SMMT
DRIVING THE
MOTOR INDUSTRY

NEW **CAR CO_2 REPORT** 2018

THE 17TH REPORT

EXECUTIVE SUMMARY

▶ 2017 was a challenging year for the automotive sector, caused by broader economic concerns and, in particular, uncertainty over Brexit, coupled with public concern and policy announcements about the air quality performance of diesel vehicles. This impacted on demand in the market and contributed to the first rise in average new car carbon dioxide (CO_2) emissions since SMMT began reporting at the turn of the millennium, up 0.8% to 121.0g/km. Ongoing improvements in efficiency and further growth in the market for battery electric, plug-in hybrid and conventional hybrid electric vehicles helped mitigate the rise – with the average new model in 2017 12.6% lower CO_2 emitting than the outgoing model it replaced. Average new car CO_2 emissions remain 33.1% lower than 2000 levels.

The rate of progress in average new car CO_2 emissions had moderated and then halted in 2017 – a result of shifts in the market, in particular away from diesel-fuelled cars, which typically offer a 15-20% improvement in CO_2 compared to petrol equivalents. In March 2017, the government announced a review of taxes on new diesel cars, which it then detailed in the November Budget 2017, to pay for mitigation measures under the National Air Quality Plan. While not due to take effect until April 2018, the announcement did have an immediate impact on diesel registrations. Diesel's market share fell to 42.0% from 47.7% in 2016 and from more than 50% in 2014. Consumers may have deferred their new car purchase altogether, or switched to a petrol model, both scenarios likely to be to the detriment of CO_2 emissions. Changing consumer vehicle preference was also ongoing in 2017, with demand for small cars such as Superminis down, whilst the Dual Purpose segment saw volumes rise. SMMT estimates that the impact of the segment shift accounted for around 55% of the rise in CO_2 emissions, with the drop in diesels around 45%. Without the increasing shift to alternatively fuelled vehicles in 2017, the CO_2 figure would have been around 0.4% higher.

Average new van CO_2 emissions fell by 4.8% in 2017 to a new low of 165.4g/km. This was a marked improvement from the rate in recent years and reflected a shift in market composition, away from the highest emitting products, bringing the UK level to below the pan-EU 2017 target of 175g/km.

2017 saw the introduction of important new test procedures for both CO_2 and air quality to provide consumers with better information on the environmental performance of new vehicles. A new test to determine a vehicle's CO_2 emissions was introduced in September 2017 for new model types, with all new cars on sale having to be type approved to the new test by September 2018. This new test procedure – called WLTP (World Harmonised Light-Duty Vehicles Test Procedure) – is designed to be more representative of the actual vehicle use and is based on real driver data. Its introduction will provide consumers with better information on an individual vehicle's CO_2 performance and help promote the message that using the right vehicle for the consumers' needs, as well as driving as efficiently as possible, can reduce the environmental burden and save money. Also, as of September 2017, all new models that are type approved must be compliant with the RDE (Real Driving Emissions) regulation – this should ensure that the latest cars deliver closer air quality performance to the laboratory test on the road (with a tolerance level to reflect testing equipment accuracy). As a package, these new regulations should address concerns around the CO_2 and air quality impact of new cars, including diesels, in real world usage.

Balancing air quality and CO_2 has long been a concern for the automotive industry and the sector is committed to reducing both pollutant and CO_2 emissions from vehicles. Improving the sector's environmental impact is a strategic priority. UK automotive seeks a consistent and technology neutral approach to policy, taxation and incentives on the transition to ultra-low and zero emission vehicles (ZEVs). The Autumn Budget announcement to increase tax from April 2018 on new diesels which do not meet a 2020 regulatory requirement was therefore disappointing, given that the latest diesel engine technologies are the cleanest ever and are also crucial in delivering manufacturers' and government's CO_2 targets. Whilst extra funding for electric vehicle infrastructure and consumer incentives for zero emission vehicles was welcome, the market is still at an early stage. Limiting any upfront purchasing incentive to battery electric and hydrogen-fuelled vehicles only would be premature with the risk of limiting consumer and technology choices at a time when it is paramount to grow and not constrain the emerging market for ultra-low and zero emission vehicles.

Meeting the pan-European 2020/2021 new car and van CO_2 targets looks ever more challenging, given recent market developments and government policy announcements. However, industry remains committed to achieve their targets, with improvements to conventional petrol and diesel powertrains, and increasing registrations of alternatively fuelled vehicles – hybrids (both conventional electric and plug-in electric) and battery electric vehicles. Most manufacturers have announced ambitious plans to ramp-up their electrified and/or hydrogen fuelled offerings, as well as make further progress in conventional petrol and diesel engine cars – which still account for more than 95% of the new car market.

In November, the European Commission put forward proposals for car and van CO_2 targets to 2030. These look challenging, especially the 2025 targets and setting the same level of ambition for vans as cars. The automotive industry believes that the UK market remaining in the EU regulation maintains a level playing field, provides greater flexibility to the industry and reduces the risk to consumers of getting limited product choice. Brexit does increase uncertainty for the sector, with the UK due to leave the EU in 2019 before the end of the current regulation.

Total CO_2 emissions from all cars in use fell by 7.4% between 2000 and 2016. However, they rose 2.1% in 2016 on 2015, and have risen in each of the past three years. This follows a rise in vehicle use, with distance travelled up 2.0% in 2016 on 2015 and 8.1% compared with 2000 (for all road transport, emissions have fallen by 1.3% since 2000, with distance travelled up 11.7%).

The renewal of the fleet and resulting shift from older technologies remains a key influence on emissions from the overall fleet. A new car is some 20% more efficient than the

average car in use. With new vehicles accounting for less than 8% of the vehicle fleet it takes over 12 years to renew the fleet. Alternatively fuelled vehicles represented 1.1% of the total car fleet in 2016, with all plug-in vehicles at just 0.2%, so the challenge for mass transition is huge and will require many different stakeholders to pull together to ensure it is as convenient and economically appropriate for consumers. Industry, as ever, looks forward to the challenge and working with other stakeholders to deliver upon it.

The automotive industry is spending billions of pounds to develop new technologies to reduce CO_2 and other environmental impacts of its products. Through collaborative partnership with key stakeholders, notably the government, the industry is transitioning to low, ultra-low and zero emission vehicles. This holistic, collaborative approach will remain key to progress and to ensuring the entire vehicle fleet consists of the cleanest, safest and most efficient vehicles. At the same time, industry has to continue to deliver desirable products that meet the demands of specific consumer types. In the short to medium term, this will include the latest petrol and diesel fuelled vehicles, hybrids and plug-in hybrids, and industry looks for a technology neutral approach to enable the market and consumers to decide which solutions best suit their needs. ■

CONTENTS

VEHICLE POWERTRAIN DEFINITIONS

(SEE SMMT ULEV GUIDE FOR FULL DETAILS):

Alternatively fuelled vehicle (AFV)
any non-internal combustion engined only vehicle

Internal combustion engine (ICE)
conventional petrol or diesel engine, including those adapted to operate on alternative or gaseous fuels

Battery electric vehicle (BEV)
or pure EVsolely powered by a battery charged from the electricity grid. They have zero emissions from the tailpipe, although some emissions maybe associated with the production of the electricity

Plug-in hybrid electric vehicle (PHEV)
vehicles with a combination of a battery rechargeable by plugging into an electricity source and an ICE

Electrically chargeable vehicle (ECV)
a BEV or PHEV, also known as plug-in vehicles

Hybrid electric vehicle (HEV)
is powered by an ICE, but has a battery and electric motors to capture and re-use braking energy

Fuel Cell Electric Vehicle (FCEV)
a hydrogen fuelled vehicle where electricity is produced through the fuel cell stack to power an electric motor, has no tailpipe CO_2 emissions

Ultra Low Emission Vehicle (ULEV)
an ultra-low emission vehicle produces 75g/km or less of CO_2 (under NEDC)

Zero emission vehicle (ZEV)
emits no CO_2 from the tailpipe, includes both EV and FCEV

Zero emission capable vehicle (ZECV)
ZEV and non-ZEV that can be used in zero emission mode, i.e. PHEV

GLOSSARY

BEIS	Department for Business, Energy, Innovation and Skills
CAZ	Clean Air Zone
CCT	Company Car Tax
CO_2	Carbon dioxide
DfT	Department for Transport
g/km	grams per kilometre
LCV	Light commercial vehicle
MPV	Multi-purpose vehicles
OLEV	Office for Low Emission Vehicles
NEDC	New European Duty Cycle
RDE	Real Driving Emissions
ULEZ	Ultra-Low Emission Zone
VED	Vehicle Excise Duty
WLTP	World harmonised Light vehicles Test Procedure

This report uses CO_2 figures from the official NEDC (New European Drive Cycle) laboratory test, which is required by law and witnessed by a government appointed agency. Real world performances may differ, due to a number of factors (such as driving style, weather conditions, vehicle load, congestion etc), which laboratory tests are designed to remove and so provide comparative figures. Since September 2017, a new laboratory test has been in place, known as the WLTP (World harmonised Light vehicles Test Procedure), which uses a different test cycle, designed to be more akin to typical driving patterns and with more clearly defined test procedures. By September 2018, all new registrations will need to comply to the new test cycle. This test is welcomed by industry and should help rebuild trust and confidence in the data supplied to consumers and other stakeholders. The test cycles are discussed in more detail later in the report.

SUMMARY

AVERAGE NEW CAR CO_2 EMISSIONS RISE 0.8% TO 121.0G/KM IN 2017

Full report can be accessed here: http://www.smmt.co.uk/co2report/#

TABLE1 | NEW CAR CO_2 PERFORMANCE AND MARKET SHARES

Year	CO_2 (g/km)	AFV (% share)	Diesel (% share)
2000	181.0	0.0	14.0
2007	164.9	0.7	40.2
2010	144.2	1.1	46.1
2015	121.0	2.8	48.5
2016	120.1	3.3	47.7
2017	121.0	4.7	42.0

- Average new car CO_2 emissions rose for the first time on record in 2017, up 0.8% from 120.1g/km to 121.0g/km. The 2017 performance remains 33.1%, or over 60g/km, lower than in 2000.
- Diesel volumes fell 17.1% in 2017 and their market share declined by more than five percentage points to 42.0%. Given diesels typically emit 15%-20% lower CO_2 emitting than petrol cars (with like-for-like performance) this market shift has adversely influenced fleet CO_2 performance.
- Further shift in new car segment type, particularly a net shift from the Supermini to Dual Purpose segment (which are on average 27.6% higher CO_2 emitting) also impacted on the overall market average.
- Alternatively fuelled vehicles (AFV) registrations rose by 34.8% in 2017 to 119,821 units. AFVs emitted on average 44% lower CO_2 than the market average. AFV registrations consistent of hybrid electric vehicles (HEVs), plug-in hybrid electric vehicles (PHEVs), battery electric vehicles (BEV) and fuel cell electric vehicles (FCEV). Registrations of HEVs rose by 40.0%, PHEVs by 25.5% and BEVs rose by 32.5% in 2017. HEVs, PHEVs and BEVs respectively made up 60.6%, 28.1% and 11.4% of the AFV market and 2.9%, 1.3% and 0.5% of the overall new car market in 2017.
- The average new light commercial vehicle (LCV, or van) emitted 165.4g/km in 2017, 4.8% below the 2016 level – in a significant pick up in the rate of improvement – and 16.6% down on 2011.
- Total CO_2 emissions from all cars in use fell by 7.4% between 2000 and 2016, as new vehicle efficiencies offset a 8.1% increase in vehicle use (for all road transport the figures were -1.3% and 11.7% respectively). However, emissions have risen in each of the past three years, reflective of the uplift in distance travelled.
- Fleet renewal remains key to the environmental performance of the overall vehicle fleet. A new car is some 20% lower CO_2 emitting than the average car in use. Further increasing the rate of fleet renewal would also give benefits to other emissions, as well as introducing the latest safety technology.
- The UK has some of the most challenging economy-wide CO_2 reduction targets in the world, including plans to decarbonise the vehicle fleet by 2050. Whilst vehicles using internal combustion engines will still have a strong role to play during this transition the sector is delivering an array of new technologies, moving towards zero emission capable vehicles. Mass transition will require collective action by a number of stakeholders to ensure these vehicles are affordable, convenient to use and desirable to the consumer. It is likely that a number of different technologies will have a role to play to meet the different array of consumer needs, across passenger cars as well as other vehicle types.

TABLE 2 | AVERAGE NEW CAR CO_2 EMISSIONS AND REGISTRATIONS

CO_2 g/km (sales weighted average)		2000	2007	2016	2017	2017 v 2016	2017 v 2000
	Total market	**181.0**	**164.9**	**120.1**	**121.0**	**0.8%**	**-33.1%**
	Registrations ('000s)	**2,222**	**2,404**	**2,693**	**2,541**	**-5.7%**	**14.4%**
BY FUEL TYPE	**Diesel**	167.7	164.3	120.1	122.0	1.6%	-27.3%
	Registrations ('000s)	313	967	1,285	1,066	-17.1%	240.3%
	Petrol	183.2	165.7	123.7	125	1.1%	-31.8%
	Registrations ('000s)	1,908	1,420	1,319	1,355	2.7%	-29.0%
	AFV	127.3	127.0	66.8	67.5	1.0%	-47.0%
	Registrations ('000s)	0	17	89	120	34.8%	33454%
BY SALES TYPE (STARTS 2001)	**Private**	**176.4**	**165.8**	**122.3**	**122.7**	**0.3%**	**-30.4%**
	Registrations ('000s)	1,212	1,046	1,206	1,124	-6.8%	-7.2%
	Fleet	**175.4**	**164.0**	**118.3**	**119.8**	**1.3%**	**-31.7%**
	Registrations ('000s)	1,031	1,195	1,381	1,319	-4.5%	27.9%
	Business	**195.0**	**165.9**	**119.0**	**118.8**	**-0.2%**	**-39.1%**
	Registrations ('000s)	214	163	106	98	-7.8%	-54.5%
BY SEGMENT	**Mini**	**153.8**	**128.5**	**105.5**	**105.9**	**0.4%**	**-31.2%**
	Registrations ('000s)	52	22	77	69	-10.1%	31.9%
	Supermini	**152.9**	**141.8**	**111.1**	**110.7**	**-0.4%**	**-27.6%**
	Registrations ('000s)	689	771	873	748	-14.3%	8.7%
	Lower Medium	**175.3**	**158.6**	**114.8**	**115.8**	**0.9%**	**-34.0%**
	Registrations ('000s)	662	722	735	728	-0.9%	10.1%
	Upper Medium	**192.4**	**169.1**	**119.0**	**120.5**	**1.3%**	**-37.4%**
	Registrations ('000s)	477	386	257	243	-5.4%	-49.1%
	Executive	**235.6**	**192.6**	**120.8**	**121.6**	**0.7%**	**-48.4%**
	Registrations ('000s)	105	104	128	123	-3.6%	17.8%
	Luxury	**292.3**	**273.8**	**182.4**	**178.9**	**-1.9%**	**-38.8%**
	Registrations ('000s)	11	13	11	9	-12.5%	-19.4%
	Sports	**220.5**	**224.0**	**161.4**	**155.0**	**-4.0%**	**-29.7%**
	Registrations ('000s)	67	66	50	48	-4.5%	-29.2%
	Dual Purpose	**259.4**	**228.3**	**141.4**	**141.3**	**-0.1%**	**-45.5%**
	Registrations ('000s)	99	176	438	460	5.1%	364.1%
	MPV	**211.0**	**179.7**	**128.7**	**132.0**	**2.6%**	**-37.4%**
	Registrations ('000s)	60	143	125	112	-10.7%	86.8%

HOW CO_2 DATA IS DERIVED

CO_2 data in this report is taken from the results of the official laboratory test for type approval figures, which is required by law and witnessed by a European or UK government-appointed agency. The data is collated by SMMT's Motor Vehicle Registration Information Service (MVRIS) and links vehicles' CO_2 levels to the MVRIS registration database to give average sales weighted data.

