Briefing Paper

ROAD TRANSPORT FUELS IN THE UK

Executive summary

- The transportation sector is expected to continue to rely on petroleum products for the vast majority of its energy needs to 2035 and beyond.
- Despite increases in traffic levels, transport GHG emissions have been on a reducing trend owing to vehicle efficiency gains and the contribution made by high-performance petroleum-derived fuels. Improvements in air quality have also been made through substantial investment in the production of cleaner petrol and diesel, which has enabled new engine and exhaust clean-up technologies in vehicles. However, non-compliance with the Ambient Air Quality Directive persists in some areas with regard to NO_x limits.
- The recently implemented Euro 6 standard, including the new Worldwide Harmonized Light Vehicles Test Procedure (WLTP) and Real Driving Emissions (RDE) testing, will make significant reductions in real life NO_x emissions and lead to greater conformity with emission standards under real-world conditions.
- The number of non-or-uncertain compliance zones is expected to decrease, with residual non-compliance areas evolving from large contiguous areas to discrete islands. Therefore, the implementation of other targeted, specific mitigation measures in non-compliant urban zones could include:
  - explicit measures, such as support for the turnover of the vehicle fleet in order to accelerate the uptake of EURO 6/RDE compliant vehicles
  - a targeted use of low or ultra-low emission zones in a technology neutral way
  - targeted measures – including retrofitting – for fleets operating in urban areas, such as buses and taxis
  - checks on vehicle maintenance and removal from the road of the most polluting and poorly maintained vehicles.

Today, different sectors of the economy rely on certain forms of energy with transportation being largely fuelled by oil. Transport is essential in our modern society to move goods, people and services and affordable mobility is intrinsically linked to economic growth. In the UK, the transportation sector currently accounts for 38%[1] of final energy consumption and relies on petroleum products to meet 96% of its energy needs. Looking to tomorrow, refined petroleum fuels will continue to be fundamental in powering the UK's mobility and will be equally indispensable to our economic future. To 2035 and beyond, it is forecast that petroleum products will continue to meet ~92%[2] of our transport sector energy needs, due to a combination of factors such as their comparatively low cost and an established infrastructure. In addition, no other transportation fuel provides more energy by volume than gasoline and diesel or is more easily stored as an energy source in cars and lorries.

Motoring in the UK

The Department for Transport estimates that 320 billion[3] vehicle miles were travelled on Great Britain's roads in the year ending September 2016, with total traffic 1.8% higher than the pre-recession peak of 2007. Rolling annual motor vehicle traffic has continued to increase each quarter in succession for the past fifteen quarters due to a number of factors, including population growth, personal travel choices and a growth in demand for goods and services. Over the last twenty years, traffic has increased across all vehicles types, with car traffic increasing by 12%, van traffic by 70% and lorry traffic by 5.5%.

Figure 1: Rolling annual and quarterly indices of road traffic in Great Britain, from 1993[4]

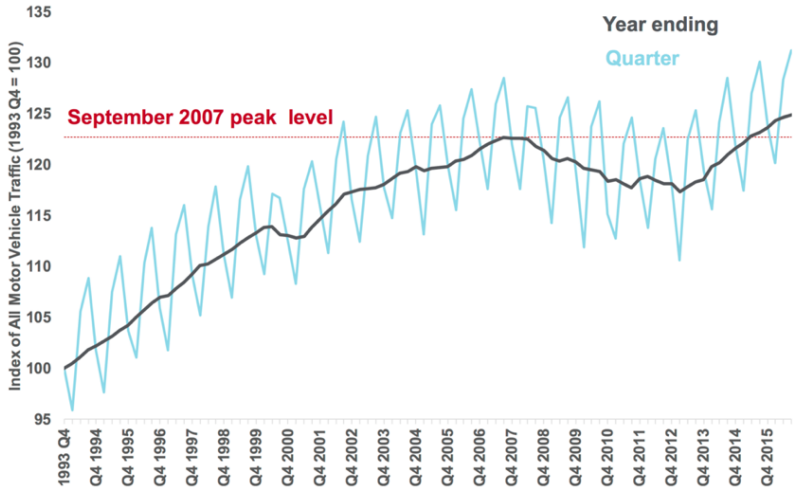


Figure 2: Share of traffic by vehicle type in 2016[5]

