Road fuel consumption and the UK motor vehicle fleet

Key points

In the UK, road transport accounts for more than half of oil demand in the UK and relies on petrol and diesel to meet around 98 per cent of its energy needs. Demand is met through a combination of production and imports; the UK is a net importer of diesel but a net exporter of petrol.

Historically, consumption of petrol was greater than diesel until the end of 2004, which marked a period of crossover. Demand for petrol had until very recently decreased each year since 2000, whereas demand for diesel has increased in 17 of the last 19 years.

The number of diesel-fuelled vehicles has nearly trebled between 2001 and 2018, primarily because of an increase in the number of diesel-fuelled cars and LGVs. In the same period the number of petrol vehicles has decreased by 14 per cent.

Diesel has accounted for around two-thirds of road fuel consumption since 2014, but in a recent reversal of the trend of growth, diesel consumption excluding biodiesel fell in 2018 for the first time since 2009. This is partly a result of slowing growth in the diesel vehicle fleet following sharp drops in new registrations as well as increased efficiencies.

The UK will remain reliant on imports to meet road diesel demand in the near to mid-term future but will diversify propulsion methods of road transport including Electric and Ultra Low Emissions Vehicles over the next few decades.

Background

This article draws together data on road fuel consumption from the Department of Business, Energy and Industrial Strategy's Energy Trends and DUKES publications, along with vehicle data from the Department of Transport (DfT) to explore trends in and between the size and composition of the vehicle fleet, miles travelled, and demand for road fuels.

More than half of oil is consumed for road transport purposes in the UK, amounting to just over 36 million tonnes in 2018[1]. Overall demand for road fuel has been generally stable since 2001, however within this there are distinct patterns for petrol and diesel consumption. Demand for petrol has reduced by 40 per cent whereas demand for diesel has increased by 60 per cent since 2001. The size and mix of the UK car fleet, in addition to changes in fuel efficiency and miles travelled are the primary factors influencing demand for fuels.

Historic supply and demand of road fuels

Consumption of imported oil products took off in 1945, rising steadily until the 1973-4 oil supply crisis. Imports were gradually replaced with indigenous production of crude oils following the major discoveries in the North Sea at that time. UK refineries, generally built in the 1960s, peaked at 23 in operation by 1970 and were built to meet post-war demand for fuels that catered for a recovering economy, including increasing (generally petrol) car ownership and fuel oil for power generation.

[1] DUKES Table 1.1-1.3, Aggregate Energy Balances (Chapter 1): https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/729420/DUKES_1.1-1.3.xls

Special feature - Road fuel consumption and the UK motor vehicle fleet

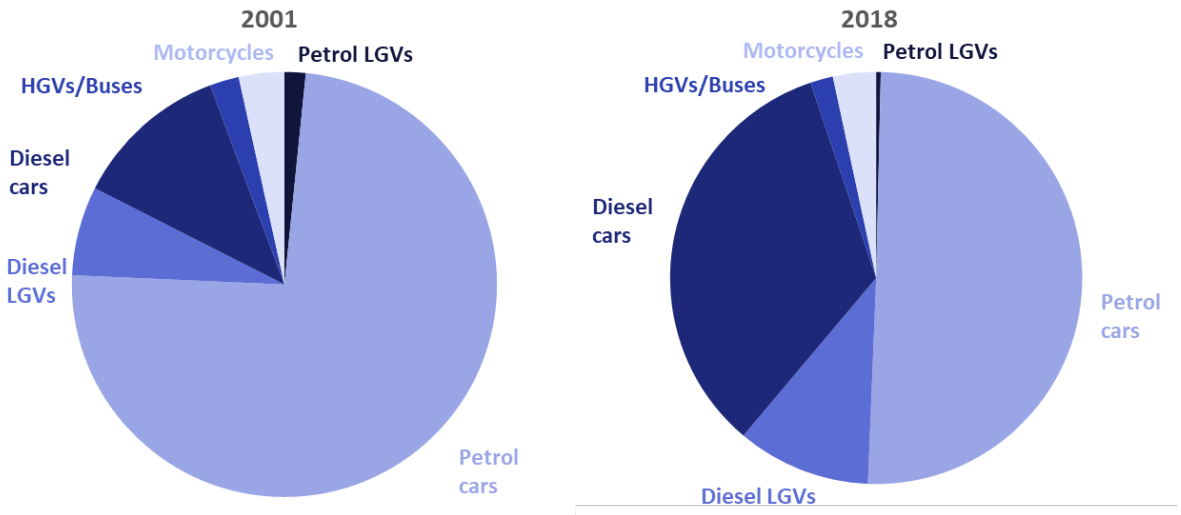
Over recent decades passenger modes of transport have changed dramatically, with more than 80 per cent of journeys completed in cars, vans and taxis in 2017 compared to just 27 per cent in 1952[2]. Road travel has trebled since 1952, and by 2017 stood at 718 billion passenger kilometres.

A growing and changing UK motor vehicle fleet

Reflecting the increasing distances travelled by motor vehicle, the size of the UK vehicle fleet has increased nearly every year since the end of WW2, and by 2018 had grown by more than a quarter compared to the end of 2001 and now stands at 39.4 million vehicles[3].

