

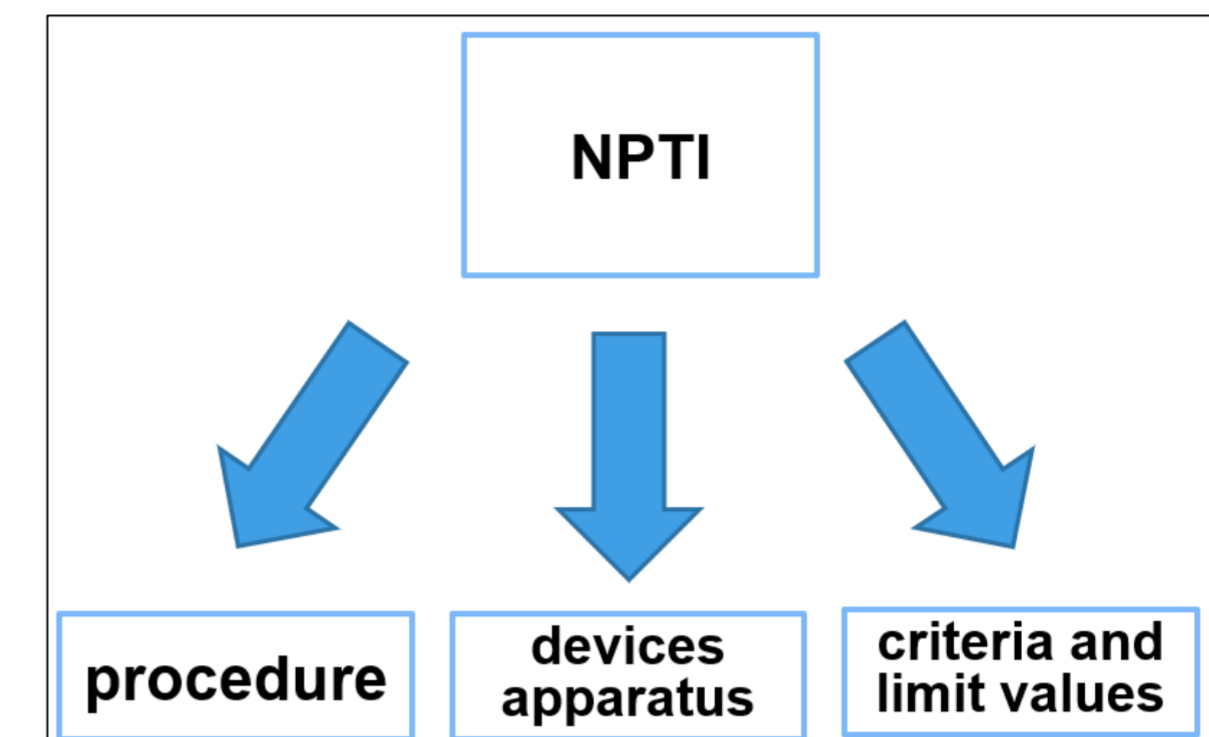
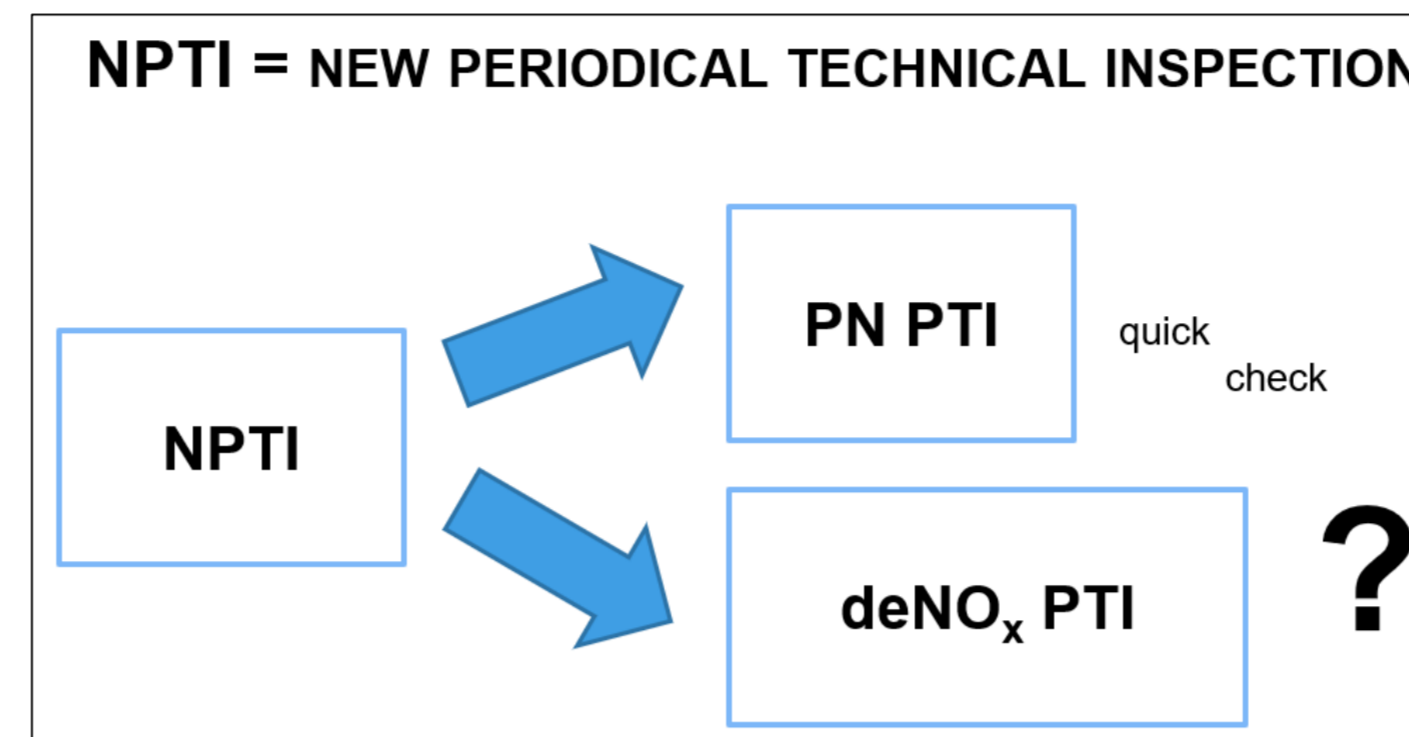
# Considerations of Periodical Technical Inspection of Vehicles with deNO<sub>x</sub> Systems

