Consistent low NOx emissions on the road - Reality with modern diesel vehicles

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AECC
ASSOCIATION FOR EMISSIONS CONTROL BY CATALYST

Association for Emissions Control by Catalyst (AECC AISBL)

AECC members : European Emissions Control companies

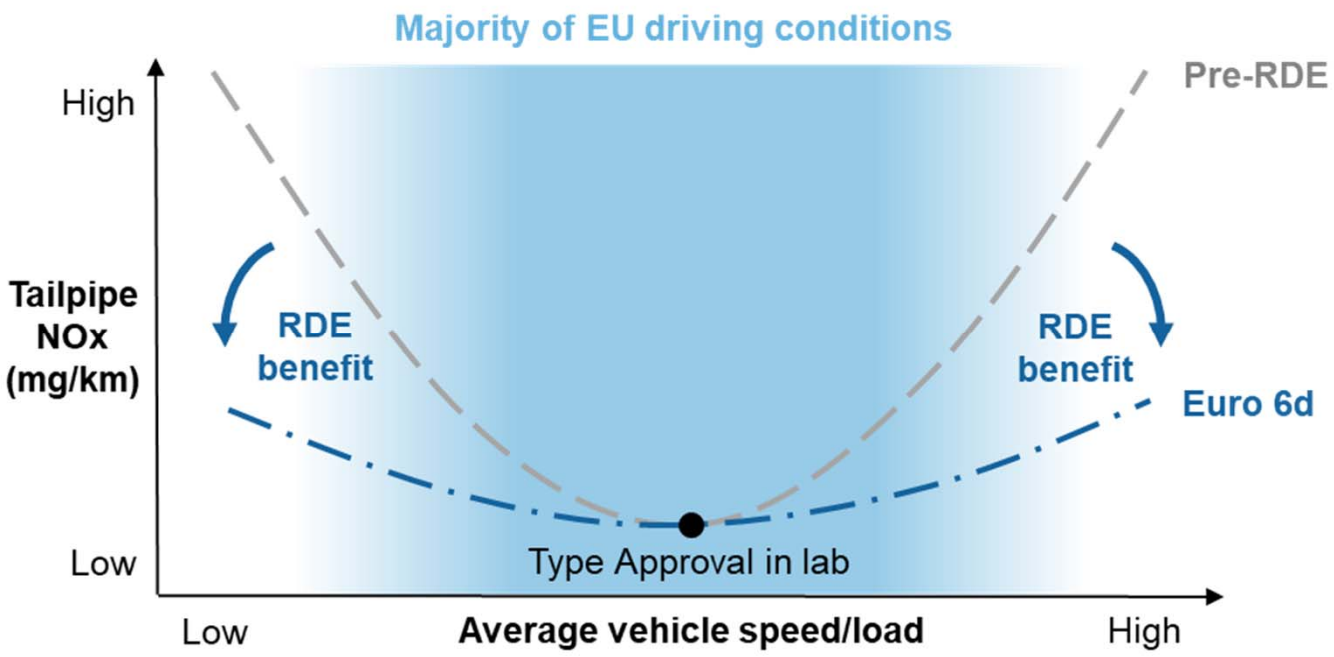
- Exhaust emissions control technologies for original equipment, retrofit and aftermarket for all new cars, commercial vehicles, motorcycles, and non-road mobile machinery
  - AECC is # 78711786419-61 in EU Transparency Register and has consultative status with the UN Economic and Social Council (ECOSOC)

Content

- RDE legislation has improved real-word NOx emissions
- AECC – IPA – IAV ultra-low NOx diesel demonstrator
  - Emissions control concept
  - Tailpipe NOx emissions summary
  - DeNOx efficiency visualisation
- Conclusions

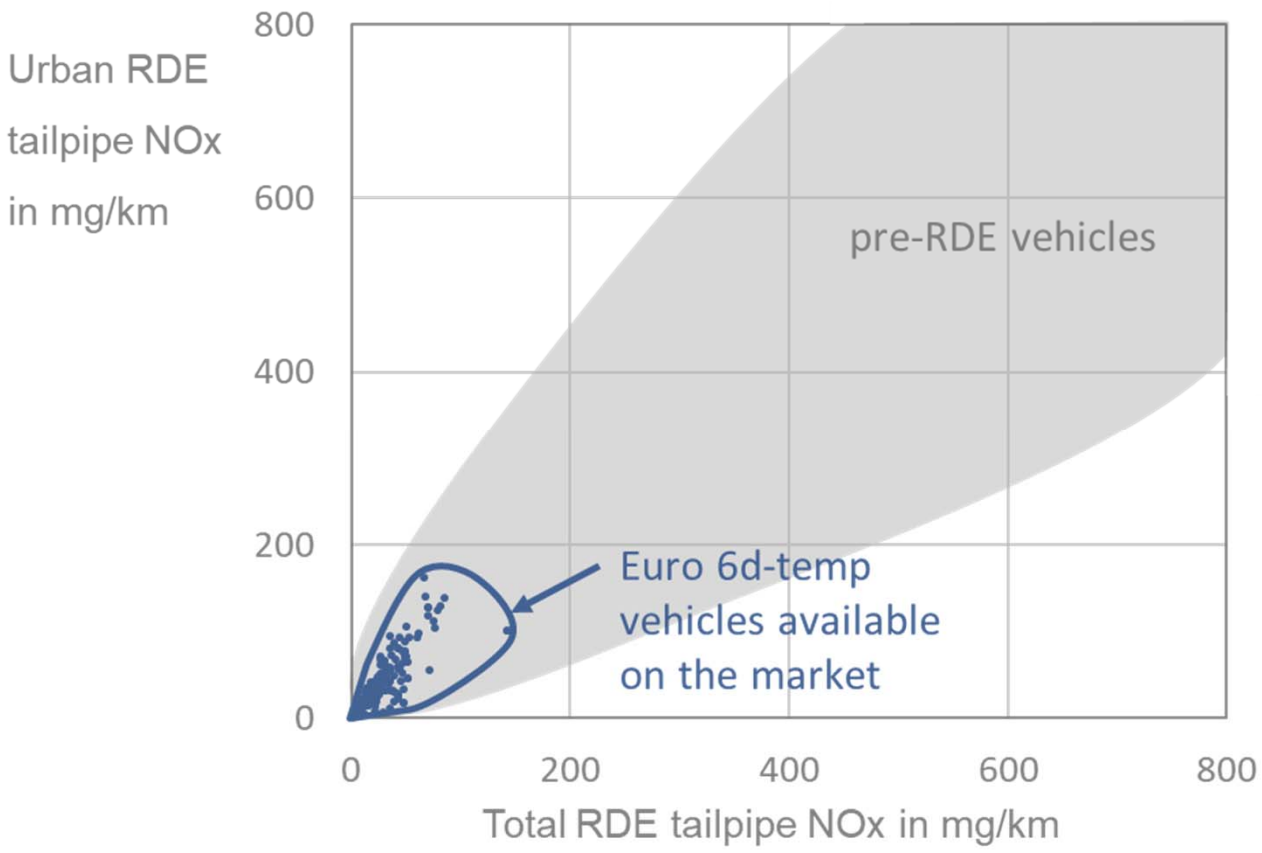
RDE legislation has improved real-world NOx emissions

