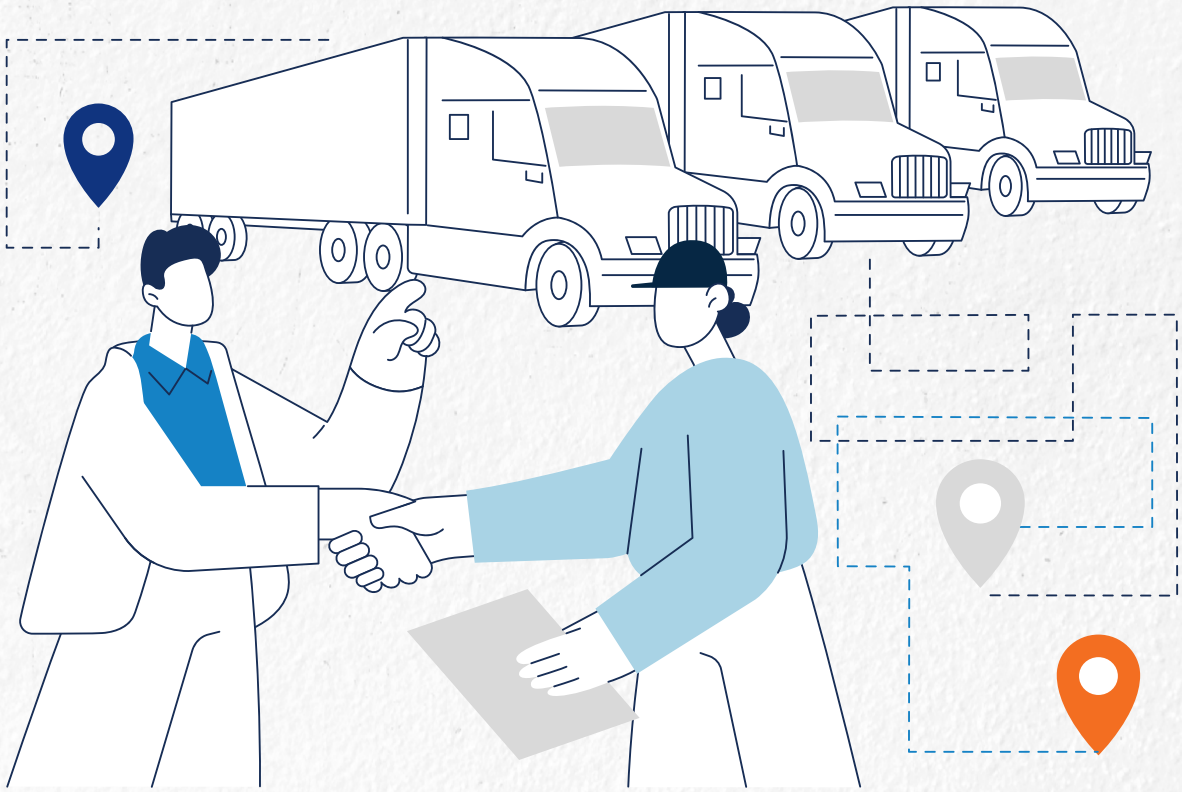
Optimising Fleet Performance

The Crucial Role of Integrated Strategies in Commercial Vehicle Operations

By Federico Biscini, Senior Consultant, Mobility

FROST & SULLIVAN WHITEPAPER

CONTENTS

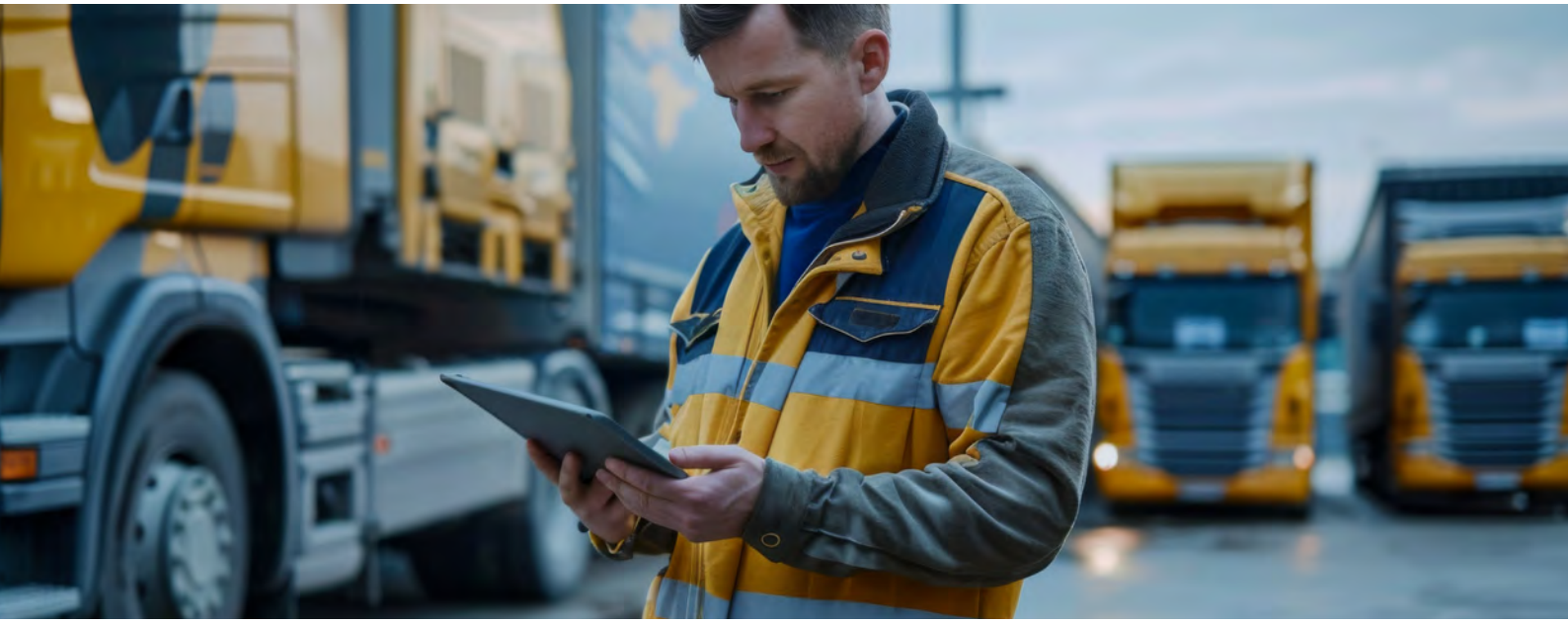


INTRODUCTION:
Challenges Shaping the Future of Fleet Management

The global commercial vehicle industry is a cornerstone of economies worldwide, with millions of medium and heavy-duty vehicles operating daily across diverse sectors such as logistics, construction, mining, public transport, and agriculture. These fleets collectively cover billions of miles each year, driven by the rising demand for goods transportation, infrastructure development, and urbanisation.

