

Sustainable Propulsion for Transport, Off Road and Operating Machines



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Off Road, Operating Machines, AG, MMT

Emissions

in areas with human presence (urban construction sites, ...)

EU regulatory framework

- Fit for 55
- Document 52021PC0556 «2035»

High priority (technically feasible, adequate, economically competitive)

Low priority (technically feasible but inadequate, economically not optimal)

Non-priority (technically subject to major restrictions, limited economic competitiveness)

Uncertain (currently technically and economically subject to restrictions but with potential relevance, research required)

(source: MIMS Report - April 2022 «Decarbonization of transport»)

Emissions– Trasport

- World (2016): 16.2% of the total (source : Climate Watch)
- Italy (2019): 25.3% of the total: (source: ISPRA)

REFERENCE CONTEXT



Infrastructure and Logistics

- Generation, distribution, storage
- "Network" consumption planning

Conversion efficiency/power transmission

- Powertrain
- Work

Reduction of emissions

- Exhaust
- Not-exhaust

Regeneration / Recovery / Accumulation

• Kinetic energy

SFIDE / OBIETTIVI

• Heat

Sustainability of energy carriers

NVH (Noise, Vibration and Harshness)









Experimental analysis



Design













Modeling and simulation

- Reliable and predictive digital twins modeling
- Concentrated/distributed parameters modeling of functional/physical components or systems, ...

Test and experimental development

- Characterization of operationl/performance of components/sub-systems/vehicles
- Tests under laboratory and real environment conditions (road/ground/water etc.)

Check

- Operation
- Environmental impact: abatement/monitoring of emissions

Optimization

- Of components/systems, with reference to layout and operating conditions
- Methods: classical, machine learning

Design

- Virtual Tools (CAD)
- Prototype (manufacturing)

SKILLS / METHODS / INSTRUMENTS



Propulsion systems technologies

- Innovative power systems and transmissions: thermal (alternative/rotary), hybrid, electric, fuel cell, ...
- Integrated control of complex architectures
- Energy and thermal wasterecovery
- Innovative materials

Thermal Propulsion

- Very high efficiency engines
- Advanced combustion systems

Electric Propulsion

- Functional and energetic characterization of storage systems (battery, supercap), actuators (motors) and entire drivelines
- Thermal-electrical modeling of components

Environmental impact of road vehicles, boats and operating machines

- Emissive and climate-changing impact of propulsion systems
- "Non-exhaust" emissions: brakes, tires, asphalt, ...
- NVH (Noise, Vibration and Harshness)
- Circular economy, LCA (Life Cycle Assessment)

Sustainable energy vectors for propulsion systems

- Sustainable and innovative fuels
- Interaction between energy vector and propulsion system



Public funding

EU (H2020), PRIN, PON, POR-FESR

Academia and Research Centres collaborations

Almost all the Italian universities, ENEA, CIRA, other CNR Institues,

