Low Emission Fuels and Vehicles for Road Freight

Executive Summary

Smart Freight Centre

GLEC GLOBAL LOGISTICS EMISSIONS COUNCIL

ACT Action toward Climate friend Transport

TRANSPORT DECARBONISATION ALLIANCE

More governments and companies are setting climate targets. The end goal is zero-emission transport for all road transport, and in this transition phase road freight transportation with low emission fuels or electric vehicles (LEFV) is an important part of an effective strategy in the transition to net zero emissions. However, it is often unclear what 'low' or 'zero' emissions really means.

The 'Low Emission Fuels and Vehicles for Road Freight' report serves as an introductory guide for different stakeholders who all have a role to play in this transition: freight transport operators ('carriers'), freight transport buyers ('shippers'), energy and infrastructure providers, vehicle and engine manufacturers ('OEMs') and policy makers.

The aim is to create a common starting point for these stakeholders in order to make emission calculations more consistent and reliable, and to inform better and aligned decision-making regarding uptake of low emission fuels (natural gas, biofuels) and electric vehicles (electricity and hydrogen) for the road freight sector.

The report explains the fundamentals of low emission fuels and energy sources, the current landscape, industry experience and perspectives, and the Total emissions of operation or TEO concept.

Next steps are recommended for improving emissions calculation and increasing uptake of low emissions fuels and vehicles. Key messages are:

- Companies need to balance what they can do in the short term (e.g. biofuels and urban electric freight vehicles) with preparing for a full switch to electricity/hydrogen for the entire trucking fleet.
- The true climate impact from fuels and vehicles can only be determined by calculating emissions from the full fuel/energy life cycle, or 'well-to-wheel' rather than fuel combustion only or 'tank-to-wheel'.
- The total emissions of operation (TEO) should be considered alongside the total cost of operation (TCO) of electric freight vehicles so that companies can be assured that their investment makes economic and environmental sense.

This review was carried out by Smart Freight Centre with support and input from GLEC members and funded by the Dutch Ministry of Infrastructure and Water Management.

Smart Freight Centre. Tel: +31 646954405. info@smartfreightcentre.org.
Full report available on www.smartfreightcentre.org

Smart Freight Centre is a global non-profit organization dedicated to sustainable freight. Our role is to guide companies on their journey towards zero emissions logistics, advocate for supportive policies and raise awareness. We work together with the **Global Logistics Emissions Council (GLEC)** as a voluntary partnership of more than 100 companies, industry associations, programs, experts and other organizations.

Action towards Climate-friendly Transport (ACT) is a global coalition of over 100 organizations aiming to catalyze transport as an enabler of sustainable development in line with the 2030 Agenda and the Paris Agreement. Component 3, led by the **Transport Decarbonisation Alliance**, currently chaired by The Netherlands, supports the creation of a mass market for zero-emission freight vehicles by increasing their global demand through commitments made by governments, cities and private companies.

Key information all stakeholders should know

Fundamentals of fuel and energy

First it is important to have a common understanding of what low emission fuels and energy sources are. Fundamentals are explained and include:

- **Terms and definitions** of carbon neutrality or 'net zero', and different types of vehicles, fuels and energy sources
- **Full fuel cycle approach** that considers both the fuel supply (upstream/indirect) and fuel use (operational/direct) emissions, also called 'well-to-wheel' – there are fundamental differences between conventional fuels, biofuels and electricity from the grid, and hydrogen
- **Fuel and energy pathways** that explain key processes within the fuel or energy life cycle, as well as corresponding emission factors to provide comparable emission calculations
- **Relation between theoretical emission factors and operator experiences**, which explains that the GHG emissions calculation need to take into account the following inputs: energy content of liquid/gaseous fuels, efficiency of the engine or motor, vehicle operation, and loading efficiency.

Overview of the current landscape

Efforts that make use of existing studies, reports, guidelines, tools and databases will be more effective. To gain insight into the fuels and energy sources used in road freight transport and their uptake, an overview is provided of:

- **Policy landscape**, studies by the International Transport Forum (ITF) and International Energy Agency (IEA), and EU Directives for renewable energy (RED II) and fuel quality (FQD)
- **Established fuel emission factor datasets**, including GREET, EU Renewable Energy Directive, national databases, international databases for maritime shipping and aviation, the European Commission's JEC collaboration, and other sources
- **Emission intensity values**, such as provided by the Handbook of Emission Factors Automotive (HBEFA) and datasets developed for the UK and France and within emission calculation tools – it is noted that the development of emission intensity values for transition fuels and energy is still at an early stage
- **Fuel and Fuel Pathway Certification Schemes**, such as the Roundtable of Sustainable Biomaterials (RSB), International Sustainability and Carbon Certification (ISCC), and the Californian Air Resources Board (CARB) – Low Carbon Fuel Standard (LCFS) Pathway Certified Carbon Intensities
- **Research institutions and independent NGOs**, of which there are many who regularly issue reports, papers and articles on the topic. Examples are provided for the Centre for Sustainable Road Freight (CSRF), Transport and Environment (T&E), International Council on Clean Transportation (ICCT)
- **CORSIA for aviation fuels**, which is strategy for management of aviation emissions that is focused on the use of sustainable aviation fuel with offsetting of remaining emissions. Setting aside potential issues with offsetting schemes, the aviation industry has agreed a set of emission factors for sustainable aviation fuel from the most likely feedstock and production pathway combinations as a crucial first step.

