

# Environmental Impact and Feasibility of Euro 7

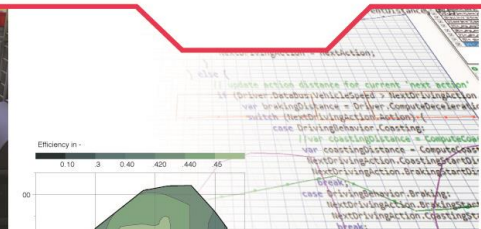
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Stefan Hausberger, Konstantin Weller, Lukas Landl

Institute of Thermodynamics and sustainable Propulsion Systems

Graz University of Technology

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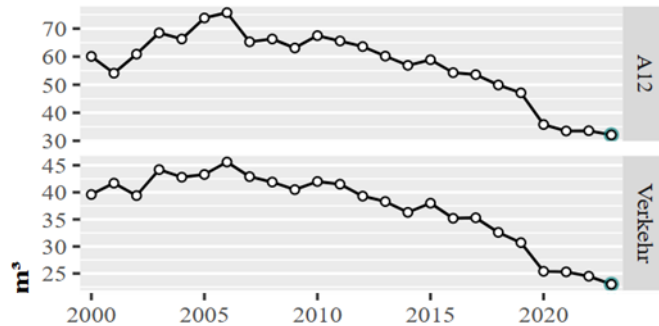
# Introduction

- Background:
  - We coordinated Euro 7 regulation developments for HDVs in CLOVE and have been involved in LDV topics too
  - We support EU COM in setting up Euro 7 implementing acts
  - We coordinate vehicle emission tests, data base and emission simulation for HBEFA and ERMES groups in EU
  - We develop the HDV CO2 certification methods and software for EU,.....
- The development of the Euro 7 (Regulation 2024/1257):
  - EU Commission developed options between 2018 and 2022 with low to high ambition scenarios and proposed rather high ambition scenario 11/2022
  - Parliament and Council made less ambitious counterproposals which were agreed 04/2024
- The details for implementation of Euro 7 are under development as “implementing acts” (what to test, how to test, on-board monitoring,...)

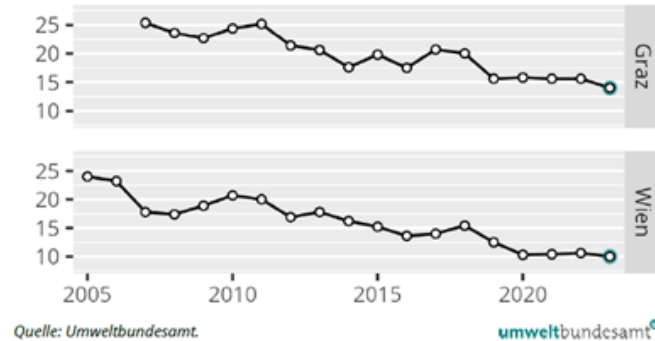
## Environmental issues from road traffic

- Air Quality limits for NO<sub>x</sub> and PM are exceeded in several hot spots near roads.
- Emissions of vehicle fleet drops significantly with penetration of EURO 6d /VI DE
- Pollutant concentrations in ambient drop continuously

**Average NO<sub>2</sub> concentrations  
at road side AQ stations Austria**



**Average PM<sub>2.5</sub> concentrations  
AQ stations Graz, Vienna**

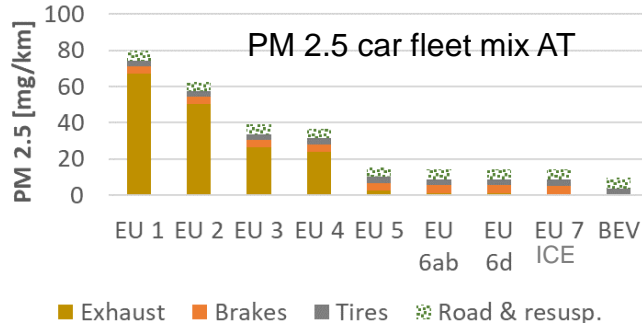
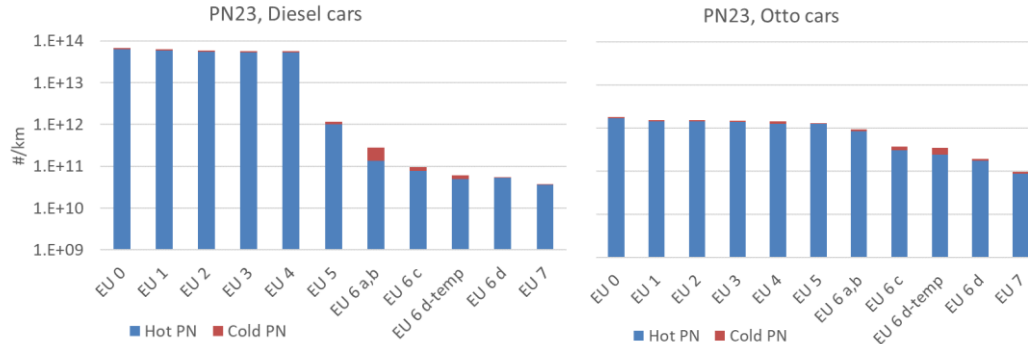


