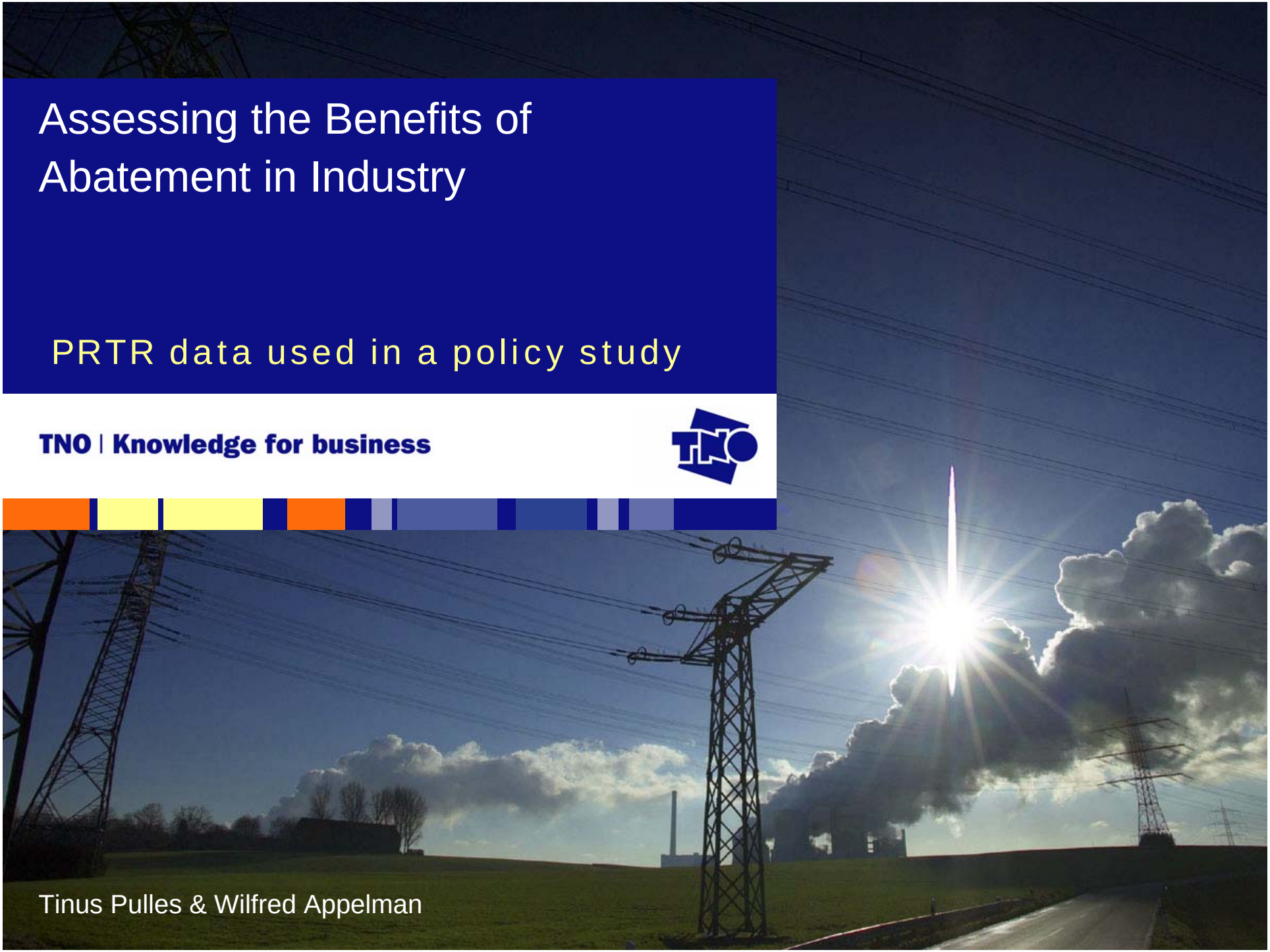
Assessing the Benefits of Abatement in Industry