However, within the overall increase there are distinct patterns for petrol and diesel vehicles. Diesel vehicles have more than doubled on 2001 to 18.9 million, whilst petrol-fuelled vehicles have decreased 15 per cent to 19.3 million[3].

Chart 1: The UK motor vehicle fleet 2001 and 2018



Source: DfT Vehicle statistics (https://www.gov.uk/government/statistical-data-sets/all-vehicles-veh01)

Of note are the increases in the number of diesel-fuelled cars and Light Goods Vehicles (LGVs), or vans. This increasing share of the fleet was at the expense of petrol cars and vans, which in 2018 comprised less than half of the fleet compared to nearly three-quarters in 2001. The proportion of the fleet that is motorcycles and Heavy Goods Vehicles (HGVs) has remained relatively constant.

The composition of the fleet is affected by government policy and new registrations. We can consider the effect of these factors to explain the shift from petrol to diesel vehicles between 2001 and 2018.

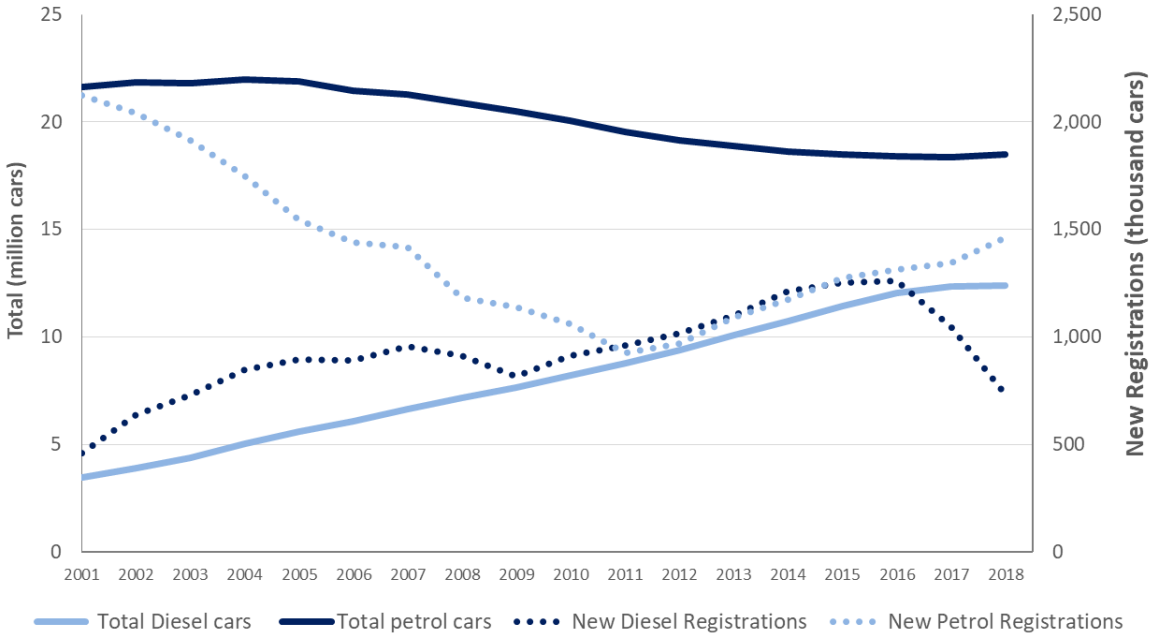
Cars and Vans

In 2001 when petrol vehicles formed 79 per cent of the fleet (Chart 1), a reduction in excise duty was introduced for vehicles with lower emissions of carbon dioxide. Diesel vehicles therefore became cheaper because they tend to be more efficient than their petrol equivalents, meaning they emit less carbon dioxide. The immediate impact was felt in a 38 per cent increase in the number of new diesel registrations in 2002[4] (Chart 2).

[2] Table TSGB0101, Passenger transport: by mode, annual from 1952; https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/762074/tsgb0101.ods
[3] DfT Vehicle statistics: https://www.gov.uk/government/statistical-data-sets/all-vehicles-veh01
[4] Vehicle Licensing Statistics (https://www.gov.uk/government/collections/vehicles-statistics)

A further policy, the Vehicle Scrappage Scheme for cars and vans, helped to boost registrations between May 2009 and April 2010 following the dip in new registrations during the 2008 recession (Chart 2). The scheme encouraged motorists to scrap their older models in favour of purchasing newer more environmentally friendly vehicles. At the time it was still considered that diesel engines emitted fewer pollutants because of their fuel-efficiency, and it can be seen from Chart 2 that subsequently diesel car registrations exceeded those of petrol cars for the first time in 2011.

Chart 2: New car registrations and size of the car fleet, 2001 to 2018



Source: DfT Vehicle Licensing Statistics (https://www.gov.uk/government/collections/vehicles-statistics)

These policies combined to encourage motorists to scrap their old car or van in favour of purchasing a new one, and to choose a diesel-fuelled engine when doing so. However, it has since become known that diesel engines emit nitrogen dioxide and particulates more heavily than petrol engines. The announcement in the Autumn 2017 Budget that diesel vehicles that did not meet new emissions testing criteria would be taxed more heavily was followed by a sharp fall in new registrations of diesel vehicles, down by nearly one-fifth in 2017 and nearly one-third in 2018 (Chart 2).

