CLEPA Input on Flexible Exhaust System Technologies
Flexible exhaust system technologies

Rationale:

„Flexible“ exhaust systems are a general concern by regulators

• Conventional exhaust systems are already flexible in terms of their response over frequency / engine rpm

• Exhaust systems with passive valves driven by exhaust flow. Customer cannot select/change sound performance.

• Exhaust systems with electronically actuated systems
  Customer can select pre-defined and homologated operation modes

• Replacing exhaust systems with electronically actuated systems
  Customer can control and may alter sound emission of the originally equipped & homologated exhaust system.

Source: https://www.maxhaust.com/
Passive (self-actuated) valves are opened by gas flow against the spring force

- Valve closed at low flow rates
  > high restriction reducing noise emission at idle and cruising
- Valve opens at high flow rates
  > low restriction leading to a reduced backpressure (improved fuel economy)

Source: Faurecia, Innovation selling toolkit presentations for external communication.
Flexible exhaust system technologies
Actuated valves

**Electronically actuated valves are operated in a similar strategy (pre-defined and homologated)**

- Valve closed at low flow rates / special vehicle conditions
  - > high restriction reducing noise emission at idle, cruising / cylinder deactivation
- Valve opens at high flow rates
  - > low restriction leading to a reduced backpressure (improved fuel economy)

Source: Faurecia, Innovation selling toolkit presentations for external communication.
Flexible exhaust system technologies
Active noise cancellation & sound generation

**Exhaust Dynamic Sound Generation**
Adding defined sound/frequencies to existing frequency content

**Exhaust Dynamic Noise Cancellation**
Reducing existing frequency content

Source: Faurecia, Innovation selling toolkit presentations for external communication.
Case study with PMR<120kW/t vehicle shows that...

- an ESDG system enhances the sportiness of the sound emitted by the vehicle
- while a proper sound box application does not significantly increase the emitted noise (Annex 3) nor does it affect the linearity of noise emission (Annex 7).

Case study with PMR<120kW/t vehicle shows that...

- ...great potential of active cancellation to reduces vehicle noise emission and hence pass-by noise levels
Flexible exhaust system technologies

Conclusion

- There are different levels of flexibility with regards to exhaust system technologies while this presentation focuses on original equipment exhaust systems with passive or active valves as well as active sound box systems.

- Flexible exhaust system technologies, such as active sound box systems or valves with pre-defined and homologated operation modes, are enabling technologies to reduce the overall vehicle noise emission and ensure compliance for the upcoming pass-by noise limit stages.
Thank you for your attention.

Questions?