



**Adapting driver behaviour
for lower emissions**

Retrofits

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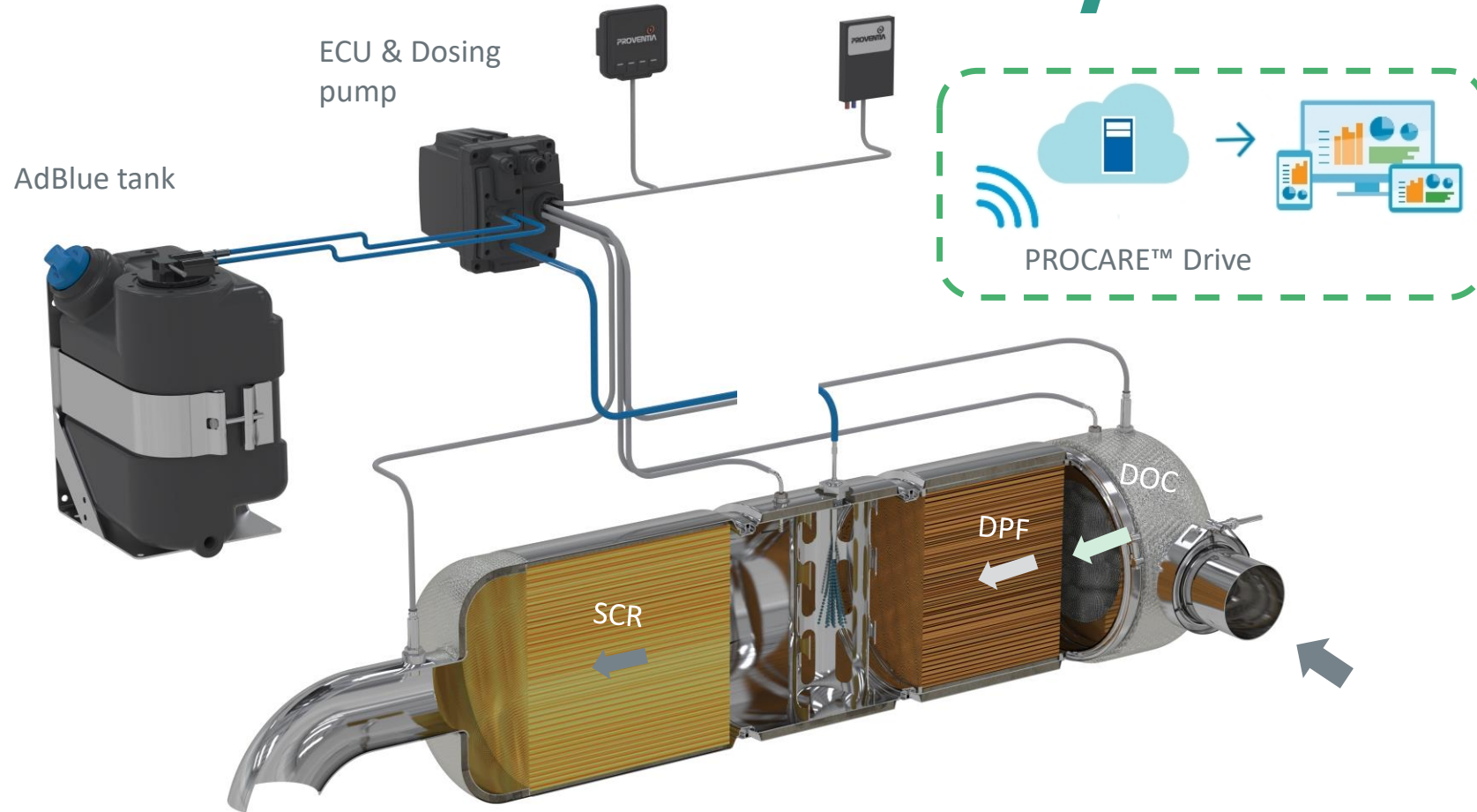
Overview

