Advanced emission controls and renewable fuels for low pollutants and lifecycle CO$_2$ emissions

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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)
Acknowledgements

- Project partners of ultra-low emissions diesel demonstrator

- Additional partner for follow-up work on renewable fuels and Well-to-Wheel analysis

- Roland Dauphin, Science Executive, Fuels Quality and Emissions at Concawe will join Q&A session.

Concawe is the scientific body of the European refining industry.
### Requirements for a sustainable ICE

#### Low pollutant emissions
- Significant steps taken with introduction of RDE towards Euro 6d
- Further steps expected from Euro 7/VII

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#### Low greenhouse gas emissions
- Increase in efficiency and level of electrification for new vehicles
- Wider usage of renewable fuels to reduce Well-to-Wheel and lifecycle emissions
  - Immediate reductions for the existing fleet
  - New vehicles

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**Today**

NT: New Types

All: All Types
Advanced emission control systems towards Euro 6d

Gasoline – introduction of GPF

Gasoline Particulate Filter (GPF)

Diesel – combination of deNOx technologies

"Twindosing"

Components in the underbody
SCR catalytic converter with ammonia slip catalyst zone

Source: PSA

Source: Daimler

Source: Audi

Source: VW
Pollutant emissions significantly reduced towards Euro 6d

Gasoline PN emissions

Diesel NOx emissions

Sources:  
- ACEA/JAMA Euro 6d(-TEMP) PEMS data consulted 17 July 2020  
- pre-RDE PN emissions factors from B. Giechaskiel, Int. J. Environ. Res. Public Health, 2018
Ultra-low emissions diesel demonstrator

Objective is to demonstrate ultra-low NOx emissions over wide range of driving conditions for various fuels

Emission control system based on combination of available components LNT + dual-SCR supported by 48V mild-hybrid system

3) Videos of instantaneous conversion performance available at www.youtube.com/channel/UCbPS9op5ztLqrv6zIMH_1cQ

Note: hydrothermal aged components used targeting 160k km
Ultra-low emissions diesel demonstrator

- Low urban NOx emissions for different tests over range of ambient temperature
- Significant improvement achieved due to LNT regeneration stabilisation and thermal management
More videos available on YouTube (AECC eu):
https://www.youtube.com/channel/UCbPS9op5ztLqrv6zlMH_IcQ
Low pollutant emissions confirmed for low carbon fuels

- Reference tests on B7 market diesel (7% fatty-acid-methyl-ester content)
- Tests on renewable fuels without modification to vehicle hardware or software
  - 100% HVO (Hydrotreated Vegetable Oil)
  - B30 diesel
Well-to-Wheel calculations to investigate CO$_2$ impact

Methodology of JEC WtW report v5 used [http://dx.doi.org/10.2760/100379](http://dx.doi.org/10.2760/100379)

Several representative production pathways studied

- **Paraffinic fuels** (associated with 100% HVO tests)
  - HVO: palm oil, waste cooking oil, EU mix
  - BTL (biomass-to-liquid): waste wood
    - Hydrothermal liquefaction
    - Fischer-Tropsch route with CCS (carbon capture and storage)
  - e-diesel: Fischer-Tropsch route with SOEC (solid oxide) electrolyser

- **FAME** (associated with B7 and B30 tests)
  - Rapeseed oil
  - Palm oil
  - Waste cooking oil

Well-to-Wheel analysis of future automotive fuels and powertrains in the European context
Well-to-Wheel calculations to investigate CO₂ impact

- Tank-to-Wheel (tailpipe) measurements show similar results for the different fuels
- Well-to-Wheel evaluation versus B7 reference depending on production pathway
  - B30: -14 to -26%
  - HVO: -60 to -82%
  - BTL: -64% to -200%
  - E-fuel: -93%
Conclusion and outlook

➢ Low pollutant emissions over wide range of driving conditions shown with the use of advanced emission control systems

➢ Significant WtW CO₂ reductions possible with the use of renewable fuels

➢ Part of this reduction is already possible for the existing fleet as most paraffinic compounds are drop-in for market diesel fuel, i.e. compatible with existing vehicles and infrastructure

➢ Internal Combustion Engine is part of the solutions to contribute to EU Green Deal climate-neutral and zero-emission goals along with electrification

➢ Further investigations for LD gasoline and HD diesel are under consideration

➢ AECC is providing input to the ongoing Euro 7 process reflecting the further developments and innovation needed for future engine systems

➢ Concawe is assessing the scalability of carbon-neutral fuel production
THANK YOU!

www.aecc.eu
dieselinformation.aecc.eu