



Department
for Transport

Decarbonising Transport

Setting the Challenge



March 2020

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Ministerial Foreword

Climate change is the most pressing environmental challenge of our time. There is overwhelming scientific evidence that we need to take action, and doing so is a clear priority for the Government. That is why in June 2019 we became the first major global economy to pass a law that requires us to achieve 'net zero' greenhouse gas (GHG) emissions by 2050.

Transport has a huge role to play in the economy reaching net zero. The scale of the challenge demands a step change in both the breadth and scale of ambition and we have a duty to act quickly and decisively to reduce emissions.

The associated benefits of bold and ambitious action to tackle transport emissions are also significant. We can improve people's health, create better places to live and travel in, and drive clean economic growth. The UK is a global centre for world-leading science, technology, business and innovation and we are perfectly placed to seize the economic opportunities that being in the vanguard of this change presents. The faster we act, the greater the benefits.

Through the Transport Decarbonisation Plan, 2020 will be the year we set out the policies and plans needed to tackle transport emissions. This document marks the start of this process. It gives a clear view of where we are today and the size of emissions reduction we need. A series of events, workshops and opportunities this year will ensure you have a chance to have your say on how we do this. We want to hear from individuals, businesses, trade associations, local authorities, scientists, researchers, innovators, interest groups and environmental groups as we develop the first comprehensive action plan for decarbonising transport.

In the coming months we will work with you to develop the plan, with a vision for how a net zero transport system will benefit us all:

- Public transport and active travel will be the natural first choice for our daily activities. We will use our cars less and be able to rely on a convenient, cost-effective and coherent public transport network.
- From motorcycles to HGVs, all road vehicles will be zero emission. Technological advances, including new modes of transport and mobility innovation, will change the way vehicles are used.
- Our goods will be delivered through an integrated, efficient and sustainable delivery system.
- Clean, place-based solutions will meet the needs of local people. Changes and leadership at a local level will make an important contribution to reducing national GHG emissions.
- The UK will be an internationally recognised leader in environmentally sustainable, low-carbon technology and innovation in transport.



- We will lead the development of sustainable biofuels, hybrid and electric aircraft to lessen and remove the impact of aviation on the environment and by 2050, zero emission ships will be commonplace globally.

We will also look to develop a universally recognised measure so that in future, people can easily compare how much CO₂ different forms of transport emit over a certain distance.

Success will require the sector, and its users, to embrace new technology and innovation like never before. We believe the transport sector is ready to step up and meet those challenges.

As we move towards a net zero GHG emissions transport system, we cannot lose sight of the fact that the UK is on a journey with the rest of the world. Action is needed beyond the UK, and we are in a unique position to demonstrate real leadership domestically, as well as leading change in sectors that require global solutions, such as international shipping and aviation.

This document marks the beginning of a conversation to develop the policies needed to decarbonise transport. As we prepare to host the UN's annual climate change conference COP26 in Glasgow this November, we will publish our Transport Decarbonisation Plan which will set out how we intend to transform the movement of people, goods and services to reach net zero.



Rt Hon Grant Shapps MP
Secretary of State for Transport

About this document

At a glance

The Government is developing an ambitious plan to accelerate the decarbonisation of transport. The Transport Decarbonisation Plan (TDP) will set out in detail what government, business and society will need to do to deliver the significant emissions reduction needed across all modes of transport, putting us on a pathway to achieving carbon budgets and net zero emissions across every single mode of transport by 2050.

Whilst there have been recently published strategies^a to reduce GHG emissions in individual transport modes, the journey to net zero demands that transport as a whole sector moves further, faster. The TDP will take a coordinated, cross-modal approach to deliver the transport sector's contribution to both carbon budgets and net zero.

Technical measures, such as the need for rapid renewal of the road vehicle fleet with zero emission vehicles, are well understood and will deliver substantial reductions in GHG emissions over the long term. But to deliver the reductions needed now, and set us on a credible pathway to net zero, we also need to consider how we travel and how our goods and services reach us today. This is needed in parallel to the rapid development and deployment of clean technology.

We will work with industry and communities around the country to develop this plan – to make our towns and cities better places to live, help to create new jobs, improve air quality and our health, as well as taking urgent action on climate change. We will also consider how UK technology and innovation can support major changes to the way people and goods move across the UK and ensure the UK benefits from the opportunities decarbonisation presents.

Over the coming months we will work closely with those in the transport sector with an interest in how it is decarbonised, its supporting supply chains, and the public and businesses that rely upon it to develop a comprehensive plan of actions.

The Government will publish the final plan in Autumn 2020.

Scope

To achieve net zero in transport we will consider 'in use' GHG emissions from transport, meaning those emissions generated from the operation and use of the UK's transport system. In addition, the choices people and businesses make about travel and transport will be considered, including how digital tools could empower consumer choice. Outside of the scope of this plan are the GHG emissions associated with power generation and distribution for transport, and construction of transport infrastructure, noting their consideration in other policy areas.

^a The Government has recently published strategies to reduce GHG emissions across all conventional transport modes, including the Road to Zero strategy, Maritime 2050 and the Clean Maritime Plan, the Aviation 2050 Green Paper and forthcoming net zero aviation consultation and Aviation Strategy. These have been supported by the Cycling and Walking Investment Strategy, Future of Mobility: Urban Strategy, the 2018 amendments to the Renewable Transport Fuel Obligation, Freight Carbon Review, the Rail Industry Decarbonisation Taskforce and the Carbon Offsetting for Transport Call for Evidence.

While we decarbonise, action is being taken to adapt the transport sector, with plans in place to enhance resilience to climate change risks across rail, road, port and aviation industries under the UK's National Adaptation Programme. Adaptation work is also outside the scope of this plan.

Structure of this document

This document is the first step to developing the policy proposals and a coordinated plan for decarbonising transport. Delivering the emissions reduction needed from transport is a significant and sustained challenge and net zero demands a fresh approach. We have a duty to act and continue our global leadership in this area.

Chapters 1, 2 and 3 present transport modes and their current GHG emissions, the existing strategies and the policies already in place to deliver against our current targets and any future activity or work already committed or underway.

Chapter 4 presents the projected trajectory of the forecast GHG emissions from transport to carbon budget 5 (2028-2032) and beyond based on the firm and funded commitments outlined. This shows the positive impact of work to date, but the scale of the challenge we face in getting onto a credible net zero pathway.

Chapter 5 describes the challenge in meeting carbon budgets and net zero by 2050 and how we have split the challenge into six strategic priorities (figure 1).

Chapter 6 outlines our approach for engaging on this work. The plan will not be deliverable without input from a wide range of stakeholders who we will work closely with to develop a bold and credible plan. It sets out how we will work with interested parties and communities around the country over the months ahead to take urgent action on climate change, as well as delivering the substantial co-benefits of decarbonisation.

How to engage with us

We will listen to transport users, collecting data and feedback on their travel preferences and choices through regular surveys and research. We will build on this knowledge to inform our decarbonisation work through workshops, regional engagement sessions and public feedback opportunities. We especially want to hear how the sector, those who use and rely on it, as well as the wider public and the Government can take the steps needed to support an accelerated shift to zero emission transport.

We intend to host a series of workshops to work with stakeholders and representative groups to generate and test policy proposals. We will launch a public feedback opportunity for transport users and stakeholders to feed in their views on decarbonising transport, and we will conduct market research to gather data on public behaviours and inform how policy can be most effective.

You can share your views on decarbonising transport, register for regular updates on the progress of the Transport Decarbonisation Plan and register your interest for the workshops by emailing TDP@dft.gov.uk as well as by following [@transportgovuk](https://twitter.com/transportgovuk) on twitter.

Figure 1: Six strategic priorities for the Transport Decarbonisation Plan, to deliver a vision of a net zero transport system



2020 United Nations Framework Convention on climate change conference (UNFCCC) Conference of the Parties 26 (COP26)

Looking ahead, Glasgow is hosting the high profile annual UN climate change conference – COP26 – in November 2020, where the UK’s leadership in tackling climate change, including in the transport sector, will be showcased on a global stage.

The Transport Decarbonisation Plan will be published ahead of November’s conference and will build on a series of events in the run up to COP26. While the TDP will be one of the world’s most comprehensive action plans to date, we will need multilateral and coordinated international action to make transport decarbonisation a success and ensure the sector plays its role in limiting global temperature rise to well below 2°C.

To do this, we will take on a leadership role, and work closely with other countries to signal long term policy change and increase medium-term commitments and give a clear signal to consumers and industry that the transition to zero emission transport technologies is really happening.



Glasgow's Riverside Museum
Source: Rob Donnelly

1.

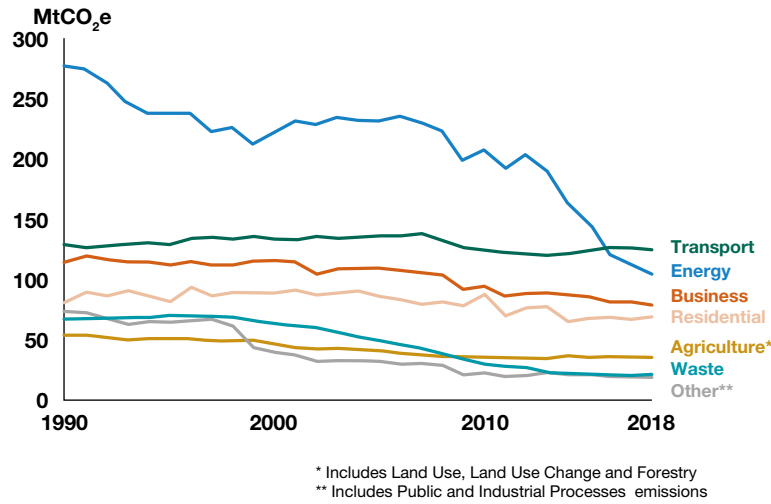
Greenhouse gas
emissions and transport

1. Greenhouse gas emissions and transport

Background

- 1.1 Climate change is the most pressing environmental challenge of our time. We agree with the need to limit global warming to well below 2°C and have legislated to end the UK's contribution to climate change by 2050. To do this will require rapid and unprecedented action across the UK economy and wider society¹ supported by technology innovation and robust policy frameworks.
- 1.2 The UK has made world-leading progress in cutting our GHG emissions while growing the economy. We were the first country to introduce legally binding long-term emissions reduction targets, known as carbon budgets, through the Climate Change Act in 2008. Under this legal framework, the UK has led the world in delivering clean growth. Between 1990 and 2018, we reduced our emissions by over 43%² while growing the economy by 75%³. In June 2019, the UK became the first major economy to pass a net zero law to end its contribution to climate change by 2050⁴ and in November we will welcome the world to the UN's climate change summit COP26 in Glasgow.
- 1.3 Net zero will require all sectors of the UK economy to deliver substantial further emissions reduction. Now is the time to build on the frameworks set out in the Industrial Strategy and the 2017 Clean Growth Strategy, which presented a 'high ambition' emissions reduction pathway through carbon budgets 4 and 5 to 2032⁵.
- 1.4 Addressing climate change will deliver a range of co-benefits including improved public health, reduced air pollution and noise. In doing so we will improve the places in which we live and work, our health and wellbeing and outcomes for future generations, as well as reducing inequality and promoting a fairer society.
- 1.5 In achieving net zero GHG emissions by 2050 and meeting our legal commitments along the way, we will see our economy and society transformed – our homes, our transport, our businesses, and how we generate and use energy. Other sectors, such as the energy and waste sectors⁶, have gone further and faster than transport to date, as the main contributors to our success in meeting carbon budgets 1 and 2.
- 1.6 Because of this success elsewhere, transport is now the largest contributor to UK domestic GHG emissions, contributing 28% of UK domestic emissions in 2018. Transport emissions are 4% higher than in 2013 and are only 3% lower than in 1990⁷.
- 1.7 Our action on climate change, including adaptation, goes hand in hand with the Government's manifesto commitment to deliver the most ambitious environmental programme of any country on earth. This is exemplified in the Environment Bill⁸, introduced into Parliament in January 2020, which acts as a key vehicle for delivering the bold vision set out in the 25 Year Environment Plan⁹.
- 1.8 The opportunities are significant, but unlocking them will require difficult decisions to be made, with large inputs from government and industry, supported and driven by shifting public attitudes and behavioural changes. The challenge presents vast and exciting opportunities for the UK, opening new markets in which the UK is poised to become a world leader and the opportunity to deliver co-benefits that lead to a better society.

Figure 2: UK Domestic GHG emissions, 2018

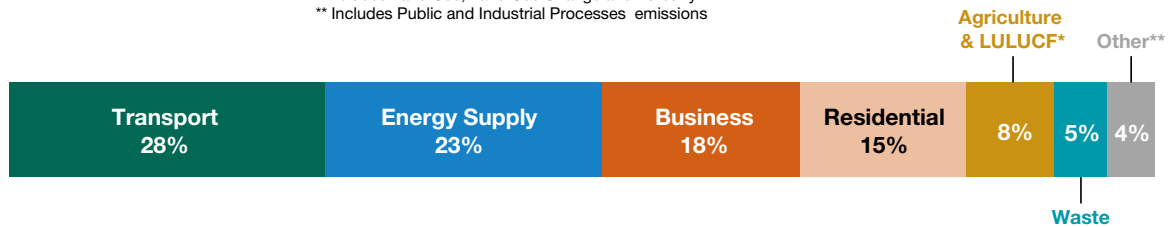


Transport became the largest emitting sector of GHG emissions in 2016

This follows large decreases in energy emissions while transport emissions have remained relatively static.

451 million tonnes of CO₂ equivalent (MtCO₂e)

is the total net domestic greenhouse gas emissions from all UK sectors in 2018, down 2.1% from 2017.



Source: 2018 UK greenhouse gas emissions¹⁰

Co-benefits

The Fifth Assessment Report of the Intergovernmental Panel on Climate Change defines co-benefits as being “the positive effects that a policy or measure aimed at one objective might have on other objectives”. Co-benefits of positive action on reducing transport emissions include:

- Public health benefits through increased active travel and improved air quality;
- Improvements to the economy and employment rates through industry and innovation; and
- Reduction in inequality where those who generate less noise and air pollution are disproportionately impacted by pollution¹¹.

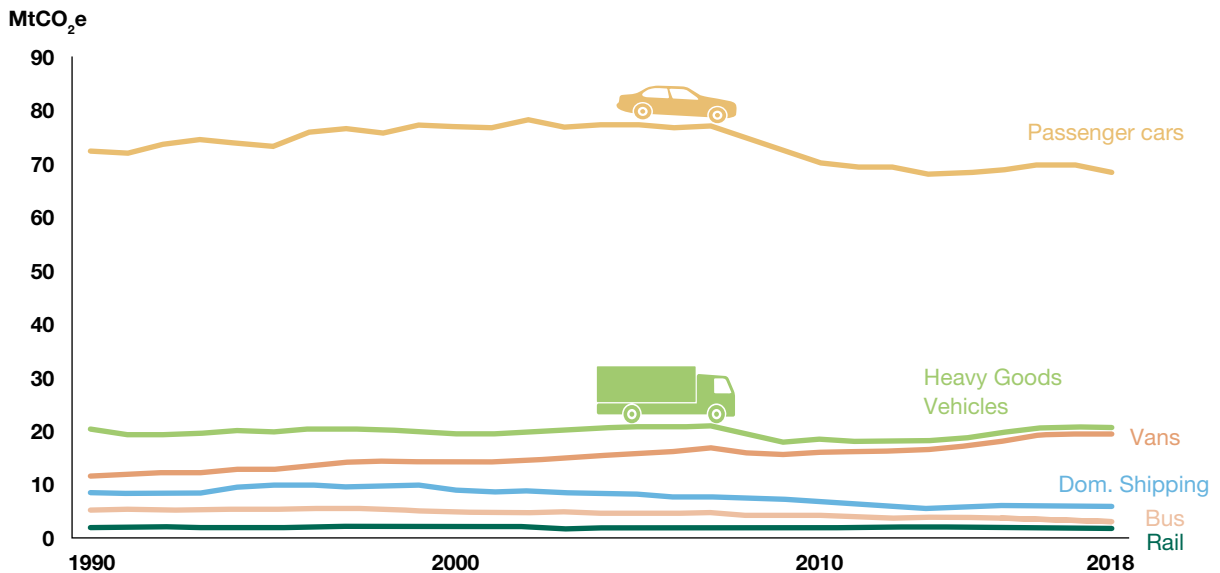
Emissions in the transport sector

1.9 The UK transport network supports people and goods to travel around the country. Whilst transport helps to connect people and places, boosting economic growth and opportunity, it now contributes over a quarter of UK GHG emissions. All transport modes must decarbonise in order to meet our economy wide net zero commitment.