In Europe alone, there is a fleet of about 6.4 million medium and heavy-duty commercial vehicles in operation[1]. Each vehicle covers up to 100,000 miles per year, a rate mirrored by other regions across the globe. In regions like North America, fleets are critical to long-haul logistics, while in India and Latin America, fleets are essential for connecting rural areas to growing urban centres. Europe's vehicle fleet is distributed across many regional and local operators, and there are extreme costs and complexities involved in managing so many vehicles and miles.

With fleet sizes expanding rapidly in developed and emerging markets, fleet management has evolved into a sophisticated and essential industry focused on optimising performance, controlling costs, and meeting environmental standards. Fleet operators globally face similar challenges, including high operational costs, vehicle maintenance complexity, and a pressing need to reduce emissions. Extreme climates further complicate fleet operations in the Middle East, while fleets must navigate diverse road conditions and regulatory landscapes in Asia-Pacific.



Several ongoing challenges pressure fleet managers' daily operations and future planning:

Pressure on Fleet Margins with Increasing Total Cost of Ownership (TCO)

Inflationary pressures and interest rates across major economies create challenges across the whole TCO equation[2], including:

- **Service and maintenance costs** are driven by parts and labour price increases.
- **Driver costs** and wages have increased to combat inflation pressures and driver shortages.
- **Fuel costs** have increased compared to pre-COVID pricing but have decreased in recent years.
- **Toll costs** have increased in several countries, reflecting a global trend. For example, Germany and India have recently raised toll rates, while Latin America has some of the highest toll rate charges worldwide[3].
- **Vehicle financing** has increased in many major markets, which impacts vehicle acquisition costs.

Analyses of fleet management practices indicate that fuel costs, vehicle financing, and driver wages are the primary focus areas for cost-reduction strategies[4].

Regulatory Challenges/Changes

Fleets face difficulties navigating regulatory challenges linked to powertrain technology, which includes vehicle emission reduction legislation for specific regions or countries and requirements for wider company decarbonisation targets. Whether diesel, EV, hydrogen or alternative fuels, fleets must select the most suitable powertrain for the next five to six years to meet targets.

Beyond selecting technology, fleets must build the capacity to manage the transition effectively. This includes developing new internal capabilities and knowledge for daily operations, as well as forming partnerships with suppliers and external service providers (such as local service and maintenance networks).

Availability of Trucks Leading to Ageing Fleet

In recent years, a lack of commercial vehicle availability has impacted the total purchase price and placed pressure on fleets to extend the length of ownership period[5] [6].

Reduced commercial vehicle availability is due to several factors, such as sourcing constraints and logistics delays for new vehicles (caused by the post-pandemic surge in demand), global supply chain issues (such as the semiconductor crisis), and eCommerce market growth.

As a result, the average age of fleet vehicles is increasing as fleets are forced to keep vehicles in service longer than planned. This often leads to higher costs to maintain the ageing fleet, including more frequent and expensive maintenance schedules and a greater need for replacement parts compared to newer vehicles.

Driver Shortages and Driver Productivity

Driver shortages are an ongoing challenge because younger generations are considering different career options. This is expected to continue as the rate of retirement currently exceeds the rate of new driver training[7] [8].

Driver productivity is crucial as wages rise and resources tighten. Challenges like miscommunication on the road can disrupt schedules and reduce efficiency. Tools such as telematics and GPS apps help fleet managers track drivers, improve scheduling, and enhance safety while cutting costs[9].

Geopolitical Landscape Disrupting Global Supply Chains

Geopolitical tensions and conflicts around the world impact global supply chains. There is a growing shift towards supply chain reconfiguration, and many countries are reducing their geographic and geopolitical trade distances with the goal of protecting supply chains[10].

This shift toward nearshoring and de-globalisation is creating new challenges for fleet operators in the near term. Unpredictable schedule disruptions in international transportation are increasingly common. Additionally, fleets must adapt to dynamic market changes, including workload fluctuations and significant adjustments to usual operating routes. In the long term, however, fleets are projected to grow, driven by the strong expansion of eCommerce.

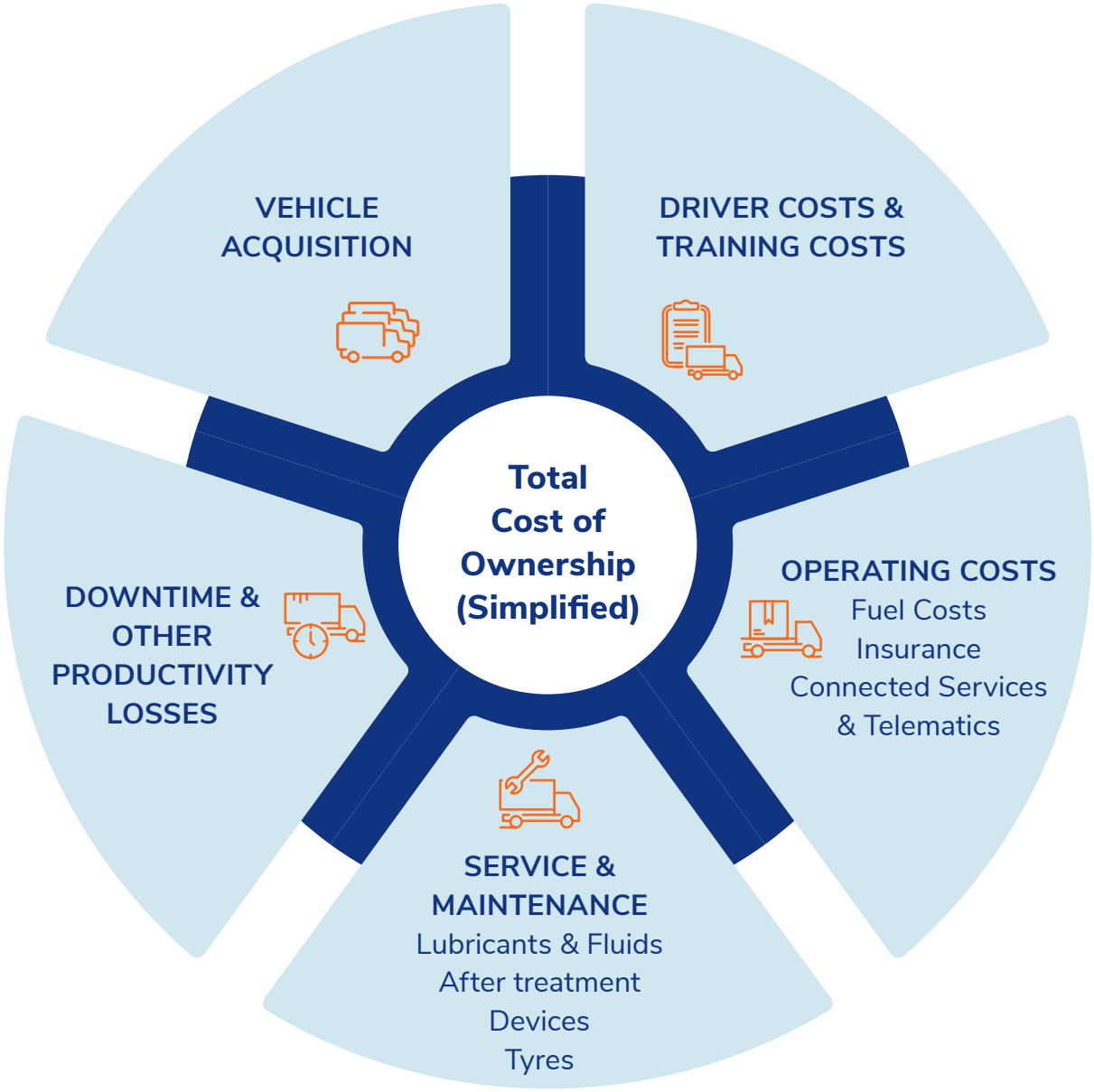
To navigate these complexities, fleet managers will increasingly rely on transport management systems (TMS) to streamline operations and mitigate risks.

