



greenture
infrastructure for a new transport



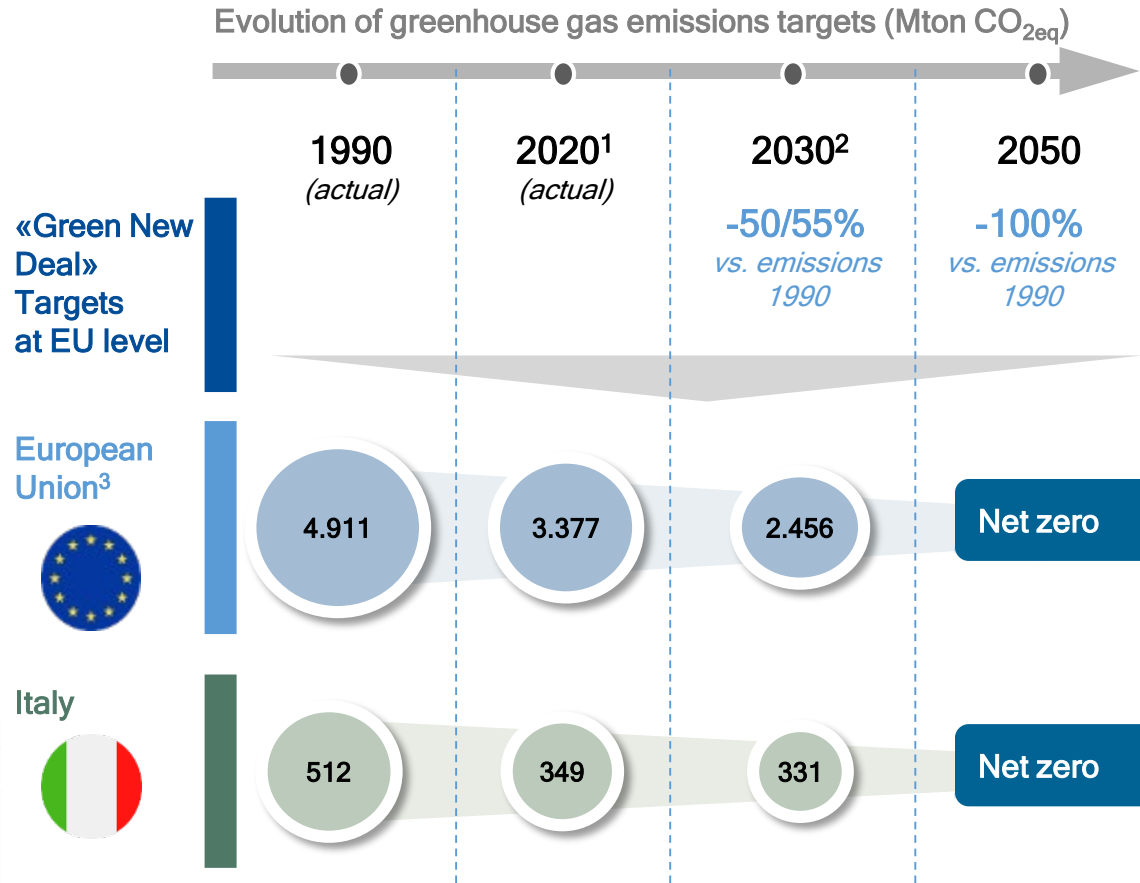
Greenture

Sustainable mobility: role and challenges of
the European automotive sector