1. Retrofit for buses
2. Retrofit for light commercial vehicles
3. Conclusions

Retrofit for City Buses



Proventia NOxBUSTER® City retrofit system



PRO-CARE™ Drive

- A web-based emissions and EAT system monitoring tool

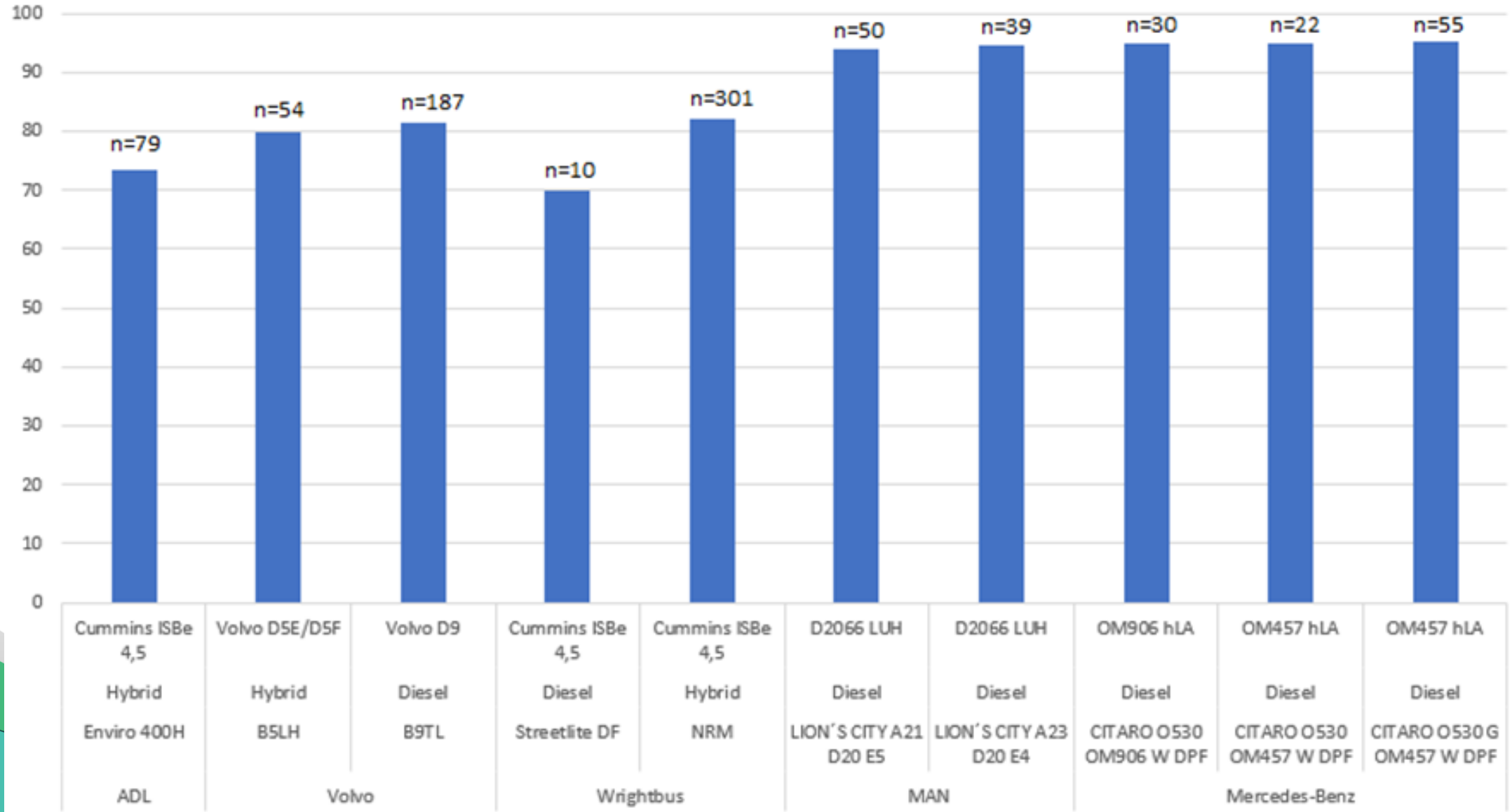
NOxBUSTER® City DPF+ SCR

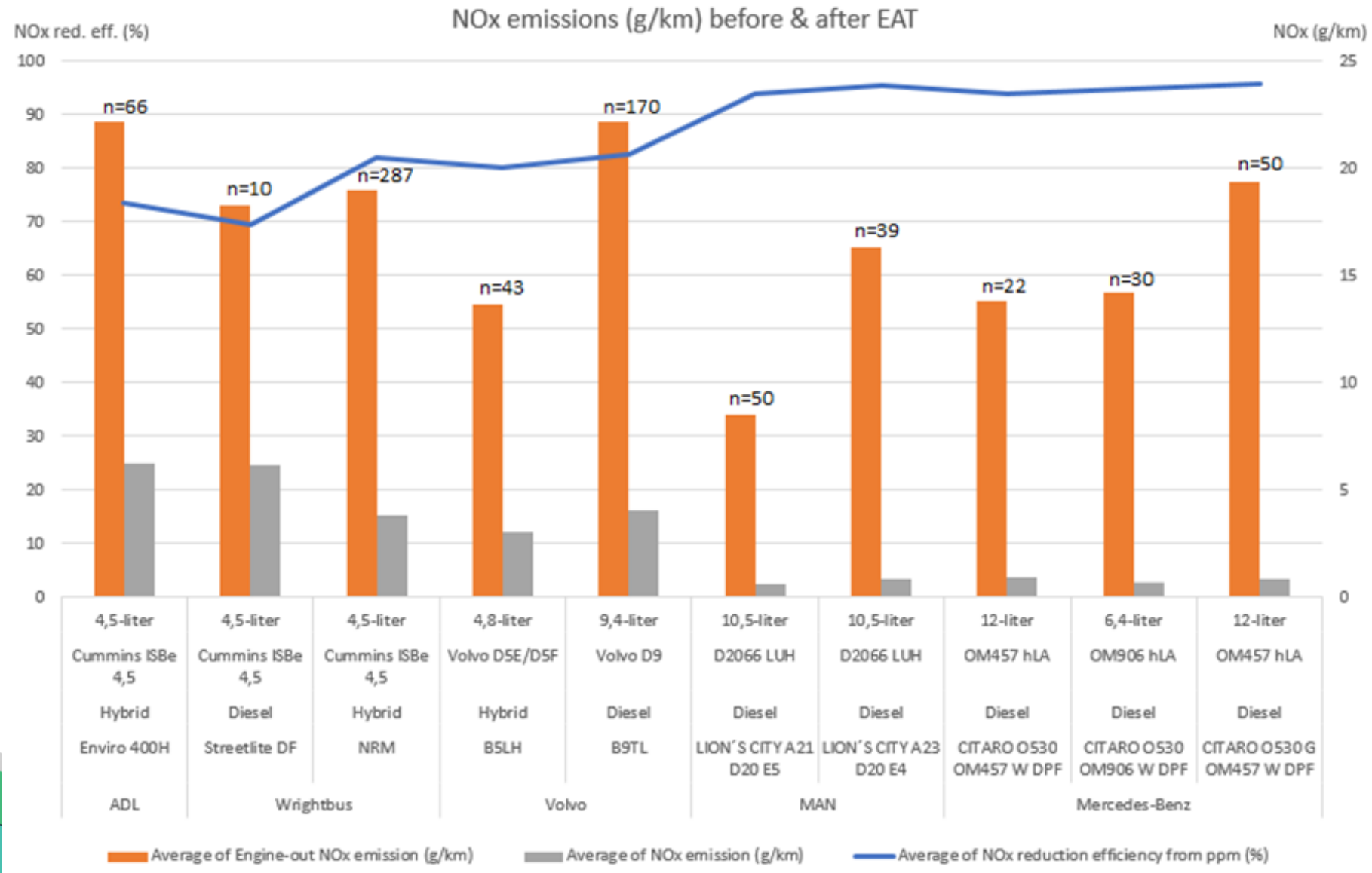
- From Euro (III), IV, V and EEV to Euro VI
- High NOx reductions at low temperatures of city driving without extra heating

