20 years of truck fuel efficiency – what progress?

methodological note

Truck CO_2 emissions are the fastest growing segment of land transport emissions in the EU. Trucks account for around 3 % of vehicles but are responsible for 25% of EU road transport emissions. This share is increasing. If current trends continue, by 2030 trucks will account for almost 40% of road transport emissions. The main reasons for this increase are the growing demand for freight transport combined with a stagnation of truck fuel efficiency.[1]

What are our sources?

The stagnation of truck fuel efficiency is well attested in scientific literature, including in:

- ACEA's 2010 briefing on Commercial Vehicles and CO_2
- The 2010 Truck Study for Shell
- The 2014 European Commission Communication on HDV CO_2
- The 2015 HDV market study by the ICCT
- The continuing survey of heavy goods vehicles by the UK Department for Transport

The ACEA briefing, the Shell truck Study and the 2015 ICCT study are based on test results obtained from Last Auto Omnibus. Last Auto is a German trucking magazine that performs extensive real-world fuel consumption testing on a select number of HDVs over a set of different duty cycles each year. It has been doing this according to more or less the same methodology for decades. Last Auto data are used by industry and researchers and are understood to be one of the best available datasets.

The comparison confirms the general trend – i.e. stagnation - found in literature. It is not impossible that for some specific truck models the picture would look slightly different but the overall trend is relatively clear: limited or no progress. Indeed, for most vehicle pairs the comparison would show similar results (little or no progress).

What is the comparison based on?

Transport & Environment has compiled a database of all the vehicles that were tested by Last Auto Omnibus between 1994 and 2016. The database values are the ones published in the original print magazines, as consulted in the 'Teilbibliothek Maschinenwesen' of the TU München in March-April 2016.

What were the criteria for selecting the truck pairs?

The comparison in the "20 years no progress" brochures was conducted after consultation with independent truck industry experts. After consultation with these experts we identified different pairs of comparable trucks. The criteria for the comparison are that the pairs should:

- Be of the same brand
- Serve the same purpose: long haul operations
- Be tractor trailer truck with 4x2 axles
- Have comparable engine **size** (where possible between 11 and 12 litres) – we did not do the comparison based on engine power since power has steadily increased over

[1] European Commission, Strategy for reducing heavy-duty vehicles' fuel consumption and CO2 emissions, 2014. http://ec.europa.eu/clima/policies/transport/vehicles/heavy/docs/com_285_2014_en.pdf

the last 20 years [TNO 2013, p23]. It is therefore representative for an average truck to be more powerful today than they were 20 years ago.

- Same test weight, similar test speed

How was fuel consumption between truck pairs compared?

The fuel consumption comparison could be based on two criteria, overall fuel consumption and highway fuel consumption. We opted for the second criterion for the following reasons.

1. **Overall/average fuel consumption over the Last Auto long haul duty cycle:**
   A comparison based on "overall" fuel consumption shows the fuel efficiency of the selected trucks had worsened considerably between 1994-1995 and 2014-2015. However, last auto omnibus has changed its long haul duty cycle in 2010. Because of construction works and bans on truck transit the original test track was no longer appropriate and since 2010 trucks are tested on a new route. It is not entirely clear what impact this has had – to our knowledge there haven't been any comparative tests - but in its April 2014 edition Lastauto Omnibus magazine states that the new track, because of the different topography, may be responsible for one to two litre extra fuel consumption per hundred kilometres. For this reason we recognise that the tests before and after 2010 are not exactly comparable. Another reason to be cautious about the 'overall fuel consumption' is that there are differences in average vehicle speed between the pairs. This is why we chose to base the comparison on part load fuel consumption.

2. **Part load fuel consumption (Teillastverbrauch).**
   The part load fuel consumption is measured during regular driving in more the less flat highway parts (always the same stretches). This part of the consumption is measured at a speed of around 85 km/h normally in 12th gear. Whilst there are small differences between the individual part load tests -in the 1990s tests were sometimes performed at 80km/h and/or 90km/h) – it does provide a more solid basis for comparison as this is a test that is consistent and comparable over time. In addition, the selected vehicles are tractor trailers which generally spend a lot of their time driving on highways. Also, highway driving will not be as significantly affected by the increase in power (Kw, HP) that took place between 1995-2015. As shown in different T&E hand-outs and the table below, part load fuel consumption stayed relatively stable for most vehicles during the 1995-2015 period.