1 BP, *Energy Outlook*, 2016

2 Department for Business, Energy & Industrial Strategy (BEIS), *Updated energy and emissions projections (including international aviation*, 2016

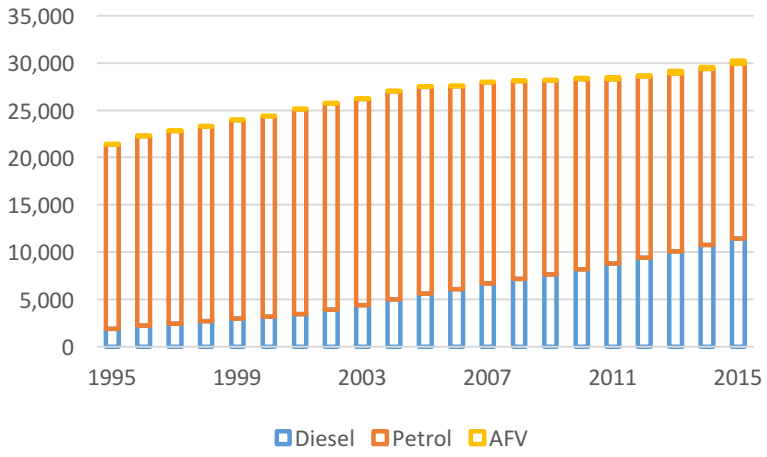
3 DfT, *Provisional Road Traffic Estimates Great Britain: October 2015 - September 2016*. Cars and taxis: 249.4 billion vehicle miles. LGVs: 48.2 billion vehicle miles. HGVs: 17.1 billion vehicle miles. Other: 5.4 billion vehicle miles.

4 DfT, *Provisional Road Traffic Estimates Great Britain: October 2015 - September 2016*

5 DVLA, *Driving Licence Data*, 2016

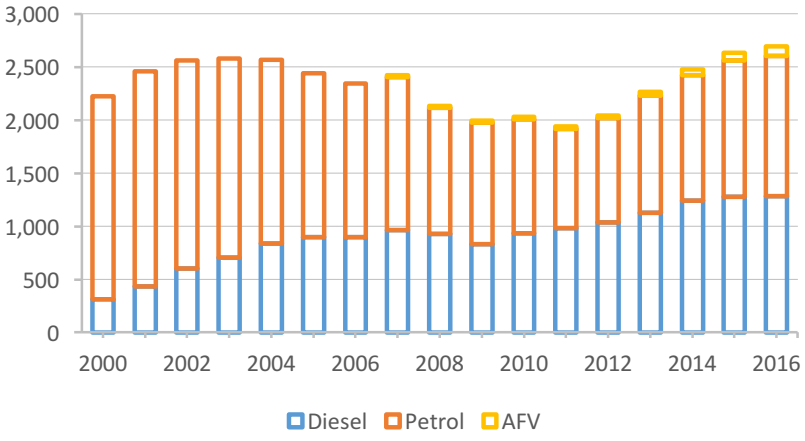
Currently, petrol and diesel powered vehicles account for 99% of the UK's passenger car fleet, with petrol cars representing 61.2% of the total and diesel vehicles 37.8%.

Figure 3: Licensed cars in Great Britain by fuel type 1995-2015 (thousand)[6]



To 2035, petrol and diesel cars are estimated to continue to account for just under 90% of total new car registrations across Europe[7]. At present, they account for the vast majority - about 97% - of all new cars sold in the UK, with the balance made up of LPG, other gas and electric vehicles. On average, 2 to 2.5 million new cars are registered every year and typically a vehicle will remain in the car parc for a period of 12 years.

Figure 4: UK new passenger car registrations – 2006 to 2016 (thousand)[8]



Across Europe, in around two thirds of Member States, registrations of new passenger cars powered by diesel engines have outnumbered new petrol powered cars for a number of years[9]. However, the future is uncertain, with signs of a trend reversal. In the UK, diesel vehicle registrations have been on an upward trend until recently, when their share in the new registrations of passenger cars fell below that of petrol cars for the first time since 2011.

