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Accelerating the decarbonisation of road transport through the faster update of alternative fuels

IRU POSITION

- Alternative fuels will play a key role in the decarbonisation of commercial road transport and their uptake must be accelerated by governments via incentives for operators (e.g. lower taxes) and refuelling infrastructure development.
- Laws and policies must be based on the well-to-wheel principle that accounts for the energy source as well as its use in terms of CO_2 emissions. The right mix of incentives and investment to accelerate alternative fuels can only be achieved if CO_2 emissions are measured correctly in this way.
- All fuel alternatives to diesel (including biofuels, e-fuels, electricity, CNG, LNG and hydrogen) are needed over the coming decades; their application depends on the wide range of use cases of transport operators around the world; no single "silver bullet" solution exists.
- Governments and policy makers need to recognise the fundamental practical and physical constraints of alternatively fuelled vehicles that may prevent their operational use for certain types of transport, or lead to large infrastructure investment costs that are not in proportion with their use case profile.
- Transport operators will determine the best alternative fuel choice for the services they provide based on vehicle and fuel availability and related investment and operational costs. They need a clear long term commitment from regulators and not biased decisions in favour of one technological pathway in order to be able to drive decarbonisation of the commercial vehicle sector.
- Governments must support the financing and deployment of refuelling infrastructure, at scale, to enable transport operators to adopt alternative fuels rapidly. Infrastructure availability and standards must be harmonised between governments to allow cross-border operations.
- Governments need to incentivise low carbon alternative fuels with a coordinated approach to CO_2 pricing and lower taxes to accelerate operator investment. The overall financial impact to the transport operator must not increase, but lead to investments in greener fuels and fleets.
- Governments and regulators need to plan for the transition to alternative fuels over the medium term (2030-2040) and embrace bridge options such as natural gas, which is a mature technology, widely available, economically viable, producing lower CO_2 emissions than diesel and will serve as a pathway to hydrogen.
- All alternative fuel options must ultimately be based on renewable energy sources. Electricity based fuels (including hydrogen and e-fuels) will play a strong role in the longer term, while battery electric vehicles are best placed to be used in cities and for shorter distances.
- Innovation and investment in alternative fuels for commercial road transport is one of the most impactful and rapid ways to reduce CO_2 emissions in the transport sector, due to the high modal share, globally, of commercial goods and passenger transport by road.

ANALYSIS

The road transport industry is committed to meet its responsibility in reducing its carbon footprint. IRU and its members on five continents have a clear vision for decarbonising commercial road transport up to 2050[1]. This vision is based on five pillars, one of which is the wider use of alternative fuels.

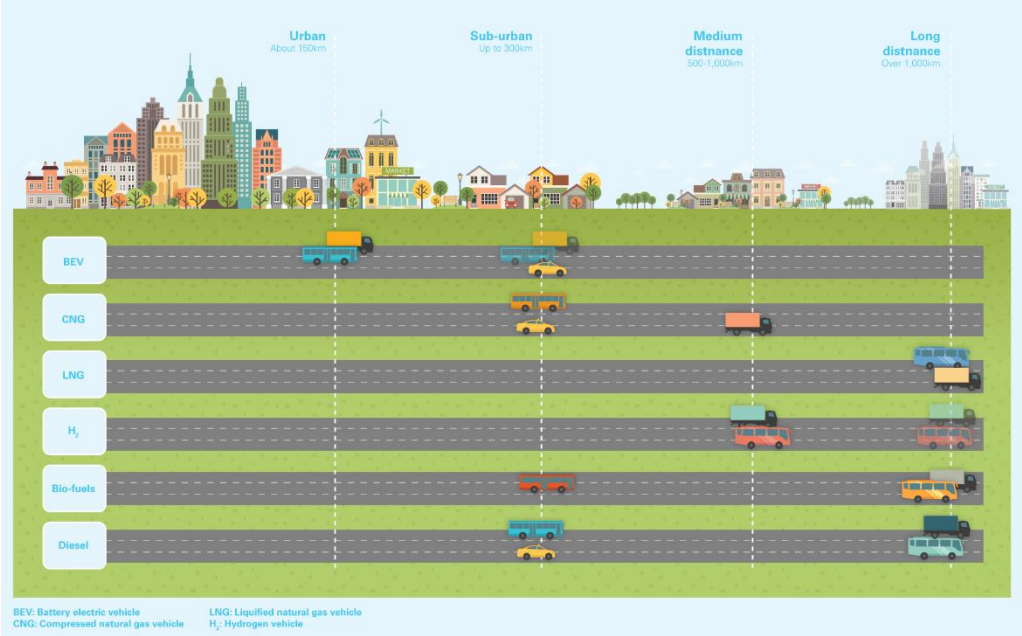

Fig. 1 – Available alternative fuels and vehicle technologies and their use cases (passenger and goods transport). Source IRU (2020).

