



GECF Expert Commentary

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road transport and its role
for a decarbonised mobility
agenda in Europe*

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The use of natural gas in road transport represents one of the most effective solutions to curb climate change and improve air quality. Being a readily available alternative to diesel and petrol-based engines, natural gas vehicles (NGV) both compressed natural gas (CNG) and liquefied natural gas (LNG) technologies offer an immediate reduction of emissions as well as pollutants in all the sub-segments – from passenger to heavy-good vehicles (HGV).

In this context, the Gas Exporting Countries Forum (GECF) has identified natural gas for road transport as one of the major options having a potential to achieve progress with the environmental and sustainable development agendas. The Malabo Declaration headlined «Natural Gas: Energy for Sustainable Development» emphasizes specifically GECF Member Countries determination to promote cooperation towards increased use of natural gas as an environmentally friendly fuel in this sector. The GECF Secretariat strives to favour this opportunity in the framework of the Environmental Knowledge and Solutions (EKS) initiative that has been established as a way to support the Paris Agreement process and the attainment of UN Sustainable Development Goals, in particular Goal 7.

The GECF EKS initiative aims to create a supportive platform allowing Member Countries to share best practices dealing with the environmental challenges, building capabilities and establishing progressive research collaborations between the GECF and different actors and organizations on various environment-related topics. The initiative gives a special attention to natural gas for road transport by targeting this matter in the studies and research activities as well as supporting cooperation with key stakeholders on the sustainable mobility.

Environmental and economic advantages of NGVs

It is estimated that NGVs emit up to 95% fewer particulate matters (PM) and up to 70% less nitrogen oxides (NO_x) than diesel and petrol counterparts, making vehicles running on natural gas much more competitive even in the framework of the strictest Euro VI fuel standard. Various studies show a clear reduction of greenhouse gas (GHG) emissions when using gas for mobility.¹ Benefits amount to 15-30% compared to diesel and petrol engines, taking a “well-to-wheel” (WTW) approach. This reduction could be as high as 95% or even close-to-zero and negative emission balance if pure biomethane is used. Thus, blending natural gas with just a small amount of biomethane will increase environmental performance significantly.

For the economic advantages, natural gas remains affordable: with respect to diesel and petrol, gas retail prices are substantially lower in the majority of markets across the world (on average, the difference is around 33% below diesel prices), as most countries impose lower rates of duty on CNG/LNG than on oil-based fuels. The shorter technological supply chain of natural gas from the wellhead to the vehicle tank also explains the discount.

¹ For example: European Commission's Joint Research Centre, Eucar and Concawe (2014) – «Well-to wheels analysis of future automotive fuels and powertrains in the European context»; Spiers, J., Balcombe, P., Blomerus, P., and Stettler, M. (2019) – «Can natural gas reduce emissions from transport? Heavy goods vehicles and shipping»; Thinkstep (2017) – «Greenhouse gas intensity of natural gas»; etc.

It is important to note, that major vehicle makers are entering mass production of NGVs. For example, there are over 68 original NGV models available in Europe. Passenger cars are similar in price to equivalent diesel versions, while buses and heavier CNG/LNG vehicles with higher purchase prices. However, both CNG and LNG powertrains offer short payback periods (as low as two to five years) thanks to savings in fuel expenses and the total cost of ownership – a crucial economic case for truck operators. Moreover, NGVs are characterized by a high level of safety and reliability in use that enhances public trust in this technology.

Overview of the global prospects of natural gas usage as a fuel for vehicles

Nowadays NGV markets are developing in several dozens of countries, including China, Iran, India, Argentina, Brazil, Thailand, Pakistan, Bangladesh, Italy, Germany, Russia, South Korea, and the US. Over the past two decades, natural gas demand in this sector surged from 4 bcm in 2000 to over 60 bcm in 2019 (driven by the consumption in China, India, Pakistan, Iran, Argentina and Brazil), while the total NGV fleet exceeded 28 million. However, despite the impressive increase, natural gas represents less than 2.5% of the total energy consumed in the global road transport market, entirely dominated by oil-based products.

