Fuel Economy in Road Fleets: A Practical Perspective

Preamble

The term “fuel economy” is traditionally biased toward internal combustion engine (ICE) vehicles. As the fleet industry begins to embrace electric vehicles (EVs), the more encompassing term “energy economy” becomes relevant. Regardless of terminology, the fundamental questions remain: How much energy do we use? What work do we get in return? And, crucially, at what cost?

Efficiency relates to physical conversion: energy in vs. work out. Economy relates to financial performance: cost vs. work done. These concepts, while related, are distinct. In every aspect of fleet energy economy, context matters. There are no universal truths in fleet management, only locally optimal strategies.

Energy Input

Fuel Theft

Fuel theft remains a persistent issue across fleet operations. Based on decades of industry experience, I’ve come to believe that fuel is being stolen in every fleet — it’s only a matter of whether you’ve discovered it. While this is not unique to Africa, the scale is magnified here due to socio-economic conditions.

The anti-theft industry thrives on this reality. OEMs design anti-siphoning tanks, and aftermarket vendors sell every form of diesel cap lock imaginable. Yet the most insidious thefts are the ones where a small volume is skimmed consistently at each refuel. Drivers who deliver good fuel consumption figures may, ironically, be using their efficiency gains to mask siphoning.

Some counterstrategies I’ve observed include: - Refueling only at shift-end or at designated locations - Issuing pre-measured fuel rations based on expected consumption - Driver briefings that include a refueling protocol

Energy theft is harder with LPG, electricity, or hydrogen, providing a subtle benefit when shifting away from diesel. This hidden gain is rarely included in EV TCO calculations, but it should be.

CAN Bus Monitoring

Most modern trucks allow access to fuel tank logs via the CAN bus. These logs can detect sudden drops in fuel level and tag the location via GPS. This is an essential tool in managing fuel economy and detecting theft.

Vehicle Design Considerations

Weight

It takes energy to move mass. Every additional kilogram — whether it's a bull bar, extended fuel tank, or aero kit — increases energy use, especially when climbing. These additions also reduce the available payload.

Rotational mass exacerbates the issue. This is why aluminium wheels are common in efficiency-focused applications. A rule of thumb in vehicle dynamics is that 1 kg of rotational mass at the wheel is roughly equivalent to 1.5–2 kg of static mass. So, an 80 kg reduction could feel like 120–160 kg in terms of energy savings during acceleration. This becomes especially valuable in urban stop-start conditions or hilly terrain, where frequent acceleration magnifies the effect.

Aerodynamics

Above 50 km/h, rolling resistance takes a back seat and aerodynamic drag becomes the dominant force working against motion. The power required to overcome aerodynamic drag increases with the cube of speed — doubling your speed increases the power needed by a factor of eight. This makes drag the silent killer of fuel economy, especially on highways or long-distance intercity routes.

The drag force F_d is defined by the equation:

$$F_d = C_d A \frac{1}{2} \rho V^2$$

where:

- ρ is air density (approximately 1.2 kg/m^3 at sea level),
- A is frontal area in square meters,
- C_d is the drag coefficient,
- V is the velocity in m/s.

But what you pay for is not the force — it's the power (energy per second), and that scales with V^3:

$$P = F_d V = \frac{1}{2} \rho A C_d V^3$$

This means that small increases in cruising speed — say from 85 km/h to 95 km/h — can result in disproportionately higher fuel use.

The two levers you have are frontal area and drag coefficient. While C_d is mostly dictated by the OEM's cab and trailer design, the operator can easily make it worse. A common issue is an oversized roof fairing that extends far above the trailer, catching air like a sail. I've seen trucks with over a metre of gap between fairing and trailer — a guaranteed efficiency penalty.

As a benchmark:

- A typical tractor-trailer (reefer) without aerodynamic treatment might have a C_d of 0.96.
- Adding a roof fairing can bring that down to ~0.76.
- With side extenders and underbody treatments, you might achieve 0.70 or better.