PRTR data used in a policy study

TNO | Knowledge for business



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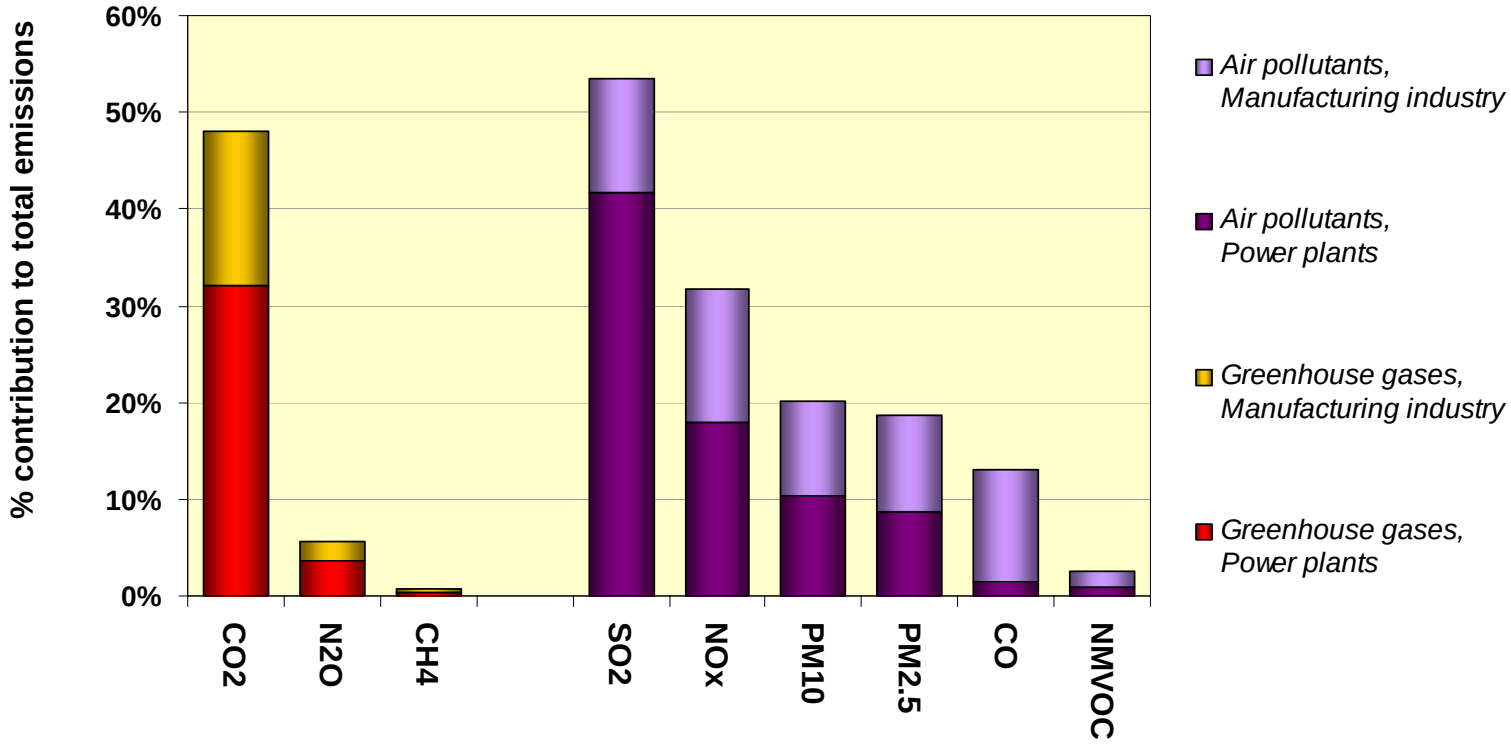
Outline

- European air pollution policy for large combustion plants
- NO_x and SO_2 emissions from large combustion plants
- Facility level emissions reporting in Europe
- Method
- Results
- Conclusion