July 2023

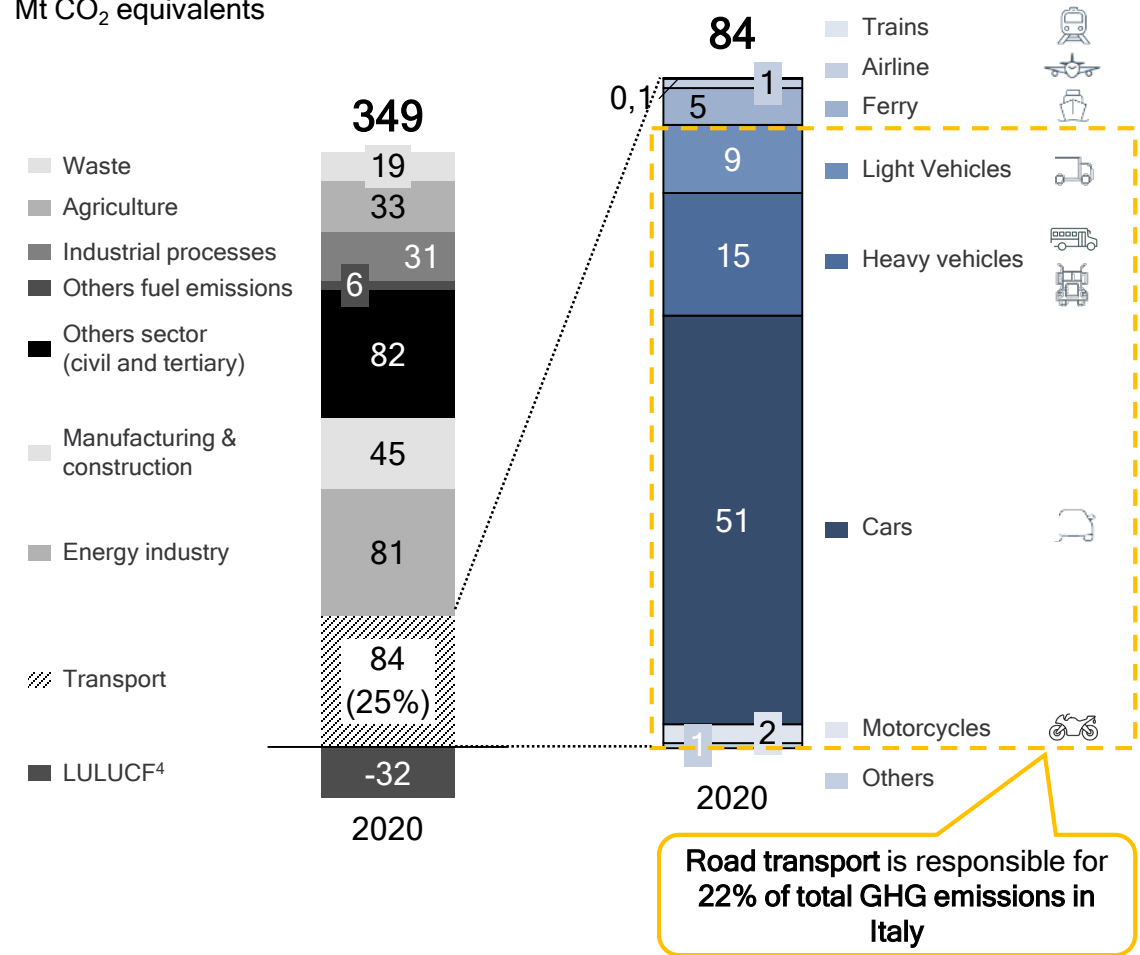
Road transport, responsible for 22% of GHG emissions in Italy, is a key sector to be decarbonised in order to meet EU targets

