

# EDGAR estimates particulate matter

EMISSION DATABASE FOR GLOBAL ATMOSPHERIC RESEARCH

<http://edgar.jrc.ec.europa.eu/eolo>

## EDGAR Project team:

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Aardenne (left to EEA), Julian Wilson



**What EDGAR v4.1 covers**  
**Results for air pollutants**  
**Discussion of particulate matter**



## Time periods:

- 1970 – 2005 historical annual emissions (some also monthly)
- 2006 - 2050 scenarios with POLES/ IMAGE growth rates



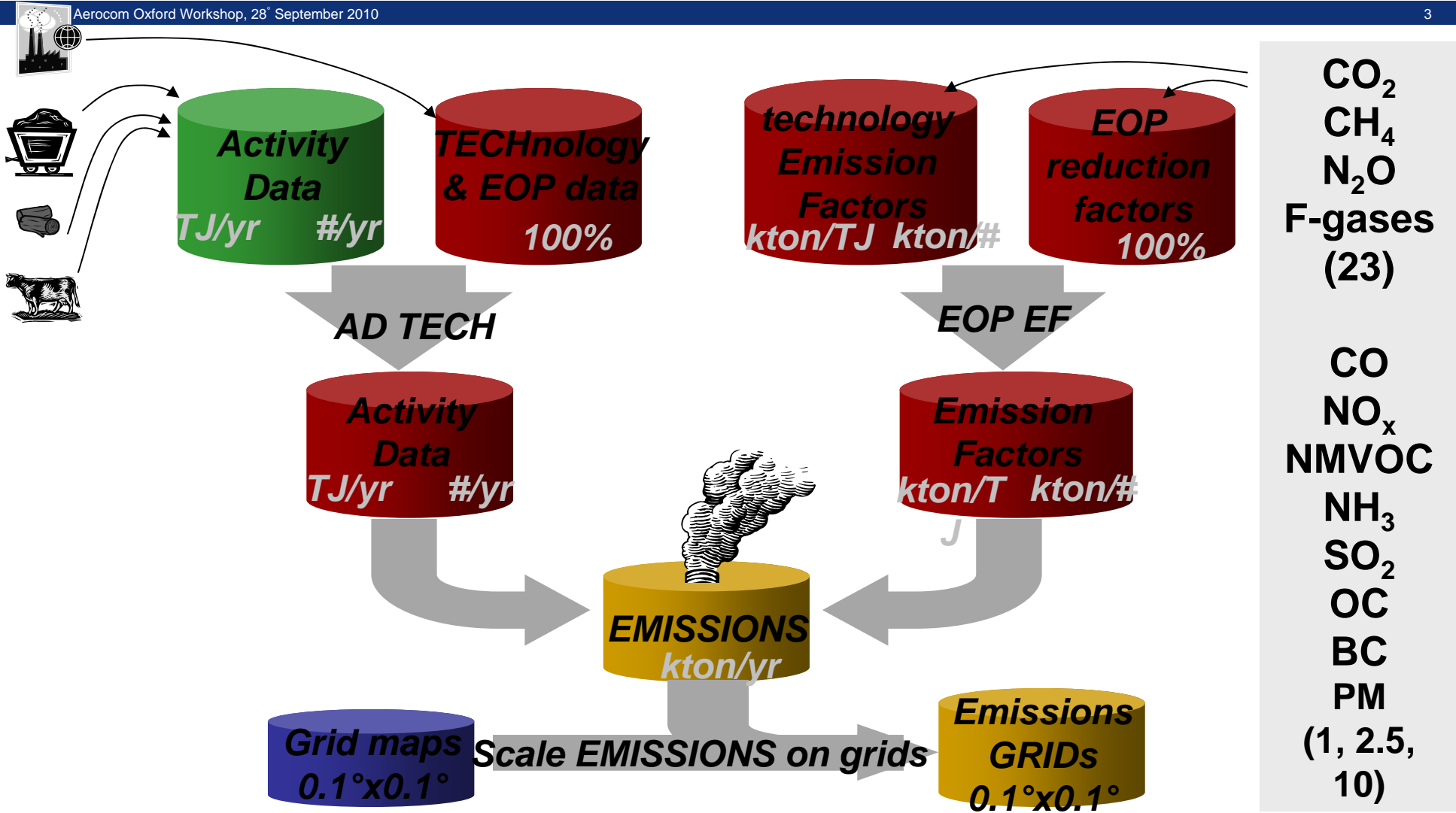
## Species:

- Direct greenhouse gases: CO<sub>2</sub> CH<sub>4</sub> N<sub>2</sub>O HFCs PFCs SF<sub>6</sub>
- Ozone depleting substances: CFCs HCFCs
- Air pollutants: CO NO<sub>x</sub> NMVOC, SO<sub>2</sub> PM<sub>2.5</sub> PM<sub>10</sub> OC BC