The fall in new diesel registrations has slowed the growth of the diesel car fleet, with a move towards increasing purchases of petrol cars. In 2018, the number of petrol cars increased for the first time since 2004 while growth of the diesel car fleet fell to its lowest in the past two decades.

A similar trend can be seen in the LGV, or van, fleet. Vans consistently form around 10 per cent of the total vehicle fleet and in 2001 around a fifth were petrol-fuelled; this had fallen to three per cent in 2018 (Chart 1). This was likely a result of efficiency improvements in diesel engines in addition to the 2001 budget, which introduced a new system of vehicle tax to make it cheaper for vehicles with lower emissions of carbon dioxide, resulting in lower VED rates for diesel vehicles.

Other vehicles

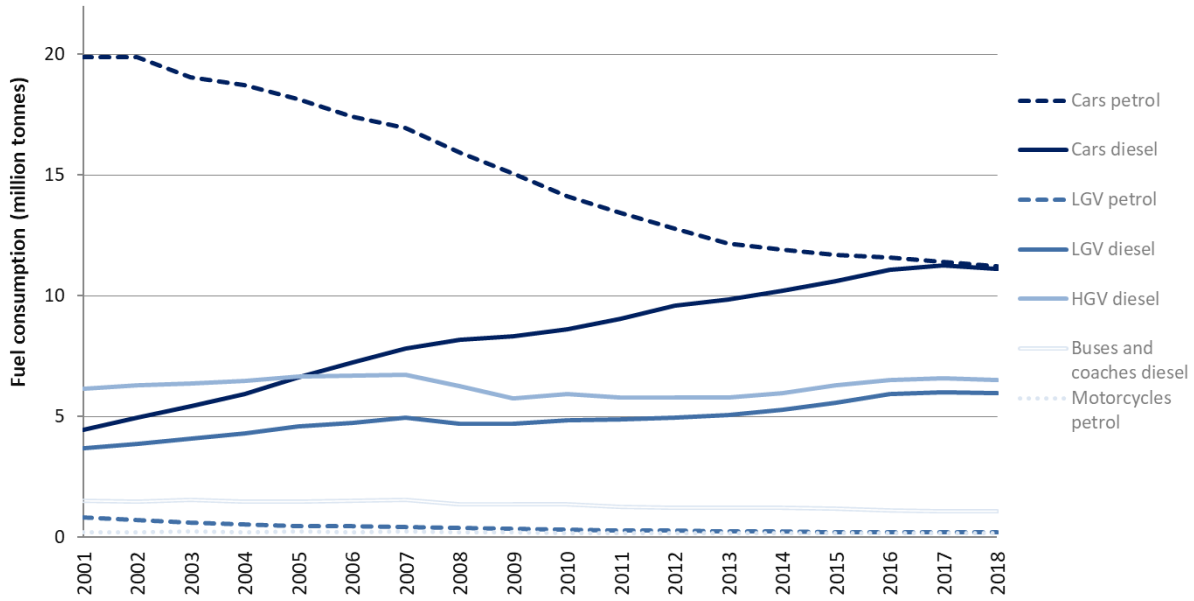
Numbers of buses, coaches and HGVs, which use exclusively diesel owing to the amount of torque which can be generated at lower speeds and their fuel efficiency, have remained relatively constant since 2001. Almost all motorcycles consume petrol owing to diesel engines having a high compression ratio which requires a stronger, sturdier and thus heavier engine. Motorcycles in the UK have increased by around 28 per cent to 1.2 million since 2001.

Changing patterns in road fuel demand

Total demand for road fuels been relatively stable over the last two decades at an average 37 million tonnes, except for a slight downturn in 2008 during a period of economic recession (covered in more detail under section 'Miles travelled'). Overall demand has grown by 2.3 per cent, but within this the rise in the number of diesel-powered vehicles means that diesel demand has increased by 60 per cent to reach 25.6 million tonnes and the decline in the number of petrol vehicles has resulted in a reduction of demand by 40 per cent to reach 12.2 million tonnes.

Given that cars and vans comprise more than 90 per cent of the UK vehicle fleet, changes to the numbers of these vehicles unsurprisingly affects the demand for fuel types (Chart 3).

Chart 3: Fuel consumption by vehicle type



Source: BEIS DUKES Table 3B, Estimated consumption of road transport fuels by vehicle class;
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/729403/Ch3.pdf