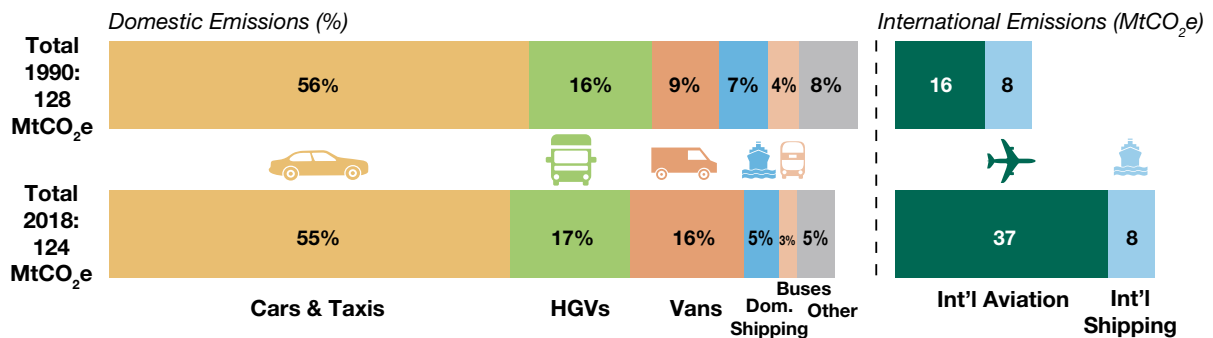
1.10 Within transport, road transport is the largest emitter of GHG. Cars contributed 55% of domestic transport emissions (68MtCO₂e) in 2018; as figure 3 shows, absolute emissions from a number of transport sectors have decreased since 1990, but there have been noticeable increases in emissions from vans and international aviation^b. Dramatic progress through regulation to improve the efficiency of new passenger cars has been largely offset by their increased use (figure 5).

Figure 3: UK domestic and international GHG emissions, 2018

UK domestic transport GHG emissions from selected sources, 1990 to 2018



UK Transport GHG emissions by mode, 1990 and 2018

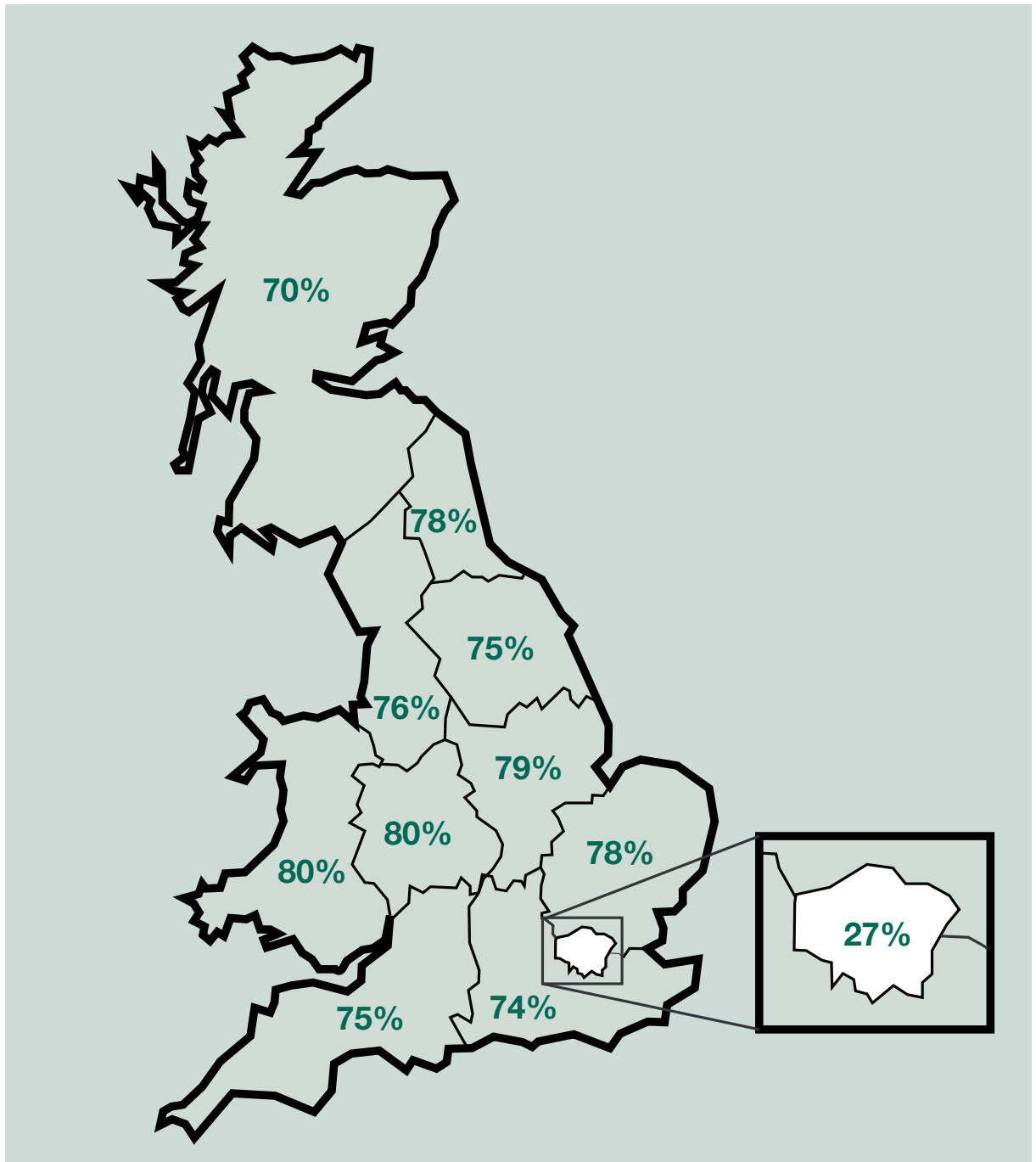


Source: 2018 UK greenhouse gas emissions¹²

^b International aviation and shipping emissions are accounted for via “headroom” within our existing carbon budgets. This is consistent with the Kyoto Protocol which gives two UN Organisations – the ICAO and IMO – responsibility for pursuing measures to reduce these emissions. There is no agreed way of allocating emissions to different countries, so our international emissions estimate are based on bunker fuels sales for international flights and journeys.

- 1.11 There are regional variations to people's travel behaviours – for example, across Great Britain, 68% of workers typically travelled to work by car in 2018. This did vary by region with London having a substantially lower proportion at just 27% (figure 4).

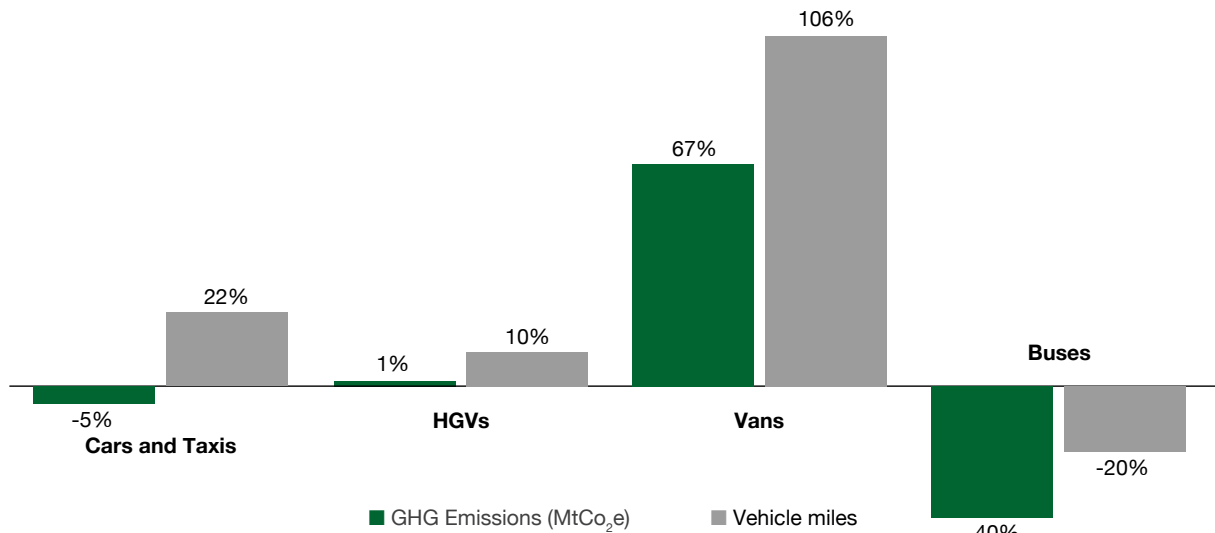
Figure 4: Percentage of workers usually travelling to work by car by region of workplace, Great Britain, 2018



Source: TSGB 2019, Chapter 1 – Modal Comparisons¹³

- 1.12 Figure 5 shows that whilst vehicle miles have increased for all road vehicles except buses, the GHG emissions have not increased at the same rate, and for cars they have decreased. Whilst we are travelling more, the vehicles we are using have become more efficient.

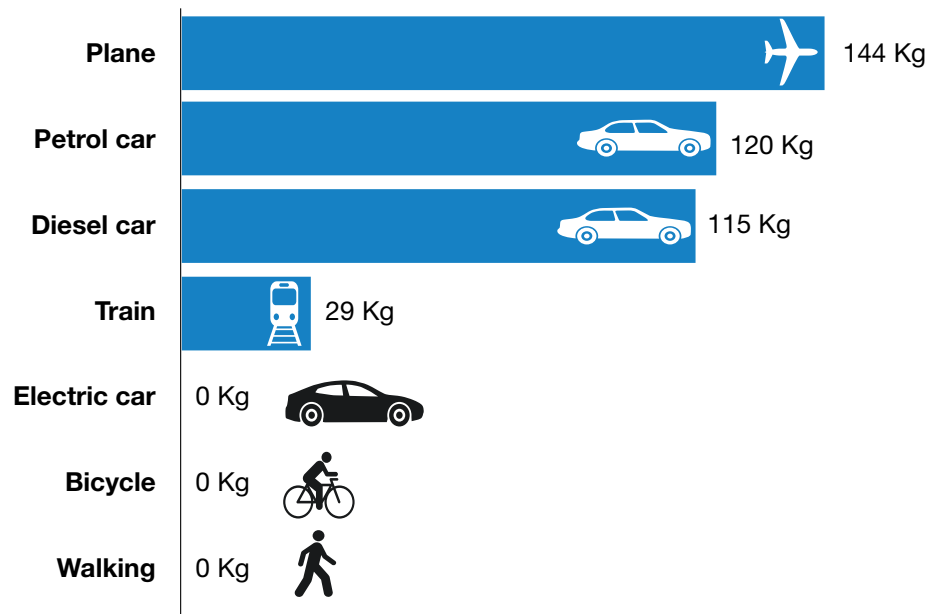
Figure 5: Change in road transport GHG emissions and traffic (vehicle miles), 1990-2018



Source: DfT Road Traffic Statistics (TRA0201), BEIS/NAEI¹⁴

Figure 6: GHG emissions per passenger travelled by mode

Indicative GHG emissions for a passenger travelling from London to Edinburgh, 2018



Source: Energy Saving Trust¹⁵

Notes

Plane journey excludes travel to/from airports.

Car emissions exclude tyre and brake wear.

Train emissions are based on an average for diesel and electric trains; if a route is fully electrified, emissions would be lower than those presented.

- 1.13 The choices people make about whether to travel or transport goods using different modes of transport determine the environmental impact of that journey. The amount of GHG emissions associated with transport will depend on various factors such as the type and size of vehicle, the type of fuel used, fuel efficiency, route choices and the weight of goods transported
- 1.14 At present, there are official statistics on total GHG emissions from different transport modes, but no official advice to help individuals understand the GHG emissions for specific journey and modal options. If individuals are able to access clear, transparent information about the emissions associated with their journeys, then this will enable more informed decisions about how individuals and goods travel.
- 1.15 Several organisations, such as the Energy Saving Trust, have made comparisons using publicly available conversion factors for the amount of emissions per unit of transport activity, like those shown in figure 6. These calculations will involve making a number of assumptions and can result in a wide range of estimates for the same journey. For example, in figure 6, adding emissions from the journeys to and from airports would have an impact, as would including different numbers of passengers within the cars.



An electric bus operating on London's 507 bus route

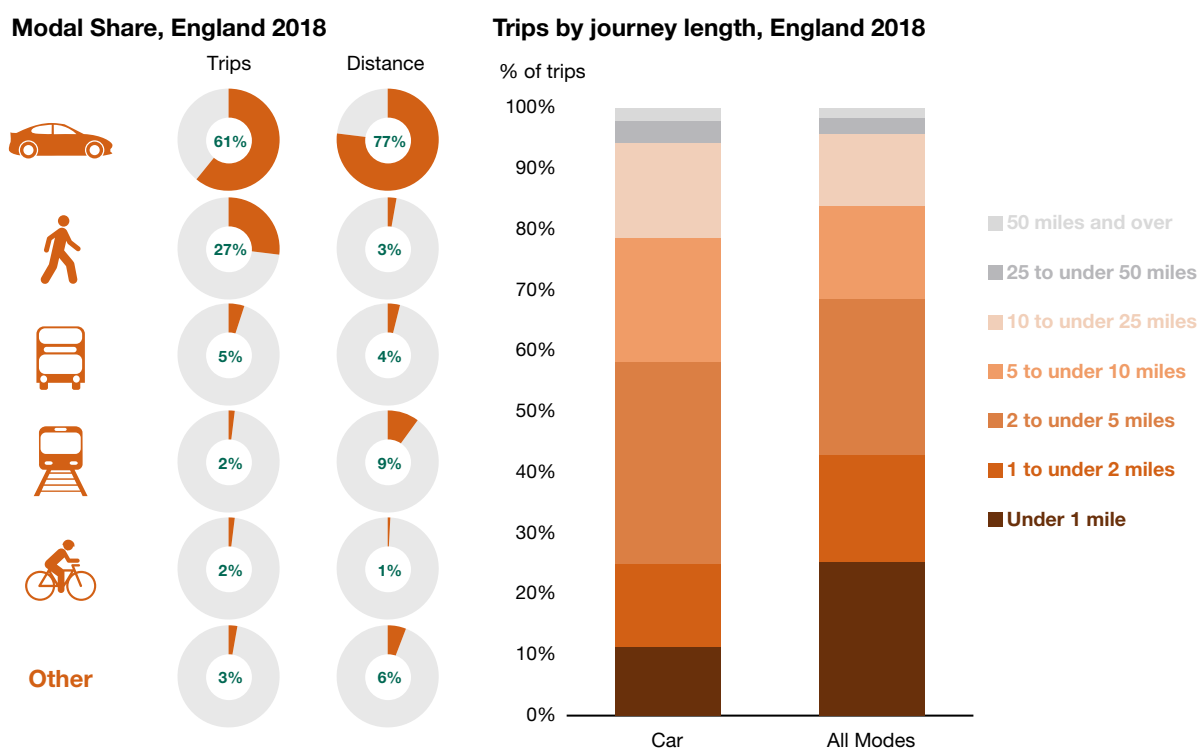
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Moving people:
emissions by mode

2. Moving people: emissions by mode

- 2.1 In this chapter, the current position of each transport mode used to move people is summarised against their historical emissions along with the current targets for each mode and the policies in place to deliver them. Future work already in place or planned for each mode is also presented.
- 2.2 The majority of the trips we make annually are for leisure, including trips to visit friends, attend sports events, for holidays and day trips, followed by commuting and journeys for work or business purposes. Cars are the most common mode of transport regardless of the journey type. 94% of these car journeys are under 25 miles, with 58% under five miles in 2018¹⁶. 87% of car users in England are of the view that their current lifestyle means they need to own a car¹⁷.

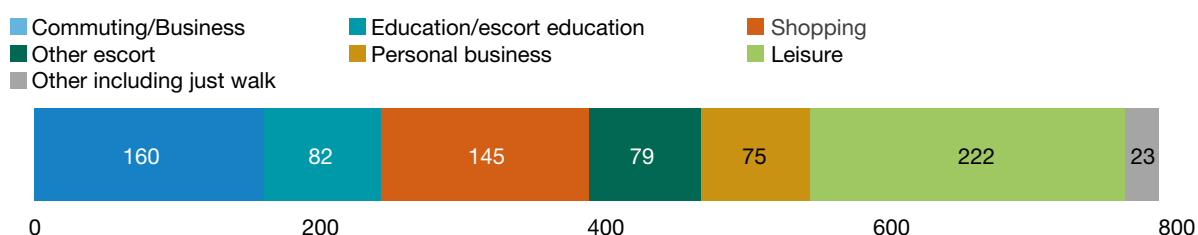
Figure 7: How we travelled, England: 2018



Source: National Travel Survey 2018, NTS0303¹⁸

Source: National Travel Survey 2018, NTS0308¹⁸

Figure 8: Average number of trips, per person, by trip purpose England, 2018



Source: National Travel Survey 2018, NTS0403¹⁸

Behaviour Change

Travel is an important aspect of our everyday activities and our daily habits are often dependent on the transport available to us, whether we are aware of it, or not.

Whether it is through the purchase of a new type of vehicle, moving to greater sharing of transport to increase utilisation, or switching modes, behaviour change will be an important aspect of the decarbonisation of transport.

Whilst an understanding of what will prompt behaviour change does exist, a greater understanding of this at a transport-system level will help to support people to change to lower carbon travel options.

On 11 February, the Prime Minister announced £5 billion funding for investment in local buses and cycling and walking infrastructure.

It includes funding at least 4,000 zero emission buses to make greener travel the convenient option, driving forward the UK's progress on its net zero ambitions; and measures to improve modal shift onto the bus, such as high frequency services, more 'turn up and go' routes, new priority schemes, and more affordable fares.

This is also part of the creation of a long term cycling and walking programme and budget that will enable delivery of the Government's aim to double cycling and increase walking by 2025, including through the £350 million Cycle Infrastructure Fund announced in the Conservative Party manifesto.

Further details and allocations will be confirmed later in 2020.