Contribution of large combustion plants to European emissions to air



European large combustion plant legislation

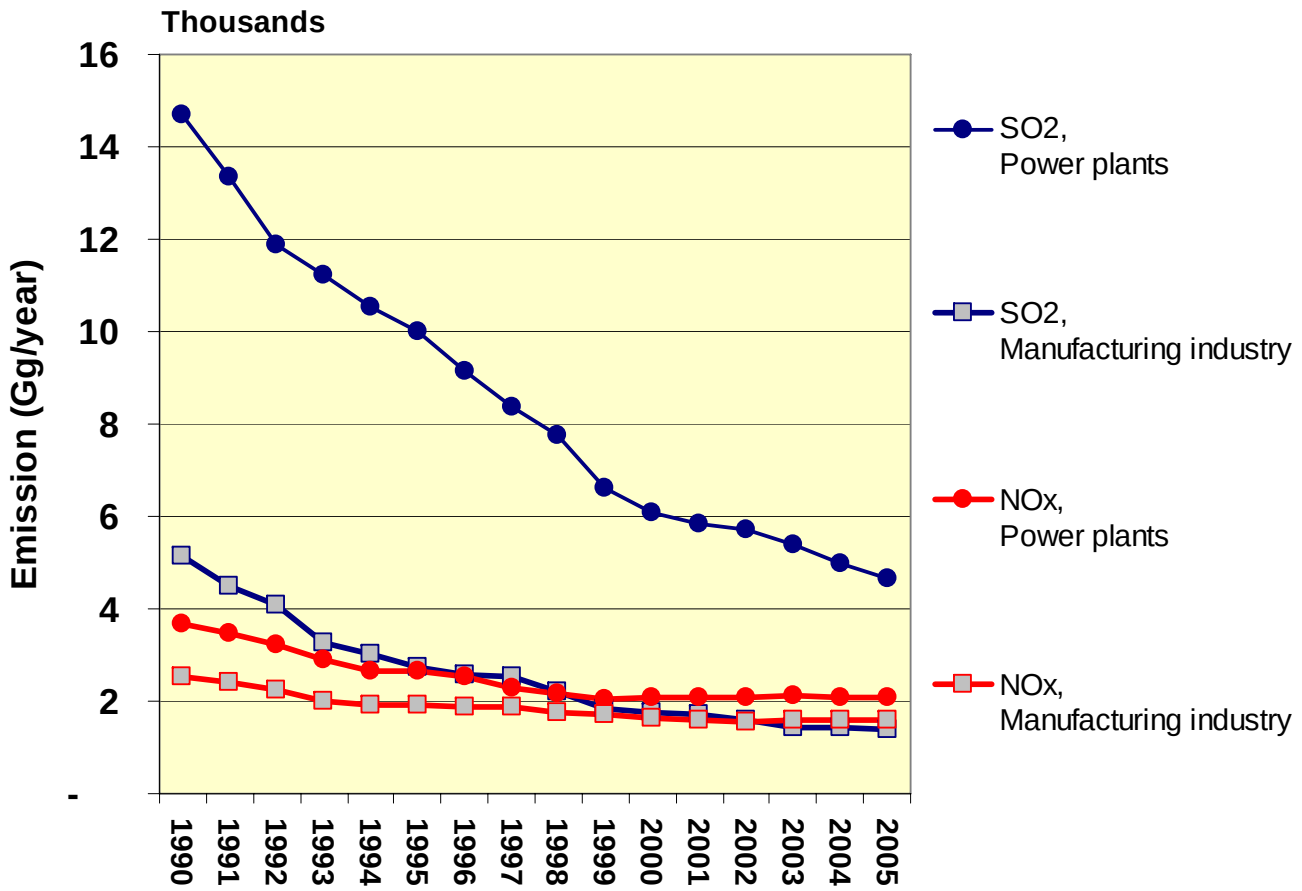
- Setting emission limits:
  - Large Combustion Plant Directive (1988, latest update: 2001)
    - Emission limit values for SO_x, NO_x and “dust”
    - “Large” means capacity over 50 MW_{th}
  - Integrated Pollution Prevention and Control (“IPPC”) Directive (1996)
    - Broader scope (pollutants, media, processes)
    - Prescribes “Best Available Technologies (BAT)”
    - Defines BAT associated emission limit values
    - BAT defines in BAT Reference reports (BREF)