The CO_2 and MPG (miles per gallon) figure is stated on each vehicle's Certificate of Conformity (CoC) – the document used to demonstrate that the vehicle complies with all the necessary regulations. For new models that are type approved from September 2017, this data is derived from the new WLTP test (World harmonized Light vehicle Test Procedure), which will be used by all cars registered from September 2018. Prior to this switch NEDC (New European Driving Cycle) test data was used. Both tests are conducted in a laboratory over a prescribed drive cycle, to ensure comparability and enable consumers to make like-for-like comparisons between the CO_2 emissions of different vehicles. The WLTP test is undertaken over a new, more representative drive cycle over a longer distance, with a higher average speed and with more aggressive acceleration patterns, to better reflect actual vehicle use. The WLTP test is performed under strict procedures to bring the results closer to real driving, e.g. road load or resistance, gear shifts, vehicle weight, tyre type and pressure and ambient temperature. The new test cycle also takes almost 50% longer to complete and covers twice the distance of the old NEDC test (see Chart 1).

The new test is designed to give consumers fuel economy and CO_2 values more representative of actual vehicle use, but actual CO_2 emissions whilst in use by the consumer will be dependent upon a huge range of factors, including driving style, state of vehicle maintenance, vehicle load, traffic flow and the weather.

CO_2 data is used for a variety of different purposes, including CO_2-based motoring taxes, the new car label (point of sale label to show CO_2 and MPG of a car) and monitoring of manufacturers' performance under the pan-European new car (and van) CO_2 regulation. The changes in the test procedure will therefore have significant impacts. Given the different test route, acceleration patterns and speeds of the test, results under the WLTP are expected to be significantly higher than for the NEDC test for most vehicles. Some estimates suggest a 20% variation.

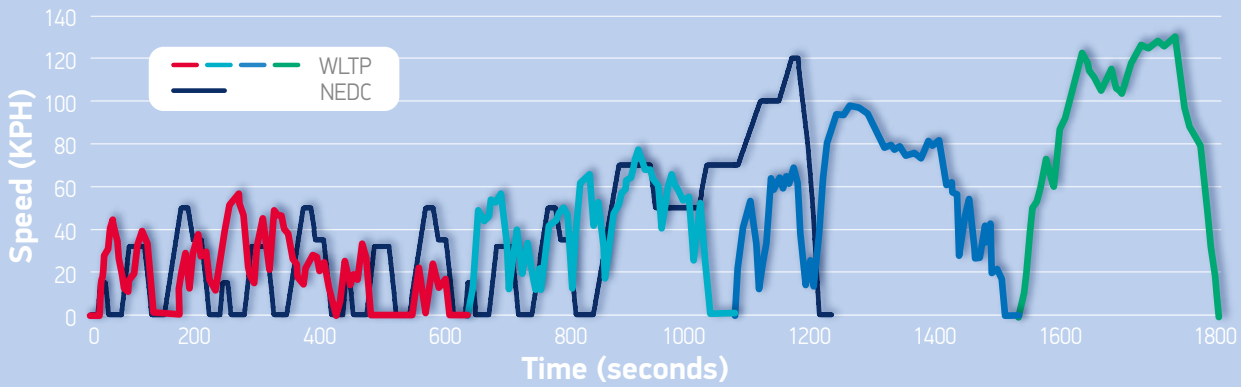
There will be a period when new cars are in the showroom with either WLTP- or NEDC-based CO_2 figures. To ensure comparability, an NEDC equivalent figure is derived from the WLTP test through a computer simulation tool called CO2MPAS. This tool is still under development by the EU and is being refined to ensure it delivers robust equivalent data.

The NEDC equivalent figure will be used until January 2019 for the new car label, April 2020 for taxation purposes and until 2021 for reporting against EU targets. How this transition is explained to the consumer and which data set or both is used, will need to be carefully managed to avoid confusion.

The CO_2 figures are measured at the tailpipe to evaluate the in-use emissions performance. This is the so-called 'tank-to-wheel' approach, rather than a well-to-wheel or life-cycle analysis approach. These other approaches look further along the emissions chain, e.g. energy involved in producing the fuel/energy used, energy from making the vehicle or its end-of-life treatment. These are extremely important issues, but industry and other stakeholders are still developing procedures for evaluating them and there is no consistent methodology in use for such an approach at this point in time.

Pollutant levels for emissions such as nitrogen dioxide (NOx) and particulates are also derived from the laboratory test required for type approval purposes. Maximum limits are regulated under the 'Euro' standards. The new RDE (real driving emissions) element to the approval process also came into effect in September 2017 for new types and requires the vehicle to meet the same air quality emissions limits on the road as in the laboratory. Conformity is typically achieved through fitment of devices to capture or treat the emissions, and so is unlike CO_2 where emissions are dependent on the type and quantity of fuel consumed. ■

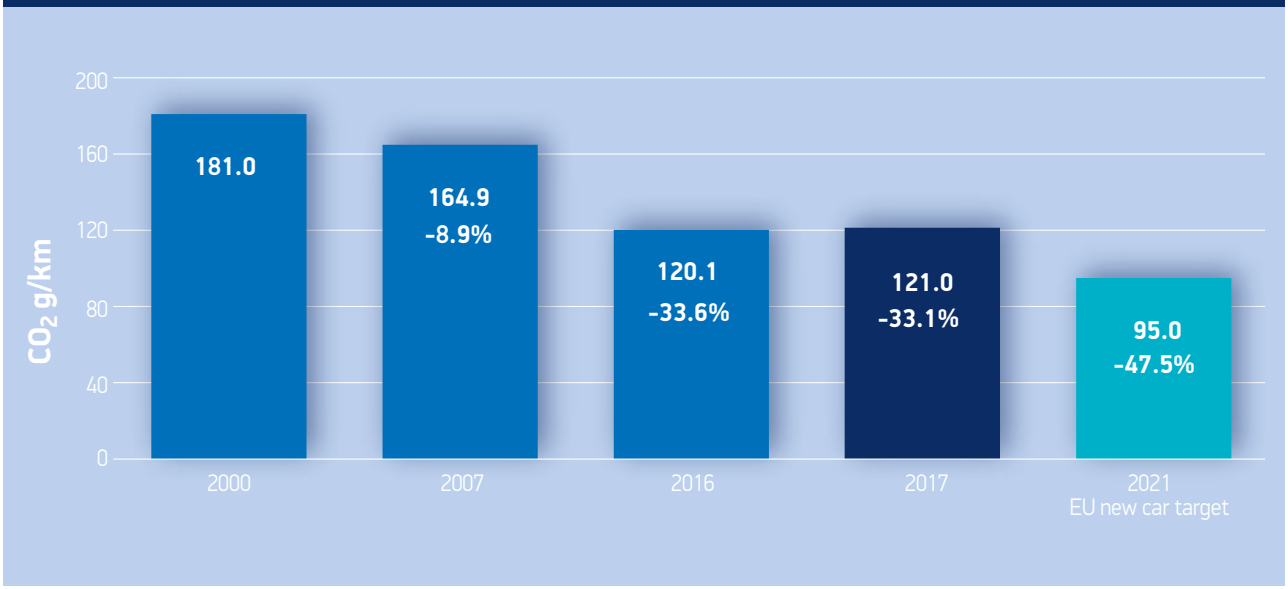
CHART 1 | COMPARATIVE SPEEDS OVER THE DURATION OF THE WLTP AND NEDC TEST CYCLES



AVERAGE NEW CAR CO_2 EMISSIONS RISE FOR FIRST TIME

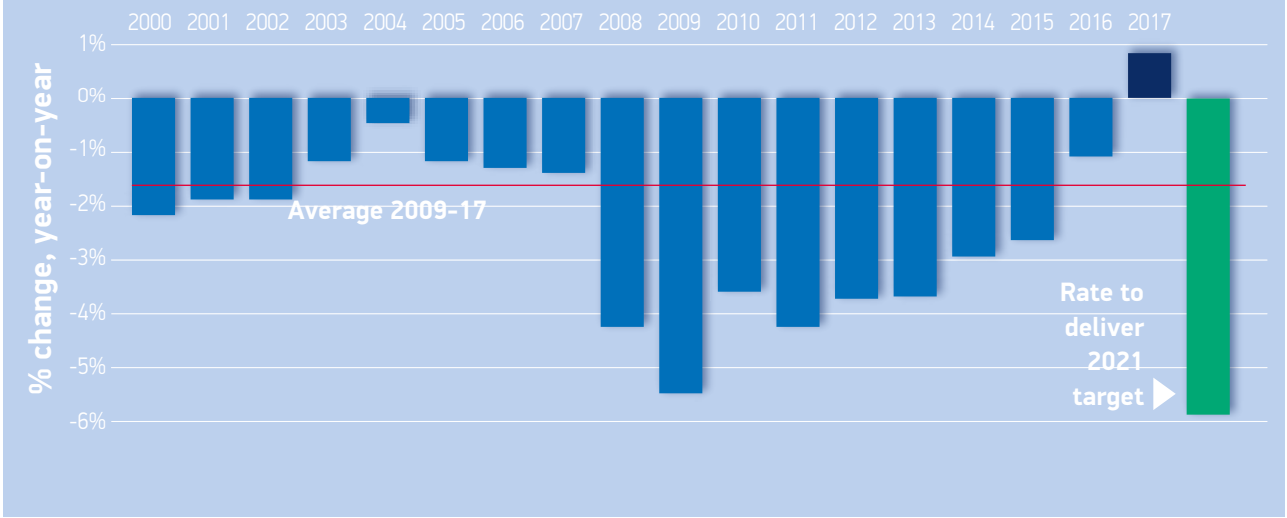
Average new car CO_2 emissions in the UK rose by 0.8% from 120.1g/km in 2016 to 121.0g/km in 2017. This is still 33.1% below the 2000 level, but an unwelcome development in respect to impact on the environment and makes the challenge of delivering on CO_2 targets more acute. The rise in emissions in 2017 reflects the decline in diesel sales and market share – given diesels are on average 15%-20% lower CO_2 emitting than a like-for-like petrol car, and consumer demand shifting from lower emitting segments to higher – with Superminis in particular suffering a further drop in registrations. Manufacturers are delivering lower CO_2 emitting models – and data shows that new models introduced in 2017 were on average 12.6% lower CO_2 emitting than the model they replaced. The average new car performance benefitted from further growth in the market for alternatively fuelled vehicles (AFVs) – namely battery electric vehicles (BEVs), plug-in electric hybrids (PHEVs) and hybrid electric vehicles (HEVs).

CHART 2 | AVERAGE UK NEW CAR CO_2 EMISSIONS AND PAN-EU 2021 TARGET (WITH % CHANGE ON 2000)



The rate of progress in reducing average new car CO_2 emissions had already been moderating ahead of the rise in 2017. The rise in emissions was the first on record since SMMT began recording CO_2 emissions in 1997. The annual rates of reduction since 2000 are shown in Chart 3 below. This also shows the average rate of decline over the past decade (red line) and annual rate of reduction required for the UK to now meet the pan-European target of 95g/km in 2021 (green bar). The rise in 2017 has meant that year-on-year improvements of 5.9% are required to meet the 2021 target, showing the scale of the challenge ahead (to note there is no obligation on the UK to meet this target, as the target is pan-European).

CHART 3 | CHANGE IN ANNUAL NEW CAR CO_2 EMISSIONS SINCE 2000



MARKET TRENDS

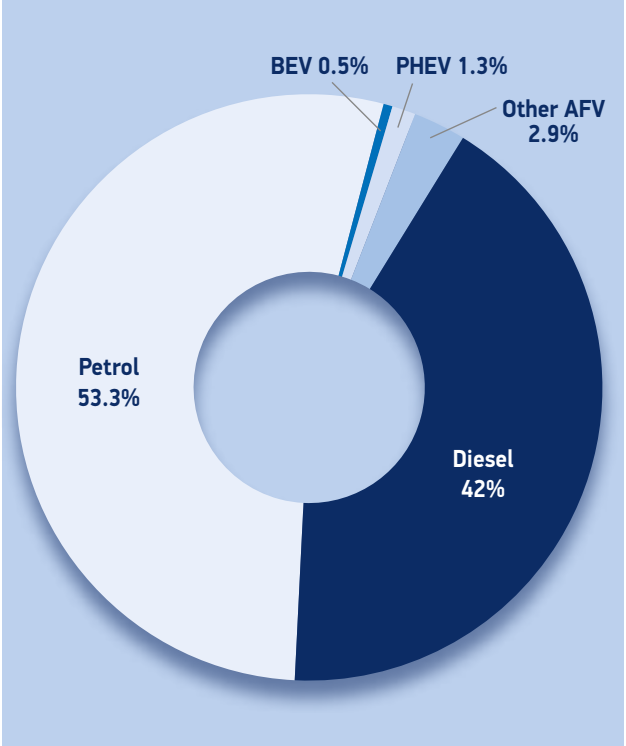
After five years of growth, the UK new car market fell by 5.7%, or over 150,000 units, to 2.54 million units in 2017. After a positive first quarter, boosted by pull forward effect ahead of change to Vehicle Excise Duty (VED) on 1 April 2017, the market slipped into nine successive months of decline. The overall market drop was concentrated in the diesel market, and a result of anti-diesel measures and messaging from government amid concerns around air quality attributes. Given that the latest diesel vehicles are fitted with the most advanced technologies to minimise their air quality impact, and the resultant impact on CO_2 emissions from discouraging their sale, this was unwelcome.

The overall market decline was evident across all buyer types in 2017 – both private and fleet/business, and all segment types bar the Dual Purpose segment. However, by segment the Supermini segment's decline represented over 80% of the market decline over the year, again adversely impacting on CO_2 emissions (Superminis had average CO_2 emissions 8.5% below the overall market average).

A positive trend was the ongoing growth in registrations of alternatively-fuelled vehicles (AFVs). AFVs include all non-conventional petrol and diesel engine vehicles, including battery electric vehicles (BEVs), electric hybrids (both plug-in (PHEVs) and conventional (HEVs)), hydrogen (fuel cell electric vehicles – FCEV) and in the past gas powered vehicles. Registrations of conventional hybrids showed the largest growth, but BEVs and PHEVs also saw double digit growth in the year, supported by new model introductions. These new models helped reduce the fleet average CO_2 by 0.4% in 2017, so are now beginning to have a real impact on the market performance.

Looking at trends over the past five years, SMMT estimates that the rise in average new car CO_2 emissions in 2017 was broadly 55% the result of the segment shift and 45% the result of the loss in diesel volumes.

CHART 5 | NEW CAR MARKET BY FUEL TYPE, 2017



DISTRIBUTION

CO_2 distribution across the market shows a wholesale move to lower CO_2 emitting products (shown by shift to the left in the lines). The peak distribution was around 165g/km in 2000, but down to 110g/km in 2017 and with notably more cars sub 100g/km and the sharp cut in those in the higher bands. The 2017 distribution compared with 2016 is very similar – given only the small net change in overall average CO_2 emissions. The 95-105g/km bands were where most of the volume loss occurred in 2017, an area typically populated by diesel and Supermini segment cars.