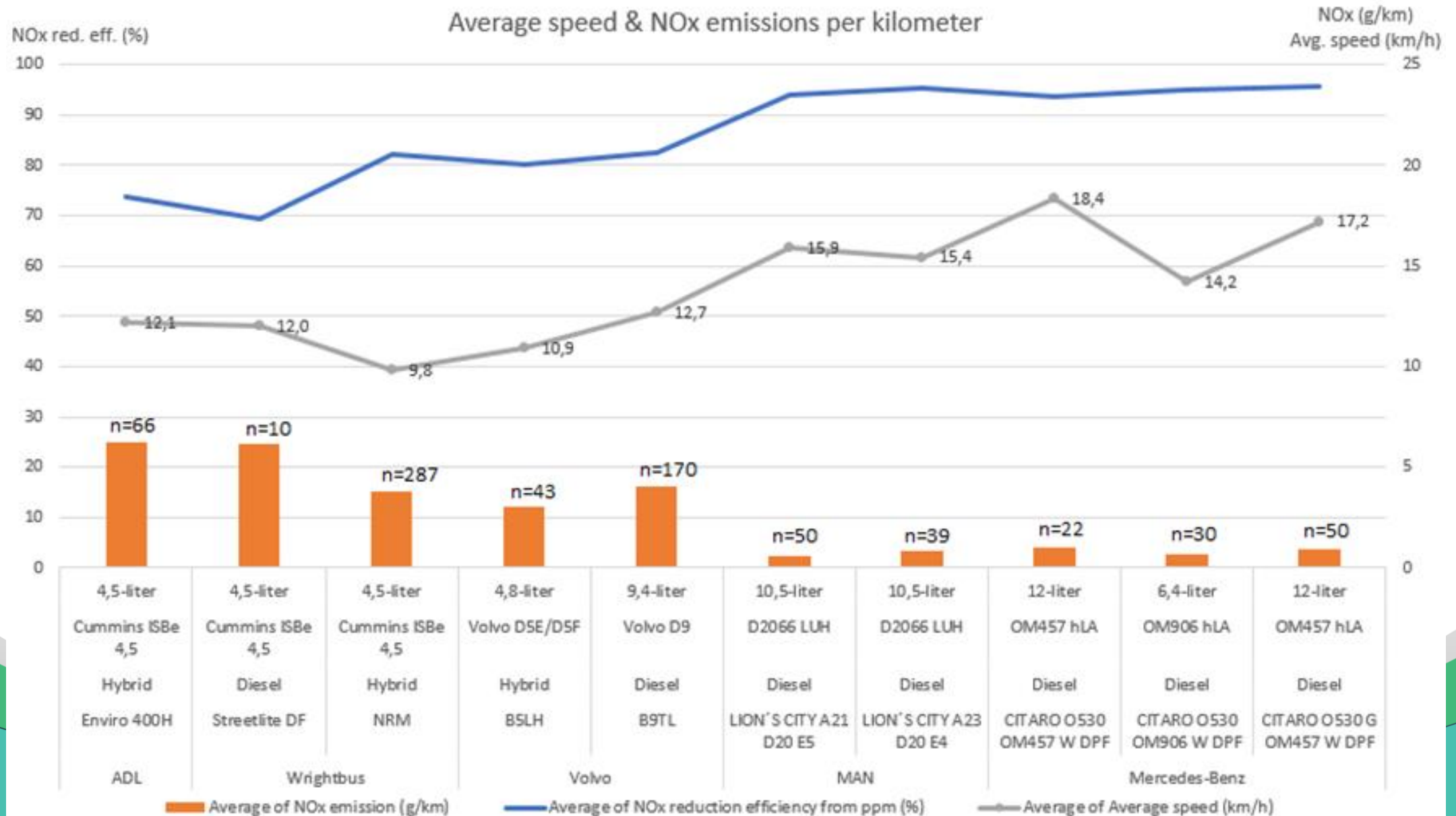
NOx reduction efficiencies

Row Labels	Distinct Count of Fleet Number	Average of NOx reduction efficiency from ppm (%)
Volvo		
⊕ B5LH	54	79,7
⊕ B9TL	188	81,5
Wrightbus		
⊕ Streetlite DF	10	70,0
⊕ NRM	301	82,1
⊕ Streetlite WF	8	89,5
VDL		
⊕ Citea LLE-120	14	85,3
⊕ DB300	83	86,7
ADL		
⊕ Enviro 400H	79	73,5
⊕ Enviro 200	284	83,4
⊕ Enviro 400	246	91,5
Mercedes-Benz		
⊕ CITARO O530 OM457	16	86,6
⊕ CITARO O530 OM457 WO DPF	13	87,2
⊕ CITARO O530 G OM457 WO DPF	68	87,9
⊕ CITARO O530 OM906 W DPF	30	95,0
⊕ CITARO O530 OM457 W DPF	22	95,0
⊕ CITARO O530 G OM457 W DPF	55	95,2
MAN		
⊕ LION'S CITY NG323	24	83,1
⊕ LION'S CITY A21 D20 E4	10	89,8
⊕ LION'S CITY A40 D20 E5	11	92,3
⊕ LION'S CITY A23 D20 E5	61	92,8
⊕ LION'S CITY A23 D28 E3	8	93,6
⊕ LION'S CITY A21 D20 E5	50	93,9
⊕ LION'S CITY A23 D20 E4	39	94,8
Grand Total	1674	86,3

