

Objectives and status

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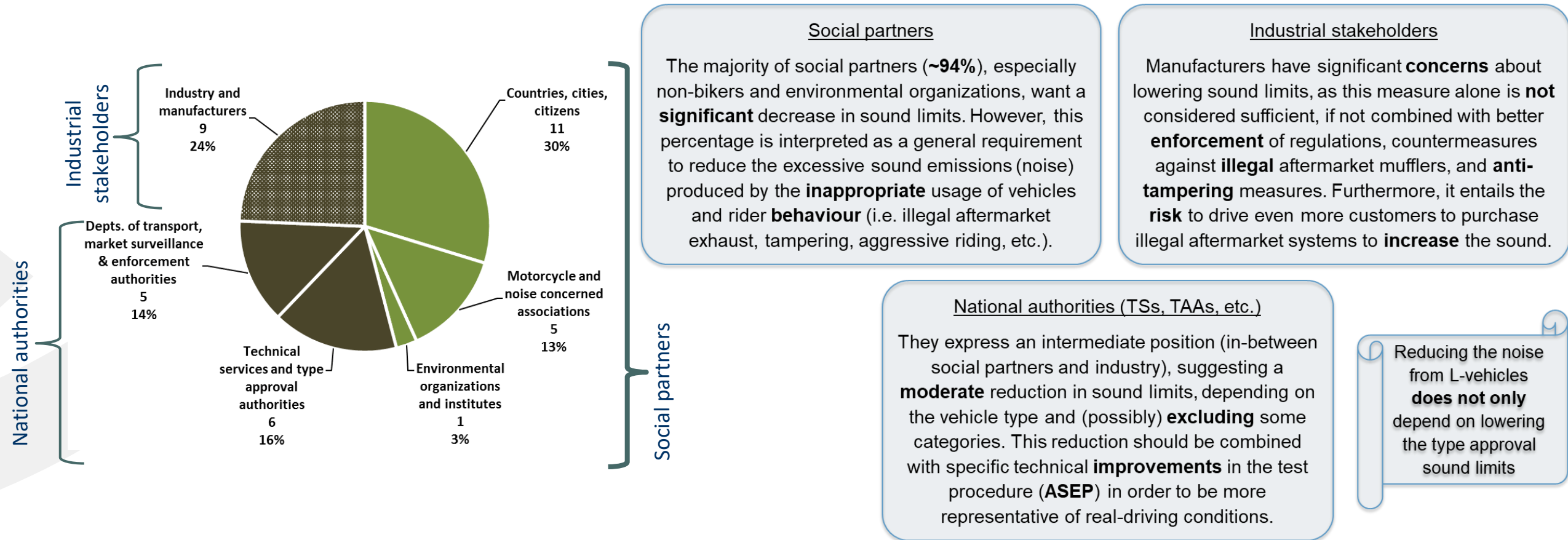
Leuven, 15.05.2024



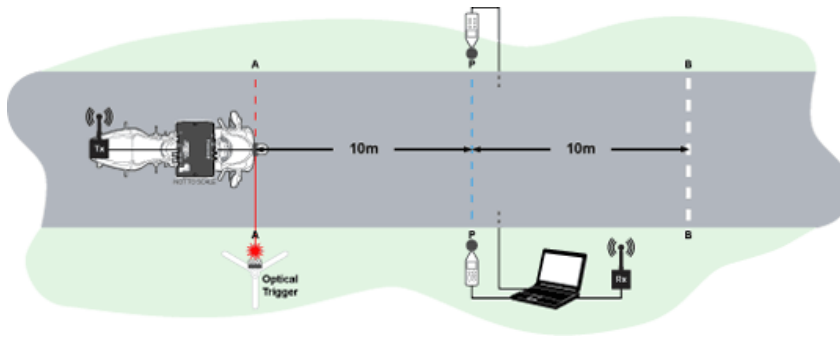
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LONS L-vehicles Emissions and
Noise mitigation Solutions

