The automotive industrial value chain: challenges and trends

or

Towards new vehicle emissions legislation in Europe

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ATIEL Technical Seminar, 13 June 2019

Emissions Legislation evolution in Europe

*First emissions legislation in Europe in **1970***

Since then…

- ***EURO 1 to EURO 6 for Light Duty Vehicles***

  Regulation (EC) 715/2007 and implementing measures (28+839 pages)

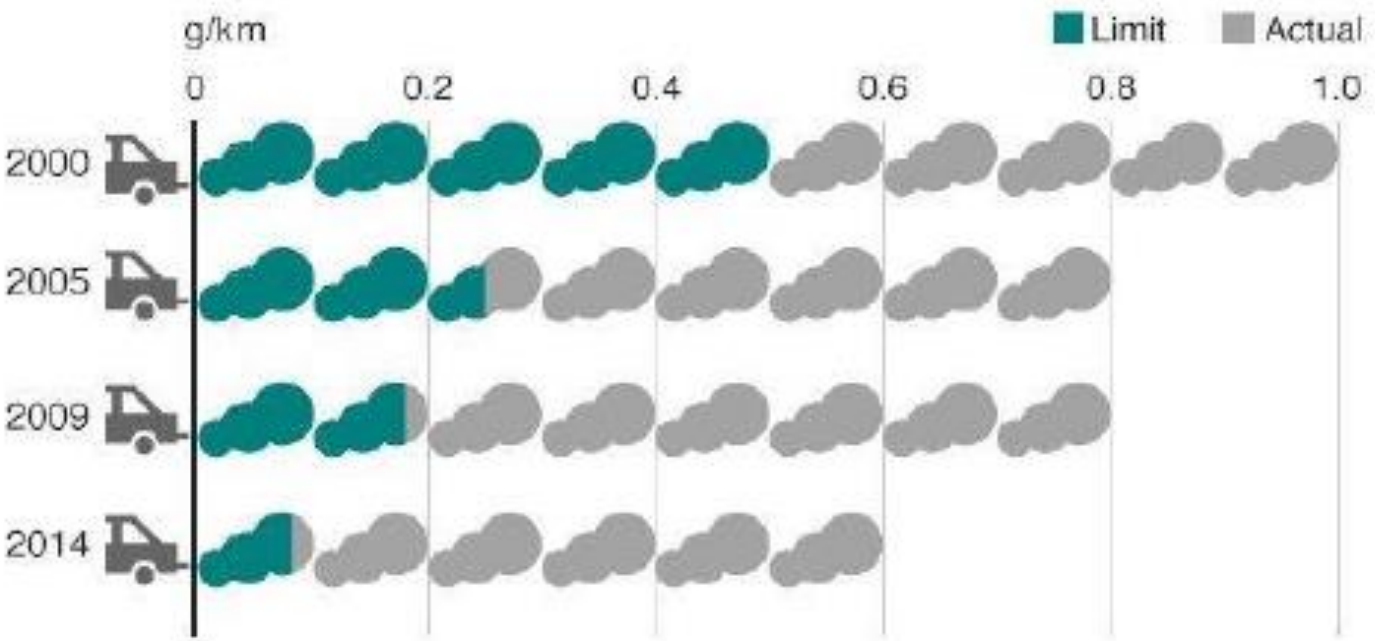
- ***EURO I to EURO VI for Heavy Duty Vehicles***

  Regulation (EC) 595/2009 and implementing measures (20+219 pages)

Compliance judged on laboratory tests NEDC/WLTP, evaporative, low-T, etc…

Clear need to update, harmonise and simplify

But in the real world….



Source: average on-road diesel NOx emissions, the ICCT

But in the real world….

Emissions on the road did not improve to the same extent as the ones in the lab

- *JRC developed a PEMS test for HDV*
- ***PEMS was introduced in HDV** legislation in 2011*

- *In 2011 JRC published a report showed LDV had similar problems…*
- ***RDE procedures for LDV** were developed (2011-2018)*

In 2015 came "dieselgate":

- *In Sept. 2015 VW group diesel vehicles were found with **defeat devices***
- ***Bad news:** Investigations from MS showed that other vehicles also may emit high quantities in real world conditions and more companies had to recall vehicles or implement changes*
- ***Good news:** Some vehicles are already below the limits in some on-road tests*