With the growing concern for accelerating the transition to low-carbon transport systems, the role of methane is expected to enhance, implying expanded interest in this fuel to meet policy priorities. According to the GECF Global Gas Outlook 2050, we assume a robust growth in gas demand in road transport to about 272 bcm by 2050 as many countries are adjusting legislation to reduce the environmental impact of transportation modes and setting targets to mitigate air pollution. Simultaneously, favourable government policy measures will be the driving force encouraging higher uptake of NGVs.

It is worth mentioning that a range of countries (for instance, India, China, France, Germany, the Netherlands, the UK, and Norway) in 2017-2019 announced forward-looking sales bans on new diesel or petrol vehicles for 2025-2040, which implicitly support gas mobility. Besides, anticipated restrictions on diesel truck movements in a range of markets/large cities open significant prospects for CNG and LNG powertrains in HGV sub-segment, where electrical technologies, despite their rapid penetration into all vehicle classes, cannot fit the specifics in the best way because of the high cost of batteries and their size, limiting effective payloads. In this context, the majority of gas demand is expected to come from LNG-powered trucks thanks to a high annual mileage.

Thus, the additional potential of global NGV market in 2050 is estimated for over 212 bcm. More than 45% of gas increments will originate in Asia Pacific. Particularly, China and India with the policy focus on air quality improvement will demonstrate an increase of about 75 bcm over the outlook horizon. As a result, Asia Pacific will represent the most promising market, accounting for almost 50% (about 135 bcm) of future total gas demand in road transport.

The European region is projected to come in second at about 15% (over 41 bcm) by 2050, where the key driver is decarbonisation. Although Europe is currently an example of a lesser developed market for NGV (gas demand at present makes up around 3 bcm), this alternative fuel is set to play an important role. Natural gas technologies will be the crucial enabler for ensuring a pathway towards low- and zero-emission mobility, while provide a bridge to a circular economy model – one of the main blocks of announced European Green Deal to make Europe the first climate-neutral continent by 2050.

Natural gas expansion in road transport in Europe: main barriers and policy supporting measures

The proposal for the first European Climate Law, released in March 2020, set a legislative framework for achieving the carbon neutrality objective. This document emphasizes that current policies will reduce GHG emissions in the region by only 60% by 2050 leading to the need for additional actions and each sector will have to contribute. Particularly, decarbonising road transport is a core theme of the EU strategy, as this sector represents almost a quarter of total Europe's emissions of carbon dioxide (CO₂), the main greenhouse gas.

The current debate is strongly focused on the deployment of electrical vehicles (EV) as a way to decarbonise the road transport sector. However, electrical technologies alone cannot meet climate goal despite they are listed with zero tailpipe emissions. On the one hand, a significant portion of electricity in some European countries is coming from dirtier generation process, where the EV policy push could potentially increase the carbon footprint. For instance, in Poland coal-fired power plants make up around 79% of the generation mix, in Germany – 38%, in Greece – 32%, in Portugal – 17%, in Italy – 10% etc. At the same time, massive investments in power grids will be needed to handle extra loads for recharging.

On the other hand, from the standpoint of the life-cycle emission assessment, the advantages of EV over NGV are not so obvious, as it considers GHG emissions at much bigger dimension including the energy intensity of the vehicle manufacturing process, dismantling and batteries' recycling (particularly important due to the scarcity of materials like lithium, cobalt and nickel). Thus, when setting policy actions to go to lower emissions trajectories, a mix of solutions on the deployment of sustainable alternative transport fuels will be required.

