

HOW TO TACKLE AIR POLLUTION

HEAVY DUTY VEHICLES AND THE MAIN POLLUTANTS

“Air pollution is the contamination of the indoor and outdoor environment by any chemical, physical, or biological agent that modifies the natural characteristics of the atmosphere.”

Sources: WHO and European Environmental Agency



The largest environmental threat to human well-being and health



7 MILLION DEATHS

are caused every year to the exposure from air pollution, which causes cardiovascular and respiratory illnesses, affecting the nervous and reproductive systems

PARTICULATE MATTER (PM)

Complex mixture with components having diverse chemical composition. The major components are sulphate, nitrates, ammonia, sodium chloride, black carbon, mineral dust, and water.

NITROGEN DIOXIDE (NO₂)

Reddish brown gas with a pungent odour. This gas reacts with water producing other NO_x group substances: nitric acid and nitric oxide. It critically participates in environmental polluting phenomena i.e. smog exposure and it is a **key precursor of a range of secondary pollutants**.

OZONE (O₃)

Photochemical oxidant formed due to the **reaction of other contaminants** present in the atmosphere nitrogen dioxides (NO₂) molecules and volatile organic compounds (VOCs) when they absorb light from solar radiation.

CARBON MONOXIDE (CO)

Non-irritant, odour, taste, and colourless toxic gas. It originates during incomplete combustions of carbonaceous fuels in different industrial processes (wood, petrol, coal, natural gas and kerosene). It is combustible and can form any explosive mixtures with air.

SULPHUR DIOXIDE (SO₂)

Colourless gas soluble in water. It is **produced during the combustion of fossil fuels** of motor vehicles and industrial processes. Its chemical oxidation reacts into the formation of sulphurous and sulfuric SO_x acids.

CARBON DIOXIDE (CO₂)

It appears as colourless, odourless, and incombustible gas. Naturally, it is **exhaled by animals and humans to produce oxygen, but it is mainly produced during the fuel combustion** in motor vehicles. It potentially affects climate change.

BENZENE

Colourless and flammable liquid with a sweet odour. It is produced from natural activities (i.e. volcanoes and forest fires) but **mostly from anthropogenic activities** such as the combustion of fossil fuels (crude petrol and diesel) and therefore motor vehicle exhaust.



THE MAIN POLLUTANTS



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HDV's REGULATORY FRAMEWORK AND STANDARDS

IN THE EU, ON-ROAD DIESEL VEHICLE EMISSIONS WERE ASSOCIATED WITH **35,000 PREMATURE DEATHS FROM AIR POLLUTANTS**

SOURCE: WHO, 2017

Heavy Duty Vehicles (HDVs) are the major **NO_x EMISSIONS** contributors

ROAD TRANSPORT SECTOR IS RESPONSIBLE FOR **ALMOST 13% OF TOTAL AIR EMISSIONS**



ABOUT 23% OF EU TOTAL CO₂ EMISSIONS ARE DUE TO ROAD TRANSPORT SOURCES: ICCT, EEA

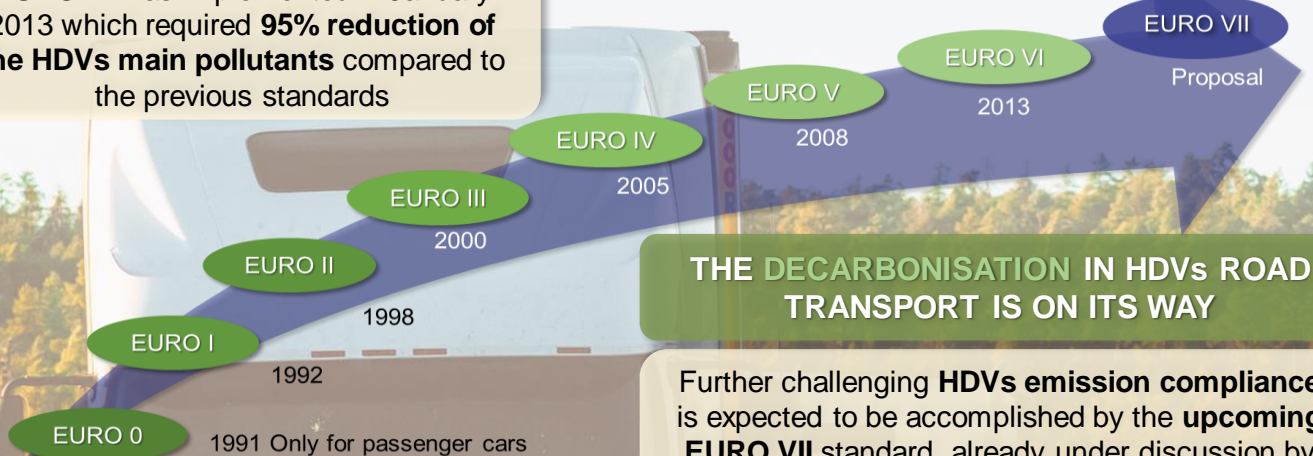
AROUND 12% OF THE EU'S PRIMARY PM_{2.5} EMISSIONS COME FROM ROAD TRANSPORT