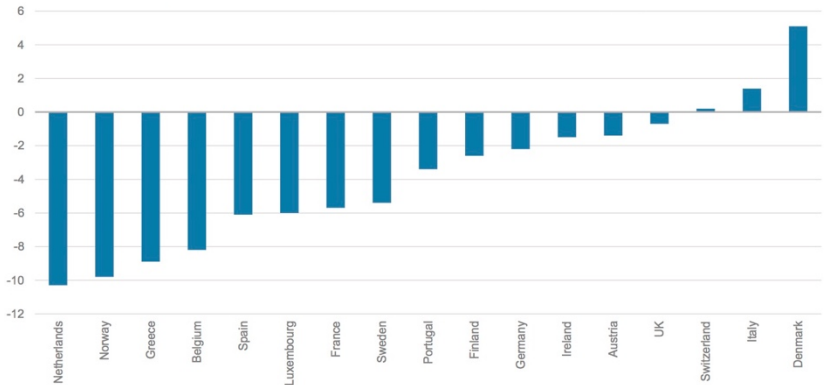
6 SMMT, 2017

7 Wood Mackenzie, 2016

8 SMMT, 2017

9 Eurostat, 2016

Figure 5: New diesel car registrations in 2016 (on-year change %)[10]



Road fuels demand

Principally owing to a fiscally driven dieselisation of the private car fleet and a marginal growth in commercial diesel consumption, diesel demand has been increasing steadily for the past three decades and now accounts for over 63% of total road fuel sales in the UK. Current retail sales of diesel fuel are about twice as high as those for the inland commercial sales market.

Figure 6: Road fuel sales[11]

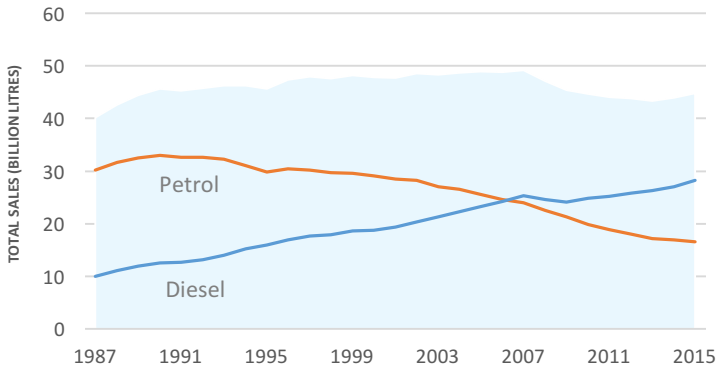
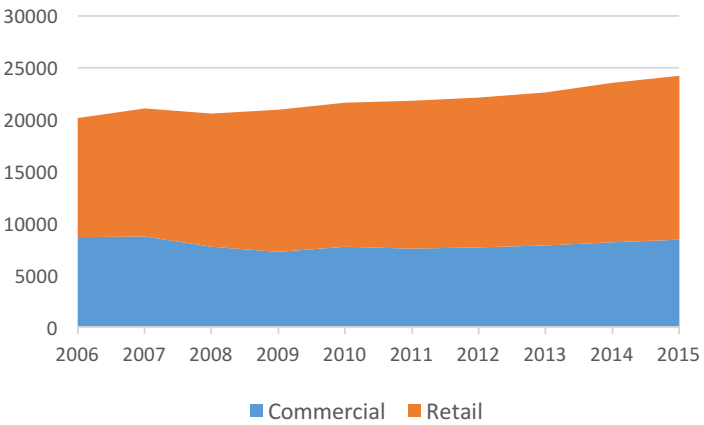


Figure 7: UK diesel consumption (Kt) – commercial and retail[12]