- Emissions reporting
  - “Community Right to Know”: European Pollutant Emission Registry (EPER)
  - Included in national inventories

Trends in European SO_2 and NO_x emissions

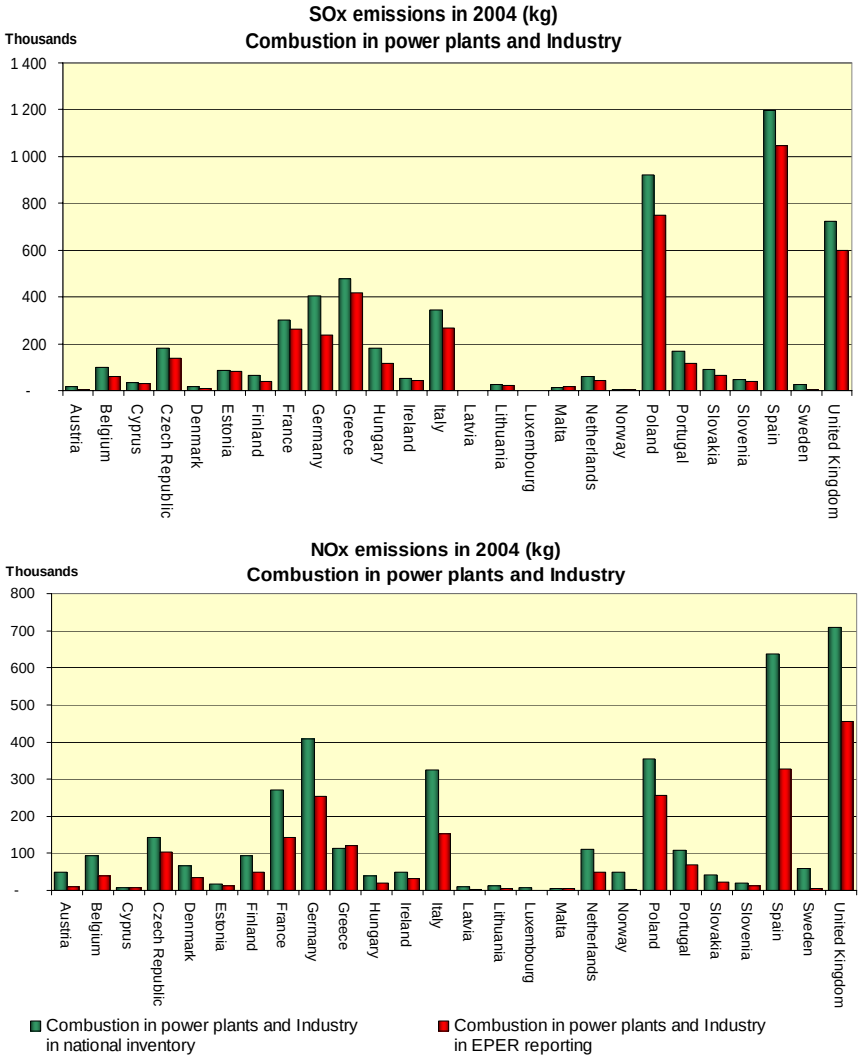
- SOx from power plants decreased by 68%
- NOx from power plants decreased by 43%