With the rapid adoption of new technologies—such as electric vehicles, telematics, and fuel-efficient powertrains—the industry is constantly innovating to improve efficiency and sustainability. Despite regional differences in regulatory frameworks, infrastructure readiness, and market maturity, the commercial vehicle sector shares a common goal: achieve greater operational efficiency, reduce the total cost of ownership (TCO), and minimise environmental impact. This goal resonates across North America, Europe, Asia, and emerging markets like India and Latin America.

The Cost of Poor Fleet Management

Amidst a challenging global landscape, effective fleet management strategies are crucial to maintaining and optimising operations. The ability of fleets to navigate these challenges can be measured through the TCO and how it compares to previous years and similar fleet profile benchmarks. Because the TCO equation is complex, it is important to have a clear strategy for each aspect to successfully manage the overall fleet.

The TCO consists of elements such as vehicle acquisition costs, driver costs, training costs, operating costs, service and maintenance costs, and other costs caused by downtime. Here, we will focus on selected areas that fleet managers can target for improvement.

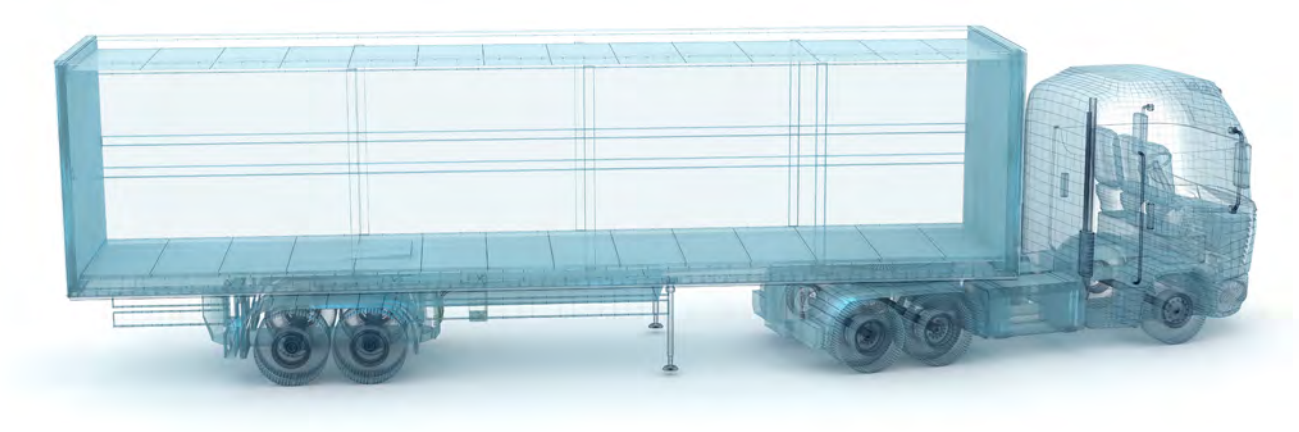


Optimising Fuel Costs through Fleet Management

Fuel is a critical area for all fleets in managing costs and accounts for 25 to 30% of the TCO[11]. Many elements impact overall fuel consumption, including driver behaviour, vehicle condition, and route planning.

Vehicle maintenance and management are focus areas for optimising the fuel economy. To achieve good fuel economy, fleets must address all vehicle areas, including the powertrain, after-treatment system, brakes, wheels, and tyres. Combining all this with a strong maintenance schedule will improve fuel economy. The cost of not doing this is also high, both in fuel costs and potential vehicle downtime.

Fuel Efficiency Impact from Fleet Management[12] [13]



VEHICLE

- Preventive maintenance can result in fuel savings between 5-10%[16]

POWERTRAIN

- High-quality fuel can impact fuel economy by as much as 5%[14]

AFTERTREATMENT SYSTEM

- Maintaining the DPF by using correct fuel and oil, as well as regular cleaning, can impact fuel economy by as much as 2%[14]

BRAKES, WHEELS, TYRES

- Air leaks in the brake system can impact fuel economy by as much as 2% as the compressor is working hard to maintain brake pressure[14]
- Wheel alignment can impact fuel economy by up to 3%[14] [17]
- Non-optimal tyres can result in an increase fuel consumption by up to 3%[15] [17]
- Incorrect tyre pressure can impact fuel consumption by 2%, and can reduce service life by ~20%[14] [17]

Fuel economy can also be impacted by driver behaviour. Fleets will seek to address this through regular driver training to encourage efficient driving and by installing smart devices in the vehicle to provide live performance feedback. They can also use telematics devices to track driver performance and prioritise drivers for training.

Route planning can maximise fuel economy by optimising a route's topology, traffic, and road conditions. For example, it is important to schedule refuelling away from high-cost locations and avoid or minimise tolling and restricted area costs where possible, such as in low-emission city centre zones.

Leveraging Connectivity & Telematics to Improve Operational Efficiency

Connectivity and telematics are transformative tools for fleet operations, offering far-reaching benefits beyond reducing fuel consumption. By collecting and analysing data across the fleet, these technologies enable informed decision-making and continuous improvement in multiple areas.