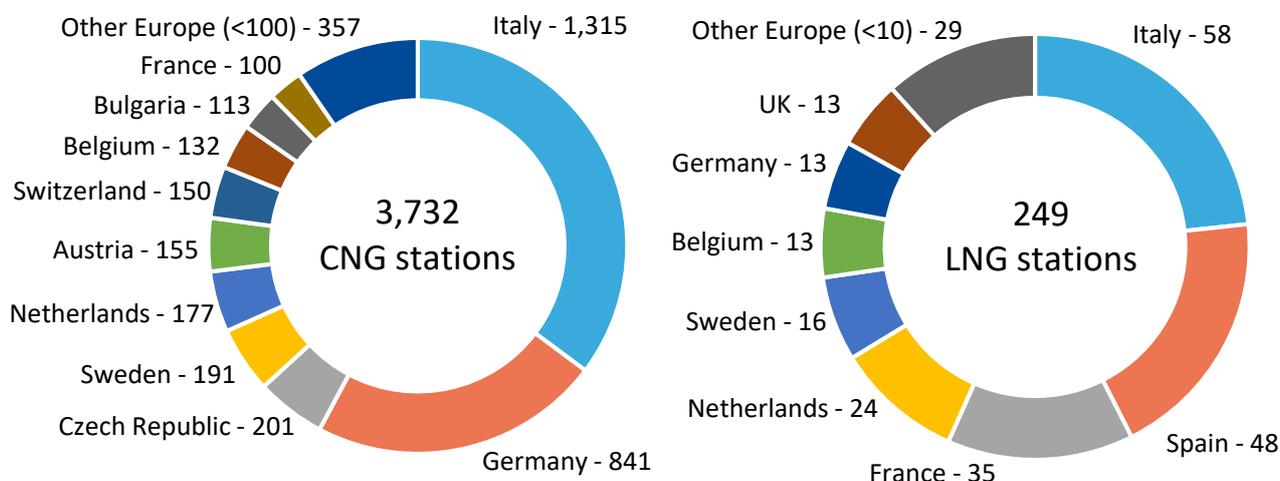
At present, the total vehicle fleet of NGVs in Europe is around 1.4 million. Italy represents the most developed NGV market, accounting for 76% of methane-driven fleet with over 1.3 bcm of demand in 2019. Italian government opted to promote CNG vehicles in the early 2000's as an alternative for both fuel security and environmental reasons. According to the European Alternative Fuel Observatory, the number of cars has been steadily growing from 612,000 units in 2009 to 972,199 units in 2019 (90% of all NGVs in the country), although their market share in new registrations fluctuated between 1.7% and 5.5% over the mentioned period.

Italy possesses the highest quantity of CNG and LNG refuelling stations (1,315 CNG and 58 LNG stations) in Europe and national company SNAM has been investing significantly to strengthen the network for both cars and trucks. Government elaborated a set of initiatives stimulating conversions of existing vehicles to run on natural gas. There was also R&D programmes to promote innovations in gas-powered engines, refuelling and storage systems. Purchase price subsidies, tax rebates for new sales as well as exemption from road taxes, parking fees, and congestion charges are widely used. In addition, much lower fuel duties on CNG continues to maintain interest in NGVs (CNG price is about 0.7 €/diesel equivalent litre – less than half of the diesel price), that is reflected in new registrations (38,593 units in 2019 vs 37,408 units in 2018 of CNG passenger cars). Sales of CNG and LNG-powered trucks also showed positive trend (1,416 units in 2019 vs 992 units in 2018).

The case of Italy demonstrates how NGV market with appropriate incentives can evolve, however this example is out of the common. At present the main barrier hampered the uptake of NGVs in Europe is the availability of gas refuelling infrastructure. This obstacle resides not only in the number of stations, but also in their locations: CNG/LNG refuelling network does

not cover key highways in many countries, accordingly a non-optimal allocation can affect the potential of the future natural gas demand.