EU limit yearly avg.: 40 µg/m<sup>3</sup> (20<sub>@2030</sub>)  
WHO guideline: 20 µg/m<sup>3</sup>

EU limit yearly avg.: 25 µg/m<sup>3</sup> (10<sub>@2030</sub>)  
WHO guideline: 5 µg/m<sup>3</sup> as AEI

# Environmental issues from road traffic

EURO 6d-TEMP and 6d for LDVs and EURO VI DE for HDV have low **PN and PM RDE** exhaust emissions in most driving conditions, if there are no defects or manipulations

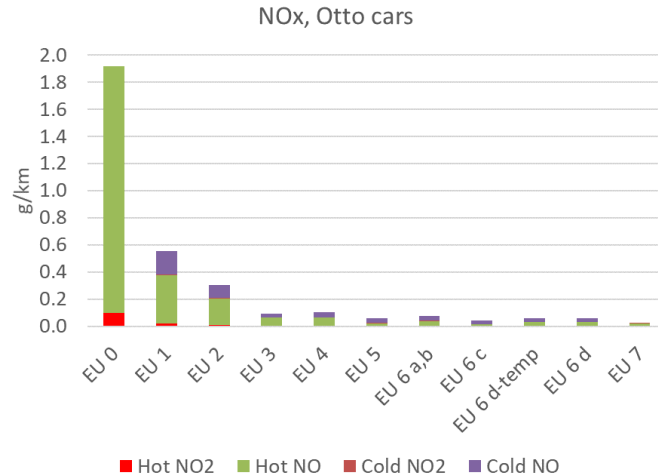
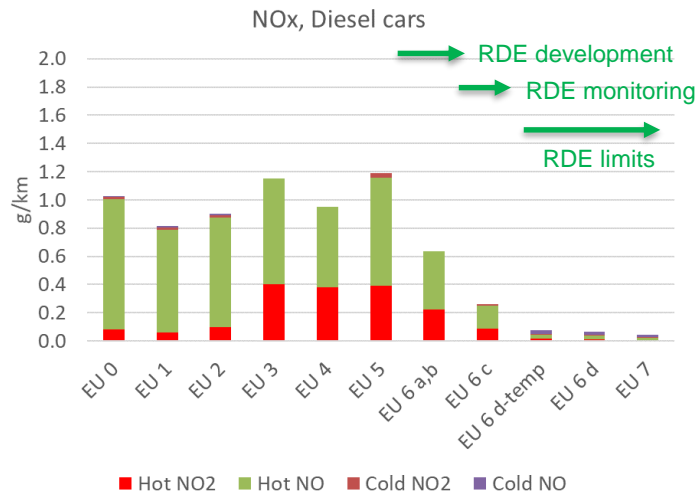


Note: full hybrids also have near to zero brake emissions

- Euro 6d diesel cars emit ca. 50% less PN than Euro 6d gasoline cars
- ➔ Tighten SI exh. PN limits (?)
- ➔ Extend durability & OBD
- OBD...On Board Diagnostic
- RDE....Real Drive Emissions
  
- PM from road traffic dominated by Non-Exhaust
- EU AQ limits for PM tightened in 2030
- ➔ Introduce Non-Exh. limits

# Environmental issues from road traffic

EURO 6d-TEMP and 6d for LDVs and EURO VI DE for HDV have low **RDE NO<sub>x</sub> emissions** in most driving conditions, if there are no defects or manipulations



- With defect or manipulated exhaust aftertreatment, EURO 6d and 7 cars have more than 20 time increased NO<sub>x</sub> levels
- Extend durability & OBD