In order to define the role of alternative fuels and alternatively fuelled vehicles, it is essential to understand the different use cases for commercial vehicles and the technology constraints and broader context of each solution.

The road transport industry distinguishes between urban, sub-urban/intercity, medium and long distance. Not every solution can meet operators' needs due to the higher or lower energy content and density of each fuel, which translate into shorter or longer ranges of each technology (e.g. battery electric vehicles are not a viable option for longer distances).

Diesel fuel has powered buses, coaches and trucks for over a century. In terms of the main available alternatives, there are liquid fuels (including biofuels, electricity based fuels/e-fuels), gaseous fuels (including CNG, LNG, hydrogen, e-fuels) or electricity (which would normally be stored in batteries).

The application of each of these fuel alternatives also depends on their scalability, availability and energy grid infrastructure by region, to be able to distribute different energy carriers to the point of use (refuelling station).

In some parts of the world natural gas (CNG) is far more widely used than diesel due to the proximity of natural gas reserves, for example in Iran. Biodiesel has been widely deployed in countries like Brazil as its use depends on the availability of feedstock to produce biofuel.

Fuel costs represent at least one third of the total cost of ownership for the operator, hence the fuel price is the main argument for transport operators when it comes to the adoption of lower carbon and alternative fuels.

While some alternative fuels like natural gas (CNG, LNG) are on average 30-40% cheaper than diesel, biodiesel can cost twice as much as diesel, and e-fuels three

[1] IRU vision for decarbonisation up to 2050

times as much or even more. Electricity prices are very volatile globally and depend heavily on how the electricity is being produced in terms of its cost.[2]

However, all energy carriers and fuels have one challenge in common: they ultimately have to reduce CO_2, which is why it is important to consider the entire chain from production (well-to-tank) to use (tank-to-wheel) to determine how effectively alternative fuels can lower CO_2 emissions from commercial vehicles.

Measuring CO_2 emissions only at the tailpipe does not take into account CO_2 emitted at the source of the vehicle's energy. It therefore produces a distorted picture of actual and potential decarbonisation, especially in cases where there are high CO_2 levels at the source of the energy, such as coal fired electricity, used by electric vehicles that emit zero emissions at the tailpipe, but in reality may lead to an increase of CO_2 emissions versus diesel. See Fig. 2.

Without proper measurement of CO_2 emissions in transport, investments and incentives to accelerate alternative fuels and their use will be distorted over time. Although improved vehicle efficiency remains an important contributor to decarbonisation, governments must use a more comprehensive well-to-wheel approach as a legal and operational basis for calculating CO_2 emissions from transport, and therefore in designing policies and deciding on public investments to meet decarbonisation objectives.

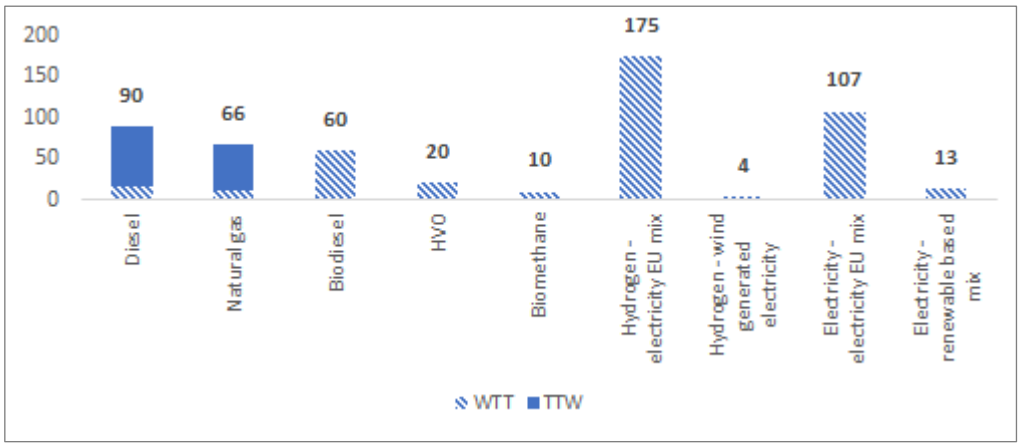

Fig. 2 – Well-to-wheel emission factors (kg CO_2/GJ) per fuel type Source: ADEME, GLEC framework, State of the Art on Alternative Fuels Transport Systems in the European Union, Joint Research Centre 2020