- RDE entered into force on 1 September 2017 with Euro 6d-temp type-approval
- RDE requirements ensure that emissions are controlled over wider range of driving conditions



RDE legislation has improved real-world NOx emissions

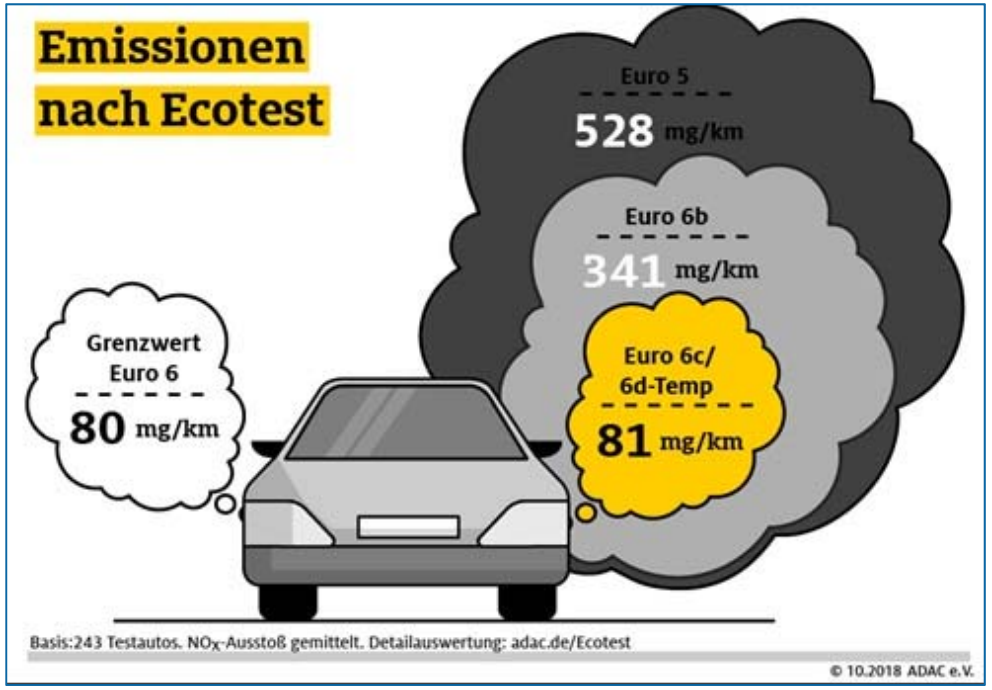
- On-road emissions of Euro 6d-Temp diesel vehicles are well within standards



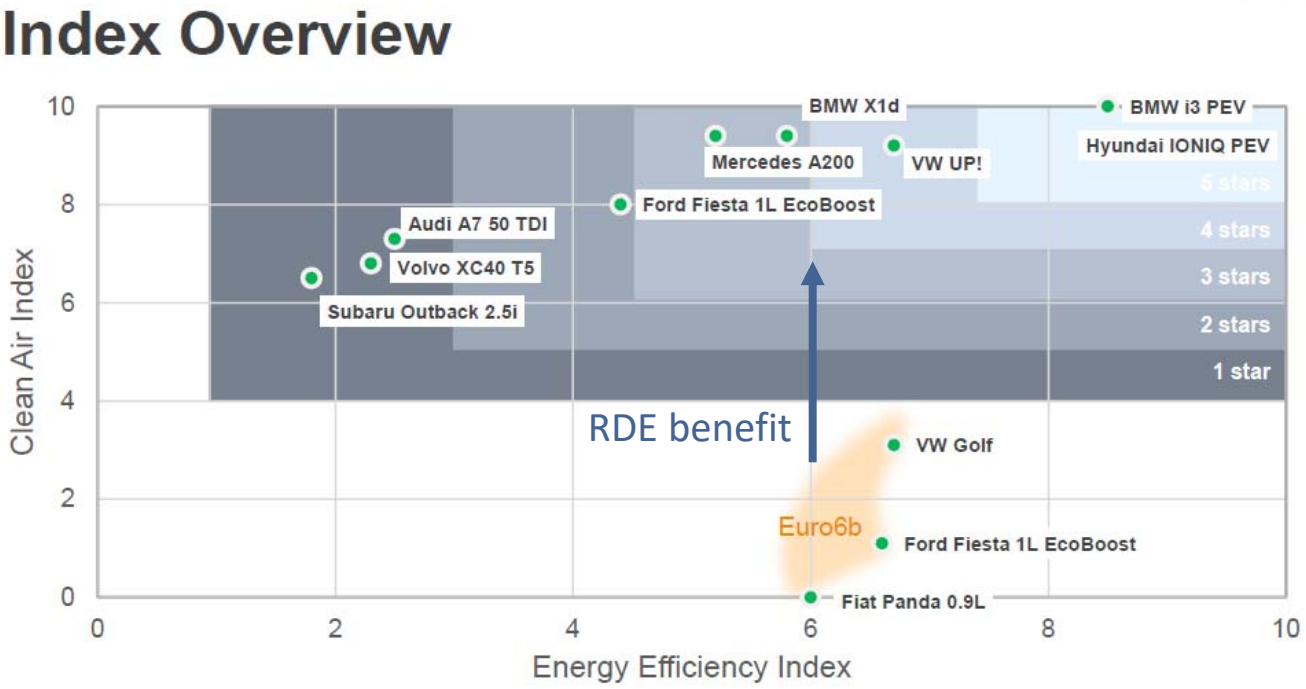
Source: PEMS results from ACEA and JAMA RDE databases