Cars

Current position of the sector versus historical emissions

- 2.3 Cars today have lower emissions, with the average car in 2018 emitting just over 20% less CO₂e for the same mileage than the average car in 1990¹⁹. However, total fleet GHG emissions from cars have fallen just 11% since 2001 to 68MtCO₂e²⁰.
- 2.4 Motorists are making the switch to electric vehicles (EVs) and there are record numbers of them on UK roads. In 2019, the UK was the third largest market for ultra low emission vehicles (ULEVs) in Europe and is a global leader in their development and manufacture²¹. There are over 240,000 battery electric and plug in hybrid vehicles registered in the UK, nearly 230,000 of which are ultra low emission cars, up from just over 1,300 ultra low emission cars in 2010²².
- 2.5 The UK is one of the largest markets in the world for the automotive sector. The number of battery electric car models on the global market is around 30, compared to over 350 for conventional vehicles. Supply is starting to increase and we expect to see around 20 new models available in the UK in 2020. Battery prices, a large part of the current total cost of EVs, have fallen almost 80% since 2010²³. However, falling battery costs have largely been offset by an increase in the battery size used in vehicles, increasing the vehicle range.
- 2.6 As we move to the mass adoption of ULEVs, more infrastructure will be needed alongside improvements to the consumer experience of using it. Whilst many EV drivers are likely to choose to charge their vehicles at home, or at their workplace, 20 to 30% of motorists do not have off-street parking²⁴. More than a third of households in England do not have access to off-street parking, and this proportion increases in



urban areas where air quality concerns are most acute. Not everyone without offstreet parking has a vehicle, but there are indications that around 25% of cars are parked on streets overnight²⁵.

Current government aims and targets

- 2.7 The Government's aim is to put the UK at the forefront of the design and manufacturing of zero emission vehicles²⁶. We are consulting on bringing forward the end to the sale of new petrol and diesel vehicles to 2035 (from 2040), or earlier if a faster transition appears feasible, as well as including hybrids for the first time. As part of this consultation, we are asking stakeholders to understand what the accompanying package of support will need to be to enable the transition and minimise the impacts on businesses and consumers across the UK, building on the significant demand and supply side measures already in place. We plan to conclude the consultation in the summer 2020.

There has been a 5% decrease in car emissions since 1990 despite a 22% increase in car traffic in this period²⁷.

This is due to increases in average car fuel efficiency – though efficiency gains have stalled in recent years²⁸.

Despite the fact that tighter regulation of CO₂ emissions from new cars and vans has been in place since 2015, average CO₂ emissions per mile for new cars have risen since 2016. UKERC analysis indicates that while there has been a decline in the sale of diesel vehicles (from 42% in 2009 to 32% in 2018), the main contributor has been the significant increase of UK sales of SUVs. In 2018, SUVs made up 21% of new car registrations, up from 14% in 2015²⁹.

Current policies to deliver the targets

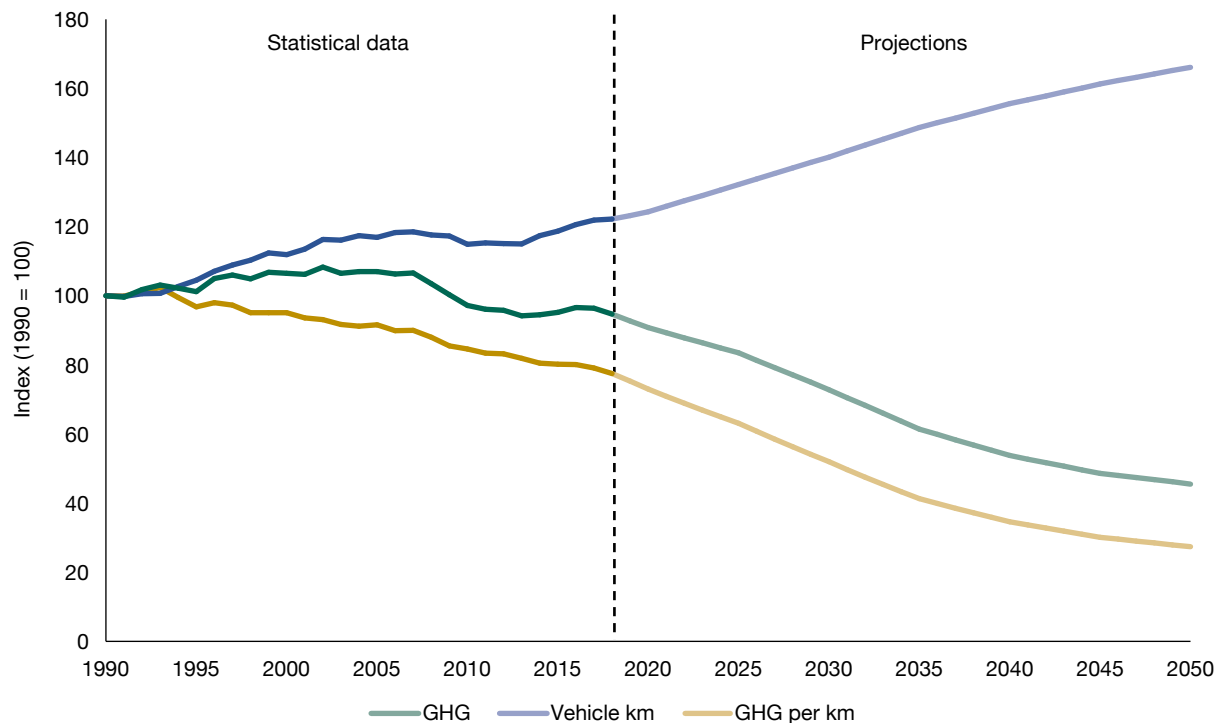
- 2.8 We are investing around £2.5 billion with grants available for plug in cars, taxis and motorcycles, as well as funding to support charge point infrastructure at homes, workplaces, on residential streets and across the wider roads network. This adds up to one of the most comprehensive support packages in the world for the transition to zero emission vehicles. A holistic approach is needed – adequate vehicle supply, a strong consumer base, the right market conditions and a fit for purpose infrastructure network are all vital to meeting our ambitions.

The Government launched the Go Ultra Low advertising campaign, 'The Car', with industry in September 2019, which aims to increase awareness and purchase consideration of electric vehicles.

Research released to mark the launch of the campaign suggests **two thirds of people** think electric cars will be the new normal in just ten years³⁰. But there's still a long way to go: our public attitudes tracker survey from December 2017 indicates that **17% of people** considering buying or replacing their current car or van would choose a hybrid and 5% would choose an electric vehicle³¹.

- 2.9 In 2019, over 3% of new cars sold were ultra low emission vehicles (1.6% were battery electric vehicles and 1.5% were plug in hybrid electric vehicles)³².
- 2.10 Government funding and leadership, alongside private sector investment, has supported the installation of more than 18,000 charging devices providing over 25,000 public chargepoints. This includes over 2,600 rapid chargepoints, one of the largest networks in Europe³³. Government is providing £500 million over the next five years to support the rollout of a fast-charging network for electric vehicles, ensuring that drivers will never be further than 30 miles from a rapid charging station. This will include a Rapid Charging Fund to help businesses with the cost of connecting fast charge points to the electricity grid. In addition, Budget 2020 included the announcement that the Office for Low Emission Vehicles will complete a comprehensive electric vehicle charging infrastructure review.
- 2.11 The Government launched the £400 million Charging Infrastructure Investment Fund to catalyse private investment in public chargepoints, the first £70 million tranche of which will create 3,000 new rapid chargepoints across the UK by 2024. In addition, in January 2020, the Government doubled the value of the Onstreet Residential Charging Scheme from £5 to £10 million for 2020-2021 (compared to 2019-2020) which should support the delivery of up to 3,600 chargepoints. Government grant funding to date has supported the installation of over 120,000 domestic chargepoints³⁴. Grants for chargepoints in the home and at workplaces will continue for at least a further year, to 2021. The Government has also awarded over £20 million across 27 local authorities to deliver over 900 chargepoints dedicated to electric taxis and private hire vehicles (PHVs).
- 2.12 Government closed consultations on requiring chargepoints to be built in all new homes with a parking space, and smart requirements for private chargepoints. We are investing in research projects to develop wireless charging technology that could make charging even easier.
- 2.13 Of the nearly 230,000 ultra low emission cars registered in the UK, over 200,000 of these vehicles have been supported by the plug in car grant³⁵. Government currently offers a range of incentives to support consumers to make the shift to EVs, including the tax system, direct grants and other financial support. Budget included £532 million additional funding to keep the Plug in Vehicle Grants for another three years to 2023, and favourable benefit in kind rates for zero emission vehicles were extended out to 2025.
- 2.14 Regulation to reduce tailpipe emissions for new cars and vans remains a crucial lever. As committed to in the Road to Zero strategy, now that the UK has left the EU it will pursue a future approach that is at least as ambitious as the current arrangements for vehicle emissions regulation. New cars CO₂ emission reductions regulations came into effect on 1 January 2020 setting targets out to 2030 which apply in the UK. The regulation sets binding CO₂ emission reduction targets for new cars of 15% by 2025 and 37.5% by 2030 (based on a 2021 baseline). Manufacturers face fines for non-compliance³⁶.

Figure 9: Projection of change in car GHG emissions, distance driven and gCO₂/km from current policy compared to 1990^c



- 2.15 Figure 9 shows our central projection for GHG emissions from cars to 2050, based on current firm and funded policies. This shows that car GHG emissions are projected to fall by 52% from 2018 to 2050, despite a projected increase in car km of more than 35% over the same period. Emission savings are driven by the package of support to drive the uptake of EVs and the 2020 and 2030 car CO₂ regulations.
- 2.16 These forecasts only include legislated policies or those with confirmed funding, and therefore do not include the 2040 ambition in the Road to Zero strategy or the consultation on bringing forward the end of the sale of new petrol and diesel vehicles. Other outcomes to the one shown are possible, but based on the best available evidence we project that these ambitions will not currently be met without additional action being taken. Policies to help deliver these ambitions will be included in the Transport Decarbonisation Plan.

Planned future work

- 2.17 We are working to improve the consumer offer for charging infrastructure, and we want to see all new rapid and higher powered chargepoints provide debit or credit card payment by Spring 2020. We also expect industry to develop a roaming solution across the charging network, allowing EV drivers to use any public chargepoint through a single payment method.

^c Historic emissions are final UK GHG statistics³⁷. Historic vehicle km are from road traffic statistics. Car emission and demand projections are made using the National Transport Model, with inputs from the Road Carbon and Fuel Fleet Model. Modelling assumes increased uptake of Ultra Low Emission Cars and further car efficiency improvements. This is driven by the policies and support listed above, and the falling costs and expanding market for Ultra Low Emission Vehicles.

- 2.18 We are also working with industry to make chargepoint data freely available so that software developers can develop the tools drivers need to easily locate and access available chargepoints. Government has powers in the Automated and Electric Vehicles Act 2018 to facilitate this and is prepared to intervene to ensure a good deal for consumers if the market is too slow to deliver improvements across the entire network.
- 2.19 We are supporting R&D to ensure that technologies for electric vehicles are developed and brought to market as early as possible, to help make electric vehicles more affordable for consumers, and to find innovative solutions. For example, R&D funding is being used to pilot and demonstrate technologies around batteries, power electronics and drives, on-street and wireless charging and vehicle to grid.
- 2.20 We will publish the Government response to our consultations on chargepoints in new homes, smart requirements for private chargepoints and on the introduction of green number plates to raise awareness of cleaner vehicles and increase their uptake. The Government will publish a vision in Spring 2020 for a core network of rapid/high powered chargepoints along England's key network of roads.



Buses and Coaches

Current position of the sector versus historical emissions

- 2.21 In 2018, 5% of journeys were made by bus³⁸. Buses and coaches represented 3% of domestic transport GHG emissions, emitting 3.2MtCO₂e³⁹.

Current government aims and targets

- 2.22 There are no current government targets set for buses. The Confederation for Passenger Transport (the trade body for bus and coach operators) set a target in their recently published bus strategy for all buses to be ultra-low or zero emission by 2025 (2023 in some urban areas).
- 2.23 The aims prioritised by government are that conventional buses will be replaced with zero emission buses and infrastructure over a period of time, and that measures will be introduced to address declining bus usage across the country.

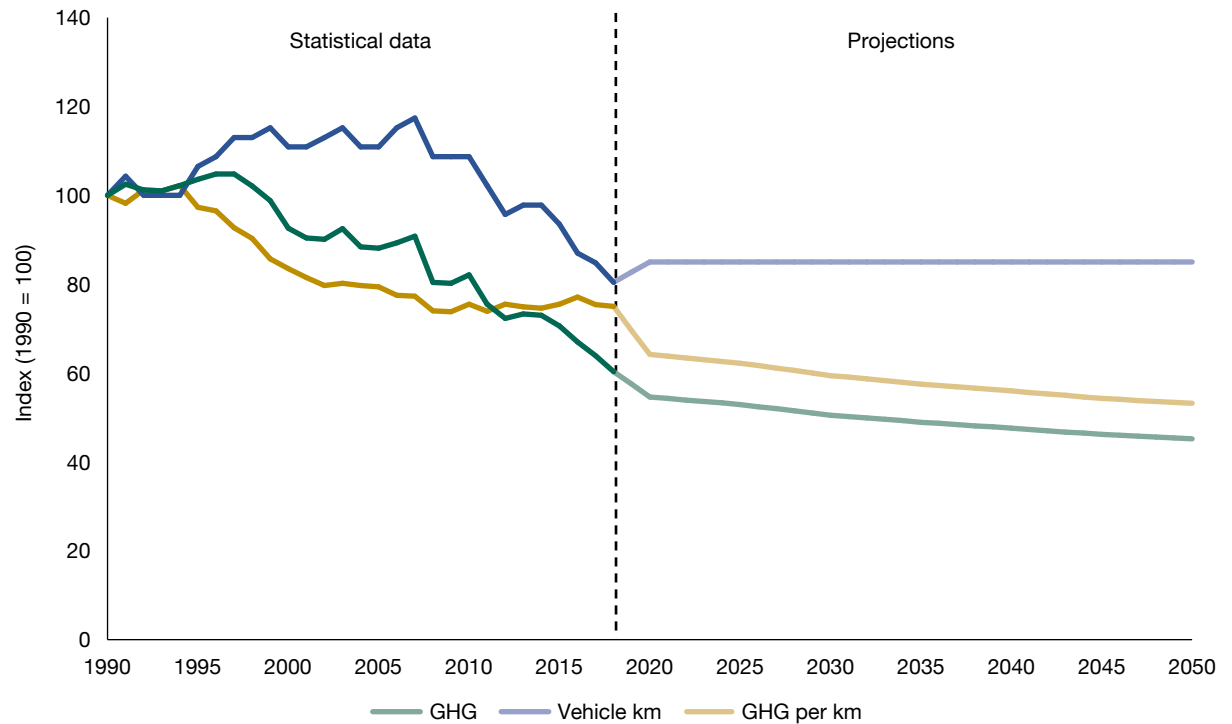
UK manufactured electric buses

Each of the UK's three largest bus manufacturers, spread across the UK – Alexander Dennis in Falkirk, Optare near Leeds and Wrightbus in Ballymena – produce zero-emission buses. Combined, these businesses support thousands of jobs and produce hundreds of clean vehicles for our streets.

Current policies

- 2.24 In 2015, £30.4 million was allocated to operators and local authorities under the Low Emission Bus Scheme which funded 326 low emission buses. A further £11.2 million was allocated in August 2017, funding an additional 153 buses. In March 2018, the Government launched the £48 million Ultra-Low Emission Bus Scheme which provided funding to 19 local authorities and bus operators to support the purchase of 263 zero emission buses.
- 2.25 A series of Clean Bus Technology Fund and Clean Air Funds have awarded significant funding to local authorities to retrofit buses to Euro VI standard to help meet local air quality targets.
- 2.26 Figure 10 shows our central projection for GHG emissions from buses and coaches to 2050, based on current firm and funded policies. This shows that bus and coach GHG emissions are projected to fall by 25% from 2018 to 2050. Emission savings are driven by previous Low Emission Bus and Ultra Low Emission Bus schemes which supported the uptake of these zero and low emission buses. In addition, the continued Low Carbon Emission Bus incentive aims to encourage the future uptake of low emission buses. As noted previously, the uncertainty surrounding projections is significant and other outcomes to the one shown are possible.

Figure 10: Projection of change in bus and coach GHG emissions, distance driven and gCO₂/km from current policy compared to 1990^{d40}



Planned future work

- 2.27 In September 2019, £220 million was announced to transform bus services, to deliver a better deal for bus users. This includes creating Britain's first all-electric bus town, which will see an entire place's bus fleet change over to zero emission electric capable buses. The town, which will be announced later this year, will serve as a model for zero-emission electric bus travel.
- 2.28 The announcement also referred to a National Bus Strategy, with accompanying long-term funding, which we expect to be launched in 2020.
- 2.29 The Government currently supports bus services through a grant of around £250 million per year (Bus Service Operators Grant). The distribution of this grant will be reviewed to ensure it supports the environment, as well as improving passenger journeys.

^d Historic emissions are final UK GHG statistics⁴¹. Historic vehicle km are from road traffic statistics. Bus emission projections are made using the National Transport Model, with inputs from the Bus fleet model. Modelling assumes increased uptake of Ultra Low Emission Buses and further bus efficiency improvements. These are driven by Ultra Low Emission Bus Scheme, as well as falling battery costs. Bus service level projections are based on 2015 usage levels. The average km growth rates of the bus km figures from 2006 to 2015 are used to estimate future km travelled²⁶. Bus km are flatlined from 2020, and coach km from 2017. Projections do not include the estimated impact of the £5 billion Local Transport funding package, announced in February 2020.