Different viewpoint by stakeholders on motorcycle noise



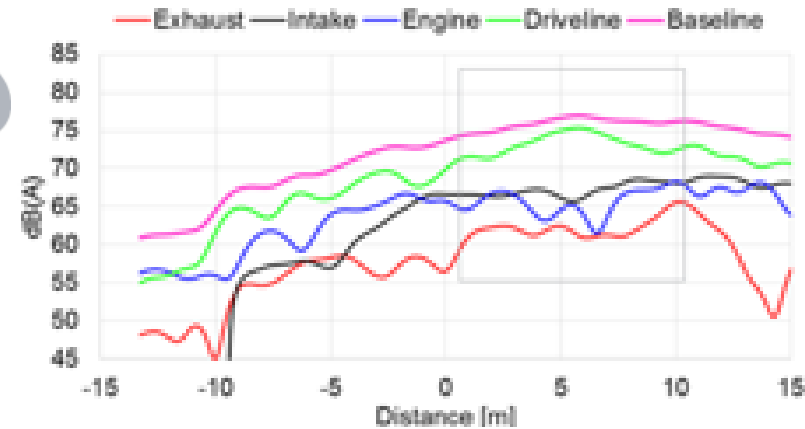
Noise does not only come from the exhaust



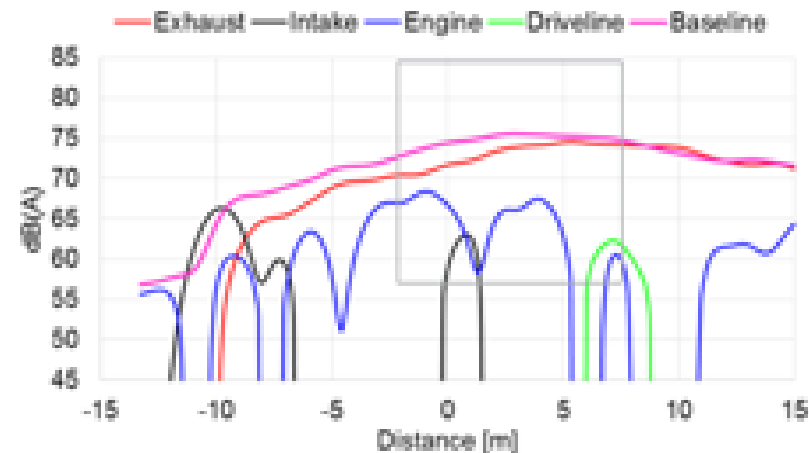
Maximum pass-by area

Contributions of:

- Exhaust
- Intake
- Engine
- Driveline
- Baseline sound level in original configuration, also equivalent to the total of all contributions