Key benefits include:

- **Real-time location tracking:** Enhances route optimisation, reduces delays, and improves delivery reliability
- **Diagnostics and vehicle health monitoring:** Minimises unplanned downtime by addressing maintenance needs proactively
- **Driver performance monitoring:** Improves safety and productivity through data-supported training and feedback systems
- **Fuel efficiency tracking:** Identifies opportunities for reducing fuel consumption through actionable insights
- **Optimised scheduling and utilisation:** Supports smarter allocation of resources using fleet and transport management software, maximising truck and driver efficiency

By integrating telematics data into fleet management systems, operators can holistically monitor costs, assess performance, and unlock new efficiencies across all aspects of their operations. This data-driven approach ensures fleets remain competitive in a dynamic market environment.

Extending the Useful Life of the Vehicle through Service & Maintenance

Service and maintenance are crucial to prolonging a vehicle's life, and this directly impacts the total cost of ownership (TCO) in several ways:

- Regular servicing and maintenance can reduce the risk of failure that necessitates more expensive repairs.
- Maintaining a vehicle can protect the vehicle's residual value and reduce depreciation.
- Regular maintenance can reduce the risk of needing to prematurely replace vehicles.
- A clear maintenance strategy could also prolong vehicle life past the estimated end-of-life, positively impacting the TCO.

Minimising Fleet Downtime

Service and maintenance are not just important for extending vehicle life, but also for minimising fleet downtime during operation. Downtime losses can be costly and are factored into the overall TCO.

Preventative maintenance can be important to reduce the risk of unexpected repairs, which are often more costly than planned maintenance. However, this must be balanced with potential impacts on fleet productivity.

Remote monitoring and diagnostics can be an excellent tool to monitor vehicle health and performance while on the road. The ability to assess any vehicle defects and to track vehicle fuel economy means that vehicles can be scheduled for maintenance before a major fault, eliminating downtime.

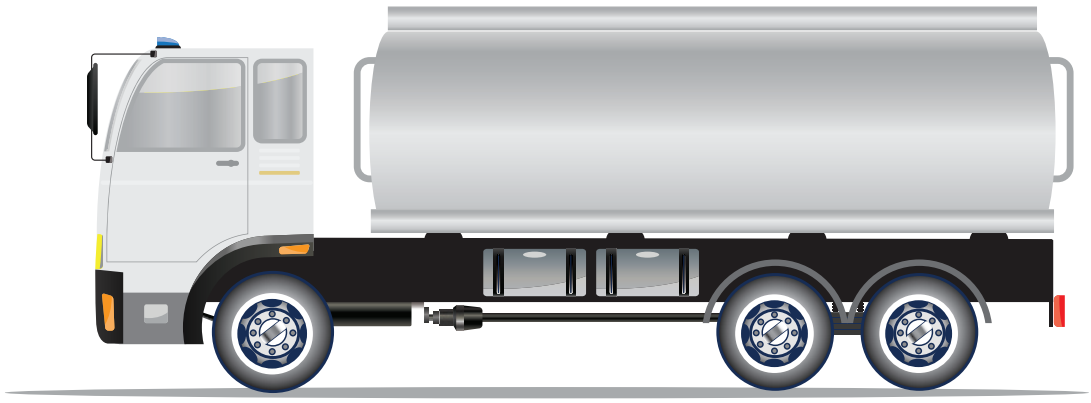
The Impact of Fluids on Fleet Efficiency

Fluids and lubricants are essential for effective fleet maintenance and optimisation, protecting components against corrosion, reducing wear, and maintaining peak operational efficiency to extend vehicle lifespan.

Benefits of Fluid Management on Commercial Vehicle Fleet

IMPROVING PERFORMANCE
Powertrain Efficiency

REDUCING DOWNTIME
Engine and Transmission



WEAR AND CORROSION PROTECTION
Extending Useful Life

AFTERTREATMENT SYSTEM
Performance and Maintenance

Improving Performance – Powertrain Efficiency

Selecting the right lubricants for the engine, transmission, and power steering systems can significantly enhance vehicle efficiency. Studies show that low-viscosity engine oils can improve fuel economy by 0.4% to 1.5%, reducing overall fuel costs across a fleet[18] [19]. While seemingly modest, these gains add up over time and can significantly reduce fuel expenses across a fleet.

The correct choice of transmission fluid further supports fuel efficiency by minimising friction and regulating temperature; in colder conditions, an oil cooler can warm the fluid, saving up to 0.3% on fuel, while in warmer climates, it prevents overheating and reduces wear[14].

The optimal power steering fluid enhances steering response, contributing to vehicle safety and extending the fluid's lifespan. These strategic lubricant choices help improve overall powertrain performance, maximise fuel economy, and support long-term operational efficiency.

Reducing Downtime – Engine and Transmission

Effective lubrication is crucial in minimising downtime by reducing the risk of breakdowns and extending service intervals. Selecting the optimum engine oil can increase oil life and extend drain intervals, lowering maintenance costs, reducing vehicle downtime, and increasing fleet operation sustainability.

High-quality transmission oils are equally essential, as they minimise transmission wear, extend component lifespan, and reduce the need for frequent maintenance.

The right engine and transmission lubricants form a comprehensive fluid strategy that enhances reliability and keeps vehicles operational for longer periods, supporting overall fleet efficiency.

Wear and Corrosion Protection

At its core, the role of lubricant is to minimise friction, reduce wear, and protect against corrosion, ensuring that engine components function efficiently and last longer. By selecting the correct lubricant and adhering to an optimised maintenance schedule, fleet operators can also prevent deposits and soot buildup, which can otherwise impair engine performance and increase downtime.

High-quality greases further support other critical components, such as fifth wheels on heavy-duty trucks, by reducing friction and preventing corrosion to ensure safe and reliable trailer operation.

These lubrication strategies reinforce fleet durability and reliability, lowering maintenance costs and extending service life.

Aftertreatment System Management

Common Aftertreatment Failures

Aftertreatment systems face challenges due to the large number of parts and sensors required when operating in harsh conditions. This can lead to sensor faults and short circuits due to contamination and buildup[18].

- Diagnosing engine faults can be challenging because diagnostic tools often identify the immediate issue, such as a diesel particulate filter (DPF) fault, without highlighting potential upstream causes like a malfunctioning exhaust gas recirculation (EGR) cooler or injector.