Figure 1. Number of CNG and LNG refuelling stations in selected European countries



Source: Natural Gas Vehicle Europe (as of December 2019)

For comparison, the number of normal and fast public charging points for EVs in Europe increased by 219% since 2015, from 67,064 to 213,892 in 2019, while the network of CNG stations raised less than 20% within the same period. It is important to note, that a set of measures applied for the expansion of gas refuelling stations (direct involvement of government investments, part-funded programmes, easing the bureaucracy procedures associated with project approval, special tax deductions, technical standard adjustments etc.) are now implementing to accelerate the development of the charging infrastructure. Undoubtedly, the progress in the rump-up of refuelling points cannot be equally comparable, as the level of investment to construct CNG station vs fast charger is more than 10 times higher. Nevertheless, it shows the overall tendency as public charging points are becoming more accessible.

Moreover, many European countries are conducting a strong EV and plug-in hybrid cars policy with CNG cars receiving less support or even considered a secondary niche priority. For example, Germany provides subsidies for the purchase of electric cars in the amount of 4,000 to 6,000 euros (the directive will expire on 31 December 2025), resulted in the steep increase of new EVs' sales up to 60,511 cars in 2019 (compared to new registrations of 7,628 CNG vehicles). In the UK, buyers can receive 25% of the cost of EV or 20% for electric light-commercial vehicle (LCV). Spain has introduced subsidies of 5,500 euros for the purchase of EV, when a combustion engine car of at least ten years old is decommissioned.

Despite NGVs in Europe are also ensured with broad examples of government measures (e.g. subsidies and tax benefits, low fuel duties, exemptions from congestion charges and parking fees, toll road exemptions and other local initiatives), policy orientation to support EVs in passenger and LCV sub-segments will represent a substantial challenge accompanied by the necessity to strengthen the gas refuelling infrastructure.

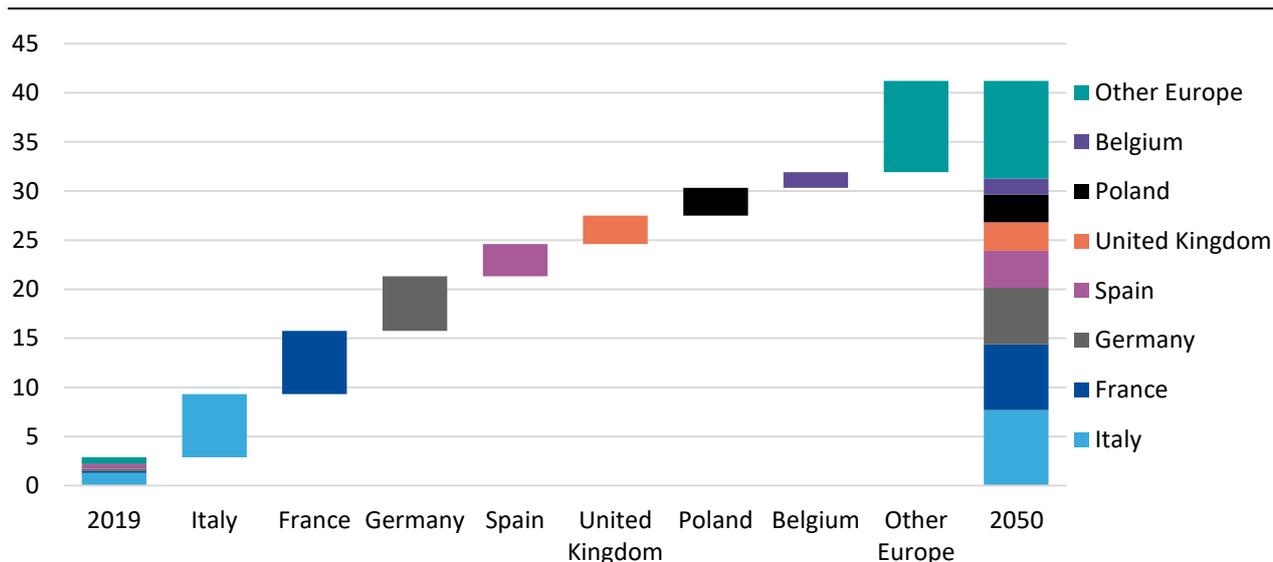
Although there is a disparity between countries in terms of promoting NGVs compared to other clean alternatives such as EVs, the need for the expansion of CNG and LNG infrastructure was recognized in 2014. The Alternative Fuels Infrastructure Directive requires