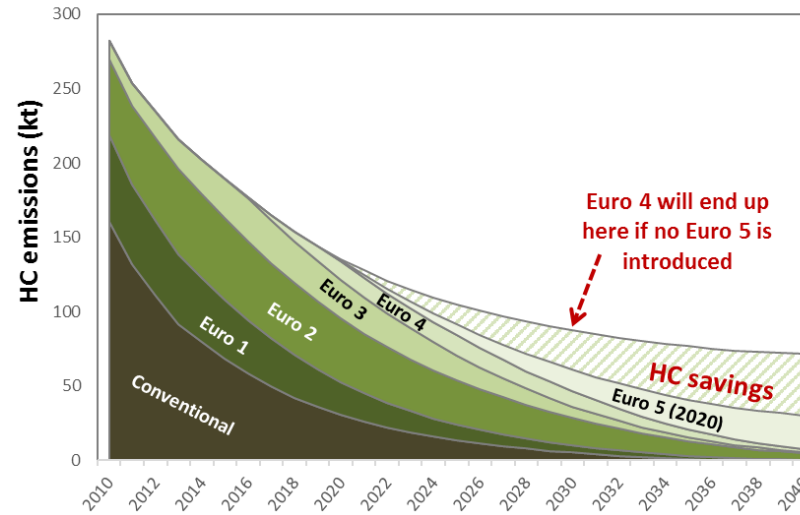
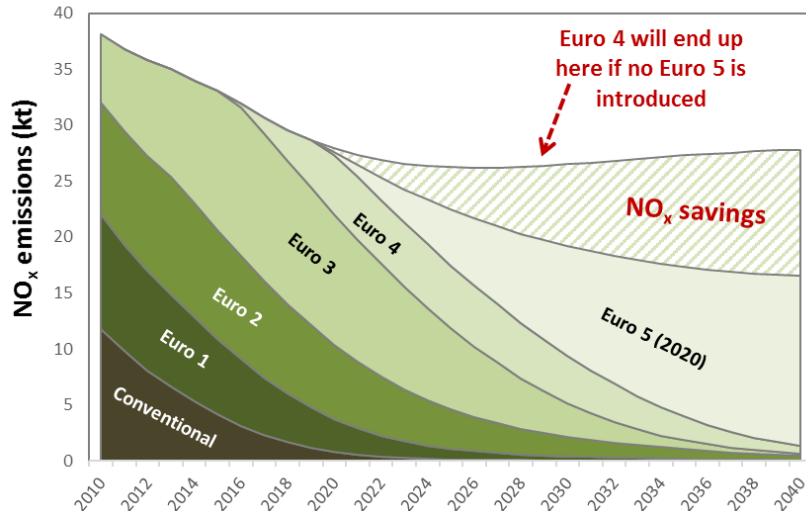
Scooter 125cc
25 < PMR ≤ 50