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## Abstract

An independent periodical technical inspection (PTI)<sup>\*)</sup> of vehicles is proposed in the last time as a better prevention against increased emissions of the fleet.  
 Several projects focused on the Diesel vehicles (HD & LD) and on the functionality of the exhaust aftertreatment systems as a key element for lowering emissions of a vehicle or machine.  
 The present paper summarizes the results obtained on 3 modern passenger cars Euro 6b (with EGR, DOC, DPF & SCR) during load jumps, representing the heat-up or cool-down behaviour of the exhaust system.  
 The portable devices for PTI were tested together with the stationary measuring systems of the engine laboratory.  
 In the second part of the report, the present knowledge and proposals of supplementary test procedures (like IUC or PTI) were shortly described.

It can be stated that the efficiency of the SCR-systems in a short PTI test is visible, and it is possible to quantify it in the positive or negative load jump, if a longer driving period at the constant OP (10 to 15 minutes) is realized in order to attain the stabilization of the system. For that a chassis dynamometer is recommended. A simple "5 minutes" test of the functionality of a deNO<sub>x</sub> system is not possible. On the contrary, the testing of DPF quality can be easily and quickly performed by means of a PN-measurement at vehicle standstill and it became already a legal reality in some countries.



## PN PTI actual situation (as per January 2019)

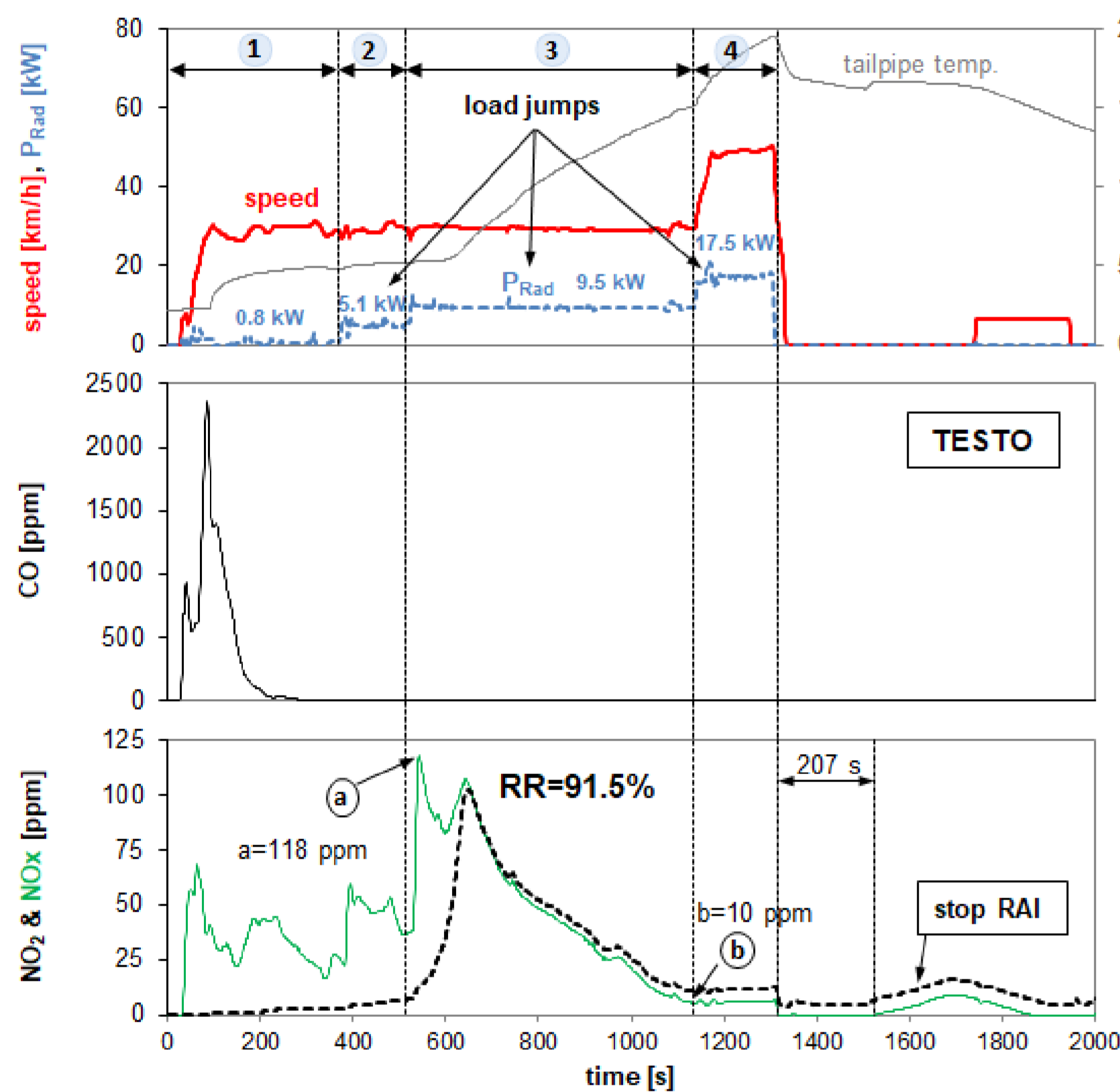
Road maps for:  
 Germany and Netherlands  
 → stepwise introduction of PN PTI until 2021  
 quick check possible

2018 available low cost PTI-PN-testers  
 Potential suppliers of PTI PN testers:  
 • TSI  
 • Testo  
 • Naneos  
 • Sensors  
 • AVL  
 • Dekati  
 • TEN  
 • .....

