

Air Pollution Emission Controls in Europe

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Greenhouse Gases

Figure 1: EU greenhouse gas emissions 1990-1999¹

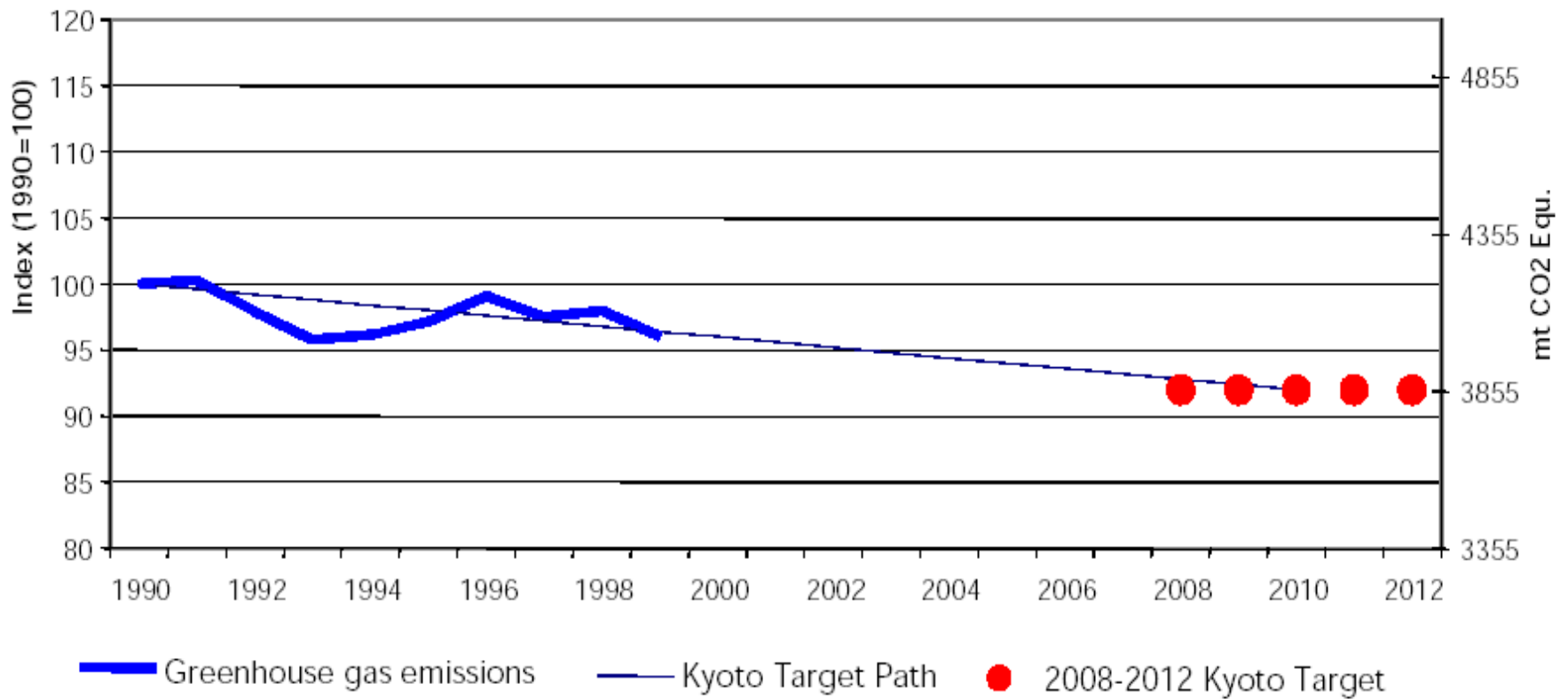
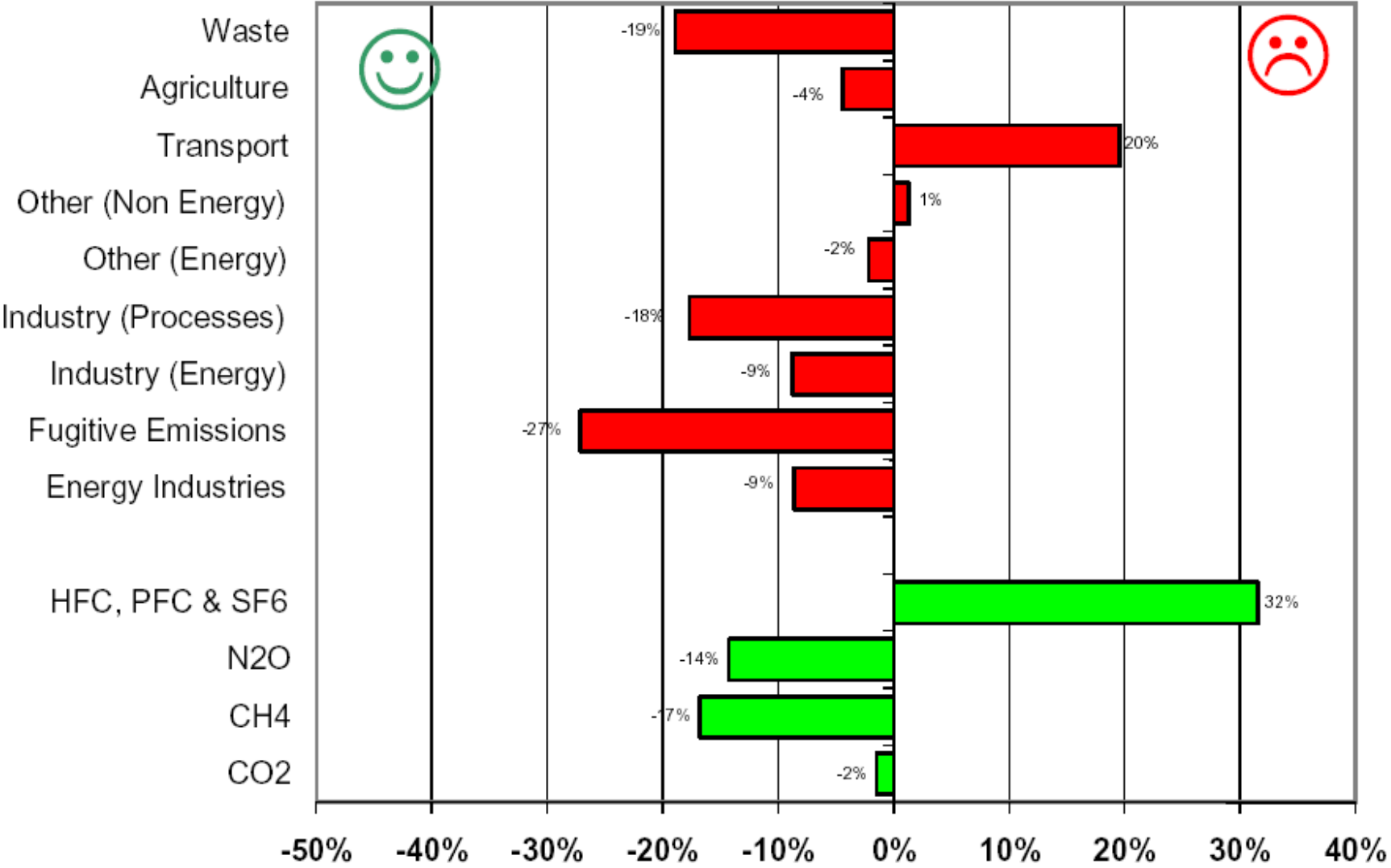
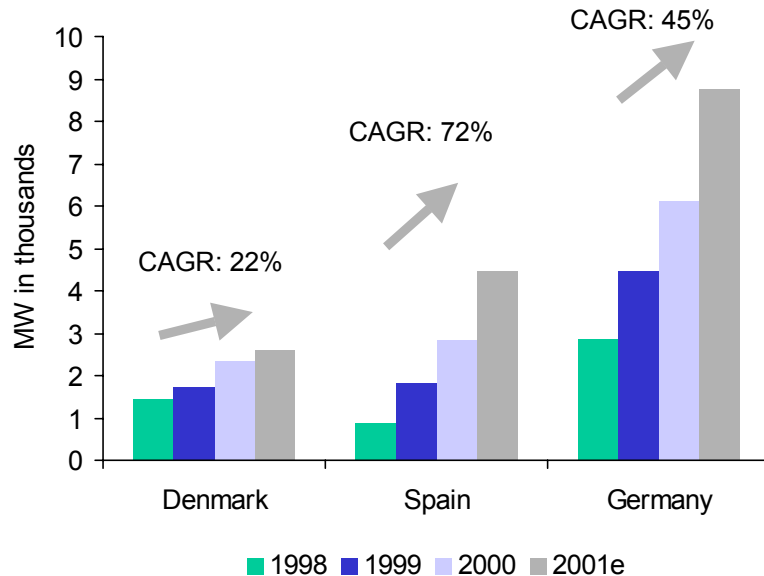


Figure 3. Change (%) in EU greenhouse gas emissions by sector and pollutant (1990-1999)



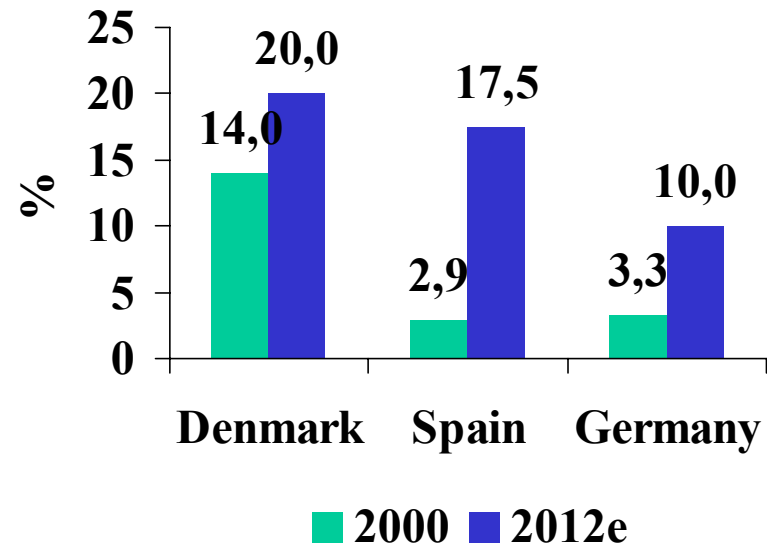
Wind Energy Leaders: Germany, Denmark and Spain

Total wind energy capacity installed



Source: BTM March 2001, DEWI 2002;
Germany 2001 actual, not estimate

Share of total electricity output

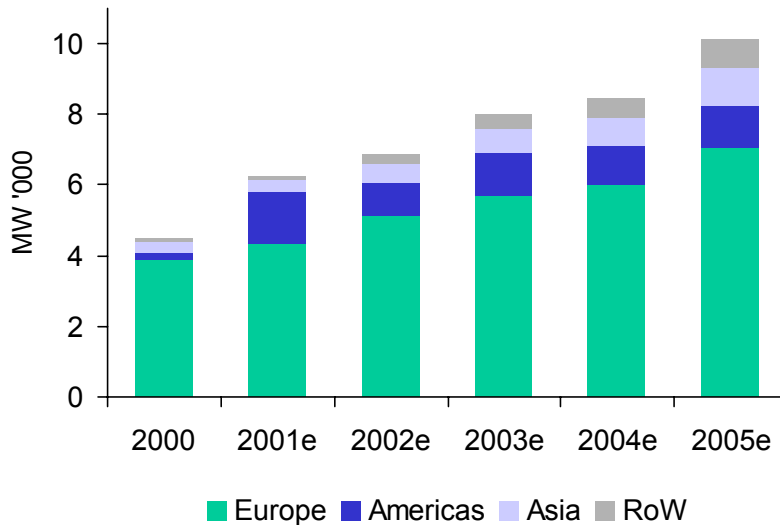


Source: WestLB Panmure September 2001;
Germany 2000 = 2001 actual (DEWI 2002)

- ▶ In 2000, these three countries accounted for almost 85% of the European wind turbine market
- ▶ Under peak conditions wind energy already accounts for over 14% of electricity supplied in Denmark; 1 of 20 individuals in Denmark has direct ownership in a wind turbine
- ▶ The German government anticipates more than 6% of total energy generation to come from wind in 2010; Schleswig Holstein expects up to 50% of its electricity to be wind generated by 2010

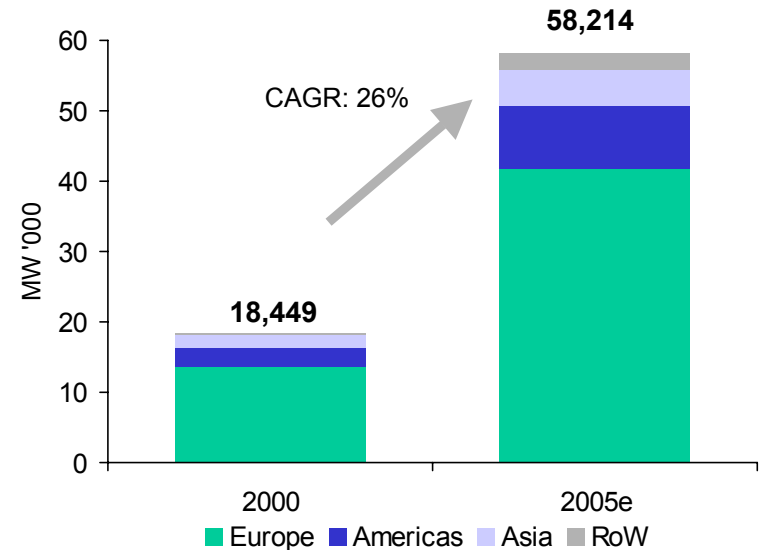
Wind Market

Global Capacity Additions (in MW)



Source: BTM March 2001

Global Cumulative Capacity

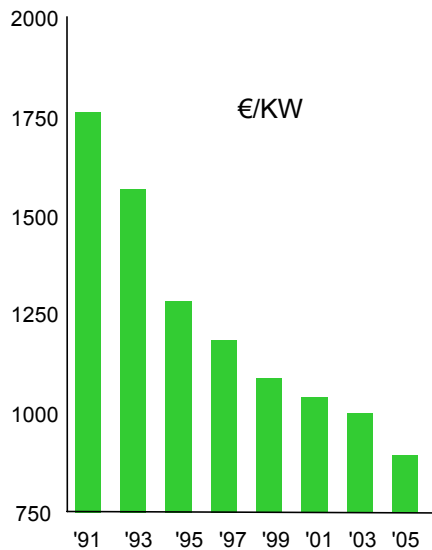


Source: BTM March 2001

- Europe is set to continue to remain the most attractive region for the wind turbine industry