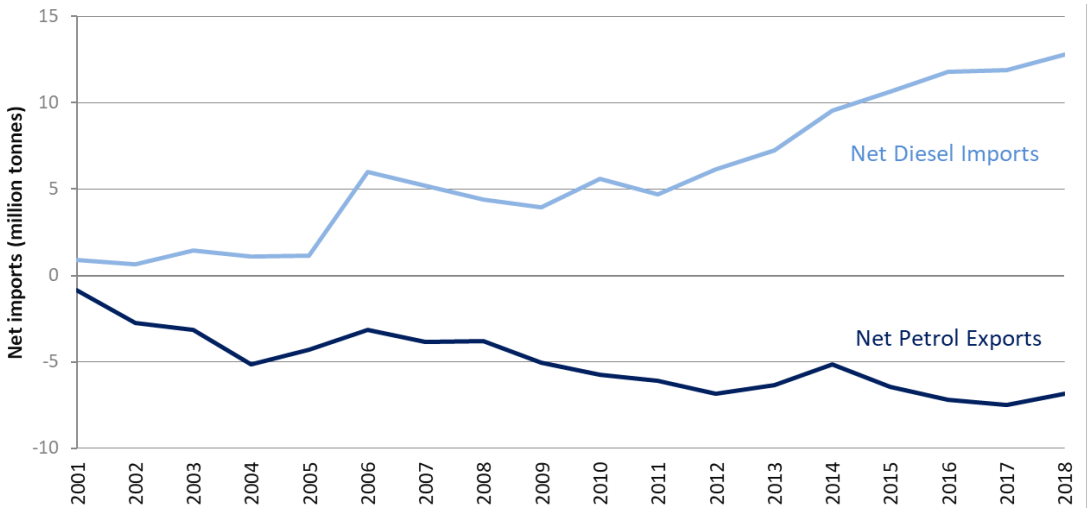
The switch to diesel by almost all the LGV fleet has driven an increase in demand for diesel of two-thirds. Conversely, demand for petrol by LGVs fell by three-quarters and now stands at only 0.2 million tonnes. Demand by HGVs and buses has remained relatively stable, aside from the downturn in 2008 during the recession.

Changing patterns of road fuel supply

Road fuel demand in the UK is met by a combination of imports and indigenous production from UK refineries. The UK has some of the largest refineries, and one of the largest total refining capacities in the EU but changing demand for different fuels has led to a shortfall in certain products from UK refineries. Global prices have led to downward pressure on refinery margins; the refining sector has been rationalised to six major refineries and two smaller refineries, following the closure of the Coryton refinery in 2012 and Milford Haven in 2014. Refinery production of both petrol and diesel has decreased by almost a quarter since 2001, meaning that the UK has become increasingly reliant on imports to meet demand.

Investment in UK import capacity has been strong, and the UK is a net importer of diesel (Chart 4). Diesel imports have nearly trebled between 2005 and 2018, with nearly half coming from EU member countries[5]. This meant that by 2018, 59 per cent of demand was met by imports compared to 16 per cent in 2005.

Chart 4: Net trade of road fuels



Source: Energy Trends (https://www.gov.uk/government/statistics/oil-and-oil-products-section-3-energy-trends)

With regards to petrol, UK refinery output has outstripped petrol demand despite falling demand, leading to a surplus of petrol. As such, the UK is a net exporter of this fuel (Chart 4). Exports have more than doubled since 2001[6] and petrol exports comprise almost a half of all product exports, particularly to countries such as the United States, Netherlands and Belgium.

A key dissociation since the end of 2001 has been the increase in road fuel demand by 2.3 per cent despite the substantially larger increase in the total fleet size by more than a quarter. This could be due to the combination of changes to road fuel prices, miles travelled, and efficiencies.

Prices

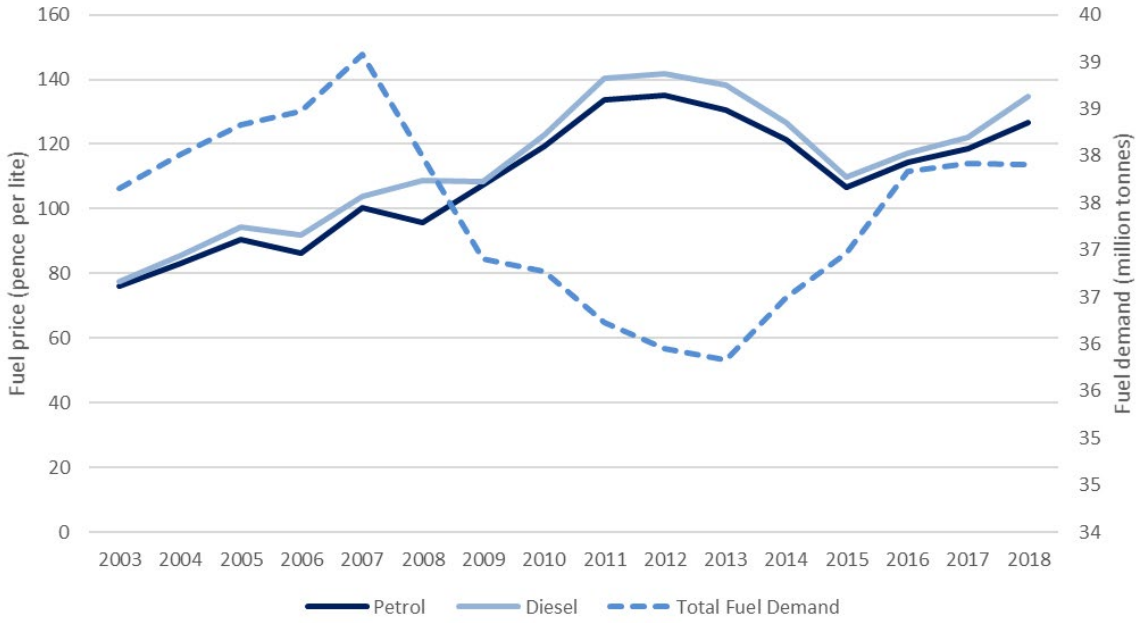
The price of road fuels tends to be correlated with global crude oil prices, and as such major disruptions to global supply dictate UK prices. The price of diesel per litre increased by two-thirds and petrol by three-quarters between the end of 2003 and 2018[7], but the trend is complicated by the impact of the 2008 recession on demand. Demand for fuel fell in 2008, and prices continued to increase until 2013. Chart 5 shows that there is some relationship between changes to prices and demand, but the direction of causation cannot be inferred; it is possible that either higher prices mean people travelled less in their cars, or that prices were higher because demand was reduced by other factors (exploration of which is outside the scope of this article).