Main EU and PNIEC targets by 2030 with a projection to 2050



GHG emissions per industry (Italy, 2020) - Focus Transport

Mt CO₂ equivalents

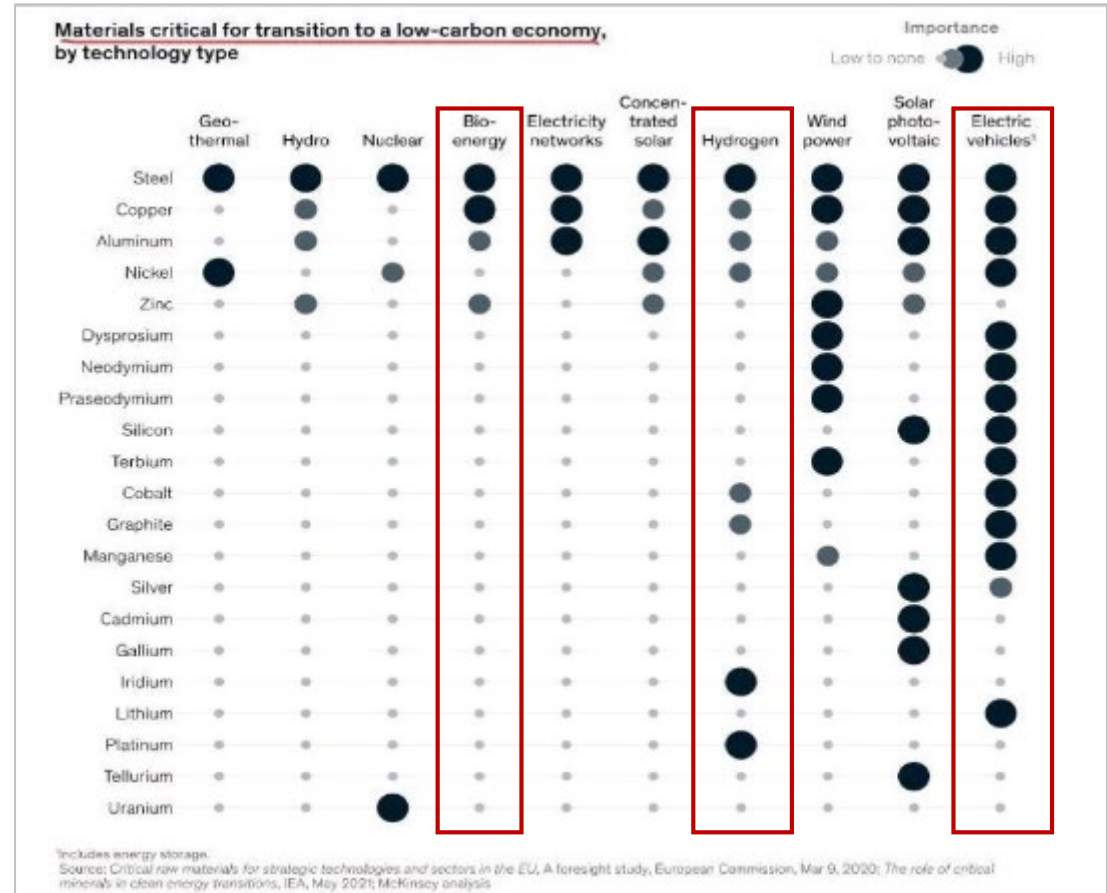
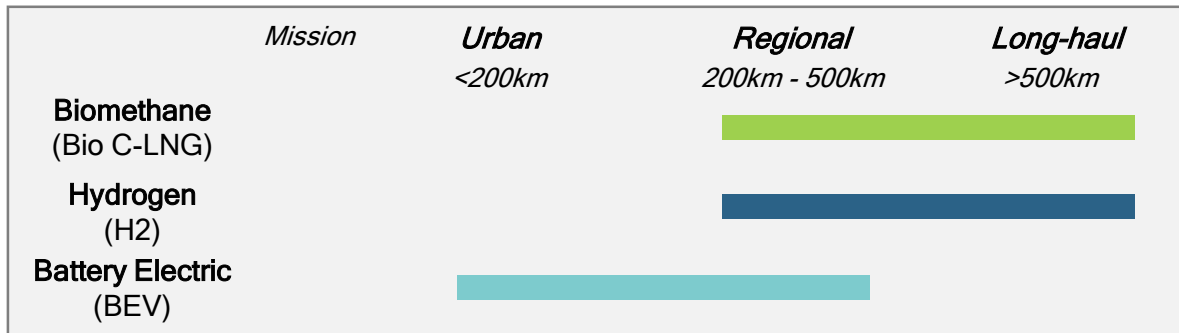


The adoption of a technology-neutral approach is key to ensure system efficiency and diversification

Different mission profiles require for different technologies...

...that allow to diversify sources reducing the dependency on specific raw materials

The example of Heavy Transport shows how different mission profiles can result in the need to rely on different technologies



The main factors limiting the deployment of **Battery electric** in heavy transport are:



reduced range related to battery capacity, cost and size



need for high-power recharging points and an adequate energy infrastructure

Biomethane and hydrogen, on the other hand, are suitable for **long distances** because they can store large amounts of energy

Natural gas and biomethane (BioCng and BioLng) are an immediate and sustainable solution to support the decarbonisation of transport



«Green» alternative

Fossil and renewable methane (biomethane), in their compressed and liquefied forms, are fuels that allow for an immediate reduction in emissions



Cost-effectiveness

Methane is economically sustainable, following the price shock of 2021-2022, wholesale prices have already returned to historical values. The “total cost of ownerships” of vehicles are more competitive than for conventional fuels



Extensive infrastructure

In Italy there are >1.400 CNG stations and >140 LNG stations with homogeneous distribution over the territory



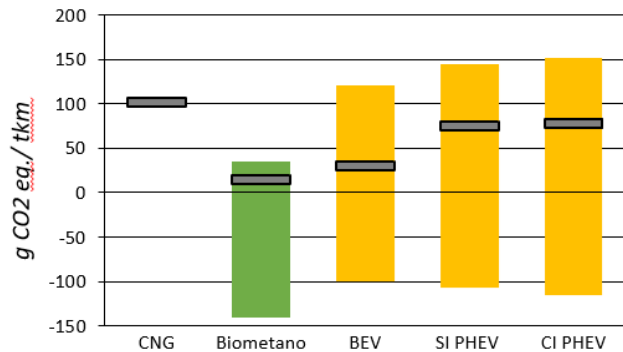
Vehicle availability

Wide availability of vehicles: +1million of C-LNG vehicles on Italian roads with the heavy vehicle fleet growing strongly (IVECO, Scania and Volvo among the main players commercializing such vehicles)