## Spatial allocation:

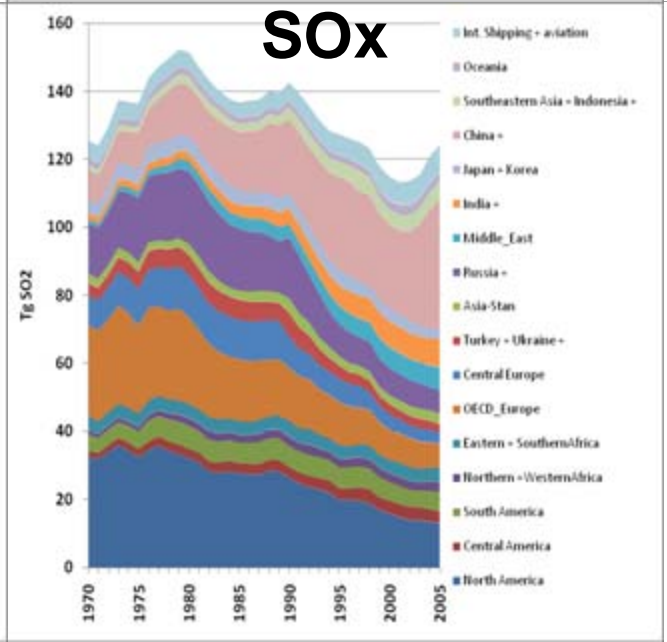
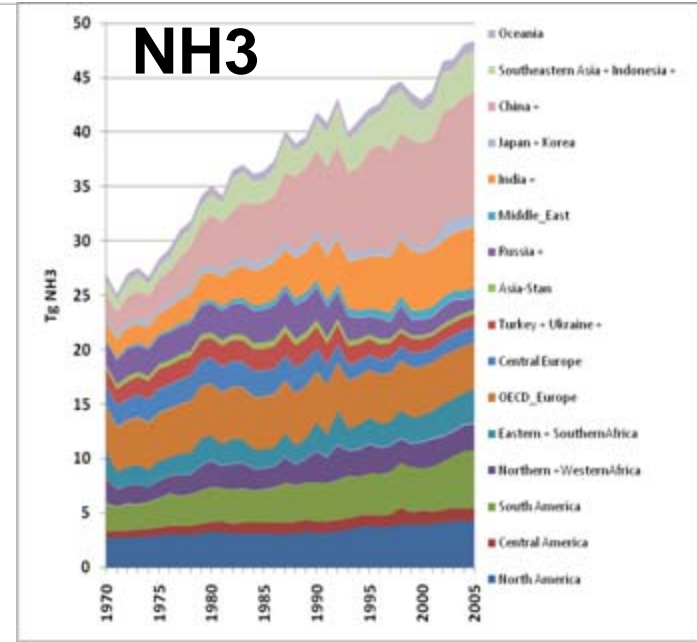
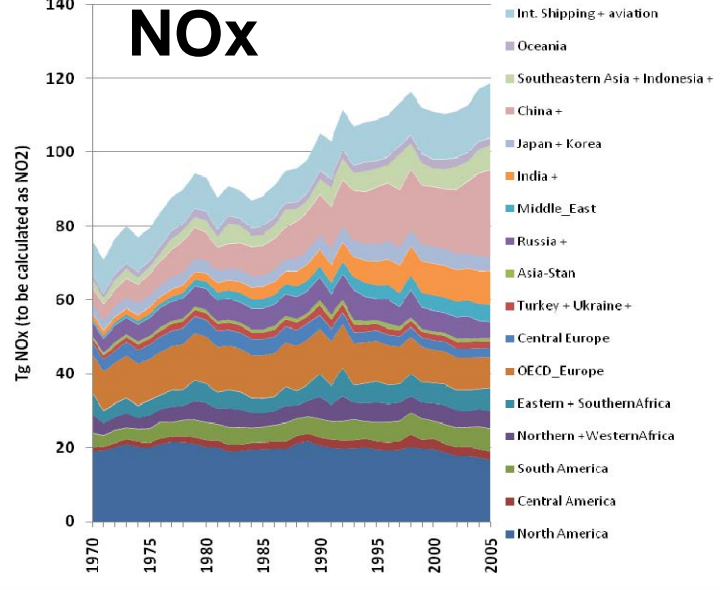
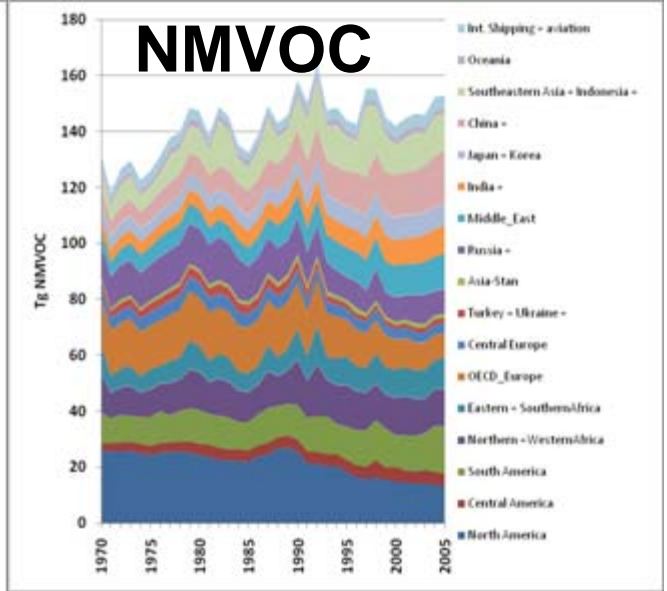
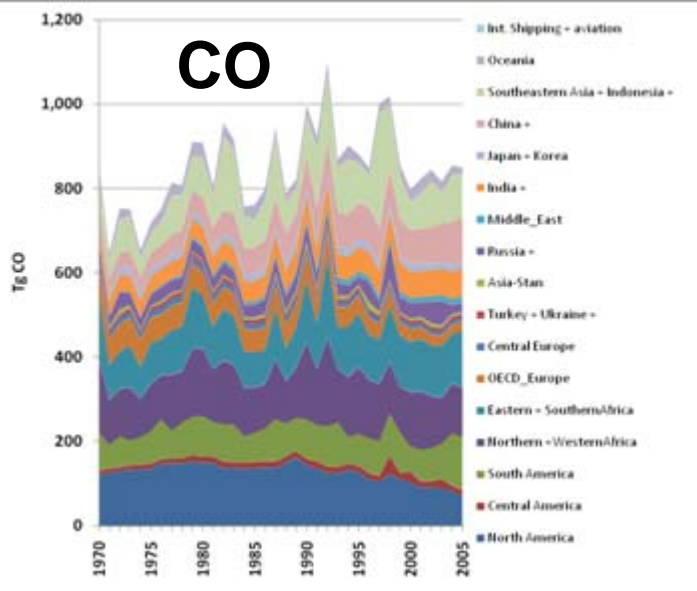
Activity & emission data on 0.1° x 0.1° grid cells  
using grid maps for urban/rural population density, animal  
density, power/industrial plants, road network,  
shipping/aircraft routes, coal mines, oil/gas fields, rice fields,  
crop/grass lands



$$EM_C(y, x) = \sum_{i,j,k} \left[ AD_{C,i}(y) * TECH_{C,i,j}(y) * EOP_{C,i,j,k}(y) * EF_{C,i,j}(y, x) * (1 - RED_{C,i,j,k}(y, x)) \right]$$

