Cost- Efffectiveness of AQM in Germany

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In Germany the cost- benefit approach is not used

Why?
We don't know the cost and we don't know the benefit.

Cost Effectiveness Approach in Europe

Develop the environmental quality goal and derive from this goal the necessary reduction and evaluate the most cost effective measures to meet the goal.

Of course the evaluation includes the availability of technology and related cost.

But also the cost estimations of the UBA in past were proven to be to high. But the implementation of the measures is not only dependent on the cost.

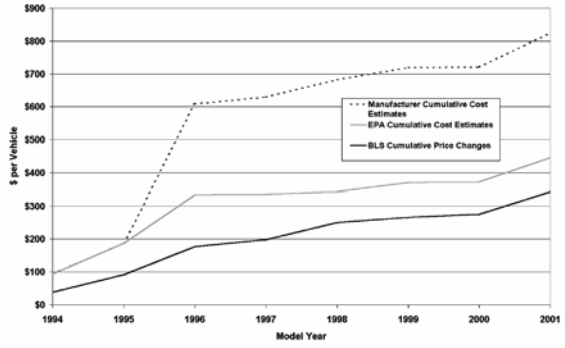
Cost Estimations from Industry

Three reasons why the cost estimations of the industry are always too high:

1. The internal cost estimations are to high due to additional safety margin on each level
2. To avoid the adoption of the measure the industry increase their internal cost estimations for the public
3. After the implementation the industry is reducing the cost by optimisation and new technology which would not used without the legislation

Cost Estimations by Government Agencies

Also government agencies tend to overestimate the abatement cost. As example the CARB and the UBA estimated in 1994 the additional cost for meeting ULEV and Euro IV level to about of 200 US $ based on at this time known technology. But the legislation forced to develop technology with lower cost



nparison of Cumulative Cost Estimates to Cumulative BLS Price Changes – all values are in 2001 dollars.

Bureau of Labor Statistics Year Price Increase

External Cost

Avoidance Potential of premature Mortality by Use of Particle Filter:

Total Mortality: (3*0,6%)	1,8% (0,6 to 3,3%)	
Cardio pulmonal Mortality (3*0,9%)	2,7% (0,9 to 4,8%)	
Lung cancer – Mortality (3*1,4%)	4,2% (1,2 to 6,9%)	
Total Mortality (800.000)	14.400	death cases per/a
Cardio pulmonal Mortality (460.000)	12.420	death cases per/a
Lung cancer (40.000)	1.680	death cases per/a

Source: Wichmann, Institute of Epidemiology, GSF

Future Diesel

Emission Limits for Passenger Cars, Light duty and Heavy Duty Vehicles- Future Standards for Diesel Vehicles

Report of the Umweltbundesamt (UBA)

TOTAL COSTS IN 2000 BY COST CATEGORY & TRANSPORT MODE

[million Euro/year]			Road							Rail		Aviation		Water-borne
	Total	%	Car	Bus	MC	LDV	HDV	Pass. total	Freight total	Pass.	Freight	Pass.	Freight	Freight
Accidents	156'439	24	114'191	965	21'238	8'229	10'964	136'394	19'194	262	0	590	0	0
Noise	45'644	7	19'220	510	1'804	7'613	11'264	21'533	18'877	1'354	782	2'903	195	0
Air Pollution	174'617	27	46'721	8'290	433	20'431	88'407	55'444	108'838	2'351	2'096	3'875	360	1'652
Climate Change High	195'714	30	64'812	3'341	1'319	13'493	29'418	69'472	42'911	2'094	800	74'493	5'438	506
Climate Change Low [1]	*(27'959)*	*(4)*	*(9'259)*	*(477)*	*(188)*	*(1'928)*	*(4203)*	*(9'925)*	*(6'130)*	*(299)*	*(114)*	*(10'642)*	*(777)*	*(72)*
Nature & Landscape	20'014	3	10'596	276	233	2'562	4'692	11'105	7'254	202	64	1'211	87	91
Up-/Down-stream [2]	47'376	7	19'319	1'585	335	5'276	16'967	21'240	22'243	1'140	608	1'592	170	383
Urban Effects	10'472	2	5'782	147	127	1'220	2'634	6'112	3'797	426	137	0	0	0
Total EU17 [3]	650'275	100	280'640	15'114	25'491	58'824	164'346	321'301	223'114	7'828	4'487	84'664	6'250	2'632

Table 2 Total external costs of transport in the EU17 countries.
Remarks:
1) Climate change costs for the climate change low scenario with a shadow value of 20€/ t CO_2 (for information only, values not used to calculate total costs).
2) Climate change costs of up- and downstream processes are calculated with the shadow value of the climate change high scenario (140€/t CO_2).
3) Total costs calculated with the climate change high scenario.