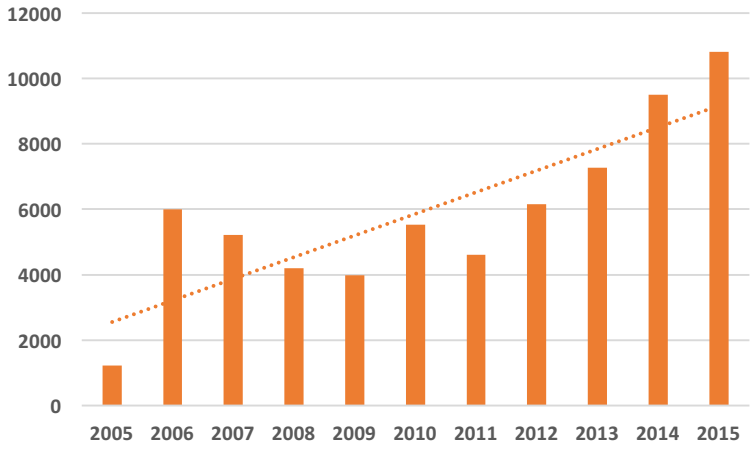
10 Platts/LMC Automotive, 2016

11 BEIS, *Digest of United Kingdom Energy Statistics (DUKES)*, 2016

12 Ibid.

This has created a substantial imbalance with refining output: the UK has only six refineries remaining and they are unable to produce sufficient volume to cover this demand. For this reason, significant diesel imports (48% of demand) are now required to maintain the UK's diesel supply/demand balance while, at the same time, the UK exports surplus petrol production.

Figure 8: UK net imports of diesel fuel (Kt)[13]

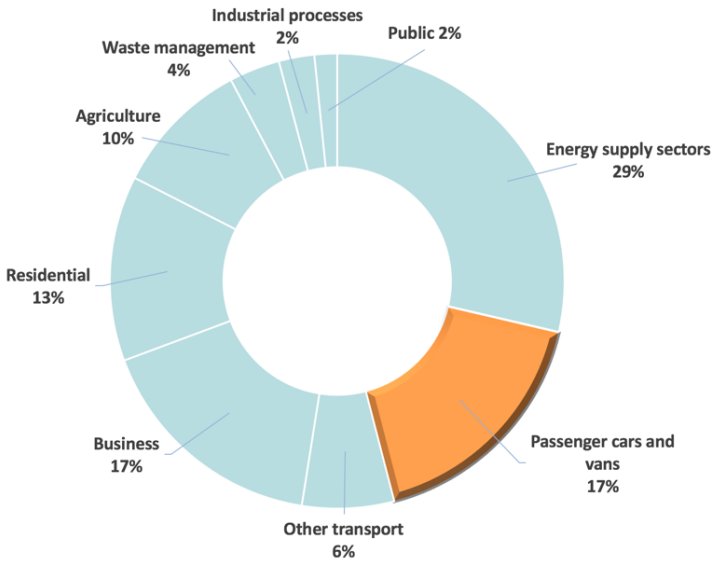


However, diesel demand is expected to peak in 2017 before declining to 2008/09 levels by 2035[14], also owing to greater vehicle efficiency gains.

GHG emissions from transport

All transport fuels and energy will produce GHGs to a varying extent based on the emissions generated during the lifecycle. In the UK, transport is responsible for about a quarter of GHG emissions by source, with passenger cars and vans accounting for 17% of total emissions. Transport GHG emissions have been on a reducing trend owing to vehicle efficiency gains, which have been achieving significant improvements, and the contribution made by high-performance petroleum-derived fuels.

Figure 9: Cars and vans account for 17% of greenhouse gas emissions in the UK[15]



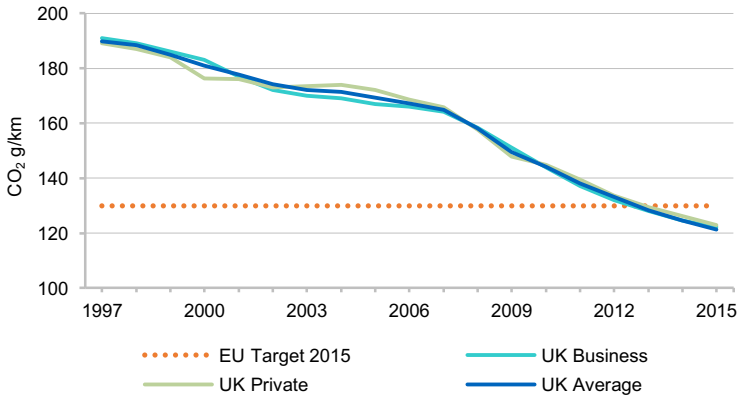
13 BEIS

14 Wood Mackenzie, 2016

15 BEIS, *UK greenhouse gas emissions statistics*, 2015

The potential for further increases in carbon efficiency for the internal combustion engine is also far from being exhausted. Together with improvements in the motor itself, the oil industry is continuously investing in R&D for ever more efficient fuels and ever lower friction lubricants. Further improvements in these technologies, along with a renewal of the vehicle fleet and smarter mobility behaviour, will play an important role in delivering further reductions in GHG emissions.

