

Carbon Neutral Fuels for efficient ICE: an alternative towards Green Mobility

Dario Sacco

FCA Italy – Powertrain Engineering

Head of Powertrain Research and Technology (CRF)

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- Global warming driving CO₂ emissions reduction legislation
- Energy security/supply decreasing oil reserves/new oil fields
- Increased urbanization & air quality issues leading to predicted ICE bans in cities
- Cultural & demographic changes consumer shifts & attitudes



Country pledges for 2030 exceed the warming limit of the Paris Agreement



Global CO2 emissions since 1980 (solid black) and country pledges under the Paris Agreement (dashed) compared to a high emissions scenario (orange) and a scenario compatible with limiting warming to 2C above pre-industrial levels (blue). Source: Le Quéré, C. et al. (2016) based on Rogelj et al, (2016)

Green House Gas (GHG) emissions



23% of global emissions are due to road transportation



Evolution of EU transport emissions volumes 1990-2012



Despite improvements in fuel consumption efficiency in recent years, CO₂ emissions remain high mainly due to increasing road freight traffic.





A deeply rooted oil-based system is asked to move towards new energy carriers



No «silver bullet» solution



Environmental Sustainability

> Customer & Local Needs / Vehicle Mission Profile

Primary Energy Sources Cost & Availability

Dedicated Fuel Supply Infrastructures



efficient internal combustion engines





electric mobility



The propulsion showing "CO₂-free tailpipe emissions" is the ultimate solution for environmental issues

BUT

CO₂ emissions for energy production must be accounted for

A unique silver bullet solution cannot fit every local and customer needs (e.g. infrastructure, accessibility, driving range,.....)

.....A BEYOND TAILPIPE EMISSION IS NEEDED !!!

Future ICE optimization



Engine Technologies

- VVL/VVT
- Advanced boosting
- Advance Injection / Ignition systems
- Exhaust Gas Recirculation
- Water Injection
- Friction reduction
- Cylinder Deactivation
- Variable Compression Ratio
- Thermal management
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Low Carbon fuels

- CNG, LPG
- Methanol, Ethanol
- Bio-diesel

Powertrain Electrification

- Higher efficiency from e-system
- Tailpipe "CO₂ free" contribution





CNG generates 25% fewer CO₂ emission





A renewable fuel must be suitable for internal combustion engine and simultaneously fully produced by renewable feedstock/source (e.g. waste, sun, wind, biomass, etc.)





Focus of the current 443/2009 CO₂ regulation



Well to Wheel comparison





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Well-to-Wheel - Passenger Vehicles -
GHG Intensity [g CO<sub>2</sub>-eq/km]
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- Renewable gas has the key property to be 100 % compatible with natural gas, being easily blended or used directly as a neat fuel in engines
- Locally produced

Renewable gas represents a fast drive towards decarbonisation



To achieve real CO₂ neutral solutions a life cycle comparison is mandatory



The Circular Economy approach: two real examples



Italian Funding Project "Biomethair" coordinated by Fiat Research Center

BioMetaNow project between FCA and Milan urban company devoted to clean waste water





Production capability = 200 kton/year feeding 400.000 Fiat Panda with a yearly mileage of 15kkm - Yearly CO2 saving = 500 kton vs fossil CNG Pure biomethane is produced by the recycling of waste water (included liquid manure)



20-years consolidated experience (>700.000 units sold)









CNG direct injection enables the adoption of highly efficient monofuel engines







GROWTH IN CNG VEHICLES AND REFUELLING STATIONS

DISTRIBUTION OF CNG REFUELLING STATIONS BY REGION (FEBRUARY 2016)



Note: Not all public CNG stations offer efficient truck refuelling (capacity, compressor, access) Source: car fleet 2005-2015 ACI; CNG stations Federmetano











SNAM

- Proactive role in supporting the growth of infrastructure and the distribution network, aiding and promoting investments by players in the industry
- Coordination of planning and development of the national network with that of vehicles in circulation (refuelling stations and distribution aligned with vehicle promotion)



- Further development of the natural gas vehicles product range ; **innovation** in the context of **the technological excellence** for which Italy is known worldwide
- Active role in promoting natural gas vehicles and their benefits



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Snam, FCA, and IVECO cooperate to optimize the development of the Italian CNG market

Conclusions



Parallel pathways are needed for environment decarburization:

- Electric vehicles, due to their CO₂-free tank to wheel emissions
- Carbon Neutral Fuels as enabler of closed loop CO₂ cycle (circular economy)





MAKING THE WORLD'S ROADS GREENER...

THANK YOU FOR YOUR ATTENTION