However, conclusions drawn from a single on-road test maybe misleading

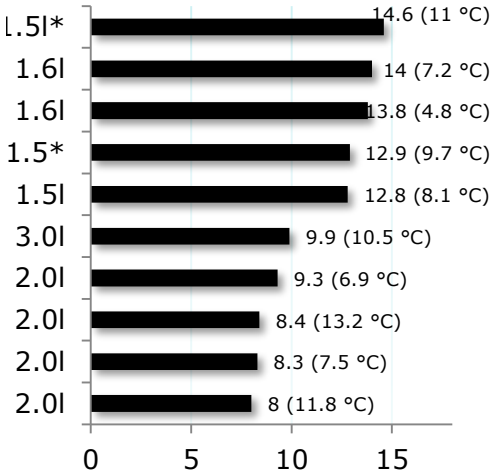
National Investigations:

EURO 6 Diesel RDE test results for ***pre-RDE vehicles***

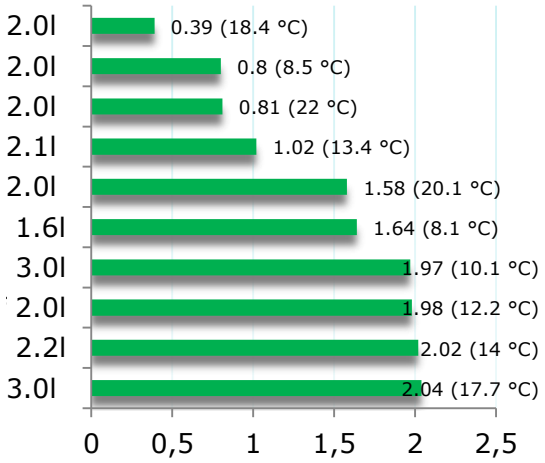
Important note: The results shown are from individual tests that were not done under similar conditions.

Ranking of vehicles is not possible on a single RDE trip

Worst cases



Best cases



CF (average ambient test temperature in parenthesis)

Compliance for post-RDE vehicles means being below the limit for any RDE trip possible

Properly maintained vehicles should not over-emit

"The technical measures taken by the manufacturer must be such as to ensure that the tailpipe and evaporative emissions are effectively limited, .. throughout the normal life of the vehicles under normal conditions of use"

And

"The use of defeat devices that reduce the effectiveness of emission control systems shall be prohibited.

'defeat device' means any element of design which senses temperature, vehicle speed, engine speed (RPM), transmission gear, manifold vacuum or any other parameter for the purpose of activating, modulating, delaying or deactivating the operation of any part of the emission control system, that reduces the effectiveness of the emission control system under conditions which may reasonably be expected to be encountered in normal vehicle operation and use;"

Need a robust system that guarantees independence, transparency, informed testing under real world conditions

RDE 1-4

History of RDE

2011-2015:

- *Kick-off in 2011: Working group on RDE*
- *Evaluation of candidate procedures by JRC*
- *Development of a PEMS on-road test*

2016:

- *RDE 1-2: Implementation of RDE Regulations 2016/427 and 2016/646 as worldwide first on-road test procedure for light duty vehicles*