CHART 4 | NEW CAR REGISTRATIONS AND FUEL TYPE

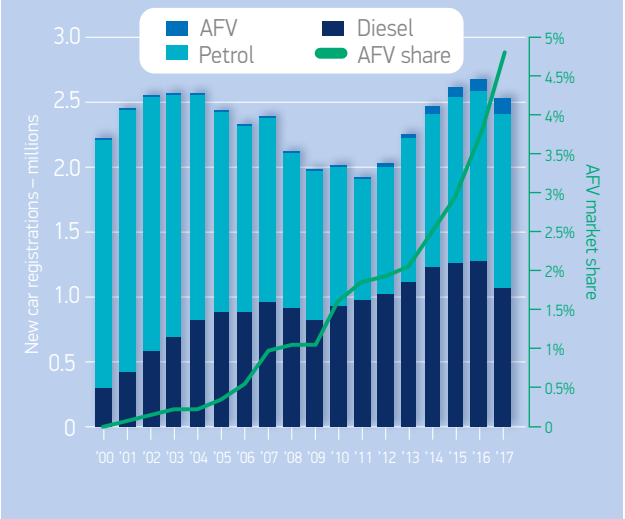
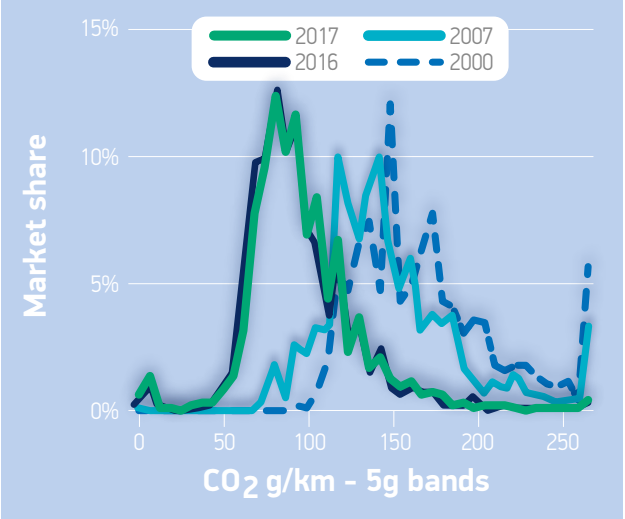


CHART 6 | NEW CAR MARKET BY 5G/KM CO_2 BANDS



ULEV REGISTRATIONS

ULEV – ultra-low emitting vehicles are classified as those that emit CO_2 of less than 75g/km. In 2017, more than 55,000 registrations or 2.3% of the new car market was an ULEV. This was up almost 10,000 units on the 2016 total and from a 1.7% market share. As recently as 2014 the ULEV share was under 1%. Zero emission vehicles (ZEVs) accounted for 23% of the 2017 ULEV total, with the remainder being PHEVs.

FUEL TYPE (note glossary on page 3)

Petrol and diesel fuelled cars accounted for more than 95% of the market in 2017 – and including hybrids, which also use a petrol or diesel engine, this figure rises to 99.5%. Manufacturers and component suppliers have improved CO_2 performance via a variety of measures. These include enhanced powertrains – involving engine downsizing and light weighting through, for example the use of aluminium, plastics and composites – and improved aerodynamics incorporating new vehicle designs and low rolling-resistance tyres. At the same time, industry has delivered enhanced safety, comfort features and space, and reduced other pollutant emissions – all of which unfortunately often involve measures that essentially add weight or reduce vehicle efficiency.

As noted earlier in this report, the market for diesel cars fell sharply in 2017, down 17.1% or almost 220,000 units over the year to 1.065 million units. This offset some of the market shift evident since 2000, when diesel volumes rose so that between 2010 and 2015 volumes surpassed petrol engines. Despite the recent shift compared with 2000, diesel volumes remain up over 750,000 units and petrol registrations down over 550,000 units – a net change of 1.3 million in a market that has grown by just 300,000 units over the period.

Chart 4 shows the market shift in volume terms, and Chart 7 shows it in market share terms. Diesel share was over 50% in three of the four years between 2011 and 2014, but fell to 47.7% in 2016 and down a further 5.7 percentage points to 42.0% in 2017.

SMMT data cannot identify whether consumers have switched from diesel to a petrol or AFV. The overall market decline suggests many may have deferred replacing their vehicle altogether. A slowdown in the rate of vehicle replacement ensures older, less efficient and higher polluting vehicles remain in use. The switch from diesel has been detrimental to CO_2 reduction, despite the advances being made in the efficiency of petrol engines – notably through downsizing and using turbo-charging to improve performance.

While petrol and diesel cars often have a very similar sales weighted average new car CO_2 emission figure, on a like-for-like performance basis a diesel car is typically 15-20% lower CO_2 emitting. Some examples of particular petrol and diesel models are presented in Table 3 below. Therefore, the shift in the market away from diesels over the past three years and, in particular in 2017, has contributed to the net rise in overall average new CO_2 emissions.

CHART 7 | CO_2 EMISSIONS BY FUEL TYPE

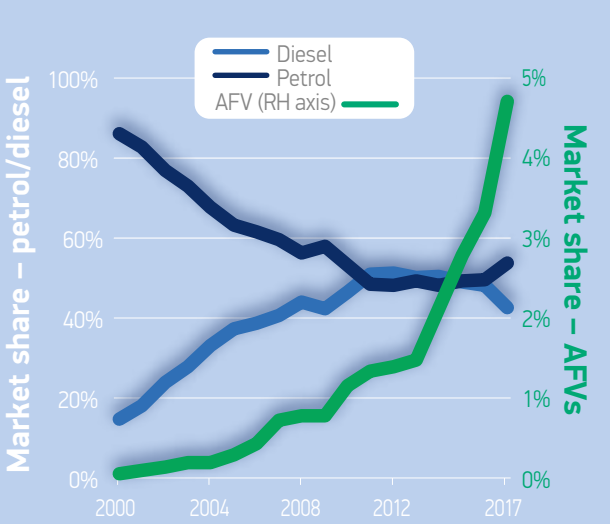


TABLE 3 | SEGMENT BEST SELLER, 2017, INCLUDING LOWEST DIESEL AND PETROL MODEL'S CO_2 PERFORMANCE

Market Segment	Model	Registrations in 2017	Lowest diesel CO_2	Lowest petrol CO_2	Difference
A Mini	Hyundai i10	25,224	n/a	93	n/a
B Supermini	Ford Fiesta	94,533	82	97	-15.5%
C Lower Medium	VW Golf*	74,605	89	99	-10.1%
D Upper Medium	BMW 3 Series*	35,904	99	122	-18.9%
E Executive	Mercedes C Class*	45,912	101	123	-17.9%
F Luxury Saloon	Mercedes S Class*	2,939	139	157	-11.5%
G Specialist Sports	Audi TT	7,762	116	133	-12.8%
H Dual Purpose	Kia Sportage	39,683	119	147	-19.0%
I Multi Purpose Vehicle	Ford C-MAX	12,655	99	117	-15.4%

*Alternatively fuelled variants of these models are available, which would offer greater CO_2 savings

The models selected in Table 3 were the best sellers in each segment in 2017. The lowest petrol and diesel emitting variant is then shown (noting these may not always have comparable performance). In the Mini segment there are no diesel-fuelled cars, reflective of the type of products, their smaller physical size and typically low retail price precluding fitment of diesel engines.

Chart 8 shows the sales weighted CO_2 performance of petrol, diesel and AFVs. On this sales-weighted basis, diesels emitted 2.4% less CO_2 on average than petrol cars (noting diesels tend to be fitted to larger, heavier and more luxurious vehicles), while AFVs had emissions 44.2% below the average new car. All three fuel types recorded a rise in CO_2 emissions compared with their 2016 performances. To note within the AFV segment, battery electric vehicles and hydrogen fuelled vehicles both have zero CO_2 emissions from the tailpipe, PHEVs had on average CO_2 emissions of 45.1g/km and conventional hybrids had, on average, CO_2 emissions of 91.8g/km in 2017. The lowest diesel car emitted 79g/km (some 35% below the market average) and the lowest petrol car emitted 84g/km of CO_2 (some 30% below the market average).

CHART 8 | CO_2 PERFORMANCE BY FUEL TYPE

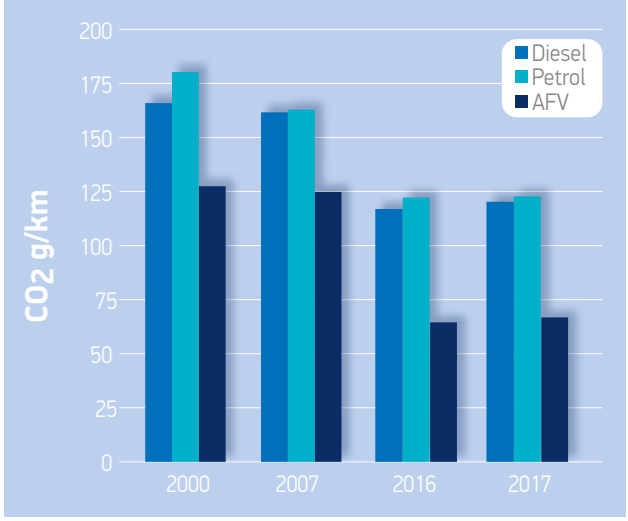


CHART 9 | CO_2 EMISSIONS BY FUEL TYPE OF A BEST-SELLING MID-IZED FAMILY CAR

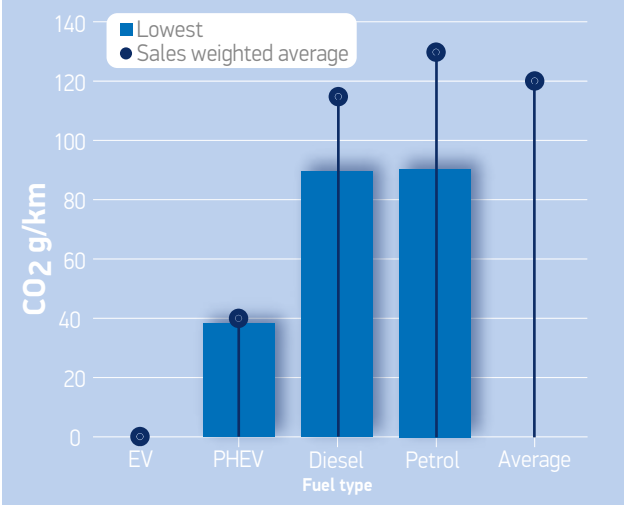
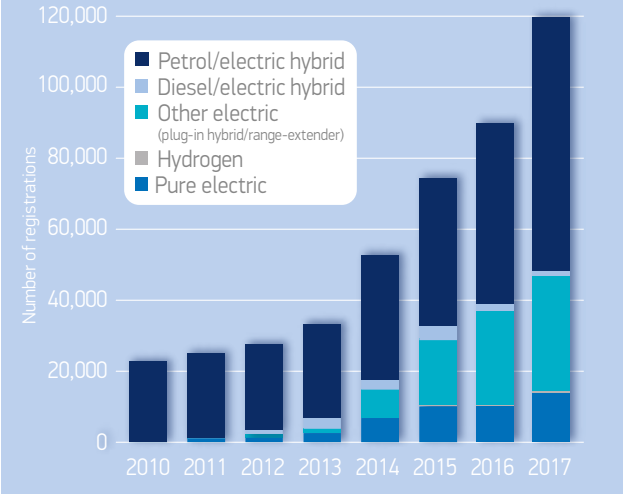


Chart 9 shows the CO_2 performance of a best-selling mid-sized family car. This has BEV and PHEV variants, as well as conventional petrol and diesel variants. Showing the CO_2 performance by fuel type of the same model shows the impact the powertrain can have. The chart shows the lowest emitting version of each fuel type and the sales weighted average CO_2 figure. The BEV model has zero emissions from the tailpipe, the PHEV has emissions less than half that of an internal combustion engine vehicle, while the diesel was 10% lower emitting than the petrol variant and 12% on a sales weighted average basis. The sales split was broadly 60/40 petrol to diesel, with the plug-in vehicles taking a 3.4% share.

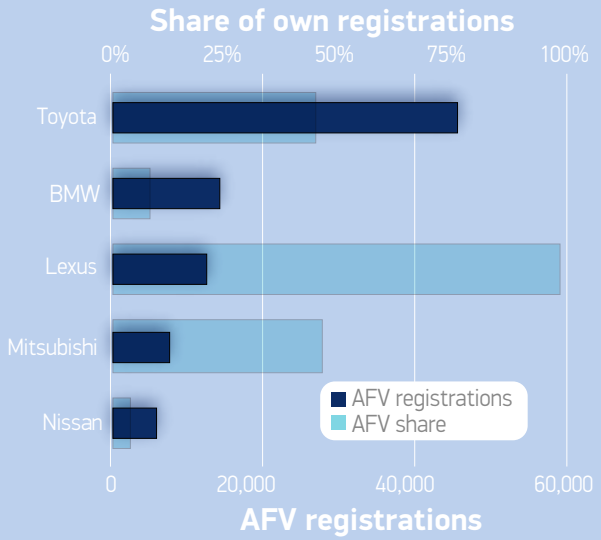
CHART 10 | AFV REGISTRATIONS



The new car market for AFVs rose by 34.8% in 2017 to 119,821 units, equivalent to a 4.7% market share, up from 3.3% in 2016. The AFV market has more than quadrupled in size since 2012. Within the AFV market HEVs accounted for 60% of volumes and saw registrations climb 40% on 2016 in 2017 to 72,523. PHEVs represented some 28% of the AFV total and rose by 25.5% to 33,666, whilst BEVs accounted for 11.4% of the AFV market and recorded a 32.5% rise in registrations to 13,597. PHEVs outsold BEVs by factor of 2.5 in 2017.

Toyota accounted for 38.0% of the AFV market in 2017. Some 45% of Toyota's 2017 registrations were AFVs in 2017, and this figure rose to 99% for their Lexus brand. BMW was the second largest AFV provider in 2017, after a 66.3% rise in registrations. BMW was the largest provider of PHEVs, representing 34.8% of the market. Some 8% of all BMWs in 2017 were AFVs, and they had both BEV and PHEVs on offer. The Nissan Leaf was the best-selling BEV in 2017 and represented 42.4% of all BEV registrations in the year. Nissan and Tesla collectively represented 77.3% of the BEV market.

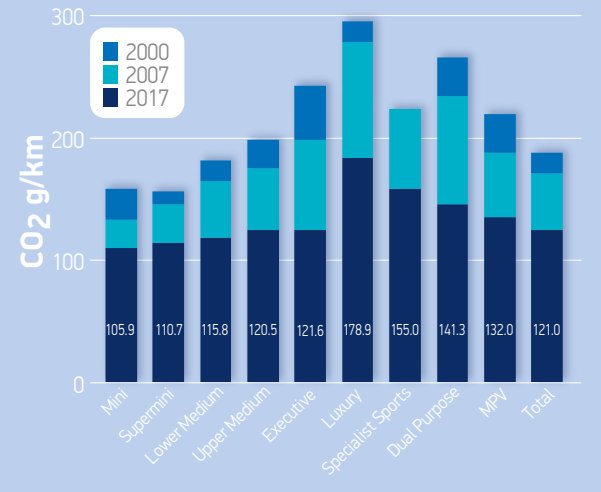
CHART 11 | TOP FIVE BEST-SELLING AFV BRANDS



SEGMENT TYPE

SMMT categorises the car market into nine different segments, broadly based on vehicle size and body style – see Table 3 for lists and examples of best sellers in each category, and for full details please contact data@smmt.co.uk. Chart 12 shows the average CO_2 emissions by segment.

CHART 12 | CO_2 BY SEGMENT (2017 CO_2g/km annotated)



Prior to 2017, all the segments had been recording annual improvements on CO_2 performance, reflective of technology gains, including dieselisation and growth in AFVs. In 2017, only four segments recorded a decline in CO_2 emissions – the Supermini, Luxury, Specialist Sports and Dual Purpose segments.

Diesel and AFVs tend to be found in the physically larger vehicles and segments that tend to command a price premium – see Chart 13. These vehicles offer greater ability to package such technologies, and are better able to absorb the costs of the technology. The high AFV share in the Specialist Sports segment is impacted by the presence of the Tesla Model S and the low diesel share reflects sports car buyers' typical strong preference for performance rather than fuel efficiency.