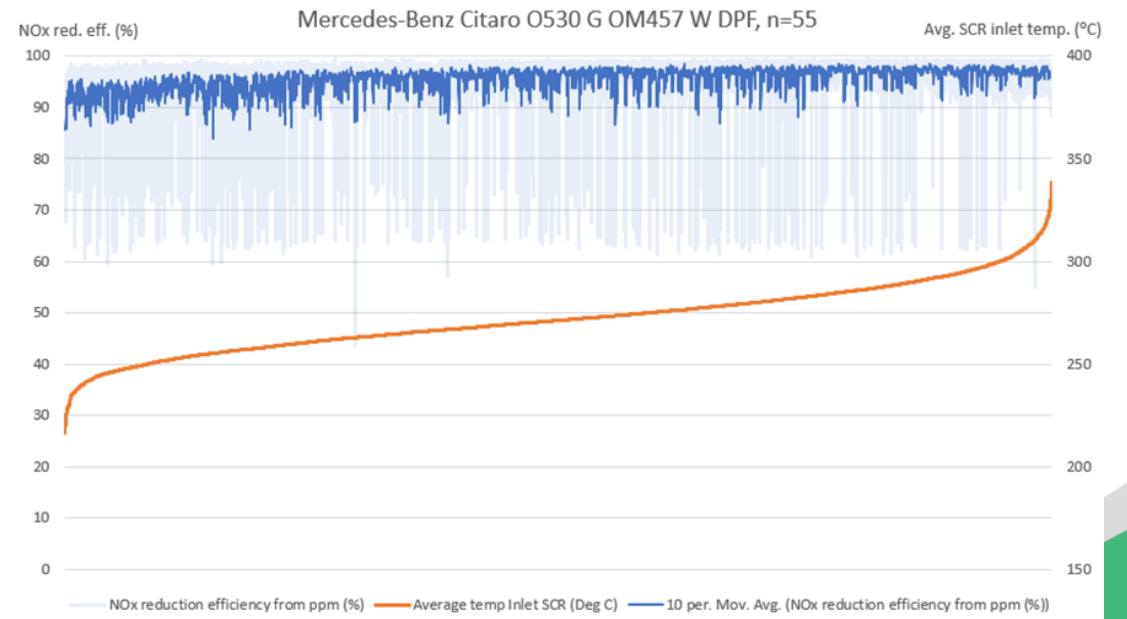
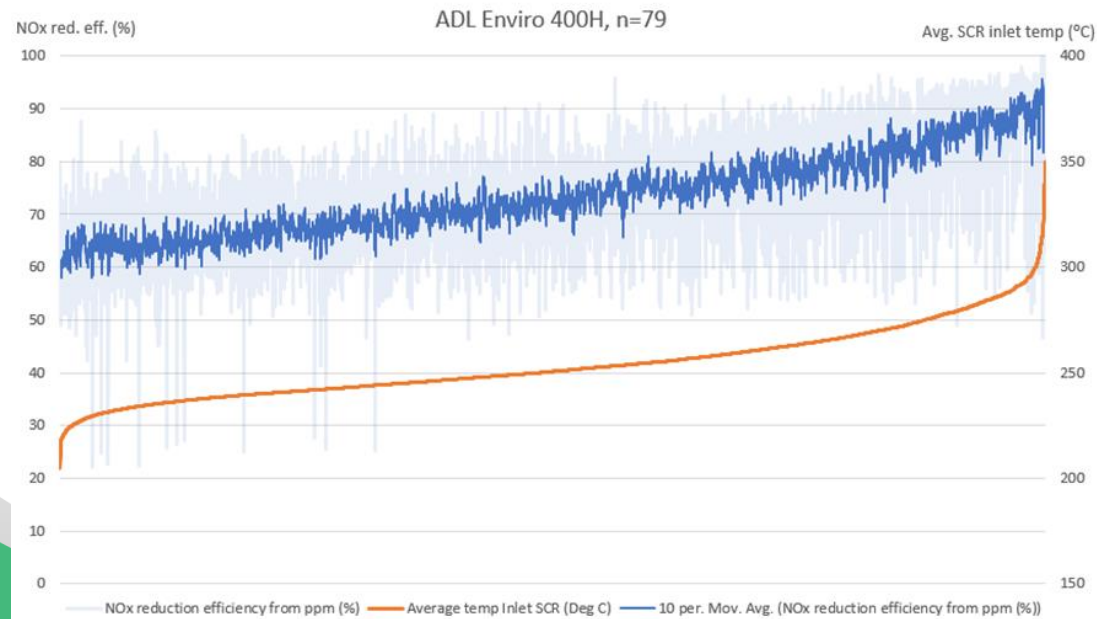
Top and bottom models in NOx reduction efficiency