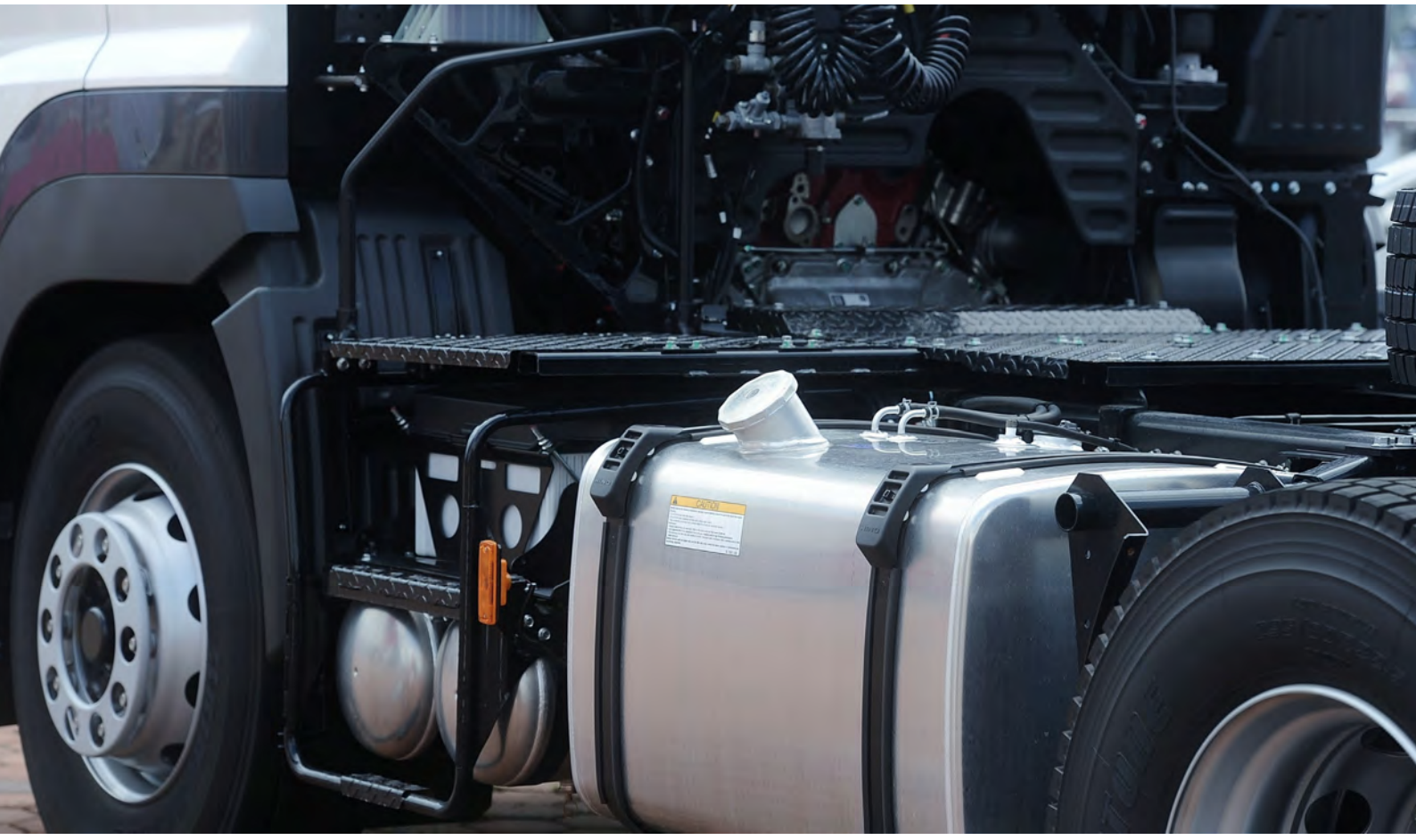
- EGR coolers can become blocked with soot, which can impact vehicle performance.
- Selective catalytic reduction (SCR) faults can include catalyst clogging, sensor failure, and injector failures.
- DPF can experience a build-up of ash despite completing regens. This can create back pressure and impact vehicle performance.

Role of Lubricants in Managing System

Lubricants can be crucial to maintaining the aftertreatment system. Studies show that the use of a low-medium ash, low-viscosity lubricant can extend the effectiveness of the aftertreatment system[19].

Cost of Poor Aftertreatment Management

Failure to effectively maintain the aftertreatment could incur costs for replacement components. DPF is a common component that requires regular maintenance and replacement. DPF cleaning and regeneration could cost between $200 and $600 while taking the vehicle out of action for a short period. However, DPF replacement can cost between $3,000 and $8,000[20] [21].



Matching the Fluids Strategy to Application Requirements

The stresses of commercial vehicle operations amplify the importance of a well-developed fluid strategy.

The unique operating conditions of on- and off-road applications create strict requirements for fluids and lubricants that fleet managers must consider.

For on-road applications, it is important to consider how the lubricant can work across a wide range of temperatures and provide long service intervals for high-mileage vehicles. For off-road applications, wear protection under high loads can be important, while there may be additional demand on the transmission and hydraulic systems that need to be managed.

Application Type	Operating Conditions	Fluid Requirements [22] [23]
On-Road	▶ **Powertrain** – New HD powertrains operate at increased temperature and pressure to meet emissions requirements; they have complex aftertreatment systems ▶ **Load** – Engine operation is mostly at lower/constant load, except for steep gradients ▶ **Temperature** – Environmental temperature varies across regions and at different times of year ▶ **Environment** – Able to handle different environmental conditions (e.g., cold and wet, dry and dusty) ▶ **Life cycle** – Able to withstand high engine/component mileage (~120,000km /year)	▶ Oils that support engine operations and are compatible with aftertreatment systems ▶ Lubricants that work in a wide temperature range ▶ Corrosion resistance for external components ▶ Enable longer intervals between services, reducing maintenance costs and downtime
Off-Road	▶ **Load** – Hydraulic systems and mining machinery transmissions face extreme pressures and constant use ▶ **Temperature** – There is a wide temperature window for operations ▶ **Environment** – Harsh environment operations include temperature, moisture, and dirt ▶ **Remote locations** – Minimising failure risk is crucial as repair challenges can extend downtime ▶ **Underground operation** – A higher concentration of dirt/dust can contaminate vehicles	▶ Focus on engine wear protection at high loads rather than purely on fuel economy ▶ Transmission oils must be heavy-duty and able to support the gearbox under a high-load/high-stress environment ▶ Hydraulic oils that can cope with constant use and operate in a wide temperature range are required ▶ Greases are important to prevent corrosion on exposed components ▶ Fluid to prevent overheating, fluid degradation, and system failures in hydraulics is needed

Matching the Fluid Strategy to Regional Requirements

Fleets must consider the effect of market-specific conditions, such as regulatory and environmental, and their fleet's general make-up and state when developing a fluid approach.

In Europe, **fleets will be managing newer vehicles with the latest aftertreatment systems** and must consider how lubricants can help maintain these. In countries like India and Latin America, fleets often consist of vehicles of varying ages and must contend with low-quality fuels. For the Middle East, high temperatures and dry conditions will impact the fluid requirements.