CHART 13 | REGISTRATIONS BY SEGMENT

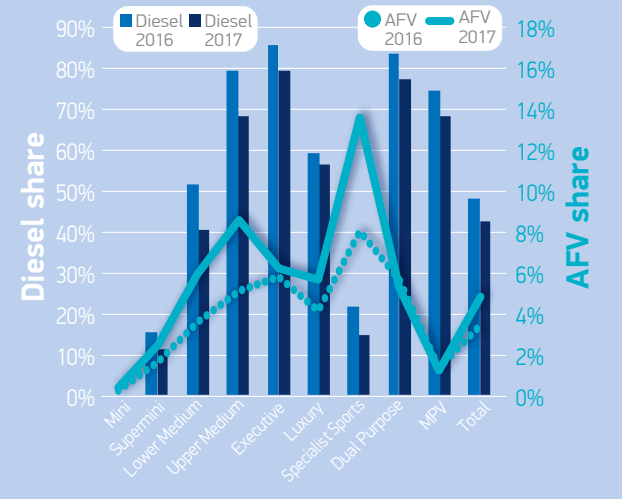


CHART 14 | REGISTRATIONS BY SEGMENT

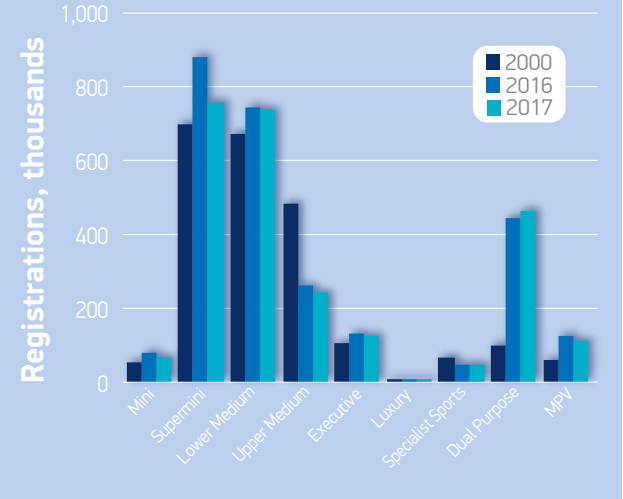
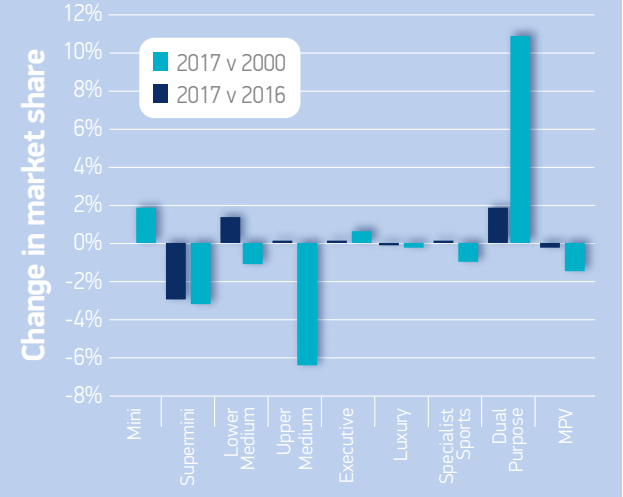


CHART 15 | CHANGE IN MARKET SHARE OVER TIME



The change in composition of the market by the segments was also significant in 2017, with registrations in the largest volume segment – the Supermini segment – falling sharply in 2017, by 14.3%, and at almost 125,000 units down represented just over 80% of the overall market's volume loss in 2017. The decline in Supermini registrations was broad based, with several of the best-selling models in the segment recording a decline in volumes. Superminis in 2017 had CO_2 emissions 8.5% below the market average. Their volume loss therefore impacted on the overall market's sales weighted CO_2 performance. Supermini diesel volume decline represented 40% of the overall diesel market's decline, despite diesels only accounting for a relatively low share of the Supermini market (down to 10.4% in 2017).

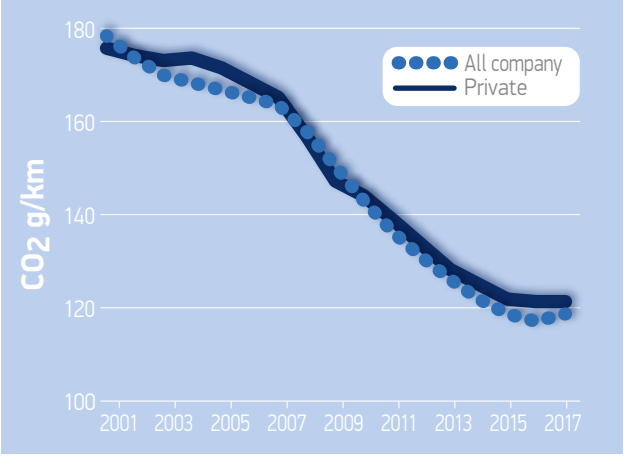
Consumers appear to have often used the improved efficiency of the products to enable them to move into larger and higher value vehicles. This is particularly evident in the growth in the Dual Purpose segment. These vehicles now represent the third largest segment, after the Supermini and Lower Medium segments. The Dual Purpose was the only segment to record growth in registrations in 2017.

SALES TYPE

SMMT differentiates the market into three sales type categories; private buyers, large fleets (registered at company address, with 25 or more vehicles in their fleet) and business (as fleet, but with less than 25 vehicles). Private buyers accounted for 44.2% of the market in 2017, broadly in line with the 46% share averaged since 2001.

Chart 16 shows that the private and all company (large fleet and business combined) sectors have moved in a largely similar and generally downwards pattern since 2001. As with the overall market both private and company saw average CO_2 emissions rise in 2017, up 0.3% to 122.7g/km and up 0.7% to 119.7g/km respectively. The average private car had emissions 2.5% above the average fleet car in 2017. The similarity in performance – despite the slightly different influences, suggests that product offerings are very important to the overall performance of the market and general market trends were influential across all sales types.

CHART 16 | CO_2 EMISSIONS BY SALES TYPE



INFLUENCE OF CO_2-BASED TAXES ON NEW CAR CO_2 AVERAGE

ARRAY OF CO_2-BASED TAXES IN PLAY

There are a number of CO_2-based taxes in use, designed to influence consumers' vehicle choice. The primary ones are Vehicle Excise Duty (VED) and Company Car Tax (CCT). VED has been CO_2 based since 2001 and CCT since 2002 – showing the longevity of CO_2-based taxes in the UK. Capital allowances and salary sacrifice schemes are CO_2 based – as are some local taxes, such as the London Congestion Charge and local parking permit schemes. While not based on CO_2, fuel duty can also influence consumer choice. This section looks at these schemes and their influence on the market.

TABLE 4 | S2017 VED BANDS AND RATES - PRE AND POST 1 APRIL

Band	Pre April 1st bands (CO_2g/km)	Pre April 1st year/ standard rates*	2017 market share	Post April 1st bands (CO_2g/km)	Post April 1st year/ standard rates	2017 market share
A	Up to 100	£0 / £0	15.3%	0	£0 / £0	0.5%
B	101-110	£0 / £20	21.5%	1-50	£10 / £140	1.3%
C	111-120	£0 / £30	21.3%	51-75	£25 / £140	0.5%
D	121-130	£0 / £110	14.9%	76-90	£100 / £140	2.3%
E	131-140	£130 / £130	10.9%	91-100	£120/ £140	10.6%
F	141-150	£145 / £145	5.8%	101-110	£140 / £140	21.5%
G	151-165	£185 / £185	4.9%	111-130	£160 / £140	36.3%
H	166-175	£300 / £210	2.0%	131-150	£200 / £140	16.7%
I	176-185	£355 / £230	1.3%	151-170	£500 / £140	5.8%
J	186-200	£500 / £270	1.0%	171-190	£800 / £140	2.9%
K	201-225	£650 / £295	0.6%	191-225	£1,200 / £140	1.0%
L	226-255	£885 / £500	0.2%	226-255	£1,700 / £140	0.2%
M	Over 255	£1,120 / £515	0.4%	Over 255	£2,000 / £140	0.4%

*AFVs paid £10 less

VEHICLE EXCISE DUTY (VED)

VED rates were significantly changed in April 2017 to reflect the shift in the market towards lower emitting vehicles. Table 4 shows the new rates, as well as previous rates, to show how the bands have become much more differentiated below the 100g/km threshold – which was the lowest band of the previous regime. VED retained its 13 bands, as it has done since 2009.

Bands A-E were the equivalent to Band A in the previous regime. The first year rates ranges from £0-£2,000, compared with £0-£1,120 previously – so the top rate is almost 80% higher than before, although noting only a very small proportion (0.4%) of the market is actually in that range. Additionally, only zero-emitting cars in the new scheme pay no first year rate, compared with cars in bands A-D previously – which means over 70% of the market has gone from paying nothing to paying something.

The standard rate for all non-zero emitting is now a flat rate of £140, compared with differentiated rates before. Cars with a showroom price of over £40,000 will pay a £310 surcharge for five years.

SMMT believes the new system provides less incentive for buying a ULEV, notably a PHEV, given they now face a VED charge. Furthermore, some ULEVs maybe over the £40,000 threshold given the costs of latest innovative technologies (such as hydrogen). The flat rate standard charge also provides no additional incentive for used car consumers to select a lower emitting vehicle.

Looking at the 2017 market by the new VED system (but not taking account of the £40,000 threshold) suggests the average motorist paid £210 in first year VED in 2017, which is more than 3.5 times the £57 average payable under the old regime and bringing over £330 million additional revenue into HM Treasury.

In 2017, 0.5% of the market was zero emitting and in the lowest VED band. In 2017 Band G (111-130g/km) had the largest volume of the market, with a 36.3% share (noting the bands are not even sizes), compared with band I (151-170g/km) in previous years (having applied the post April VED system to historical markets). Bands A-E (100g/km or less) accounted for 15.2% of the 2017 market, compared with 18.2% in 2016 – reflecting the drop in diesel models. However, prior to 2012 less than 4% of the market was in this CO_2 range – indicating the overall market's transition to lower CO_2 emitting models.

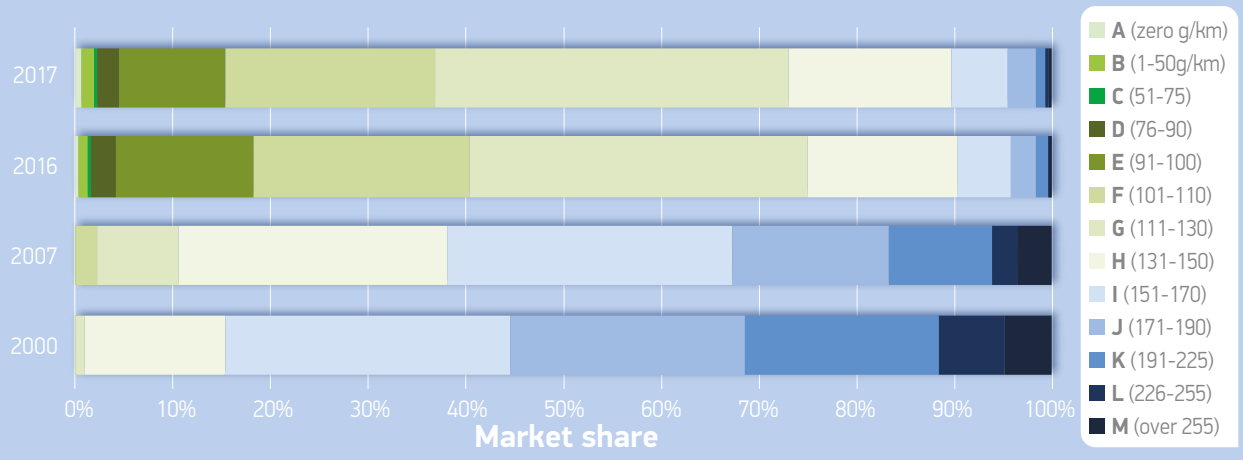
In Budget 2017, it was announced that from 1 April 2018 new diesel vehicles will have their first year rate calculated as if they were in the VED band above (e.g. one higher band) to generate money to pay for air quality improvements. This measure excludes next-generation diesel cars, classified as those which are certified as meeting emissions limits in real driving conditions, known as Real Driving Emissions Step 2 (RDE2) standards. These vehicles are not mandated until 2020 (for new models and 2021 for all registrations) and so this effectively places a VED surcharge on all diesels for two years.

Based on 2017 market data for diesels, under the up-a-band change, diesels would see on average a 53% rise in VED to £323 – with 36% paying an extra £20, 35% an extra £40 and 29% paying £300-500 extra. This move would create £120 million additional revenue for the government.

Similarly, employers who provide employees with a diesel company car that is not RDE2 compliant and is made available for private use, will be subject to a rise in the existing company car tax diesel supplement from 3% to 4%, with effect from 6 April 2018, impacting the employer and the employee.

From April 2019, zero-emission capable taxis will be exempt from the VED supplement that applies to expensive cars.

CHART 17 | NEW CAR MARKET BY VED BANDS



COMPANY CAR TAX (CCT)

Company Car Tax (CCT) aims to encourage the company car driver to drive a more efficient car to minimise their own tax liability. Since 2002, CCT has been based on CO_2 emissions, the vehicle list price, its fuel type and the user's own tax band. The CO_2 bands and rates have changed over time but government has typically provided rates out for several years to enable company car drivers to make appropriate choices and knowing they typically have a three-year ownership pattern. Longer term rates for all taxes would be welcome and should enable a more managed market transformation.

CCT tax rates from 2015-16 to 2020 are presented in Table 5 below. From April 2020, rates will be further differentiated for ultra-low emitting vehicles (classed as below 50g/km) – see Table 6 for details. Rates for every five grams above 50g/km will increase by 1% until 165g/km when the maximum 37% rate will apply (41% if a diesel).

TABLE 5 | CCT BANDS AND RATES TO 2020

CO_2 emission level (g/km)	2015-16	2016-17	2017-18	2018-19	2019-20
<=50	5%	7%	9%	13%	16%
51-75	9%	11%	13%	16%	19%
76-94	13%	15%	17%	19%	22%
95-99	14%	16%	18%	20%	23%
100-104	15%	17%	19%	21%	24%
Then 1% rise for each 5g/km band up to 37% (note diesels face 3% surcharge, 4% from April 2018					

TABLE 6 | CCT BANDS AND RATES, 2020-2021

CO_2 emission level (g/km)	Zero emission range	Rate
0		2%
1 – 50	130 miles and greater	2%
1 – 50	70 – 129 miles	5%
1 – 50	40 – 69 miles	8%
1 – 50	30 – 39 miles	12%
1 – 50	Lower than 30 miles	14%
Then 1% rise for each 5g/km band up to 37% (with 4% surcharge for diesels)		

CAPITAL ALLOWANCES (CA)

Capital allowances (CA) are a cost relief for business investment against taxable profits. They have been referenced against a car's CO_2 emissions since 2009 and help provide an incentive to persuade fleet buyers to consider low-emitting products. The current rates provide a 100% first year allowance if the car emits 95g/km CO_2 or less, then 18% if CO_2 emissions are between 96-130g/km and 8% for those over 130g/km. From 2018, the first year allowance threshold rate will be cut to 50g/km and the main rate to 110g/km.

Since 23 November 2016, 100% first-year allowances are also available to companies investing in charge-points for electric vehicles. In 2017, the government announced that employees charging their cars at work would not be subject to benefit-in-kind charges for that free electricity.

SALARY SACRIFICE

From April 2017, employees who forego cash salary for benefits will pay the same tax as the vast majority of individuals who buy those same benefits out of their post-tax income, with tax and employer National Insurance advantages of salary sacrifice schemes removed. Arrangements for ULEVs (defined as vehicles under 75g/km of CO_2) have been excluded from these changes and arrangements in place before April 2017 will be protected until April 2018, with arrangements for cars protected until April 2021.