A slight widening can be seen between diesel and petrol prices in 2018. Diesel had cost roughly 2 to 3 pence per litre more than petrol since 2015, but towards the end of 2018 the differential widened to see diesel being approximately 8 pence per litre more expensive. This was because supermarket forecourts competed to reduce petrol prices to draw in customers towards the end of 2018.

[5] DUKES Table 3.9, Imports of crude oil & petroleum products by country of origin: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/728478/DUKES_3.9.xls
[6] Energy Trends: https://www.gov.uk/government/statistics/oil-and-oil-products-section-3-energy-trends
[7] BEIS weekly road fuel prices: https://www.gov.uk/government/statistical-data-sets/oil-and-petroleum-products-weekly-statistics

In 2018, supermarkets (Asda, Morrisons, Sainsbury's and Tesco) provided 47 per cent of all petrol, and 30 per cent of diesel.

Chart 5: Fuel price and road fuel demand



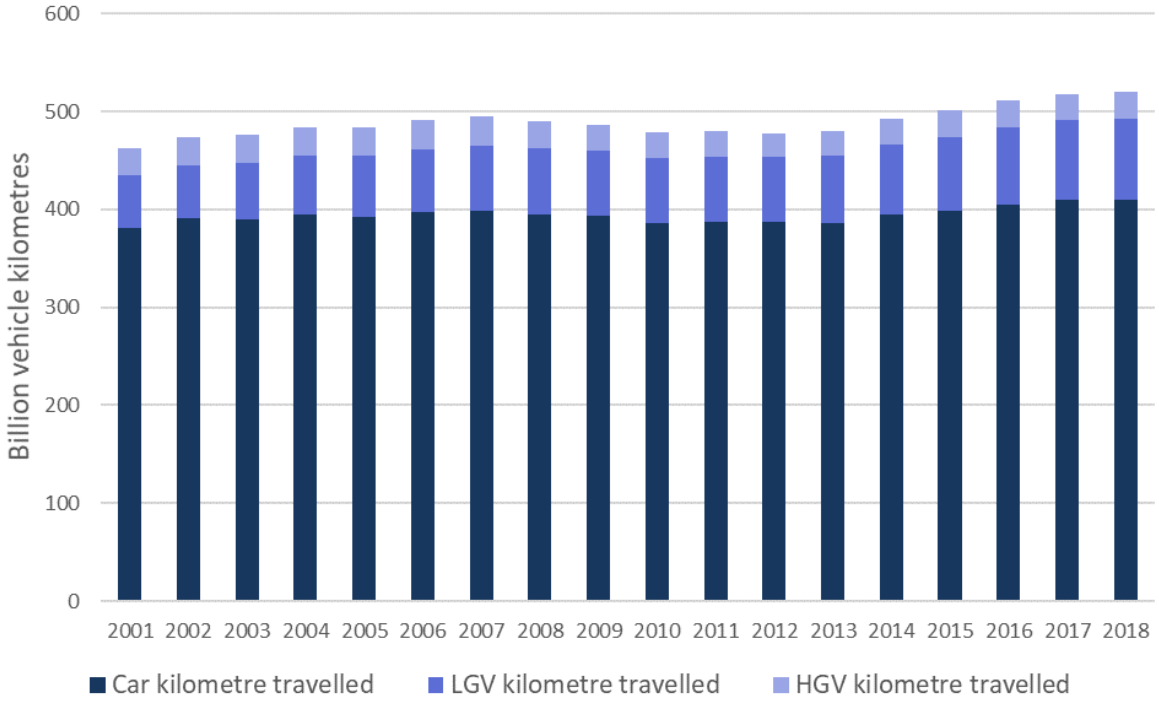
Source: Energy Trends (https://www.gov.uk/government/statistics/oil-and-oil-products-section-3-energy-trends)
DfT Road traffic statistics: (https://www.gov.uk/government/collections/road-traffic-statistics)

Miles travelled

Vehicle distance travelled by all road vehicles has increased by 12 per cent since 2001. The main contributors have been an increase of 29.2 and 28.6 billion kilometres in annual distance travelled for cars and LGVs respectively, with LGVs increasing their annual distance driven by over a half.

The effect of the recession can be seen between 2008 and 2010, during which time distances travelled by all vehicles fell. This indicates that both discretionary and business travel fell.