Passenger Rail

Current position of the rail sector versus historical emissions

- 2.30 Rail is a relatively low-carbon form of transport, and is one of the most efficient ways of moving high volumes of people into city centres and moving people over long distances. In 2018, GHG emissions from rail (passenger and freight) made up just 1.4% of the UK's domestic transport emissions⁴², while 10% of passenger miles traveled in Great Britain were by rail⁴³.
- 2.31 The railway is becoming less carbon intensive as new trains come into service and the railway uses greener electricity.
- 2.32 GHG emissions from diesel trains and electricity generation per rail passenger per kilometre in 2018-19 were 10.3% lower than for 2017-18, in a continuation of a decade-long trend⁴⁴. Whilst over 70% of passenger rail vehicles are already electric powered, there are currently about 3,700 wholly or partially diesel-powered passenger vehicles in use on the network⁴⁵.

Current government aims and targets

- 2.33 Rail passenger numbers have more than doubled since privatisation, reaching a record high of 1.759 billion passenger journeys in 2018-19⁴⁶. The Government is investing a record £48 billion in the railway between now and 2024 to support continued growth, ensure rail remains an attractive option for passengers and for the movement of goods, and to maximise the shift of users to rail from more polluting modes.
- 2.34 In 2018, the Government challenged the rail industry to produce a vision for the removal of all diesel-only trains from the network by 2040. An industry taskforce, chaired by Malcolm Brown, was formed in response and has assessed the decarbonisation options available, and made recommendations to organisations across the rail sector⁴⁷.



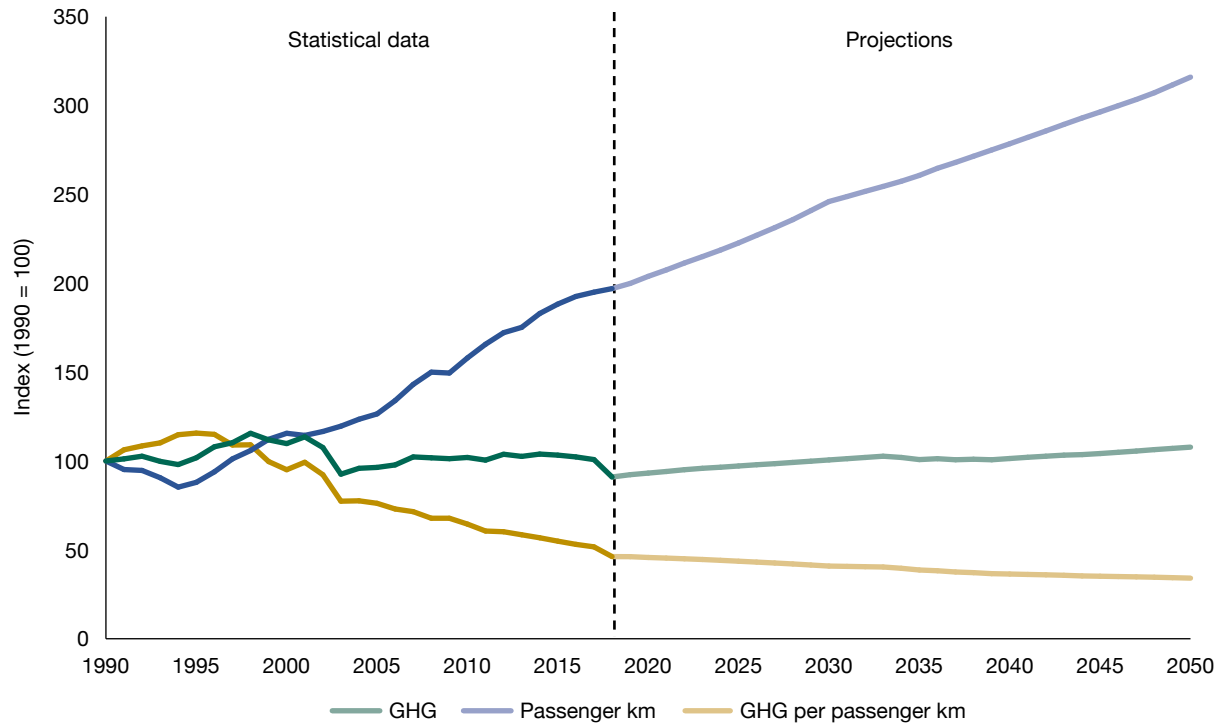
Source: Bob Martin

Current policies to deliver the targets

- 2.35 As well as ensuring rail continues to be an attractive option for users, government investment is reducing the railway's carbon emissions by improving infrastructure and rolling stock, and supporting the deployment of lower carbon technologies.
- 2.36 We recognise that electrifying more of the railway is likely to be necessary to deliver decarbonisation. We have delivered over 1,000 single track miles of electrification since 2010. Most passenger journeys are made on electric trains⁴⁸. We continue to expand the electrified rail network, delivering projects on the Great Western Main Line and Midland Main Line that will lead to further environmental and passenger benefits.
- 2.37 Since 2010, train operators have placed orders for almost 8,000 new, more efficient rail vehicles⁴⁹. These investments are having an impact: in 2018 CO₂e emissions from passenger trains dropped by 195,000 tonnes, which is the equivalent of taking around 90,000 cars off the road⁵⁰.
- 2.38 Take up of new technology will be important in decarbonising the railway and we are investing accordingly. We have recently funded, through Innovate UK and RSSB, competitions that provided over £4 million for projects to drive decarbonisation across passenger and freight. With our support the industry is developing hydrogen and battery solutions for use in rail that will play an important role in future decarbonisation.
- 2.39 Network Rail is currently preparing a cross-industry Traction Decarbonisation Network Strategy (TDNS). This will consider where overhead electrification, battery or hydrogen trains might be most effectively deployed and is building on Malcolm Brown's taskforce's recommendations, the existing electrification schemes underway and the research mentioned above. The TDNS will be completed during 2020.
- 2.40 In addition, Network Rail is actively pursuing large-scale carbon reduction activities across its estate and operations through its internal Decarbonisation Programme, aiming to improve energy efficiency, energy management practices and innovate in the areas of renewable energy, energy storage, low carbon design and transitioning the vehicle fleet to electric.
- 2.41 Figure 11 shows our central projection for GHG tailpipe emissions from all passenger and freight trains to 2050. This shows that rail GHG emissions are projected to rise by 19% between 2018 and 2050, against an increase in passenger demand of 60% over the same period. As noted previously, the uncertainty surrounding projections is significant and other outcomes to the one shown are possible^e.

^e Historic emissions are final UK GHG statistics⁵¹. Historic passenger kms are from ORR. Freight emissions are projected forwards based on demand increases and diesel fuel efficiencies. Passenger emissions projections assume no future programme of electrification and no introduction of alternatively-powered rolling stock (for example, battery or hydrogen trains). Passenger demand projections are based on June 2019 exogenous drivers, supplemented with a demand index from the FARM model past 2030/40 and assume continuation of current service patterns on the network.

Figure 11: Projection of change in rail GHG emissions, passenger km and gCO₂/km from current policy compared to 1990⁵²



Planned future work

- 2.42 Decarbonising our rail network will require significant coordinated investment in both infrastructure and rolling stock between now and 2050.
- 2.43 The Government is working with industry partners to evaluate the whole network and build an evidence base to inform decisions about which technology option will be best where. We will develop a decarbonisation programme for the rail network that will inform the deployment of electrification and new technologies over the next 30 years, building on the advice being prepared by Network Rail in the TDNS. We will also, as part of rail decarbonisation, consider how to make rail an even more attractive option, so that more people choose this greener mode of travel.
- 2.44 Building on Network Rail's internal Decarbonisation Programme, we will explore the scope to maximise efficiency from the railway, through methods like increased use of regenerative braking or the use of solar power. We will look at ambitious options to reduce carbon emissions from the railway estate, including station buildings and depots, and from the road vehicles used by the railway.

Riding Sunbeams project

The 'Riding Sunbeams: First Light' demonstrator project, funded through the DfT and Innovate UK 'First of a Kind' competition, is a world-first initiative to directly power trains using solar energy. Electrified railways and solar power are key technologies for tackling climate change by moving Britain away from reliance on fossil fuels.

The modular nature of solar generation and the diffuse nature of the energy resource – sunshine – means it can be deployed almost anywhere, from small rooftop arrays to solar farms a mile wide. This feature of solar PV makes it an ideal candidate for installation on rail corridors and south-facing embankments, turning otherwise unproductive land into a renewable-energy-generating, productive asset. Network Rail is one of the UK's biggest landowners. Although some rail stations and trains have begun to install solar PV in Britain and elsewhere, this is the first time that anybody has connected solar generation directly to rail traction networks to power trains.



Source: Andy Aitchison, Riding Sunbeams

Aviation

Current position of the sector versus historical emissions

- 2.45 In 2018, UK domestic aviation (flights that take off and land in the UK) was responsible for 1.5MtCO₂e of GHG emissions⁵³. This is a decrease of 6% since 2017, with domestic aviation contributing less than 1% of UK GHG emissions and lower than the most recent peak in 2005⁵⁴.
- 2.46 International aviation emissions, at 37MtCO₂e in 2018⁵⁵, have more than doubled since 1990. The majority of the increase came in the 1990s and early 2000s, however emissions have also been increasing since 2012. There has been an increase of 1% since 2017⁵⁶.
- 2.47 Aviation, at present, is a relatively small contributor to domestic UK GHG emissions. Its proportional contribution is expected to increase significantly as other sectors decarbonise more quickly.



Current government aims and targets

- 2.48 In December 2018, the Government published the Aviation 2050 green paper that included a range of measures to achieve its 2050 ambitions at the time, including efficiency improvements in technology, operations and air traffic management, use of sustainable aviation fuels and market-based measures. The consultation closed in June 2019 and work is underway on the Aviation Strategy.

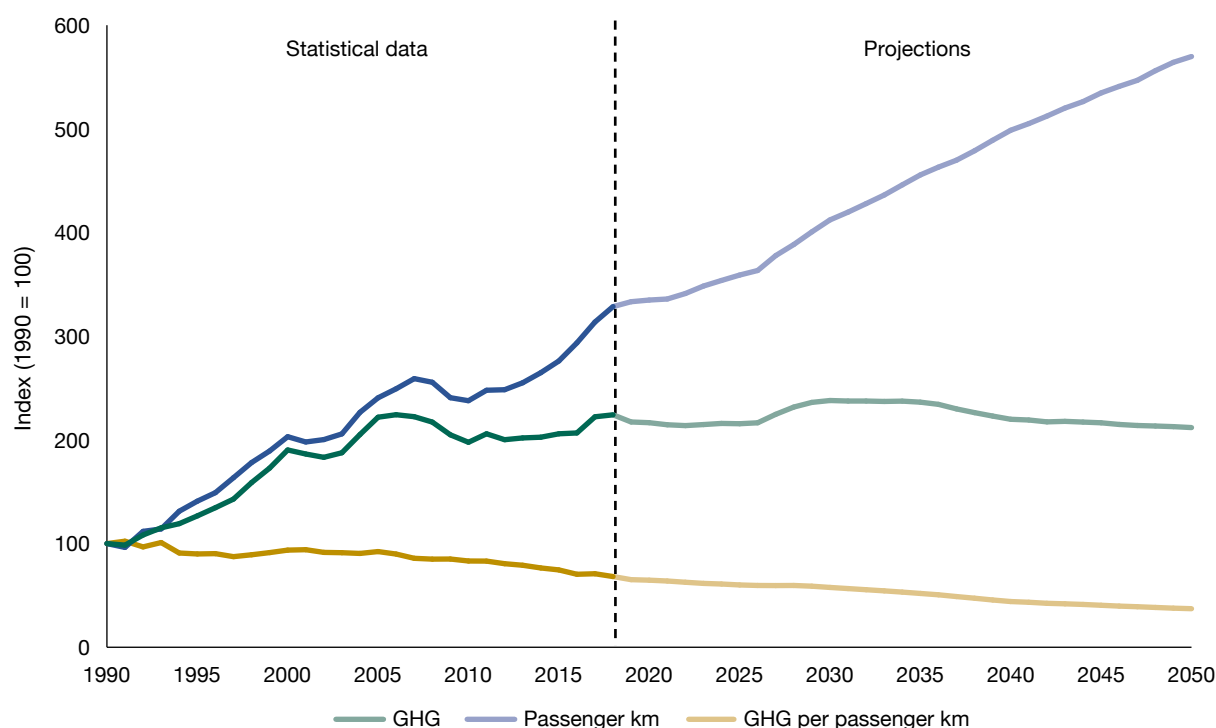
- 2.49 Airport expansion is a core part of boosting our global connectivity and levelling up across the UK. The Government takes seriously its commitments on the environment and the expansion of any airport must always be within the UK's environmental obligations.
- 2.50 Domestic aviation emissions are included in the UK's carbon budgets with international aviation and shipping emissions accounted for via "headroom" within our existing carbon budgets, meaning that the UK can remain on the right trajectory for net zero global greenhouse gas emissions across the whole economy. These international emissions are treated differently, largely because the inherently international nature of both sectors means that it is difficult to attribute these emissions to individual states. It is widely agreed among states that a sectoral approach (rather than state-by-state) is preferable, which is why the Kyoto Protocol gave UN International Civil Aviation Organisation (ICAO) and the International Maritime Organisation (IMO) responsibility for pursuing measures to reduce these emissions.

Current policies in place to deliver those targets

- 2.51 Given their global nature and the absence of any international agreement on how to assign international aviation emissions to individual states, action at an international level is the Government's preferred approach for addressing aviation's international carbon emissions.
- 2.52 The UK is already a respected and influential member of the UN International Civil Aviation Organisation (ICAO). The UK has been instrumental in securing many important environmental agreements including the 2016 Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) agreement – the first worldwide scheme to address CO₂ emissions in any single sector – and the CO₂ standard.
- 2.53 ICAO has defined a basket of measures designed to achieve its medium-term goal of carbon neutral growth for the sector from 2020 (CNG2020). This consists of more efficient aircraft technologies as incentivised by the CO₂ standard, operational improvements such as more efficient flight procedures, the development and use of sustainable alternative fuels and market-based measures like CORSIA.
- 2.54 Under CORSIA, qualifying aeroplane operators are required to offset the growth in international aviation CO₂ emissions covered by the scheme above average 2019 and 2020 levels. At present, 82 states (including the UK) have volunteered to join CORSIA from the start in 2021, representing over 75% of international aviation activity⁵⁷. From 2027 to 2035, the scheme will become mandatory, meaning that over the entire lifecycle of the scheme (2021 to 2035), it is estimated that approximately 2.5Gt of CO₂ will be offset⁵⁸. Since 2012, the aviation sector has been part of the EU Emissions Trading System (ETS). According to the European Commission, this has contributed to reducing Europe's carbon footprint by more than 17MtCO₂e per year⁵⁹. The UK committed in its 2017 Clean Growth Strategy that its future approach would be at least as ambitious as the EU ETS and provide a smooth transition for relevant sectors.

2.55 Figure 12 shows our central projection for GHG emissions from international and domestic aviation to 2050. Between 2018 and 2050 demand is projected to increase by 73%. However, emissions reductions per plane and per passenger km are driven by larger and more efficient planes, and limited uptake of low carbon sustainable aviation fuels. This results in aviation GHG emissions projections remaining broadly flat.

Figure 12: Projection of change in combined domestic and international aviation GHG emissions, passenger distance flown and gCO₂/passenger km from current policy compared to 1990⁶⁰



Planned future work

- 2.56 Later this year a consultation on net zero aviation will be published. This consultation represents the growth in government ambition since the green paper, including the 2050 net zero target and further CCC advice on international aviation and shipping, and will propose how the Government plan for aviation to play its part in delivering our net zero ambitions.
- 2.57 Internationally, we are committed to negotiating in ICAO for a long-term emissions reduction goal for international aviation that is consistent with the temperature goals of the Paris Agreement, ideally by ICAO's 41st Assembly in 2022. At the 40th ICAO Assembly in October 2019, ICAO not only reaffirmed its commitment to CORSIA but crucially, prioritised work towards a long-term climate goal for international aviation.

^f Historic emissions are final UK GHG statistics⁶⁰. Historic passenger kms are DfT estimates based upon CAA airports data. Aviation forecasts are produced using the DfT Aviation model. The model is an updated version of the model used for the Aviation forecasts 2017. Key updates include revised fleet mix and aircraft efficiency assumptions. In addition, a precautionary approach to airport capacity assumptions was adopted such that these represent an upper bound for carbon emissions, but the approach does not pre-judge any future planning applications or the development of policy (including following the outcome of proceedings e.g. on Heathrow expansion).

2.58 As a responsible national government, we need a contingency measure in case international progress does not go far enough or fast enough. That is why in the Government's response to the latest CCC Progress Report, we made it clear that we would be minded to include international aviation and shipping emissions in our carbon budgets if there is insufficient progress at an international level.