FUEL DUTY

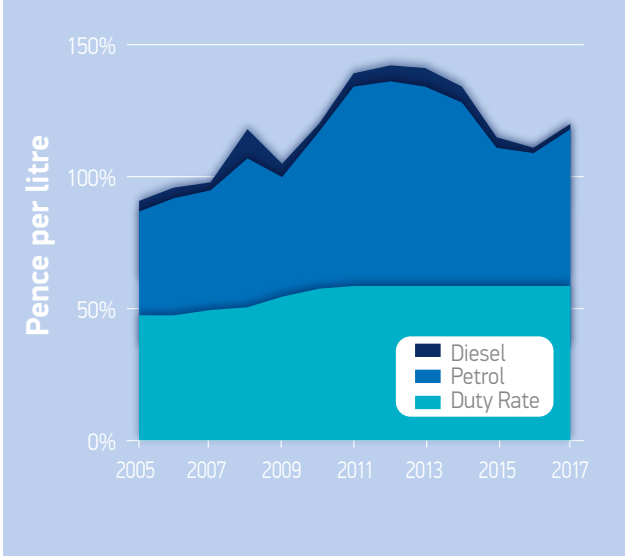
The cost of fuel is a key contributor to a vehicle's running costs and MPG figures are often cited as an important metric for consumers. MPG is derived from the same test cycle as a vehicle's CO_2 emissions. The average new car had a sales-weighted MPG figure of 59.5 MPG in 2017, down 1.1% from 60.2MPG in 2016, but still over 50% better than in 2000 and 34.4% better than in 2007.

Around 65% of the price of litre of fuel is tax – almost 50% fuel duty and some 15% VAT on that duty. Previously, the government had a fuel duty escalator in place to regularly increase the price of fuel to encourage the purchase of more efficient vehicles and consumers to drive more efficiently but, since 2011, rates have been frozen, at 57.95 pence per litre for both petrol and diesel, to minimise the inflationary impact on the economy and help competitiveness. To note most other European countries have lower duty rates for diesel than petrol, which has resulted in diesel share in the UK generally being below the EU-average.

UK pump prices fell for four successive years before a rise in 2017 – see Chart 18. Diesel is more expensive than petrol and the gap was 2.3% in 2017, after diesel pump prices rose 8.9% in the year and petrol rose 7.9%. Both remain well below prices in the peak years of 2011-2014. Lower fuel prices would tend to diminish consumer appetite for more efficient vehicles.

Fuel duty revenue was £28 billion in 2016, while VED provided a further £6 billion. These two taxes represent more than 70% of the taxes the government calls environmental taxes.

CHART 18 | UK FUEL PUMP PRICES AND DUTY RATE



(Source: BEIS)

THE PLUG-IN CAR GRANT (PICG)

Since January 2011, the UK has had the Plug-in Car Grant (PiCG) in place to help offset the initial higher purchase cost of electrically chargeable vehicles and so reduce this barrier to their uptake. The PiCG initially gave consumers an incentive of 35% or up to £5,000 off the full purchase price (list, plus VED and VAT) of a vehicle that qualifies, but this was reduced from 1 March 2016 and differentiated by zero-emission capable range – see Table 7 and www.gov.uk/plug-in-car-van-grants/eligibility for more details.

The PiCG is part of the government's commitment to invest £1.5 billion in encouraging the transformation to ultra-low emission vehicles between 2015/16 and 2020/21. To the end of 2017 some 130,000 vehicles have gone through the scheme, including 45,000 in 2017 alone – an increase of 27% on the previous year. In 2017, around 35% were BEVs. In Budget 2017, the government announced a further £100 million for the PICG for BEVs, with commitment to keep current levels to April 2018 and the PICG itself to remain in place to 2020. Whilst extra funding for EV infrastructure and consumer incentives for ZEVs was welcome, the market is still at an early stage. Limiting any upfront purchasing incentive to ZEVs only would be premature with the risk of limiting consumer and technology choices at a time when it is paramount to grow and not constrain the emerging market for ultra-low and zero emitting vehicles.

TABLE 7 | PLUG-IN CAR (AND VAN) GRANT DETAILS

Category	CO_2 requirement	Zero emission range	Grant (as % cost)	Maximum grant	Number models eligible*
Car – category 1	Under 50g/km	At least 70 miles	35%	£4,500	19
Car – category 2**	Under 50g/km	10-69 miles	35%	£2,500	15
Car – category 3**	50-75g/km	At least 20 miles	35%	£2,500	1
Van	Under 75g/km	At least 10 miles	20%	£20,000	9

* As of January 2018 **Recommended retail price must be under £60,000

GO ULTRA LOW (GUL)

To help promote the acceptance and uptake of ultra-low emission vehicles, government and vehicle manufacturers are working together on a joint consumer communications campaign that aims to promote the benefits, cost savings and capabilities of BEVs, PHEVs and FCEVs. Go Ultra Low currently includes eight manufacturers: Audi, BMW, Kia, Hyundai, Nissan, Renault, Toyota and Volkswagen. See www.goultralow.com for more details.

Go Ultra Low (GUL) expects some 30 new plug-in vehicles to enter the market over the next three years. The campaign has been strengthened by most car manufacturers committing to having electrified variants of all their models by the mid 2020s. GUL was encouraged by the ongoing growth in electric vehicle registrations in 2017, as more and more motorists realised the cost saving and environmental benefits of driving a plug-in car. With ongoing government incentives, local infrastructure initiatives and increasing product choice it expects this trend to continue, boosting the total number of ULEVs on UK roads to around 200,000 in 2018.

In 2017, Go Ultra Low focussed on educating consumers and fleets about how specific ULEVs can fit into different lifestyles and tailoring information to individual drivers. This was coupled with an increased attendance at consumer events, offering test drives, often found to be the best way to convince people on the quality of ULEVs available.

LOCAL MEASURES – INCLUDING THE LONDON CONGESTION CHARGE

CO_2 is often used by local authorities or councils to encourage the use of lower emitting cars, through measures such as CO_2-based parking permits or workplace parking measures, as well as in their own buying standards. Probably the most well-known CO_2-based measure is the London Congestion Charge, where ULEVs are exempt from the £11.50 per day charge.

There has been increased speculation, discussion and consultation around the possibility of introducing charges based on air quality – such as the T-Charge in London (£10 for pre-Euro 4 cars – circa pre 2005). While such measures might encourage the uptake of newer and lower CO_2 emitting cars, industry is concerned that they could be overtly anti-diesel, have a minimal impact on air quality and create a confusing patchwork of measures across the country if not implemented appropriately.

UK AND EU AVERAGE NEW CAR CO_2 EMISSIONS CONVERGED OVER TIME

Data from the EEA (see https://www.eea.europa.eu/publications/co2-emissions-new-cars-and-vans-2016) shows that in 2016, (latest data) the EU average new car CO_2 was 1.1% below the UK's at 118.1g/km, compared with 1201.g/km. The EU average fell by 1.3% to outpace the UK for a second successive year. The UK was ranked 14th within the EU Members States – see Chart 20.

CHART 19 | UK VS EU NEW CAR CO_2 PERFORMANCE

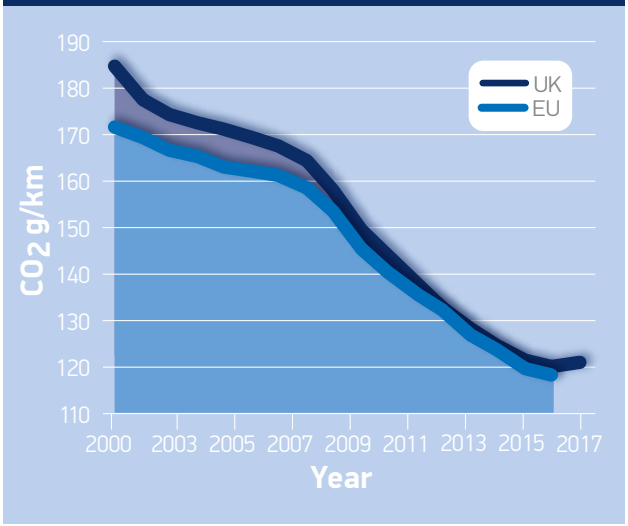
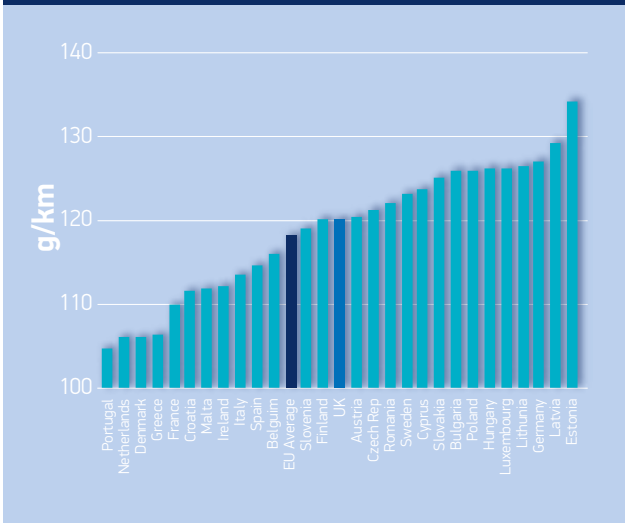


CHART 20 | AVERAGE NEW CAR CO_2, BY COUNTRY, 2016



The UK had emissions some 14.7% above the lowest emitting country, Portugal. Compared with the other two key markets within the EU – Germany and France, the UK was in the middle, with France having average emissions of 109.8g/km and Germany 126.9g/km. The EU and Portugal (and France) in particular benefitted from having a higher diesel market share than the UK. The UK had a relatively high market penetration of electrically-charged vehicles (1.8% vs 1.4% across the EU).

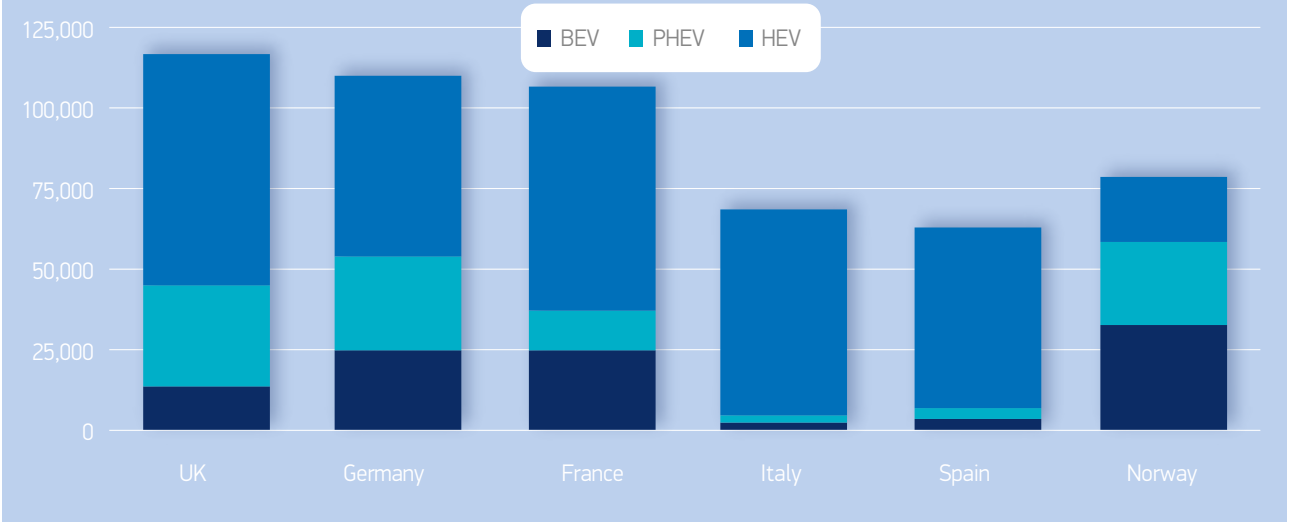
The impact of the vote to leave the EU will have implications on the monitoring and reporting of UK CO_2 emissions, and the role the UK plays in the overall pan-EU new car (and light commercial vehicle (LCV) CO_2 Regulation. This issue is discussed further in the outlook section.

Data from ACEA, the European vehicle manufacturers association, showed that the 2017 market for BEV, PHEV and HEVs collectively rose by 49.3% in 2017 to 644,480 units across the EU. The UK was the largest market for such vehicles, accounting for 18.2% of the market – see Chart 21. The UK had

the largest market for both PHEVs and HEVs, whilst Germany – the EU's largest overall car market – had the largest market for BEVs. Data for Norway is also shown, for comparison.

Reflective of its very favourable fiscal policy Norway had a larger market for BEVs than Germany, but was behind both the UK and Germany for PHEVs and had relatively few HEVs. ■

CHART 21 | NEW REGISTRATIONS OF ELECTRIC VEHICLES, 2017



(Source ACEA)

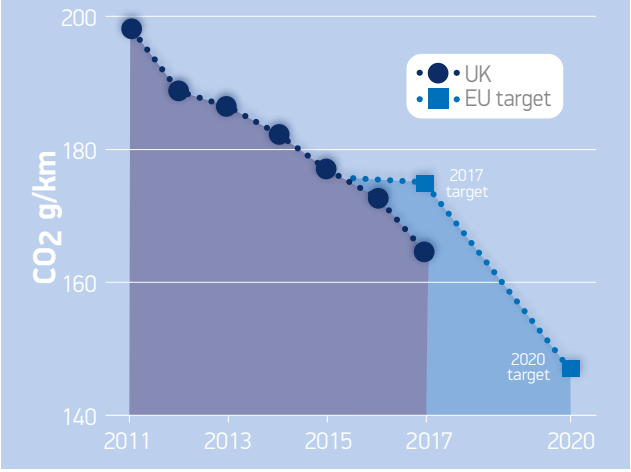
COMMERCIAL VEHICLE CO_2 EMISSIONS

LIGHT COMMERCIAL VEHICLE (LCV TO 3.5 TONNES) CO_2 PERFORMANCE

AVERAGE NEW LCV CO_2 EMISSIONS IN 2016 FALL BELOW 2017 PAN-EU TARGET LEVEL

The average CO_2 emissions of new light commercial vehicles (LCVs to 3.5 tonnes, or vans) in the UK fell 4.8% to 165.4g/km in 2017. This was the largest reduction since 2012 and brought the UK performance to 5.5% below the pan-European target of 175g/km for 2017. Delivering the 147g/km pan-EU target by 2020, in the UK (which is not mandated), would require a reduction of some 4% per annum.

CHART 22 | UK LCV AVERAGE CO_2 AND EU TARGETS



The improvement in the rate in 2017 was supported by a sharp reduction in registrations of 4x4 utility vehicles, which, while a small proportion of the overall market, have per vehicle emissions 40-50% above the overall market's CO_2 average. A cooling of demand of the heaviest vans, 3.5 tonnes, also reduced the overall market average. The further reduction in demand for small vans, below 2 tonnes, and continued low registrations of alternatively fuelled vans held back an even better rate of reduction in 2017.

MARKET SHIFT TO LARGER VANS CONTINUES

The composition of the van market has changed over time – see Chart 23 – with a shift towards larger vehicles, which give operators more space and load capacity, and so flexibility. Vans are largely bought for their size and load capacity and operators are typically keen to minimise running costs, to ensure they maximise profit for their business. This cost focus sees around 96% of all vans registered being Euro 6 diesel-fuelled. Generally, the larger the van, the higher the CO_2 emissions, as Chart 22 shows, although on a 'per tonne transported' basis larger capacity provides greater efficiencies. All segments showed an improvement in average CO_2 emissions in 2017.