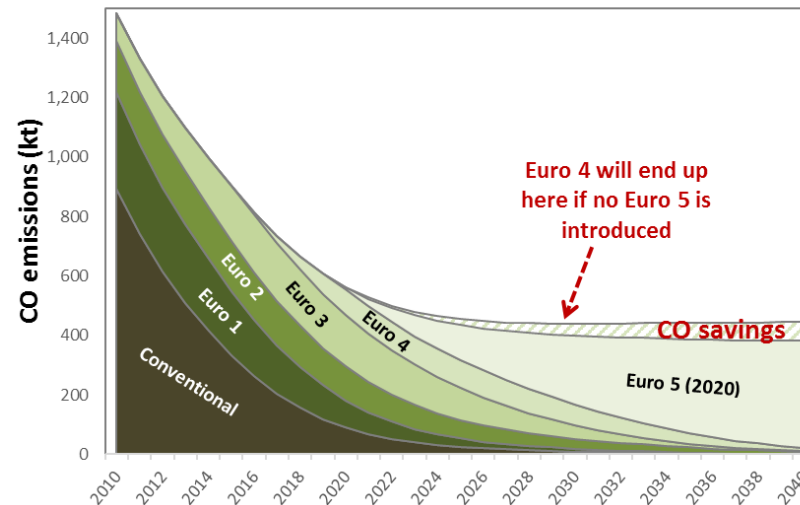
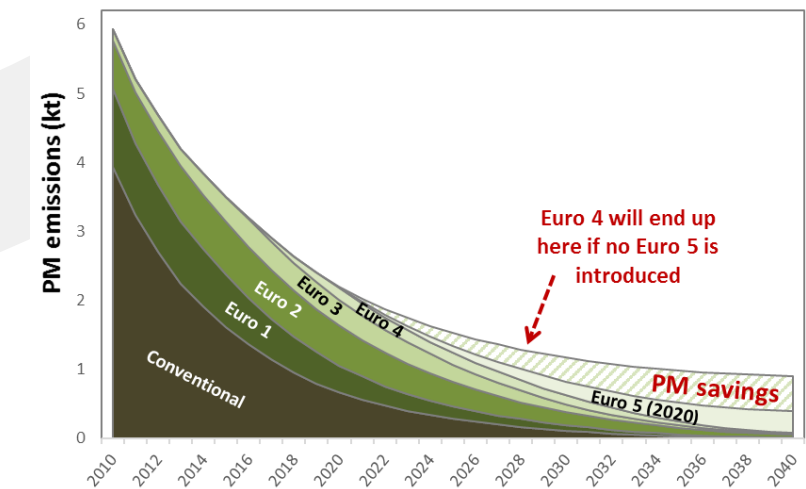
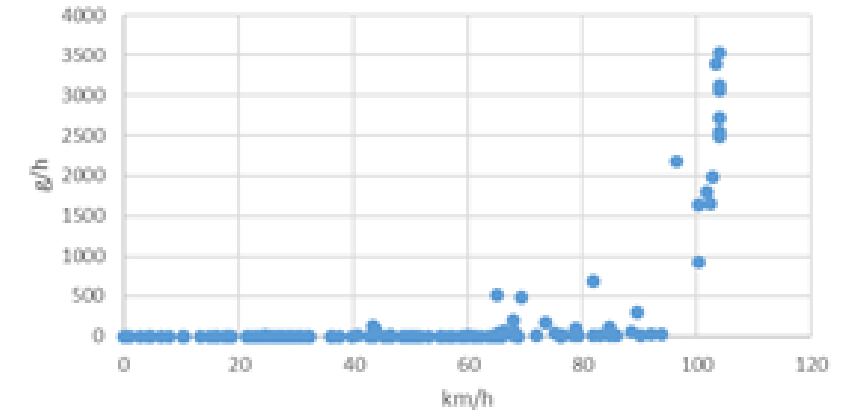
Motorcycle 800cc
PMR > 50