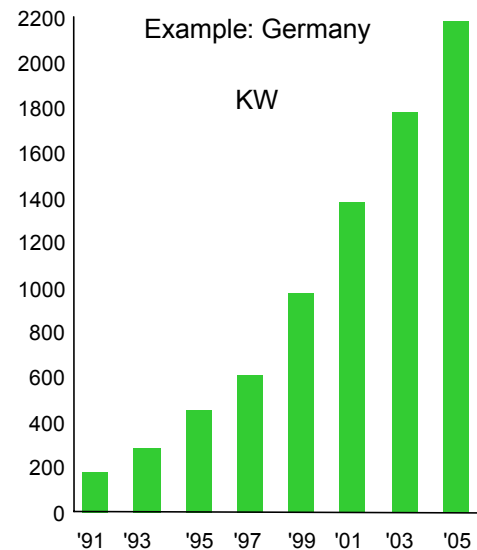
Increasing Size, Decreasing Cost

Average Price per Capacity in Germany



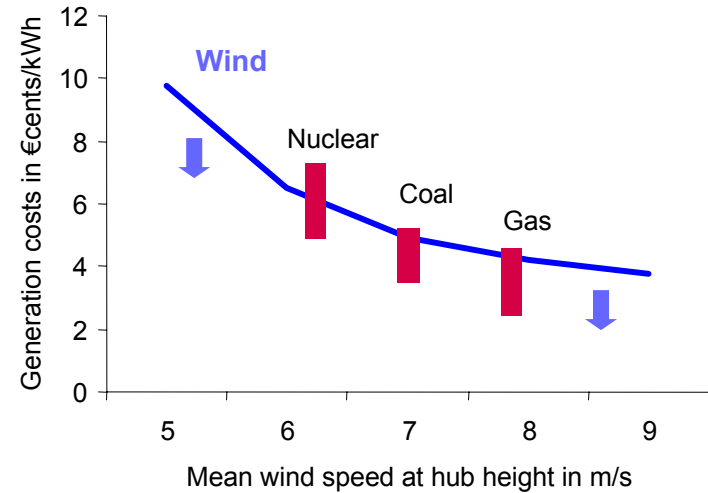
Source: BTM 2001

Average size of newly installed turbines



Source: BTM 2001

Cost of Electricity Generation



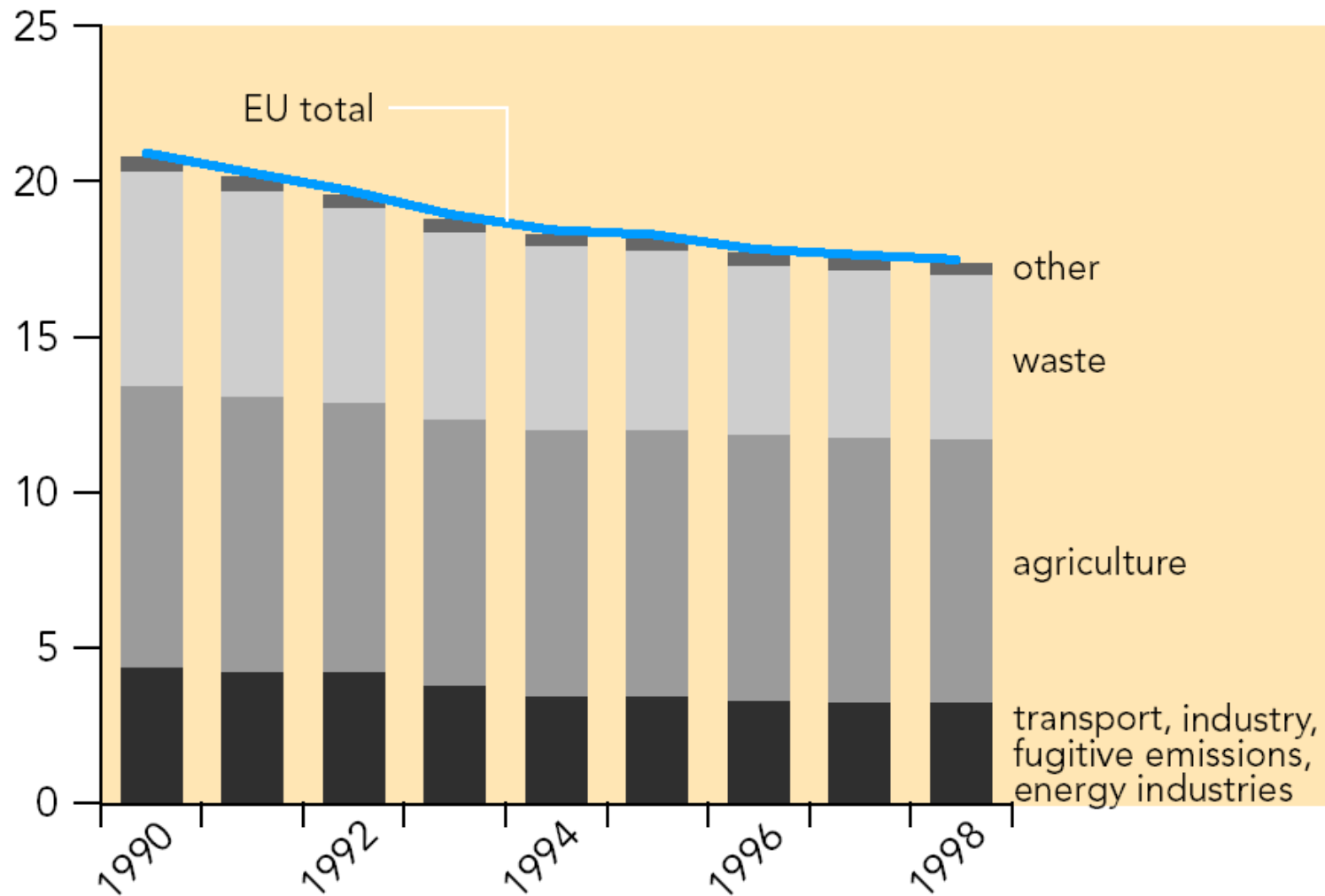
Source: Windpower monthly, January 2001; European Commission 2001

- In 2005 the average size of wind turbines is expected to be 10 times the size of 1991 average price per machine will be half of the price level seen in 1991

Figure 9.5.

Total EU emissions of methane

million tonnes



Source: EEA

Figure 9.2.

Total EU greenhouse gas emissions (carbon dioxide, methane, nitrous oxide, fluorinated gases)

million tonnes CO₂-equivalent

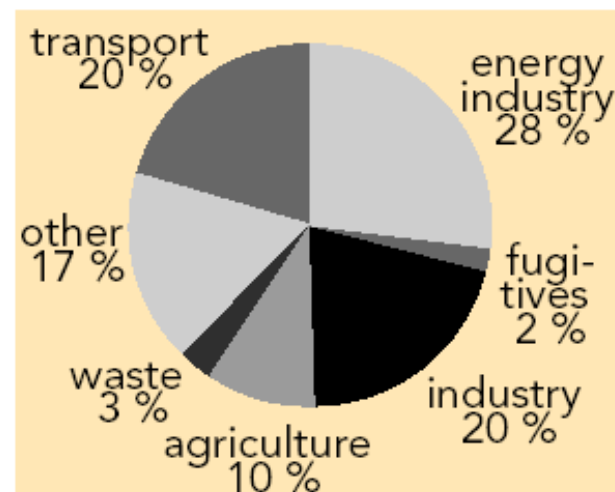
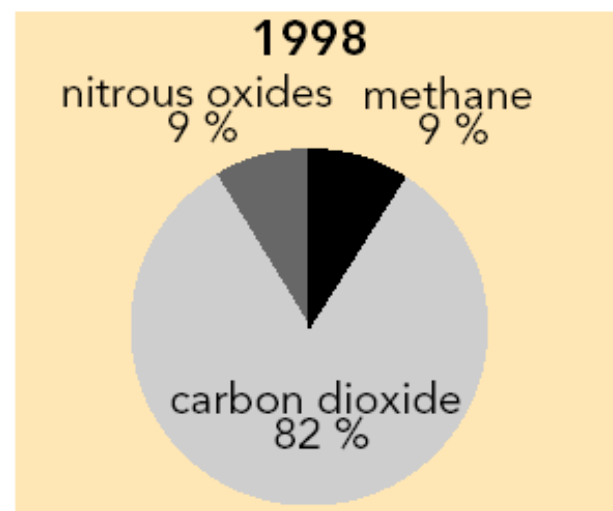
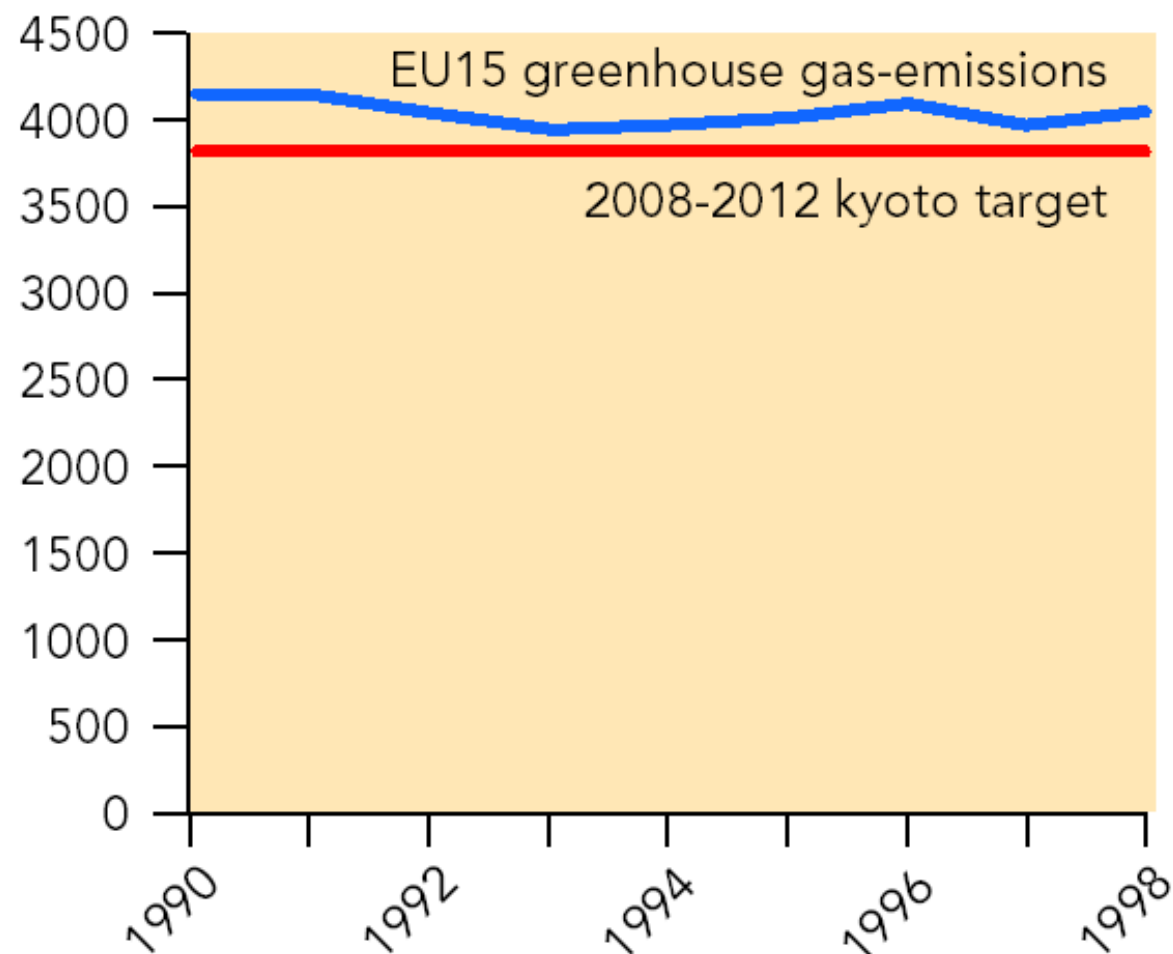
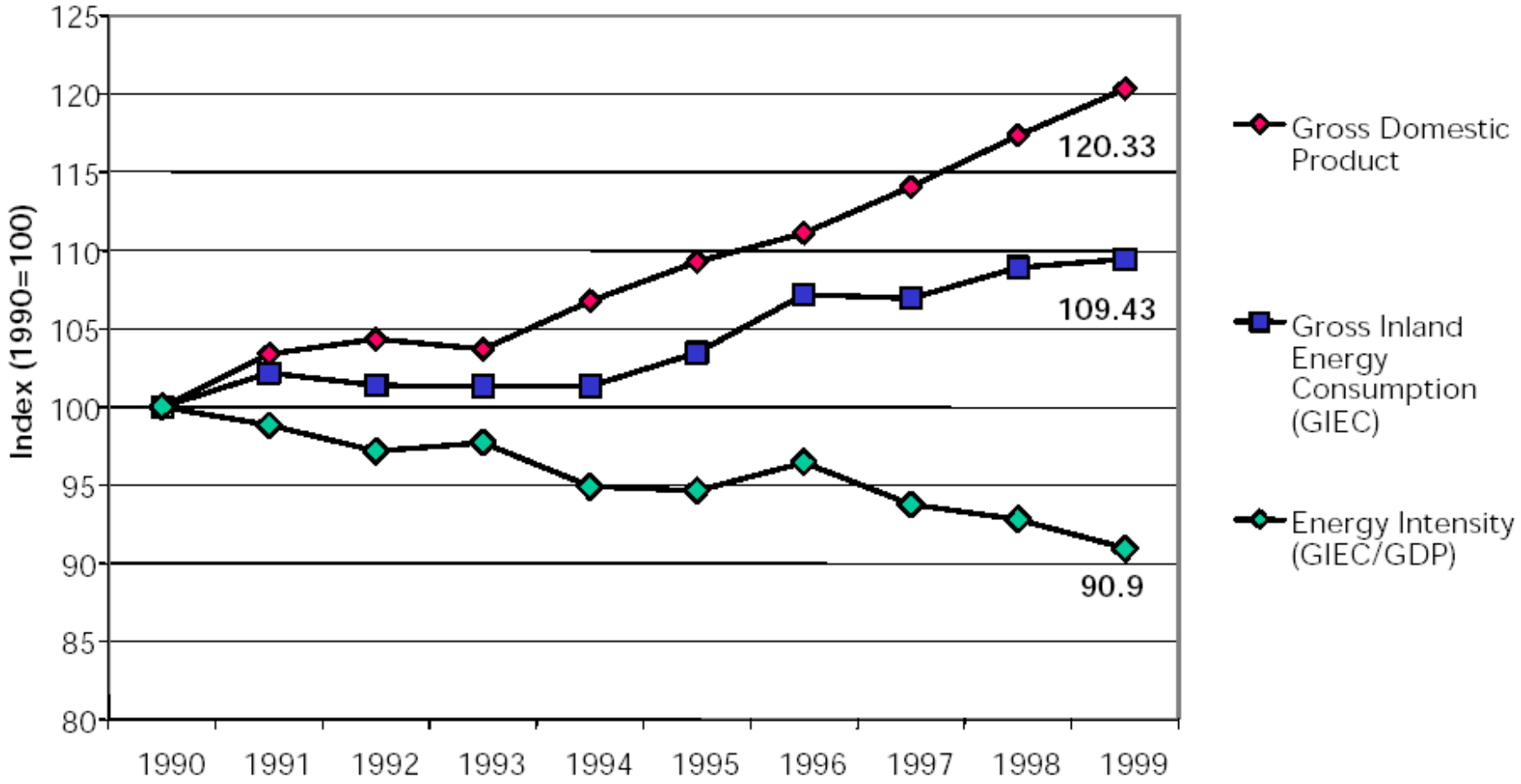


Figure 4. Index of energy intensity, EU15





CO₂ Voluntary Agreement : ACEA

Agreement between European manufacturers (ACEA) and the Commission for passenger cars (M₁):

- 140 g/km CO₂ for average of new car sales by ACEA members in the EU by 2008 (25% reduction)
- ACEA to review potential for further improvements in 2003 - indicative target range 165-170 g/km
- To move towards 120 g/km average by 2012
- Commitment based on existing test procedure
- Agreement will end in 2008 - but may be