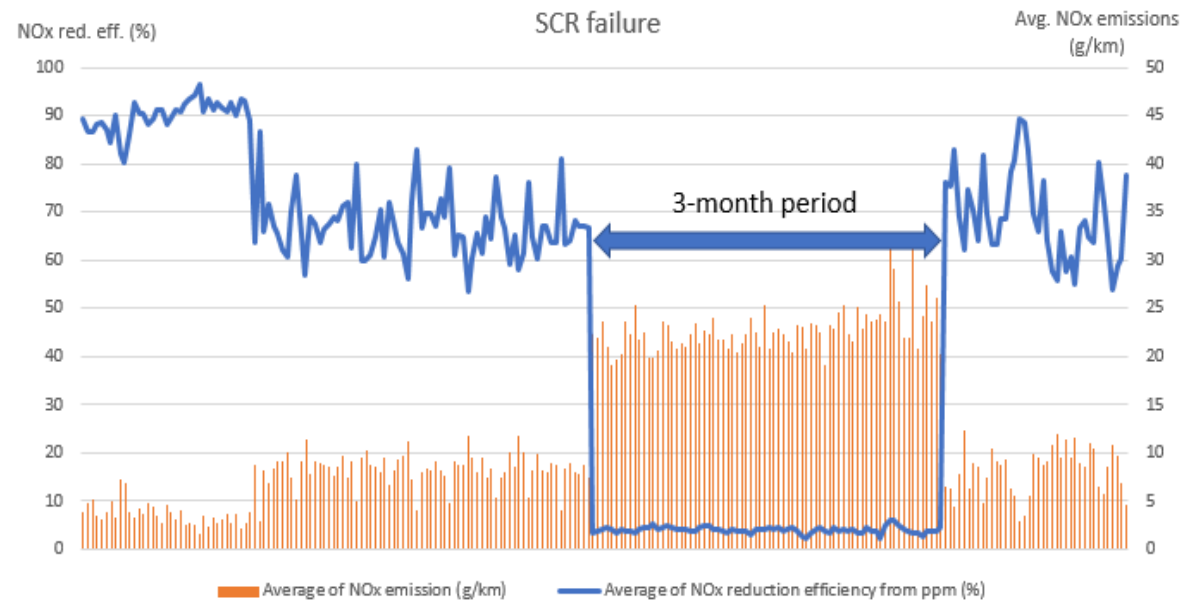
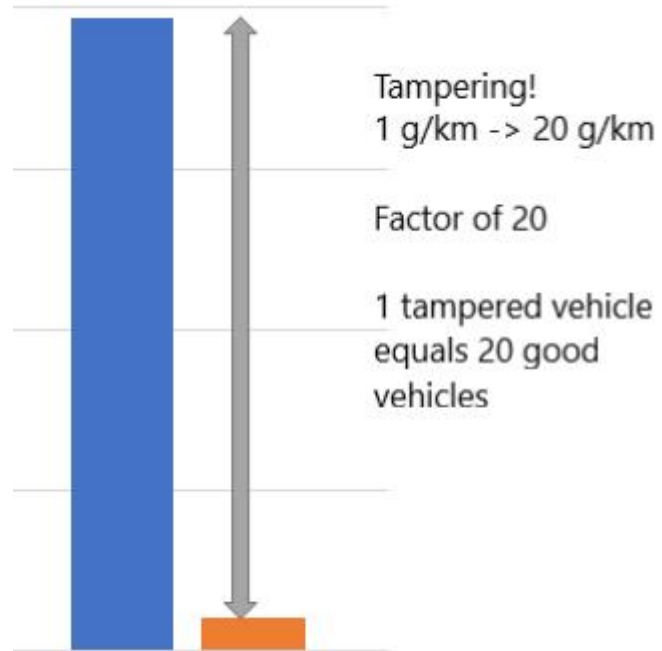




