INTERNATIONAL ENERGY AGENCY

INSIGHTS SERIES 2017

International Energy Agency
Secure Sustainable Together

The Future of Trucks

Implications for energy and the environment

EXECUTIVE SUMMARY

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INTERNATIONAL ENERGY AGENCY

The International Energy Agency (IEA), an autonomous agency, was established in November 1974. Its primary mandate was – and is – two-fold: to promote energy security amongst its member countries through collective response to physical disruptions in oil supply, and provide authoritative research and analysis on ways to ensure reliable, affordable and clean energy for its 29 member countries and beyond. The IEA carries out a comprehensive programme of energy co-operation among its member countries, each of which is obliged to hold oil stocks equivalent to 90 days of its net imports. The Agency's aims include the following objectives:

- Secure member countries' access to reliable and ample supplies of all forms of energy; in particular, through maintaining effective emergency response capabilities in case of oil supply disruptions.
- Promote sustainable energy policies that spur economic growth and environmental protection in a global context – particularly in terms of reducing greenhouse-gas emissions that contribute to climate change.
- Improve transparency of international markets through collection and analysis of energy data.
- Support global collaboration on energy technology to secure future energy supplies and mitigate their environmental impact, including through improved energy efficiency and development and deployment of low-carbon technologies.
- Find solutions to global energy challenges through engagement and dialogue with non-member countries, industry, international organisations and other stakeholders.

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Road freight vehicles are a key enabler of global economic activity and play an essential role in delivering all types of goods or commodities from their points of production to the factories and industries that use or transform them, or to their final points of sale. Economic growth is closely associated with growth in road freight activity (measured in tonne-kilometres [tkm]). Many types of road vehicles deliver goods, including trucks of all sizes. But about 65% of freight activity is accomplished by heavy-freight trucks – a mix of rigid body and articulated trucks with a gross vehicle weight of greater than 15 tonnes. Although heavy-freight trucks are the most efficient for hauling cargo, their large annual mileage means that they consume half of the oil in the road freight sector.

Road freight vehicles are a central source of global oil demand today: at around 17 million barrels per day (mb/d), oil demand from road freight vehicles accounts for around one-fifth of global oil demand – equivalent to the current oil production of the United States and Canada combined. Oil demand from road freight vehicles is roughly equal to that of the entire industry sector and is outstripped only by passenger cars, which account for around one-quarter of total oil demand. Oil demand growth from road freight transport has outpaced that of all other sectors from 2000 onward. While oil use of passenger cars has begun to plateau and decline in many industrialised countries, oil use from road freight vehicles continues to rise. Road freight transport relies primarily on diesel, which accounts for more than 80% of its oil use. Road freight vehicles alone accounted for about 80% of the global net increase in diesel demand since 2000, and make up about half of global diesel demand today. As a result, road freight today accounts for more than 35% of transport-related carbon dioxide (CO_2) emissions, and around 7% of total energy-related CO_2 emissions.

Road freight transport is set to continue to drive global oil demand growth

Without further policy efforts, oil demand from road freight vehicles is set to rise by 5 mb/d to 2050. In the Reference Scenario, global road freight activity is expected to increase by a factor 2.4, driven by robust GDP growth, bringing up oil demand. Emerging and developing countries in Asia, in particular the People's Republic of China (hereafter, "China") and India, account for about 90% of the net increase in road freight oil demand over the projection period, equivalent to around 30% of total oil demand growth from all sectors. The energy intensity (measured by unit of tkm) falls by nearly 40% below today's level, as road freight vehicles become increasingly more efficient. Efficiency improvements are driven by Canada, China, Japan and the United States, the only countries with heavy-duty fuel economy standards in place already today (although the European Union, Mexico, India and Korea are looking to introduce them). Oil-based fuels, in particular diesel, remain the primary fuel in the Reference Scenario, at around 85% of road freight transport fuel use by 2050. Biofuels and natural gas together account for the majority of the remainder. The consequence is that direct CO_2 emissions grow to 3.4 gigatonnes (Gt) of CO_2 in 2050, one-third above today's level. The increase in oil demand and CO_2 emissions in the Reference Scenario means that the importance of road freight transport for key energy policy goals, such as energy security and environmental protection, is likely to grow moving forward.