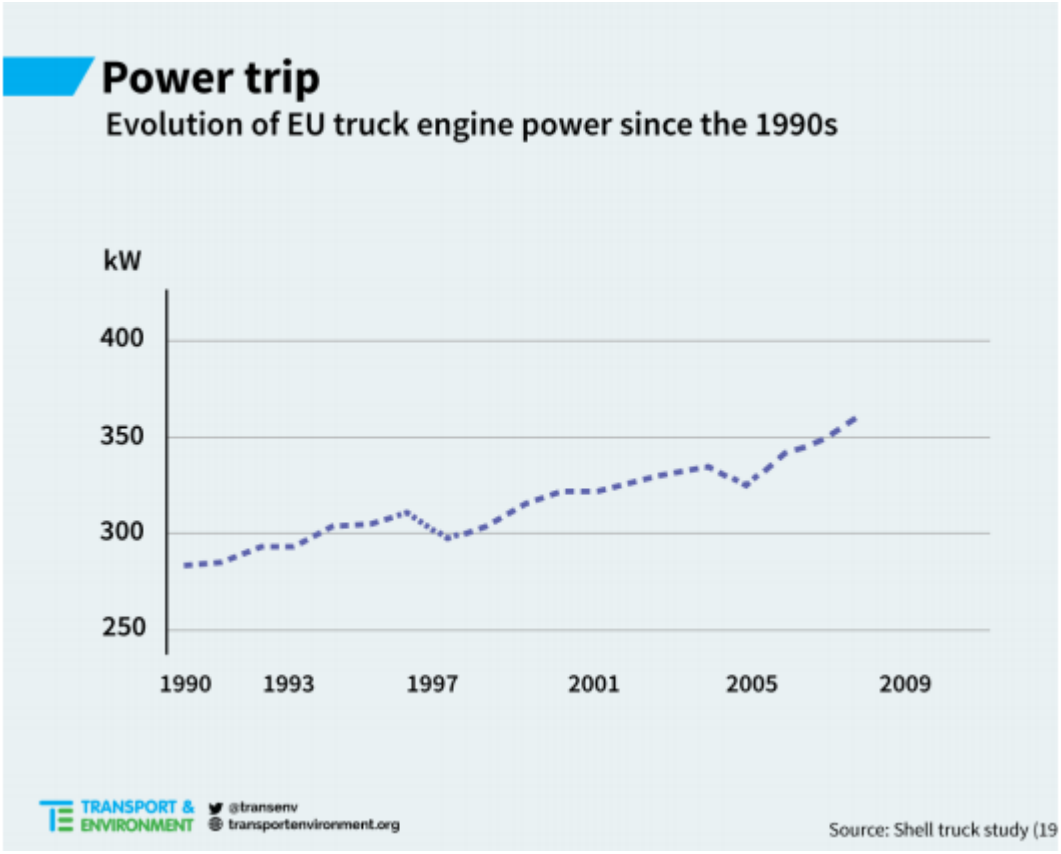
Have trucks not improved at all since 1995?

Over the last 20 years trucks have undergone some changes. The most important one is the reduction in air pollutant emissions. The EURO I-VI standards have forced truckmakers to reduce PM, NOx and other emissions drastically. With the introduction of EURO VI and a tougher compliance regime (in-service conformity testing) these improvements also appear to have materialised in real driving conditions. Truck safety too has improved. EU and UN regulations have mandated underrun protection, indirect vision and improved cab strength. Truck are now also fitted with emergency braking and stability control systems.

Safety and air quality improvements were mostly driven by regulation whilst truckmakers 'voluntarily' enhanced the performance and comfort of their vehicles. A 2015 study by ICCT[2] confirms earlier

[2] ICCT, Overview of the heavy-duty vehicle market and CO2 emissions in the European Union, December 2015. http://www.theicct.org/overview-heavy-duty-vehicle-market-and-co2-emissions-european-union

findings of TNO and shows truck engine power has increased steadily since the mid-1990s. This additional power has improved the driveability of modern trucks but has also led to increased fuel consumption. With regards to fuel consumption and CO_2, truckmakers have developed new technologies but these do not appear to be standard on new vehicles.



Manufacturer	Model	Year	"Part load" fuel consumption (l/100km)	"Overall" fuel consumption (l/100km)
DAF	FT 85.400 295kW, 11600cc	1996	20	32.9
	XF440 FT 320kW, 10800 cc	2014	20.8	35.6
MAN	19.403 FLS, 294kW, 11967cc	1995	19.9	30.4
	TGX 18.480 353kW, 12419cc	2014	22.7	37.03
Mercedes	1838LS 280kW, 14638cc	1994	24,2	35.8
	1863LS 460W, 15569cc	2014	22,7	35.8
Scania	R113 MA 400A, 295kW, 11000cc	1994	21.4	34.7
	R450 LA 331 kW, 12700 cc	2014	21.78	37.15
Volvo	FH12/340 250kW, 12100cc	1995	23.2	34.7
	FH460 338kW, 12800cc	2014	22.79	37.15