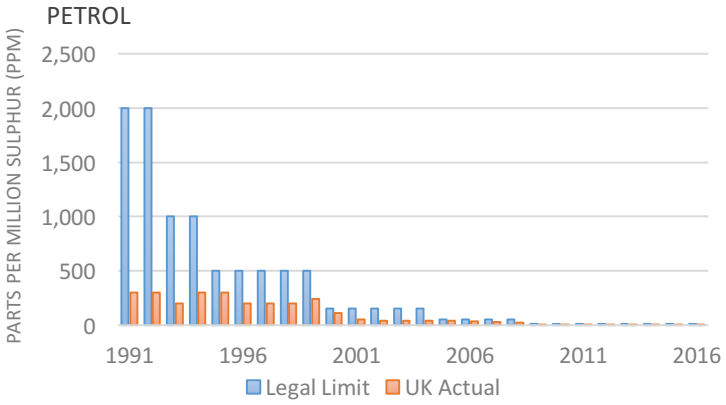
Figure 10: New car fleet average CO_2 emissions[16]

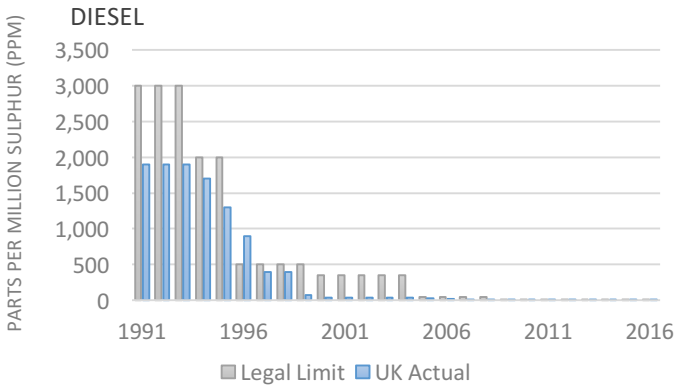


Urban air quality and emissions from transport

One of the key drivers for the oil industry is reducing the environmental impact of fuels. Since 1990 road fuels and vehicles have become significantly cleaner, resulting in much lower exhaust emissions despite increases in traffic levels.

Figure 11: Road fuels have been virtually sulphur free since 2009[17]



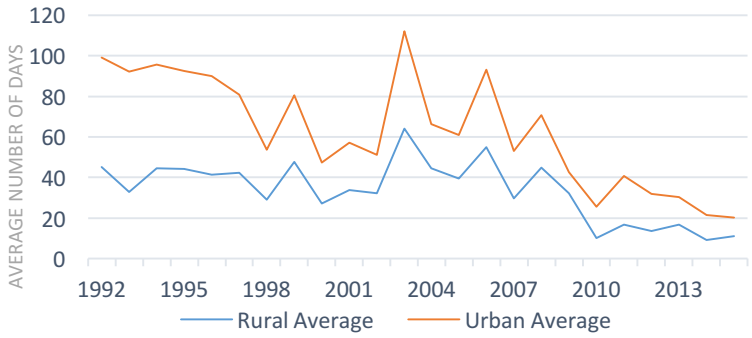


16 SMMT/European Commissions, 2015

17 BEIS/UKPIA, 2016

While significant improvements in air quality have been made, non-compliance with the Ambient Air Quality Directive persists in some areas, in terms of specific ambient air quality limit values being breached either occasionally or more recurrently. Air pollution in urban areas has fluctuated over time, but there has been a general long-term decline in high air pollution days both at urban and rural motoring sites. The variability of weather from year to year also plays an important role - with ozone formation increasing in warm, still and sunny conditions - along with transboundary sources (as in the hot summers of 2003 and 2006).

Figure 12: Number of days when air pollution is moderate or higher[18]



In the UK, road transport accounts for 14% of primary emissions of particulate matter (PM) and 32% of nitrogen oxide (NO_x) emissions.