- Fuel input increased by 12%



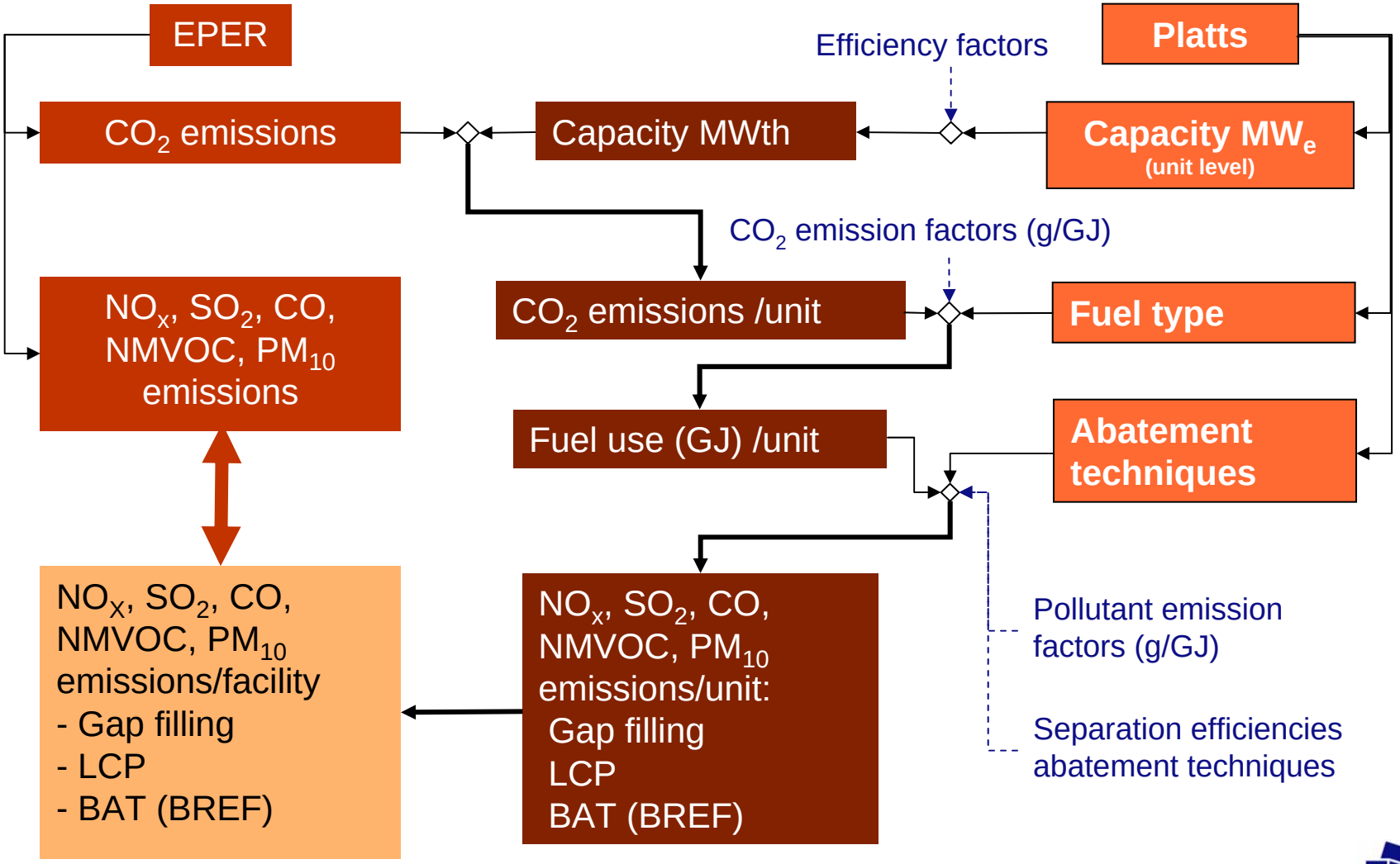
Data from European Environment Agency
http://dataservice.eea.europa.eu/dataservice/metadetails.asp?id=1006

Comparison of EPER emisison reports with national inventories



- EPER includes a large fraction of SO_2 and NO_x emissions in the European Union