These fuels can accelerate wear on lubricated components and lead to incomplete combustion, increasing the presence of wear particles and byproducts in the oil and resulting in faster oil degradation[24]. Fleet managers should consider how high-quality lubricants can help mitigate these challenges effectively.

Region	Operating Conditions	Fluid Considerations [25] [26] [27] [28]
Europe	▶ Stringent emission regulations (EU7) ▶ Cold climate (northern Europe, Nordics, Germany, Poland) ▶ Hot climate (southern Europe, France, Spain, Italy)	▶ Fluids must be compatible with the latest aftertreatment systems ▶ Temperature changes (extreme cold or hot) can impact oil viscosity and result in additional engine component wear
North America	▶ Stringent emission standards, especially in the United States (EPA regulations) ▶ Cold climate (northern United States and Canada) ▶ Hot climate (southern United States) ▶ Predominance of heavy-duty diesel trucks with advanced aftertreatment systems	▶ Fluids must be compatible with the latest aftertreatment systems ▶ Temperature changes (extreme cold or hot) can impact oil viscosity and result in additional engine component wear
China	▶ Implementing stringent emission standards similar to EU6 ▶ Increasing focus on fuel efficiency and environmental sustainability ▶ Rapidly growing fleet of modern vehicles, mixed with older models still in operation ▶ Varying climate conditions from northern cold winters to southern hot, humid conditions	▶ Compatibility with advanced emission systems in newer vehicles (DPF, EGR, SCR) ▶ High humidity in southern regions increases the risk of corrosion, requiring rust-resistant lubricants ▶ Variations in climate require oils with stable viscosity across temperature extremes ▶ Fuel contamination in rural areas necessitates robust lubricant formulations to prevent viscosity loss and engine wear
India	▶ Fuel quality differences to the European market ▶ Hot climate ▶ Moisture ▶ Older fleets	▶ Lubricant performance can be impacted by fuel contamination, impacting the viscosity and life cycle of the oil ▶ High temperatures will change lubricant requirements ▶ High humidity and rainfall create different requirements for rust/corrosion resistance

Region	Operating Conditions	Fluid Considerations [25] [26] [27] [28]
Asia Pacific (Excluding China and India)	▶ Hot and humid climates dominate, especially in Southeast Asia ▶ Fuel quality variations across countries ▶ Rapid urbanisation leading to mixed-use fleets (new and older vehicles) ▶ High levels of dust in some regions (e.g., Australia)	▶ Corrosion-resistant lubricants are essential due to high humidity and rainfall in tropical climates ▶ High temperatures demand thermal stability and resistance to viscosity breakdown ▶ In dusty areas, such as Australia, greases and oils must offer superior filtration and wear protection ▶ Fuel contamination risks require lubricants with robust additive packages to protect engine components and extend oil life
Middle East	▶ Hot climate ▶ Sand/dust	▶ High temperatures will change lubricant requirements ▶ Greases required to protect external components from dirt and sand
Latin America	▶ Fuel quality ▶ Moisture ▶ Hot climate ▶ Older fleets	▶ Lubricant performance can be impacted by fuel contamination, impacting the oil viscosity and life cycle ▶ High sulphur content in fuel can cause corrosive engine wear ▶ High temperatures will change lubricant requirements

Outlook for Commercial Vehicle Sector

Total Cost of Ownership

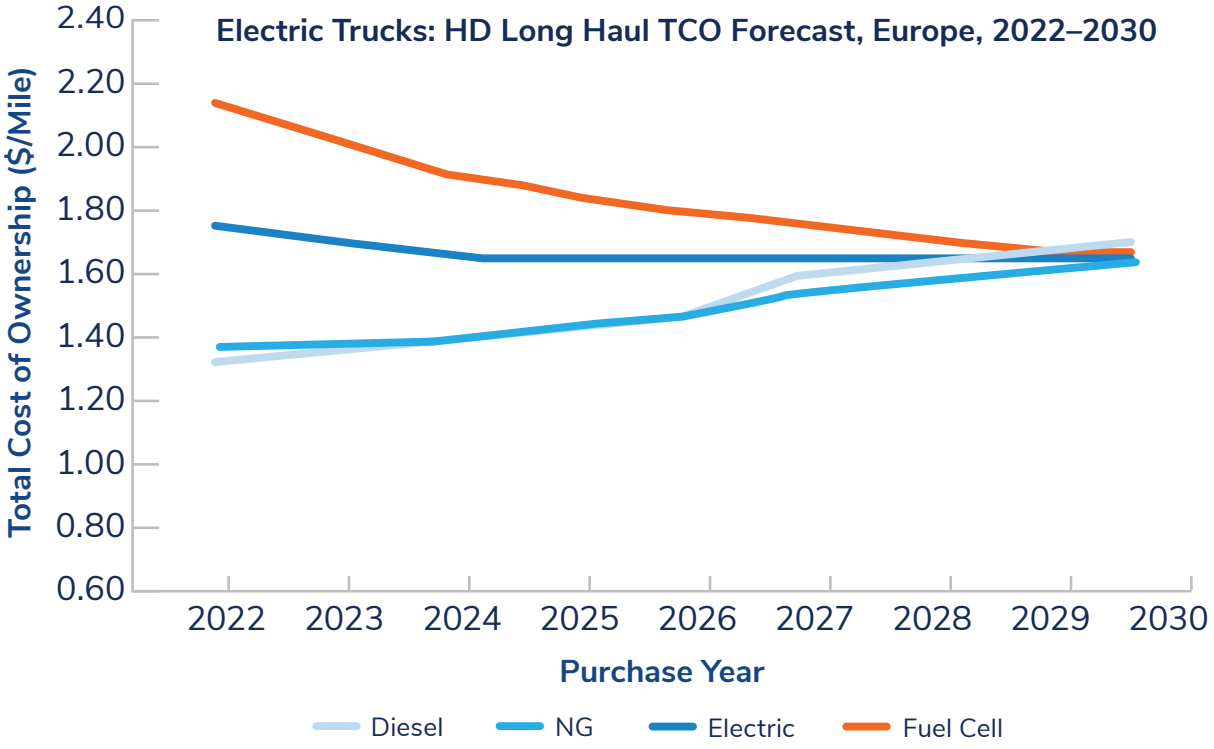
By 2028, heavy-duty electric trucks will achieve Total Cost of Ownership (TCO) parity with diesel trucks in Europe. This is expected to drive a large increase in adoption[29].

> Where EVs are unsuitable, other alternative fuels, such as natural gas and hydrogen fuel cells, will achieve TCO parity with diesel between 2029 and 2030.

TCO parity will be achieved as vehicle costs reduce, driven by more affordable batteries and higher production volumes of EV truck platforms. Energy costs are also expected to decrease as governments increase renewable energy production and charging infrastructure becomes more abundant.

