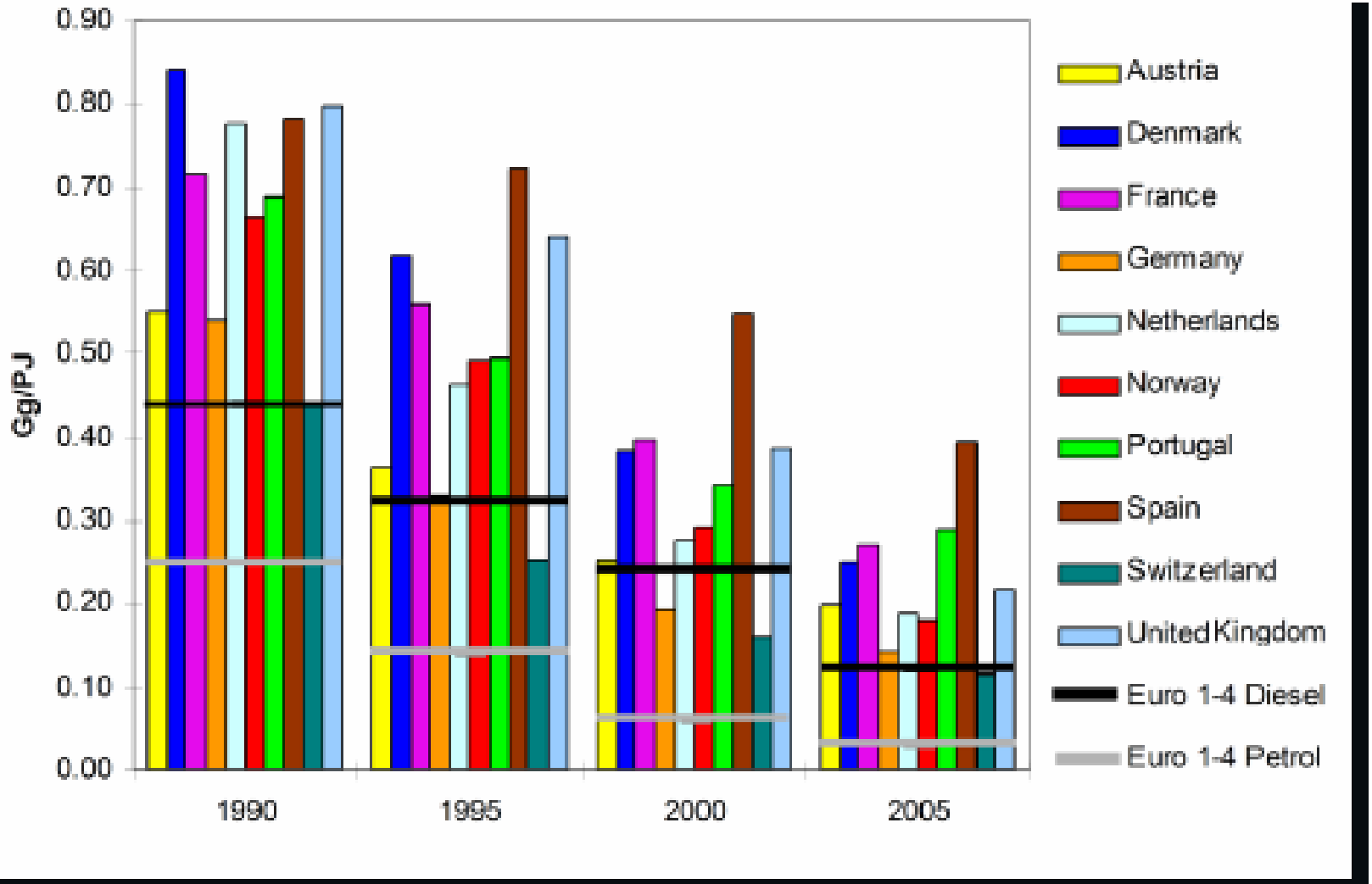
Effectiveness: Trends in IEFs - HDV

Euro I (1992) Euro II (1996) Euro III (2000) Euro IV (2005)