ROAD TRANSPORT CONTRIBUTES TO MORE THAN 40% OF NO_x EMISSIONS



ROAD TO ZERO: EURO STANDARDS FOR HDVs

EURO VI was implemented in January 2013 which required **95% reduction of the HDVs main pollutants** compared to the previous standards



THE **DECARBONISATION** IN HDVs ROAD TRANSPORT IS ON ITS WAY

Further challenging **HDVs emission compliance** is expected to be accomplished by the **upcoming EURO VII** standard, already under discussion by the European Commission

THE HDVs CURRENT POLICY-SCENARIO

REGULATION AND COMMITMENT IS REQUIRED TO TACKLE AIR POLLUTION AND MAKE THE HDVs SECTOR TRULY **CARBON NEUTRAL**

Regulation (EC) No 592/2009

Approval of motor vehicles and engines with respect to emissions from **HDVs Euro VI** and **access to vehicle repair and maintenance information technical requirements** for the type-approval of motor vehicles, engines and replacement parts

Regulation (EU) 2019/1242

Sets **CO₂ emission performance standards** for new HDVs. It includes an **incentive mechanism** for zero- and low-emission vehicles (ZLEV) to achieve the reduction targets

Regulation (EU) 2020/1589

Monitor and report the actual fuel and energy consumption on **new HDVs** by EU member states and manufacturers

DIRECT ACTIONS AT ALL LEVELS OF GOVERNMENT AND INCENTIVES FOR THE HDVs MANUFACTURERS AND COMPANIES ARE ESSENTIAL

BUT... HOW TO ACCELERATE THE TRANSITION TOWARDS HDVs ZERO EMISSION?



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INNOVATIVE AND GREEN SOLUTIONS FOR HDVs

To comply with the European Regulations and Emission Limits, manufacturers have successfully introduced new green technological solutions

The project aims to implement an emission control system on HDVs for their motor engine and exhaust which will significantly reduce the air pollutant emission and the associated environmental and health impacts



LONG-TERM EXPECTATIONS: UP-SCALE THE TECHNOLOGY TO IMPROVE THE GLOBAL AIR QUALITY

APAM
Mantua, Italy
 Demonstration on real paths for 5 HDVs

ge.am.
 gruppo amiu
Genova, Italy
 Demonstration on real paths for 9 HDVs

MONOLITHOS
 CATALYSTS - RECYCLING - INNOVATION
Galatsi, Greece
 Demonstration on real paths for 10 HDVs

MAIN CAT4HEAVY RESULTS

TECHNICAL

- 1) Up-scaling of CAT4HEAVY for public HDV.
- 2) Fulfilment of emission standards better than Euro VI (>10%).
- 3) Cost reduction up to 50% compared to state-of-the-art of Catalyst-Based Emission Control Systems (CECS).

ENVIRONMENTAL

- 1) Reduction of the GHG emissions of public transport fleets by 30%.
- 2) Elimination of NH₃.
- 3) 50% of PGM reduction
- 4) Recycling of >98% of PGM thanks to the HDVs retrofitted.

POLICY

- 1) Stakeholder network creation: policy decision makers, technology experts, manufacturers and companies to foster the HDVs EU emission regulation.
- 2) Dissemination and communication activities on HDVs emission control within and outside of Europe.
- 3) Support of circular economy principles and GHG and PGM reduction policies.

Nano-CATalysts for HEAVY Duty Applications

More than 10 HDVs will be retrofitted within the project



Specific project actions will involve the scaling up of the pilot and testing it on real conditions of Greek and Italian Municipalities to prove the feasibility of the technology and its policy and EURO VI Emission Standards compliance.



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