Total Cost of Ownership

In Europe, HD long-haul battery-electric trucks are expected to achieve TCO parity with diesel trucks after 2028.



*TCO does not include incentives. Driver and toll wages are the same across different powertrains and have not been considered.
Source: Frost & Sullivan

Alternative Fuels

While electrification is expected to accelerate in regions such as Europe, the United States, and China, EV adoption will be later for other regions. Internal combustion engines will continue to play a central role in many markets, whether as a diesel engine or adopting alternative fuels. With these, lubricants will remain crucial to operation and maintenance even though specific formulations and requirements could evolve[30].

- Diesel and biodiesel
- Alternative fuels – CNG, LNG, methanol
- Hydrogen ICE
- Hybrid potential, with smaller engines in combination with battery

Fluids for Electric Vehicles

Zero-emission vehicle (ZEV) penetration will continue to grow, but many of the same challenges and fluid requirements will remain across the rest of the vehicle. This will still be a key maintenance consideration for fleet managers.

- Transmission oils
- Power steering fluids
- Hydraulics
- Linkages

Software-defined Truck

A growing trend across the automotive and transportation sectors is the increased focus on software. For commercial vehicles, this will impact the vehicle performance, monitoring, and updatability. This could result in increased data visibility for the powertrain to make more informed decisions on preventative maintenance and repairs.

The key advantages unlocked by leveraging the software capabilities in modern commercial vehicles include:

- Data visibility across vehicle
- Preventative maintenance, remote diagnostics, OTA updates
- New areas to drive fleet efficiencies

Future Regulatory Landscape

The future regulatory landscape will include tightened emissions standards in leading and developing markets. This will impact powertrain technology, lead to higher EV adoption, and result in new engine and aftertreatment technologies.

In Europe, Euro 7 regulations for heavy-duty vehicles are anticipated by 2028 for new vehicle model certification and 2029 for all new vehicles. The proposed regulations will place stricter limits on NOX (a 50% reduction) and particulate matter (PM) (a 20% reduction). Euro 7 also introduces limits on brake and tyre emissions, which will require new compounds to be developed, tested, and approved[31].

India will also seek to adopt Bharat Stage 7. This is aligned with Euro 7 and is on a similar timeline, with aggressive implementation targets for passenger and commercial vehicles already being set.

For other regions around the world, emissions standards are further behind. In the Middle East, the United Arab Emirates adopted Euro 5 for diesel engines in 2018, while in Saudi Arabia, Euro 5 standards were adopted in 2024 for diesel engines. Mexico has plans to introduce Euro 6 in 2025, which aligns to current European standards.

As new vehicles are introduced to markets, fleets must understand how vehicle maintenance and operations will change the engine and aftertreatment systems.

Next Steps in Achieving Fleet Efficiencies

Key Findings

- Fleets are under increasing internal and external pressures impacting their operations and profitability.
- Fleet management strategy is vital to minimise operating costs, maintenance costs, and downtime.
- Fluid strategy is an important aspect of protecting vehicles (regarding engine and component wear), maximising fuel efficiency, and providing extended service intervals and predictable downtime scheduling.
- Lubricant strategies will vary based on the application and the region. It is crucial to have a tailored lubricant strategy for your fleet.
- Fluids will continue to be essential, even as fleets shift to alternative fuel engines or electric powertrains.

Fleet and fluid management is crucial to ensuring efficient operation and minimising TCO. The landscape is complex and each fleet has unique use cases and operating conditions, so it is critical to engage with experts to develop the most suitable solutions.

Gulf Oil Solutions

Optimising fleet operations requires a strategic focus on fluid management, where the right selection of lubricants is necessary to enhance efficiency. Gulf offers a **comprehensive portfolio of high-performance lubricants** designed to protect and optimise **all critical components and lubricated systems**, including **aftertreatment devices**, across mixed fleets.

Gulf works hard to develop products that meet the approval of leading original equipment manufacturers, such as MAN, Daimler, and Iveco. Its lubricants can significantly extend oil drain intervals, from 50,000 km up to 150,000 km, reducing the amount of waste oil generated over the lifespan of engines and equipment. By improving engine longevity and extending equipment lifespan, fleets can achieve substantial cost savings and strengthen their **preventive maintenance** programs by minimising wear and preventing unexpected breakdowns.

The **Gulf Superfleet Professional ECON 5W-30**, specifically designed for heavy-duty engines, helps deliver up to 1.2% better fuel economy while providing enhanced engine protection. This helps lower CO2 emissions and drive down operational costs. Additionally, Gulf's **lubricant analysis** services provide valuable insights into the health of your fleet's lubricated systems, supporting more effective **preventive maintenance** and helping avoid costly unplanned repairs.

Discover how Gulf's advanced lubricants and fluid management solutions can help optimise your fleet's operations, enhance preventive maintenance, and reduce total ownership costs.

Contact us today to learn more about our comprehensive lubricants portfolio or to schedule a consultation for our expert lubricant analysis services. Let Gulf support your fleet in operating efficiently, sustainably, and cost-effectively.

CLICK HERE

Sources

[1] "Vehicles in Use Europe 2023," ACEA, [Online]. Available: https://www.acea.auto/publication/report-vehicles-in-use-europe-2023/.

[2] "Cost pressure in the European road transport industry is increasing," Trans Info, [Online]. Available: https://trans.info/en/cost-pressure-in-the-european-road-transport-industry-is-increasing-383047.

[3] "Mexico, Uruguay and Chile have Latin America's most expensive toll rates," Rio Times, 2022. [Online]. Available: https://www.riotimesonline.com/brazil-news/rio-business/mexico-uruguay-and-chile-have-latin-americas-most-expensive-toll-rates/.

[4] "Fleets Face Pressure to Save Cash," Fleet News, [Online]. Available: https://www.fleetnews.co.uk/news/latest-news/2023/06/08/fleets-face-pressure-to-save-cash-one-in-four-expect-business-to-contract.

[5] "European Truck Market Slows," ING, [Online]. Available: https://think.ing.com/articles/european-truck-market-slows-while-electric-journey-accelerates/.

[6] "Top 15 Fleet Trends Impacting Commercial Fleets," Automotive Fleet, 2023. [Online]. Available: https://www.automotive-fleet.com/10206931/top-15-fleet-trends-impacting-commercial-fleets.

[7] "HGV Driver Shortage to Double by 2028," Routing UK, [Online]. Available: https://routinguk.descartes.com/resources/hgv-driver-shortage-to-double-by-2028#:~:text=A%20recent%20report%20released%20by,to%207%25%20of%20all%20positions.