Cycling and Walking

Current position of the sector versus historical emissions

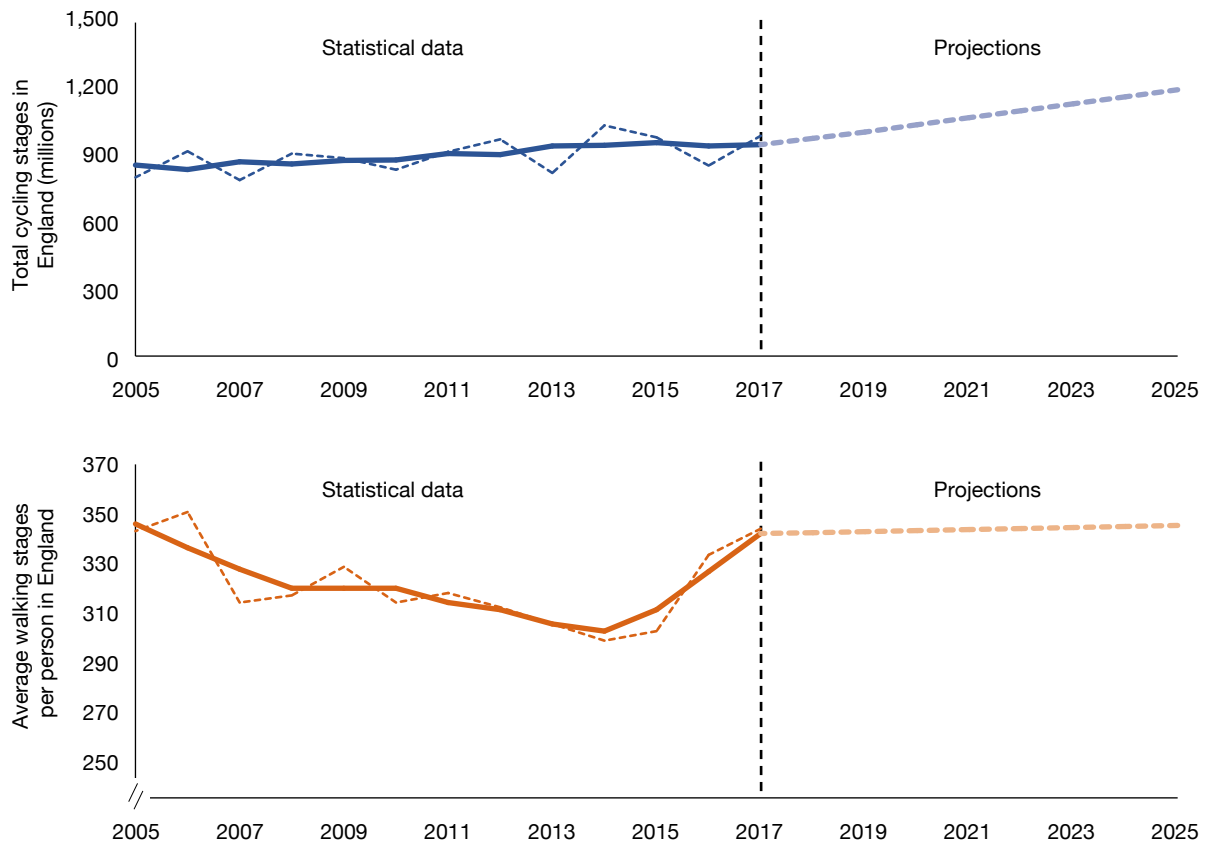
- 2.59 Cycling and walking are the ultimate forms of zero GHG emission transport. Committed spending on active travel could reduce total car km in England by around 0.9% in 2020, compared to what it would otherwise be. This is equivalent to a reduction in GHG emissions of around 0.55MtCO₂e in 2020⁶¹.

Current government aims and targets

- 2.60 The Government is committed to increasing cycling and walking and making our roads safer for those who walk or cycle. In 2017, the Government published its first statutory Cycling and Walking Investment Strategy (CWIS). The CWIS set out the Government's ambition to make cycling and walking the natural choice for all shorter journeys or as part of a longer journey by 2040.
- 2.61 The Government has set an aim to double cycling activity, increase walking to 300 stages⁶² per person per year and increase the percentage of children aged 5 to 10 that usually walk to school to 55% by 2025.

Current policies in place to deliver those targets

- 2.62 The CWIS identified £1.2 billion of funding projected for investment in cycling and walking between 2016 and 2021. However, interest from metro mayors and local councils has been so great that £1.2 billion has already been invested and a further £1.2 billion is projected over the next two years for infrastructure and other active travel projects. The result is that £2.4 billion is being invested in this area.
- 2.63 This includes projects such as £50 million for Bikeability training for school children (three million children have been trained since Bikeability was launched in 2006); £101 million for Cycle Ambition Cities for cycling infrastructure as part of a total of £210 million for eight cities; £80 million for the Local Authority Access Fund to support behaviour change and mode shift to active travel options (for example, for Big Bike Revival and Walk to School initiatives) and £85 million from Highways England for cycling and walking schemes crossing motorways and major roads.
- 2.64 Many of the decisions on the allocation of these funds will be made by the relevant local body, in line with the Government's devolution agenda. Therefore, the Government is currently providing £2 million to enable local bodies to take a more strategic approach to improving conditions for cycling and walking, by providing a support package that will assist local authorities with the development of their Local Cycling and Walking Infrastructure Plans.
- 2.65 46 local authorities are receiving access to specialist technical advice and expertise, which will help to produce high quality plans and boost capability at the local level.

Figure 13: Projection of cycling and walking demand to 2025 (based on committed funding)⁹

Planned future work

- 2.66 The Government will establish a £350 million Cycling Infrastructure Fund as one element of a wider investment package for active travel which will also include extending Bikeability cycle training to every child and engage parents. We will create a long-term programme and budget that dramatically increases investment in cycling and walking, including through the £100 billion of additional infrastructure spending announced in the Conservative Party manifesto for national renewal of roads, rail and other infrastructure that helps to generate growth. Final decisions on future funding for cycling and walking over this Parliament (to 2025) will be made as part of the Spending Review, expected later this year.
- 2.67 The Government plans to undertake further research to estimate the impact of delivery of the Cycling and Walking Investment Strategy aims for 2025 and 2040 on carbon emissions for cycling and walking and through a shift to cycling and walking from private vehicles.

⁹ Data represents cycling and walking demand in England only. Outturn data shows both annual and three-year average figures. The projection uses a three year average baseline from 2016 to 2018. Projections are estimated from the impact of past and committed investment up to 2021, final decisions on future funding up to 2025 will be decided in the Spending Review. Outturn data is derived from the national travel survey, available at: <https://www.gov.uk/government/statistical-data-sets/walking-and-cycling-statistics-cw>. Projections do not include the estimated impact of the £5 billion Local Transport funding package, announced in February 2020.



Walk to School Outreach

Travelling to education is the most common single purpose of walking journeys but there is huge potential to increase the proportion of children walking to school. Living Streets, with support from the Department for Transport, has been running the Walk to School Outreach project since 2017 across various cities in England.

Over the period 2018-19, the project promoted walking in 275 primary schools including 133 new schools. The project is estimated to have encouraged around 10,000 extra children and around 2,500 extra adults to walking to school over this period.

In March 2019, walking rates of pupils from new schools involved in the project increased by 38%, and increased walking rates were sustained in existing participating schools in 2018-19. This represents around 4 million new walking trips and 1.3 million fewer school run car journeys in that year with total vehicle miles reducing by around half a million. This will lead to considerable transport, environmental and health benefits⁶³.

Cycling Cities Ambition Intervention in Greater Manchester

Greater Manchester is one of eight cities, or groups of cities, that received funding through the £191 million Cycle City Ambition programme, part of the Cycling and Walking Investment Strategy. Data from Transport for Greater Manchester indicates that more than 30% of journeys under half a mile in Greater Manchester are made by car.

3 miles of cycle lanes were built along the Wilmslow Road and Oxford Road corridor through funding from the programme. Compared with a baseline count in March 2015, a traffic count in March 2018, over a year after installation, showed increases in cycle volumes of between 85% and 176%, between 0 and 2 miles from the city centre.

In 2018, more than 1 million journeys were counted on the route on Oxford Road, with up to 5,000 people passing each day. This equates to 621,000 car journeys, and reduces up to 873.5 tonnes of CO₂⁶⁴.

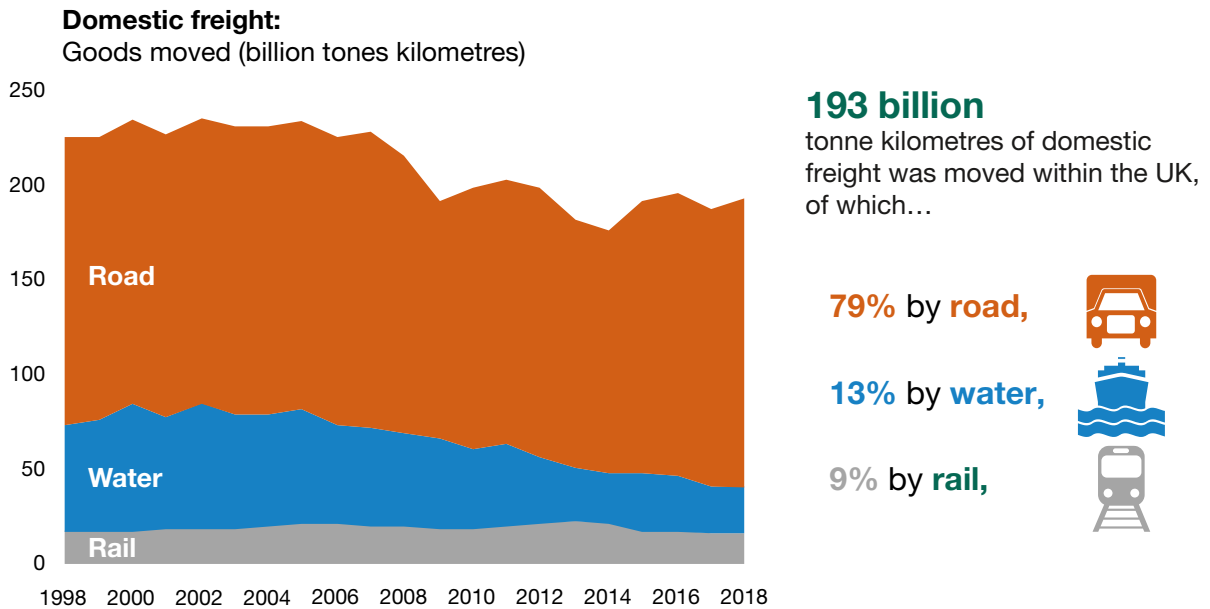
3.

Delivering goods
and services:
emissions by mode

3. Delivering goods and services: emissions by mode

- 3.1 The swift and efficient movement of goods is vital to the UK economy. How goods are moved in, out and around the UK is changing. Van traffic has increased by 104% since 1990⁶⁵. Much of this change is attributed to service vehicles and 'last mile' delivery services.
- 3.2 This section considers the GHG emissions from how our goods are moved around the country and the current policies to tackle these emissions. It also captures other activities including service vehicles.

Figure 14: UK domestic freight, goods moved by mode, 2018



Source: Transport Statistics Great Britain 2019⁶⁶



Source: Highways England

Heavy Good Vehicles (HGVs)

Current position of the sector versus historical emissions

- 3.3 In 2018, road transport accounted for 91% of UK domestic transport emissions⁶⁷. Heavy goods vehicles (HGVs) accounted for 17% of this, with HGV traffic increasing by 10% between 2012 and 2018⁶⁸. HGV traffic went up from 15.5 billion miles in 2012 to 17.1 billion miles in 2018⁶⁹.
- 3.4 The 2018 CCC Progress Report states that emission increases are driven partly by decreasing fleet efficiency⁷⁰. GHG emissions from HGV traffic increased by 14% between 2012 and 2018, from 18.2MtCO₂e to 20.7MtCO₂e⁷¹.

Current government aims and targets in this area

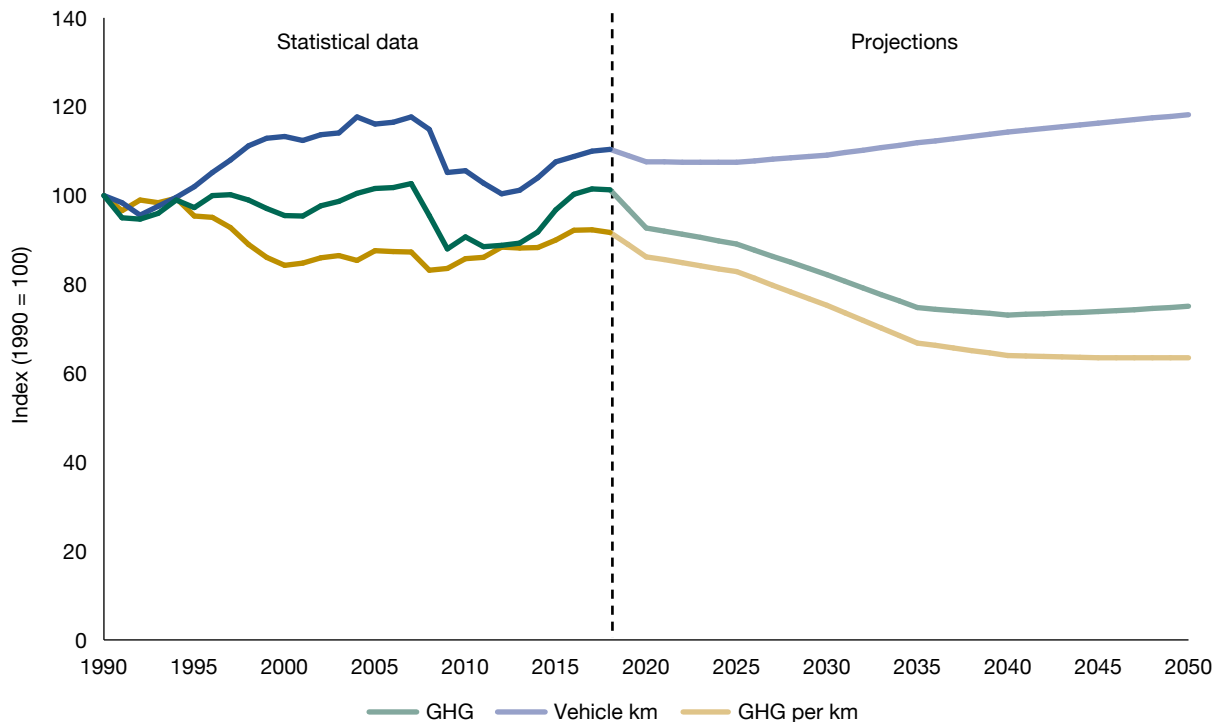
- 3.5 In 2018, the Government agreed a voluntary, industry-supported commitment to reduce HGV GHG emissions by 15% by 2025, from 2015 levels. Providing more and better information to road freight operators on the steps that they can take to reduce emissions from their fleets is key to achieving reductions.
- 3.6 In the coming months, the Government will work with the Energy Saving Trust and LowCVP to develop, improve and promote their existing Freight Portal. We will make it more relevant to small and medium-sized operators and focus on the practical actions small and medium-sized enterprises can take to achieve significant emissions reduction and realise the commercial benefits that come through improved fuel and logistical efficiency. The Government will continue to work with and consult stakeholders like Freight Transport Association, Road Haulage Association and other stakeholders across the freight industry as well as lobbying groups and freight operators to recommend actions and incentives to meet net zero commitments.
- 3.7 Additionally, new Heavy Duty Vehicle (HDV) CO₂ emission standards regulation came into effect in July 2019. This establishes, for the first time, CO₂ reduction targets for HDVs. The new regulation sets binding CO₂ emission reduction targets for HDV manufacturers of 15% by 2025 and 30% by 2030 (based on 2019 emission levels). Manufacturers face fines for non-compliance⁷².

Current policies in place to deliver those targets

- 3.8 In 2018, the Road to Zero strategy⁷³ set out government aspirations for zero emission HGVs including the following objectives:
- Taking forward a research project to identify and assess zero emission technologies suitable for HGV traffic on the UK road network;
 - Working with industry to develop an ultra low emission standard for trucks;
 - The £20 million Low Emission Freight and Logistics Trial supporting industry-led R&D projects, trialling of a range of low-emission technologies for freight;
 - Conducting an operational trial of longer semi-trailers, which is authorising longer articulated goods vehicles to run on UK roads; and

- Additionally, the Government is working to understand the potential for demonstrator projects to overcome some of the hurdles associated with the implementation of novel freight decarbonisation technologies with partners including the Connected Places Catapult.

Figure 15: Projection of change in HGV GHG emissions, distance driven and gCO₂/km from current policy compared to 1990^h



3.9 Figure 15 shows our central projection for GHG emissions from HGVs to 2050, based on current firm and funded policies. This shows that HGV GHG emissions are projected to fall by 26% from 2018 to 2050, despite a projected increase in HGV km of 7% over the same period. Emission savings are driven by the new 2030 HDV CO₂ regulations⁷⁴, alongside baseline efficiency improvements driven by the market. As noted previously, the uncertainty surrounding projections is significant and other outcomes to the one shown are possible.

Planned future work

3.10 The regulation for HDV vehicle manufacturers making new vehicles requires reductions of 15% for 2025 and 30% for 2030 against a 2019 baseline and includes incentives for sales of zero and low emission HDVs⁷⁵. As committed to in the Road to Zero strategy, now that the UK has left the EU it will pursue a future approach that is at least as ambitious as the current arrangements for vehicle emissions regulation.

^h Historic emissions are final UK GHG statistics⁷⁶. Historic vehicle km are from road traffic statistics. HGV emission projections are made using the National Transport Model and the Great Britain Freight Model, with inputs from the Road Carbon and Fuel Fleet Model. These models aim to forecast long-term trends over 5-year intervals with a base year of 2015 and may not capture short term fluctuations. This leads to an apparent drop in GHG emissions in 2019 when the modelled data is adopted. Modelling assumes HGV efficiency improvements. These are driven by incentives to improve efficiency driven by HGV operators and manufacturers and the 2030 CO₂ regulations.