Emissions from biomethane, computed through well-to-wheel approach, can be significantly lower than those of electric vehicles

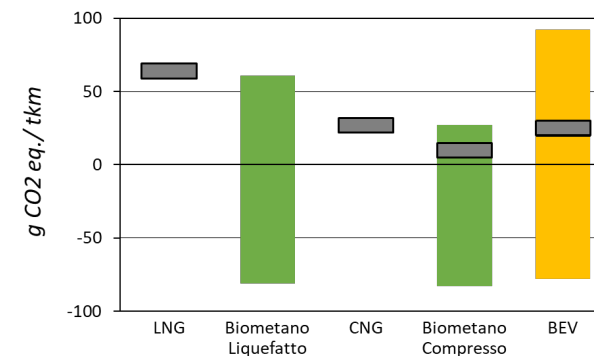
Emission comparison with Well-to-Wheel approach for light vehicles with different fuels



CNG= Compressed Natural Gas
BEV= Battery Electric Vehicle
CI PHEV= Compression Ignition Plug in Hybrid Electric Vehicle
SI PHEV= Spark Ignition Plug in Hybrid Electric Vehicle

- █ = Emission range according to the feedstock used to produce the biomethane (min. biomethane from livestock manure and max. biomethane from maize)
- █ = Emission range according to the energy source used to produce the electricity (min. electricity from small agricultural CHP-plants and max. electricity from coal-fired power plants)
- █ = Emission level for vehicles fuelled by CNG, compressed biomethane from FORSU and electric vehicles fuelled by grid electricity (EU electricity mix)

Emission comparison with Well-to-Wheel approach for heavy-duty vehicles^[1] with different fuels



LNG = Liquefied Natural Gas
CNG= Compressed Natural Gas
BEV= Battery Electric Vehicle

- █ = Emission range according to the feedstock used to produce the biomethane (min. biomethane from livestock manure and max. biomethane from maize)
- █ = Emission range according to the energy source used to produce the electricity (min. electricity from small agricultural CHP-plants and max. electricity from coal-fired power plants)
- █ = Emission level for vehicles fuelled by LNG, CNG, compressed biomethane from FORSU and electric vehicles fuelled by grid electricity (EU electricity mix)


- WtW emissions of methane vehicles (i.e. CNG) are equal to 100 gCO₂e/t*km, value that in some cases can be lower than BEV/PHEV
- Biomethane vehicles are even more effective:
 - depending on the used feedstock, emissions can reach negative values
 - biomethane produced from municipal waste can reduce the emissions more than BEV fuelled with EU electricity mix

- WtW emissions of LNG vehicles are equal to 60 gCO₂e/t*km, value that can be even lower than BEV
- Biomethane vehicles are even more effective:
 - depending on the used feedstock, emissions can reach negative values
 - biomethane produced from municipal waste can reduce the emissions more than BEV fuelled with EU electricity mix

The proposed update of PNIEC raises ambition on biomethane, that could represent ~25% RES contribution to transport decarbonization by 2030

The most cautious scenarios predict in Italy
~3 bcm of biomethane by 2030...

...of which about 1.5 bcm are for road transport according to the targets defined by the PNIEC 2023



Descr. Scenari Snam-Terna

5,4 bcm


From the FF55 scenario to 2030 (i.e. aligned with the EU Fit-for-55 targets) developed by Snam-Terna, the biomethane supply will amount to 5.4 bcm (of which approximately 1.5 bcm for transport)



CIB
Consorzio Italiano Biogas

8 bcm

The CIB - Consorzio Italiano Biogas - estimates a biomethane production of 8 bcm by 2030, based on high recovery of unused agricultural land