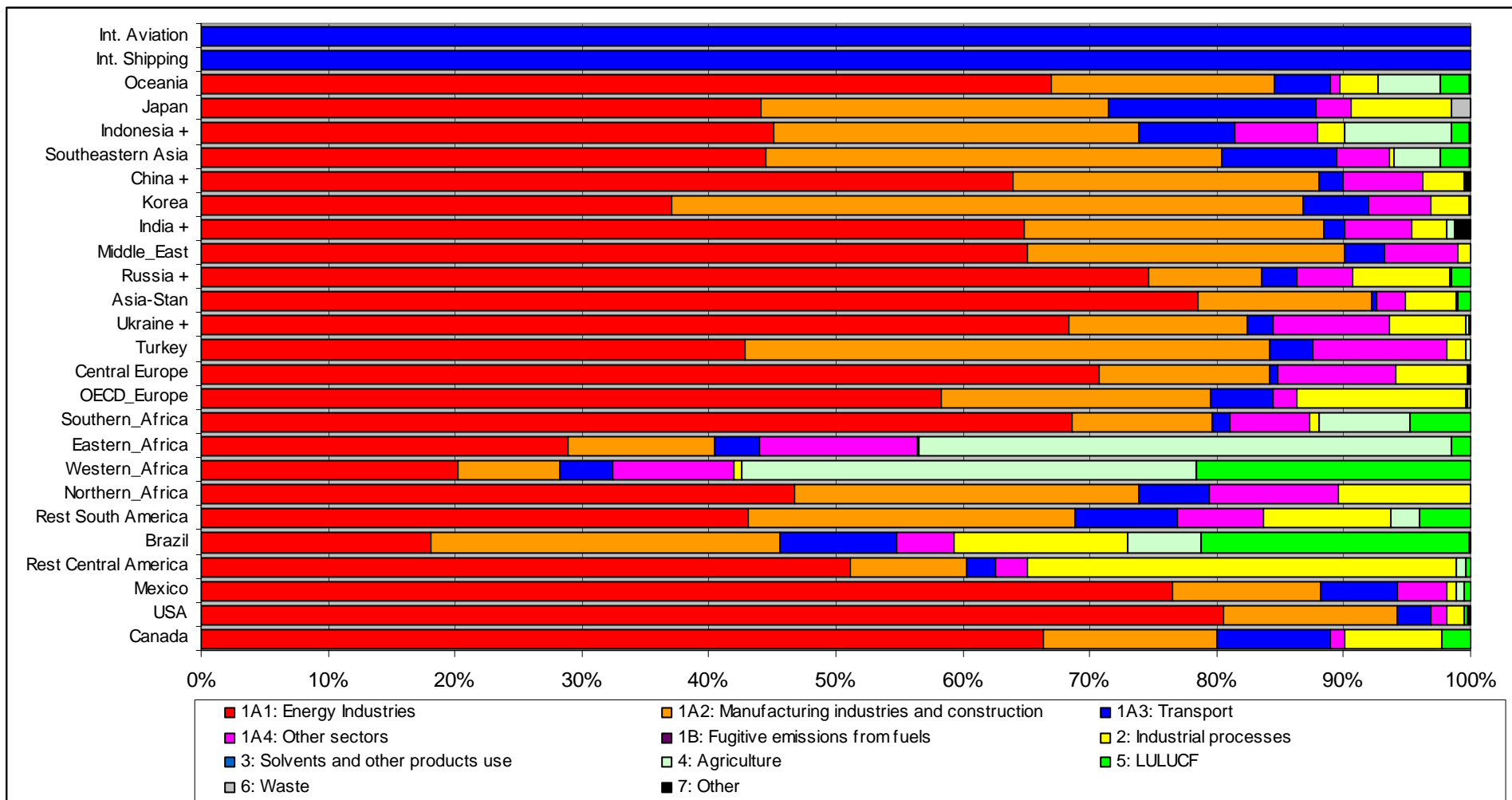
	transp./energy	ch.ind/waste	agriculture
<b>Activity data</b>	IEA stat. fuel prod./comb.(64x94), CDIAC (fossil fuel fires) & sc. lit.	USGS stat., UN commodity stat.	FAO data (livestock, rice, crop production), IFA stat. on N-fert., IPCC factors, soil type maps, GFED (savannah burning)
<b>Technologies</b>	UCI Platts Power Plant DB, mining, transform.&-mission nat. fleet distr.	techn. mix chem. prod., waste water treatment	IRRI cultivation ecosystems, manure management systems
<b>Emission abatement</b>	CH4 recovery (UG mines), sim. NMVOC, EURO cl. vehicles	CH4 recovery sim. NMVOC	
<b>Emission factors</b>	IPCC 2006 & 1996, IEA, sc.lit., EMEP/Corinair guidebook	IPCC 2006, FOD model for landfills	IPCC, sc. lit.

**Datasets: EDGAR\_v4.1 (GHG + AP)**



Global anthropogenic emissions in Tg species per year, including LULUCF sector, shown in function of world regions

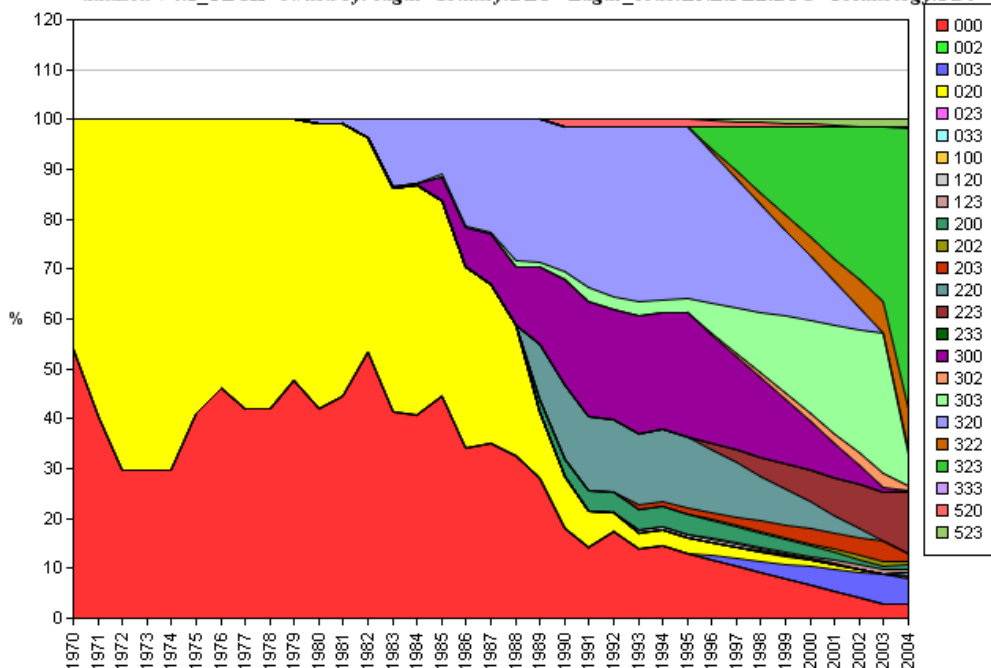
## Main sources of SO<sub>2</sub> emissions