RDE legislation has improved real-world NOx emissions

- Reduction confirmed by independent testing



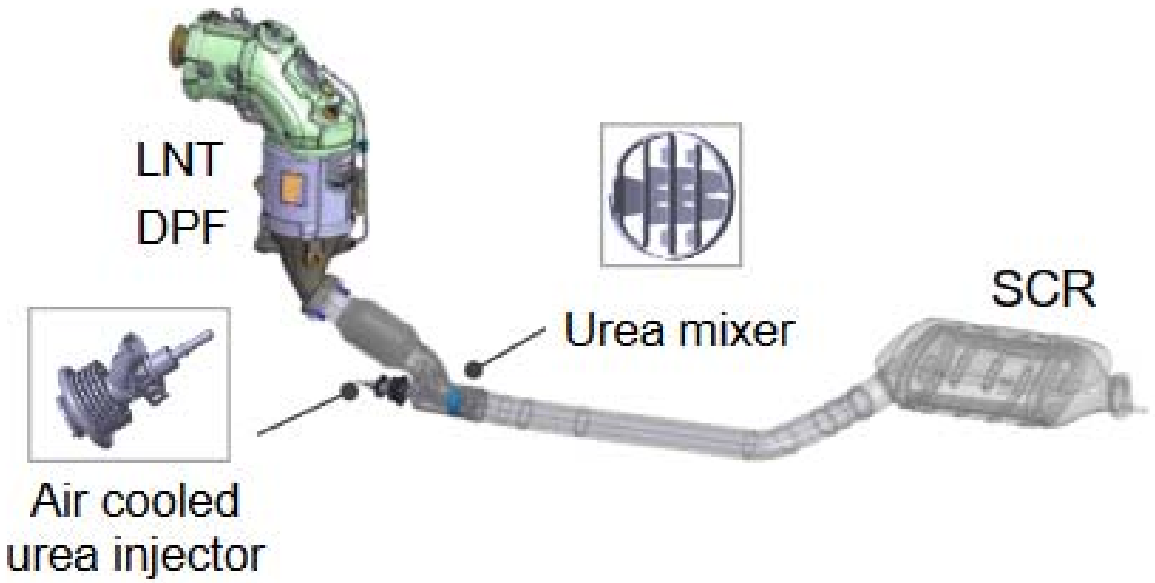
Source: ADAC Ecotest



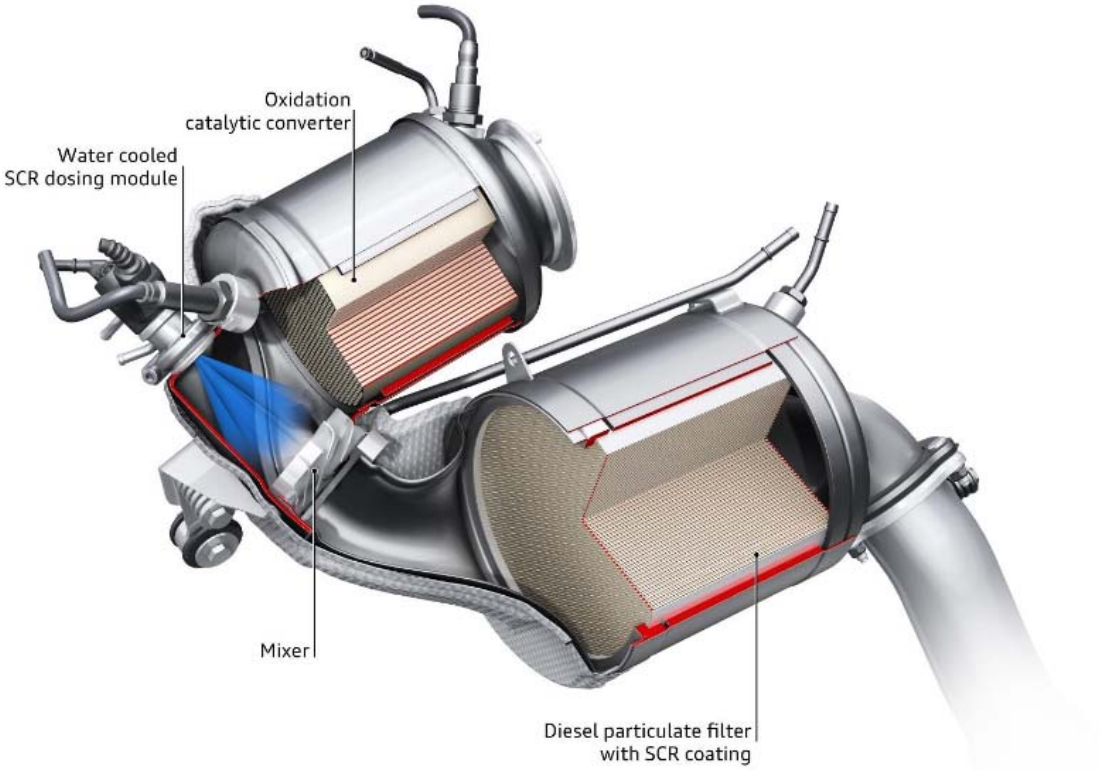
Source: Green NCAP

Light-duty diesel emissions control technology evolution

Towards combination of technologies in a compact design for RDE compliance



Source: Hyundai – Vienna Motor Symposium 2019



Source: Audi – Vienna Motor Symposium 2019