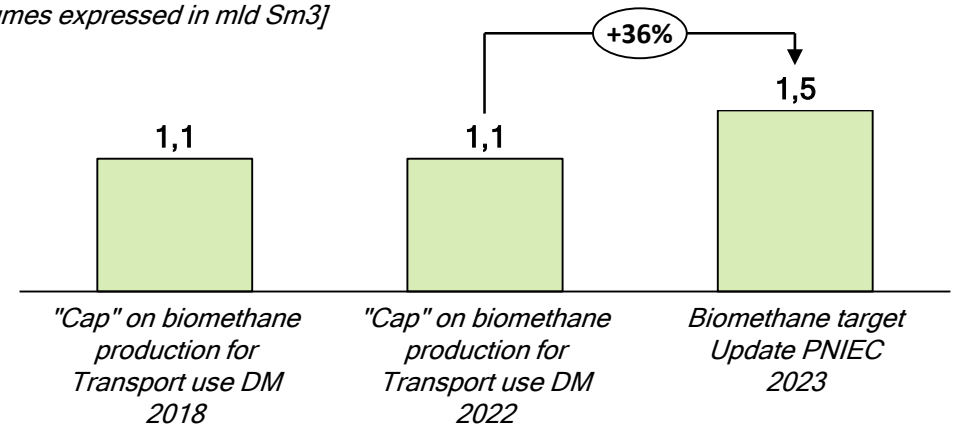


CMA
Consorzio Monviso Agroenergia

3,2 bcm

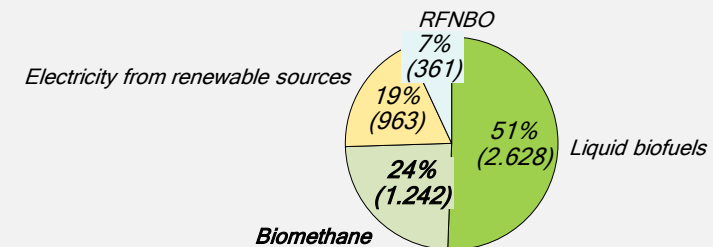
The CMA - Consorzio Monviso Agroenergia - estimates a biomethane production of ~3 bcm by 2030, with 'intermediate crops' accounting for a majority share (55%+) of the source matrices

[Volumes expressed in mld Sm³]



The proposed update of "Piano Nazionale Integrato Energia e Clima" (PNIEC), sent in June by the MASE to the European Commission, sets a target of ~1,5Mld M³ biomethane for transport use, higher than ~1,1Mld M³ envisaged as upper limit of biomethane dedicated to transport by "Decreti Biometano" 2018/2022

PNIEC 2023 - «Contribution of RES in the transport sector expected by 2030, according to the calculation criteria defined in the RED III Directive (ktoe)



The development of H2 mobility also continues, with benefits especially for medium-heavy vehicles and specific mission profiles for light vehicles

Growing availability of vehicles across different segments



- ❑ **+21,000 Toyota Mirai** sold worldwide with no evidence of safety issues



- ❑ **300+ hydrogen buses** operating in urban local public transport in the centres of several EU cities



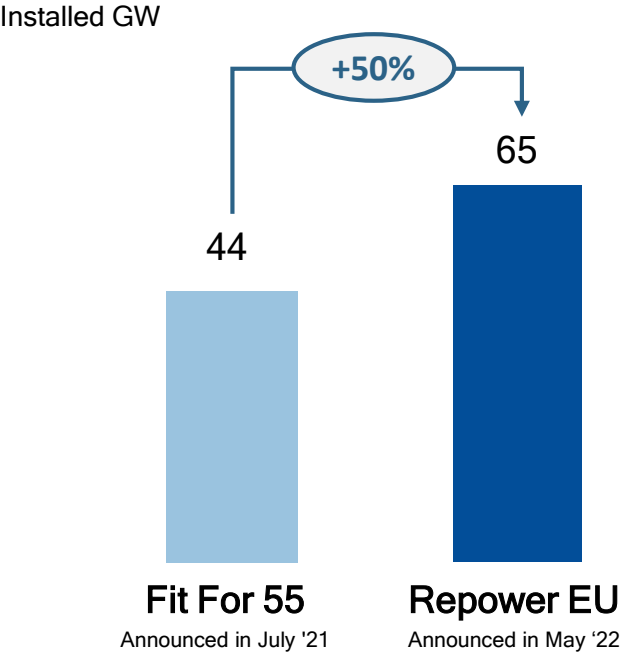
- ❑ **+5 million kilometres** travelled by Hyundai Xcient Fuel Cell Trucks on Swiss roads

150+ operative H2 refuelling stations in EU, of which 90+ in Germany



Note: Bolzano the only successful case in Italy

Strong increase of green H2 production targets to '30 in EU



H2 benefits in mobility

Zero emissions
pollutants and climate altering exhaust gases*

Long range
Over 100km/kg for passenger cars and over 12km/kg for buses and trucks

Fast refuelling
3-15 min for refuelling, comparable to diesel/petrol

Known customer experience
Infrastructure similar and integrable to the existing diesel/petrol/methane network

* when using internal combustion engines, emissions are in any case extremely limited