Reducing future growth of oil demand from road freight vehicles is a challenging, but possible task; opportunities arise from three main areas. Systemic improvements in road freight operations and logistics can reduce growth in road freight trucking activity and improve the on-road efficiency of truck operations. Near-term examples include using Global Positioning System to optimise truck routing; driver training and the use of on-board, real-time feedback devices that monitor the on-road fuel economy of trucks; and a wide range of measures to improve the utilisation of vehicles to maximise load. Other measures, including autonomous

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trucks or the "physical Internet" – an open, shared and modular system wherein all physical assets used in goods delivery are shared across companies – could transform the road freight operations entirely, but face higher barriers to implementation. Similarly, many vehicle efficiency technologies pay back their higher capital costs through fuel savings within only a few years. For the existing stock of trucks, aerodynamic retrofits can reduce the drag coefficient and lead to reductions in road load; and low rolling resistance tyres can translate into immediate improvements in fuel economy. For new trucks, additional technologies exist for reducing idling and for improving vehicle efficiency, such as the use of lightweight materials and improvements to truck engines, transmissions and drivetrains. However, some of these opportunities have longer payback times than operators tend to consider when purchasing new trucks. Finally, the use of alternative fuels and alternative fuel trucks could help achieve key energy and environmental policy goals, such as diversifying the fuel supply of road freight and reducing CO_2 and air pollutant emissions. Natural gas, biofuels, electricity and hydrogen are the main alternatives to oil, but they differ in the extent to which they can contribute to policy objectives.

A vision for modernising road freight transport

In the Modern Truck Scenario, targeted efforts to modernise road freight transport reduces oil demand from road freight vehicles by nearly 16 mb/d by 2050, relative to the Reference Scenario, with benefits for environmental goals. The Modern Truck Scenario sets out a plausible, yet ambitious, vision to modernise road freight transport. It capitalises on the opportunities for systemic improvements in operations and logistics across all aspects of road freight, vehicle efficiency improvements and support for the use of alternative fuels. In the Modern Truck Scenario, the energy intensity of vehicle operations (in energy used per tkm) drops by more than one-third in 2050, relative to the Reference Scenario. Improvements to logistics and road freight operations reduce tkm by 13% in 2050 and total vehicle activity (measured in vehicle-kilometres) by more than 20%. Energy efficiency and alternative fuels, including electrification, lead to a reduction in energy intensity, relative to the Reference Scenario, of 34% in 2050. The result is that direct CO_2 emissions from road freight transport decline by 2.5 Gt in 2050, or 75%, relative to the Reference Technology Scenario.

Not all elements of the Modern Truck Scenario are easily implemented, but there are three key enablers that present important near-term energy policy opportunities. Tightening fuel economy standards and expanding their geographic coverage can accelerate fuel economy improvements over the coming decades. Standards can be supported by differentiated vehicle taxation to incentivise the purchase and operation of efficient trucks. Care must be taken to ensure that test procedures reflect real-world operations and that simulation tools rely on accurate component testing. Data availability and data sharing are key prerequisites to realising some of the potential that underlies systemic improvements in freight logistics, capitalising on the advancement of digital technologies and their application across all aspects of road freight, including supply chain and fleet management, collaboration across shippers, and the optimisation of vehicle operations. The rules of data exchange must be multilaterally defined and transparent for everyone, and confidentiality safeguarded. Some of the potential for systemic improvements can be realised by individual operators alone, but the better the system is designed (i.e. the more operators and other stakeholders that are included), the more effective its implementation. Support for alternative fuels and vehicles needs to cover four main areas: RD&D, market uptake of alternative fuel vehicles, adequate access to charging or refuelling infrastructure and the availability of alternative energy carriers. A focus on low- or zero-emitting fuels not only at the point of use but also across the entire supply chain, both with regards to air pollutant and greenhouse gas emissions, can help ensure the pursuit of multiple energy policy goals at the same time.