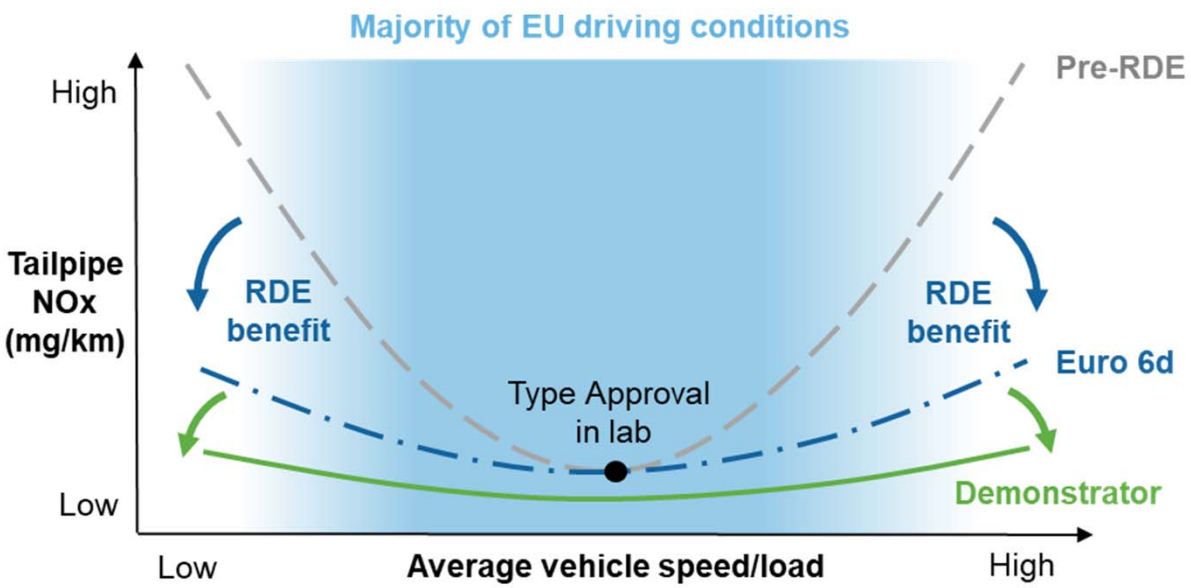
AECC-IPA-IAV ultra-low NOx emissions diesel demonstrator

- Objective: demonstrate consistent low NOx emissions

  - Low speed/load
    e.g. city driving

  - High speed/load
    e.g. motorway driving

  - Transients



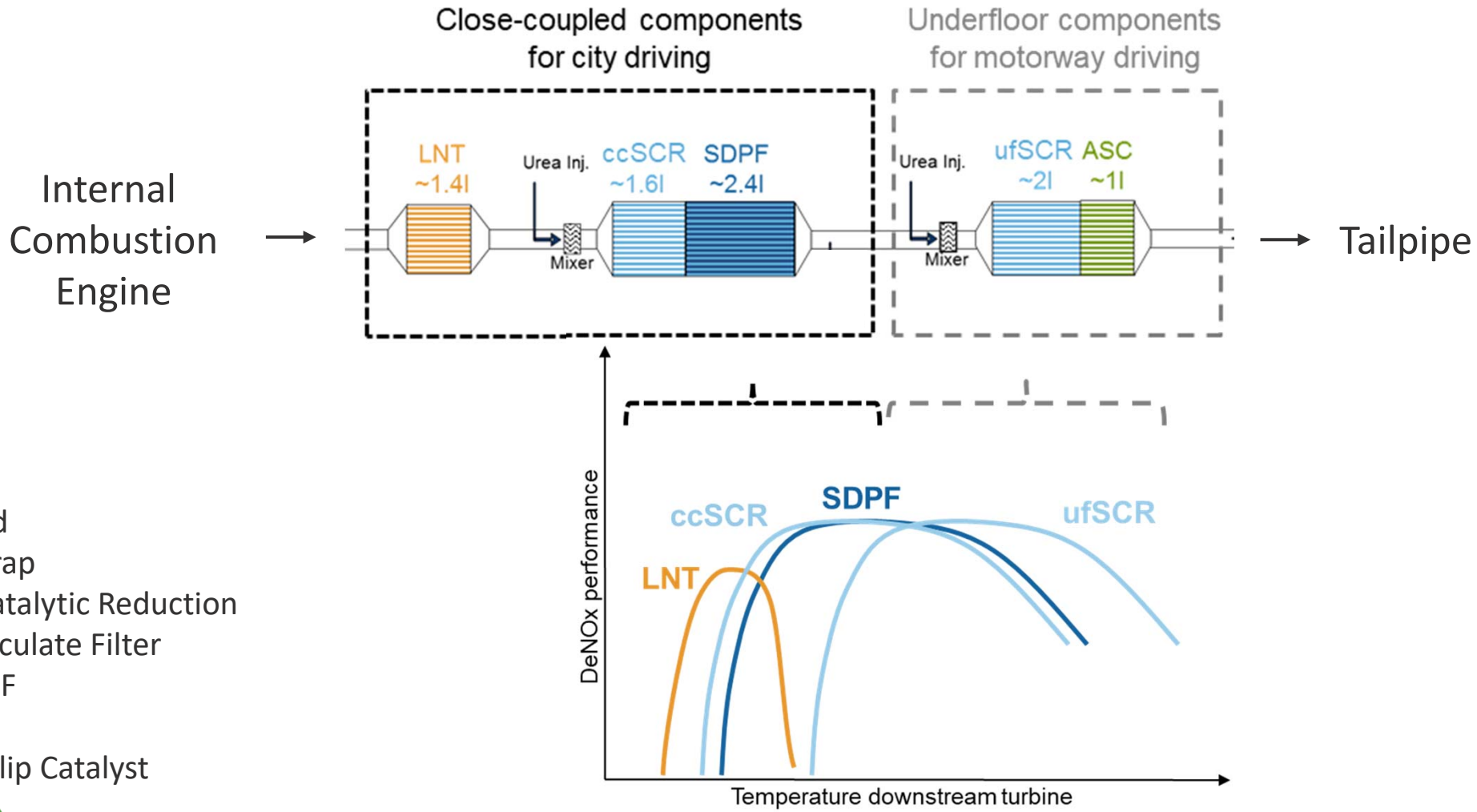
More details: *J. Demuynck, et al.; "Integrated Diesel System Achieving Ultra-Low Urban and Motorway NOx Emissions on the Road", 40th International Vienna Motor Symposium, 15-17 May 2019*