Effectiveness: Trends in IEFs - PC

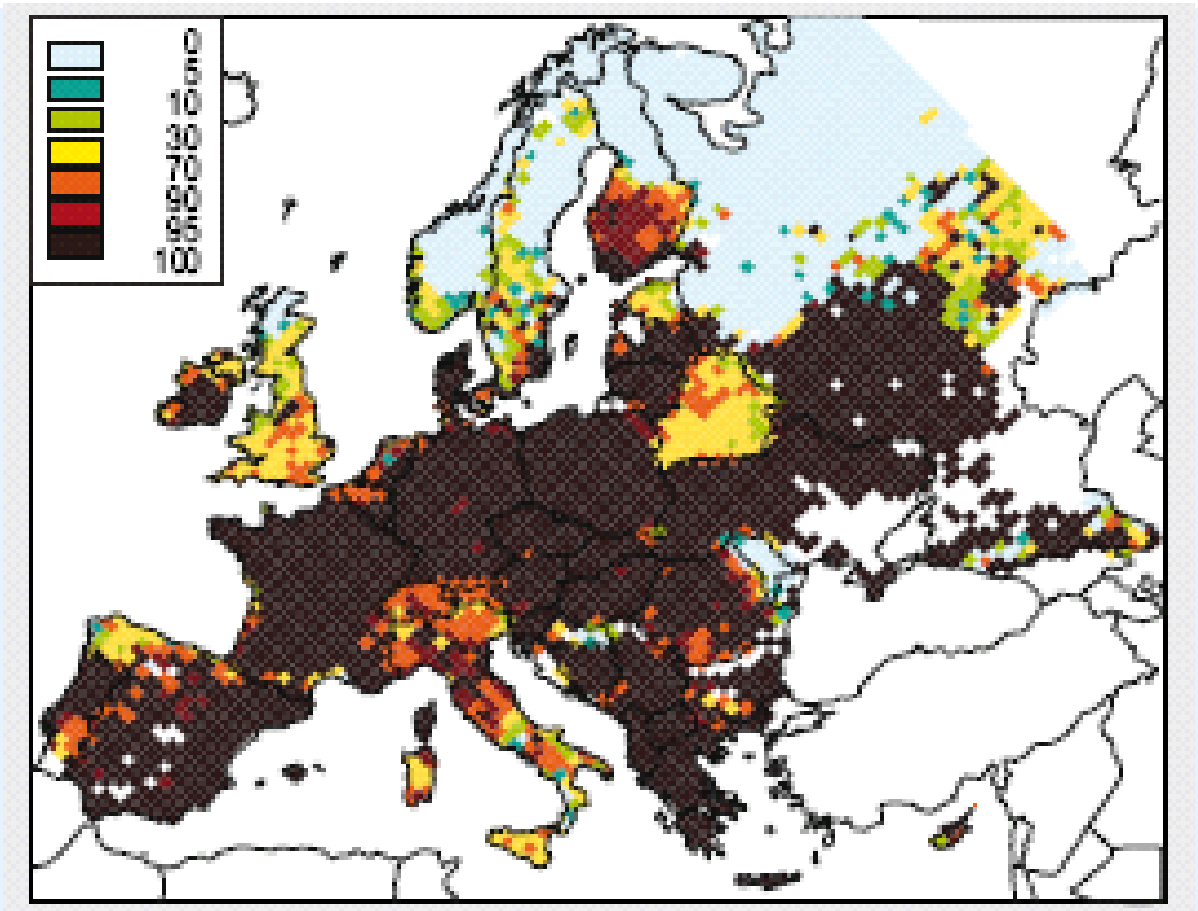
EURO 1 (1992) EURO 2 (1996) EURO 3 (2000) EURO 4 (2005)



s ft: Conclusions

1. European policies have facilitated substantial NO_x reductions from road transport.
2. Increasing emissions in the Eastern part of Europe.
3. The ECE-15 regulations postponed the onset of the downward road transport emission trend
4. "Dieselization" has hampered larger NO_x reductions.
5. Holistic approach
6. Effectiveness of policies hampered by slow vehicle turn over and loopholes in the type approval testing.
7. Continued monitoring and abatement of air pollution

sft: Eutrophication



Vegetation – Nitrogen deposition. Source: IIASA

Brown colour:
95-100% of ecosystems are not protected against eutophication (2000)

s ft: Conclusions

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Future perspectives

- **Revision of GP and NECD**
- **Financial crises**
- **Climate change mitigation**
  - Increase in primary NO2 emissions
  - Increase in NOx/VOC ratio
  - Implications of biofuels


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Thank you for your attention!

