Light Trucks

HIGHLIGHTS

TECHNOLOGY STATUS – This brief covers powertrain technologies for trucks with a gross vehicle weight of less than 3.5 tonnes, in the light of reducing greenhouse gas emissions in the transport sector. The efficiency of light trucks has been steadily increasing. Global average energy intensity fell from around 13.8MJ/tkm in 1995 to around 12.2 MJ/tkm in 2005. However there are still significant improvements available today that could produce a reduction in operating costs of up to 75%. Almost 100% of the worldwide fleet of light trucks are propelled by internal combustion engines (ICEs) running on fossil fuels. Alternative powertrains are currently in the prototype stages or deployed only in niche applications and unlikely to become mainstream before 2020 - 2030. Examples include hybrid electric, hydraulic hybrid, battery electric, plug-in hybrid and hydrogen fuel cell vehicles. Alternative hydrocarbon-based fuels can also be used, such as compressed natural gas or liquefied petroleum gas.

PERFORMANCE AND COSTS – ICE technology is expected to remain competitive for the foreseeable future. Alternative energy carriers can offer substantial efficiency savings, although the actual improvements achieved depend on whether the technology is suited to the drive cycle. Hybrid technologies are particularly well-suited to the typical driving patterns of light trucks, where they can recover energy from braking. CO_2 reductions of 18% - 22% are achievable for full hybrid models. Electric vehicles currently have limited range so suitable only for shorter range/local delivery applications, but are particularly beneficial where air quality issues are a concern due to the fact that they have zero tailpipe emissions. The additional capital cost for hybrid electric, plug-in hybrid and battery electric vehicles is around €5k, €13k and €60k respectively.

POTENTIAL AND BARRIERS – There is significant overlap with technologies for passenger cars and light trucks, which is expected to yield beneficial crossover effects. Drivers for increased uptake of alternative energy carriers include rising fuel prices and concerns about energy security and climate change. CNG and LPG are currently used in niche applications, but are expected to become less important over time. Hybrid and electric vehicles are expected to be mainstream in the medium term (2020 - 2030). Hydrogen fuel cell vehicles are currently not expected to become mainstream until the longer term (2030 - 2050), primarily due to the need for hydrogen supply infrastructure.

TECHNOLOGY STATUS – Light trucks are defined in this brief as goods or service vehicles with a typical gross vehicle weight of less than 3.5 tonnes. They are also known as light goods vehicles (LGVs), light commercial vehicles (LCVs) or vans. Heavy goods vehicles are discussed in ETSAP brief T09 (Heavy Trucks). Surface freight transport[1] accounts for over a quarter of global transport energy use and road freight transport makes up about 90% of this [1]. The majority of countries are heavily reliant on trucks for freight movement. Although rail or inland waterways are more efficient options - at least for longer distance transport cases - a significant modal shift is unlikely without significant infrastructure investment and government intervention [1]. In spite of steady improvements in efficiency, light trucks remain the most energy-intensive mode of surface freight [2]. Global average energy intensity fell from around 13.8MJ/tkm in 1995 to around 12.2 MJ/tkm in 2005 [1]. The following sections discuss technology options that could further improve the efficiency of light trucks. While significant overlaps and beneficial synergies exist with passenger cars, key differences such as drive cycle and buyer preferences will shape the uptake of new technologies for light trucks. For example, light trucks are predominantly used in urban conditions, for short low-speed journeys, with frequent restarts, periods of idling [3] and high number of miles per year. The effects of the technology on vehicle reliability, running costs and pricing, can influence purchasing decisions for light trucks to a much greater extent than for passenger cars [4].

- **Internal combustion engines** (ICEs) running on fossil fuels are by far the dominant technology (close to 100% of the global fleet). There is some geographical variation as to whether diesel or gasoline is preferred (e.g. diesel is the main technology in Europe, whilst gasoline is predominant in the US). Some advanced gasoline and diesel engine technologies are applicable both to passenger cars and light trucks (covered in ESTAP technology briefs T01 and T02, respectively). In general these relate to improving the combustion process and reducing losses, for example though reduced engine friction losses, engine downsizing and variable valve actuation. However, some novel concepts regarding passenger cars will not necessarily enter the light truck segment as this is more demanding in terms of robustness and durability; examples of technologies which are likely to be less important in the light truck segment include piezo-injectors, continuous variable transmission, and strong weight reduction [2].

- **Hybrid vehicles** can use energy from multiple sources, of which at least one allows storage of surplus energy. **Hybrid electric vehicles** (HEVs) operate a combination of an ICE and an electric motor with

[1] Light trucks, heavy trucks, and rail

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