Vehicle and powertrain characteristics

- Vehicle
  - C-segment
  - 1700 kg
- Drivetrain
  - Manual gearbox, 6-speed
  - 48 Volt mild-hybrid
- Engine
  - 1.5l, 4-cylinder, 2-valve
  - Exhaust Gas Recirculation (EGR)
- Euro 6b type-approval (LNT + DPF)

Emissions control technologies on demonstrator car

LNT + dual-SCR to cover wide range of driving conditions



cc: close-coupled
LNT: Lean NOx trap
SCR: Selective Catalytic Reduction
DPF: Diesel Particulate Filter
SDPF: SCR on DPF
uf: underfloor
ASC: Ammonia Slip Catalyst

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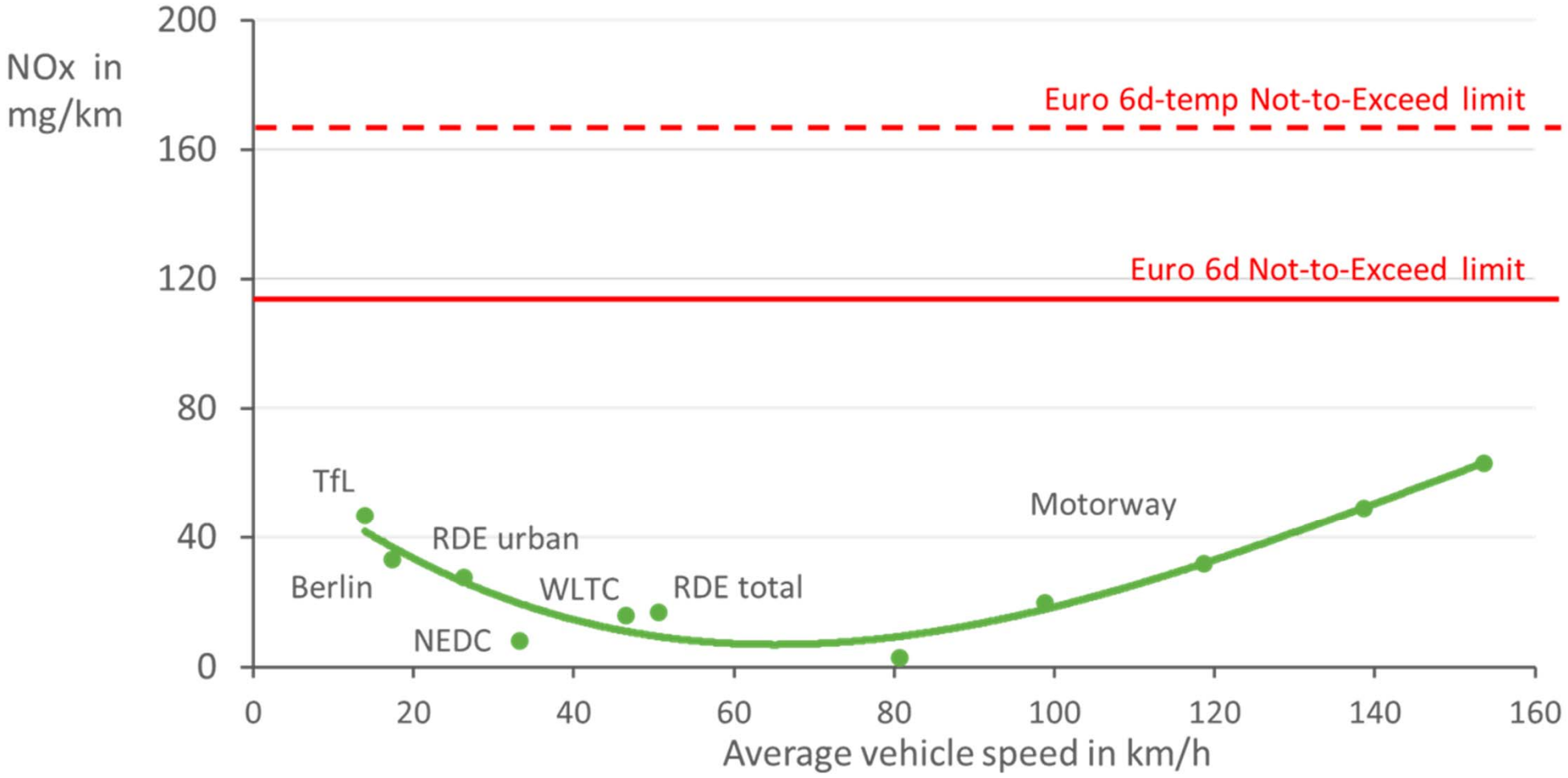
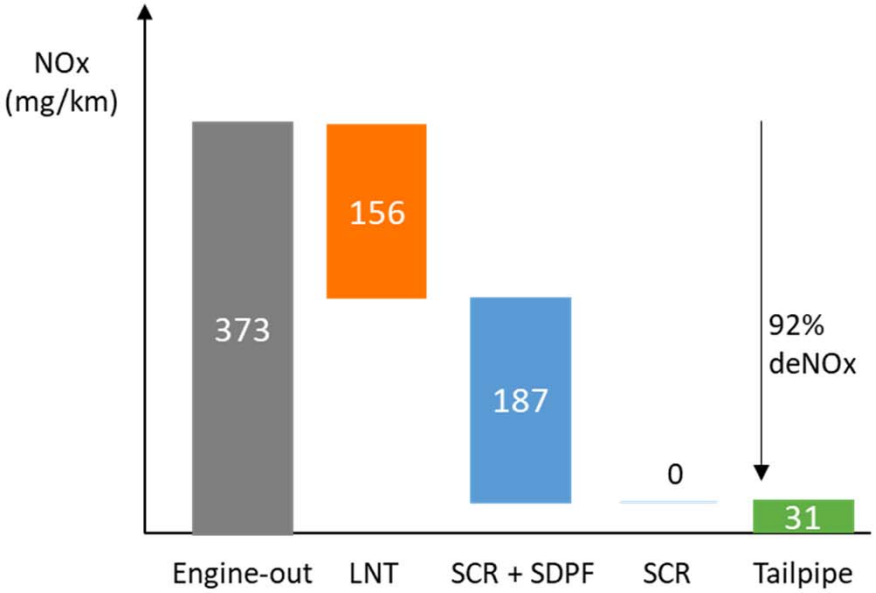
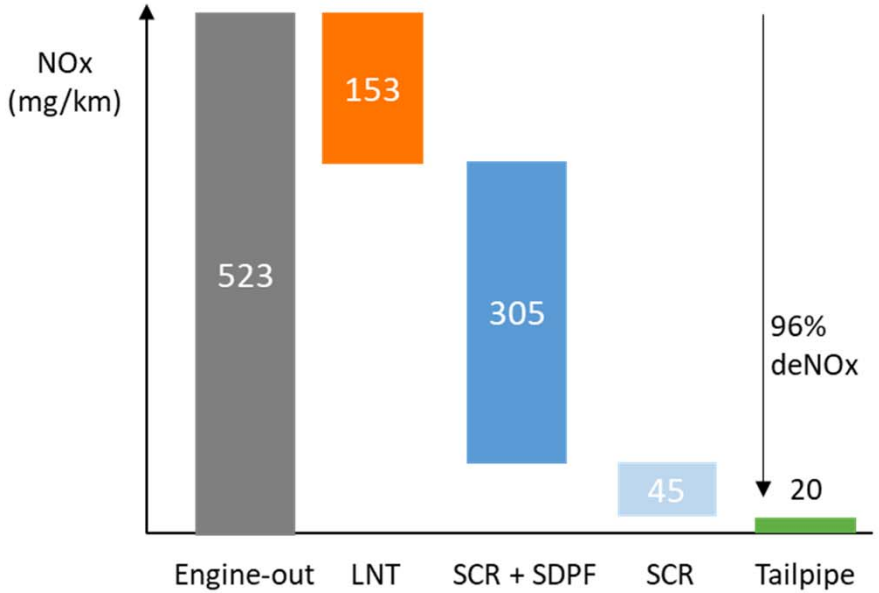
Consistent low NOx emissions were achieved