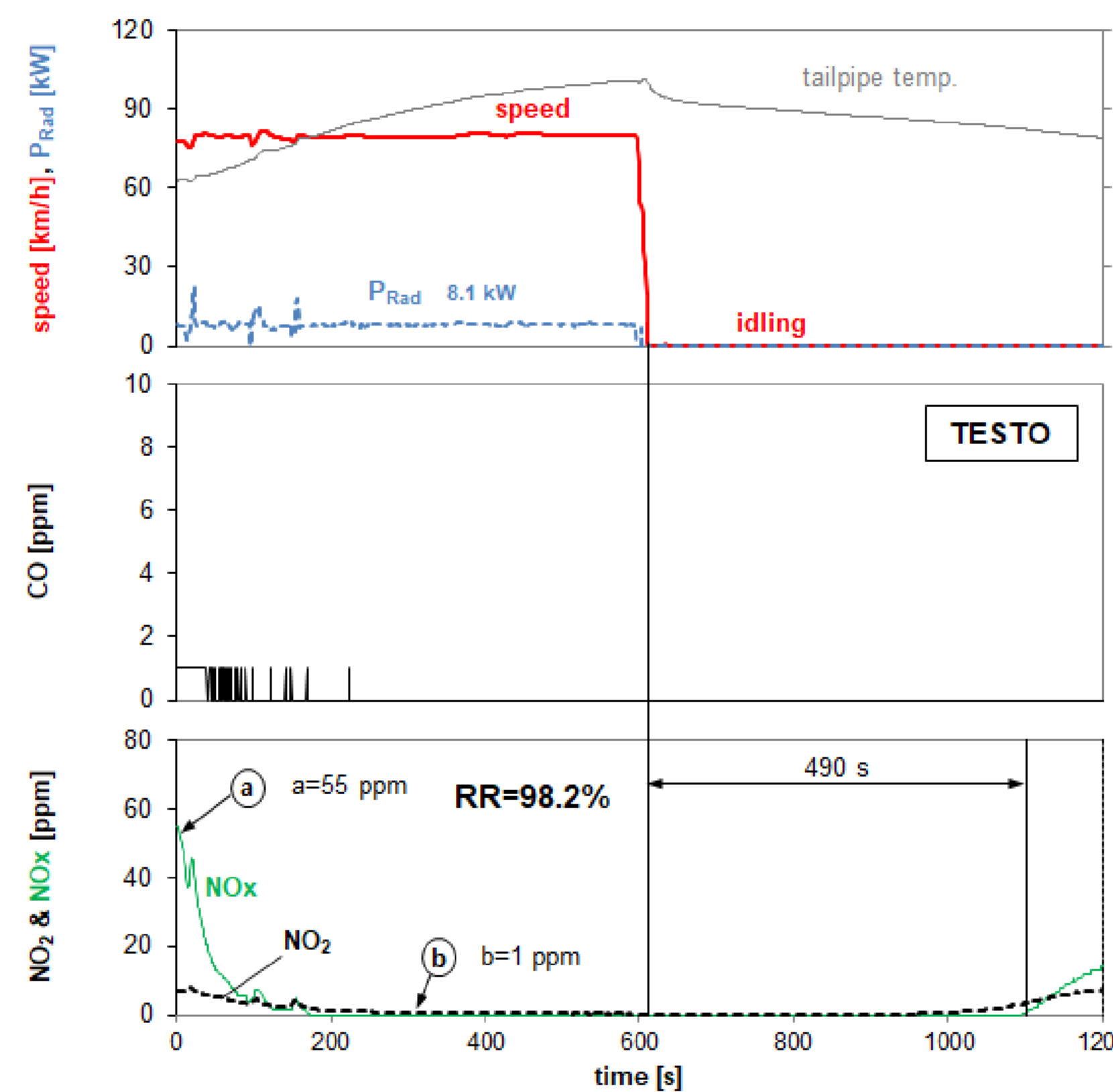


Participants  
 Italy: EC JRC  
 Netherlands: TNO, NMI  
 Germany: BAST, PTB, DUH  
 Switzerland: VERT, ASTRA, AFHB  
 Belgium: GOCA  
 Industrial partners: measuring - and EAT - technologies  
 Task Sharing activities