EURO standards:

http://europa.eu/scadplus/leg/en/lvb/l28186.htm

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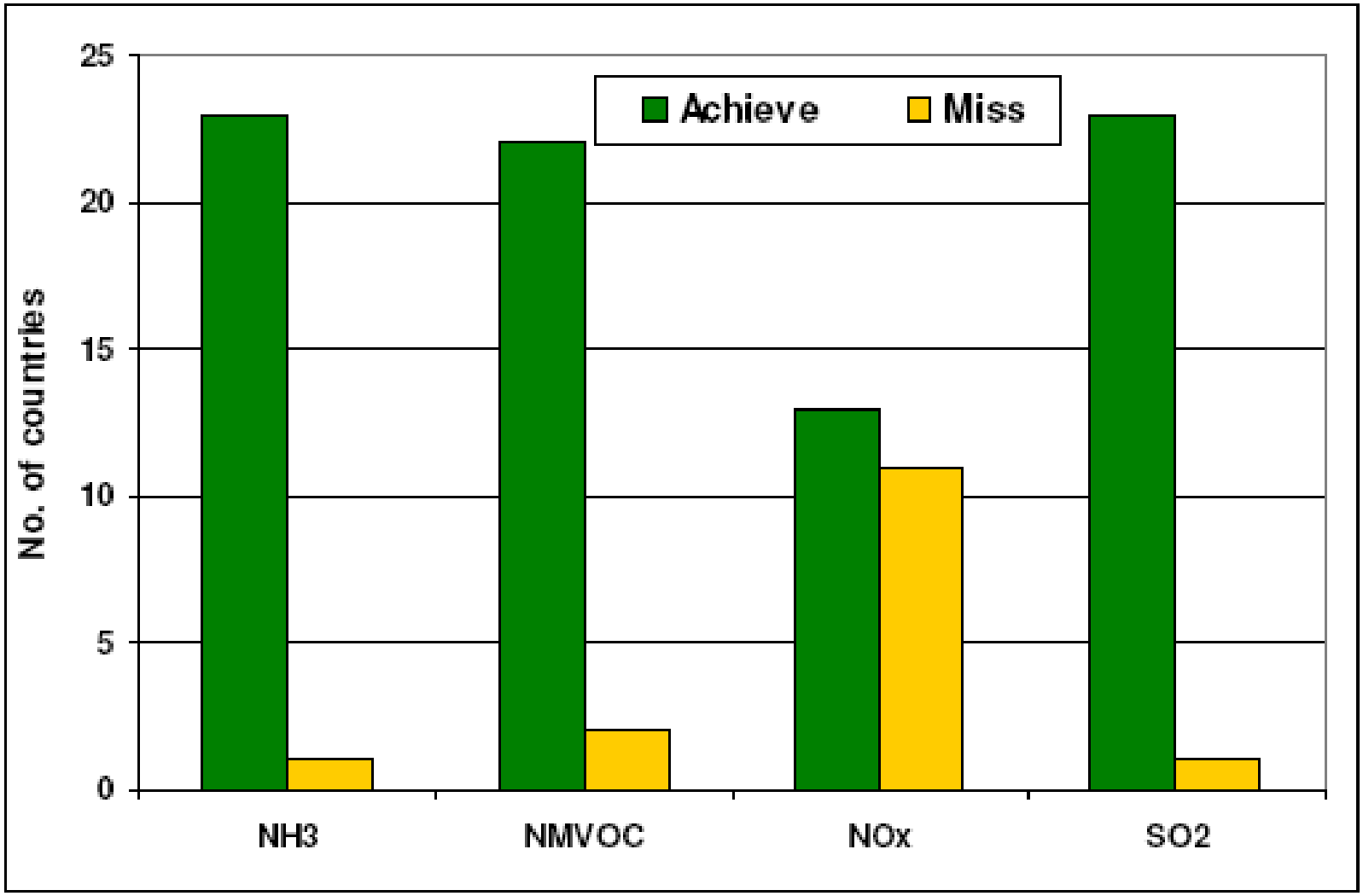
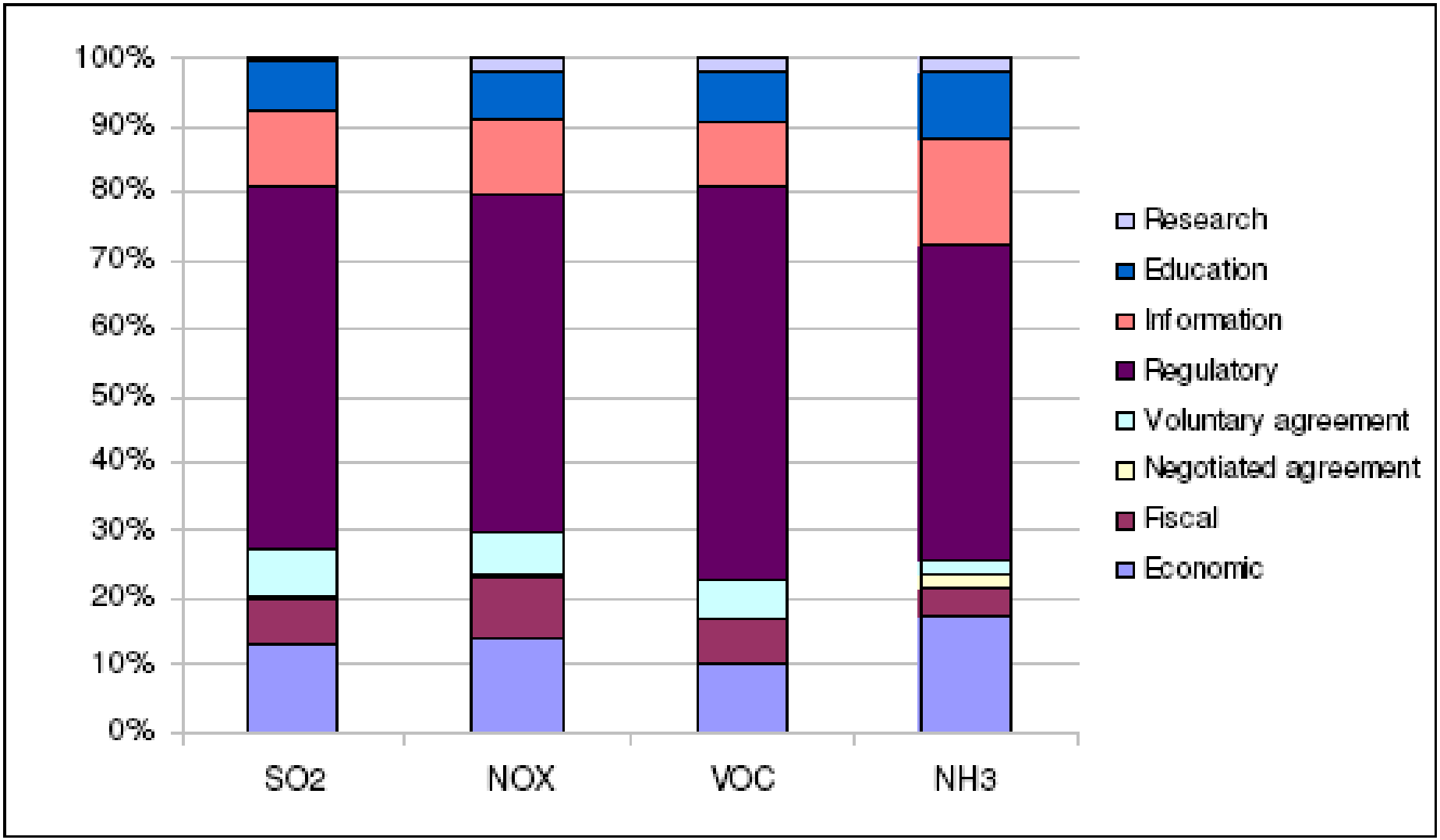
