



# Future EU vehicle emissions regulations:

- Principles and requirements for real-world emissions –
- Status of on-going activities – committees -

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- **Background**
- **Expectations of the legislators**
- **Existing regulatory elements**
- **Underlying principles for implementing real-world requirements**
- **Critical issues**
- **On-going efforts**

- **EU Air Quality Directives**
  - Persisting NO<sub>2</sub> exceedances in urban areas despite more stringent emissions standards
  - Main contributor is road transport, significant deviations between actual and expected NO<sub>x</sub> emissions
- **Strategy for climate and GHG emissions**
- **Long term vision for transport in Europe - 2011  
Transport White Paper:**
  - 60% CO<sub>2</sub> reduction over the 1990 levels by 2050
  - Halve the use of 'conventionally fuelled' cars in urban transport by 2030; phase them out in cities by 2050

# Expectations of the legislators



- To have clean vehicles on the road and not only in the test cell
- To improve the ability to measure and quantify the real life emissions
- To push for an optimized design of emissions control technologies within the normal operating conditions
- To introduce cost-efficient<sup>1</sup> regulatory tools, able to cope with the upcoming technologies and limiting the use of defeat devices/strategies

# Existing regulatory elements



- **EURO VI 582/2011 & 64/2012: In-Service Conformity and type approval for heavy-duty engines, based on real-world vehicle testing with portable measuring equipment (PEMS)**
- **Verifies conformity of heavy-duty engines on vehicles during normal driving – at type approval and during their normal life (“In-Service”)**
- **Does not explicitly include to ‘real-world’ emissions requirements but provides a functional and performance check of the emissions control technologies**

# Underlying principles (1)



- **Range of applicable normal vehicle operating conditions**
  - Ambient temperature, atmospheric pressure
  - Vehicle/engine condition (cold/hot) and usage (e.g. speed, acceleration, engine power)
- **Testing**
  - Under real on-road driving conditions with Portable Emissions Measurement Systems (PEMS) as 'golden' method

# Underlying principles (2)



- **Data evaluation rules<sup>1</sup>**
  - Suitable averaging principles and statistics need to be developed due to variability of conditions within a test and longer test durations than for the conventional laboratory tests.
- **Not To Exceed principle**
  - Vehicle/engine need to comply within the range of predefined operating conditions
- **Decisions made from sound statistical methods and samples of vehicles/engines**

- **Portable instrumentation for light-duty vehicles**
  - Power consumption, size and weight acceptable for heavy-duty vehicles
  - Equipment needs to be smaller for light-duty vehicles
- **Definition of boundary conditions in which the real-world requirements must be fulfilled**
- **Engine/vehicle development processes will become more challenging<sup>1</sup>**



# On-going efforts (HDE)



- **Heavy-Duty Engines**

  - *In-Service Conformity:*

  - Review of Euro VI PEMS In-Service Conformity procedures (practicability, implementation) by the end of 2014
  - PEMS PM Instrumentation evaluation exercise completed: instrumentation requirements proposed
  - PEMS PM Pilot Program (Industry run program)





  - *Real Driving Emissions:*

  - Assessment of existing requirements to check whether they ensure that EURO VI + engines are sufficiently clean. Attention paid to urban and low load operation.

# On-going efforts (HDE PEMS PM)



- **PEMS PM Instrumentation evaluation program**
  - Total PM + Real-time sensor whose integrated signal is scaled by the total mass
  - Requirements proposed for gravimetric and real-time PM measurements
  - Instrumentation for gravimetric measurements (e.g. proportional dilution, sampling, filters) mostly aligned with existing laboratory standards
  - Real-time sensors key measurement performance is a particle penetration rate at a given particle size (e.g. limiting the influence of ultra-fine particles)

- **Light-Duty Vehicles**

- *Real Driving Emissions (RDE):*

- Development of procedures (PEMS and laboratory random cycle) by the end of 2013.
    - Joint effort EU authorities and industry
    - Implementation for Euro 6 vehicles, calendar and implementation measures (e.g. sampling of vehicles, administrative aspects) not officially agreed.



# On-going efforts (NRMM)



- **Non-Road Mobile Machinery Engines**

- In-Service Conformity:*

- Pilot Program (Industry run program) to be completed by the end of 2012
- Implementation for Stage IV or V standards (under discussion)
- Contributions from major EU and US engine manufacturers
- Adaptation of heavy-duty procedures to NRMM
- Equivalence with US methods being assessed



- **Many thanks for your attention !!!**
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