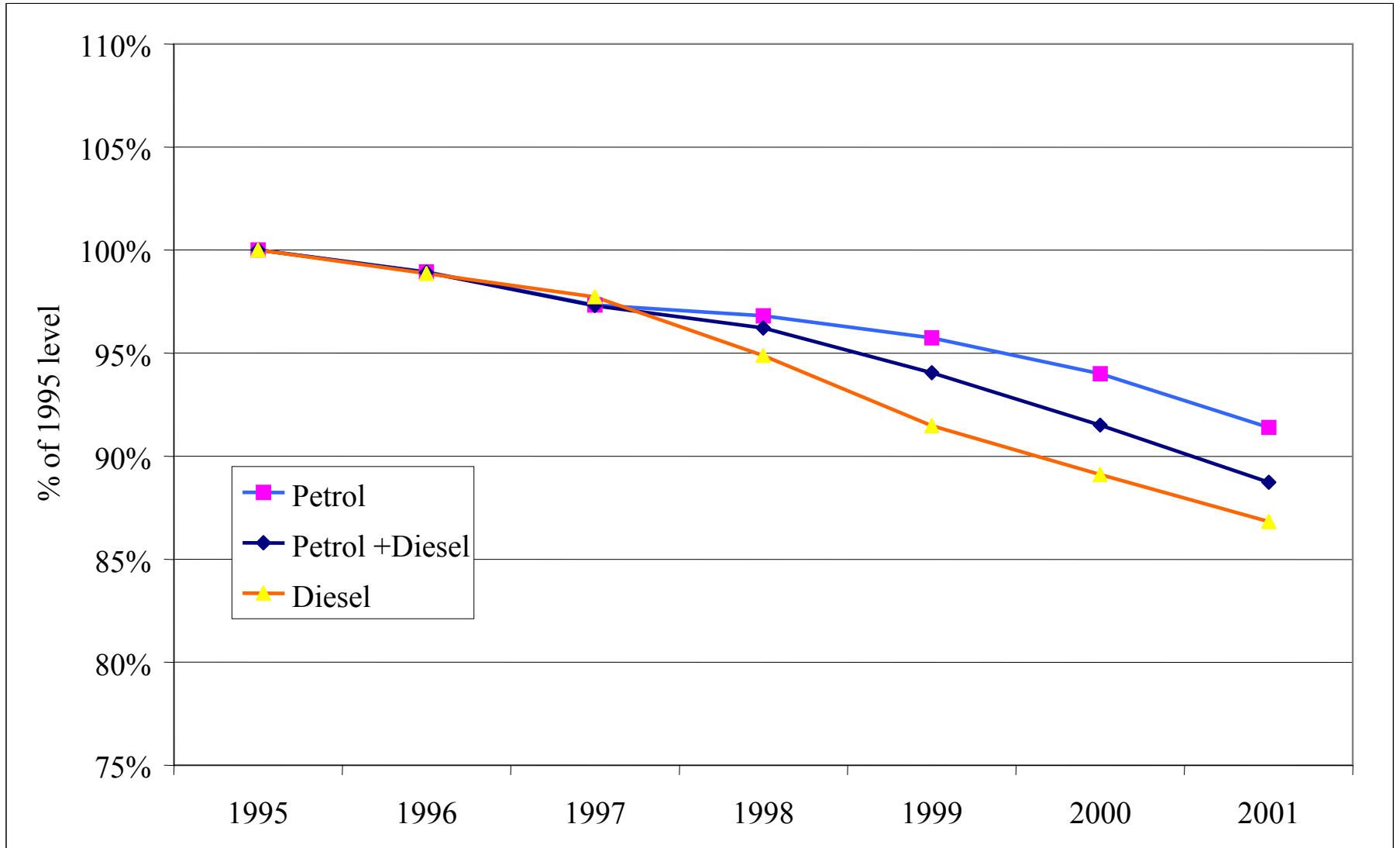
CO₂ : monitoring and labelling

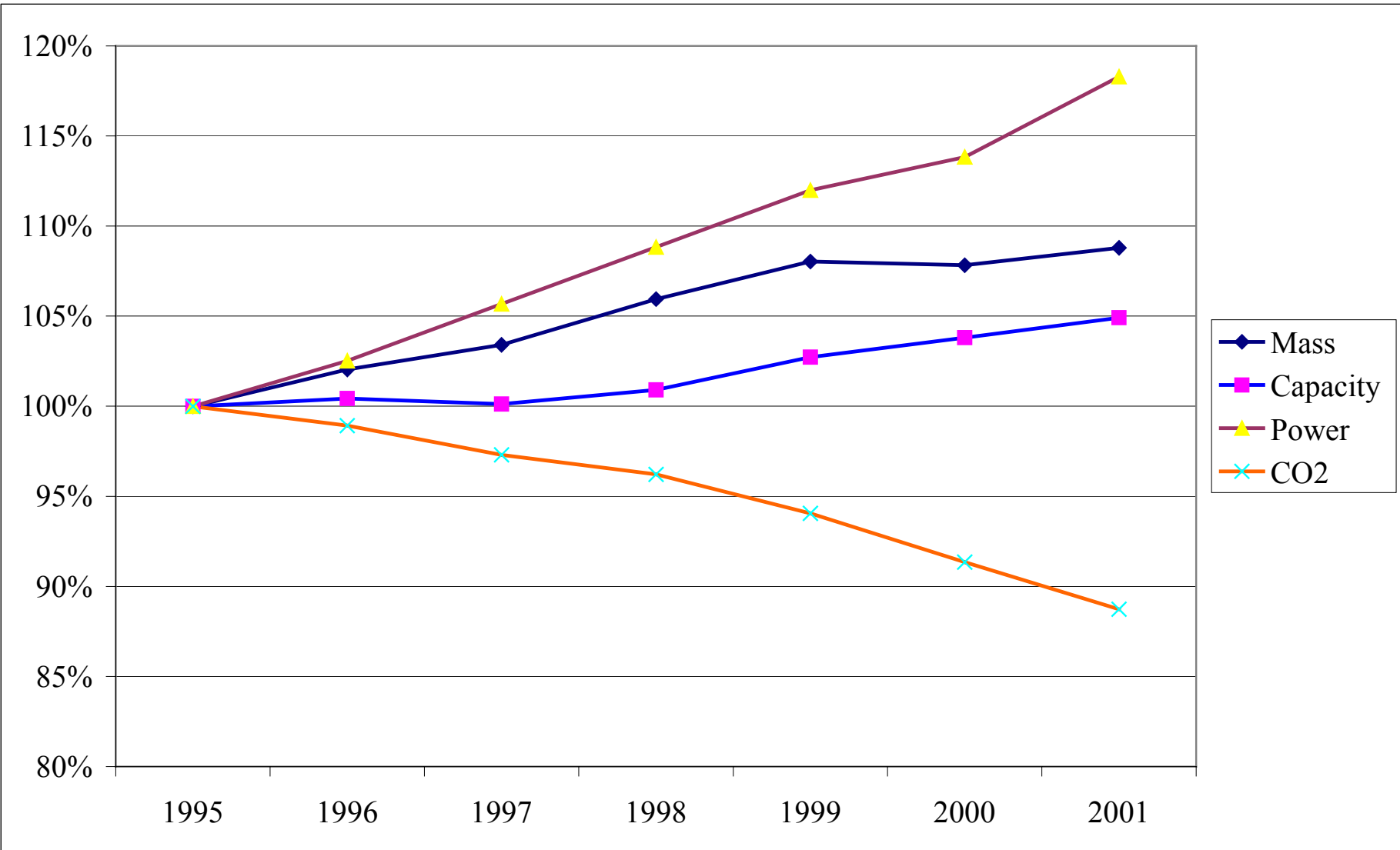


- Commission will report annually to Council and Parliament on the implementation of the agreement and progress of average CO₂ emissions
- Member-States data on new vehicles, ACEA market average figure
- labelling information, e.g. at point of sale, to enable consumer choice

EU-directive in force since Jan. 2001

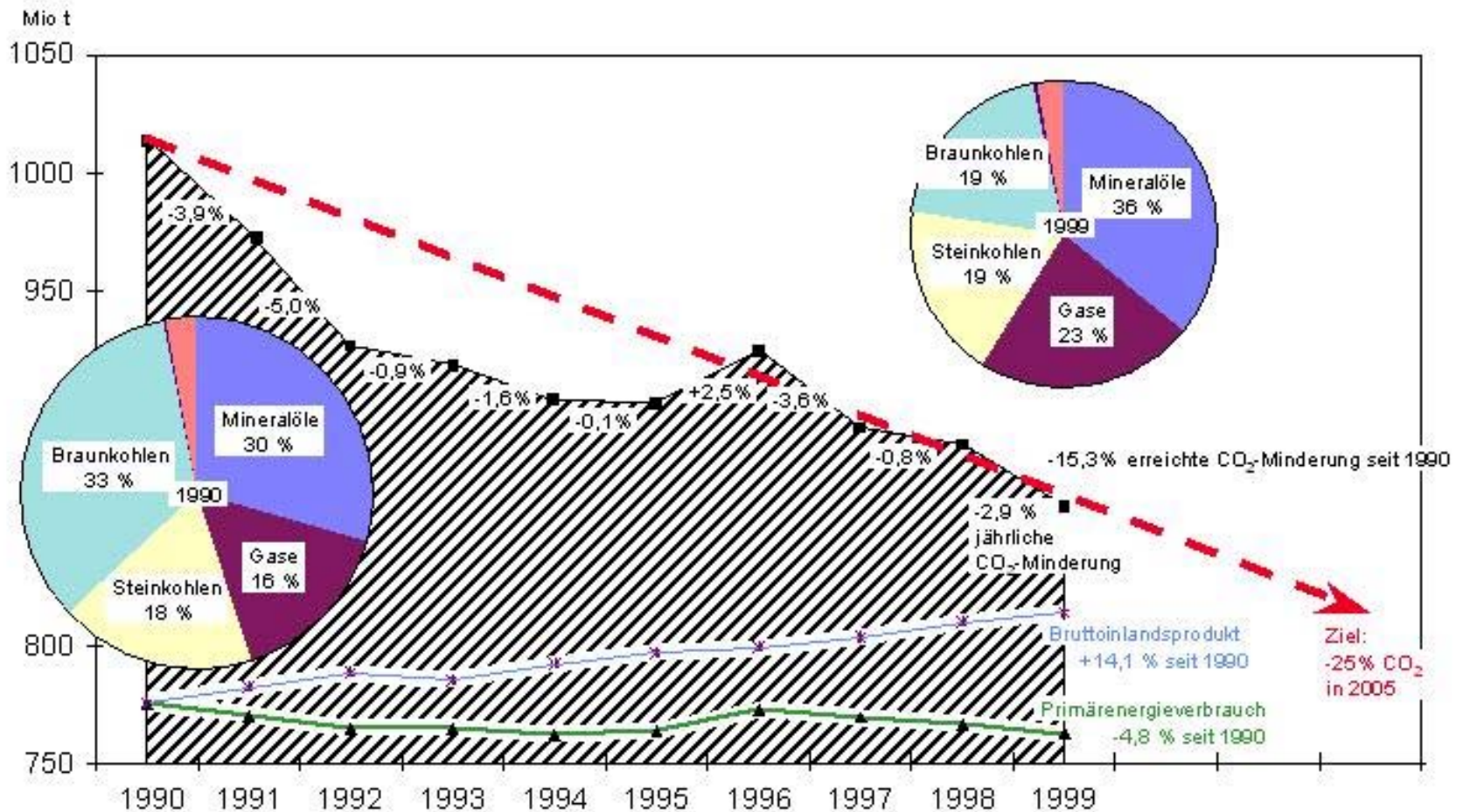
ACEA's CO₂ Reduction Index (1995= 100)





CO₂-Emissions in Germany and the Shares of Fossil Energy Carriers

CO₂-Emissionen in Deutschland
und die Emissionsanteile fossiler Energieträger



National Plan to reduce Greenhouse Gases

Each Ministry has to supply a defined
amount of CO₂ Reduction

e.g. Ministry of Transport:

15- 20 Mio t of CO₂ until 2005

Measure	Reduction in mio t until 2005 compared to 1990	Reduction in mio t until 2010 compared to 1990
Eco tax reform	6 to 8	
CO ₂ -reduction by new vehicles / voluntary agreement with automotive industry	4 to 7	10
Financial incentives for low sulfur fuels	2 to 5 Estimate of the German car manufactures. Reductions already included in the voluntary agreement	

Measure	Reduction in mio t until 2005 compared to 1990	Reduction in mio t until 2010 compared to 1990
Energy Strategy in the transpor sector	-	1 to 2 Estimate of the German vehicle manufactures
Truck mileage depending Road Tax	5	not quantifiable
Information campaign for fuel efficient driving	5	not quantifiable

Pollutants

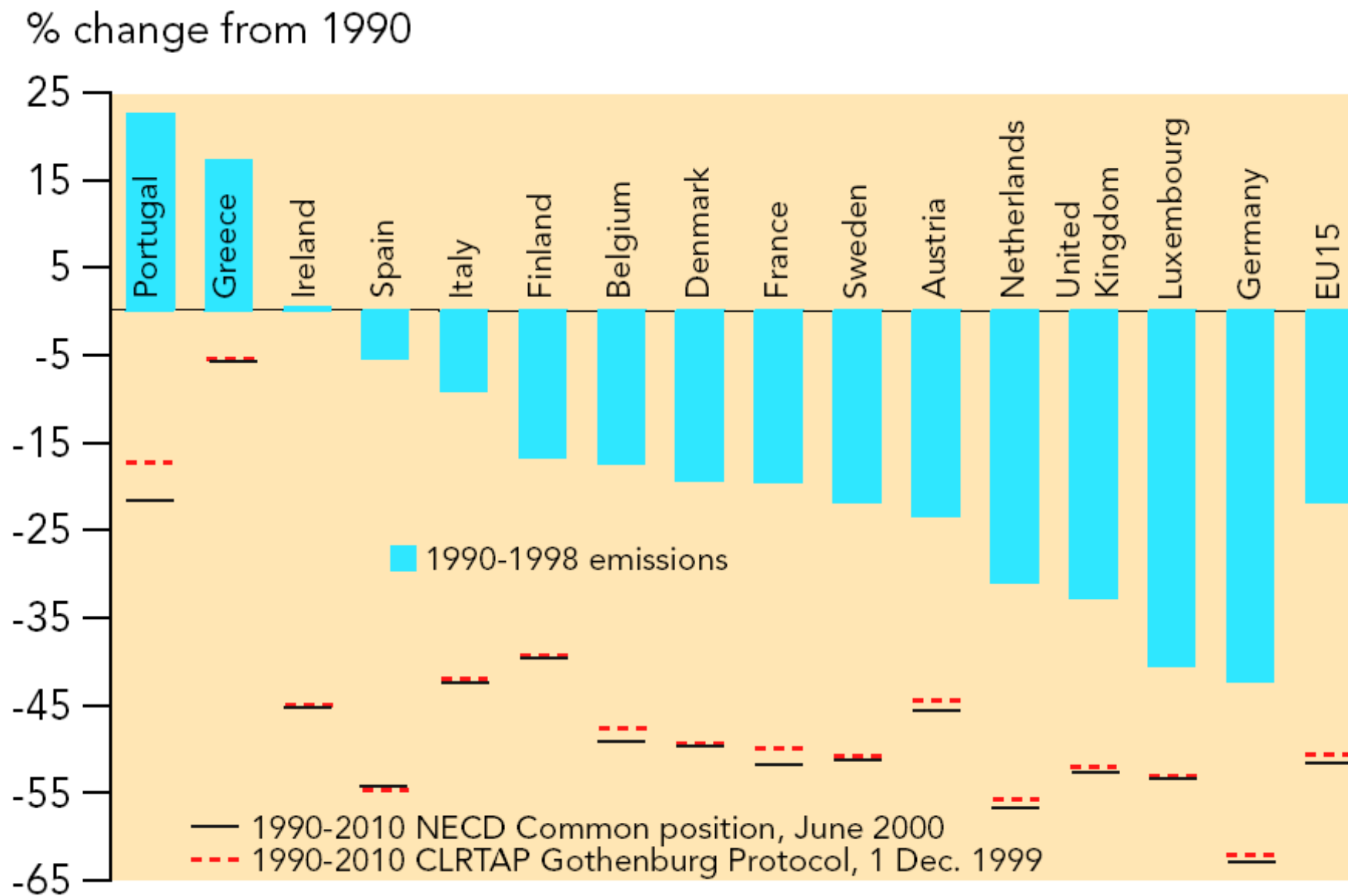
(Nox, HC, Particulates)