## Methodology: Abatement measures in coal fired power plants

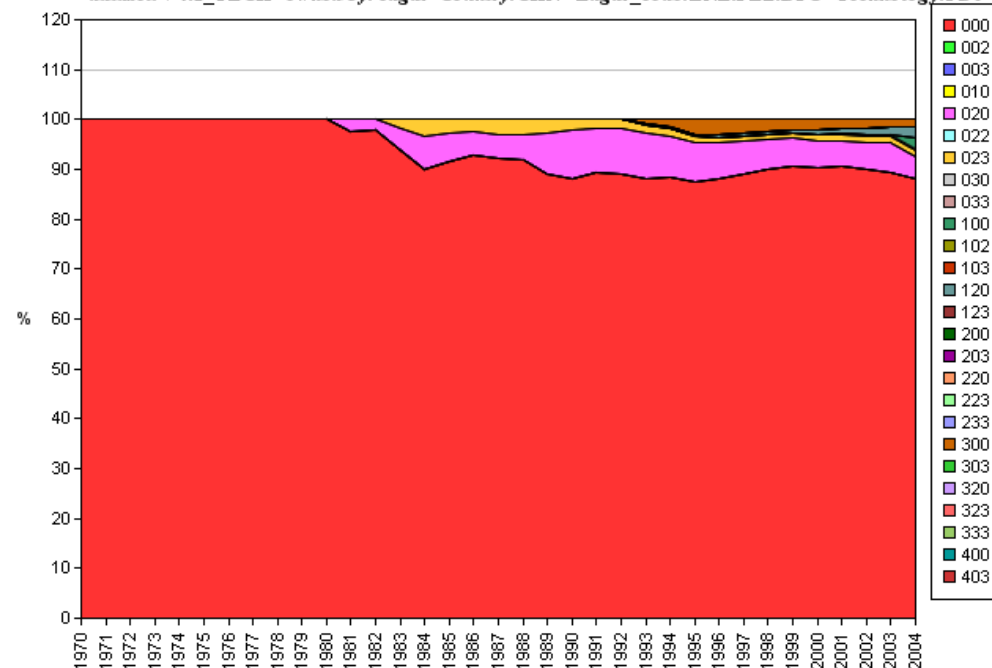
APPLICATION OF EOP to TECHNOLOGIES

dataset: V4.1\_TECH owned by: edgar Country: DEU - Edgar\_code: ENE.PEL.BTC - Technology: PD0



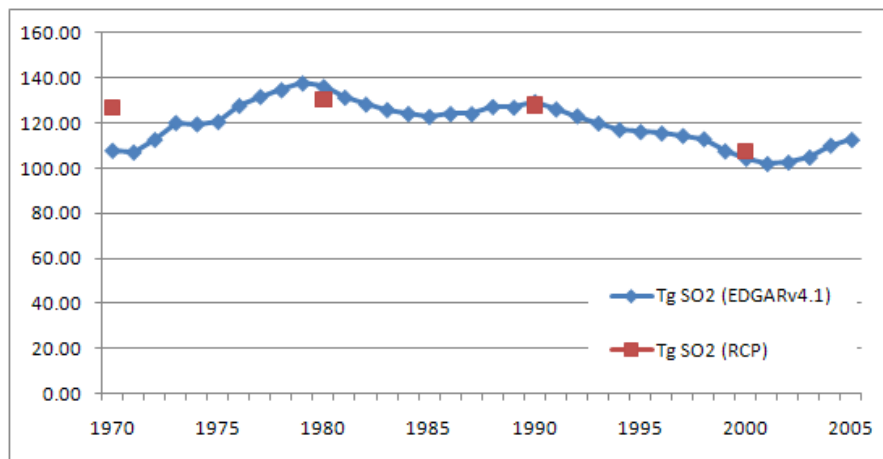
APPLICATION OF EOP to TECHNOLOGIES

dataset: V4.1\_TECH owned by: edgar Country: CHN - Edgar\_code: ENE.PEL.BTC - Technology: PD0



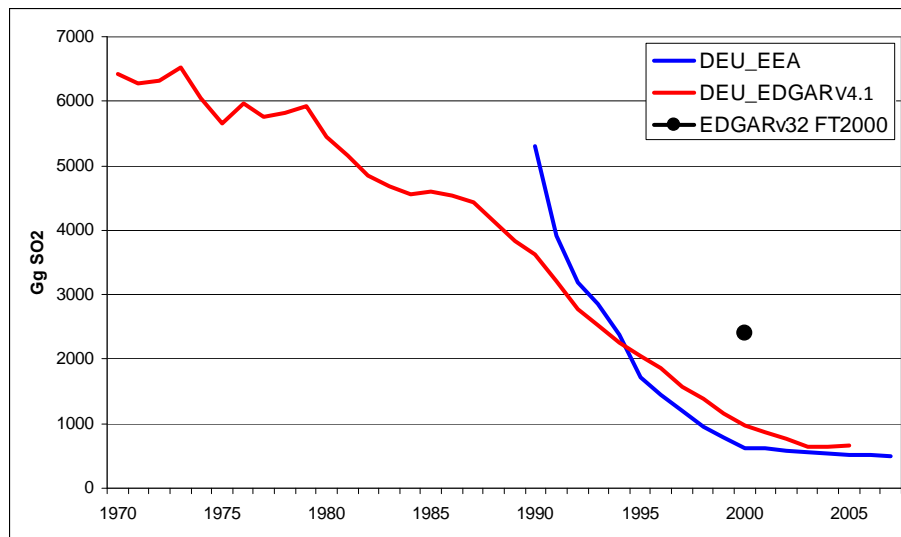
Abbrev.	Description	Reduction (BREF)	EOP_code EDGARv4	Emission reduction (EDGAR)
SND	Non-regenerative-dry (dry FGD)	50 %	SO2	50%
SNS	Non-regenerative semidry	90 %	SO3	90%
SNW	Non-regenerative wet (wet FGD)	90 %	SO3	90%
SRN	Regenerative	95 %	SO3	90%
NSN	SOxNOx	95 %	SO3	90%
NSF	Non-specified	0 %	SO0	0 %
NOC	No control	0 %	SO0	0 %