Vans

Current position of the sector versus historical emissions

- 3.11 In 2018, road transport accounted for 91% of UK domestic transport emissions. Vans accounted for 16% of UK domestic transport emissions. Van emissions have increased by 19% since 2012, from 16.4MtCO₂e in 2012 to 19.4MtCO₂e in 2018⁷⁷.

67% increase in van emissions since 1990⁷⁸

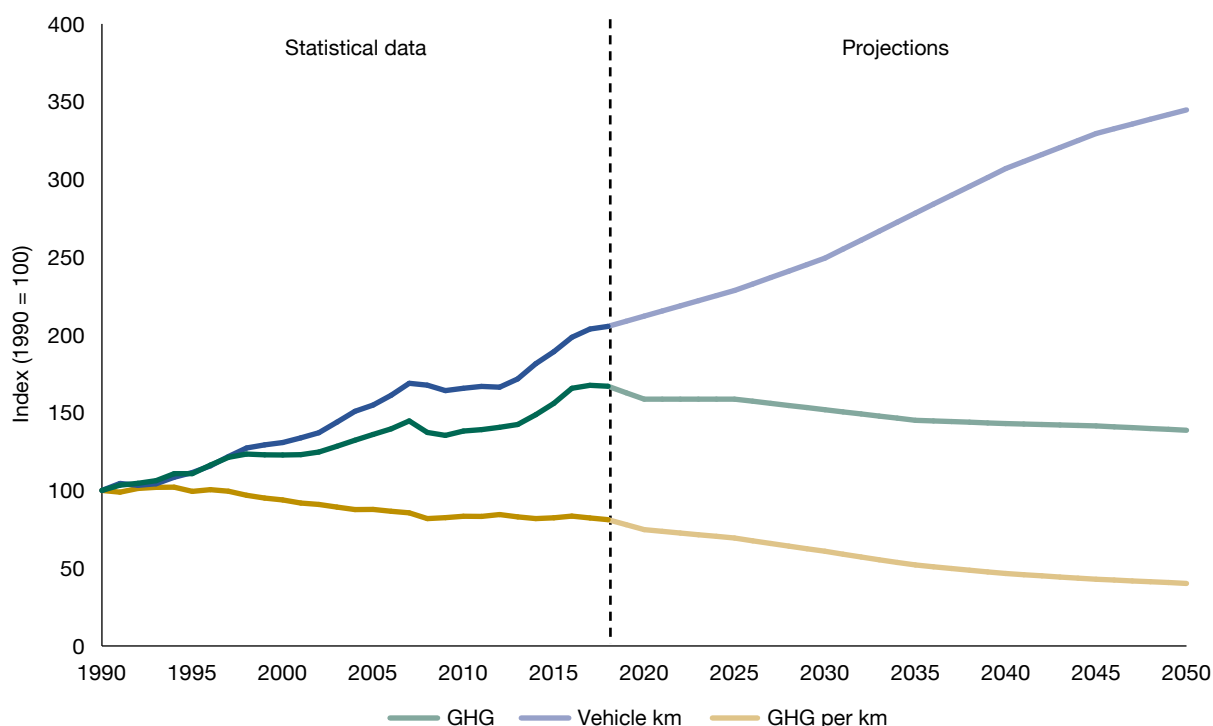
Over the same period, van traffic has more than doubled to 51 billion miles⁷⁹.

Current government aims and targets in this area

- 3.12 The Government's aim is to put the UK at the forefront of the design and manufacturing of zero emission vehicles, and for all new cars and vans to be effectively zero emission⁸⁰. We are consulting on bringing forward the end to the sale of new petrol and diesel vehicles to 2035 (from 2040), or earlier if a faster transition appears feasible, as well as including hybrids for the first time.
- 3.13 Current policies in place to deliver those targets puts the UK at the forefront of the global transition to zero emission vehicles.
- 3.14 We are investing around £2.5 billion with grants available for plug in vans and lorries, as well as funding to support charge point infrastructure at homes, workplaces, on residential streets and across the wider roads network. The Plug-in Van Grant (PIVG) provides 20% of the price of a qualifying vehicle to a maximum grant amount of £8,000, or £20,000 for the first 200 large vans (3.5 tonne +) or trucks.
- 3.15 We have legislated to allow category B (car) licence holders to drive certain alternatively fuelled vans up to a maximum weight of 4.25 tonnes, rather than 3.5 tonnes. This will help to compensate for lost payload capacity due to the added weight and size of some current alternative fuel technologies and help grow the market for ULEV vans.
- 3.16 Regulation to reduce tailpipe emissions for new cars and vans remains a crucial lever. The Government committed in the Road to Zero strategy that as the UK leaves the EU it will pursue a future approach that is at least as ambitious as the current arrangements for vehicle emissions regulation. New van CO₂ emission reductions regulations came into effect on 1 January 2020 setting targets out to 2030 which apply in the UK. The regulation sets binding CO₂ emission reduction targets for new vans of 15% by 2025 and 31% by 2030 (based on a 2021 baseline). Manufacturers face fines for non-compliance⁸¹.
- 3.17 Figure 16 shows our central projection for GHG emissions from vans to 2050, based on current firm and funded policy. This shows that van GHG emissions are projected to fall by 17% from 2018 to 2050, despite a projected increase in van km of nearly 70% over the same period. Emission savings are driven by the package of support to drive the uptake of EVs and the 2020 and 2030 van CO₂ regulations.

3.18 These forecasts only include legislated policies or those with confirmed funding, and therefore do not include the 2040 ambition in the Road to Zero strategy or the consultation on bringing forward the end of the sale of new petrol and diesel vehicles. As noted previously, other outcomes to the one shown are possible, but based on the best available evidence we project that these ambitions will not currently be met without additional action being taken. Policies to help deliver these ambitions will be included in the Transport Decarbonisation Plan.

Figure 16: Projection of change in van GHG emissions, distance driven and gCO₂/km from current policy compared to 1990ⁱ



Planned future work

3.19 Government is providing £500 million over the next five years to support the rollout of a fast-charging network for electric vehicles, ensuring that drivers will never be further than 30 miles from a rapid charging station. This will include a Rapid Charging Fund to help businesses with the cost of connecting fast charge points to the electricity grid. In addition, Budget 2020 included the announcement that the Office for Low Emission Vehicles will complete a comprehensive electric vehicle infrastructure review. The £400m public-private Charging Infrastructure Investment Fund, alongside government grant schemes, will see thousands more electric vehicle chargepoints installed across the UK. We will set out a vision in Spring 2020 for a core infrastructure network of rapid and high powered chargepoints along England's key road network.

ⁱ Historic emissions are final UK GHG statistics⁸². Historic vehicle km are from road traffic statistics. Van emission projections are made using the National Transport Model and the department's LGV Model, with inputs from the Road Carbon and Fuel Fleet Model. Modelling assumes increased uptake of Ultra Low Emission vans and further van efficiency improvements. This is driven by the policies and support listed above, and the falling costs and expanding market for ULEVs.

- 3.20 We have consulted on proposals for new private chargepoints to have smart functionality and related minimum device standards; and on changing building regulations to require a chargepoint in every new home where there is an appropriate parking space, and minimum infrastructure provision in new non-residential buildings. We are also consulting on the introduction of green number plates for ultra low emission vehicles to raise awareness and help normalise cleaner vehicles and increase their uptake.

e-Cargobike trials

With funding from an innovation grant from DfT, e-Cargobikes.com worked with the supermarket chain Sainsbury's to trial the use of electric cargo bikes to deliver groceries. A fleet of five zero emission e-cargo bikes was located at the Streatham Common store, delivering up to 100 orders a day to local customers who shopped via the retailer's groceries website.

The findings from the trial showed that 96.7% of orders could be fulfilled in a single e-cargo bike journey. It also demonstrated shorter delivery routes and journey times, and increased traffic flow in urban residential areas, due to the ability of e-cargo bikes to make use of cycle and bus lanes, road speeds greater than delivery vans and their narrower size⁸³.



Rail Freight

Current position of the rail sector versus historical emissions

- 3.21 Rail is one of the most carbon efficient ways of moving goods over long distances. The level of CO₂e emissions per freight tonne km in 2018-19 was 4.1% lower than the equivalent figure for 2017-18⁸⁴.
- 3.22 Rail freight offers benefits to the environment, helps reduce road congestion and is important to UK businesses. Rail freight is estimated to remove over 7 million lorry journeys each year, the equivalent of 1.5 billion road kilometres⁸⁵.
- 3.23 Rail freight is becoming more efficient. The total volume of rail freight moved rose to 17.4 billion net tonne kilometres in 2018-19, a 3% increase compared with 2017-18⁸⁶. Since 2003, the number of freight train movements on the network has fallen by 47%⁸⁷ yet the amount of freight moved on each train has increased by 74%⁸⁸.
- 3.24 The main way to achieve rail freight decarbonisation is to stop using diesel traction, through direct government intervention to roll out further electrification⁸⁹. Network Rail is leading the Traction Decarbonisation Network Strategy (TDNS), which will inform decisions about the scale and pace of decarbonisation between now and 2050.
- 3.25 The challenge for rail freight is that current alternatives to overhead electrification, such as hydrogen and battery, do not have sufficient power to pull heavy freight trains. There is potential for bi-modes to reduce emissions.

Current government aims and targets

- 3.26 The Government recognises the economic and environmental benefits of rail freight; the sector plays an essential part of the UK economy. The Government has invested £235 million in the Strategic Freight Network between 2014 to 2019 to improve the capacity and capability of the rail network for freight.
- 3.27 In 2018, the Government challenged the rail industry to produce a vision for removal of all diesel-only trains from the network by 2040. An industry taskforce, chaired by Malcolm Brown, was formed in response and has assessed the decarbonisation options available, and made recommendations to organisations across the rail sector⁹⁰.

Current policies to deliver the targets

- 3.28 Take up of new technology will be important in decarbonising the railway and we are investing accordingly. We have recently funded, through Innovate UK and RSSB, competitions that provided over £4 million for projects to drive decarbonisation across passenger and freight.
- 3.29 The Government is providing freight grant schemes to support the carriage of freight by rail and water on routes where road haulage has a financial advantage. These schemes help to remove around 900,000 lorry journeys a year from Britain's roads. Funding has been increased to £20 million for 2020/21, a rise of 28% from 2019/20.
- 3.30 Figure 11 in the rail passengers section shows our central projection for GHG tailpipe emissions from all passenger and freight trains to 2050.



Planned future work

- 3.31 The Government is working with industry to better understand and deliver the current environmental benefits of rail freight. We will consider how to make rail an even more attractive option for companies to move goods around the country. To further reduce the carbon impact of rail freight we are working with Network Rail and industry partners such as RSSB on a Traction Decarbonisation Network Strategy. This strategy will consider both passenger travel and rail freight and will inform the deployment of electrification and novel technologies across the railway. We will build on Network Rail's internal Decarbonisation Programme to reduce carbon emissions from the railway estate, including depots.

Government plans to publish a new cross-modal freight strategy later this year to reflect the sector's contribution and the important role freight plays in achieving our wider policy goals. The strategy will build on the work of the National Infrastructure Commission and will include the Government's final response to the recommendations in the Commission's report *Better delivery: the challenge for freight*.

Maritime

Current position of the sector versus historical emissions

- 3.32 Shipping accounts for 95% of UK trade⁹¹, and is considered one of the most carbon-efficient modes of transport⁹². GHG emissions from UK domestic shipping (passenger, cargo and fishing) decreased by 30% between 1990 and 2018⁹³. Over the same period, based on refuelling at UK ports, GHG emissions from UK international shipping decreased by 3%⁹⁴.
- 3.33 In 2018, UK domestic shipping accounted for 5.9MtCO₂e, amounting to 1.3% of all UK domestic emissions⁹⁵. In the same year, based on refueling at UK ports, UK international shipping was responsible for 7.9MtCO₂e⁹⁶.
- 3.34 The most recent study by the International Maritime Organisation (IMO) estimates that international shipping represented 2.2% of global CO₂ emissions in 2012⁹⁷. If no further action is taken, then estimates from the IMO suggest that the CO₂ emissions from international shipping could grow by between 50% and 250% by 2050⁹⁸, and a study for the European Parliament suggests that international shipping could account for 17% of global CO₂ emissions by 2050⁹⁹.

Maritime as a freight and passenger mode, with a key economic role

Whilst maritime remains a significant freight mode, its contribution to UK passenger services is substantial. In 2018, 21.8 million passengers travelled on international sea routes, and 42.7 million on domestic routes¹⁰⁰.

Maritime provides vital passenger services, connecting communities across the UK and supporting local economies. In 2018, 8.4 million passengers travelled by sea across Scottish islands, one and half times the population of Scotland. Over the same year, there were 9.7 million passengers to and from the Isle of Wight, and 19 million passengers on London river crossings¹⁰¹, supporting the modal shift from roads and reducing pressure on other forms of public transport.

Cruising has become a leading contributor to the nation's leisure and maritime economies, with 1.9 million cruise passengers in 2017¹⁰² and £9.4 billion generated in 2017¹⁰³, supporting Britain's coastal economies.

The UK leisure industry is crucial in supporting UK exports, with 30% of UK leisure, superyacht and small commercial marine industry revenue in 2017 originating from export transactions¹⁰⁴. The overall contribution of the maritime sector to the UK economy in 2017 amounted to £17 billion in GVA and 220,100 jobs for UK employees¹⁰⁵.

The maritime policies outlined apply across the whole UK shipping sector, including freight and passenger services. These policies set out the UK's pathway to zero emissions shipping, securing clean growth opportunities and placing the UK at the forefront of the global transition to clean maritime.

^j It is important to note that whether emissions from refuelling at UK ports can be used as an accurate estimate of UK international shipping emissions will depend on what assumptions are being made about how to allocate international shipping emissions to different countries. The approach utilised here is in line with internationally agreed norms.

Current government aims and targets

3.35 In January 2019 the Government published the Maritime 2050 Strategy¹⁰⁶, which sets out its vision for clean shipping in the UK:

“In 2050, zero emission ships are commonplace globally. The UK has taken a proactive role in driving the transition to zero emission shipping in UK waters, and to be seen globally as a role model in this field, moving faster than other countries and faster than international standards. As a result, the UK will successfully capture a significant share of the economic, environmental and health benefits associated with this transition.”

3.36 The UK has been at the forefront of pushing for an ambitious global strategy to reduce GHG emissions from shipping. Agreed in April 2018, the Initial IMO Strategy on reduction of GHG emissions from ships includes a commitment to phasing out GHG shipping emissions as soon as possible in this century, and to reducing total annual GHG from international shipping by at least 50% by 2050 compared to 2008¹⁰⁷. It sends a strong signal to the shipping sector to invest in clean and innovative technologies.

Current policies to deliver the targets

3.37 The Clean Maritime Plan, announced in the Government’s Clean Air Strategy, is the environmental route map of Maritime 2050, outlining the UK’s pathway to zero emissions shipping¹⁰⁸. The route map identifies ways to tackle air pollutants and GHG emissions while securing clean growth opportunities for the UK.

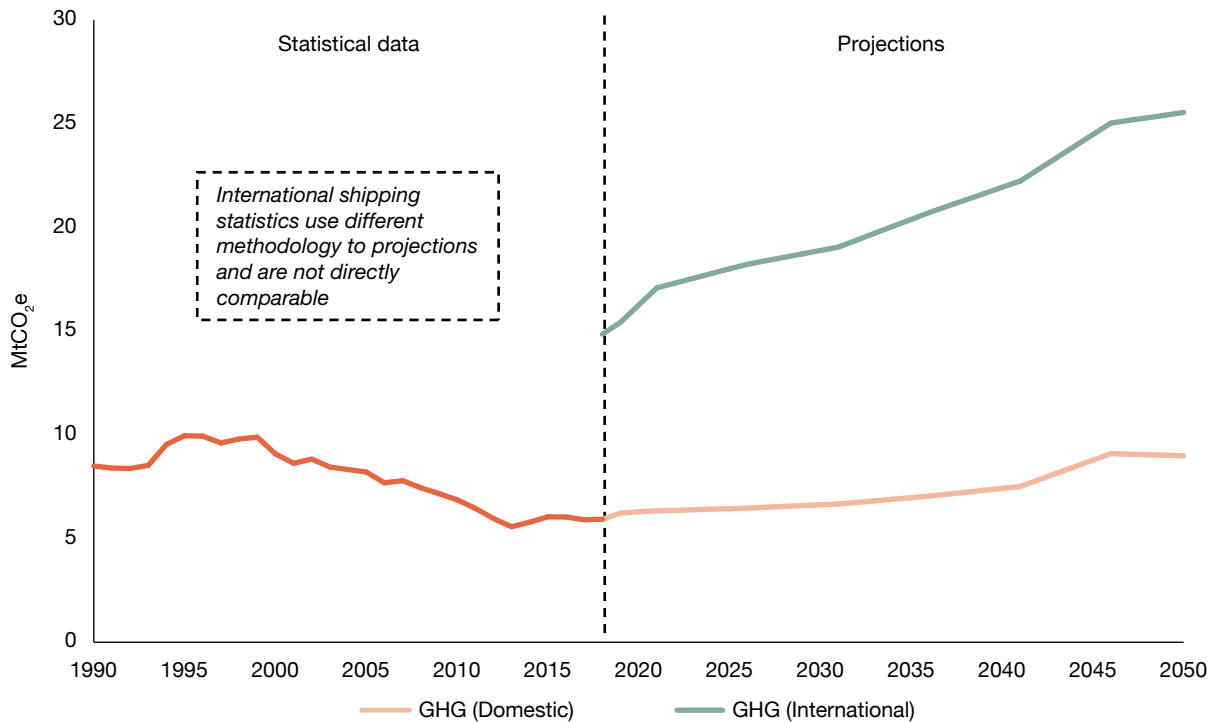
Research commissioned by the Government in support of the Clean Maritime Plan estimates that the global market for the elements of alternative fuel production technologies¹⁰⁹ in which the UK has a particular competitive advantage (for example, upfront design) could rise to up to around £11 billion per year by around 2050, and if the UK maintained its current export market share (which is estimated to be around 5% of the relevant global markets), this could result in economic benefits to the UK of up to £0.5 billion per year by around 2050¹¹⁰.