National Emission Ceilings Directive

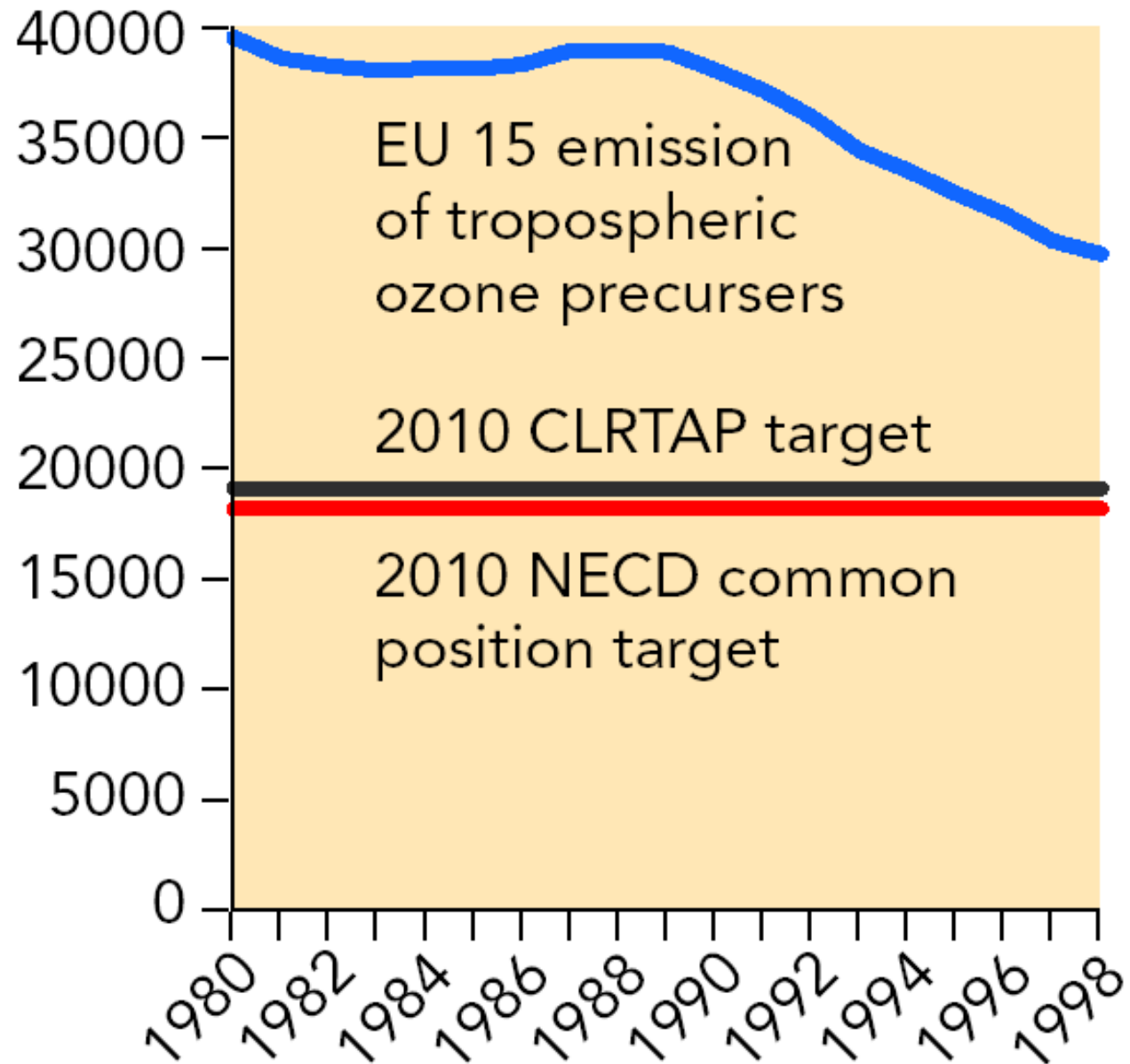
			Reduction in%
NECD ⁴	1990	2010	77
Sulphur dioxide			
Nitrogen oxides	1990	2010	51
Non-methane VOCs	1990	2010	60
Ammonia	1990	2010	18

Change in national emissions of ozone precursors since 1990 compared with 2010 targets

Figure 10.2.



kilotonnes tropospheric ozone formation potential (TOFP)



NO_x Emission Development for EU 15

Nitrogen oxides

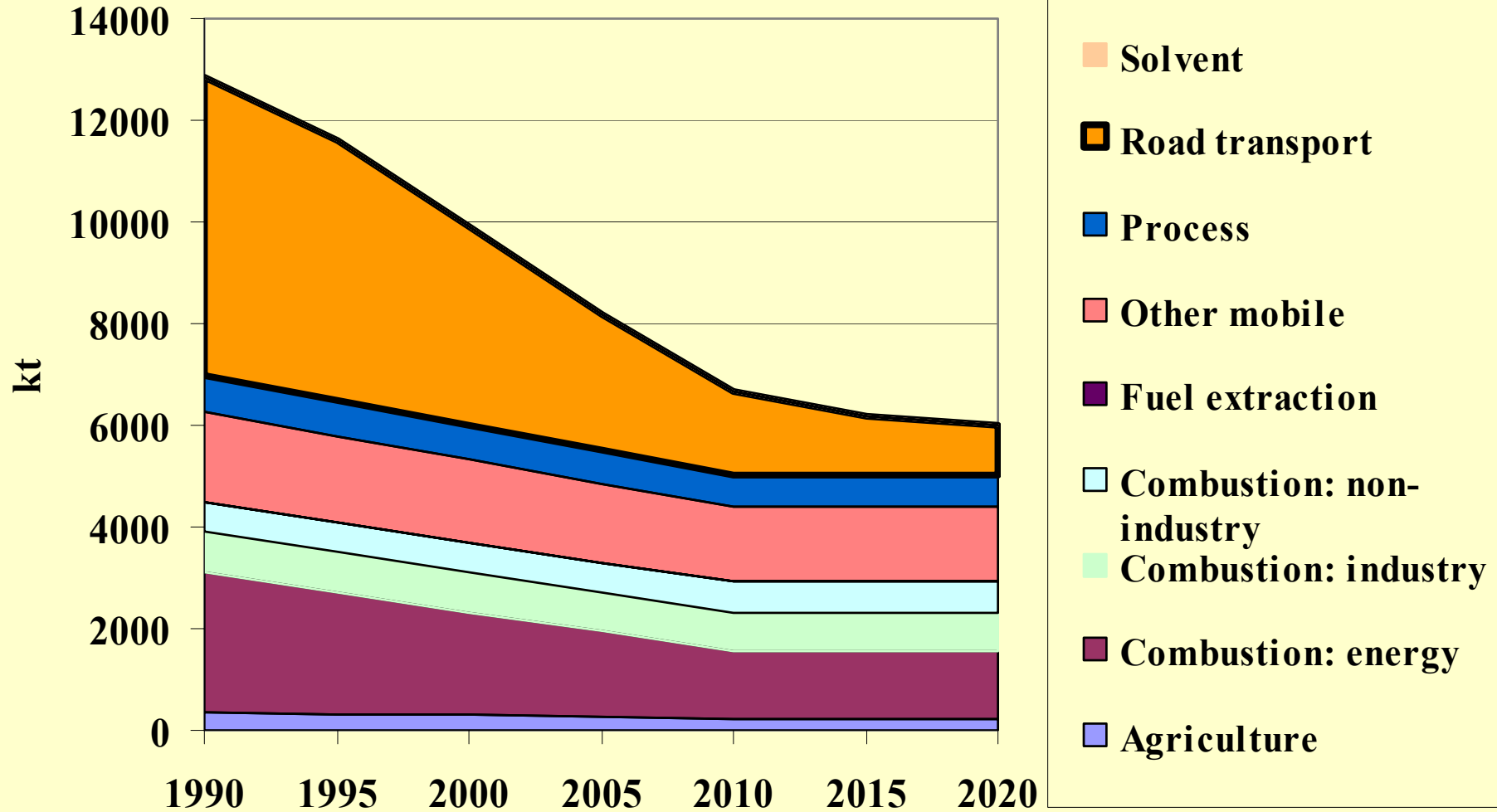
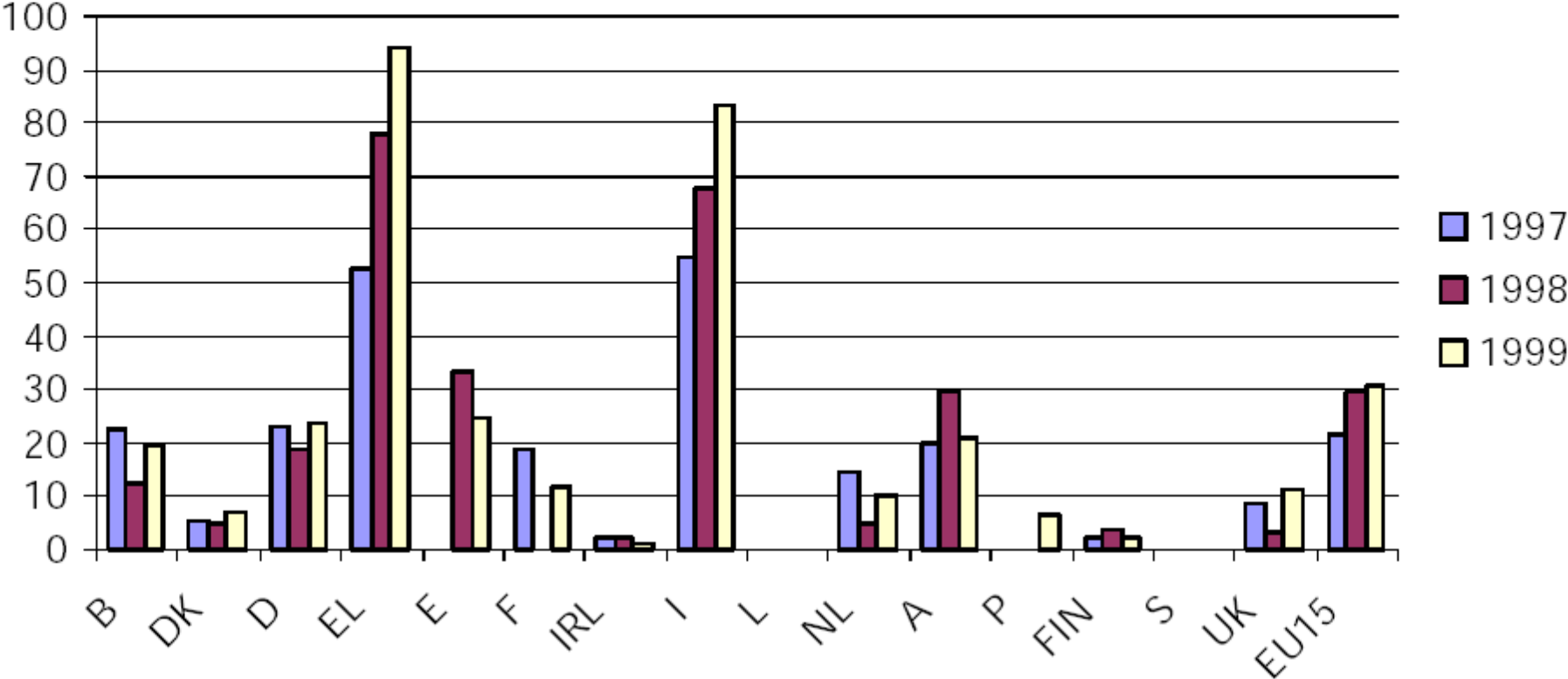
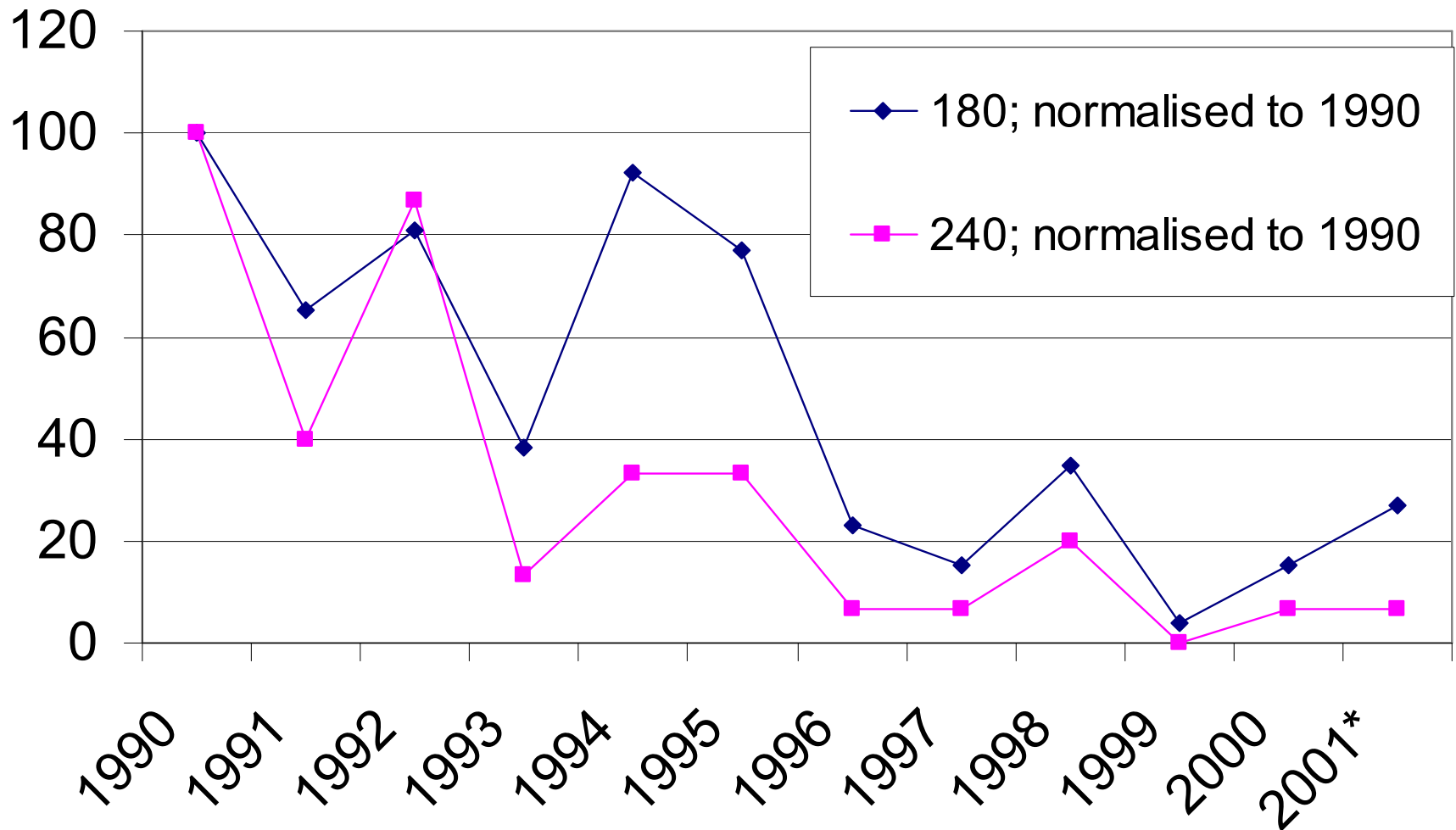


Figure 12. Average exceedances of objectives, ozone 1995-1999 and PM10 1997-1999 (EU 15).