The transition to alternative fuel solutions will not happen overnight, so increasing the decarbonisation potential of current powertrain concepts based on low carbon fuels used in internal combustion engines will continue to play an important role towards 2050, as the changeover from the existing fleet composition to new powertrains, including electrification or hydrogen in particular, will take time. Moreover, the development of new vehicle fleets, covering both new and second-hand vehicles, poses an immense financial challenge.

The use of lower carbon fuels in existing engine technology, including diesel or natural gas engines, will remain particularly important as the majority of CO_2 emissions from commercial vehicles are generated in long-haul transport (75%), and new powertrain concepts are not existing or will take more time to be brought to scale, such as hydrogen (Fig. 3).[3]

Low-carbon fuels have a strategic role to play in the transition to a climate-neutral economy by 2050. Low-carbon fuels are sustainable fuels from non-fossil origin with no or very limited CO_2 impact from production to use. Blended with conventional fuels, low-carbon fuels should progressively replace fossil-based fuels. In addition, low-

[2] https://www.iea.org/reports/energy-prices-2020
[3] ITF, 2018

carbon fuels can be supplied using the existing infrastructure and will facilitate emission reduction for vehicles already on the road.

To illustrate the challenge approximately 444,000 heavy commercial vehicles (over 3.5t) were purchased by European road transport operators in 2019.[4] One of the alternative options for operators for some use cases is battery electric vehicles. However, this option is, on average, €200,000 more expensive than a standard EURO VI vehicle. Assuming all vehicles sold annually were battery electric vehicles, it would cost the sector €89 billion over a one year period. Over seven years (the average age of a commercial vehicle when it is replaced) this would represent an investment need of €623 billion.[5] At the same time, Fuels Europe found that zero carbon liquid fuels could be deployed by 2050 for a total investment of in the range of €400-€650 Billion.[6]

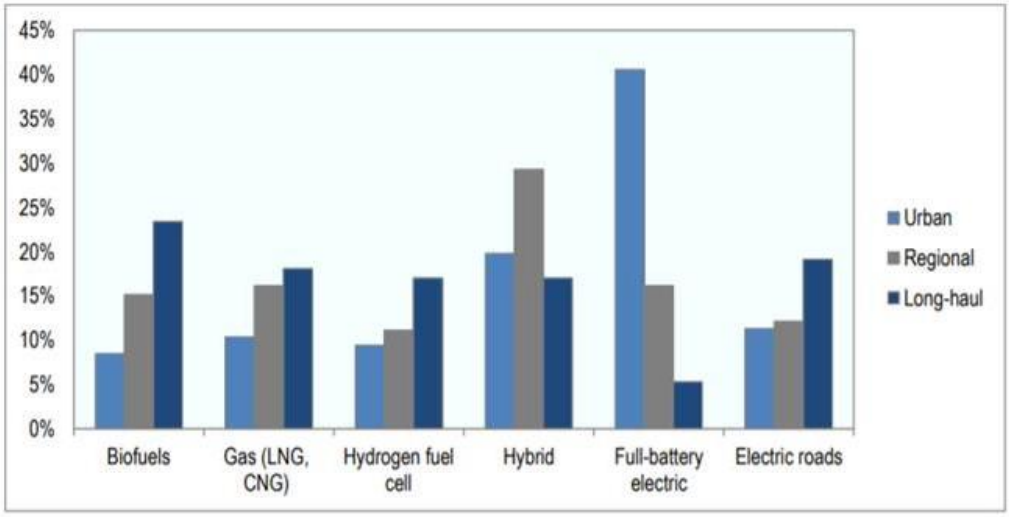

Fig. 3 – The most cost-effective alternative fuels for each operation type. Source: ITF expert opinion survey (2018).

All fuel options must be ultimately based on renewable sources to achieve the decarbonisation of the commercial road transport sector.