Alternatively fuelled vans registrations surpassed the 1,000-unit limit in 2017, growing 23.1% to 1,183 units. This still only represented 0.3% of the total market. Within the AFV market the battery electric Nissan NV200 accounted for 70% of

CHART 23 | LCV NEW REGISTRATIONS BY SEGMENT

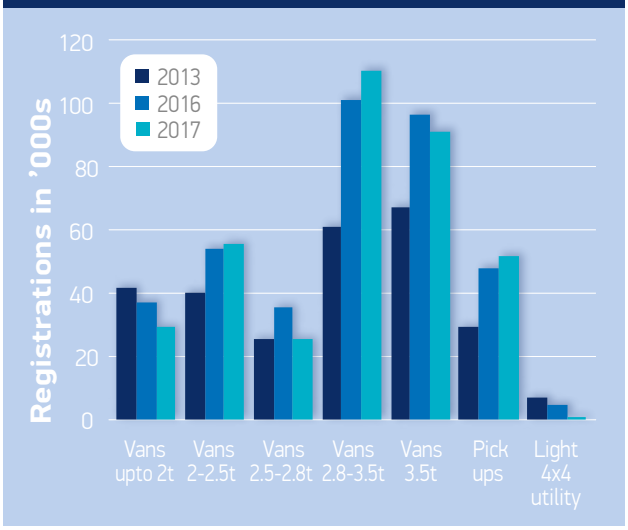
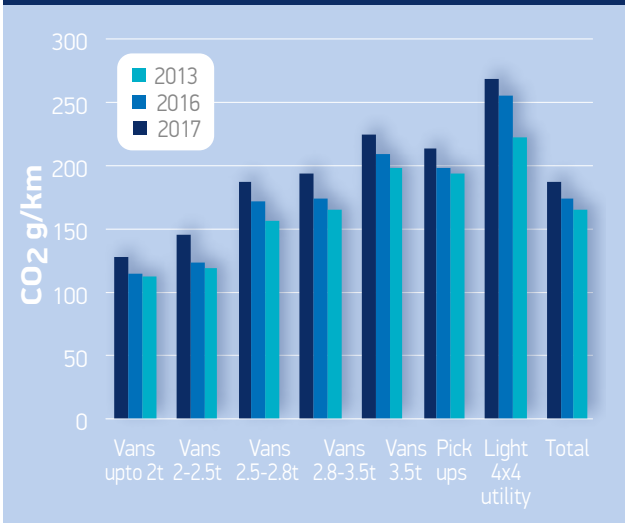


CHART 24 | LCV CO_2 PERFORMANCE BY SEGMENT

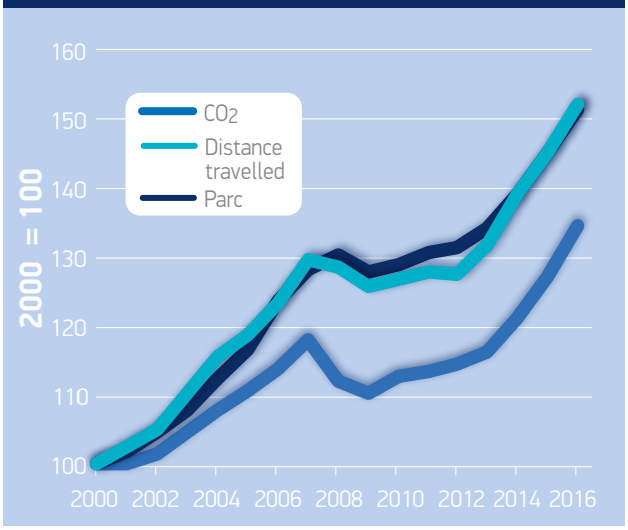


volumes. This share had been reduced since 2016 following strong growth – albeit from a low base – by Peugeot's Partner and Citroen's Berlingo battery electric models.

CO_2 EMISSIONS FROM ALL VANS IN USE

CO_2 emissions from all vans in use rose by 34.1% between 2000 and 2016, and their share of total UK CO_2 emissions has almost doubled over this time to 5.0%. The rise followed a sharp uplift in the distance such vehicles are travelling, up by more than 50% since 2000 and rising by some 5% in each of the past three years. This is reflective, in particular, of the increase in home deliveries, which are typically undertaken by vans. The step change to increased internet shopping and home deliveries has also coincided with manufacturers offering more attractive finance packages, which enable businesses easier access to new products. The LCV parc (total number of vehicles in use) has risen by more than 50% since 2000 to 4.18 million units in 2016. The LCV market doubled in size from the low of 2009 and 2016, and, while it slipped by 3.6% in 2017 to 362,149 units, it remains 94% above the 2009 level.

CHART 25 | TOTAL LCV CO_2 EMISSIONS



HEAVY COMMERCIAL VEHICLES (HCVS)

Heavy commercial vehicles (HCVs) – those commercial vehicles over 3.5T, are business tools used to transport goods around the country. On a European basis they carry more than 75% of all land-based freight and are crucial for the economic well-being and functional operation of modern society. In the UK in 2016, HCVs accounted for 5.3% of all CO_2 emissions in the UK, recording a 2.1% rise in the year to 19.9Mt CO_2, a level broadly unchanged since 2000 (up 2.7%). HCVs are therefore an important element to reducing total emissions from all road transport. Measures to improve efficiency could also help improve competitiveness, however, the inflationary impact of adding costs to operators also needs to be considered.

Because of the commercial nature of these vehicles, operators are very focused on running costs, of which fuel is a significant proportion. Therefore, fuel efficiency is a very competitive issue for the sector. Given the vast array of different types of HCVs – e.g. rigids and artics, 2, 3 or 4 axle variants, flat-beds or high-sided vehicles – comparing the efficiency of different types of vehicles is complicated, especially if payload or capacity is also a factor. In addition, the same 'tractor' unit can often be used to pull different types of trailers, with different loads, shapes and sizes.

From 1 January 2019, vehicle manufacturers will have to declare the fuel consumption and CO_2 emissions from new trucks placed on the market under Commission Regulation (EU) 2017/2400. The regulation uses a simulation tool called VECTO (Vehicle Energy Consumption Calculation Tool) to generate fuel efficiency and CO_2 data for each new vehicle, based on certified data taken during type approval (from the engine, gearbox, aerodynamic drag and tyre rolling resistance). The mandatory declaration of truck fuel consumption and CO_2 emissions should enable operators to compare different vehicles' CO_2 and fuel efficiency in a standardised way.

Forthcoming EU legislation on VECTO Monitoring and Reporting will require vehicle manufacturers to report fuel consumption

and CO_2 emissions data for every truck placed on the market in the EU. These data will be reported annually to the European Commission (commencing from 2020), along with all truck registration data held by National Registration Authorities within the Member States. Emissions and registration data will then be matched to help the European Commission monitor the CO_2 baseline of the new truck market, and inform the development and introduction of EU CO_2 standards for heavy commercial vehicles. It is expected that the European Commission will bring forward proposals for EU truck CO_2 standards during 2018.

The industry is developing an array of different technologies to address environmental performance, including biofuels and other alternative fuels. The types of journeys and payloads will greatly influence the suitably of some technologies.

SMMT continues to welcome a more comprehensive approach being taken to reduce vehicle CO_2 emissions, looking at all vehicles in the fleet and how all stakeholders can influence their environmental performance.

Other measures which could be reviewed and assessed to help improve the fleet's CO_2/fuel efficiency include CO_2 labelling of trucks to improve market transparency and inform operator purchasing decisions, enabling longer and heavier HCVs to be used, enhancing the use of Intelligent Transport Systems/ telematics/connected and autonomous vehicle technologies (which would help vehicles operate more efficiently and reduce journey distances and times) and platooning – vehicles travelling in close convey to reduce wind resistance.

Greater support for AFVs, including infrastructure provision and allowing additional weight (given AFVs may be heavier and so may fall into different vehicle classes) would encourage their uptake. Incentivising fleet renewal to ensure the most efficient (and safe) vehicles are in operation, potentially linked to AFV support, would also help reduce emissions from the fleet.

Vehicle taxation could be better used to encourage purchase and use of more efficient vehicles. Enhanced road infrastructure (including better/intelligent road signage and low rolling resistance roads), encouraging even more driver training (e.g. eco-driving), as well as government procurement policies can also shape the types of vehicles used and how they are driven.

BUSES AND COACHES

As with HCVs, the efficiency of buses and coaches is also an important element to the profitability of operators. Many operators though are required by local authorities to meet minimum environmental standards, and the UK has already seen a number of lower CO_2 emitting technologies come into use, e.g. hybrid, pure electric, biofuels and hydrogen. Efficient diesels, using mild-hybrid systems for the ancillaries (rather than to drive the vehicle) have also been introduced. The enhanced performance of new vehicles has contributed to a 29% decline in total CO_2 emissions from all buses in use between 2000 and 2016, including a 6.7% decline in the last year alone. Reduced distance travelled by buses has also been an influence on this performance.

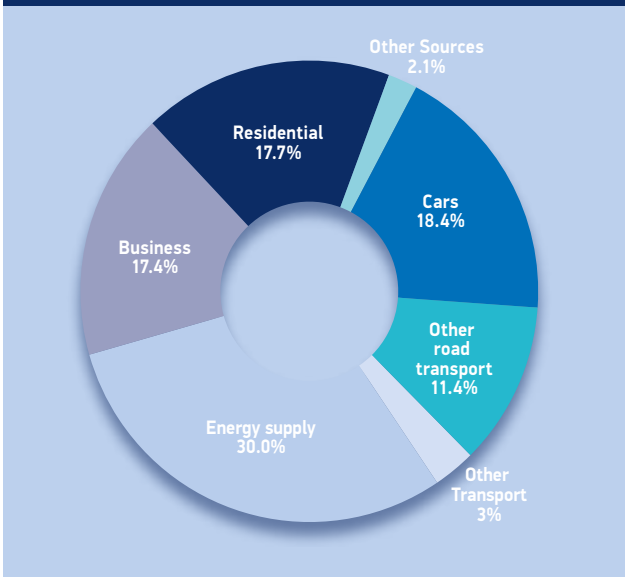
Given most buses run on prescribed routes in urban areas and with dedicated depots, the economics of shifting to alternative fuels can be more readily calculated, alongside the need for refuelling/recharging infrastructure. For coaches, however, which tend to cover longer distances and have more varied routes, such opportunities maybe more limited.

The aforementioned role of bus standards by local authorities should ideally be aligned as much as possible to ensure manufacturers and operators can plan and bring to market effective solutions, albeit understanding different authorities or cities might have different air quality or emissions targets. Broader policy considerations, including better planning and suitable infrastructure provision, alongside bus specific measures like the bus service operators grant (BSOG), can help deliver a modal and technological shift. ■

TOTAL CO_2 EMISSIONS AND VEHICLES IMPACT

Overall UK CO_2 emissions have fallen by 31.6% since 2000 to 378.9 million tonnes of CO_2 equivalent (MtCO2e) in 2016. They fell by 5.9% in 2016, compared with 2015, after a sharp fall in emissions from the energy supply sector. Since 2000, the drop is largely a result of the energy supply sector moving from coal to gas and now to renewables, as well as the closure of some manufacturing businesses (such as steelworks).

CHART 26 | CO_2 EMISSIONS BY SOURCE

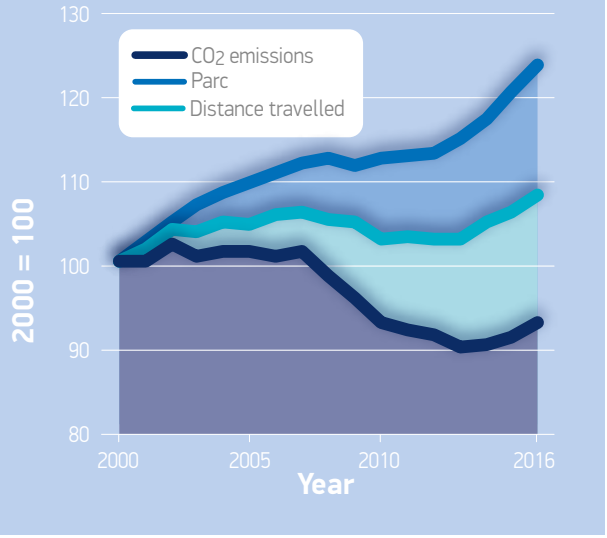


(Source: BEIS 2016)

Transport was the largest source of CO_2 emissions in 2016 for a second successive year, having surpassed the energy supply sector. Road transport, at 113 MtCO2e, accounted for 91% of all transport emissions in 2016 and was almost as large as the energy supply sector. Emissions from road transport have risen in each of the past three years, as vehicle use has increased. The rise has largely offset the gains made between 2008 and 2013, to leave emissions just 1.3% below their 2000 levels. Vehicle use since 2000 has increased by 11.7%. Given limited road space extra journeys often create congestion, which increases emissions, as well as economic loss through wasted time. Stop-start technologies, as well as electrified vehicles, can help limit some of the impacts of stationary traffic, but measures that can speed up the flow of traffic and enable vehicles to operate more effectively should be sought.

Cars accounted for 61.6% of all road transport emissions in 2016. This share has fallen steadily from 65.7% in 2000, but emissions from cars also rose in each of the past three years, with a 2.1% rise in 2016 alone. CO_2 emissions from cars since 2000 have fallen by 7.4%, despite an 8.1% rise in vehicle use. HCVs were the second largest source of road transport emissions in 2016, at 5.3%, but LCVs closed the gap and have seen emissions rise by 34.1% since 2000 after a sharp uplift in vehicle use.

CHART 27 | CO_2, PARC SIZE AND USE



(Source: BEIS, SMMT and DfT)

TABLE 8 | CO_2 EMISSIONS BY SOURCE IN 2016

Source	MtCO2e	% change v 2000	% change v 2015	% total (2016)
All	378.9	-31.6%	-5.9%	
Road transport	113.0	-1.3%	2.3%	29.8%
Cars	69.7	-7.4%	2.1%	18.4%
HGVs	19.9	2.7%	2.1%	5.3%
LCVs	19.0	34.1%	5.5%	5.0%

FLEET RENEWAL

A new car is some 20% more efficient than the average car in use – in 2016, the average car in use emitted 149.6g/km, compared with 120.1g/km for a new car (a 19.7% difference). If a car leaving the fleet (for example being scrapped), is assumed to be 14 years old, then a new car is almost a third more efficient.

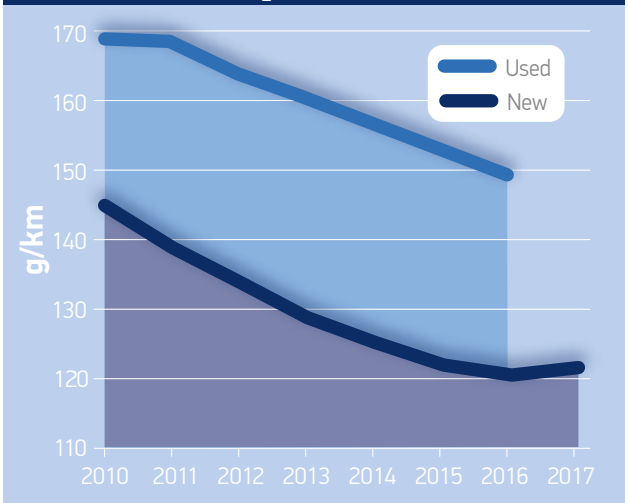
New vehicles also offer consumers enhanced information to help improve emissions in use, e.g. gear shift indicators, trip computers and sat navs. New vehicles also are designed to meet the latest air quality standards, as well as having the latest safety features.

In 2016, new cars only represented around 8% of the 34.3 million cars in use. It is also a concern that the average age of the car in use has increased in recent years, from 6.8 years to 7.8 years over the past decade, which will be to the detriment of the environmental profile of the fleet.

Measures which could undermine the residual values of certain technologies, such as has been the risk to diesels in 2017, could potentially leave consumers with lower value assets. This may effectively force them to remain in their existing vehicle for longer, so slowing the rate of fleet renewal, to the detriment of the environment.