3.38 In launching the Clean Maritime Plan, the UK became one of the first countries to publish a strategy on domestic action to reduce shipping emissions following the agreement of the Initial IMO Strategy on reduction of GHG emissions from ships. The Clean Maritime Plan sets out a series of commitments to support the sector as it moves towards the vision set out in Maritime 2050. We have already made progress on delivering these commitments, including by:

- Launching a ‘Greening Finance/Financing Green’ for Maritime Initiative at London International Shipping Week. This will be a bi-annual conference on green finance for maritime, the first of which will be held in 2020;
- Providing seed funding to contribute to the establishment of MarRI-UK, to ensure strong collaboration between government, industry and academia in the field of clean maritime innovation;

- Funding a competition for innovation in clean maritime in 2019. Government has so far provided £1.5 million for clean maritime innovation competitions; and
- Launching a round of government grant support contributing to early stage research projects related to clean maritime¹¹.

Figure 17: Projections of future UK domestic and international shipping GHG emissions from current policy^{kl}



3.39 Research commissioned by the Government in support of the Clean Maritime Plan¹¹² estimates that, in the absence of a mitigating intervention, the total GHG emissions from UK domestic and international shipping could increase by around 80% between 2016 and 2050. Figure 17 presents the estimates of how UK domestic and international shipping GHG emissions could evolve in the future in the absence of further action, from this research.

3.40 Whilst these estimates are subject to uncertainty (including due to the long-term nature of this analysis and the lack of an agreed international approach to allocating international shipping emissions to different countries), they provide useful evidence illustrating the scale of the challenge of decarbonising shipping at the UK level.

^k The domestic shipping statistical data presented here is from final UK GHG statistics¹¹³. The projections are estimates from research commissioned by the Department, which was undertaken by Frontier Economics, UMAS and CE Delft (2019). There is an important distinction between the two sources in terms of how international shipping emissions are measured. The UK GHG statistics estimate international shipping emissions based on refuelling at UK ports, whereas the commissioned research estimates international shipping emissions based on the shipping activity that is undertaken for the purposes of UK trade. As the two are not comparable, we do not present historic data here for international shipping. In addition, as the commissioned research did not provide comparable estimates of shipping demand, indices of GHG emissions against demand are not presented here as for other modes.

^l The projections are estimates of the operational GHG emissions from UK domestic and international shipping under the business as usual scenario (Scenario A) analysed in the research commissioned by the Department, which was undertaken by Frontier Economics, UMAS and CE Delft (2019).

Planned future work

3.41 The Clean Maritime Plan sets out further commitments including:

- A call for evidence in 2020 on non-tax incentives to support the transition to zero emission shipping, and a consultation in 2020 on whether and how the Renewable Transport Fuel Obligations could be used to encourage the uptake of low carbon fuels in maritime;
- A working group and a study to identify and support potential UK zero emission shipping clusters;
- Government support to clean maritime innovation in the UK, including:
 - Establishing a clean maritime award, to celebrate leaders in the field of emissions reduction.
 - A Maritime Emissions Regulation Advisory Service (MERAS), in place by 2020, to provide dedicated support to innovators using zero emission propulsion technologies.

3.42 At an international level, the UK will continue to concentrate its efforts on transitioning the sector to zero emissions. Alongside this, we will continue to cooperate with other high ambition states to agree short term measures to peak and reduce emissions, and make a case for more ambitious reductions in advance of the revision of the Initial IMO Strategy on reduction of GHG emissions from ships.



Cross-modal decarbonisation actions: Low Carbon Fuels

Current position of the sector versus historical emissions

- 3.43 Low carbon fuels play an important role in reducing emissions by displacing fossil fuel use, and their increased use have made one of the most significant contributions to reducing the GHG emissions of UK road transport over the last ten years. Sustainable, low carbon fuels, typically bioethanol and biodiesel, are blended with petrol and diesel.
- 3.44 For 2018, the total GHG emission savings achieved by displacing fossil fuels with low carbon fuels have been estimated at 3.7MtCO₂e. This is equivalent to taking over 1.7 million cars off the road¹¹⁴.

Current government aims and targets in this area

- 3.45 In 2008, the Renewable Transport Fuel Obligation (RTFO) was introduced. This requires suppliers of road and non-road mobile machinery (NRMM) fuel to ensure a percentage of their fuels are renewable.
- 3.46 In September 2017, the Government amended the RTFO for the next 15 years, aligned with the commitments in the Clean Growth Strategy. This was designed to provide a firm platform for investment in sustainable advanced fuels for automotive, road freight and aviation use.
- 3.47 We committed to increasing the use of renewable fuels in road transport and NRMM, doubling the targets to 9.75% between 2018 and 2020, and to at least 12.4% by 2032. These targets are enshrined in legislation.

Current policies in place to deliver those targets

- 3.48 The amended RTFO is expected to save between 6MtCO₂e and 7MtCO₂e per year between now and 2032¹¹⁵. Waste-derived fuels are eligible for twice the reward that crop derived biofuels receive, in recognition of their higher potential to deliver GHG savings. The use of waste-derived fuels has increased from 12% of UK low carbon fuels in 2008/09 to 69% in 2018¹¹⁶.
- 3.49 A new 'development fuels' sub-target introduced in 2019 further incentivises waste-based fuels made using new technologies and for use in difficult to decarbonise sectors, such as aviation and HGVs. These advanced fuels deliver a range of benefits including very high GHG savings, reduced waste disposal and improvements in fuel quality, potentially with air quality benefits too.
- 3.50 To minimise the risk of some kinds of crop biofuels indirectly leading to increased emissions, and to support the move to advanced waste-based fuels, we have put in place a cap that limits the maximum contribution that biofuels made from agricultural crops can make to our renewable transport fuel targets. This sends a clear signal to industry to focus future investment in waste-derived fuels.

3.51 In 2014, the Government launched the Advanced Biofuels Demonstration Competition (ABDC), in which £25 million was available, to be matched funded by the private sector, for companies to build demonstration scale plants for the production of advanced biofuels to be used in transport.

Planned future work

3.52 In addition to the ‘development fuels’ sub-target we are providing funding to support the development of new technologies to produce advanced low carbon fuels that can lead to reduced GHG emissions in the real world.

3.53 The Government’s Future Fuels for Flight and Freight Competition (the F4C) makes £20 million in capital funding available to projects that will produce low carbon waste-based fuels to be used in aeroplanes and HGVs. Government funding will be matched by the private sector, and is expected to support construction of up to four UK based, first of a kind plants from 2021.

3.54 There is also an opportunity to increase the amount of bioethanol in petrol, from up to 5% today (known as E5) to up to 10% (known as E10). Bioethanol offers GHG savings compared to fossil fuels, even when taking other factors such as indirect land use change into account. A vehicle using E10 would emit around 2% less CO₂ than one using E5 for the same distance travelled. On the 4 March 2020, the Government launched a consultation on proposals to introduce E10 petrol to the UK in 2021.

3.55 Further work is also planned on how to support the uptake of low carbon fuels in aviation and maritime as well as higher blends in freight, and to ensure that our legislation keeps pace with industry developments. This includes the potential inclusion of low carbon fossil fuels from wastes and updates to our sustainability criteria.



Cross-modal decarbonisation actions: Government support for regional solutions

Transforming Cities Fund

Through the £2.5 billion Transforming Cities Fund, the Government is taking a new approach to tackling urban transport investment priorities to combat congestion and drive productivity through low carbon transport infrastructure investment. £1.08 billion has been devolved to six Mayoral Combined Authorities, such as Greater Manchester, where funding is being provided to deliver 27 additional Metrolink trams and the first £160 million of investment in the city's Bee Network to increase active travel journeys across the conurbation.

At Budget 2020, the Government announced packages of investment with 12 further cities as part of the £1.28 billion competitive fund. This includes £161 million for Derby & Nottingham for a range of low carbon measures including Bus Rapid Transit and a new cycle way linking Derby, Nottingham and East Midlands Airport. In addition £57 million was announced for Southampton which includes measures on improving cycle network routes and Bus Rapid Transit, and £79 million for South East Dorset which includes measures on creating cycle 'freeways' between Bournemouth and Ferndown, Wareham to Poole, Landsdowne to Christchurch and Merley to Poole.

Through taking a place-based approach to investment, the Government is actively working with local authorities to develop packages of schemes which meet wider government objectives, from reducing carbon to tackling air quality and unlocking housing.

Clean Air Zones

In 2017, the Government published the UK Plan for Tackling Roadside Nitrogen Dioxide Concentrations. This sets out how we will achieve compliance with legal limits in the shortest possible time and is supported by a £3.5 billion investment into air quality and cleaner transport.

Clean Air Zones are one measure being implemented to improve air quality in towns and cities across England. Clean Air Zones will deliver targeted action in air pollution hot spots to improve air quality, to improve health and support economic growth in the urban environment, encouraging the replacement of old, polluting vehicles with modern, cleaner technologies.

Future Transport Zones

£90 million of funding was made available at Budget 2018 to create up to four Future of Transport Zones (FTZs). Each FTZ will be a globally significant demonstrator of new mobility services, modes and models. The FTZs will create a functioning marketplace for mobility, combining new and traditional modes of transport.

The zones will introduce measures to tackle local issues and will contribute to decarbonisation by: using mobility credits to incentivise sustainable travel; limiting dead mileage (particularly for logistics); providing people with integrated travel choices; and incentivising mass transit/active travel.

Up to four FTZs will be created, including the West Midlands region, which has been allocated £20 million, and will be home to the first FTZ. The four designated FTZs sharing the £90 million of funding will be located in: the West Midlands; Portsmouth and Southampton; Derby and Nottingham; and the West of England Combined Authority.

4.

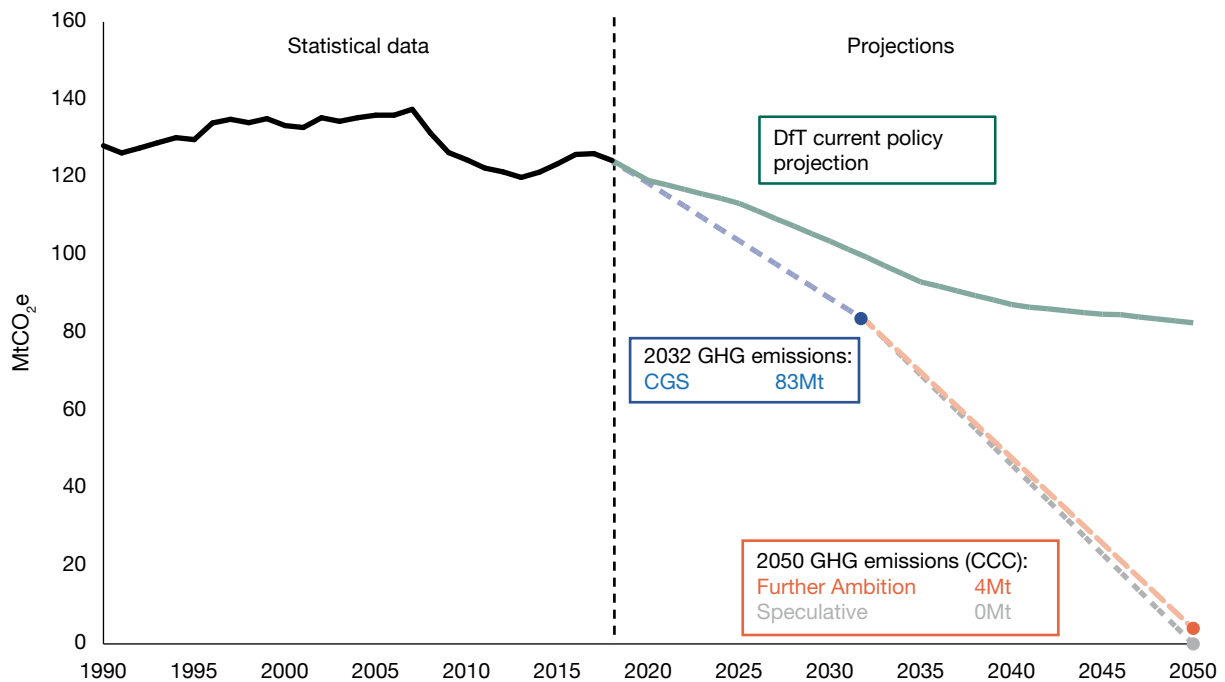
The current trajectory

4. The current trajectory

- 4.1 This section presents the projection of overall UK domestic transport GHG emissions based on current policies and compares this to what may be required to meet our obligations.
- 4.2 The UK has maintained a flexible approach to meeting carbon budgets, by not setting individual sector targets for emissions. This means that transport is not currently legally required to achieve specific emissions targets.
- 4.3 However, the 2017 Clean Growth Strategy (CGS)¹¹⁷ included illustrative ‘scenarios’ for the contribution needed to meet the fifth carbon budget (2028-2032), which can be used to compare progress and underlines the magnitude of ambition that is required by transport to play our role. Since then, the UK has legislated for net zero. Later this year, the Committee on Climate Change (CCC) will advise the Government on the level of the sixth carbon budget, and will set out a pathway to net zero in 2050. In its Net Zero report¹¹⁸ last year, the CCC said what may be required from UK transport to meet net zero in 2050, and we have taken their ‘Further Ambition’ scenario as an illustration of the level of emissions savings that will be required.
- 4.4 Figure 18 shows DfT’s current central projection for domestic transport emissions, based on firm and funded policies, and compares this to the 2032 Clean Growth Strategy and CCC net zero ‘Further Ambition’ scenarios (along with an illustrative CCC ‘Speculative’ scenario where transport emissions reach 0MtCO₂e by 2050). DfT projects transport emissions to fall steadily as a result of the existing firm and funded policies, but that the speed of reduction is much slower than what is likely to be needed if transport is to fully play its part in contributing to our legal obligations.
- 4.5 There is, of course, considerable uncertainty over how far and fast transport emissions will fall in the future. The projection depends on how quickly technology evolves and how quickly consumers adopt these new technologies, as well as how individual travel behaviour changes over the coming decades. DfT’s current domestic projection is based on the best available evidence and data, but other scenarios are possible. Nonetheless, it is clear from figure 18 that the UK must go much further in reducing domestic transport emissions than currently projected if we are to meet the emission levels set out in the 2032 Clean Growth Strategy scenario (there is an estimated gap of 16MtCO₂e between this and DfT’s current projection in 2032), and to meet our legal obligation to reach net zero GHG emissions by 2050.
- 4.6 International shipping and aviation emissions must also be reduced, and Government agrees with CCC advice that the primary policy approach to reducing these emissions should be international. Accordingly, the UK is working through ICAO and IMO to reduce international aviation and shipping emissions respectively. We continue to provide “headroom” for these emissions within our carbon budgets, meaning that the UK can remain on the right trajectory for net zero GHG emissions across the whole economy. Emissions from domestic flights and shipping are already covered by our domestic legislation and the CCC account for international flights and shipping in their advice on setting our carbon budgets.

- 4.7 As this current projection only includes committed expenditure or regulation in place, excluding future policies, spending measures and ambitions, we would expect to make significant further emissions reductions as we move towards 2050. However, the projection highlights the scale of the challenge that the transport sector faces, to ensure that it contributes to the emissions reduction required across the economy.

Figure 18: DfT's latest domestic GHG emissions projections based on current policies, compared to Clean Growth Strategy (CGS) targets and CCC Net Zero 'Further Ambition' and 'Speculative' scenarios^m



^m The projections above are produced using a range of models. This includes the National Transport Model (road transport), the Aviation model, and the GloTraM model (shipping), as well as other DfT modal models. These forecasts will not be consistent with either the 2018 or (not yet published) 2019 BEIS Energy and Emission Projections (EEP) for a number of reasons. Primarily, these are DfT projections which use the National Transport Model rather than the elasticity-based model used to produce the EEP, and differences in methodology will result in small deviations in the forecast (any difference will be small compared to overall forecast uncertainties). It should also be noted that the 2018 BEIS Energy and Emissions projections only covered the time period up to 2035. DfT projections are provided as a point forecast for clarity of messaging, the uncertainty in forecasts is however significant (see text earlier in the chapter).

5.