Policy decisions by regulators need to be based on data and robust analysis in a regional context.

Given the different geographic, economic and infrastructure development differences across the world, a set of decarbonising solutions is more suitable than one unique solution. Ultimately, full decarbonisation of commercial passenger and goods transport by road requires a set of options that can be scaled up to a regional level.

Any alternative fuel needs to be feasible for transport operators to invest in. Additionally, vehicles and refuelling infrastructure need to be available, economic and operationally practical, and based on a solid business investment case for operators and the needs of their clients.

Alternative fuels are heavily impacted by a lack of supply and refuelling infrastructure. The slow availability of new vehicles is also a problem.

Overall there is still a great degree of uncertainty regarding the widespread use of alternative fuels at a global scale. Exact pathways and alternatives will vary for different regions.

[4] ACEA, 2019
[5] IRU calculations
[6] https://www.fuelseurope.eu/wp-content/uploads/FuelsEurope-Press-Release-Clean-Fuels-for-All-Final.pdf

Type of fuel and propulsion systems	Type of barriers by level of importance			
	Technological	Costs (vehicle purchase, maintenance and fuel)	Refuelling infrastructure	Fuel supply
Bio-LNG	Low (mature technology)	Low (higher vehicle acquisition costs)	Medium (not yet fully developed)	Low (natural gas supply available)
HVO	Low (mature technology)	Medium (maintenance and vehicle costs)	Low (use of existing infrastructure)	High (very limited resources)
Diesel-hybrid	Low (mature technology)	High (vehicle acquisition and maintenance costs)	n/a (based on diesel fuel distribution	Medium (accessibility to fast charging infrastructure)

Fig. 4 – Comparison of feasible alternative fuels and propulsion systems and related barriers to their adoption (IRU study, Coach of the Future, 2019).

	Infrastructure costs	Vehicle costs	Fuel costs	Pollutant emissions	CO_2 WTW
Bio-LNG*	High	Medium	Saving	-50% NOx -90% PM	-30%
HVO**	n/a	n/a	Higher	-0/1% NOx and PM	-15%
Diesel-hybrid***	n/a	High	Saving	-15% NOx -70% PM	-10%

* 80% natural gas; 20% biomethane
** 70% diesel; 30% synthetic biofuel
*** 90% diesel (motorway); 10% electric (urban)

Fig. 5 – Investment costs for feasible alternative fuels and propulsion systems versus emission benefits (IRU study, Coach of the Future, 2019).

Governments need to invest in infrastructure to ensure it is scaled up to the required capacity and availability at a national or regional level. This is particularly true for the significant investments that will need to be mobilised to deploy alternative fuel infrastructure – including production, distribution and recharging/refuelling.

Government incentives to promote fleet renewal will lead to more fuel-efficient vehicles on the road, replacing old vehicles with a higher CO_2 impact. Governments should use recovery and economic stimulus packages to boost the decarbonisation of road transport.

In summary, given the different geographic, economic and infrastructure development differences across the world, a set of decarbonising solutions is more realistic than one unique pathway.

Ultimately full decarbonisation of commercial road passenger and goods transport will mean that a set of options must be scaled up, including CNG, LNG, hydrogen refuelling and electric charging infrastructure in addition to sustainably produced biofuels (without impact on indirect land use change) or e-fuels, which can be used with the existing infrastructure.

In order to advance low carbon fuels on a wide and global scale, governments need to follow a “coordinated approach” on CO_2 pricing, in order to incentivise low carbon fuels compared to fossil equivalents and to make them more competitive. Unless this is done, road transport operators will remain forced to opt for the more economical, but maybe less sustainable solution.

This will require a paradigm shift in setting fuel prices and taxation worldwide, a discussion which has not even started in most parts of the world, yet needs to be accelerated.

The commercial road transport industry is heavily dependent on high energy content fuels in order to provide the needed range and ability to deliver services. However, fuel taxation worldwide is still focussing on taxing the energy content of a fuel, while CO_2 is neglected. In other words, the higher the energy content of a fuel is, the more tax it accrues, regardless of the carbon impact of the fuel. CO_2 reduction in commercial road transport comes at a price which has to be offset by the right policy decisions.

The wide adoption of alternative and low carbon fuels will be a result of close cooperation between regulators and transport operators, as well as other key industry players including fuel suppliers, energy companies, vehicle manufacturers and users of commercial road transport services.

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