Chart 6: Road traffic journey distances



Source: DfT Road Traffic statistics (https://www.gov.uk/government/collections/road-traffic-statistics)

Efficiencies

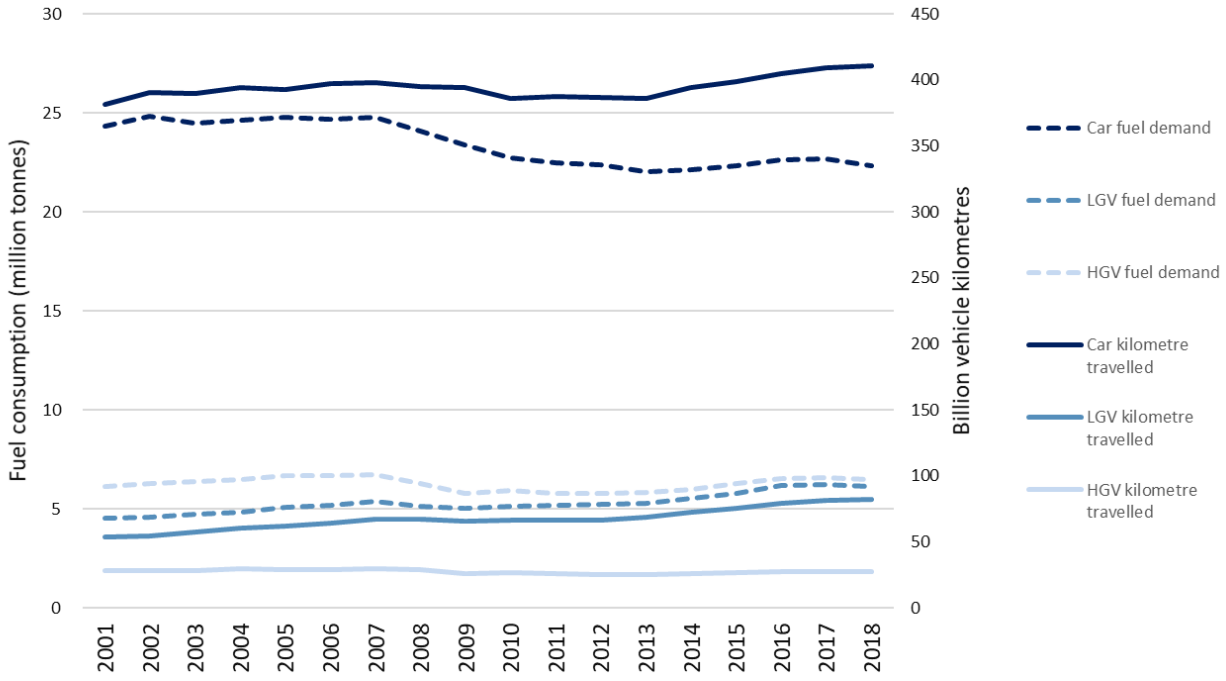
The relatively small increase in road fuel demand between 2001 and 2018 compared to the increase in the vehicle fleet by a quarter cannot be explained by miles travelled because this also increased by 12 per cent in the same period. Specifically, for car travel, demand for both road fuels has decreased by 8.2 per cent, while distance travelled has increased 7.7 per cent in line with an increase to the car fleet of more a quarter.

Energy intensity is the amount of fuel required for a kilometre of distance travelled. Distance travelled and fuel demand are not perfectly correlated because of changes to the efficiency of engines and vehicle design. The energy intensity of car travel has decreased as cars are able to travel further with less fuel (Chart 7).

Data available for cars shows that average miles per gallon achieved in new petrol cars has increased substantially since 2001[8]. New diesel cars are on average 34 per cent more efficient and able to achieve 61 miles per gallon, while new petrol cars increased in efficiency by 44 per cent and can attain 52 miles per gallon in 2018. There have been some efficiency improvements to specific types of HGVs[8], most notable an 8.7 per cent increase in miles per gallon achieved by HGVs between 3.5 and 7.5 tonnes between 2015 and 2016. However, real world efficiencies will further depend on driving conditions and styles.

[8] DfT Energy and Environment statistics (https://www.gov.uk/government/statistical-data-sets/energy-and-environment-data-tables-env)

Chart 7: Energy intensity of cars, LGVs and HGVs



Source: DUKES Table 3B: https://www.gov.uk/government/statistics/petroleum-chapter-3-digest-of-united-kingdom-energy-statistics-dukes
DfT Road traffic statistics (https://www.gov.uk/government/collections/road-traffic-statistics)