Figure 13: Sources of primary particulate matter (PM)[19]

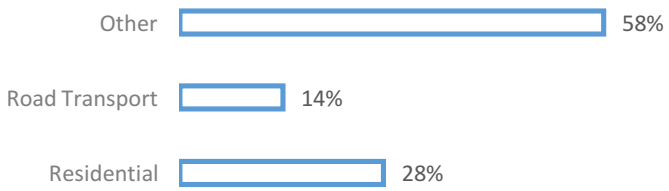
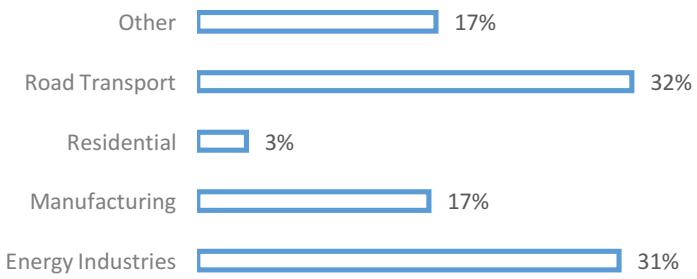


Figure 14: Sources of NO_x[20]



The implementation of Euro standards, in particular from Euro 4 onwards, has dramatically reduced PM levels from diesel vehicles. These reductions have occurred in both real driving conditions and official certification tests.

18 Department for Environment, Food & Rural Affairs (DEFRA)

19 DEFRA

20 Ibid.

Figure 15: Diesel PM - Euro 6 v Euro 1 standards[21]

30 new diesel cars emit less PM than

1 new diesel car in 1994

Looking ahead, it is estimated that primary PM emissions from road transport will continue decreasing and, by 2020, the majority of these will consist of non-exhaust emissions from tyres, break wear and road abrasion (whether from an internal combustion engine or electric motor).

Figure 16: Contribution from road to transports to total PM emissions EU27 – Kt (% of total)[22]

		2015	2020	2025	2030
PM_{10}	**Road transport exhaust emissions**	**77 (4%)**	**38 (2%)**	**21 (1%)**	**15 (1%)**
	Road transport non-exhaust emissions	149 (7%)	186 (9%)	199 (11%)	208 (11%)
$PM_{2,5}$	**Road transport exhaust emissions**	**77 (5%)**	**38 (3%)**	**21 (2%)**	**15 (1%)**
	Road transport non-exhaust emissions	50 (4%)	53 (4%)	54 (5%)	56 (5%)

While Euro standards have not replicated the same level of NO_x reductions in official certification tests and real driving conditions, the recently implemented Euro 6 standard[23], including the new Worldwide Harmonized Light Vehicles Test Procedure (WLTP) and Real Driving Emissions (RDE) testing, will make significant reductions in real life NO_x emissions and lead to greater conformity with emission standards under real-world conditions.
The number of NO_2 limit non-or-uncertain compliance zones is expected to decrease, with residual non-compliance areas evolving from large contiguous areas to discrete islands[24]. Therefore, the implementation of other targeted, specific mitigation measures in non-compliant urban zones could include:

- explicit measures, such as support for the turnover of the vehicle fleet in order to accelerate the uptake of EURO 6/RDE compliant vehicles
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In building a transport system that addresses climate and air quality issues, and one that also remains effective and competitive for businesses and individuals, a full range of options will have to be pursued: from lower carbon fuels and vehicles, to measures aimed at improving the efficiency of traffic demand, infrastructure, as well as driving behaviour. Maintenance checks, especially to support air quality improvement, should also form part of considerations. Above all, policies should be cost effective, technology neutral and predictable to avoid disadvantaging businesses and consumers alike.

21 Eucar

22 Aeris Europe, *Urban Air Quality Study*, March 2016

23 In Euro 6, the NO_x limit for light duty diesel vehicles declines from 0.18 g/km to 0.08 g/km, a reduction of 56% from Euro 5. Explicit NO_x limits were introduced at the Euro 3 level, and in the Euro 6 standards the NO_x limit is 84% lower than the Euro 3 level. The Euro 6 NO_x standards for gasoline cars are the same as those for Euro 5 (0.06 g/km), but they are 60% lower than those for Euro 1.

24 Aeris Europe, *Urban Air Quality Study*, March 2016