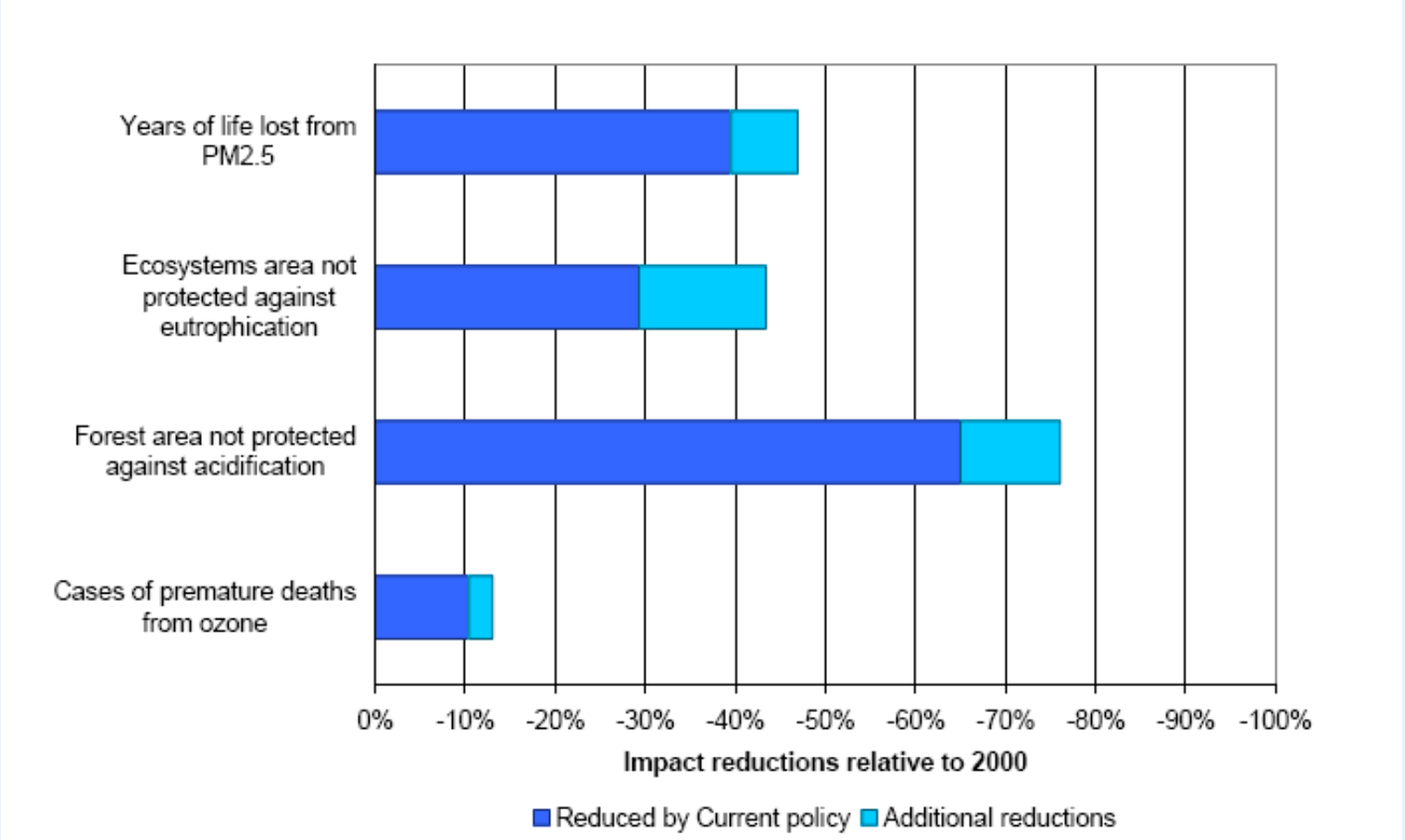
EU Member States' projected compliance with NEC emission ceilings in 2010