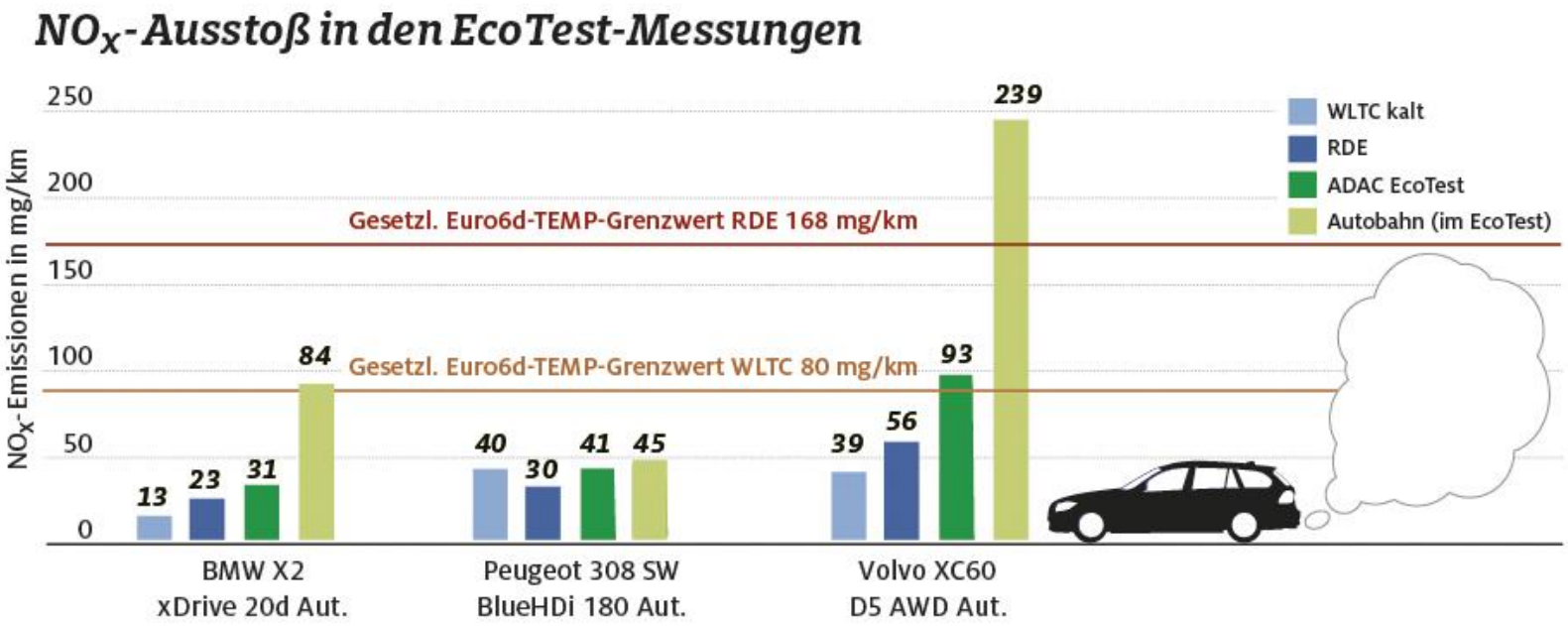
2017:

- RDE 3: introduced coverage of cold and hot start and particle number emissions

2018:

- ***RDE 4: Provisions for in-service conformity / Reviewing RDE procedure and adapting provisions to ensure practicality and effective emissions testing***

The post-RDE era (EURO6d-temp vehicles):



*Tests performed by ADAC

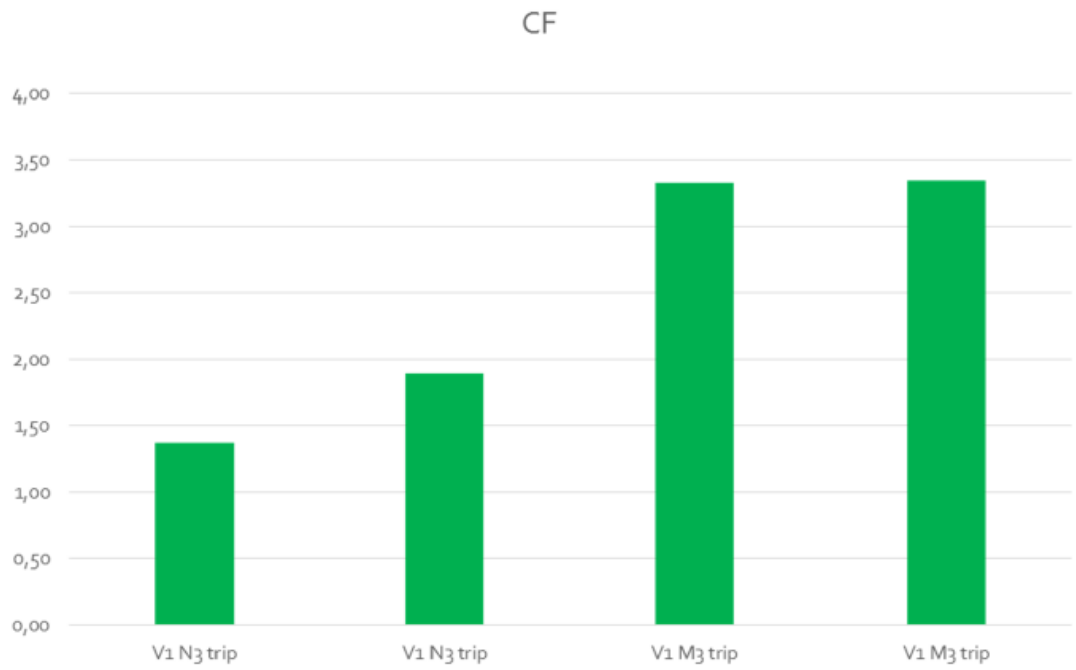
All Vehicles sold in Europe

after 1 September 2019 RDE compliant!