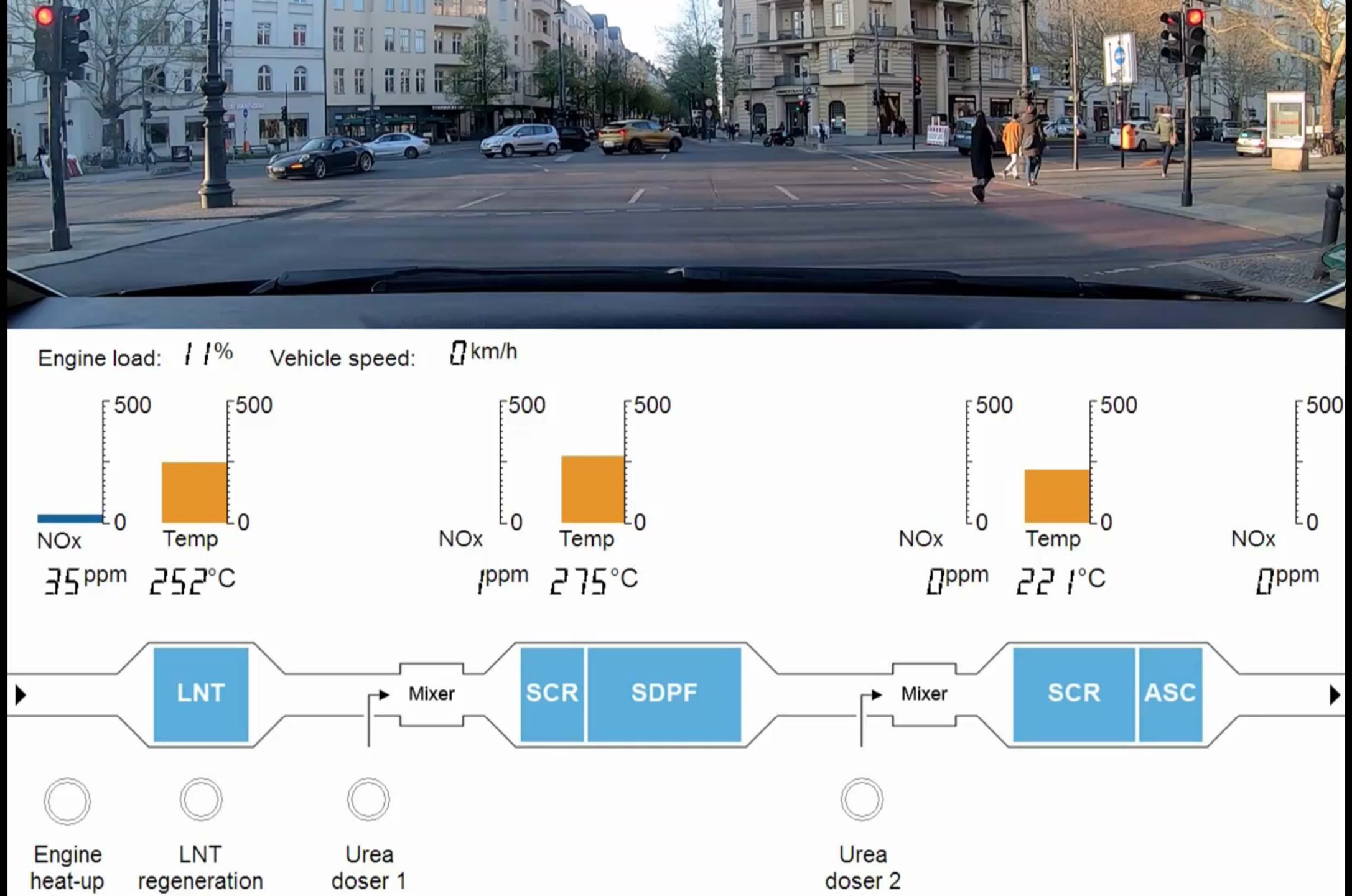


All aftertreatment components contribute to NOx control

- City driving: LNT and close coupled SCR+SDPF
- Motorway driving: underfloor SCR required to secure robust emissions control