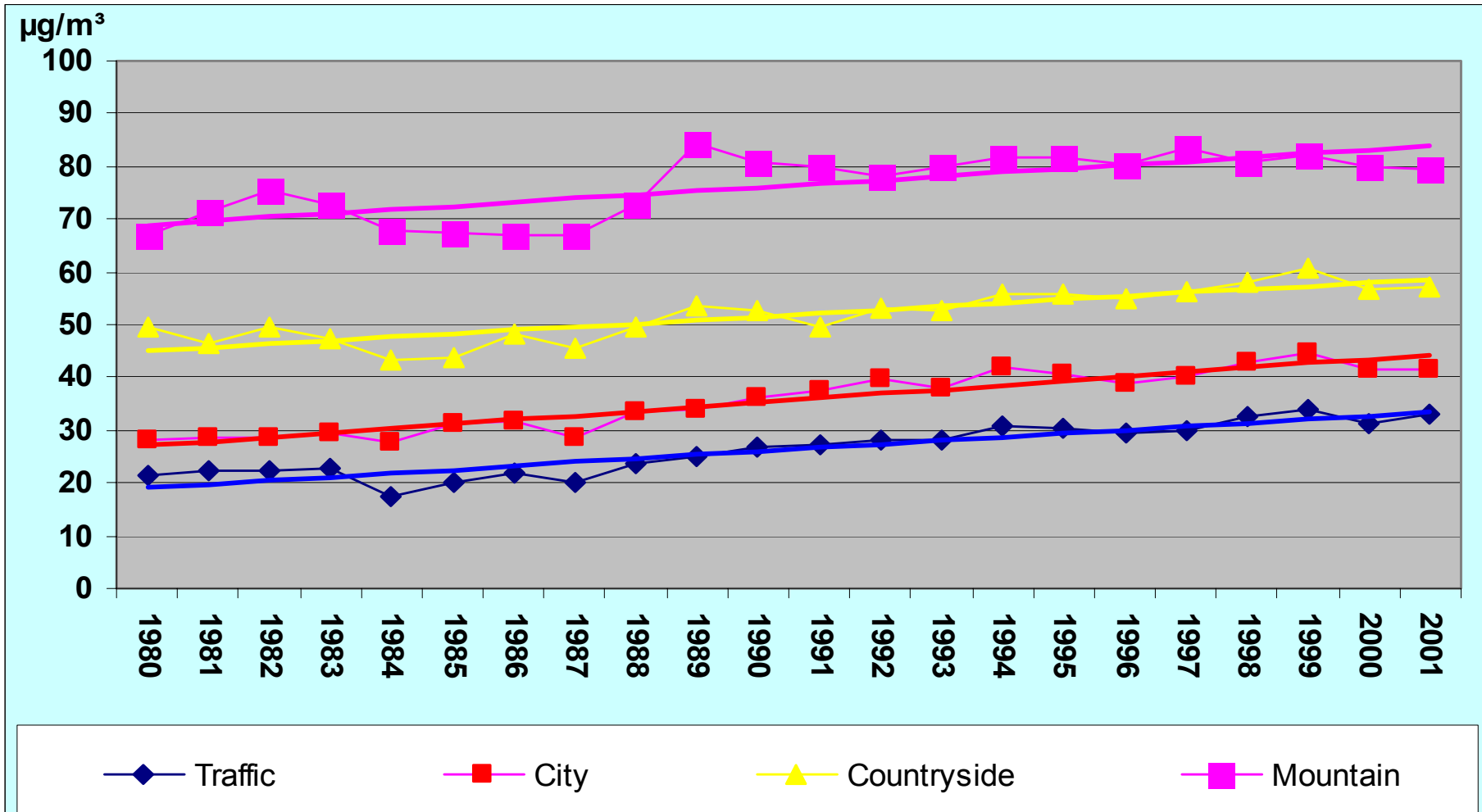
Average number of exceedance days for ozone



Av. Exceeding Hours of $180 \mu\text{g}/\text{m}^3$ and $240 \mu\text{g}/\text{m}^3$ normalised to the Year 1990 (100 %)



Linear Trend of Yearly Average of Ozone Concentrations in Germany 1980 until 2001



Transport

Mandatory limits - cars & LDV I

➔ Table shows limits and percentage reductions from 1996 levels, taking into account the revised Type I test cycle.

	CO (g/km)		HC (g/km)		NO _x (g/km)		HC+NO _x (g/km)		PM (g/km)
	P	D	P	D	P	D	P	D	D
2000	2.3 (30%)	0.64 (40%)	0.20 (40%)	-	0.15 (40%)	0.50 (20-40%)	-	0.56 (20-40%)	0.05 (35-50%)
2005	1.0 (70%)	0.50 (54%)	0.10 (70%)	-	0.08 (68%)	0.25 (60-70%)	-	0.30 (58-68%)	0.025 (68-75%)

Euro IV limits (2005)

Euro IV provides additional reductions of 30% for CO, HC and NO_x and 80% in particulates over Euro III.

→ ESC and ELR cycles:

	CO (g/kWh)	HC (g/kWh)	NO _x (g/kWh)	Particulate (g/kWh)	Smoke (m ⁻¹)
Euro IV	1.5	0.46	3.5	0.02	0.5

→ ETC cycle:

	CO (g/kWh)	NMHC (g/kWh)	NO _x (g/kWh)	CH ₄ (g/kWh)	Particulate (g/kWh)
Euro IV	4.0	0.55	3.5	1.1	0.03

EURO V: From 1st October 2008, the NO_x limit on both the ESC and the ETC cycles will be **2.0 g/kWh**

New Limit values for motorcycles

	Class	CO g/km	HC g/km	NOx g/km
A 2003	I(<150 cc)	5.5	1.2	0.3
	II(=150 cc)	5.5	1.0	0.3
B 2006	I (<150 cc) 1)	2.0	0.8	0.15
	II (=150 cc) 2)	2.0	0.3	0.15

1) Test cycle : *ECE R40 (with emissions measured for all 6 modes - sampling starts at T=0)*

2) Test cycle : *EUDC for LDV*

Fuel specifications

Mandatory fuel specifications for gasoline and diesel in two stages - 2000 and 2005:

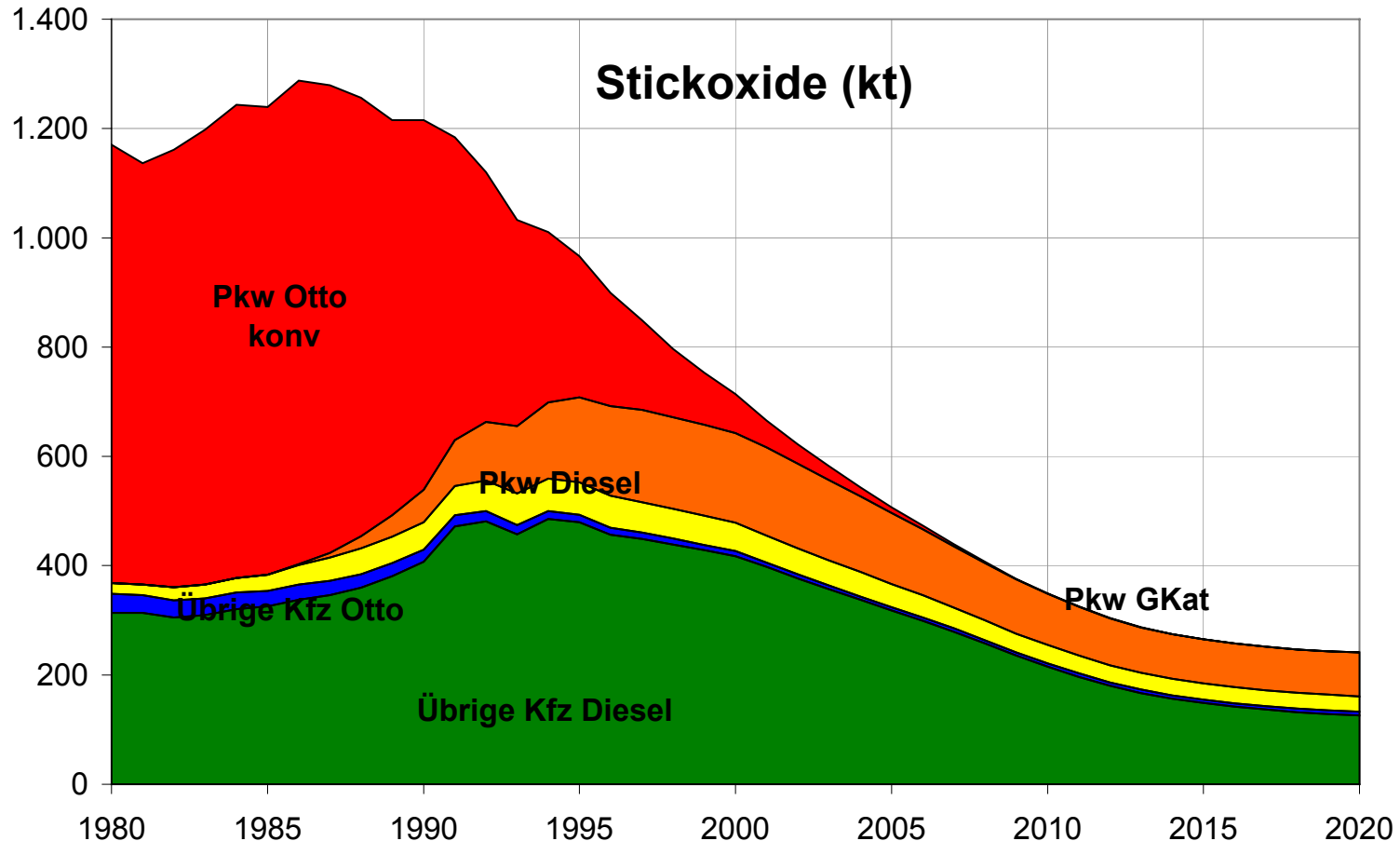
Petrol	2000	2005
RVP summer	60	-
Aromatics	42	35
Benzene	1	-
Olefins	18	-
Oxygen	2,7	-
Sulphur	150	50

Diesel	2000	2005
Cetane # (min)	51	-
Density 15°C	845	-
Distillation 95°C	360	-
Polyaromatics	11	-
Sulphur	350	50

Maximum specifications except where indicated

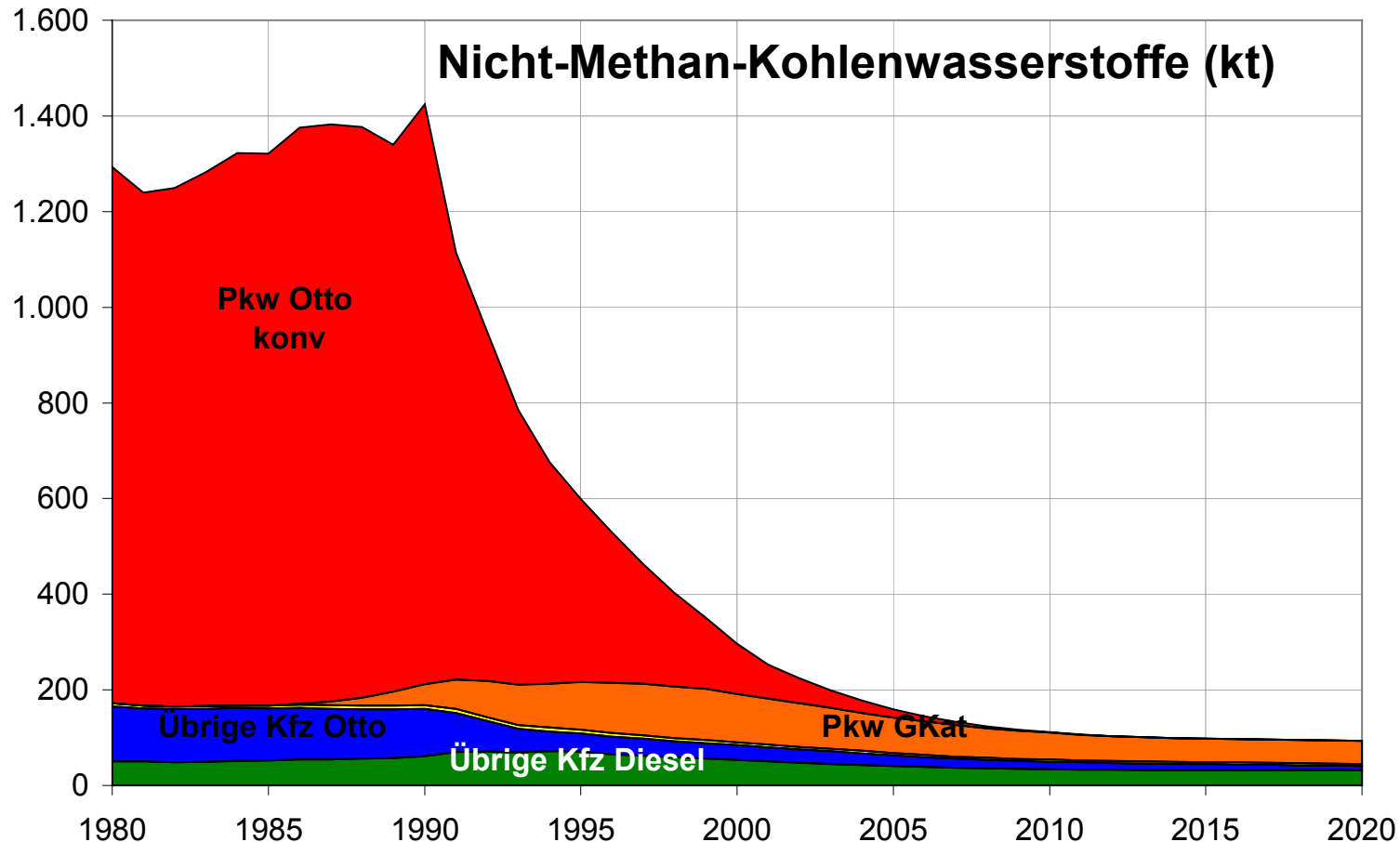
From 2011 sulphur limit is 10 ppm; it has to be available on stations 2008; tax incentives can be used to introduce this quality earlier; e.g. in Germany from 1. January 2003 1.5 €ct/ l