There's more than noise when it comes to two wheelers

Standards are designed to offer emission reductions

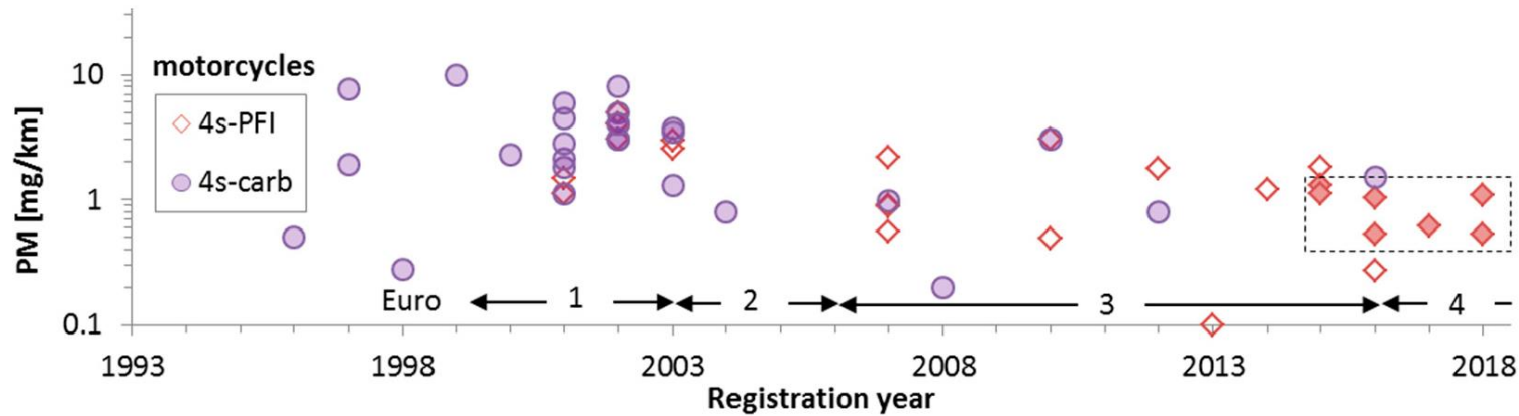


But cannot cover all operation conditions

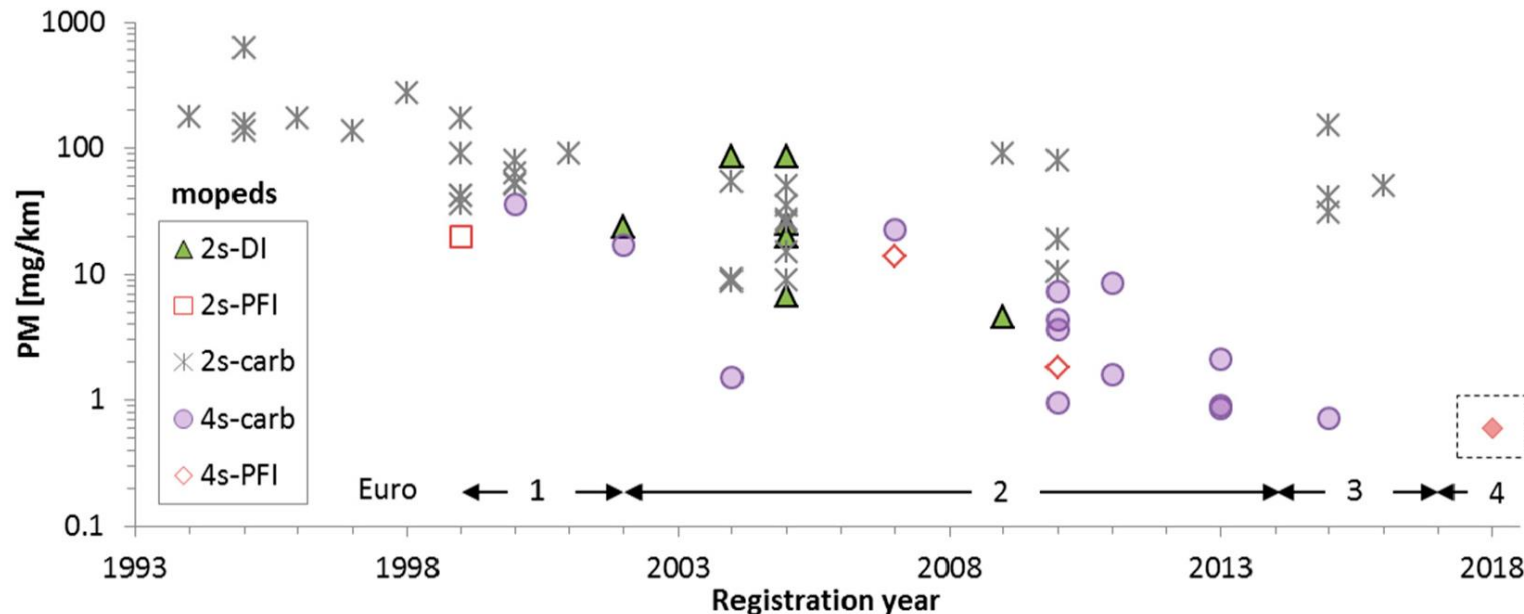


Example: CO from Euro 5 scooters <250 cc under high-speed driving

Technology enforced by regulation can be effective



(a)



PM emissions have been indirectly dropping with technology introduced to address CO and HC standards

Source: *Particulate Emissions of Euro 4 Motorcycles and Sampling Considerations*, *Atmosphere* 2019, 10, 421; doi:10.3390/atmos10070421

LENS Objectives I

- **Beyond state-of-art LVs emission & noise measurement techniques**
 - Mini-PEMS to measure down to PN2.5nm
 - On-board noise monitoring in the real world
 - In-field measurement of gaseous pollutants, PN and noise
 - Compact FTIR PEMS for non-regulated pollutants

LENS Objectives II

- **Characterise noise & pollutant emissions of LVs**
 - Tests on 150 vehicles spanning all major LV subcategories
- **In-field identification of tampered LVs**
- **Demonstration of solutions for 3 case studies**
 - Leuven
 - Paris
 - Barcelona

Recommendations & expected impact of decreasing noise & pollutants

How is this being achieved?