Issues raised on lubricants

➢ *Engine Lube Oil Carryover in HD-CNG engines*

- PN emissions from CNG are mainly caused by oil combustion, thus is closely related to oil carryover. Consequently CNG vehicle driving conditions and payload will significantly influence the PN emissions.
- This is not the case for diesel equipped with DPF since DPF will remove most particles from combustion independent of driving conditions.



Lessons Learned

- *RDE is a significant step towards achieving full compliance with the spirit of the emissions regulation*
- *Differences still exist between LDV and HDV rules*
- *Some pollutants still need to be addressed (sub-23 nm particles, NH_3, N_2O, …)*
- *Lifetime needs to be redefined: (150.000 km for LDV and up to 700.000 for HDV)*

A new step in the EURO emissions legislation still needed…

The bigger picture:

- *The future will surely be largely based on electrification*

- *Vehicles with combustion engines will only survive the trend if they prove to* ***be as clean as possible under all conditions of use and clean throughout their lifetime***

Stakeholder event on future emission standards

- Took place in Brussels on the 24th October 2019 with the participation of more than 120 experts
- Preceded by a meeting of academic experts

All presentations are available on the link: http://ec.europa.eu/growth/content/stakeholder-event-preparing-future-european-emission-standards-light-and-heavy-duty-vehicles_en

Broad list of issues

- *In use performance monitoring for compliance and enforcement over the lifetime of the vehicle*
- *Pollutant emissions to be considered along with CO2/GHG emissions*
- *Currently non-regulated emissions should also be considered*

In use performance monitoring

- *Emphasis on **continuous emission monitoring**, but care should be taken on privacy rules*
- *Link regulations with impacts: towards averages and (lifetime) totals, and reducing risks*
- *Substantial increase in the durability requirements, including Market Surveillance and In-Service Conformity requirements*
- *Closer links with On-Board Diagnostics and the developments therein. Regulatory emphasis and signaling for further exhaust emission sensor development.*
- *Modelling and cloud monitoring should also be accounted for improved accuracy and performance*

Pollutant emissions to be considered along with CO_2/GHG emissions

- *Help address the question: How much emission control needed and what expense on fuel consumption is acceptable?*
- *Air and climate pollutants should not be dealt separately*
- *No separate standards for different types of fuels and or engines*
- *Address non-CO2 greenhouse gas emissions*
- *Energy consumption and CO2 emissions in normal use, including lights, auxiliaries, winter tires, options, deterioration, etc.*

Non-regulated emissions

- *Sub 23 nm particles and total (i.e. solid and volatile) particles*
- *NH_3 – Ammonia (hazardous, PM precursor, significant contributor to the formation of Secondary Organic Aerosols)*
- *HNCO (isocyanic acid)*
- *NO_2 - Less direct NO2 helpful to reduce exposure – Maybe sufficient to be reported for AQ modelling purposes*
- *N_2O – Nitrous oxide (High GHG potential, ozone depleting substance)*
- *CH_4 – Methane (High GHG potential)*
- *PAHs – polycyclic aromatic hydrocarbons and Aldehydes*
- *Brake, tire, and road wear emissions: particle sizes and composition.*

Additional topics

- *Fuel and technology neutral regulations and emission standards*
- *Intelligent geofencing*
- *Investigate if and how Remote Sensing can complement the existing regulatory arsenal*
- *Investigate if OBD is still necessary in the emissions regulation or it is only a duty of the OEM towards its clients*
- *Evaporation losses: to further investigate for fuel neutrality and running losses*

Further steps

- *Two big studies in 2019-2020 to address the issues*
- *Own reflections and international harmonisation*
- *Legislative process in Europe can be long. At least two years from the proposal to the final rule*
- *Lead time for the industry to adapt its products*

In the meantime RDE regulations brought a significant improvement in car emissions in Europe

Thank you for your attention!

For more info on European emissions legislation visit our website:

https://ec.europa.eu/growth/sectors/automotive_en

or contact:
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