Source:Infras,IWW 2004

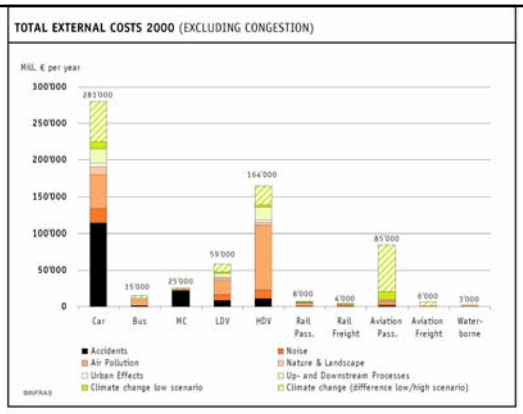


Figure 1 Total external costs 2000 (EU 17) by means of transport and cost category. Road transport is responsible for 84% of total external costs.

Source:Infras,IWW 2004

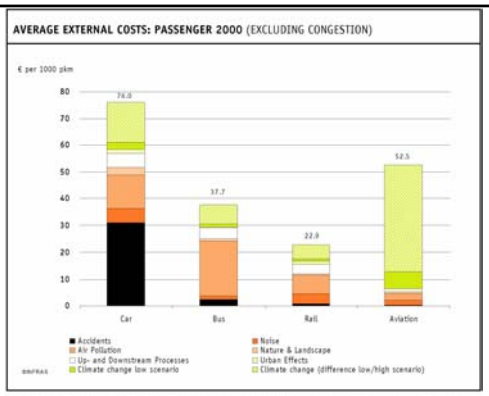


Figure 2 Average external costs 2000 (EU 17) by means of transport and cost category: Passenger transport. The high value of climate change costs in aviation is due to the higher global warming effect of aviation's CO_2 emissions at high altitude during flight (factor 2.5 used compared to the impacts of CO_2 emissions on the earth surface, based on IPCC 1999).

Source:Infras,IWW 2004

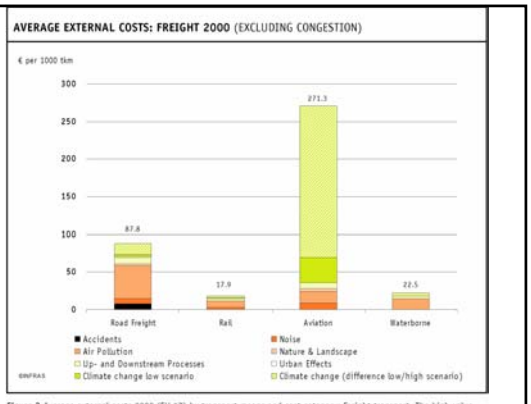
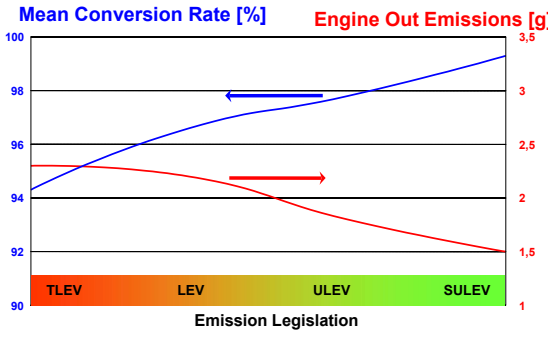


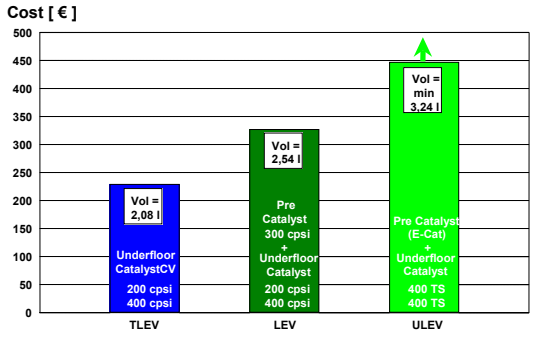
Figure 3 Average external costs 2000 (EU 17) by transport means and cost category: Freight transport. The high value of climate change costs in aviation are due to the higher global warming effect of aviation's CO_2 emissions at high altitude during flight (factor 2.5 used compared to the impacts of CO_2 emissions on the earth surface, based on IPCC 1999).