Each 0.1 reduction in C_d can reduce fuel consumption by about 3–5% at highway speeds. Over the lifespan of a vehicle doing 120,000 km annually, that's a lot of litres saved — and a lot of money unburned.

Aerodynamic aids help — to a point. My long-term test of vortex generators showed no statistically significant improvement.

Context matters: we don't apply aero kits to weight-limited payloads. They are most effective on high-speed, volume-limited routes.

Emissions Equipment

Euro 4–6 exhaust treatment systems are heavy and introduce exhaust flow resistance. Cleaner air doesn't come free — these systems increase fuel use. "Clean" is not "Green" from an energy economy standpoint.

Energy Conversion: Motor Efficiency

Combustion vs Electric Motors

Petrol engines are around 20–30% efficient, diesel slightly better at 30–45%. EV motors often exceed 90% efficiency. Combustion engines have narrow optimal rpm bands and require complex transmissions. EVs operate across wide rpm ranges and need no clutch or torque converter.

More complexity means more loss: every heat exchanger, exhaust system, or transmission component dissipates energy. The simplicity of electric drivetrains is a strong efficiency argument, even before energy cost is considered.

Energy Storage and Supply

Fuel vs Battery

Fuel tanks get lighter as they empty. Batteries do not. This is a permanent efficiency penalty for EVs. Hydrogen fuel cells offer a different pathway but come with issues like hydrogen embrittlement. Still, these technologies often reduce theft risk and idle emissions.

Driving Behavior

The Learning Curve

Fleet operators must plan for a learning curve — not just for drivers but also for planners and technicians. Standardizing the fleet helps manage this.

Driver Training & Telematics

Modern OEMs offer advanced coaching systems: Renault's Optifuel, Volvo's Dynafleet, Mercedes EcoSupport, Scania Driver Support. These tools: - Identify drivers who need coaching - Quantify improvement post-training - Reduce maintenance costs through smoother driving

Green Band Driving

Most trucks highlight a "green band" on the tachometer — the engine speed at which specific fuel consumption is lowest. If you don't have an SFC map, estimate it as the mirror image of the torque curve. This is where the engine does the most work for the least fuel.

Eco Roll

Advanced gearboxes now include Eco Roll functions, where the truck shifts to neutral on descents to reduce engine drag. Combined with predictive cruise control and GPS-based terrain mapping, this can significantly lower energy use.

Regenerative Braking

EVs can recover 10–30% of braking energy through regenerative braking. While not perfect, this reduces overall energy cost and brake wear. Some systems use supercapacitors to further enhance recovery. Also keep in mind that you can only recharge the batteries until they are full, then regen is not available.

Route Planning & TCO

Optimal routing reduce fuel through minimized idling, elevation changes, and stops. It also reduces time — more trips per shift, better revenue. Refueling strategy matters too: zone pricing and rebates can shift the optimal fuel stop.

Energy economy must be considered within the broader Total Cost of Ownership (TCO). A 2 L/100 km improvement over 400,000 km saves 8,000 litres. At R24/litre, that's R192,000 — multiplied across a fleet, the impact is enormous.

More importantly, unlike capital cost, energy economy can be improved mid-lifecycle. That makes it a powerful lever in fleet cost control.

Final Thoughts

Energy economy is not about chasing theoretical efficiency. It's about reducing the real cost per unit of work done, in your context, with your constraints. From drag coefficients to driver behavior, every detail matters — and every detail should pay its way.

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Fuel Economy in Road Fleets: A Practical Perspective
From diesel theft to drag coefficients, energy costs are shaped by more than just engine choice. In this article, we explore how design, driving behavior, and technology intersect to influence fuel economy—and why every detail should pay its way. Whether you're managing ICE trucks or transitioning to electric fleets, this is a field guide to making energy economy work in your real-world context.