Used car data from DVLA and SMMT showed transactions of alternatively-fuelled cars surpassed the 10,000 mark for the first time in 2017, highlighting the increased role these vehicles are having in the fleet. AFV transactions rose 21.3% in 2017, including a 77.1% rise for ZEVs. Total transactions slipped 1.1% to 8.1 million in the year. ■

CHART 28 | NEW CAR AND AVERAGE CAR IN USE CO_2 EMISSIONS



INDUSTRY COMMITTED TO REDUCING CO_2 AND IMPROVING AIR QUALITY IN PARALLEL

The automotive sector is committed to reducing both pollutant and CO_2 emissions from vehicles and improving the sector's environmental impact is a strategic priority. The sector has made significant investment in new technologies, which has helped reduce CO_2 emissions by over a third since 2000 and emissions of particulates (PMs), nitrogen oxides (NOx) and other pollutants have either been all but eliminated or reduced significantly. CO_2 impacts on global warming, whilst pollutant emissions impact local air quality and public health.

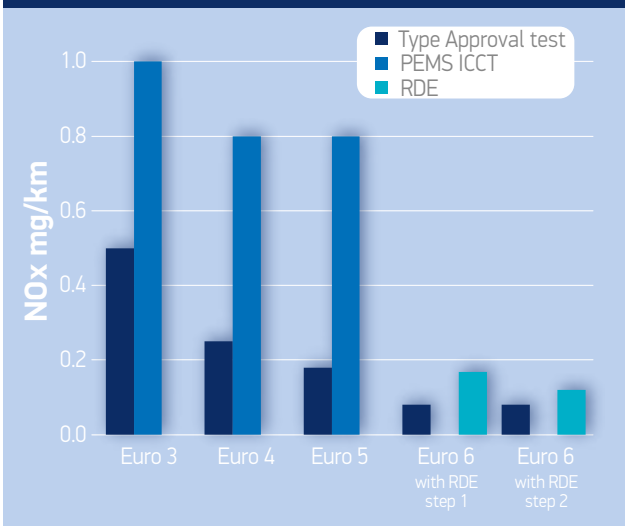
These pollutant emissions are regulated by tailpipe 'Euro' standards, which set maximum levels that a vehicle can emit. To accurately determine emissions on a consistent basis vehicles are tested in a laboratory, with a pass-fail approach. From 1 September 2017, a new Real Driving Emissions (RDE) test has applied to all new models (and will apply to all registrations from September 2019), which will ensure that emissions in use on the public highway are aligned with the laboratory limits. This on road testing is made possible through development of portable emissions measurement systems – PEMS. Due to unavoidable and inherent inaccuracies in the PEMS equipment a tolerance limit, or conformity factor, is applied (this is 2.1 currently and will be 1.5 when RDE step 2 is introduced from January 2020 for new models (and January 2021 for all registrations)).

NOx limits for a diesel car under the Euro standards, including the latest Euro 6 with RDE step 1 and forthcoming RDE step 2 are shown in Chart 29. This shows that a Euro 6 diesel car (post 2015) has limits 84% below a Euro 3 (2000-2004). The chart shows levels recorded by older vehicles using PEMS equipment by the International Council on Clean Transport (ICCT) (in turquoise) and demonstrates the reductions that will need to be delivered moving forward by the RDE test. Once data is widely available it should demonstrate that new vehicles are delivering on reducing air quality pollutants in the real world. Vehicles that fail the test would not be type approved and so unable to be put on sale.

Under the latest Euro 6 standards, the NOx emissions of a petrol and diesel car are at their lowest ever levels – 60mg/km for petrol and 80mg/km for diesel (limits for previous Euro 5 diesel were 180mg/km). New diesel cars should not, therefore, be discriminated against through regulations, standards or policies.

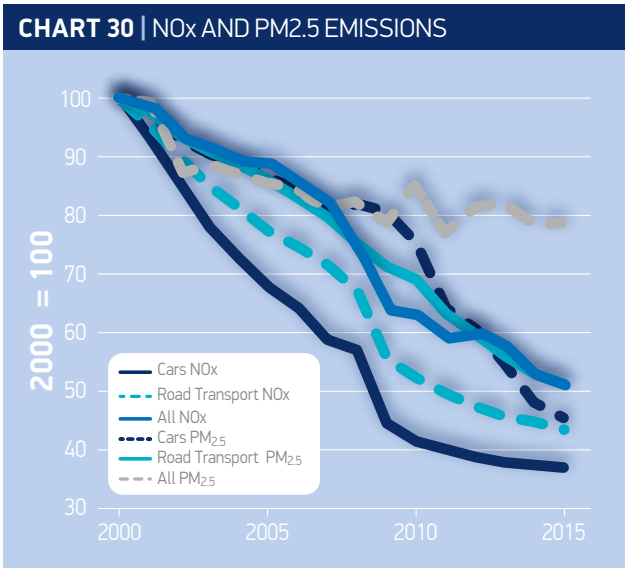
However, measures have been introduced, notably the changes to VED from April 2018, which directly penalise the latest diesel vehicles. Industry believes this is potentially harmful for the environment if consumers hold onto their older, higher emitting, vehicles for longer.

CHART 29 | DIESEL NOx EMISSIONS –STANDARDS/LIMITS



Department for Transport statistics show that at a national level NOx and $PM_{2.5}$ emissions from road transport and, in particular, cars, fell sharply between 2000 and 2015 (see chart 30), although at a local level concerns may be much more acute and require local action to deliver further reductions. In many cases high pollution levels come down to one or two specific roads in the local area. In 2015, road transport accounted for 33.9% of all NOx emissions, with cars accounting for 16.1%. For $PM_{2.5}$ the figures were 13.2% and 2.9% respectively. Since 2000, NOx emissions from cars have fallen by 63.1% and $PM_{2.5}$ emissions by 54.7%.

CHART 30 | NOx AND PM2.5 EMISSIONS



To tackle air quality, the government has launched a number of initiatives, largely collated in the July 2017 National Air Quality Plan. Central to government's objective of tackling NO_2 is replacing conventional petrol and diesel vehicles with electrified vehicles. The government has also announced requirements for five cities (Birmingham, Leeds, Nottingham, Derby and Southampton) to introduce Clean Air

Zones (CAZs) by 2019. These cities will need to implement action plans to deliver these CAZs. CAZs are also expected to be introduced in a further 29 local authorities where annual NOx limits have been persistently exceeded.

Local authorities are required to look at a number of measures to reduce pollutants which impact upon air quality. If those have been exhausted then as a last resort, charging zones can apply to a CAZ. Any charges would need to be assessed against the effects on local residents and businesses – which might limit the use of charges if it pushes business or retail consumers out of an area. Emission standards for CAZs for cars/vans is Euro 6 for diesel and Euro 4 for petrol, and for HGVs/buses is Euro VI. Vehicles which meet these minimum emission standards, as well as fully electric and hydrogen vehicles, will be able to enter or move within the zone freely.

Industry has long called for measures to help speed up the replacement of the fleet, as older vehicles are typically the most polluting. Scrappage is one way to achieve this, with fiscal support provided to consumers to encourage them to retire their vehicle early. Several vehicle manufacturers introduced their own schemes in 2017. However, a nationwide scheme targeted at improving air quality is not expected to be an effective use of public funds, especially when compared with more targeted approaches for local areas where air quality is an issue.

Government is also to review consumer information, and potentially look to broaden the new (and used) car fuel efficiency label to include data on a vehicle's air quality performance. This will most likely be done through Euro standards or showing if the vehicle is CAZ compliant. The effectiveness of the label and how much information consumers would find of use on it needs to be reviewed and consumer messaging needs to be thoughtfully considered and a collaborative approach taken to ensure consistent and useful information is provided. This should be done in conjunction with the switchover to the WLTP test data on the label and corresponding timing of tax changes.

An Air Quality Strategy is due to be published in 2018, which is expected to work toward reducing emissions from five air pollutants – nitrogen oxides, particulate matter, sulphur dioxide, non-methane volatile organic compounds and ammonia. ■

OUTLOOK FOR CO_2 EMISSIONS

INTRODUCTION

Motor vehicles have helped shape the world we live in and enabled freedom of movement and economic growth. The burning of fossil fuels does emit carbon and other emissions. Carbon emissions impact on climate change, while other emissions (including pollutants such as NOx and PM) impact air quality, at a local rather than national level.

The automotive sector is committed to reducing overall vehicle emissions and spends more than 5% of its turnover on research and development (source ACEA). Most manufacturers have made well published announcements totalling billions of pounds of spending to bring to market lower CO_2 emitting vehicles, particularly electrified products. The pan-European new car and van CO_2 regulations set out specific targets for individual manufacturers to deliver improvements in CO_2 emissions across their fleets. There are also strict standards limiting other pollutants that a vehicle can emit, known as Euro standards, with which vehicles have to comply to be able to be certified for sale.

NATIONAL UK CO_2 TARGETS

The UK has a legally binding target to reduce greenhouse gas emissions (GHG) by 80% by 2050 from a 1990 basis. CO_2 is the principle source of GHG. To achieve this target, the government has adopted five-year Carbon Budgets. The second Carbon Budget covers the period to 2017, while the furthest looking – and fifth – Budget sets out emission reduction targets to 2028-2032.

Whilst the UK does not have specific reduction targets for road transport, or cars, it has set out ambitions for the type of vehicles to be in use. In July the government's 'Plan for Roadside NO_2 Concentrations' was published (see https://www.gov.uk/government/news/plan-for-roadside-no2-concentrations-published). Whilst this was in response to plans to reduce pollutant emissions it included an ambition to see an end to the sale of all new conventional petrol and diesel cars and vans by 2040 and for almost every car and van on the road to be a zero emission vehicle by 2050. These ambitions had been previously set out in 2011, but created far greater media coverage and so market impact after the 2017 announcement.

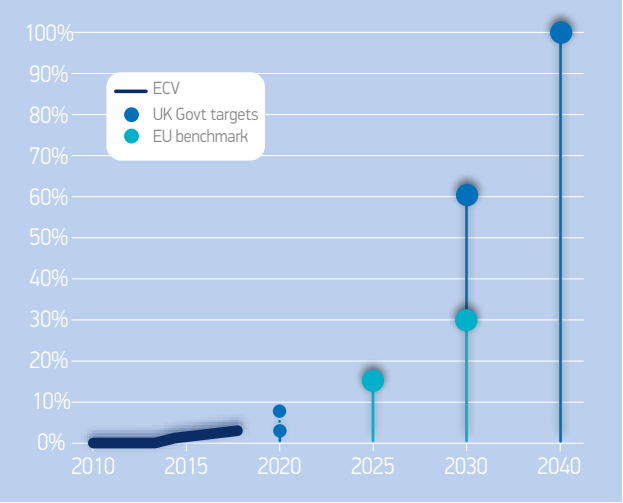
On the definition of zero emission vehicles, the government has since said this means that almost all new cars and vans will need to deliver a 'significant' proportion of journeys with zero tailpipe emissions. It remains unclear what 'significant' means, with industry particularly concerned about whether conventional electric hybrids and plug-in electric hybrids will still be able to play an important role. Limited industry data suggests that plug-in hybrids are driving 40-50% of their miles on electric power, whilst for conventional hybrids the figure maybe around 35-40%.

In order to meet the 2040 ambition, the Committee on Climate Change suggests that electrically chargeable vehicles (ECVs – BEVs and PHEVs) will need to obtain a 60% market share by 2030 (with a split of 30% as BEVs and 70% PHEVs). The Office for Low Emission Vehicles (OLEV) targets a 3-7% share of the 2020 market by ULEVs (less than 75g/km).

These targets will greatly influence CO_2 emissions from the new car market. Industry is unclear how these targets have been derived, what will be the rate of change to the transition to the 2040 level and in particular what technologies will be in place, or allowed to be in place, then. In addition, what actions the government would introduce if the market does not look to be on course to meet these levels.

Chart 31 shows the current uptake of ECVs and the targets from both the UK government and also within the EC proposal for post 2021 CO_2 regulation as benchmark levels for zero and ultra-low emission vehicles (those under 50g/km – which would likely only be BEVs and PHEVs). This shows the huge uplift in registrations required, but also the variation in outlook. There is a large number of forecasts for AFVs and caution is needed when reviewing them to ensure they are using the same metric. In addition, because the forecasts are also so reliant on a number of variables – such as supply of new models and consumer demand – influenced by product affordability, infrastructure provisions, levels of incentives and regulations/standards in place, that they can deliver very different scenarios.

CHART 31 | ECV MARKET SHARE TO 2017 AND TARGETS TO 2040



The impact of further improvements in CO_2 performance of conventional petrol and diesel cars will remain a key contributor to the total market's CO_2 performance for some time, considering the proportion of registrations they account for. If there were no changes in the average CO_2

emissions from petrol or diesel cars then to meet the EU's 2021 95g/km target in the UK would require AFVs to take a 51% of the market – requiring a rise of almost 1,000% in registrations, or ZEVs to take a 23% market share – requiring a rise of more than 4,000% in registrations.

PAN EUROPEAN NEW CAR CO_2 REGULATION

The European new car CO_2 regulation (EC 443/2009) is the cornerstone of the EU's strategy to improve vehicle efficiency and is part of its target to reduce greenhouse gas emissions by 20% by 2020 (from 1990 level). It set a tailpipe target for new cars in the EU to emit not more than an average 130g/km in 2015 – which was met – and 95g/km in 2021 (with a phase-in of 95% of the fleet achieving this target in 2020). The 2021 target represents a 40% reduction from the 2007 level of 158.7g/km. There is also a regulation for new vans (EC 510/2011), which sets out fleet average targets of 175g/km by 2017 and 147g/km by 2020.

The regulation applies to all manufacturers with more than 1,000 registrations per annum in the EU. Small volume manufacturers (SVMs), with up to 10,000 EU registrations for cars and 22,000 for LCVs, can apply for a derogation to get a more appropriate target that reflects their economic and technical potential (and recognising they often operate in specialist market sectors). Niche manufacturers, with fewer than 300,000 registrations, can apply for a target of a 45% reduction from their own 2007 base by 2021. Manufacturers are allowed to pool with each other (e.g. join forces) to meet collective targets.

There are significant penalties for companies that miss their targets (at €95g/km per gram CO_2 over target, multiplied by number of vehicle registrations). So, for example, a manufacturer missing their target by 5g and selling one million vehicles in a year would face a €475 million penalty.

On 8 November, the European Commission published proposals for post 2021 new car and LCV CO_2 Regulation – see https://ec.europa.eu/clima/policies/transport/vehicles/proposal_en. The proposals must now go through the European Parliament and Council, as well as public consultation, before being adopted – expected by summer 2019.

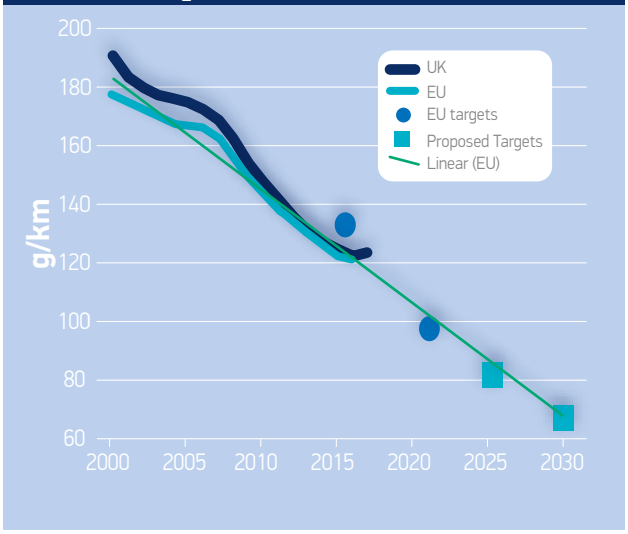
The proposal seeks a 15% reduction by 2025 and a 30% reduction by 2030 from both the car and LCV markets (separately), from a 2021 base. Targets will continue to be based on individual manufacturers, using a mass parameter, and ultimately expressed in g/km, but become based on WLTP (rather than NEDC) data. The regulation will continue to apply to those manufacturers with more than 1,000 registrations per annum, and while SVMs will be able to seek derogations, the niche provisions are proposed to be dropped.