Source:Infras,IWW 2004

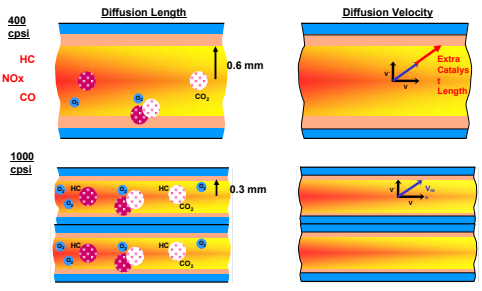
Technology



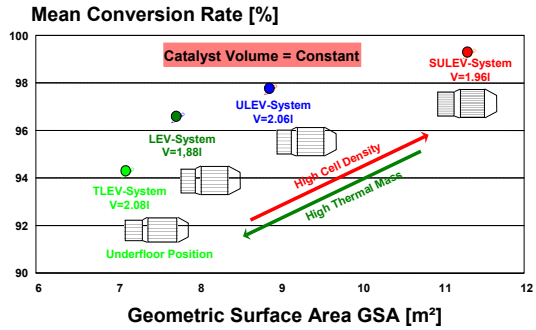
Needed Mean Conversion Rate in theFTP-Cycle and Development of the Engine Out Emissions



Catalyst System Cost Dependent on Emission Legislation and Conventional Technology (cost estimation before implementation)

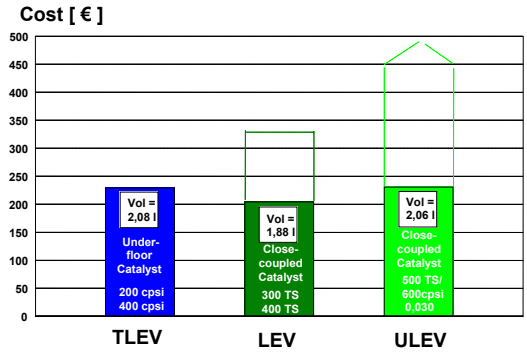


Diffusion Length as a Function of Cell Density

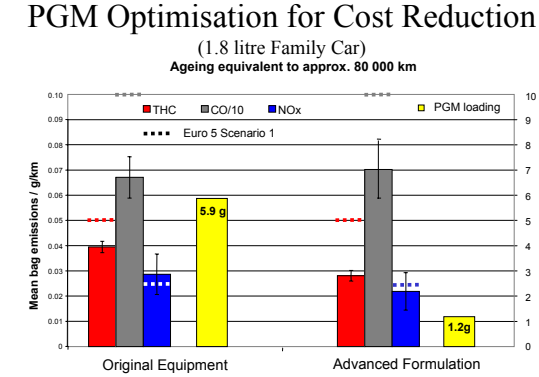


Needed Mean Conversion Rate in the FTP-Cycle

Influence of Catalyst Location and Geometric Surface Area (Cell-Density)

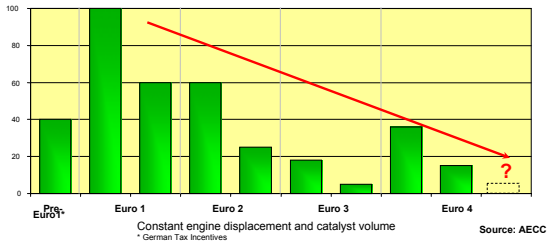


Catalyst System Cost Dependent on Emission Legislation and Cost Optimization Based on Innovative Developments today



Gasoline catalyst PGM loading trends

- PGM loading reductions through:
  - Improvement of catalyst activity and durability.
  - Cell density changes and substrate improvements.
  - Changes from underfloor to close coupled catalysts.
  - Improvements of engine control with optimised catalyst heating.



Data used by the World Bank for Cost- Benefit Calculations

For example, the U.K. government reports that compliance with Euro IV for gasoline vehicles in 2005, which yields an extra 4 percent reduction in NOx and VOC, incurs an incremental cost of 200 Euros (€200) per vehicle. This is nearly as much as the cost of removing the first 75 percent of NOx and VOC. The cost of the latter corresponds to the introduction of a three-way catalytic converter. Meeting Euro II standards in 1996 cost an additional €50 per vehicle corresponding to a further 12 percent reduction of NOx and VOC. Meeting Euro III standards in 2000 incurred an additional €400 and reduced NOx and VOC by another 6 percent. Thus the cost of removing that extra 6 percent from the exhaust was substantially more than the cost of removing the previous 87 percent.

Source: **Reducing Air Pollution from Urban Transport**
Ken Gwilliam, Masami Kojima, and Todd Johnson World Bank

Sulphur "Free" Fuel

From 1st of January 2003 1.5 €ct per litre tax incentive for sulphur content less than 10 ppm for both gasoline and diesel fuel (Onroad and offroad !).
Market changed completely

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