NO_x from Road Transport



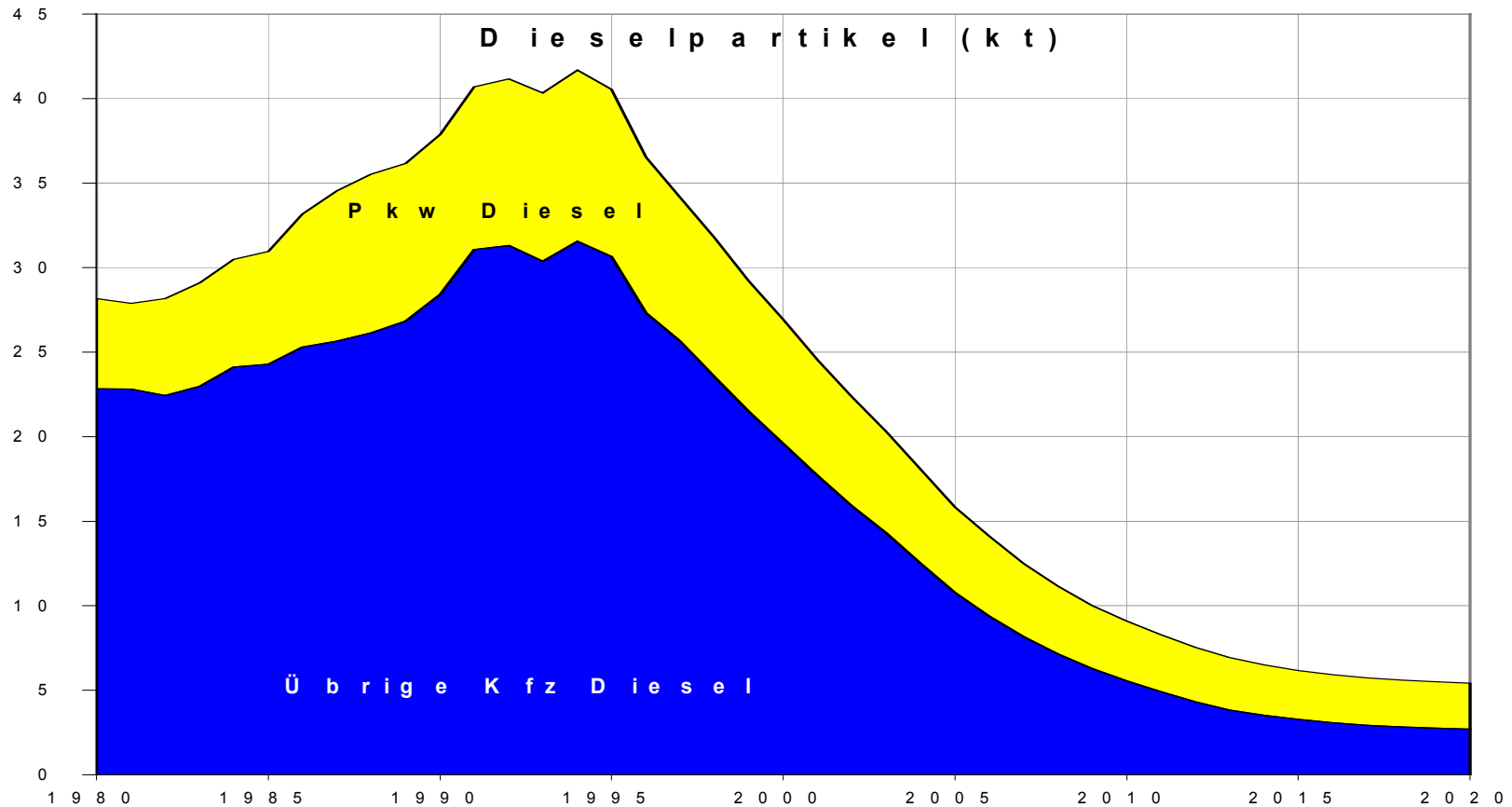
Direkte Emissionen des Straßenverkehrs; Übrige Kfz Otto: leichte Nutzfahrzeuge und motorisierte Zweiräder; Übrige Kfz Diesel: leichte und schwere Nutzfahrzeuge, Busse; Fahrleistungsentwicklung der Pkw ab 1997 in Anlehnung an die Trendprognose des ifo-Instituts München für den BMV (1995); Fahrleistung des Güterverkehrs ab 1997 nach ifo-Institut München für den VDA (1998); Emissionsberechnungen unter der Annahme einer jeweils vorzeitigen Erfüllung neuer Grenzwerte; Emissionsfaktoren EURO 2 – 5 abgestimmt zwischen UBA und VDA; bei Diesel-Pkw keine eigene Berücksichtigung von Partikelfiltern; Einführung verbesserter Kraftstoffe

NMHC from Road Transport



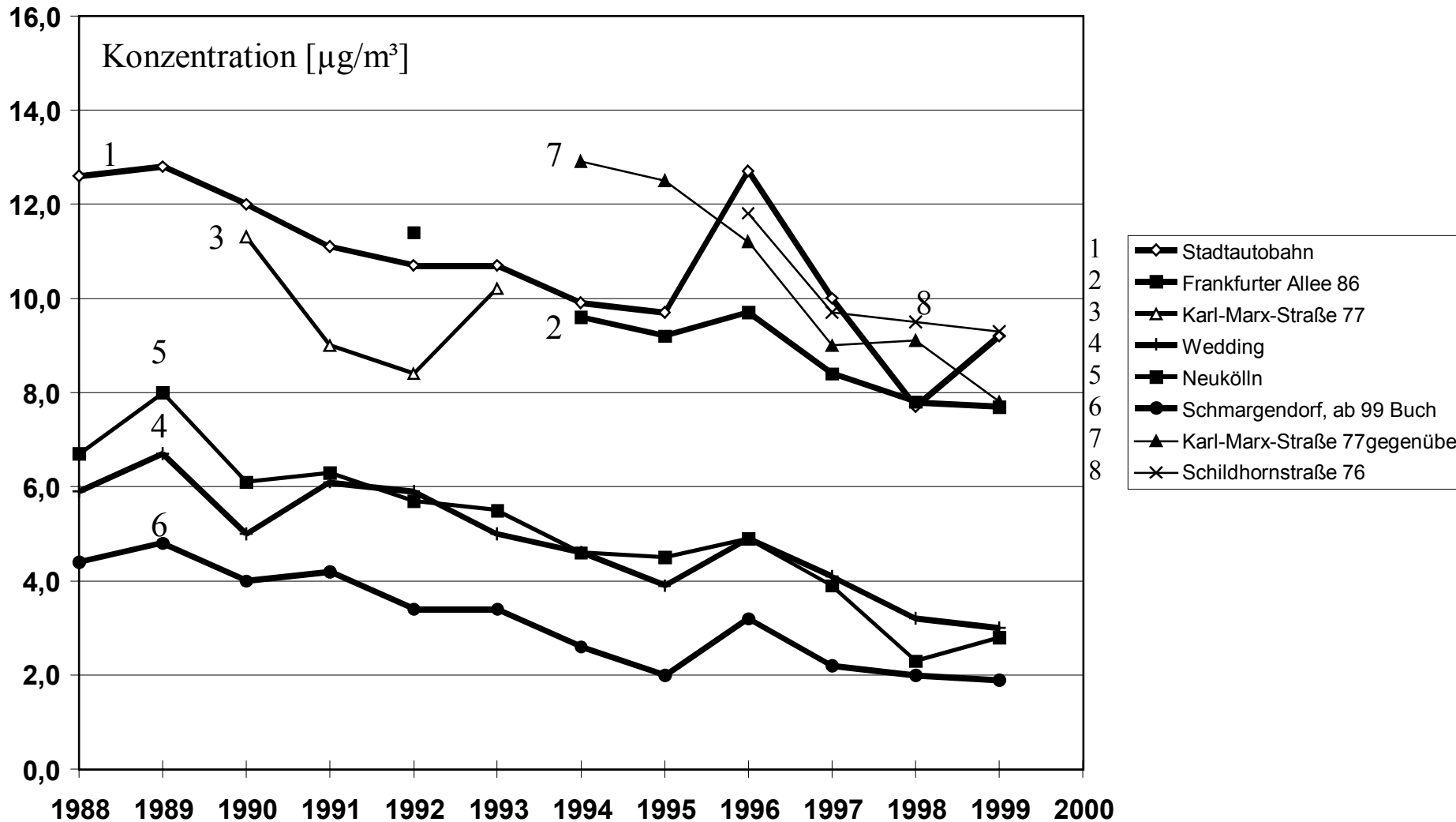
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Diesel Particles from Road Transport

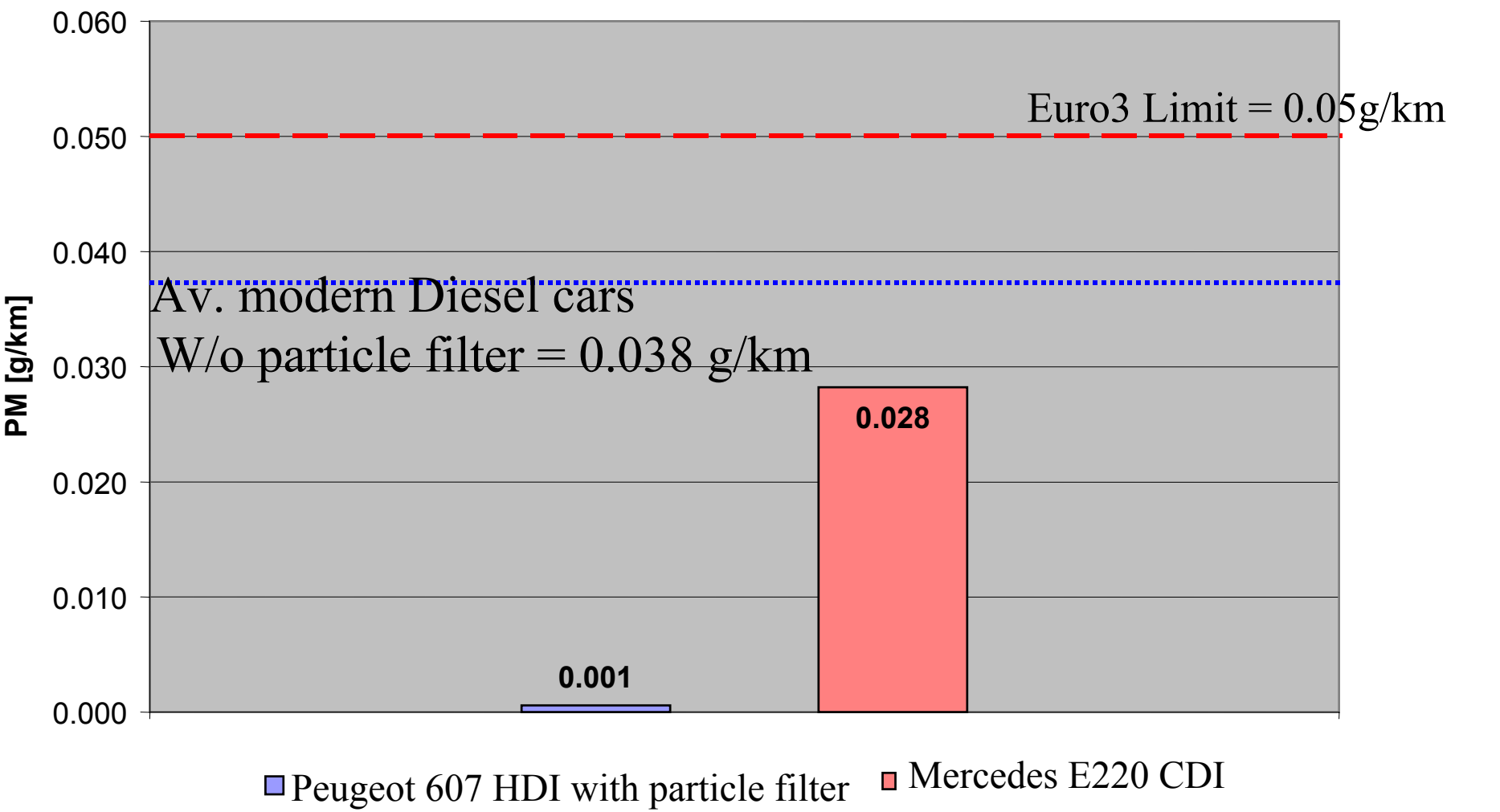


Quelle: IFEU-Berechnungen mit TREMOD, Version 9/99

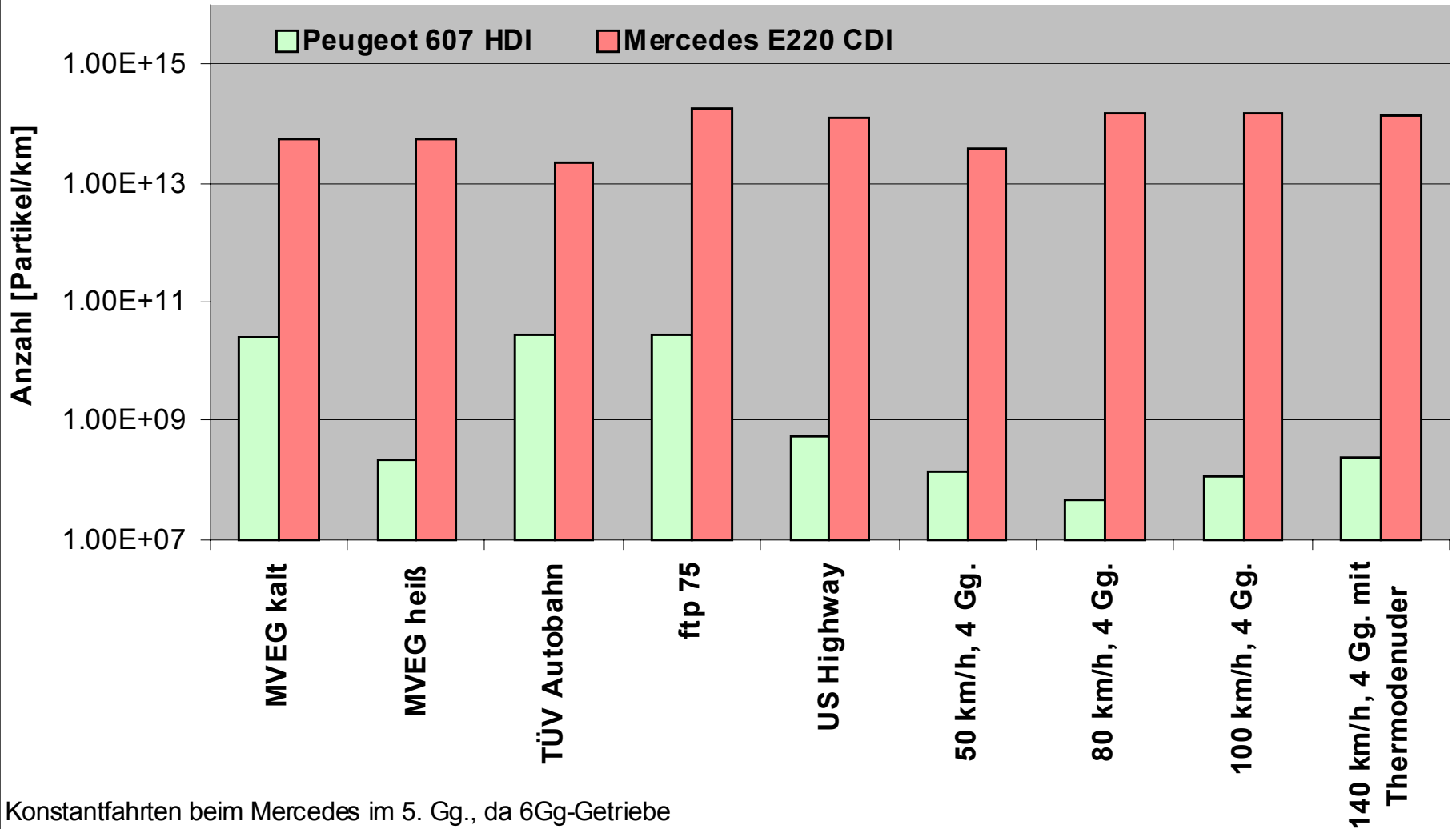
Concentration of Black Soot in Street Canyons