In lab

PN_{<23}

On road/test track

Peak events

Remotely

Tampering detection

Case studies demonstration

Update of models

Recommendations

Regulations E_x e_x

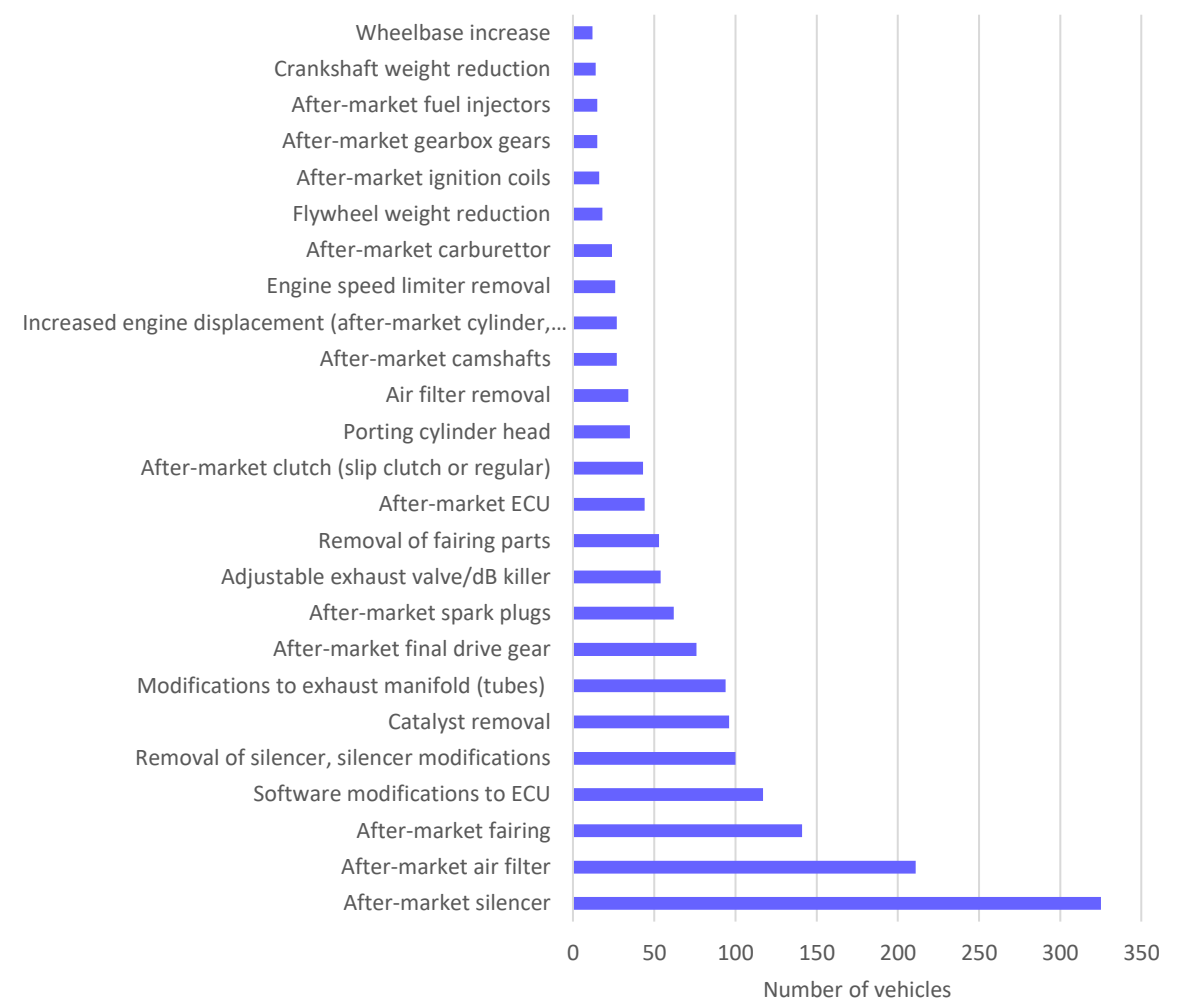
Surveillance

Traffic measures

Urban planning

Extent of tampering

- Target group: motorcycle or LV owners and enthusiasts
- More than 75% of the vehicles were not in their original configuration
- Muffler replacement was the most common practice
- Some 15% of vehicles with more than 6 modifications
- Large number of vehicles with modifications that may significantly affect noise/emissions:
 - Software modified ECU (20%), removed catalyst (15%), replaced ECU (6%)



	Online Questionnaires	Face-to-face Interviews	Total
Questionnaires completed	602	64	666
No modifications mentioned	157	3	160
Reviewed Questionnaires	445	61	506

Lab Testing

Round-robin executed

- Two motorcycles distributed around labs for cross-checking
- EMISIA/LAT, IDIADA, TUG, (Prague Univ., IFP)

Protocol finalized:

- Regulated and non-regulated pollutants, including PN2.5
- WMTC and RDC cycles

Measurement devices:

- Closed or open CVS depending on vehicle/PN requirement
- Lab instrumentation + FTIR + PMP PN (+ Total PN)

Status:

- ~30 vehicles have been measured
- Results are being synthesized