Targets will be relaxed by up to 5% if the zero or low emission (<50g/km under the WLTP test) proportion of the manufacturer's fleet exceeds a benchmark of 15% in 2025 and 30% in 2030. Zero emission vehicles (ZEVs) of 20% or 35% in 2025 and 2030 respectively would deliver the maximum 5% relaxation in CO_2 target. Higher proportions of low emission vehicles (LEVs) are required to achieve the same results, with a sliding scale dependent on their CO_2 emissions. Eco-innovations – measures which reduce emissions outside of the test cycle – are also still to be permissible, but super credits will be dropped (given the new LEV/ZEV benchmark).

The proposal also seeks to introduce real world monitoring data, through fitment of a standardised device. This data will be collated and published, with a mechanism introduced to reduce the gap between real world and test data. In-service conformity will also be undertaken, with a sample of vehicles tested to ensure they meet type approved emission levels.

The proposals were part of the EC's "Clean Mobility Package". This was the second mobility package and also included measures to boost investment in alternative fuel infrastructure and develop a network of fast and interoperable recharging and fuelling stations across the EU.

CHART 32 | UK AND EU AVERAGE NEW CAR CO_2 EMISSIONS AND FUTURE TARGETS



The European automotive industry has expressed concerns over the high level of ambition in the proposal, and in particular the 2025 target and the use of a linear approach to the targets. This will in effect see industry required to deliver a 60% improvement in efficiency, compared with 30% for the EU's overall CO_2 reduction target. While industry recognises that CO_2 emissions from the total fleet have not come down as rapidly as hoped this is largely to do with increased vehicle use. Other measures – such as faster fleet renewal, driver training, journey planning and availability of alternative modes of transport – could also influence total fleet emissions.

The stipulation that LCVs face the same reduction target as cars is also a concern, given LCVs typically have longer product life cycles, as well as the suitability of new technologies to certain vehicle types and their impact on available payloads.

Industry is also concerned about the low weighting of LEVs

within the benchmark and that there is no reference to other fuels such as biofuels or e-fuels, which could also be introduced to reduce emissions.

BREXIT AND CO_2 REGULATION

At present the UK is set to leave the EU in April 2019, before the end of the current phase of the CO_2 regulation. It is unclear what impact this will have on the CO_2 regulation. Industry would prefer the UK to remain part of the EU target.

If the UK replicates the EU targets unaltered through the EU Withdrawal Bill this would leave manufacturers having to meet the 95g/km target for cars (and 147g/km targets for vans) solely in the domestic market. In addition, any excess premiums would be payable to UK authorities and the derogation limits may need to be adjusted. Industry is concerned such a development would greatly reduce manufacturers' ability to balance markets and leave them with a much smaller market with which to meet targets. The UK new car market in 2017 was 2.54 million, compared with 15.1 million for the whole of the EU. It would leave industry much more vulnerable to local market fluctuations – as evident in 2017 with the 17% reduction in diesel volumes, which could undermine the sector's ability to meet any targets.

While the UK average new car CO_2 performance is only modestly above the EU average (1.7% or 2g/km in 2016), the performance of individual manufacturers may have larger differences. If the UK was treated as a single entity and was 2g/km over the target, the penalty would be over €500 million.

Revising the derogations to reflect the UK withdrawal would likely create reclassifications of manufacturers being exempt, having a small volume or niche derogation or facing the full impact of the Regulation. It is unclear if this would necessitate new derogation applications. Whilst the UK overall accounted for 16.8% of the EU market in 2017, for individual manufacturers the proportion could be very different, notably with many small volume manufacturers having a higher UK market focus.

A suggested two-year transition or implementation period could take the UK closer to the end of the current phase of the regulation, but still leaves uncertainty around the post 2021 situation. If the UK were to adopt a different approach this would create uncertainty for the market. Manufacturers may need to decide whether to change the mix of models they produce or offer for the UK market, and whether this creates additional cost for UK consumers required to purchase more technologically advanced products.

MANUFACTURER COMMITMENT TO NEW TECHNOLOGIES

The push to bring new technologies to the market is of significant commercial interest to vehicle manufacturers. More efficient vehicles typically create a competitive advantage for the manufacturer and can create market and economic

TABLE 9 | MANUFACTURERS CURRENT AND FUTURE CAR ELECTRIFICATION PLANS

Manufacturer	Current	Future
Ford	1 BEV, 1 PHEV	70% of models electrified by 2025, 16 BEVs and 24 PHEVs by 2022
Volkswagen	2 BEVs, 2 PHEVs	Every model to have an electric option by 2025 and 25% of sales to be electrified
Vauxhall		By 2020 4 electrified models (e.g. Grandland X PHEV and Corsa BEV). By 2024, all models electrified – including BEV or PHEV versions
Mercedes	1 BEV, 3 PHEVs, 4 hybrids	15-25% of sales to be electrified by 2025, 10 EV models by 2022
BMW Group	1 BEV, 5 PHEVs, 2 hybrids	25 pure EV and hybrids by 2025
Audi	2 PHEVs	Every model to offer an electric option by 2025 and 25% of sales to be electrified
Nissan	2 BEVs	20% of sales to be BEVs by 2020
Toyota	6 hybrids, 1 PHEV, 1 FCEV	An electrified option across every model by 2025, 60% of UK sales be electrified (HEV, PHEV, FCEV) by 2020. BEVs from 2020s
Hyundai	1 BEV, 1 FCEV, 1 PHEV, 1 hybrid	Up to 38 green models by 2025, many BEVs
Kia	3 PHEVs, 1 hybrid	11 new models by 2020 – including BEV, FCEV, PHEVs and hybrids
Lexus	9 hybrids	98% of UK sales full hybrid electric and a diversity of electrified options by 2025 (PHEVs, BEVs, FCEV)
Mitsubishi	1 hybrid	20% of cars to be EV-based by 2020
Jaguar Land Rover	2 hybrids	Every model from 2020 to have electrified variant
Aston Martin		100% hybrid by mid 2020s
LEVC	PHEV	All PHEVs, including new van
McLaren Automotive		Following the PHEV P1TM model (the first hybrid supercar) 50% of cars will feature hybrid technology by 2022. Full electric prototype being tested.

Source: various manufacturer announcements and media articles. SMMT takes no responsibility for the accuracy of future plans, and plans may be subject to change.
To note: BEV – battery electric vehicle, FCEV – fuel cell electric vehicle, PHEV – plug-in hybrid electric vehicle, hybrid – hybrid electric vehicle. Electrified could be all of above, plus 48v mild hybrid.

gains. However, delivering those lower emitting technologies is expensive. Deciding which technologies to invest in is difficult, as it is unclear what consumers want – especially given changing political agendas (notably increased focus on air quality). New technologies take significant investment to develop and bring to market, and, given uncertainty over which technologies to develop and match to consumer demand, this brings commercial risk. This investment is typically funded by the sale of current products, so measures that undermine that investment cycle can be to the detriment of industry and overall pace of change in products.

There were 76 alternatively fuelled models with registrations in 2017, up 7.3% on 2016 (for models with at least 50 registrations, the growth was 20% to 59). These represent more than 20% of all the different models offered by manufacturers and included petrol and diesel electric hybrids, petrol and diesel plug-in hybrids, pure battery electric and hydrogen fuelled vehicles.

During the year most manufacturers announced plans to bring further alternatively fuelled vehicles to market. Announcements by the top 10 best-selling brands are detailed in Table 9, as well as selected others.

SMMT fully supports a technology neutral approach (policy not favouring a particular technology, so enabling all technologies to compete and allow the market to decide which technologies best serve the market's needs). It is clear that industry is set to continue to deliver a mix of different technologies ahead. No single technology is likely to stand out as the solution for all, rather specific technologies for specific users – in line with the right vehicle for the right journey approach. Industry is therefore concerned with any legislation or incentivisation that focuses overly on specific technologies (such as technology mandates or fiscal support for a particular technology or technology infrastructure) and it should be up to consumers to decide which technologies they prefer.

There is also scope for cleaner fuels in conventional cars to be introduced. This could include fuels with modest uplifts in biofuels, e.g. E10 petrol (petrol with 10% blend of ethanol), or more significantly different fuels, such as efuels (efuels are liquid fuels derived from converted energy from renewals, e.g. solar power, that is then stored in a liquid form, and able to be used in conventional internal combustion engine vehicles).

The Nissan Leaf, Europe's best selling BEV, is produced in the UK, alongside an assembly plant making batteries for both the Leaf and other electric vehicles. Toyota produces an Auris hybrid model at its plant in Burnaston, Derby, and the all-new electric, with range extender, taxi from LEVC is also built in the UK. LEVC will soon produce a second model, an electric commercial vehicle, while BMW announced in 2017 that the forthcoming electric MINI will be built in the UK. Jaguar Land Rover – the UK's largest vehicle producer – will also be producing significant volumes of BEVs and PHEVs in the future. The UK's small volume manufacturers are often at the forefront of technology provision and, as outlined in Table 9, McLaren Automotive and Aston Martin, as well as Bentley and Rolls Royce, are set to bringing new-electrified products to market shortly.

ROLE OF OTHER STAKEHOLDERS – INCLUDING GOVERNMENT

As outlined earlier in the report the government plays a key role in enabling industry to deliver lower CO_2 emissions. The government sets the legislative framework to which industry must comply with – in terms of technical regulations and environmental standards and policies. It also sets fiscal policy (taxes and incentives), influences infrastructure provision, delivers information and signals to consumers, can shape action at local authority/ borough level and is also a large buyer of vehicles through its own fleet procurement. Industry therefore looks to government to support the transition to electric and hydrogen vehicles through overcoming the 3As – range Anxiety, infrastructure Accessibility and product Affordability.

The transition to zero-emission vehicles will reflect how products improve, availability of infrastructure and product affordability. The government is set to produce a Road to Zero strategy in 2018, detailing how government will support this transition. Industry looks to work closely with government, and other stakeholders, on this journey. Within this strategy, industry is particularly keen to see the government's definition of zero and ultra-low emission vehicles, a glide path for the role of different technologies through to 2040/2050 – importantly including in the short term, and how it will help with overcoming the 3As.

Government is already supporting industry with this transition, as illustrated through the Faraday Challenge, which is providing funding for battery research and development and manufacturing. Measures in the Automated and Electric Vehicles Bill seek to improve charging infrastructure provision and interoperability, while infrastructure funding incentivise consumers, businesses and local authorities to install charge points. Industry looks for further engagement with all stakeholders in the process to ensure the right amount and right type of charge points are provided. Measures such as the plug-in grants and other fiscal measures greatly shape the cost of alternatively fuelled vehicles, which due to their new and innovative technology and currently low sales volumes remain expensive compared with petrol and diesel products (although those cost comparisons are continually changing).

While industry understands that incentives are in place to aid the initial take-up of AFVs, which often face a price premium due to their advanced technologies and more limited production runs, the way incentives are tapered or removed is very important to the market. Evidence from other countries has already shown that consumer incentives, be they one-off grants or recurrent fiscal incentives, have strong positive correlations to ULEV sales. BEV sales fell sharply in Denmark when it was announced in 2015 that favourable registration tax treatment for BEVs would end by 2020 – showing even a five-year lead-time can be too short. Similarly, EV registrations in Holland and Hong Kong have fallen sharply after tax breaks and incentives were withdrawn.

Within the Automotive Sector Deal (www.gov.uk/government/publications/automotive-sector-deal) the government recognises the importance of the automotive sector to the UK, both in terms of jobs and economic influence, but also how new technology and changes in the types of vehicles and how they are produced are all going through significant change. The deal develops the work of the Automotive Council, which, through government-industry partnership, aims to ensure the UK continues to be a successful place to develop, build and bring to market vehicles that meet our future needs.

New vehicles offer the latest technologies, as well as other consumer demands, for example space, style and safety. But in some instances retrofitting of cleaner technologies could prove beneficial. Similarly, advanced fuels, such as biofuels or efuels, could help reduce emissions. Industry and fuel providers would need to work together to ensure vehicles are capable of running such fuels and consumers would need to be aware and possibly incentivised to switch to them.

Biofuels, which include ethanol, biodiesel and natural gas, can help reduce CO_2 by replacing fossil fuels with those derived directly from plants or indirectly from agricultural, commercial, domestic, and/or industrial wastes. Biofuels can also reduce some other pollutant emissions, notably particulate matters.

Currently petrol and diesel sold in the UK already contain biofuels, E5 allows for up to 5% of petrol to be made up of ethanol and B7 allows for up to 7% of diesel fuel to be biodiesel. The UK may see the introduction of E10, and most petrol cars are designed to run on this level of fuel (provided it meets the appropriate BSI standards). It is important that the fuel quality is correct, to avoid any issues which impede the normal operation of the vehicle and tarnish the image of biofuels. The higher use of biofuels could help reduce emissions from the vehicle fleet. However, the source of the biofuel is important to sustainability and the broader environmental issues.

The media and other stakeholders can also play an important role in shaping consumer choice and actions through their messaging. During this transition to a variety of new technologies it is important that these information providers are well informed.

Increasingly, consumers and businesses are taking a much more holistic view to their impacts on society, through commitments and measures to reduce and offset emissions.

OTHER INFLUENCES – AUTONOMOUS, CONNECTED, ELECTRIC AND SHARED VEHICLES (ACES)

The role of autonomous, connected and shared vehicles will also be important in the transition to lower emission vehicles, as well as reducing emissions from the vehicle fleet as a whole. Some of these technologies are already in place, although they will be developed much further in the future. Vehicles that select optimal routes and inform other road users of traffic and incidents which slow the efficient movement of people and goods, that drive more efficiently and can share journeys can all make a real difference to emissions. Many of these technologies have also been wedded to the introduction of alternatively fuelled vehicles, notably electric, although they need not necessarily be. Modelling undertaken by the International Transport Forum in Auckland, New Zealand, shows the positive effect shared mobility can have on emissions. By replacing half of all private car trips with rides in shared vehicles, CO_2 emissions would decrease by 20%, while replacing just 20% of private car trips with shared mobility leads to a 15% reduction in CO_2 emissions.

ROLE OF CAR CLUBS

The role of car clubs and use of technology to enable car sharing – e.g. for taxis, private hire and delivery vehicles, can also play a role in reducing traffic and utilising the vehicles more effectively. It could also help share the costs and ensure the most efficient vehicles are being used.

Trends to urbanisation and consumer preference for 'mobility solutions' rather than vehicle ownership support this transition. This will also lead to significant changes to the traditional business model of selling vehicles. SMMT's response to the EC's consultation on post-2020 CO_2 regulation called for manufacturers which actively support car clubs or efficient driver training to be given credit to reflect the additional real world CO_2 savings these could deliver.

The introduction of car clubs often needs public-private partnerships, with regulators, planners, vehicle manufacturers and service providers coming together to ensure barriers are overcome. These barriers will include issues around insurance and liabilities.

TIME TO RE-ENGAGE WITH CONSUMERS

Given the breadth of changes at present – notably around introduction of the new WLTP emissions test and clean air zones, there is an opportunity to re-engage with consumers, fleets and professional drivers to ensure they are aware of the importance of purchasing and using the right vehicle for their needs. This will help them minimise their CO_2 impact, their broader environmental impact and the impact on their own personal economics. More fuel-efficient vehicles help reduce emissions, as well as minimise fuel costs and can lower any tax liabilities related to CO_2 emissions.

Industry is working with the Low Carbon Vehicle Partnership (LowCVP) and government on how best to provide messaging to consumers on the switch to the new test cycle and on revising the new car label. GUL is also providing consumer messaging to help consumers understand the benefits of zero emission vehicles.

Technology can help reduce the need to travel in the first instance and provide information on the different modes available to make any necessary journey. If the consumer then chooses a motor vehicle technology, this can enable them to take the most effective route, but how the vehicle is driven and how it is maintained is still a responsibility of the consumer. A poorly maintained vehicle can emit as much as 50% more CO_2, while efficient driving techniques can reduce emissions by 5-15%. ■

SMMT
DRIVING THE
MOTOR INDUSTRY

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