Method


EPER
Efficiency factors
Platts
CO_2 emissions
Capacity MWth
Capacity MW_e
(unit level)
CO_2 emission factors (g/GJ)
NO_x, SO_2, CO, NMVOC, PM_{10} emissions
CO_2 emissions /unit
Fuel type
Fuel use (GJ) /unit
Abatement techniques
NO_X, SO_2, CO, NMVOC, PM_{10} emissions/facility
- Gap filling
- LCP
- BAT (BREF)
NO_x, SO_2, CO, NMVOC, PM_{10} emissions/unit:
Gap filling
LCP
BAT (BREF)
Pollutant emission factors (g/GJ)
Separation efficiencies abatement techniques

Type of fuels used in the 450 power plants in this study

Fuel type	Fuel	Number of EPER facilities linked to fuel type in Platts	Number of Platts units in selected EPER facilities linked to fuels
Hard Coal	Anthracite and bituminous coal	3	8
	Anthracite or semi-anthracite coal	5	11
	Bituminous coal	147	370
	Bituminous coal and anthracite coal	3	4
	Sub-bituminous coal	5	14
Brown coal	Bituminous coal and lignite (brown coal)	7	10
	Lignite (brown coal)	41	182
	Lignite and bituminous coal	3	12
	Lignite and sub-bituminous coal	2	6
Fuel Oil	Heavy fuel oil (Number 6 oil or bunker)	64	239
	Residual oil	1	1
Other Oil	Diesel oil	8	22
	Distillate oil (also Number 2 oil and light fuel oil)	32	82
Gas	Natural gas	220	511
	Liquefied natural gas	2	10
Total (*)		**450**	**1 482**

(*) Since the Platts database contains information at the unit level, an EPER facility can consist of more than one unit and therefore can be assigned to more than one fuel type. Therefore, the total number of times that EPER facilities are assigned to Platts units (543) is higher than the total number of EPER facilities included in the evaluation.

Fuels combusted from reported CO_2 emission

$$[CO_2]_{unit} = [CO_2]_{facility} \times \frac{Operation\ time_{unit} \times Cap_{unit} \times EF_{CO_2, fuel_{unit}}}{\sum_{all\ units} Operation\ time_{unit} \times Cap_{unit} \times EF_{CO_2, fuel_{unit}}}$$

Fuel combusted at European power plants, included in this study (PJ in 2004)