NOx reduction efficiency related to exhaust temperatures



Maintenance importance

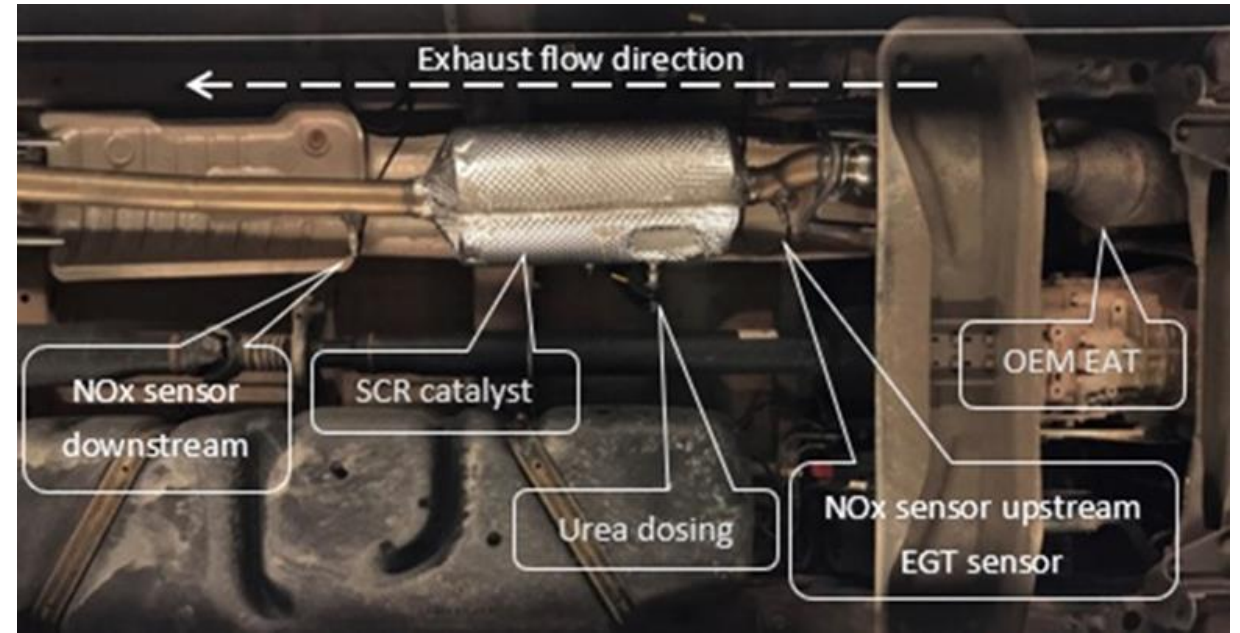


In certain cases tampering has less negative effect, but still in magnitude of x 3...10