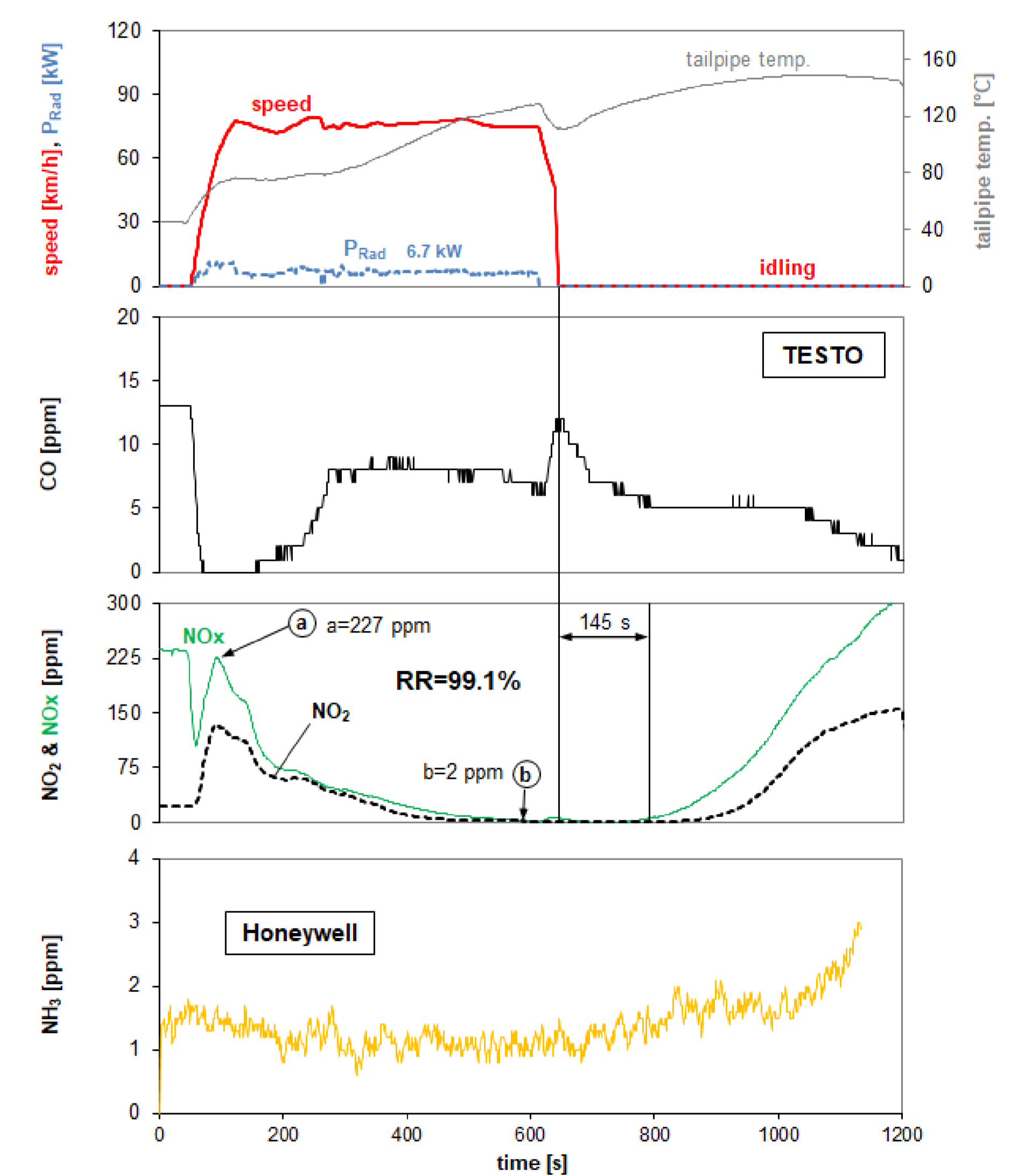
## deNO<sub>x</sub> PTI → pilot project "In use control Diesel"



Vehicle 1: exhaust emissions during constant speed, with cold start



Vehicle 2: exhaust emissions during constant speed and idling. EGR, DOC, DPF, SCR; fuel: Diesel; tailpipe.