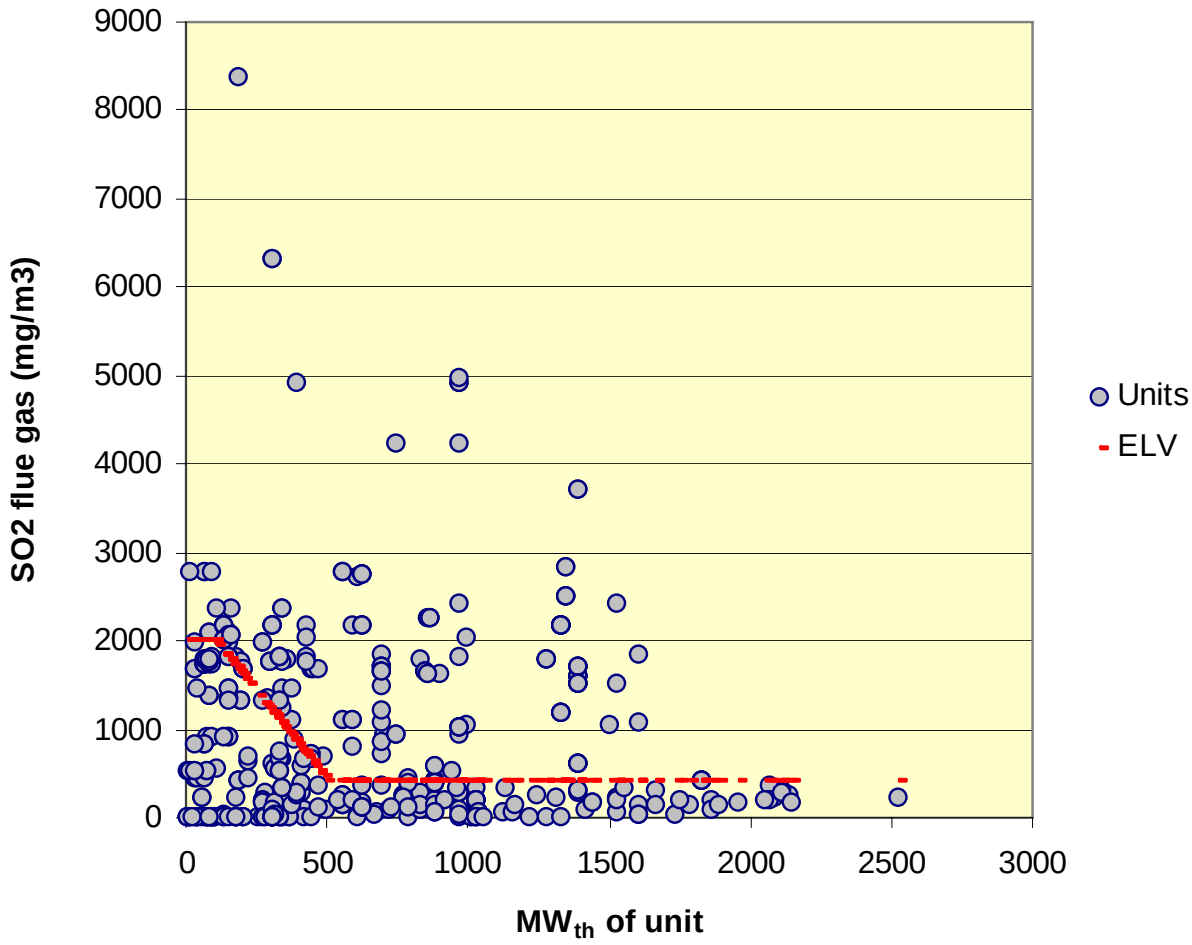
Fuel type	Our estimate	EUROSTAT data[7]	Percentage
Hard Coal Brown Coal	4 540 3 270	9 391	83 %
Fuel Oil Other Oil	914 117	1 189	87 %
Gas	2 970	5 680	52 %
Total	**11 800**	**16 260**	**73 %**

Air pollutant reporting in the 2004 EPER data set (for the selected set of 450 facilities)

pollutant	threshold Gg/yr	Emission (Gg/year)				
		Reported in EPER	Gap filled	Estimated above threshold	Missing emission reports	
					Gg	Completeness**
CO_2 *	100	1 004 008	-	-	-	100 %
NO_x	0.1	1 494	1 506	1 506	12	99 %
SO_2	0.15	2 773	2 853	2 851	79	97 %
CO	0.5	207	525	485	278	43 %
NMVOC	0.1	6	59	49	43	12 %
PM_{10}	0.05	91	1 692	1 691	1 601	5 %

* CO_2 emissions are used to estimate fuel use and is available for all 450 power plants in the study.
** "Reported EPER emission"/ "Estimated emission above threshold" in per cent

SO_2 flue gas concentrations in solid fuel fired power plants with the LCP Directive's emission limit values