## Comparison global SO<sub>x</sub> emissions of EDGAR v4.1 and RCP (Lamarque, 2010)

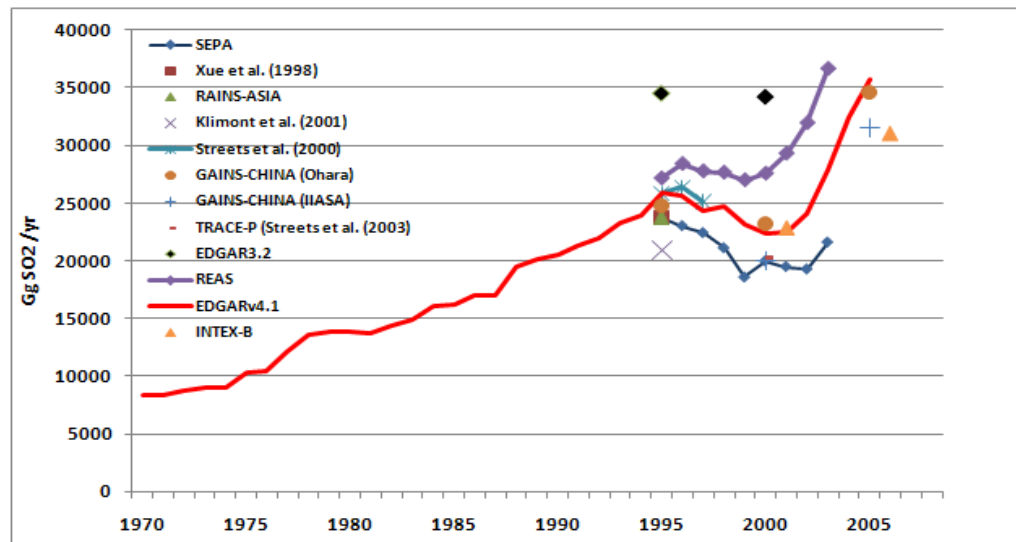


Agreement on global and on regional scale  
thanks also to the accounting of country-  
specific S-content of the fuel

## EDGAR v4.1 and EMEP for Germany



## or EDGARv4.1 and GAINS for China.





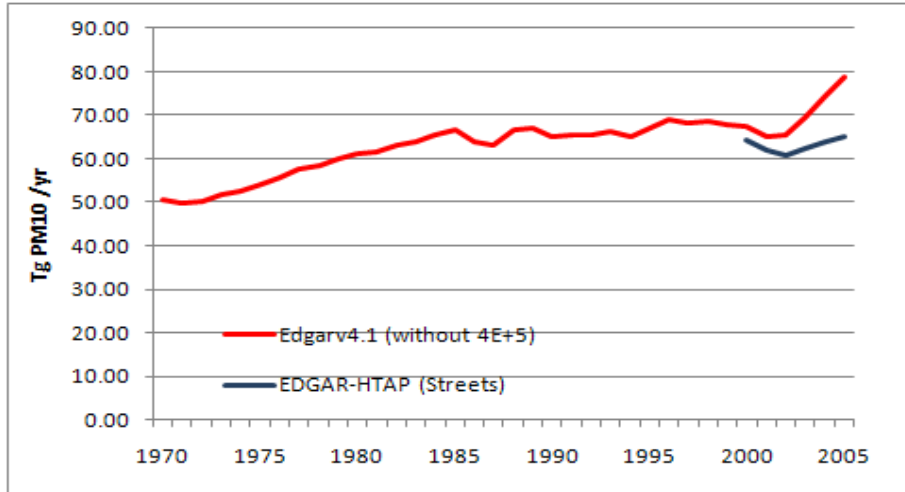
Methodology: For year  $y$ , country  $x$ , sector  $z$ , BC/ OC emission factors are derived from Emission factors for PM<sub>10</sub> of the EMEP/ EEA Guidebook, June 2010 and share of PM<sub>1</sub>/OC/BC from T. Bond (2004, 2007)

$$EF_{BC}(y, x, z) = EF_{PM10}(y, x, z) \Big|_{EEA('09)} * \frac{EF_{PM1}(z) \Big|_{Bond('07)}}{EF_{PM10} \Big|_{Bond('07)}} * \frac{EF_{BC}(z) \Big|_{Bond('07)}}{EF_{PM1} \Big|_{Bond('07)}}$$

$$EF_{OC}(y, x, z) = EF_{PM10}(y, x, z) \Big|_{EEA('09)} * \frac{EF_{PM1}(z) \Big|_{Bond('07)}}{EF_{PM10} \Big|_{Bond('07)}} * \frac{EF_{OC}(z) \Big|_{Bond('07)}}{EF_{PM1} \Big|_{Bond('07)}}$$

In addition and independent of the EF, there are defined for each technology-type :  
End-of-pipe abatement measures: based on typology info of UCI Platts database,  
and reduction percentages from EIA Clean Coal