Outlook for demand and supply of fossil road fuels in the UK

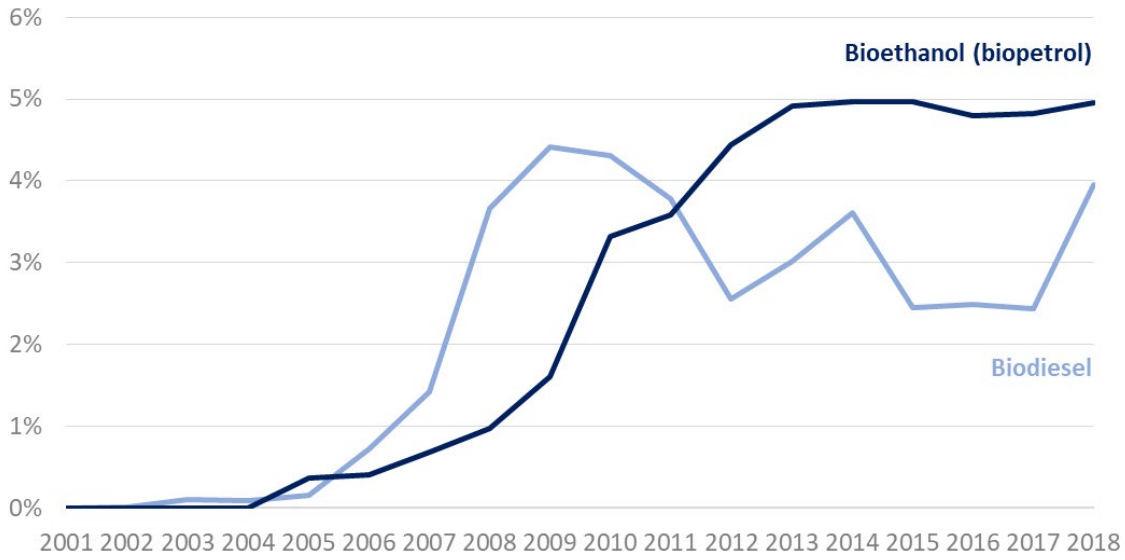
In the immediate to medium-term future the UK will continue to be reliant on imports to meet road diesel demand. In the period from 1999 to 2018, UK refinery production has fallen by a quarter (4.0 million tonnes) following closures and rationalisation in the sector in the last 10 years. In the same period demand has increased by 10 million tonnes to reach 25.6 million tonnes in 2018, with imports more than quadrupling from 3.4 million tonnes in 1999 to 14.4 million tonnes in 2018.

The story is very different for petrol. While production has fallen by a third, demand has fallen by nearly one-half meaning that the UK produces 35 per cent more petrol than is used here; exports of petrol comprise nearly half of all UK product exports. In recent developments, increased utilisation of refining capacity in the US resulting from extraction of tight oil has meant that this traditional export market has been contracting in recent years. In 2018 surplus petrol has instead been exported to alternative destinations, including a 60 per cent increase (to reach 3.0 million tonnes) to the Netherlands, which is then likely shipped elsewhere, as well as increasing volumes to the African market.

Within the UK itself, there is an emergent reversal of the trend of declining demand for petrol. Early indications in 2019 suggest that petrol demand is increasing and demand for diesel beginning to fall in the wake of media attention surrounding the fact that diesel engines emit particulates and nitrous oxides more heavily than petrol engines. Whereas diesel cars accounted for nearly half of all new registrations in 2016, by 2018 this had fallen to less than one-third. In 2018 we also saw the first increase in new petrol registrations, up 9 per cent. In the same year the proportion of the fleet that was diesel fuelled fell to 39 per cent from the peak in 2017 of 40 per cent as registrations of petrol and alternative fuel cars increased.

In the UK, road transport is responsible for about a quarter of greenhouse gas (GHG) emissions source, with passenger cars and vans accounting for 70 per cent of road transport emissions and nearly one-fifth of total emissions[9]. To support the government's policy to reduce pollution and emissions of greenhouse gases the Renewable Transport Fuel Obligation mandates suppliers of road fuels to meet minimum levels of biofuels in petrol and diesel supplied to the UK market[10]. Biofuels must be from renewable and sustainable sources, and the levels required by the obligation increase each year so that by 2032 around 12 per cent of total road fuel should be from sustainable sources.

Chart 8: Proportions of total petrol and diesel that came from a renewable and sustainable source, 2001 to 2018



Source: Energy Trends (https://www.gov.uk/government/statistics/oil-and-oil-products-section-3-energy-trends)

It can be seen from Chart 8 that the proportion of biofuel blended into petrol (bioethanol) has generally been steadily increasing as a share of total petrol since 2004. The series for biodiesel is much more volatile and appears to be more susceptible to changes in prices, the taxes imposed, and implementation of the Renewable Energy Directive in 2011, which restricts the proportion of biofuels that can be crop-derived[11].

Alternative propulsion engines

Among increasing concerns over the impact of road travel pollution on air quality and subsequent negative impacts on health, in 2017 Government announced a ban on all new conventional petrol and diesel cars and vans by 2040 as part of a wider plan to tackle emissions[12]. The Road to Zero strategy, published in July 2018, lays out ambitions to prompt growth in alternative fuel vehicles including ultra-low emission vehicles[13]. These include reducing emissions from existing vehicles (e.g. by increasing the use of low carbon fuels and retrofitting new technology as well as influencing driver