Industry experience and perspectives

It is critical that low emission fuel and energy solutions work for business. After all, freight transport operators and buyers will assess risks and benefits before deciding to invest; for example, ROI, capital costs, and technology availability. To help companies and those that want to support them, an insight of existing experiences is provided through

- **End user experiences and operational evaluation projects**, including barriers to the adoption of fuel saving technologies in the trucking sector and anticipated progress of these technologies from 2015 through to 2030 by the ITF
- **Emission factor challenges** especially which emission factors to use and requirements for fuel tracking and certification schemes – companies want and need to be confident about their emission calculations
- **Low emission fuel trials**, which describes the UK Low Emission Freight Trials (LEFT) Programme and its results as an example
- **GLEC partner interviews**, which highlights key general, GHG calculation, technology, infrastructure and policy barriers that limit the adoption of low emission fuels and vehicles, as well as some proposed actions to help overcome these barriers.

Total Emissions of Ownership (TEO) models

Companies considering investing in electric vans or trucks want to know the Total Cost of Ownership (TCO): the purchase price of the vehicle as well as the operating costs over the time that the operator keeps the vehicle. In a climate-constrained world, it is important to also consider the Total Emissions of Ownership (TEO) – you don't want to buy a vehicle that makes financial sense but it does not deliver substantial emission 'well-to-wheel' reductions over the vehicle's lifetime.

Initial guidelines for the TEO calculation for electric road freight vehicles are proposed, based on emission reductions that could be realistically achieved under three scenarios: conservative, moderate or ambitious. An example application of the TEO calculation to a 7.5T truck in the UK shows that

- For an electric truck average emission reductions of -8%, -19% and -31% can be achieved over the 12-year vehicle ownership
- If a diesel biofuel blend of 5% were to be increased to 10% after year 5 this would result in a 1% additional emission reduction, and if pure biodiesel would be used from year 7 onwards then this would lead to 17% emission reductions over a 12-year period
- A carbon price would tilt the financial benefits even more towards operators that invest in electric freight vehicles or switch to biofuels. There is a noticeable differential in favor of the EV, particularly for the later years when the carbon price is higher and the electricity generation has had the maximum chance to decarbonize.

The above calculations succeed in proving the TEO concept, whilst also showing the benefit that can arise from using electric trucks, provided that the power sector moves towards low carbon energy sources. The approach was also shown to work when applied to liquid biofuel substitution as a transition fuel, and could also be used for other alternatives such as hydrogen and biomethane.

Key recommendations

Improving emission calculations

Companies find it challenging to calculate emissions from low emission (transition) fuels and electric vehicles that take into account the full fuel life cycle, also called 'well-to-wheel'. Reasons vary but it all comes down to the need for a common approach and support systems for emission calculations.

Key recommendations to improve reliability and trust in reported emissions are:

- Develop reporting standards for low emission fuel/energy suppliers to enable fair comparisons between conventional fuels and low emission alternatives
- Compare existing emission certification schemes and develop common, consistent protocols
- Establish a mechanism for regular/ongoing updates of emission factors for transition fuels that consider the full fuel life cycle
- Develop a protocol for trials/pilots of transition fuels and electric vehicles to capture data and emission calculations in a consistent manner, to be fed back into emission intensity datasets that are kept by established research and other organizations and used for policy and other 'official' purpose
- Apply the 'Total Emissions of Ownership' (TEO) concept to emission calculations associated with vehicle purchase decisions
- Conduct further research into emissions from both vehicle production and dismantling as well as the required transportation infrastructure, to give a full technology life cycle picture.

Uptake of low emission fuels or electric vehicles

Companies find it challenging to start using low emission fuels or electric vehicles in practice. Cited reasons are lack of coordination and collaboration, vested interests and hidden agendas, and inconsistent policies. Other concerns include the availability of feedstocks for biofuels, the energy efficiency or losses around hydrogen supply, practicality of battery electric vehicles, upfront costs of battery or hydrogen fuel cell vehicles, and re-fueling infrastructure.

Key recommendations to accelerate uptake are:

- Collate trials and pilots that are taking place, starting with those across Europe, and summarize the costs and benefits realized by operators and shippers
- Develop mechanisms that can help consortium building of different stakeholders for collaborative projects on low emission fuels and electric vehicles
- Develop mechanisms for cross-border collaboration that remove the barriers due to differing policy and lack of consensus
- Consult with a wide range of TCO model developers to promote incorporation of the TEO approach and the link to carbon pricing, or shadow carbon pricing.