Real world driving conditions & Testing requirements

- **Literature review**
- **Analysis of available real world driving data to identify emissions**
- **Roadside measurements**
- **Recommendation to record vehicle data:**
 - Engine speed
 - Gear settings
 - Exhaust temperature
 - Mass of vehicle & rider
- **Conditions for highest noise and emission levels**

- ❖ Cold engine start
- ❖ Driving at max rated speed (mainly for mopeds)
- ❖ Strong accelerations, including from standstill
- ❖ Transition from constant speed or acceleration phases to deceleration phases
- ❖ Restarting during the test
- ❖ Testing at max technically permissible mass
- ❖ Stop and go testing simulating traffic congestion
- ❖ Engine revving

On-road testing

Systems available:

- SEMS with selected sensors (NO_x, CO₂, CO, NH₃, O₂, HC, BCPM et al.)
- On-board FTIR
- On-board PN measurement

Challenges being addressed:

- Can-bus access for vehicle data
- Difficult access to exhaust gas at tailpipe
- Exhaust gas flow measurement
- Suitability of systems for small LVs

Status:

- 15 vehicles measured on the road

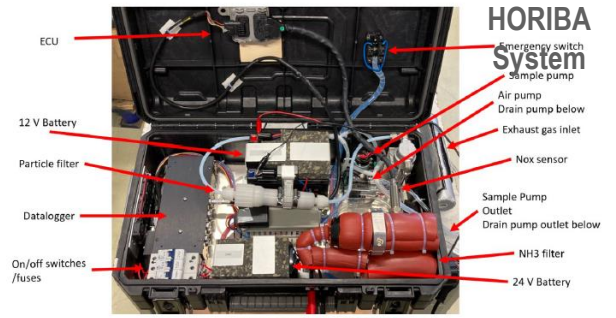
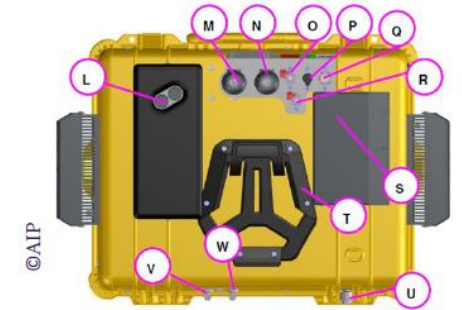


Figure 6-3: Horiba SEMS Unit

EMISIA System

IFPEN System



Emissions and
ation Solutions



Thank you!

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