member states to provide refuelling points on the main corridors of the Trans-European Network for Transport (Ten-T), suggesting CNG stations to be built every 150 km and LNG stations every 400 km by 2025. Requisite infrastructure is projected to increase also driven by investments of proactive gas companies. Thus, we assume, that the lack of refuelling stations, particularly LNG, could be a barrier holding back the NGV uptake, but it should be considered in a short- to mid-term period.

At the same time, natural gas technologies are favoured in HGV-segment and we expect that both CNG- and LNG-fuelled trucks will gain momentum in the region. The implementation of the Blue Corridors project demonstrated that LNG could be a viable option in the future transition to clean mobility. This trend is also evident as a number of haulage, transport and logistics companies have started to shift their fleet to natural gas. For instance, the Jost Group (Belgium) is planning to acquire around 500 LNG-fuelled trucks and to achieve 35% of its fleet running on LNG. In October 2019, XPO Logistics (France) purchased 100 IVECO Stralis NP Euro VI trucks and expanded its gas-powered fleet to 170 vehicles. In February 2020, Ocado, a UK food distributor, ordered 30 gas-powered trucks, doubling the number of their HGV fleet running on gas (the UK government has also contributed to the attractiveness by freezing the duty difference between gas and diesel until 2032, which represents a huge initiative to operators).

According to the new CO₂ emission standards, introduced by the EU in 2019, emissions from passenger cars are to be reduced by 37.5% in 2030 (relative to a 2021 baseline), for LCVs – a 31% target was agreed upon. New target for HGVs and buses is also ambitious with 30% abatement by 2030. These performance standards represent a substantial policy push for the deployment of clean transport vehicles including NGVs. In addition to the Euro VI, these measures, implemented in the framework of the European clean air policy, are expected to reveal a higher potential of CNG or LNG-fuelled vehicles, particularly in light of bans on diesel utilisation in major European cities.

Figure 2. Natural gas demand trends in road transport in Europe² (bcm)



Source: GECF Secretariat based on data from the GECF GGM

² Europe (according to the GECF regional groupings): the European Union and Albania, Bosnia and Herzegovina, Iceland, Montenegro, Norway, Serbia, Switzerland, the Former Yugoslav Republic of Macedonia, the Republic of Moldova, Turkey, and the UK.

With the combination of government support and affordability of natural gas technologies, the European region will observe gas demand growth in road transport to over 41 bcm by 2050, compared to around 3 bcm in 2019. The majority of this rise is projected to come from Italy, France, Germany, Spain, the UK, Poland and Belgium. The forecast envisages a partial switch from LPG to CNG as well as from petrol and diesel for passenger cars, however future growth will be mostly concentrated in HGV sub-segment driven by the long-haul operations of increasing fleet of LNG-fuelled trucks. It is important to mention, that promising options to use biomethane (biogas which is upgraded to vehicle fuel quality) in road transport are assumed to provide additional opportunity for natural gas expansion as a blend and to be instrumental in a more significant reduction of emissions.

To summarise, LNG and CNG can make a huge contribution towards decarbonisation that is fully in line with the European Green Deal and environmental commitments of countries on the continent. NGV technologies are affordable, safe and well-developed, ecological advantages are meaningful, and the economics is attractive in many cases. As the number of CNG and LNG stations grows, by maintaining a technological neutrality and a level-playing field between different alternative fuels, natural gas will play an important role in road transport in Europe.

In its turn, the GECF Secretariat is keen to promote sustainability benefits and cooperation towards increased use of natural gas in this sector. This work is also a part of the ongoing efforts at assessing the options that improve the environmental footprint of natural gas and support the significance of this fuel in mitigating carbon emissions.