[8] "Global Truck Driver Shortage," IRU, 2023. [Online]. Available: https://www.iru.org/news-resources/newsroom/global-truck-driver-shortage-double-2028-says-new-iru-report.

[9] "Top 3 Challenges Fleet Managers Are Likely To Struggle With In 2023," Fleetpal, [Online]. Available: https://www.linkedin.com/pulse/top-3-challenges-fleet-managers-likely-struggle-2023-fleetpal/.

[10] "Geopolitics and the Geometry of Global Trade," McKinsey, 2024. [Online]. Available: https://www.mckinsey.com/mgi/our-research/geopolitics-and-the-geometry-of-global-trade.

[11] "Frost & Sullivan Analysis," 2024.

[12] "3 Ways to Increase Fleet Efficiency," Fuel Mate, [Online]. Available: https://www.fuelmate.co.uk/news-advice/3-ways-to-increase-fleet-efficiency.

[13] "6 Ways to Improve your Commercial Fleet Operations," Fuel Tek, [Online]. Available: https://www.fueltek.co.uk/6-ways-to-improve-your-commercial-fleet-operations/.

[14] "How Good Vehicle Maintenance Can Save You Fuel," Volvo, [Online]. Available: https://www.volvotrucks.com/en-en/news-stories/insights/articles/2022/apr/how-good-vehicle-maintenance-can-save-you-fuel.html#:~:text=Having%20the%20correct%20oil%20temperature,to%200.3%20per%20cent%20fuel.

[15] "How Fleets Can Combat Rising Maintenance Costs," Fleet Owner, [Online]. Available: https://www.fleetowner.com/operations/article/21280716/how-fleets-can-manage-rising-maintenance-costs-in-2024.

[16] "Preventative Maintenance," NACFE, [Online]. Available: https://nacfe.org/research/technology/operational-practices/preventive-maintenance/.

[17] "Tyres & How They Impact Fuel Consumption," Volvo Trucks, [Online]. Available: https://www.volvotrucks.com/content/dam/volvo-trucks/markets/master/home/news/insights/articles/pdfs/2019/oct/how-aerodynamics-and-rolling-resistance-impact-your-trucks-fuel-consumption/Guide-Tyres-and-how-they-impact-fuel-consumption.pdf.

[18] "Aftertreatment Diagnostics and Best Practice," Fleet Maintenance, [Online]. Available: https://www.fleetmaintenance.com/in-the-bay/diagnostic-and-repair/article/21280423/aftertreatment-diagnostics-and-best-practices.

[19] "Impact of Mid-to-Low-Ash, Low-Viscosity Lubricants," Suzhou Automotive Research, 2024. [Online]. Available: https://www.researchgate.net/publication/381976479_Impact_of_Mid-to-Low-Ash_Low-Viscosity_Lubricants_on_Aftertreatment_Systems_after_210000-Kilometer_Real-World_Road_Endurance_Trials.

[20] "How much do you spend on DPF maintenance?," Fleet Maintenance, [Online]. Available: https://www.fleetmaintenance.com/equipment/emissions-and-efficiency/article/21075868/how-much-do-you-spend-on-dpf-maintenance.

[21] "Maintenance issues in aftertreatment systems: The causes and the costs," Chevron, [Online]. Available: https://www.chevronlubricants.com/en_us/home/learning/from-chevron/heavy-duty-diesel-vehicles-and-equipment/maintenance-issues-in-aftertreatment-systems-the-causes-and-the-costs.html.

[22] "Longer Lived Lubricants," Transport Engineer, [Online]. Available: https://www.transportengineer.org.uk/content/features/longer-lived-lubricants/.

[23] "Off Road Regulations and Their Impact on Lubricants," [Online]. Available: https://portallubes.com.br/2024/05/new-off-road-regulations-and-their-impact-on-lubricants/.

[24] A. Global, "Effects of poor quality fuel on engine reliability," [Online]. Available: https://www.alsglobal.com/en/news-and-publications/2022/06/effects-of-poor-quality-fuel-on-engine-reliability.

[25] "Heavy Duty Truck Failures Caused by Heat," OTRPerformance, [Online]. Available: https://otrperformance.com/blogs/quick-tips/8-most-common-heavy-duty-truck-failures-caused-by-heat#:~:text=High%20temperatures%20can%20decrease%20the,tear%20in%20the%20engine%20components..

[26] "Preparing Heavy Duty Truck for Summer," Bus & Truck Chicago, [Online]. Available: https://www.busntruckchicago.com/blog-posts/preparing-your-heavy-duty-truck-for-summer-essential-maintenance-and-inspections.

[27] "Effects of Extreme Cold on Heavy Duty Operation," National Fleet Management, [Online]. Available: https://www.nationalfleetmgt.com/articles/understanding-the-effects-of-extreme-cold-on-heavy-duty-truck-engine-oil-viscosity-and-lubrication.

[28] "Sulfur in Diesel," American Petroleum, [Online]. Available: https://americanpetroleumpr.com/en/sulfur-in-diesel/#:~:text=In%20the%20presence%20of%20a,of%20sulfuric%20acid%20(H2SO4)..

[29] F. &. Sullivan, "Growth Opportunities in European Heavy-duty Electric Trucks," 2024.

[30] "Future Power Train Solutions for Long-Haul Trucks," [Online]. Available: https://www.mdpi.com/2071-1050/13/4/2225.

[31] "Euro 7 Standard Final," ICCT, 2024. [Online]. Available: https://theicct.org/wp-content/uploads/2024/03/ID-116-%E2%80%93-Euro-7-standard_final_v2.pdf.

[32] "Total Cost of Ownership Trucks Europe," ICCT, 2023. [Online]. Available: https://theicct.org/publication/total-cost-ownership-trucks-europe-nov23/.

[33] "Low Viscosity Lubricant," NACFE, [Online]. Available: https://nacfe.org/research/technology/powertrain/low-viscosity-lubricant/.

[34] "Engine Oil Viscosity," Geotab, [Online]. Available: https://www.geotab.com/blog/engine-oil-viscosity/.

[35] "Global truck driver shortage to double by 2028," IRU, 2023. [Online]. Available: https://www.iru.org/news-resources/newsroom/global-truck-driver-shortage-double-2028-says-new-iru-report.

[36] "Construction," Exol Lubricants, [Online]. Available: https://www.exol-lubricants.com/what-are-oils-and-lubricants-used-for-in-construction/.

YOUR TRANSFORMATIONAL GROWTH JOURNEY STARTS HERE

Frost & Sullivan's Growth Pipeline Engine, transformational strategies and best-practice models drive the generation, evaluation, and implementation of powerful growth opportunities.

Is your company prepared to survive and thrive through the coming transformation?

Join the journey. ➜

Gulf | FROST & SULLIVAN