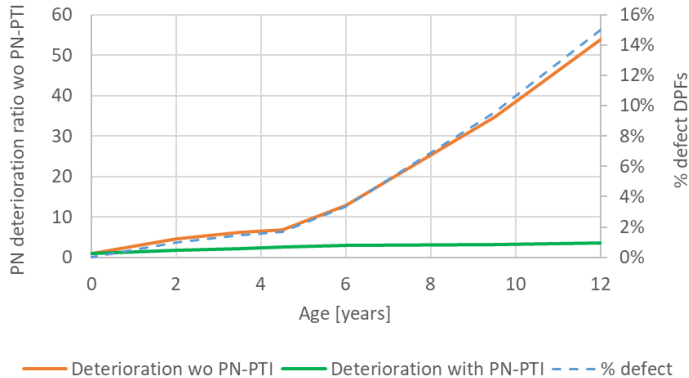
# Environmental issues from road traffic

## Examples for impacts of deterioration and manipulation

### PN idling test introduced in PTI for cars and vans in Germany, NL, Flanders

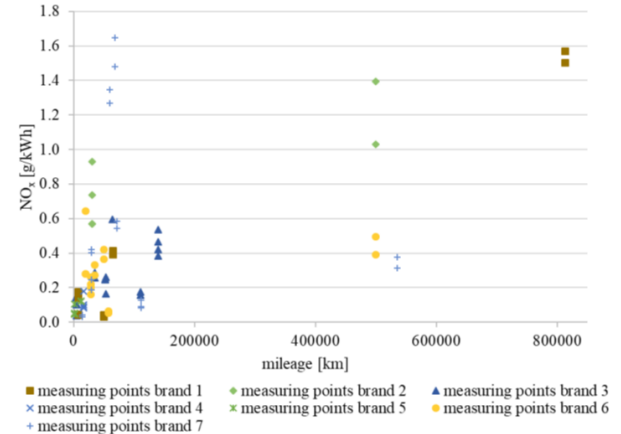
Unexpected high share of cars and LCVs failed PN PTI test. Assuming  $2.7E+13$  PN/km for car with defect DPF →

Example deterioration function PN Euro 6 a-d diesel cars



### HDV tests at TUG also on older vehicles

NO<sub>x</sub> emissions more than double over lifetime due to aging. In addition, a share of ca. 10% of HDVs is manipulated or defect (age dependent, manipulated instead of repair)

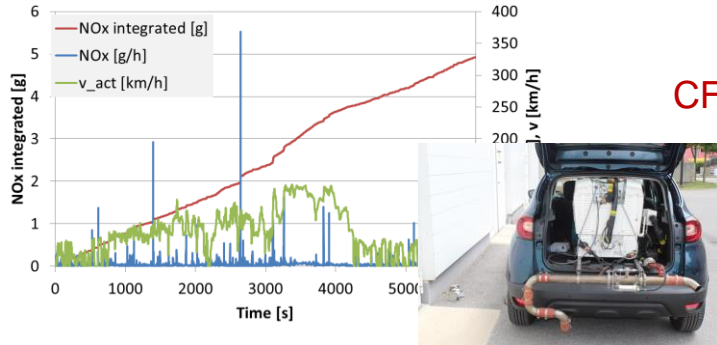


PTI...Periodical technical inspection

→ Better monitoring of exhaust control and support of PTI

## What will Euro 7 change for LDVs exhaust?

- Intro. 12/2026 new types, 12/2027 new registrations; emission limits remain as in Euro 6
- Test procedures remain as in Euro 6 with chassis dyno (WLTC) and RDE testing
- RDE conformity factors (CF) remain on Euro 6e level and  $PN_{10}$  tested instead of  $PN_{23}$


 $CF =$ 

$$\frac{\text{RDE Result [g/km]}}{\text{Limit Value}}$$

CFs	NOx	PN
Euro 6d	1.43	1.5
Euro 6e	1.1	1.34
Euro 7	1.1	1.34




- Vehicle useful life extended to 200 000 km (Euro 6 foresees emission tests < 100 000km)
- On-Board Monitoring (OBM) supporting On-Board Diagnostics (OBD) for NOx and PM (details yet open, % defect and manipulated vehicles shall drop)

➔ > 50% NOx reduction and > 60% PN reduction vs. Euro 6d vehicles expected (detailed analysis ongoing)



## What will Euro 7 change for HDVs exhaust?

- Intro. 06/2028 new types, 06/2029 new registrations; emission limits reduced vs. EU VI
- Test procedures remain as in Euro VI with engine dyno (WHTC) and RDE testing
- PN<sub>10</sub> tested instead of PN<sub>23</sub>, NH<sub>3</sub>, N<sub>2</sub>O added
- Vehicle useful life extended to 375 /875kkm (Euro VI 300 / 700 kkm for </> 16t)