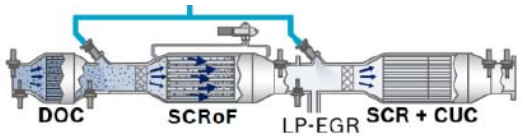



Engine load: 11%
Vehicle speed: 0 km/h
500
0
NOx
Temp
35 ppm
252°C
1 ppm
275°C
0 ppm
221°C
0 ppm
LNT
Mixer
SCR
SDPF
Mixer
SCR
ASC
Engine heat-up
LNT regeneration
Urea doser 1
Urea doser 2

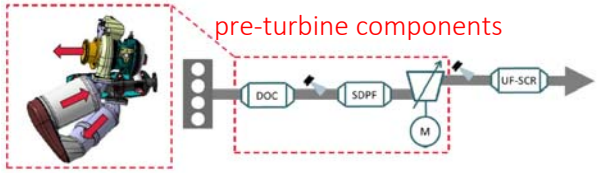

Engine load: 67 %
Vehicle speed: 118 km/h
500
0
NOx
Temp
442 ppm
393 °C
96 ppm
368 °C
5 ppm
321 °C
0 ppm
LNT
Mixer
SCR
SDPF
Mixer
SCR
ASC
Engine heat-up
LNT regeneration
Urea doser 1
Urea doser 2