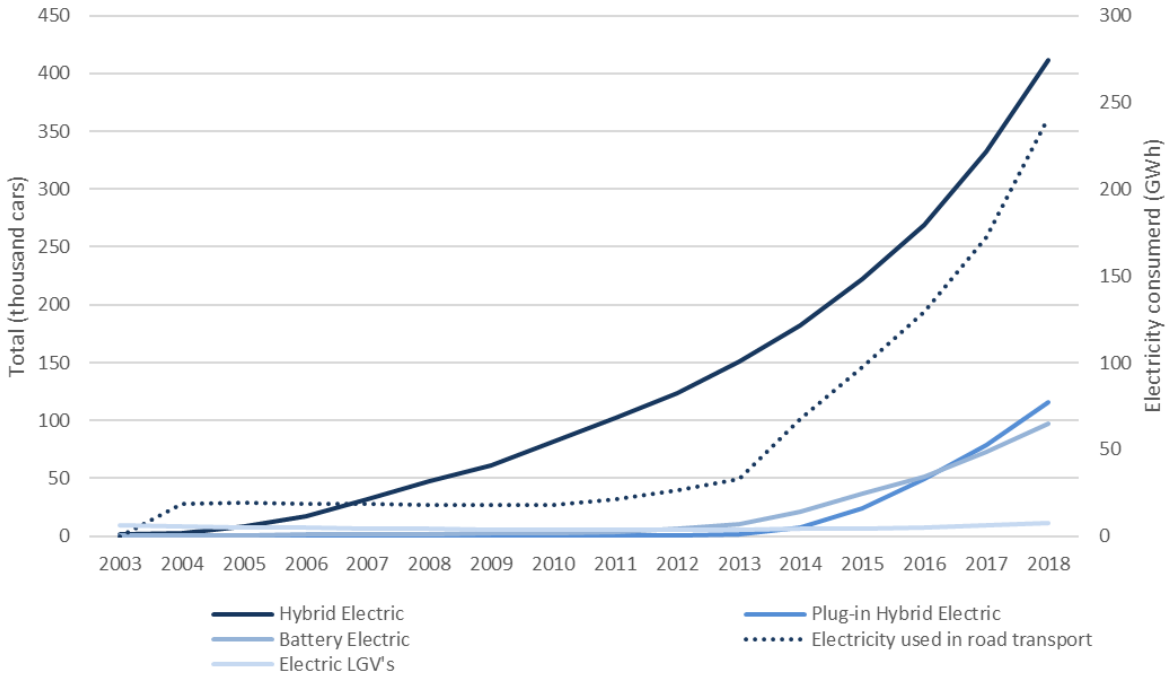
[9] https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-2017
[10] Renewable Transport Fuel Obligation https://www.gov.uk/guidance/renewable-transport-fuels-obligation
[11] Renewable Transport Fuel Obligation Process Guidance year 11
[12] Plan for roadside NO2 concentrations https://www.gov.uk/government/news/plan-for-roadside-no2-concentrations-published
[13] https://www.gov.uk/government/news/government-launches-road-to-zero-strategy-to-lead-the-world-in-zero-emission-vehicle-technology

behaviour); encouraging uptake of Ultra Low Emissions Vehicles (ULEVs); and developing the UK's Electric Vehicle (EV) charging infrastructure.

It is anticipated that EV sales will overtake diesel and petrol by the late 2030s, but to achieve the ambitions set out in the Road to Zero strategy the Government's response to the Business and Industrial Strategy Parliamentary Committee reported that investment will need to be promoted to overcome the obstacles to EV and ULEV adoption, including the relatively higher costs, the lack of charging infrastructure, and consumer concerns around having sufficient charge to complete a journey[14].

Nonetheless, the impact of government policies on vehicle registrations has already been seen in the overall fall in new car registrations over the last two years, and the sharp decreases in diesel registrations since 2017. New registrations of alternative fuel cars have been rapidly increasing since 2014.

Chart 9: Electricity consumed and the electric vehicle fleet



Source: DUKES Table 5.2 (https://www.gov.uk/government/statistics/electricity-chapter-5-digest-of-united-kingdom-energy-statistics-dukes)
DfT Vehicle licensing statistics (https://www.gov.uk/government/statistics/vehicle-licensing-statistics-2018)

While still forming a relatively small proportion of the vehicle fleet (around 0.5 per cent), in 2018 there were 620,000 licensed alternative fuel cars of which 200,000 were ULEVs. This sector has been rapidly growing and there were nearly 40 per cent more ULEVs at the end of 2018 compared to 2017 after 64,000 new registrations in 2018 – up one-fifth on the year before. The majority of these are plug-in hybrid electric or battery electric vehicles (Chart 9), and many of these purchases were supported by the Plug-In Car Grant[15].

While the UK is one of the world leaders in terms of developing technologies to reduce emissions, in particular from road transport, existing barriers to EV and ULEV adoption make it likely that petroleum fuels will continue to play a fundamental role in transport in the near to medium term

[14] https://publications.parliament.uk/pa/cm201719/cmselect/cmbeis/383/383.pdf
[15] https://www.gov.uk/plug-in-car-van-grants

future, with estimates that around 90 per cent of energy needs in this sector will still be met by petroleum fuels in 2035[16].

User Feedback

Please send any comments or queries regarding this analysis to the contact details below:

Nick Jesson

Oil&Gas.Statistics@beis.gov.uk

Tel: 0300 068 5346

Main data Sources

Road fuel consumption figures are published monthly in Energy Trends Table 3.13: https://www.gov.uk/government/statistics/oil-and-oil-products-section-3-energy-trends

Consumption of road transport fuels by vehicle class are published in DUKES, Table 3B in Chapter 3: https://www.gov.uk/government/statistics/petroleum-chapter-3-digest-of-united-kingdom-energy-statistics-dukes

Vehicle licences, registrations and kilometres travelled are published by the Department of Transport; VEH0101, VEH0253, VEH0203; VEH0403; TRA0201:

https://www.gov.uk/government/collections/vehicles-statistics

https://www.gov.uk/government/collections/road-traffic-statistics

[16] Energy emission projections, Annex F: https://www.gov.uk/government/publications/updated-energy-and-emissions-projections-2018