	Euro VI	Euro 7	Red.	Test	
NOx [mg/kWh]	690	260	-62%	RDE	 > 65% reduction
PN [#kWh]	9.8E+11	9E+11	n.a.	RDE	 > 40% reduction
PM [mg/kWh]	10	8	-20%	WHTC	 > 20% reduction
CO [mg/kWh]	4000	1500	-63%	WHTC	Diesel already <1000
NH3 [mg/kWh]	n.a.	85	n.a.	RDE	
N2O [mg/kWh]	n.a.	200	n.a.	WHTC	 <4% contr. to CO <sub>2</sub> -äquiv.

- On-Board Monitoring (OBM) supporting On-Board Diagnostics (OBD) for NOx and PM (all details yet open for HDVs, % defect and manipulated vehicles shall drop)

# What will Euro 7 change for Non-Exhaust particles?

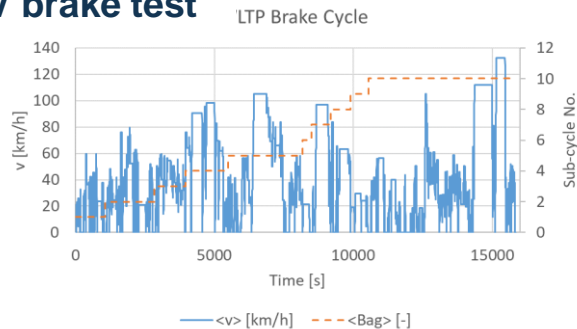
## LDVs:

- Brake wear: test procedure and PM limits defined (3 mg/km PEVs, 7 mg/km others)  
PN limits open; *PM limits represent ca. average of current brake systems*
- Tire wear: test procedure under evaluation, limits open, in force from ca. 2030-2032 on  
(*see presentation C. Lex*)

## HDVs:

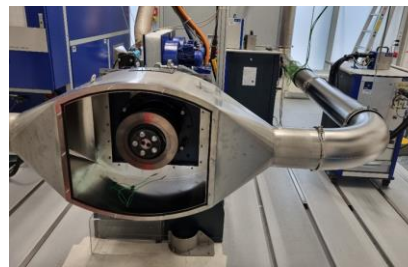
- Brake wear: test procedure under development, limits open, introduction ?
- Tire wear: everything open, introduction ?

## LDV brake test



Conversion to  
brake power  
rpm cycle

## Component test stand



Chassis  
dyno:  
Red. for  
HEV, BEV

mg/km  
#/km

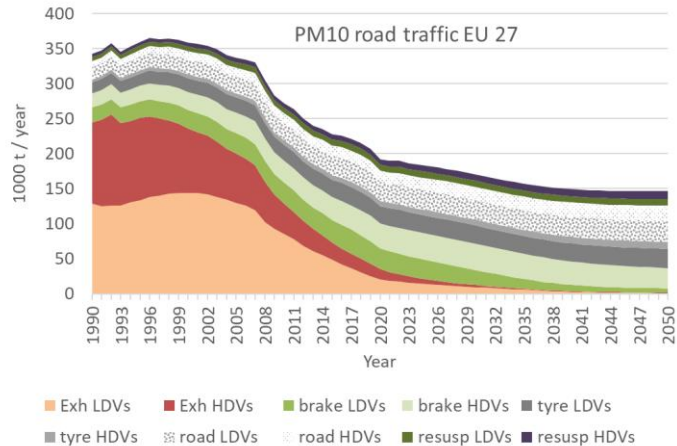
## What about CO<sub>2</sub>?

- Limits in separate regulations, updated recently to fit for Green Deal CO<sub>2</sub> targets
- Targets applicable for weighted average of new sold vehicles per OEM
- Exceeding targets → fines of €95/g/km total exceedance for cars (4250/g/t-km for HDVs)

Targets	Cars	LCVs	Trucks & coaches	City buses
2025	-15%	-15%	-15%	-
2030	-55%	-50%	-43%	-90%
2035 <sup>(1)</sup>	-100%	-100%	-64%	-100%
2040	-100%	-100%	-90%	-100%