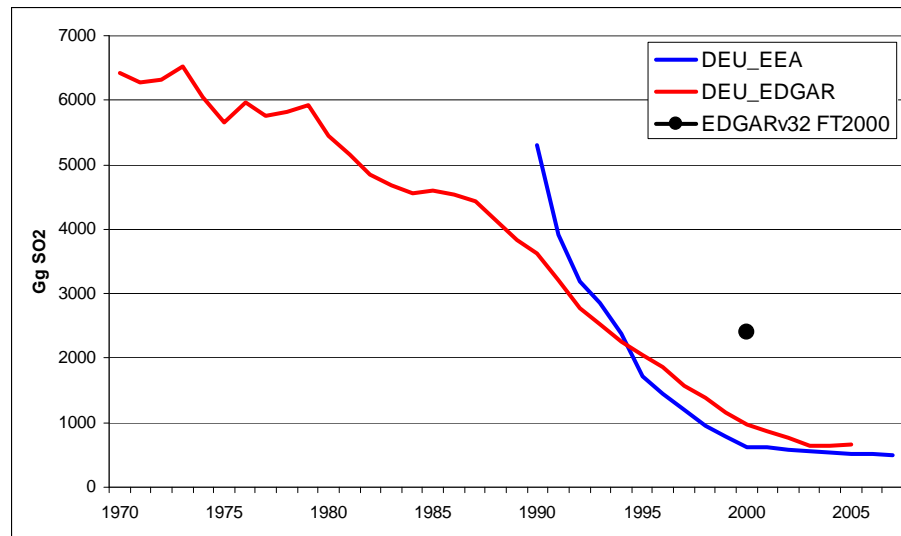
## Comparison global PM emissions of EDGAR v4.1 and HTAP (Streets, 2010)



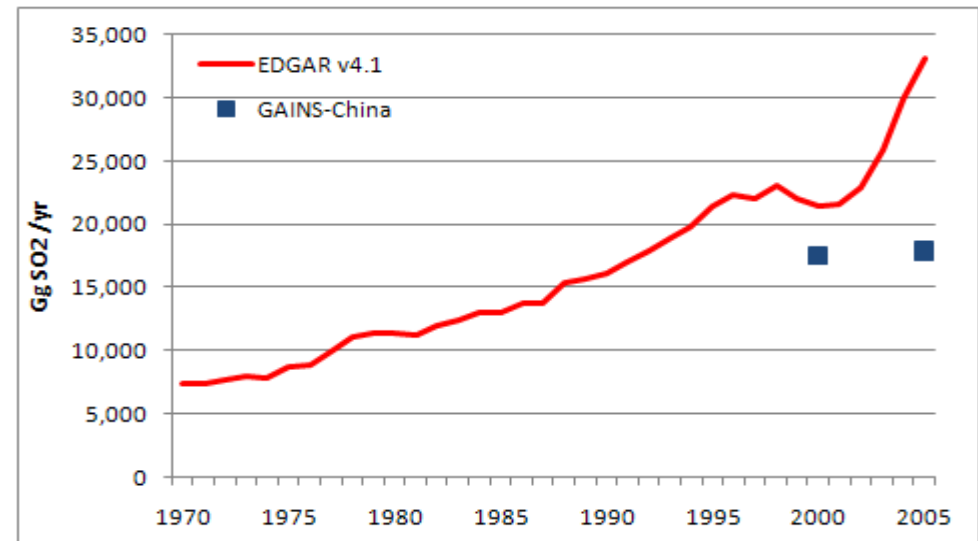
Taking into account higher uncertainty, results are acceptable.

Noted issues: biofuel burning in power and transformation industry, category allocation of flaring, superemitters in road transport

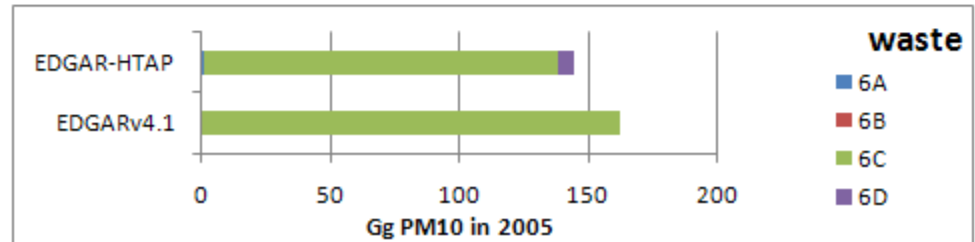
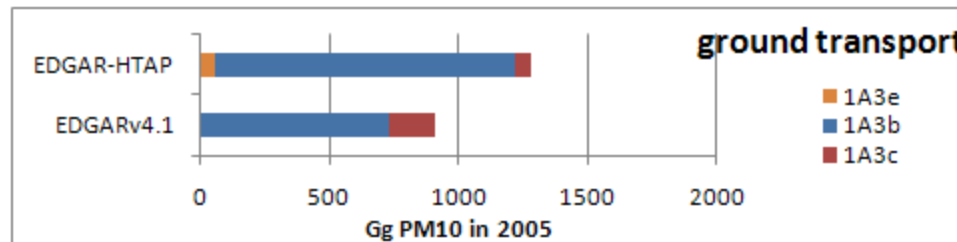
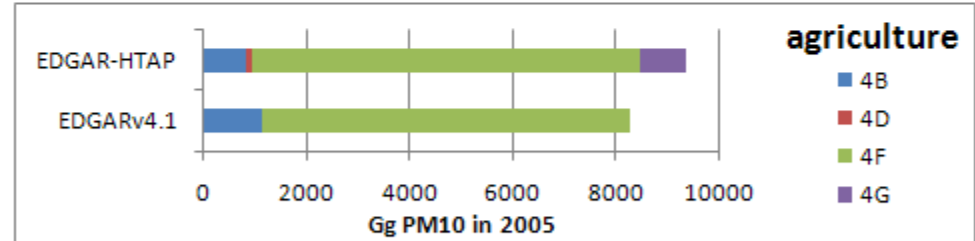
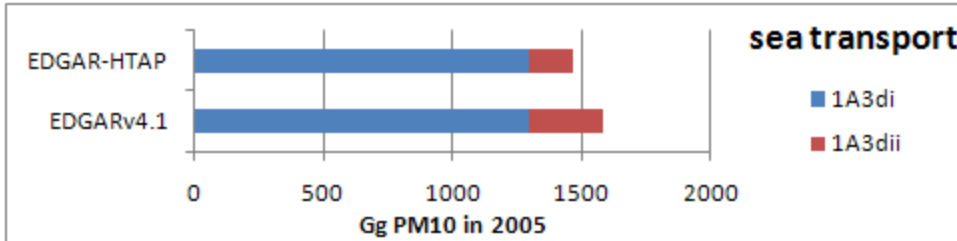
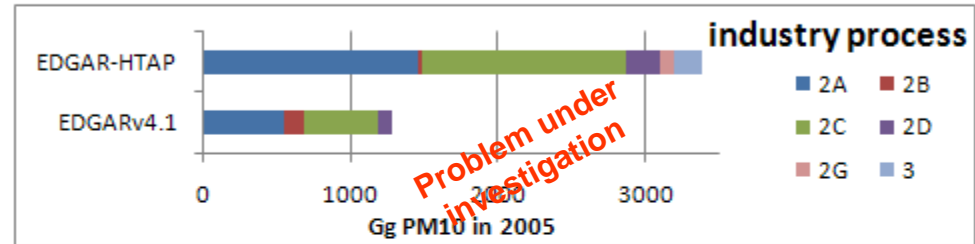
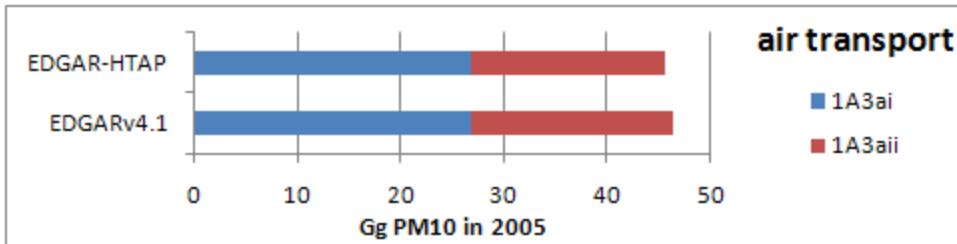
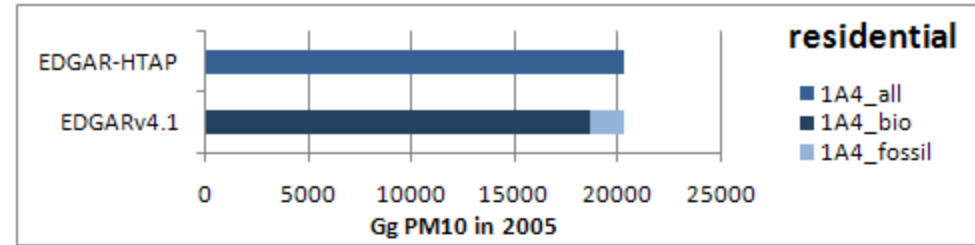
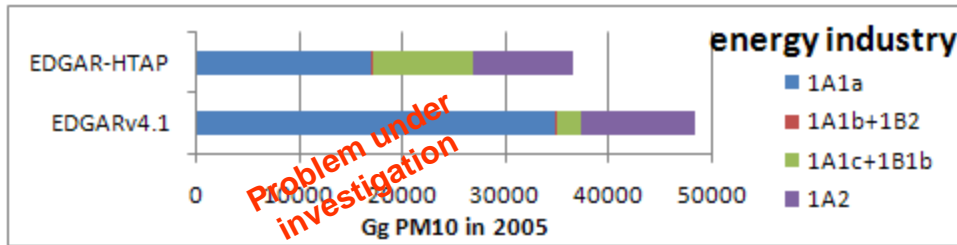
## EDGAR v4.1 and EMEP for Germany