EU Driving Cycle: Particulate Emissions

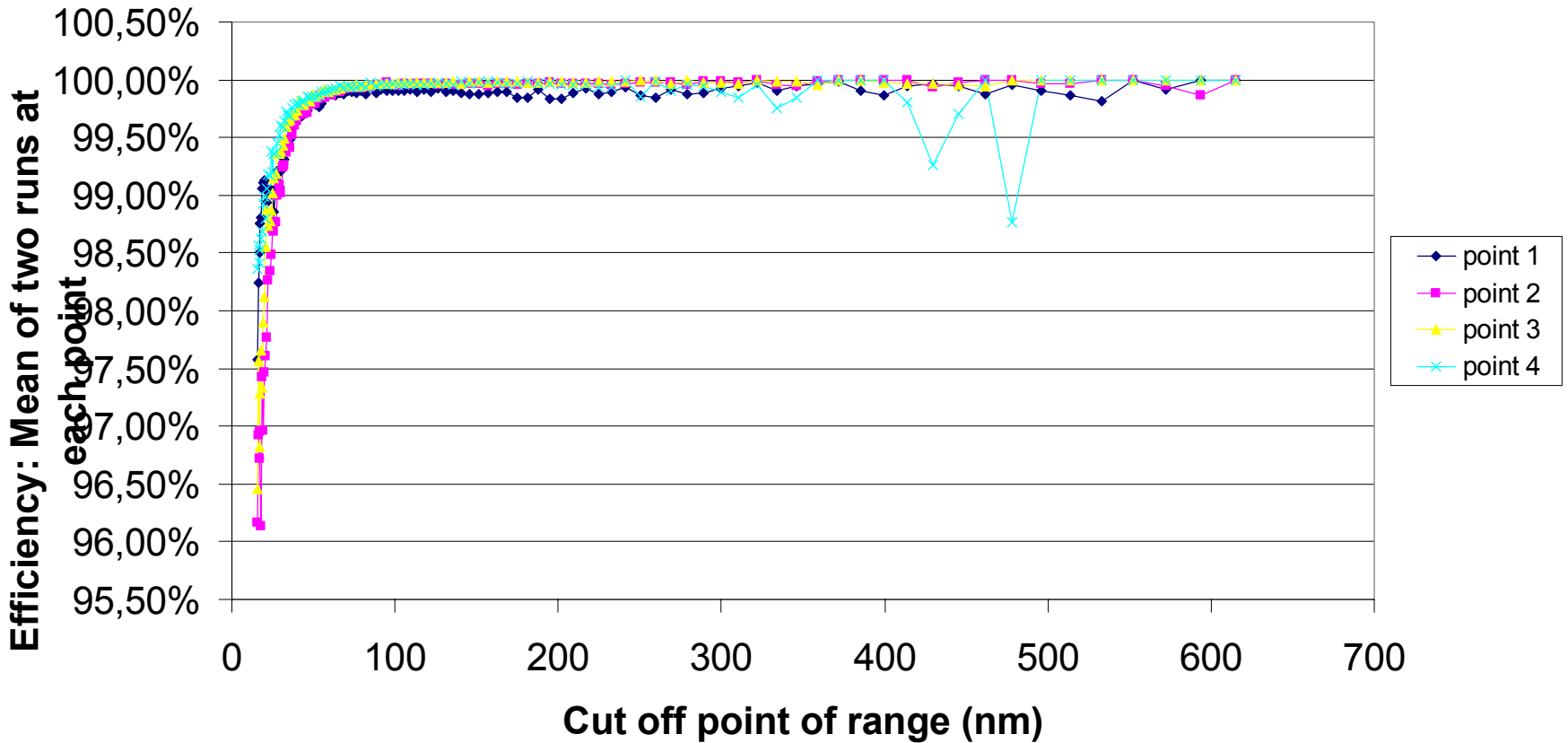


Partikelanzahl, gemessen mit SMPS

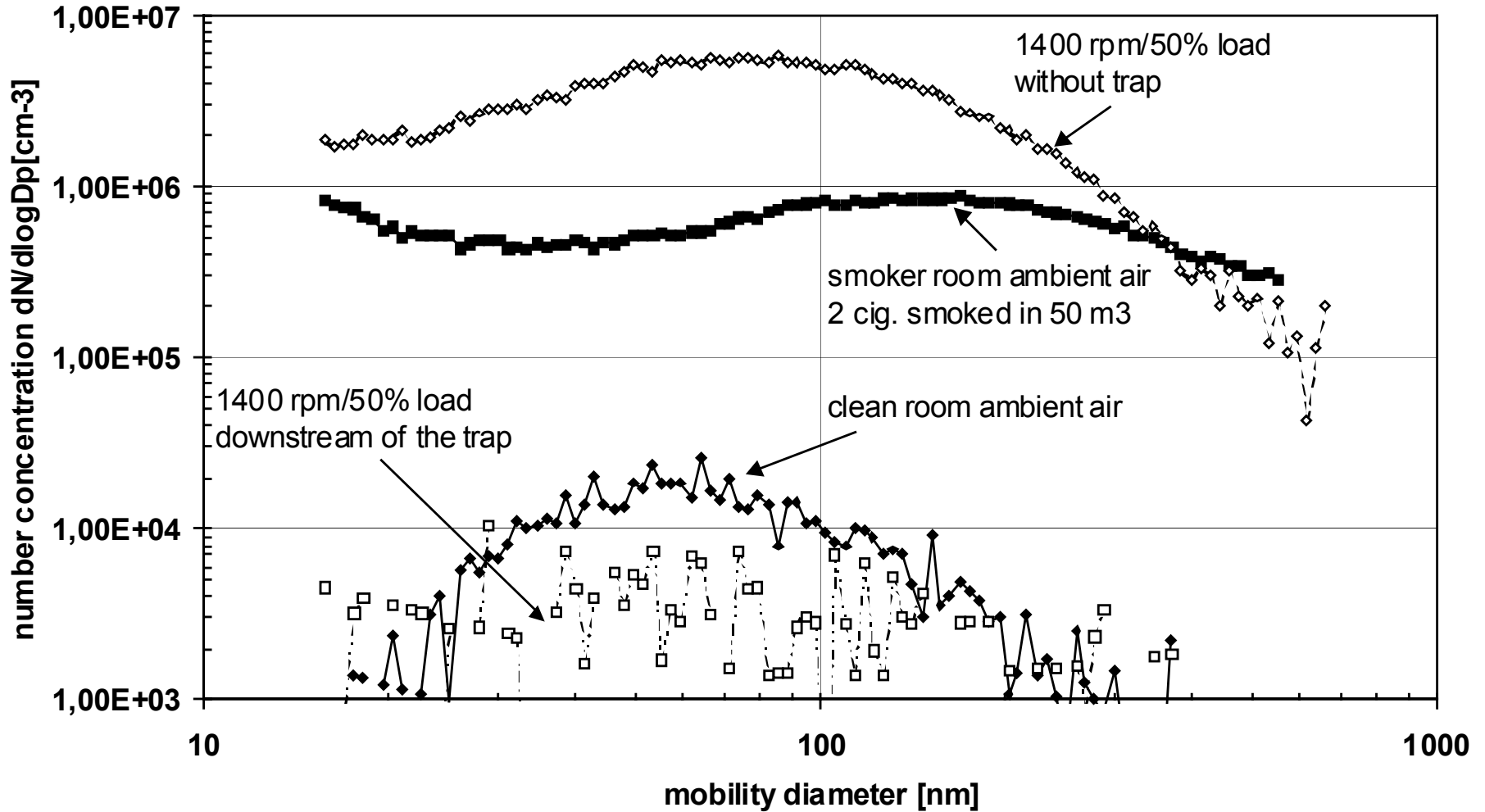


The Peugeot 607 emits a factor 10.000 less particle number than the Mercedes E220 CDI

Efficiency of DPF for Solid Particles by SMPS Measurement

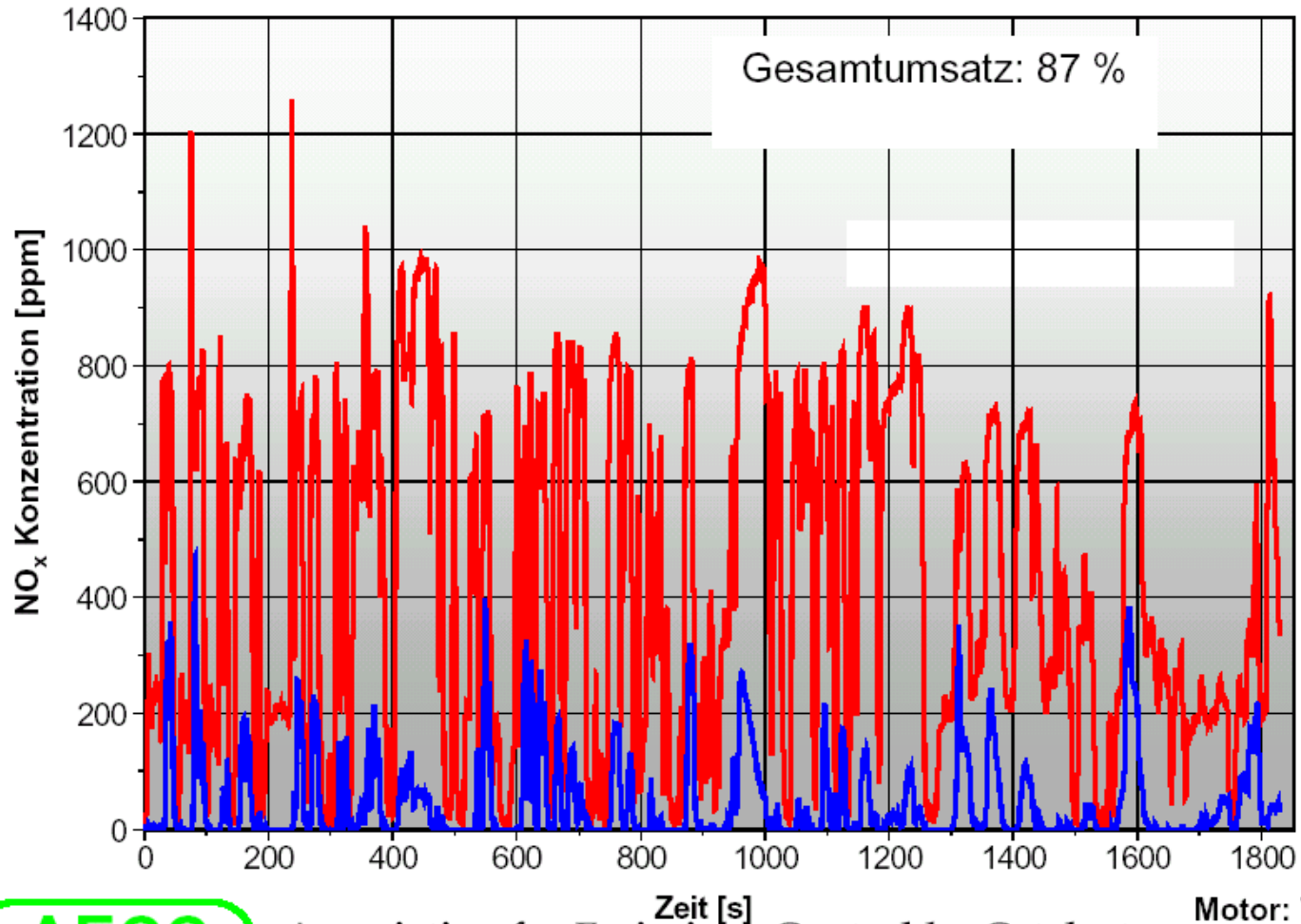


Diesel Emissions with and without Particle Trap vs. Ambient Air Particle Concentrations



Heavy Duty Vehicle SCR System

NO_x concentration before/after SCR System (ETC)

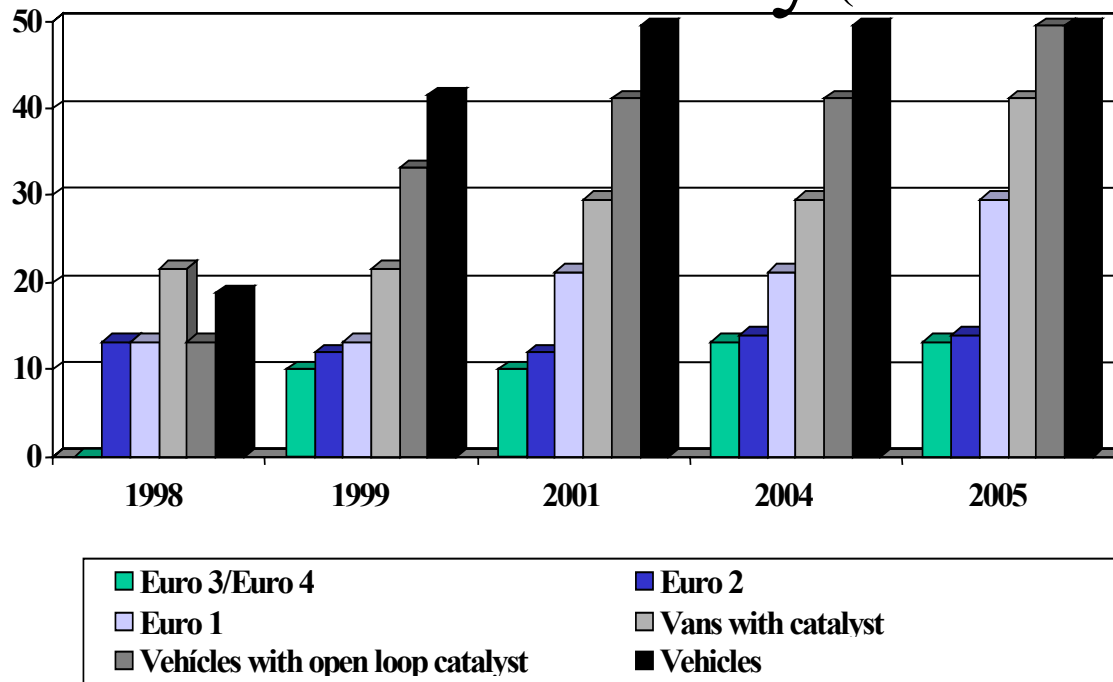


AECC

Association for Emissions Control by Catalyst

Motor: 7 l DI TCI
97

Annual Emission Related Vehicle Tax in Germany (in DEM/100 ccm per ano)



Example:

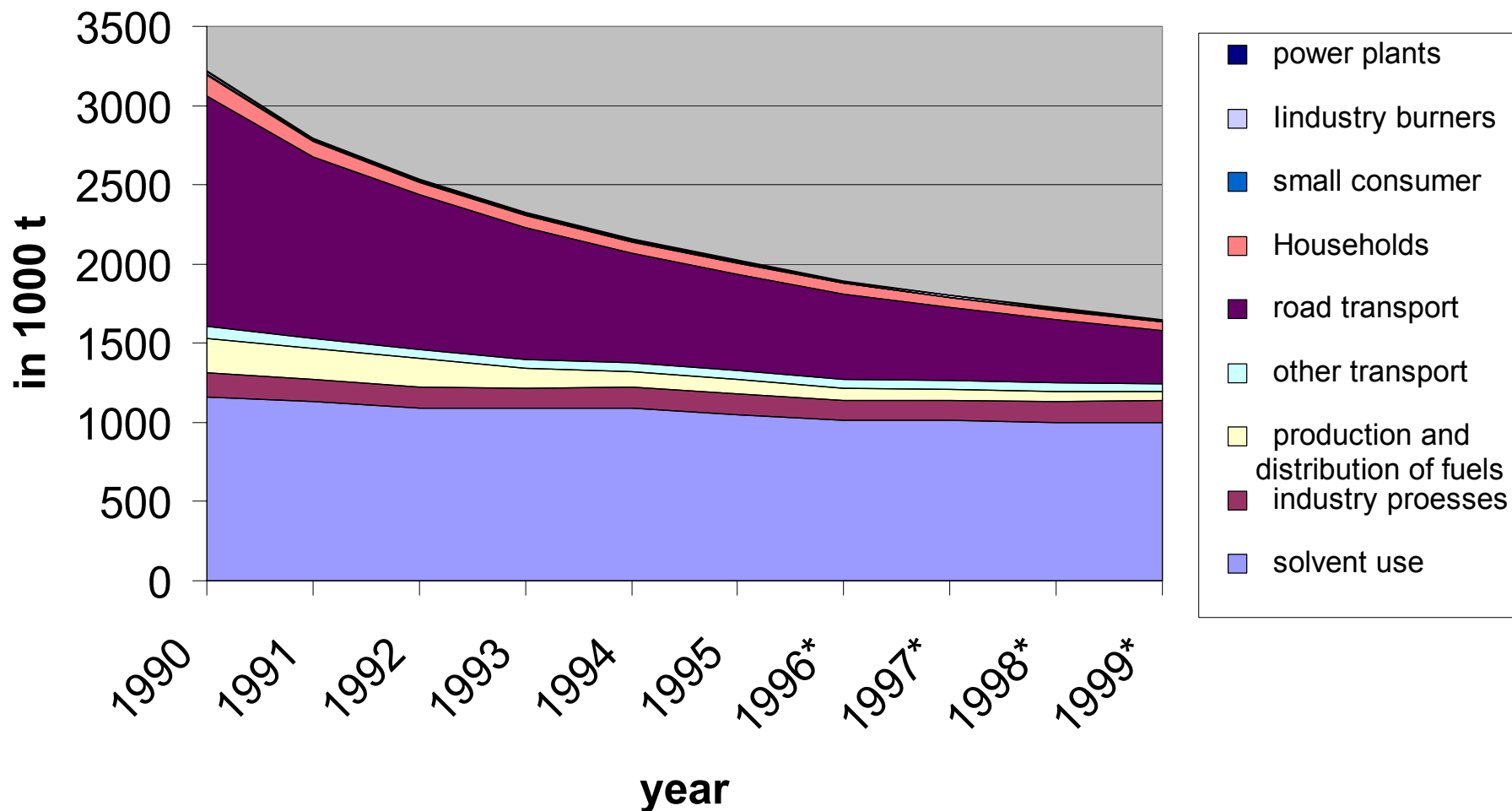
Gasoline car with a engine volume of 2000 ccm

- meet Euro IV: Annual tax in 2002 : Exempted up to 250€, afterwards 100 € per year until 2003 from 2004 135 €
- Without catalyst:
Annual tax: **500 €** per year

Difference in 5 years: about **2500 €**

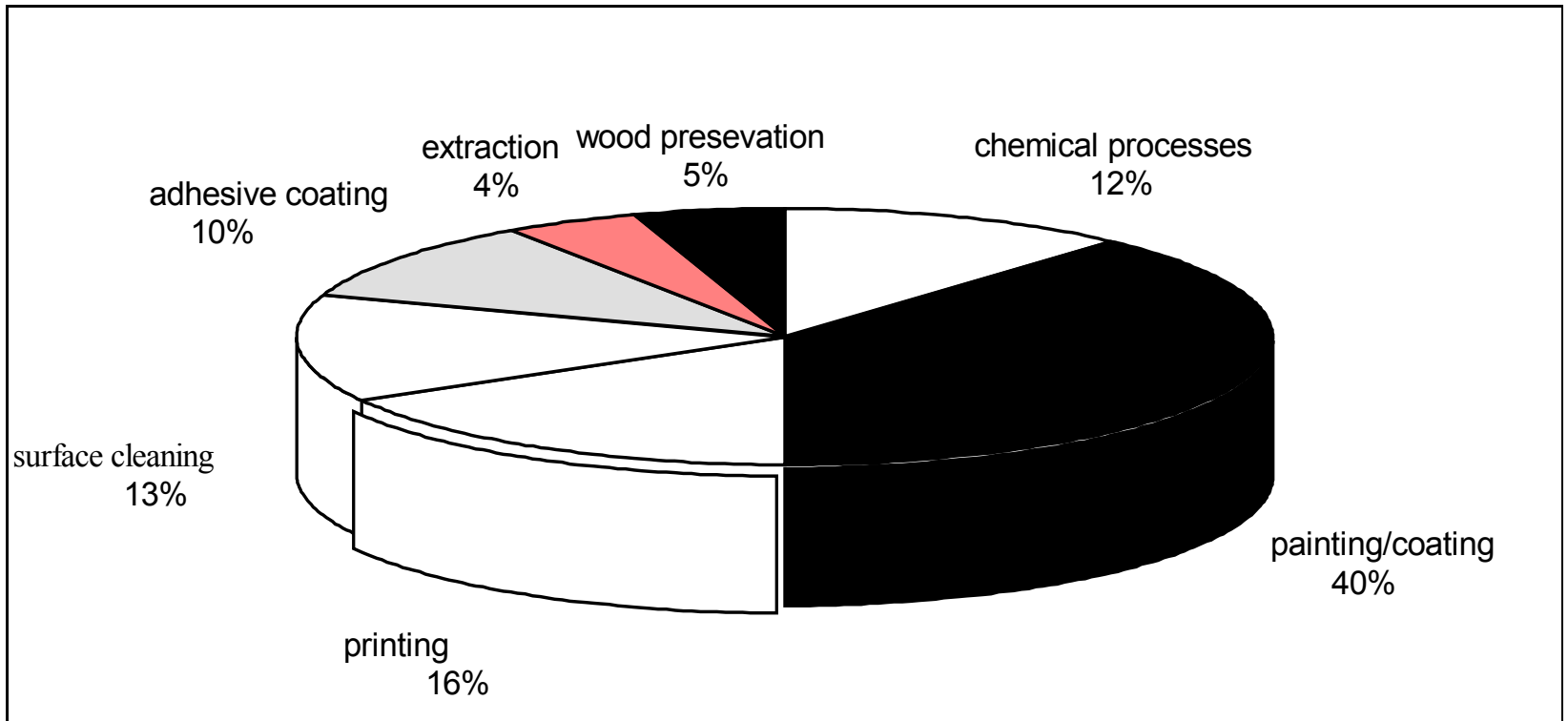
Solvent Control

Development of NMVOC-Emissions 1990 bis 1999



Situation in Germany

Contribution solvent use



Regulations in Germany

Federal Immission Control Act
(Air Pollution Act)

- Technical Air Instruction
- Second Ordinance
- Solvent Ordinance based on EU- solvent directive

The Solvent Ordinance

Implementation of the

Council directive 1999/13/EC of 11th
of March 1999 on the limitation of
emissions of volatile organic
compounds due to the use of organic
solvents in certain activities and
installations

Purpose: reduction of tropospheric
ozone

The Solvent Ordinance

Emission limits

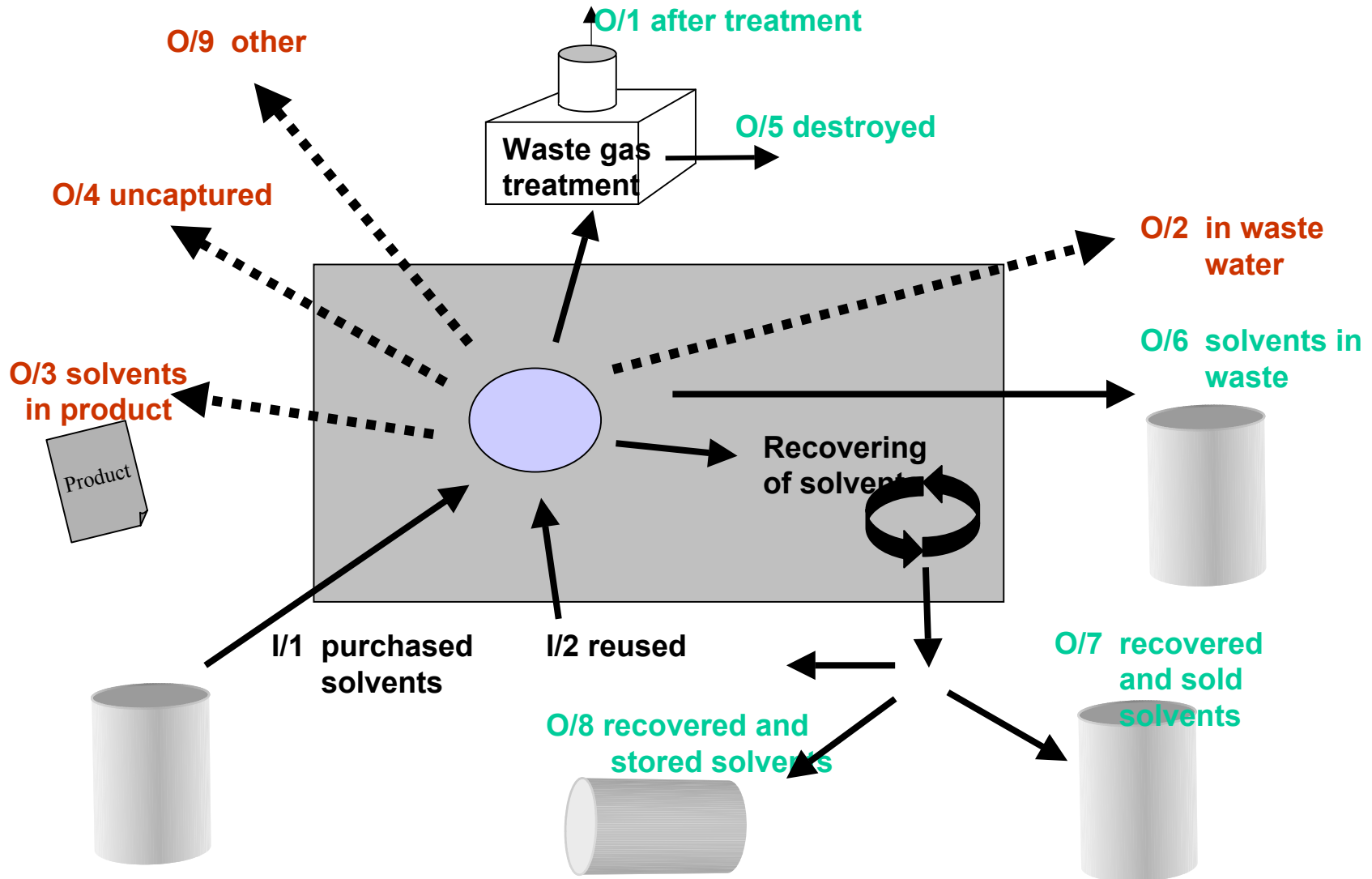
Either

- mgC/m^3 in waste gas + fugitive emissions in % of solvent input and/or
- total emissions
 - waste gases + fugitive in % of solvent input
 - per product, piece or weight (e.g. shoes, kg animal fat)
 - per m^2 , m^3 (e.g. leather coating, wood impregnation)

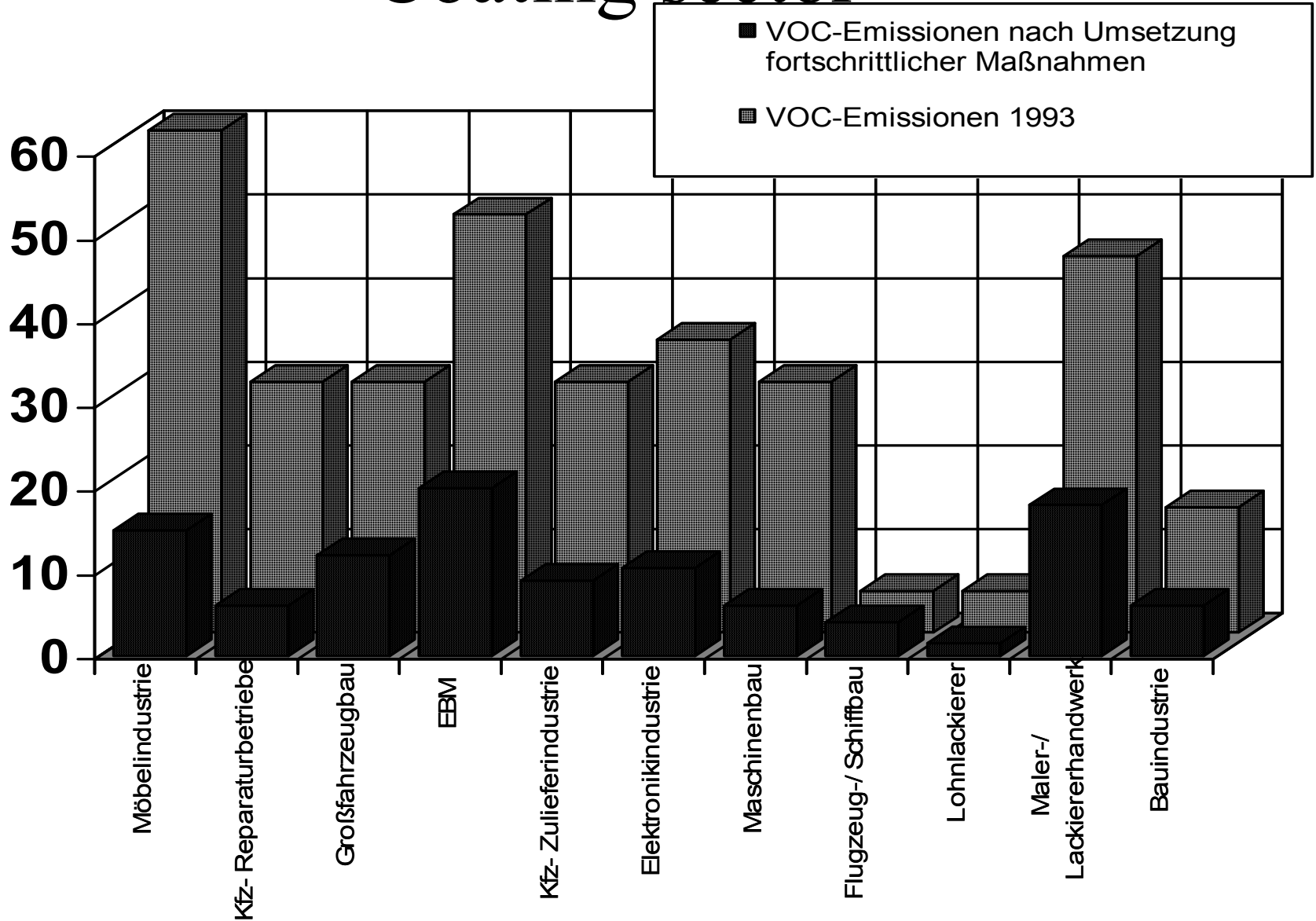
The Solvent Ordinance

Requirements to the operator

(picture designed by Ökopol)



VOC emission reduction potential in Coating sector





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www.umweltbundesamt.de