Type of policy instrument used to target reductions for different NECD pollutants (% of total measures cited)



EU ambition level for reduction of adverse effects (TSAP)



Thematic Strategy on Air Pollution (TSAP) environmental objectives

The environmental objectives that are expressed in the TSAP as relative improvements of impact indicators for human health and ecosystems:

1. **Health effects from fine particulate matter,** i.e., the number of life years lost (YOLLs) from PM2.5, should decline by 47 % between 2000 and 2020;

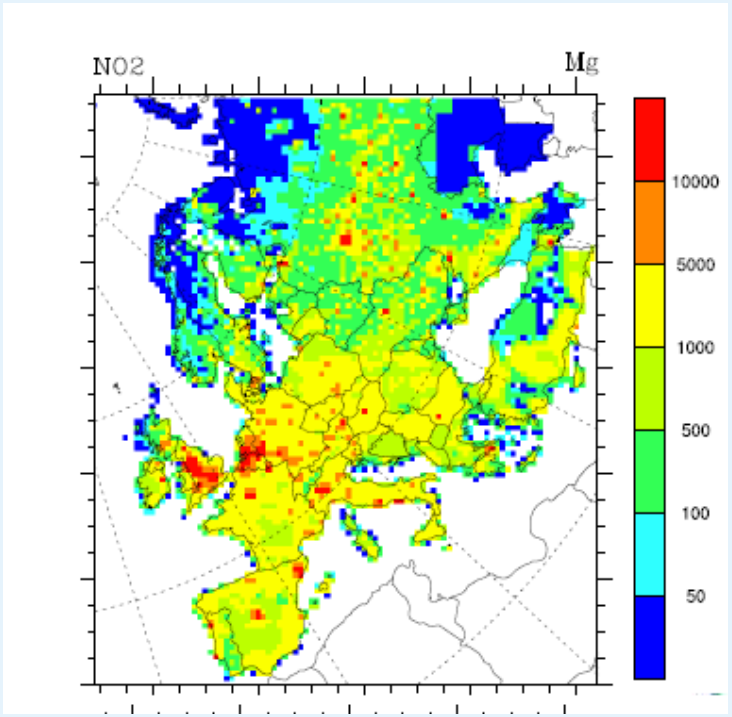
2. **Cases of premature deaths** attributable to the exposure to **ground-level ozone** should decline by at least 10 % ;

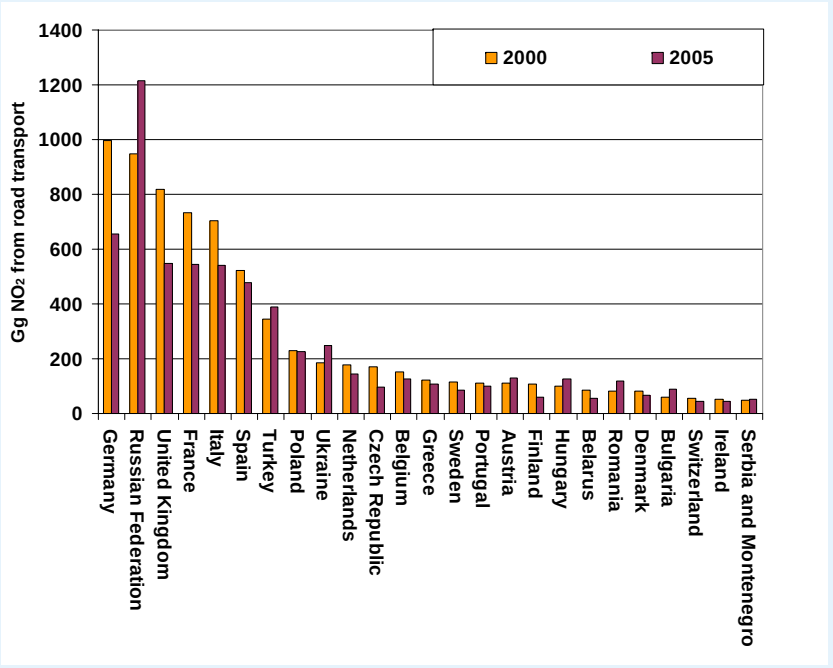
3. **Area of ecosystems** that is not protected against **excess nitrogen deposition** threatening biodiversity should be reduced by 43 % in comparison to 2000;

4. **Forest area** receiving unsustainable levels of **acid deposition** should shrink by 74 %;

TSAP has specified additional targets for the protection of freshwater ecosystems against acidification (39%) and for vegetation damage from ground-level ozone (15%). **These targets have not been used as primary targets for the GAINS optimization, but their achievement through the optimized scenarios presented in this report has been confirmed in an ex-post analysis.**

s ft: Largest contributors and recent trends





Thank you! Questions?

History of observed effects

Severe fish kills in Scandinavia in the 1960's and 70's, due to acidified waters

Courtesy: WGE