## or EDGARv4.1 and GAINS for China.



## Sectoral details for PM emissions in EDGAR v4.1



Example of PM emission differences in road transport:  
comparison of EF/EOP with T. Bond (2007, 2004):

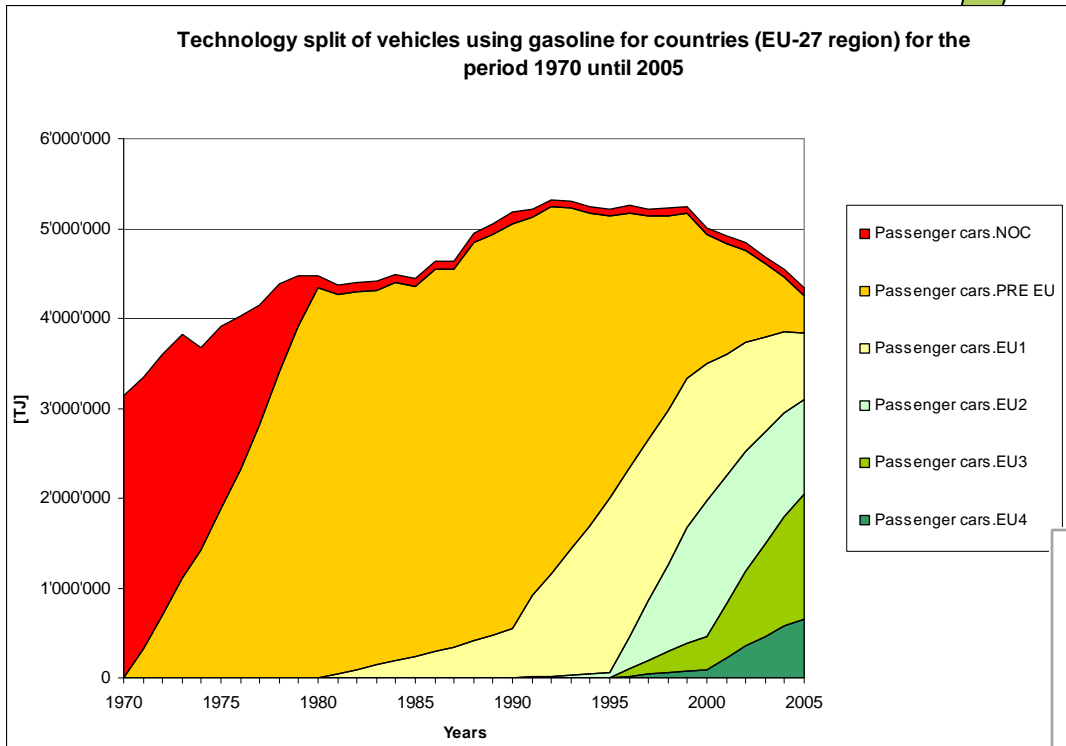
	Control measures	EDGARv4.1 (kg/TJ)	EDGARv4.1 (g/kg)	T. Bond et al (2004)	T. Bond et al (2007)
<b>Diesel, on road general</b>	PEU/ standards only beginning	97.9	4.49	3.5 g/kg diesel	2 g/kg mid. dist. diesel
passenger cars	UT1/ standards in place	40.7264	1.87	1.5 g/kg	
passenger cars	UT2/ standards in place	6.853	0.31	1.5 g/kg	
heavy duty	PEU	49.76104	2.28	3.5 g/kg diesel	2 g/kg mid. dist. diesel
heavy duty	UT1/ standards in place	18.2945	0.84	1.5 g/kg	
heavy duty	UT2/ standards in place	8.8859	0.41	1.5 g/kg	
superemitters				12 g/kg diesel	
<b>Gasoline, all vehicles</b>	PEU/ standards only beginning	5.721	0.27	0.5 g/kg gasoline	
passenger cars	UT1/ standards in place	2.379936	0.11	0.15 g/kg	
passenger cars	UT2/ standards in place	1.041222	0.05	0.15 g/kg	
heavy duty	PEU	9.683268	0.45	0.5 g/kg gasoline	
superemitters				2 g/kg	
<b>Gasoline, two-stroke</b>	NSF/ standard	17.34	0.81	15 g/kg	
motorcycles	EU1	9.8838	0.46		
	EU3	1.734	0.08		
	high-emission practice			30 g/kg	