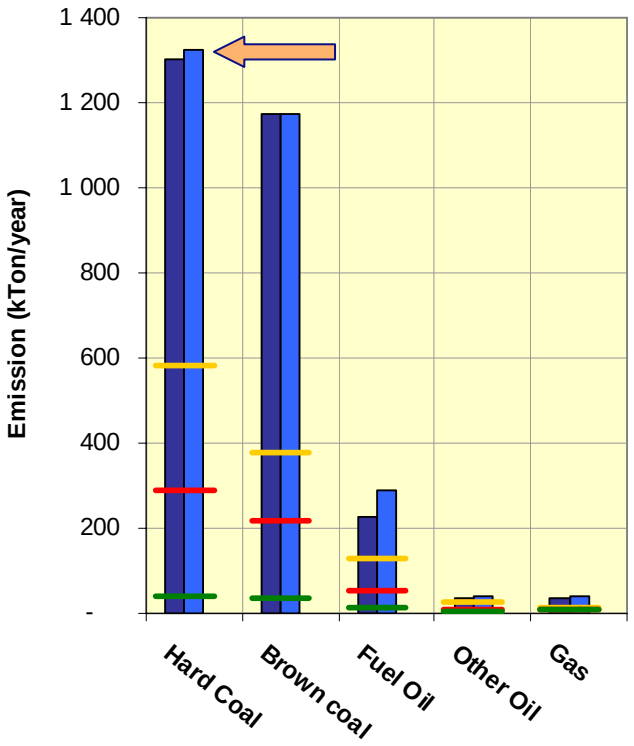


Estimated emission reduction in 2004 through full introduction of BAT (450 power plants)

pollutant	Estimated Emission (kt/year)				
	"as is" gap filled emissions	Potentially remaining reduced emissions with full introduction of BAT as described in the LCP BREF			
		Upper end of BAT		Lower end of BAT	
		kt	% of "as is"	kt	% of "as is"
NO_x	1 506	622	41 %	198	13 %
SO_2	2 853	566	20 %	98.9	3 %

Estimated emission reduction in 2004 through full introduction of BAT (450 power plants)

SO2 emissions in All countries;
450 facilities
1482 combustion installation units



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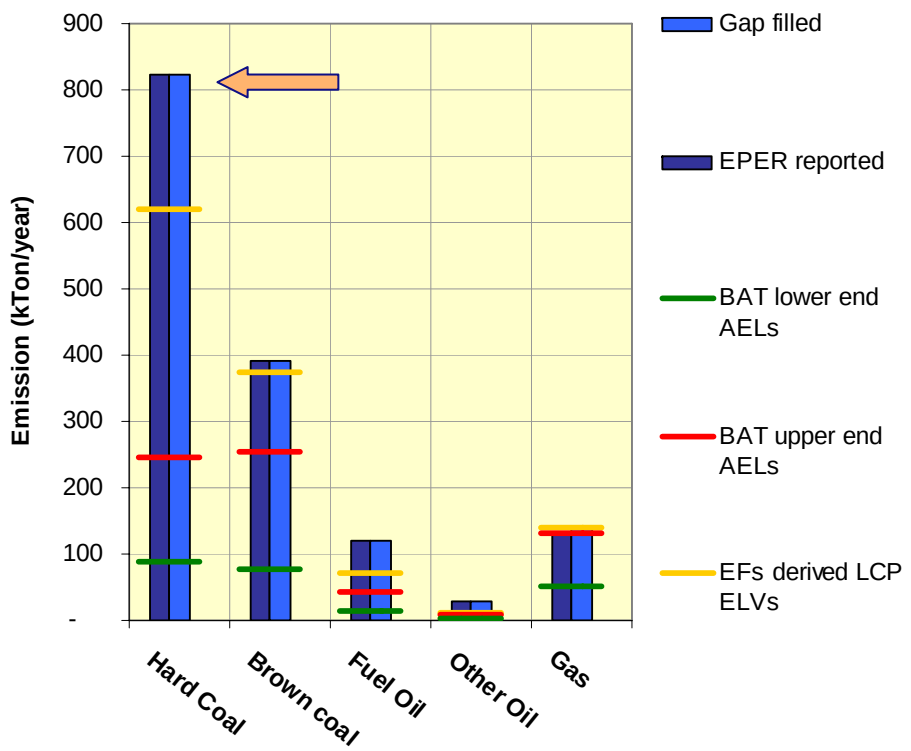

Conclusions

- Facility level emission reports can be used to assess policy effectiveness
  - Provided that activity data are available or can be estimated

- In Europe large emission reductions of NO_x and SO_2 at power plants can still b e achieved by introducing best available technologies.