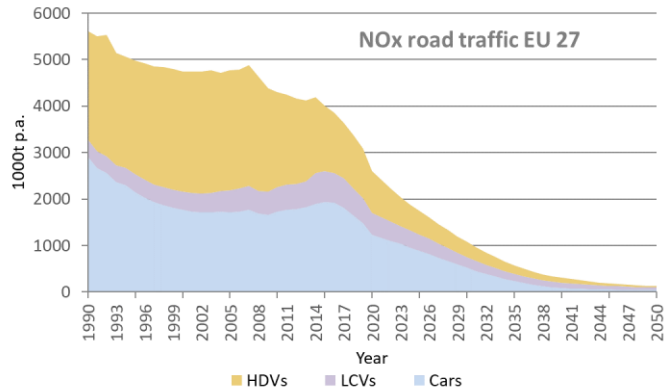
(1)..."-100%" means only zero emission vehicles can be registered, which are currently BEVs and H2 systems

## Draft results for EU 27 emission trends road traffic



Simulation with NEMO  
(Network Emission Model from TUG, ITnA):

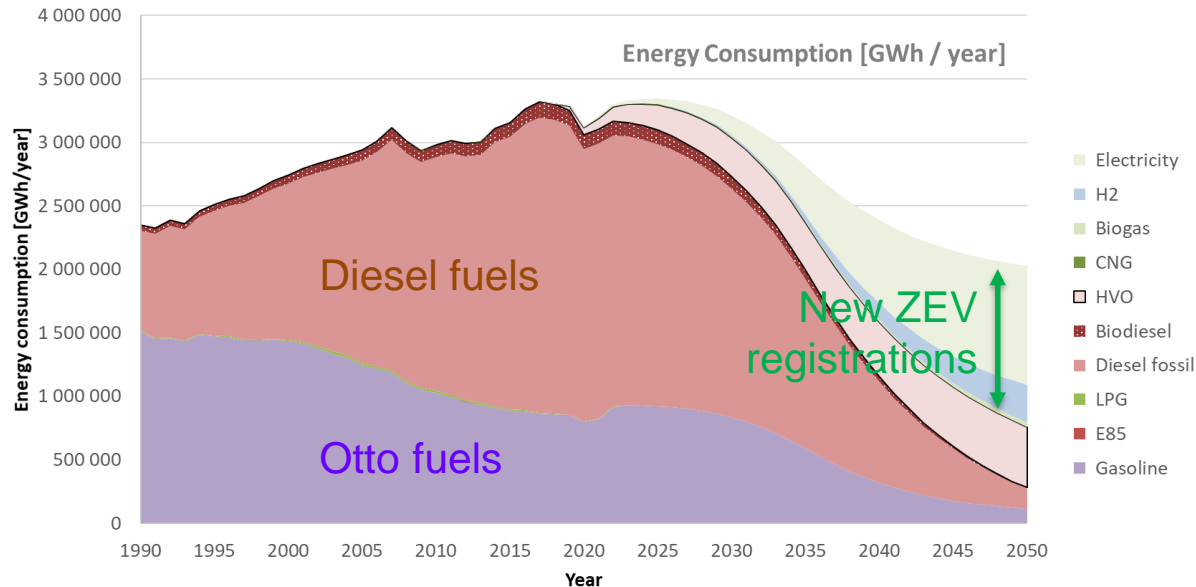
- PM: exhaust and brake emissions drop sharply, total PM ca. -20%



- NOx: Exhaust emissions drop due to Euro 6d, Euro 7 and increasing share ZEVs by > 90%

## Draft results for EU 27 emission trends road traffic

- Energy: drops due to increasing share of BEVs by > 30%
- CO<sub>2</sub>: tailpipe drops by more than 50%, drop in WTW depends on energy mix  
In 2050 still > ca. 40% energy demand from vehicles with Otto- or Diesel engines!  
**Yet no reasonable policy to replace fossil gasoline and diesel!**



## Summary

- Pollutant emissions from EURO 6de / VI DE already low
- Manipulations, deterioration and cold start emissions to be better controlled
- CO<sub>2</sub>-fleet standards need ~100% ZEVs in new registrations until 2035 (LDVs), 2040 (HVs)
- Fleet penetration of Euro 6 & 7 and ZEVs reduce exhaust pollutant emissions drastically
  
- Euro 7 introduces minor reduction in emission limits for LDVs vs. Euro 6e
- PN10 instead of PN23, extended lifetime and CFs=1 will lead to emission reductions
- Euro 7 introduces more ambitious reductions in emission limits for HDVs vs. Euro VI
- Euro 7 shall introduce efficient OBM system supporting also vehicle inspection
- Euro 7 introduces world wide first standards for brake and tire wear particles



**Thank you very much for your attention!**

Contact:  
Stefan Hausberger  
[hausberger@ivt.tugraz.at](mailto:hausberger@ivt.tugraz.at)