Similar EF for diesel and gasoline

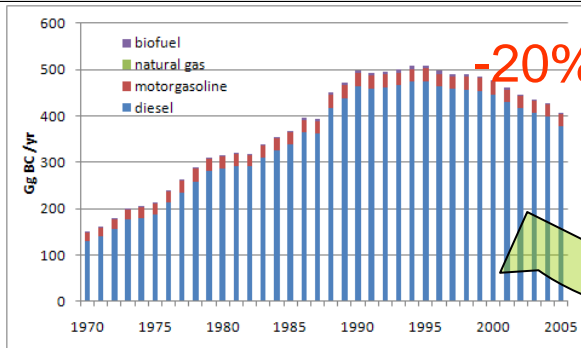
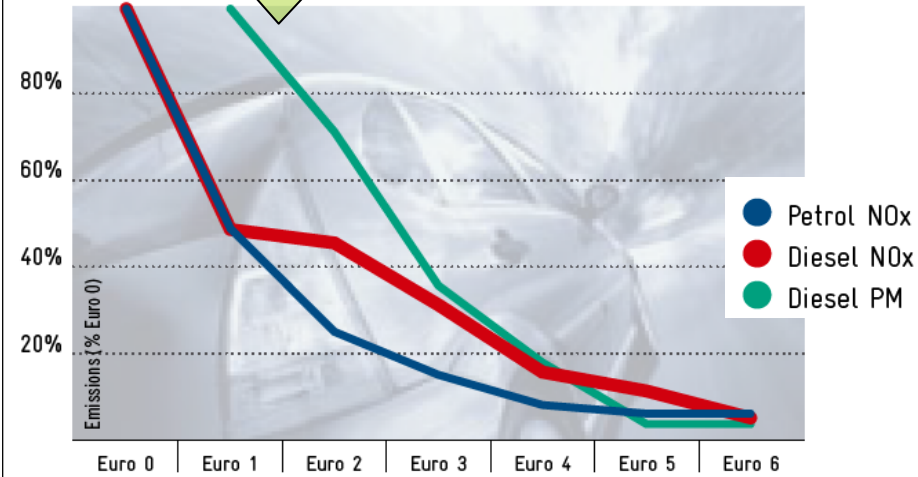
But EDGARv4.1 opted for no “superemitters”

A 10% share emitting 10x as much implies 2x total emissions

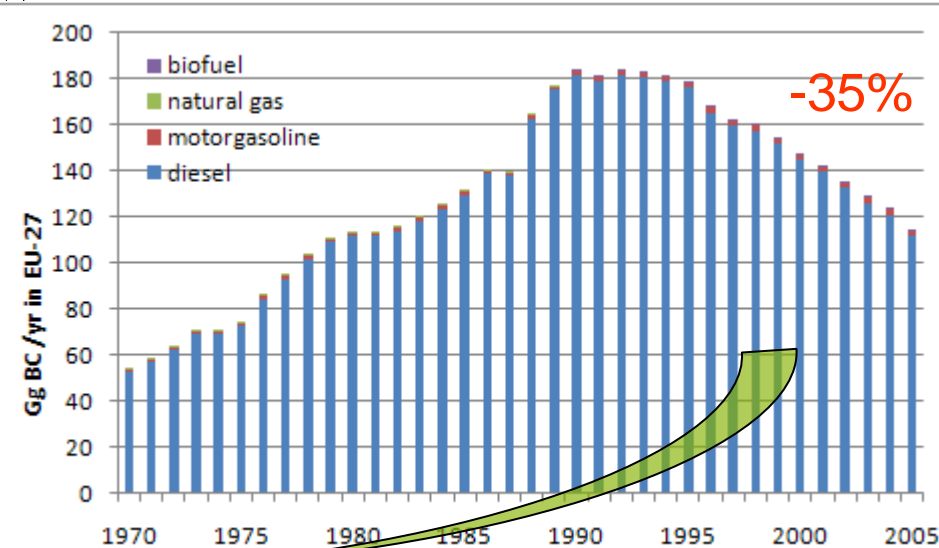
## Road transport: details of abatement measures implemented in EDGARv4.1



**Passenger Cars**



Comparison  
Global trend:  
less  
decreasing



## Upgrade to EDGARv4:

technology mixes, also BC/OC and NH<sub>3</sub>, 0.1° x 0.1° grid, multiple datasets (e.g. biomass burning)

## Release of Air Pollutants:

available on [edgar.jrc.ec.europa.eu](http://edgar.jrc.ec.europa.eu) since July 2010 (incl. SO<sub>2</sub>)

## Release of PM (10, 2.5), BC, OC:

Final checks ongoing, release foreseen for 1st October 2010

## Outlook:

Update of EDGARv4.1 to 2008 (including GHG, AP and particles) by end of 2010



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## Europe needs researchers

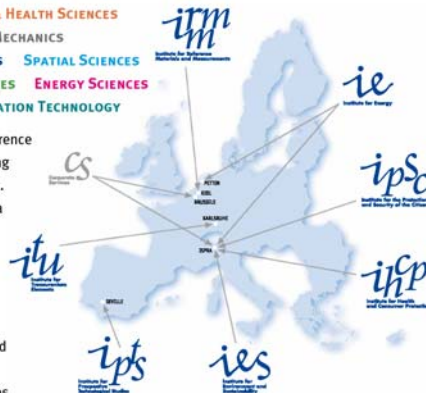
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