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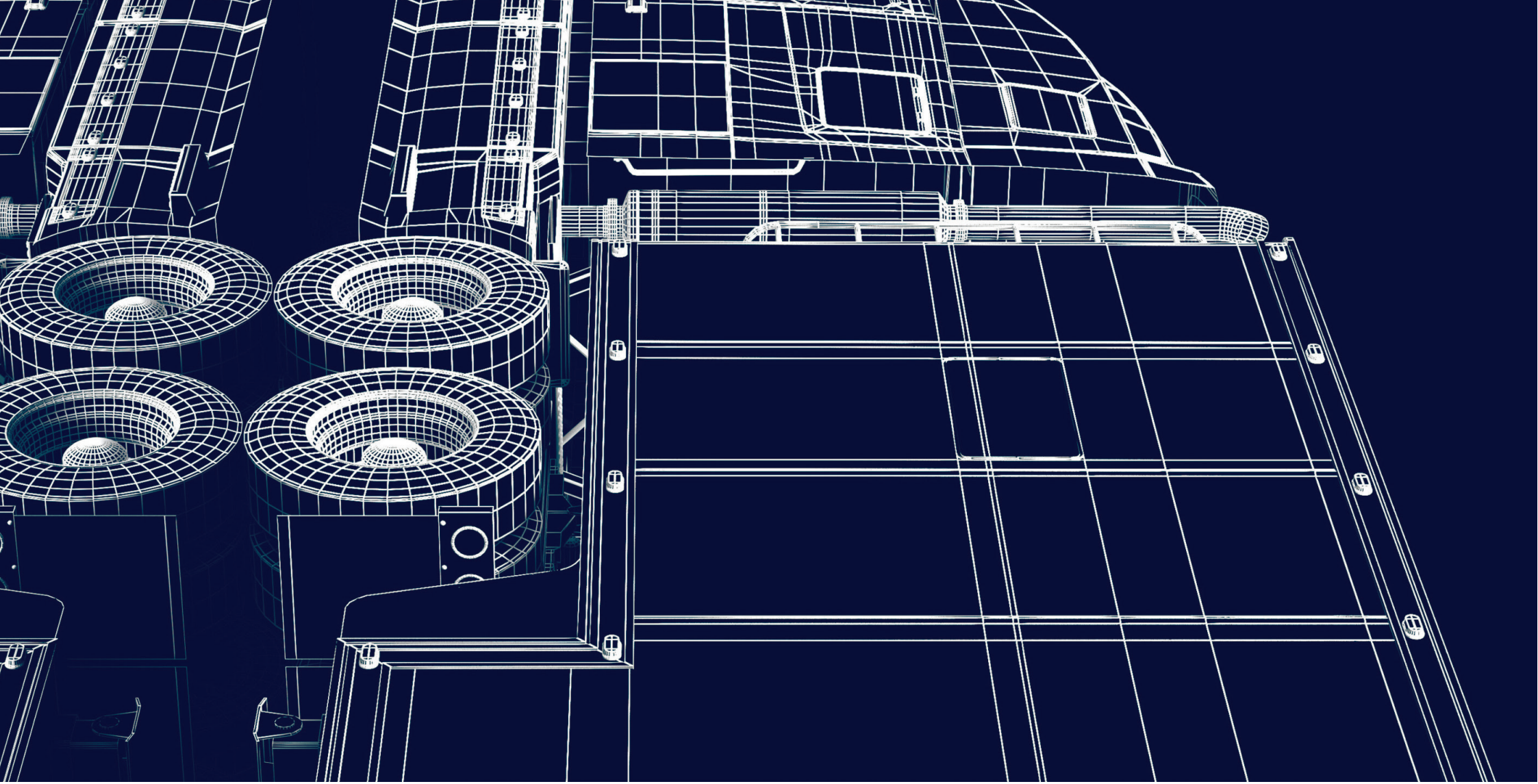

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