Vehicle 3: exhaust emissions during constant speed and idling. EGR, DOC, DPF, SCR; fuel: Diesel; tailpipe.

### Tested vehicles



Modell / Jahrgang	Mercedes-Benz Vito 114BT	VW PassatV 2.0TDI 4M	Citroën SpaceTourer
Engine typ / code	651950	DFCA	AHH / AH01 (DW10FC)
Number of cylinders	4 / in line	4 / in line	4 / in line
Displacement	2143 cm <sup>3</sup>	1968 cm <sup>3</sup>	1997 cm <sup>3</sup>
Power	100 kW @ 3800 rpm	140 kW @ 4000 rpm	130 kW @ 3750 rpm
Torque	330 Nm @ 1200 rpm	400 Nm @ 1900 rpm	400 Nm @ 2000 rpm
Fuel / injection	Diesel / DI (CR)	Diesel / DI (CR)	Diesel / DI (CR)
Charging	yes	yes	yes
Curb weight	1976 – 2374 kg	1674 – 1915 kg	1730 – 2170 kg
Total weight	3050 – 3200 kg	2220 – 2240 kg	2770 – 2840 kg
Drive wheel	Rear-wheel drive	all wheel drive	Front-wheel drive
Transmission / gearbox	7 automatic steps	m6a	6 automatic steps
First registration	14.12.2015	26.01.2016	new
Fulfilled exhaust gas standard	EURO 6b	EURO 6b	EURO 6b
Exhaust gas aftertreatment systems	DOC, DPF, SCR-catalyst, EGR	DOC, DPF, SCR-catalyst, EGR	DOC, DPF, SCR-catalyst, EGR

## Possible procedure/conclusions

The experiences gained from the observations of emissions behavior during load jumps on the investigated cars can be summarized as follows:

- the efficiency of the SCR-systems is visible, and it is possible to quantify it in the positive or negative load jump, if a longer driving period at the constant OP (10 to 15 minutes) is driven,
- some vehicles (V1 and V3) perform the RAI stop at wheel-stop,
- by means of NH<sub>3</sub>-measurement it is possible to visualize some draw-backs of urea mixture preparation.

After the tests of different aftertreatment devices by means of positive and negative engine load jumps, it can be stated:

- as a method to obtain a heat-up and light-off of the exhaust system the authors recommend the use of a simple, only-braking roller dynamometer, which enables a continuous NO/NO<sub>x</sub>-measurement,
- the deterioration of the filtration efficiency of the DPF can be easily remarked by means of the PN-measuring instruments; this can be done also at idling,
- the low-cost analyzers, which were used for CO, NO/NO<sub>x</sub>, NH<sub>3</sub> and PN were confirmed as useful for the simple (field) tests.

The procedures, which are proposed up to date, can be summarized as follows:

- DPF: PN-measurement at one OP, standstill of vehicle, total time of testing including preparations, visual control, conditioning and measurements, circa 10 minutes;
- SCR: warm-up or cool-down the vehicle on a chassis dynamometer with continuous NO<sub>x</sub>-measurement, total test duration at control station approximately 1.5 hours (including assembling and disassembling of the vehicle on chassis dyno).



Load Jump on a Low-Cost on Floor Chassis Dyno

- Open questions
- Fixing of the minimum limit value of NO<sub>x</sub> reduction rate (RR)
  - Solution of the question "wheel-stop → RAI-stop",
  - fixing of the time to drive after load jump for LD and for HD
  - More testing for statistical robustness
  - Testing of LNT
  - Testing with failures

NPTI ... new periodical technical inspection just on the way  
 → for DPF quick & simple  
 → for deNO<sub>x</sub> more efforts → random checks ?

With DPF, SCR and GPF, it is possible to:  
 → Eliminate PN and  
 → Reduce NO<sub>x</sub> below the legal limits