Other approaches are available to achieve low NOx

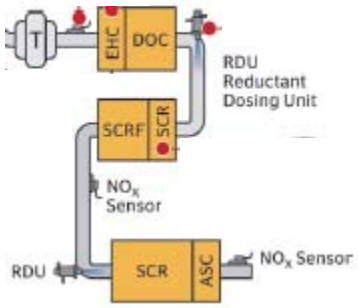
- Bosch [1]: DOC + dual-SCR

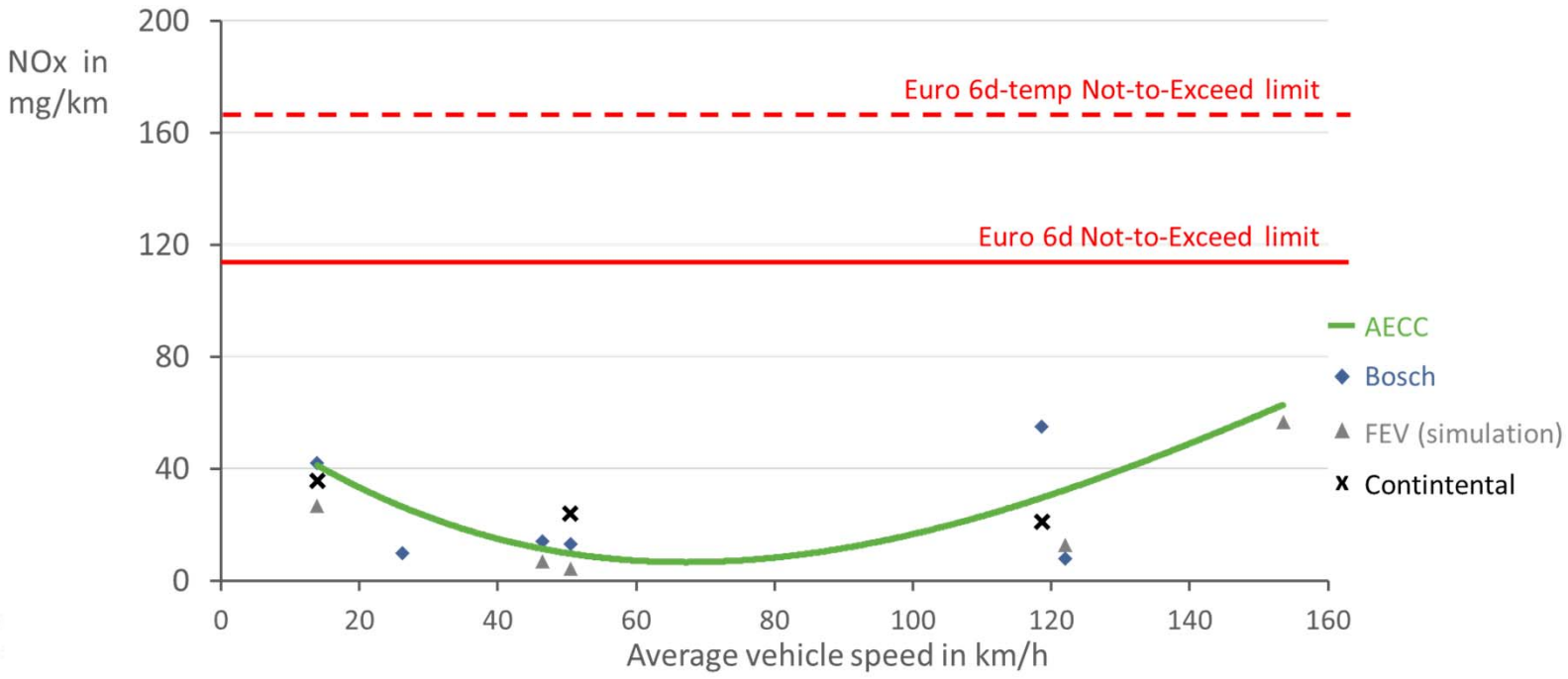


- FEV [2]: DOC + dual-SCR



- Continental [3]: eDOC + dual-SCR

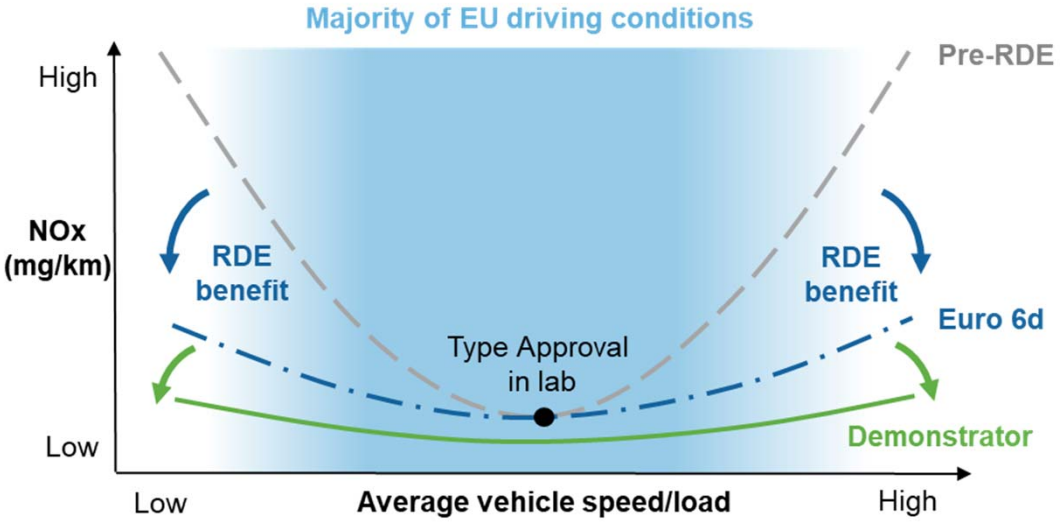




1. A. Kufferath, et al.; "EU6d – Analysis of Boundary Conditions and Evaluation of the Impact on Emissions using the Example of the Advanced Diesel Powertrain", 40th Vienna Motorsymposium, 2019
2. M. Schönen, et al.; "White Eco Diesel Powertrain with Pre-Turbine Exhaust Aftertreatment and Mild-Hybrid Concept for lowest NOx Emission under Urban Driving Condition", 40th Vienna Motorsymposium, 2019
3. G. Avolio, et al.; "Super Clean Electrified Diesel: Towards Real NOx Emissions below 35 mg/km", 27th Aachen Colloquium, 2018

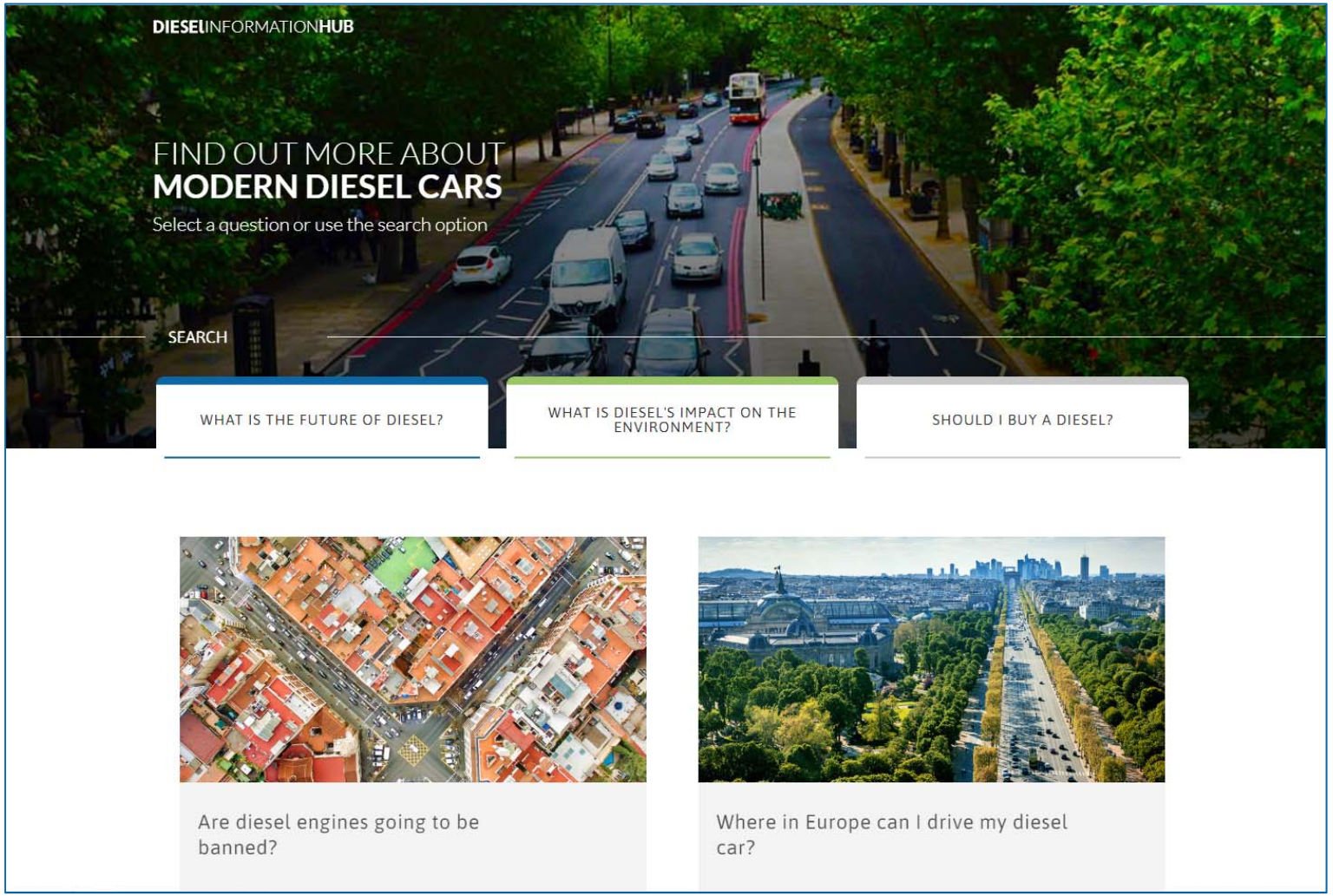
Conclusions

- RDE requirements have ensured better control of NOx emissions under most EU driving conditions – these Euro 6d-temp cars are on the road today.
- Independent testing confirms low emissions of RDE compliant vehicles.
- AECC-IPA-IAV demonstrator car shows that diesel NOx emissions can be kept at a very low level in a consistent way, over a wide range of driving conditions.
- This is achieved by combining existing catalyst technologies with improved emissions control functions supported by hybrid technology.



Diesel Information Hub

https://dieselinformation.aecc.eu (now available in EN, FR, ES, IT; DE expected)



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THANK YOU !

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