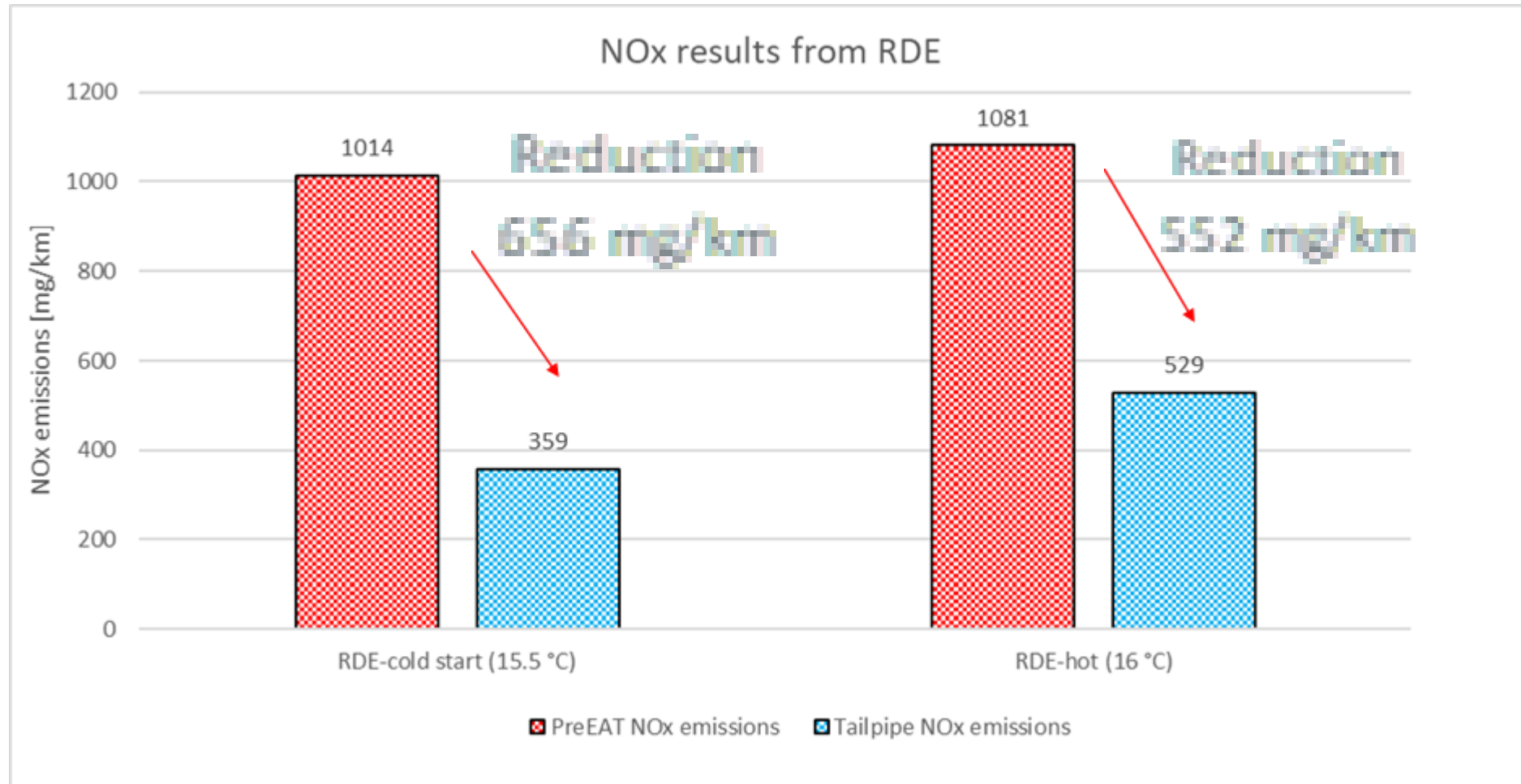
Retrofit for Light Commercial Vehicles

Euro 5 as base vehicle, MB Sprinter 316

- Retrofit SCR system
- Original DOC / DPF and control remained as it was
- OBD monitoring of SCR was connected to vehicle OBD with power derating in case of low efficiency or empty AdBlue tank etc.



LDV Retrofit



Conclusions 1/2

Retrofit for city buses

- Effectively reduces emissions of PM (>90%) and NOx (70...95%) from Euro IV and V vehicles
- Business case is getting weaker, as these buses are more than 10 years old in Europe and annual mileage is getting lower
- Poor maintenance increases emissions back to baseline levels = no return to investment

Retrofit for NRMM vehicles

- System very similar to bus retrofit system
- Special vehicles and machines operating in areas with pollution exposure to humans
 - High pollution to few persons
 - Or even low pollution to many persons
- Retrofitting is feasible when only emissions are outdated and vehicle / machine has long enough lifetime left

Conclusions 2/2

Retrofit for cars and light duty vehicles

- Light duty Euro 5 vehicles, NOx reduction ~50-60% bringing emissions into or close to Euro 6 levels
 - Euro 5 vehicles have already DPF, no effect on PM emissions
- Low value of vehicles compared to retrofit kit
 - Missing or weak motivation to do retrofits
- **Retrofitting for cars considered as non-feasible**
 - Emission reduction under real driving conditions is issue
 - High variation of different models and therefore
 - Politically diesel is dead



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Thank you

Arno Amberla

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