Setting the challenge

5. Setting the challenge

- 5.1 As shown in figure 18, to deliver the reduction in transport emissions needed for our interim carbon budgets and net zero, we will need to go further than the existing plans set out in this document. This is not optional; there is no plausible path to net zero without major transport emissions reductions, reductions that need to start being delivered soon.
- 5.2 The Transport Decarbonisation Plan (TDP), to be published later in 2020, will put forward a credible implementation plan of how to put the UK's entire transport system on a pathway to deliver the necessary GHG emissions reduction.
- 5.3 The CCC have stated that whilst it is technically possible to deliver net zero based on "current consumer behaviours and known technologies", the target will only be credible if policy measures ramp up significantly and urgently¹¹⁹. We agree and do not underestimate the challenge of delivering what will be fundamental changes to the way people and goods move around. This will require changes to people's behaviours, including encouraging more active travel and the use of public transport, alongside increasing the uptake of zero emission vehicles and new technologies.
- 5.4 The plan will not just consider existing and new modes of transport. The role for people and places will be crucial as we consider where and how transport contributes to GHG emissions and how to maximise the benefits of decarbonisation for all of society.
- 5.5 We will work with local authorities and other regional bodies to identify and support place-based solutions for the greatest polluting areas, to help enable lower carbon communities. A range of potential measures will be considered to encourage progress, recognising that different areas will need different combinations of solutions.
- 5.6 For consumers, we will need to provide different travel options, which meet their needs and improves mobility, whilst also reducing emissions. Using approaches informed by behavioural science to encourage people to make more environmentally-friendly choices will be key.
- 5.7 As we set out in the Future of Mobility: Urban Strategy published in March 2019, the wave of change in transport technologies and business models is creating an opportunity to support the UK's ambitions for decarbonisation and net zero. New types of travel and new business models, enabled by data and connectivity, automation and electrification are starting to transform how people and goods move.
- 5.8 We want to support industry and put the regulatory mechanisms in place to set the UK up to become a world-leader in low-carbon transport technology. Through the Future of Transport Regulatory Review, we are creating a fertile environment for innovation and investment, enabled by a flexible, responsive regulatory system¹²⁰, and we will look to build on this in the TDP.

Utilising data to drive the green transport revolution

Data has a key role as an enabler for the UK's green transport revolution. We want to ensure that transport CO₂ emission data is easily available, comparable and fully accessible so that people, businesses and places can be informed about the carbon emissions associated with their journeys. As such, we will look to develop a universally recognised measure so that in future, people can easily compare how much CO₂ different forms of transport emit over a certain distance.

For people and businesses, this data could enable them to make more informed decisions about how individuals and goods travel, and ensure they have the tools to understand what they can do to make cleaner, greener journeys.

Unlocking and providing better data associated with transport emissions will give a clearer picture of the impact in local areas.

The revolution in mobility we are facing must be hand in hand with the digital revolution. The UK is well-placed to embrace the use of smart, green technology, and benefit from the industrial opportunities that technology and innovation can play in solving climate change. Digital technologies can play a fundamental role in keeping UK businesses competitive and more resilient in the new transport landscape.

- 5.9 Research and innovation will play an important role in all areas with respect to decarbonisation. We will need to use scientific, social research and behavioural expertise, and make the most of the UK research-base to answer key questions that arise. We will also need to be ruthlessly evidence-based, concentrating on those policies and interventions that deliver the real reductions in emissions needed.
- 5.10 Whilst we know the scale of the challenge, we do not currently know the optimal path for delivering a decarbonised transport network. We, therefore, intend to work with business, academics, researchers and innovators, environmental NGOs and the wider public over 2020 to design the package of decarbonisation policies that can serve the needs of both passengers and wider society, and deliver our goals.
- 5.11 By presenting how we intend to address the challenge and identify a path to net zero, the plan will provide a clear direction to the transport industry and wider businesses that their efforts in delivering contributions to net zero are supported by government.
- 5.12 Whilst the opportunities are significant, we also know there will be difficult decisions ahead, with substantial investment needed from government and industry. This will need to be supported by a genuine understanding of people's diverse needs and preferences, allowing us to achieve lasting behavioural change.
- 5.13 An early transition also brings massive opportunities to make the UK a world leader in low carbon transport. We want to deliver all the co-benefits we can, using the TDP to make the UK a better, easier, cleaner country to travel and live in.

Strategic priorities

5.14 In order to provide structure to the work over the next year, and taking account of the above considerations, we have looked to split the work into strategic priorities. These are purposefully not aligned to particular modes of transport, instead reflecting the core areas we believe plans are needed for delivery of the aims of the TDP. These are:

- **Accelerating modal shift to public and active transport**

We want public transport and active travel to be the natural first choice for our daily activities. An important aspect of reducing emissions from transport will be to use our cars less and be able to rely on a convenient, cost-effective and coherent public transport network. For those able to do so, we would like cycling and walking to be the easy and obvious choice for short journeys. We are already exploring how we can use vehicles differently, such as through shared mobility. New technologies and business models may help facilitate modal shift, such as Mobility as a Service platforms. This will require behavioural changes and we will consider how government and others can support this shift through infrastructure and encouraging those forms of travel.

- **Decarbonisation of road vehicles**

From motorcycles to HGVs, the transition to zero emission road vehicles requires major changes to the vehicles we drive and the way we use our roads. Key considerations will include ensuring a supportive regulatory framework, a strong consumer base developed by building trust in new technologies as providing a viable alternative, the right market conditions, adequate vehicle supply and ensuring the necessary refuelling and recharging infrastructure. Investing in innovative technology developments across road transport, and developing sustainable supply chains, must be fully considered to ensure the maximum possible benefits from the transition, in the UK and internationally.

- **Decarbonising how we get our goods**

Future demand for transporting goods, in response to changing consumer behaviours, is an important consideration. A huge opportunity exists to transform 'last mile' deliveries, ensuring an integrated, clean and sustainable delivery system. Reducing emissions for last mile deliveries, particularly in urban areas, as well as potential improvements in logistics efficiency have a key role to play. As we consider the future of the transport system, innovative digitally-enabled solutions, data-sharing and collaborative platforms could transform how our goods are moved, potentially also reducing the negative impact of congestion.

- **Place-based solutions for emissions reduction**

Emissions are not consistent across the country and a single solution for emissions reduction will not be appropriate for every location. Understanding where, how and why emissions occur in specific locations, be it around a major airport, port, motorway junction, or within a city centre, will enable us to develop a tailored response. We will work with relevant stakeholders to consider how local management of transport systems can best address emissions at a local level, and make an important contribution to national GHG emissions.

Local authorities, mayoral combined authorities, subnational transport bodies and other interested parties will provide valuable insights into considering place-based solutions for emissions reduction.

- **UK as a hub for green transport technology and innovation**

Building on the work of the Future of Transport Grand Challenge which aims to make the UK a world leader in the movement of people, goods and services, we want to utilise the UK's world-leading scientists, business leaders and innovators, to position the UK as the internationally recognised leader in environmentally sustainable technology and innovation in transport. We want to build on the expertise within the UK for both the necessary technological developments and to nurture near market quick wins. We want to ensure robust R&D measures for investment in key technologies to support the move to net zero. Transport innovations, such as digitalisation and making data available to empower customer choice, could tackle congestion, pollution and disconnection whilst improving our environment.

- **Reducing carbon in a global economy**

Reducing emissions from transport is a global, as well as a UK, priority. Clearly areas of transport, including aviation and maritime, are international by nature, and are vital components of our international trade and economy. We want to harness the UK as a centre of expertise to drive low carbon innovation and travel behaviour that helps enable a global transition to low carbon transport. This will boost the UK economy and help to lead the change internationally, as well as continuing to drive ambition for global emissions reductions in international fora.



Science, Research and Innovation

Science, research and innovation are fundamental to the decarbonisation of the transport system. We need to fully exploit the technologies and expertise already available and invest in science, research and innovation to achieve our zero-carbon goals as effectively, efficiently and speedily as possible.

The Science Plan

DfT will publish a Science Plan in Spring 2020 which will set out transport's key science, research and innovation challenges, our investment priorities, how we will engage across government with academia, business and industry to meet these challenges, and how we will join up across the transport landscape to develop, test and deploy solutions. It will set out how delivery of those solutions will be underpinned and enabled by skills in government, industry and academia.

Departmental Chief Scientific Advisers are developing Science Plans to set out how Departments will support the Government's goal of increasing R&D investment in the UK to 2.4% of GDP¹²¹. The DfT Science Plan will work to position the UK as a global leader in transport science, research and innovation, delivering a step-change in our transport systems by using leading-edge solutions to meet user needs.

Decarbonisation and the Science Plan

Decarbonisation will be one of the key challenges in the Science Plan, with the priorities and actions designed to support the successful delivery of the Transport Decarbonisation Plan. To help us achieve this, we are developing a technology roadmap for decarbonisation. This will give advice on the support we need to provide in the near and medium term in order to de-risk, and have in place, the technologies which will help us deliver a decarbonised transport system by 2050.

We are working with our partners across academia and business to identify priorities and where we can build on existing expertise and progress across government and industry. The Science Plan will build on this and identify priorities for action. Across the Transport Decarbonisation Plan's six priorities, example areas include:

Electric Vehicles: Battery technology development, associated production and recycling, charging infrastructure, and the need to understand the behavioural interventions which would be most effective in accelerating consumer uptake continue to be areas where further development work is vital to bring solutions at scale to market. We are working with the Faraday Battery Challenge and the broader industry to retain our world leadership in electric drivetrain research.

Hydrogen: Electric batteries are a viable technology for smaller vehicles today, but the fuel for delivering a solution for larger road, marine and rail vehicles is not yet clear. Hydrogen is a potential solution, and the UK has a number of world leading centres that could readily test the viability of the hydrogen economy for transport.

Modal Shift: Decarbonisation of transport will not happen without users changing their behaviours. It is essential we continue to explore how best to encourage a shift to more sustainable and active travel and the adoption of zero carbon technologies and services to achieve a smooth transition to net zero transport.

Future of Flight: The challenge for aviation is set out in Chapter 4. We will continue to work with our world-leading scientists, researchers and UK businesses to drive forward thinking around new technologies and new and improved fuels.

Place-based: There are centres of excellence across the UK working to decarbonise and clean-up their local areas. We aim to work with these areas to develop, test, demonstrate and deploy decarbonisation solutions.

Carbon in a global economy: Working towards zero carbon transport will not be tackled by the UK alone; we need to build on our international reputation and partnerships in science, research and innovation, working together to develop and deliver solutions.

Carbon Capture Utilisation and Storage (CCUS) will likely play a role in meeting our net zero 2050 ambitions. Thirteen, £30,000 decarbonisation projects commenced in January 2020, funded by DfT's Transport-Technology Research and Innovation Grants (T-TRIG) project, including a project looking at the feasibility of on-board carbon capture for maritime decarbonisation.

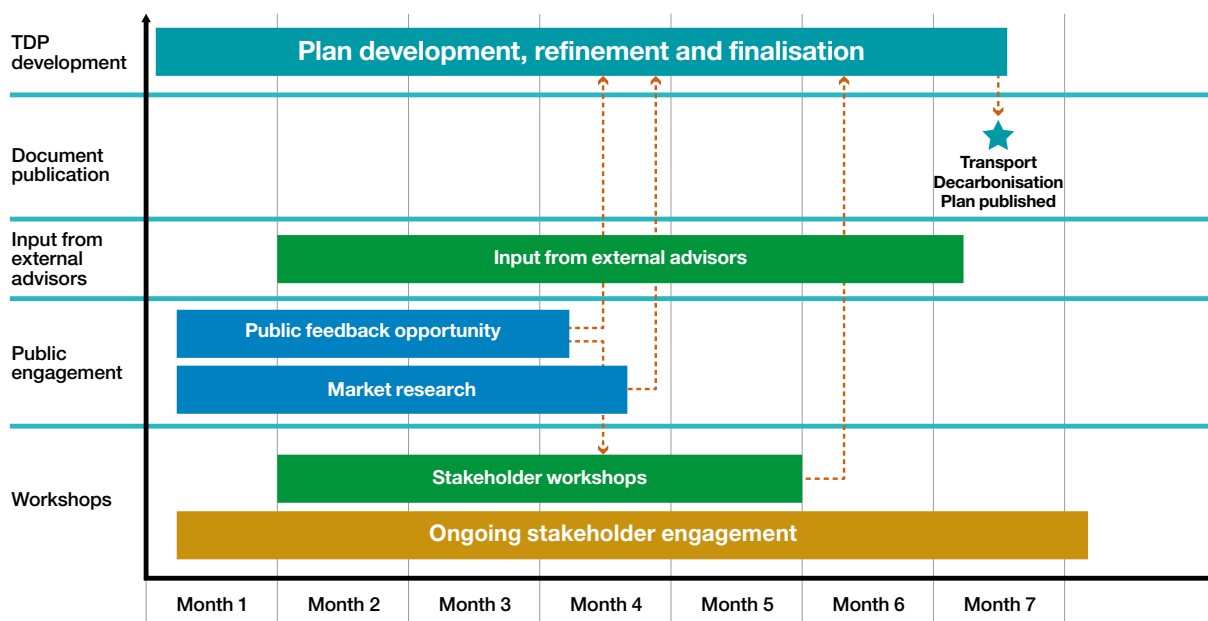
6.

Next steps

6. Next steps

- 6.1 This document marks the beginning of a conversation to develop the policies needed to decarbonise transport. We will take a holistic view of transport, looking at challenging new cross-modal approaches to mobility whilst maximising the potential in each mode to deliver our carbon budgets and reach net zero. We want to build on the policies outlined by working with industry and business groups, academics and researchers, community and interest groups, environmental NGOs, local authorities and the public. We will do this through various forms of engagement, focused around our six strategic priorities.
- 6.2 Input, engagement and collaboration with all our stakeholders will be integral to producing a credible plan and supporting its successful implementation and delivery. We will take a three-pronged approach to engagement through a Minister-led advisory council, stakeholder events and workshops complemented by ongoing public engagement. Some engagement within modes is already underway or planned, including the net zero aviation consultation, the National Bus Strategy, the Science Plan and Future of UK Freight Strategy.
- 6.3 The timeline (figure 19) shows how we intend to engage with a wide range of stakeholders and how feedback will inform the development of the plan.

Figure 19: Timeline of stakeholder engagement



Public engagement

- 6.4 Engagement with the public is crucial as we develop the plan, acknowledging that changing the way people travel and use transport will be required to meet net zero. We listen to transport users – collecting and using systematic data and feedback on travel preferences and choices through regular surveys and research. We want to build on

this knowledge by engaging the public to ensure we take account of their needs and preferences as we decarbonise whilst supporting and encouraging people to change travel behaviours.

- 6.5 Views will be sought via multiple channels, including through a public feedback opportunity and conducting market research to gather data on public behaviours.

Share your views: decarbonising transport

- 6.6 We welcome all views on how to reduce emissions from transport.
- 6.7 **Public feedback opportunity:** We will be inviting feedback and engagement via questions online. Your responses offer important insights and will inform wider stakeholder engagement activity as part of DfT's work on decarbonising transport.
- 6.8 The public feedback opportunity will be made available from Spring. It will cover the six strategic priorities and you can choose to answer as many questions as you like. The information we receive will be anonymous and will be used to inform discussions in Wave 2 and 3 workshops (explained in paragraphs 6.12 to 6.18). You will have the opportunity to provide your contact details so that we can keep you updated with progress of the plan, and you will have the opportunity to input in writing if preferable.
- 6.9 **Share your views as a business or organisation:** You are invited to share your views on what actions government should take in order to decarbonise transport. We would also welcome research or evidence you have undertaken in this area. Please email TDP@dft.gov.uk or write to Transport Decarbonisation Plan, Great Minster House, 33 Horseferry Rd, London, SW1P 4DR.
- 6.10 **Public behaviours:** The Department will conduct market research to gather data on public behaviours and inform how policy can be most effective.

Workshops

- 6.11 We intend to host a series of workshops, each focused on a specific strategic priority. These workshops are aimed at engaging the transport sector so we want specialists, innovators, researchers, businesses and NGOs to collaborate with us to identify bold, ambitious and credible steps, considering different technology, systems, policies and support mechanisms, that will put us on the pathway to net zero transport GHG emissions by 2050.
- 6.12 Stakeholders and representatives of organisations are invited to register their interest for one or more strategic priority workshop by emailing TDP@dft.gov.uk. As spaces may be limited, invitations will be offered to ensure diverse and representative views are captured.
- 6.13 The workshops will help to inform the development of the TDP by engaging stakeholders on how the sector can decarbonise; commencing discussions on the contribution from industry, different transport authorities, researchers and NGOs in transport decarbonisation; listening to what is needed from government to support the industry; sharing examples of existing best practice; and sharing ideas to deliver transport decarbonisation.

Wave 1 workshops

- 6.14 A first wave of workshops will be based on the six cross-cutting strategic priorities, and will be attended by industry stakeholders, environmental NGOs and charities, and transport providers.

Wave 2 workshops

- 6.15 We intend to hold a second set of workshops across the UK to test the ideas and conclusions identified from Wave 1, as well as considering the insights received from the public feedback. We will explore emerging ideas in more detail and discuss how they might be implemented regionally. Local and devolved government, sub-national transport bodies, local transport providers, researchers, and local public interest groups will be invited to participate.
- 6.16 Discussions will focus on local barriers to decarbonisation, what steps to decarbonisation are being taken locally, plus future opportunities.

Wave 3 workshops

- 6.17 The final set of workshops will present a range of potential policies to a smaller group of stakeholders. There will also be a chance for government to outline expectations on stakeholders for taking the plan forward, implementing the policies involved and socialising it in their respective regions, industries, sectors and representative groups.

Ongoing stakeholder engagement

- 6.18 The three waves of workshops will be complemented by additional stakeholder engagement opportunities. We will use existing stakeholder meetings and forums to engage as many stakeholders as possible to share their views.
- 6.19 The workshops will not be a one-off event. Following the workshops, there will be an ongoing dialogue with stakeholders. This process across each strategic priority will inform the development of the final Plan.
- 6.20 Engagement on decarbonisation initiatives will continue within each transport mode. As far as possible, these will be aligned with, and contributing to, the TDP. This engagement includes, but is not limited to, bringing forward the end to the sale of new petrol and diesel cars and vans to 2035, or earlier if a faster transition appears feasible, Future of UK Freight, Rail Traction Review, net zero aviation consultation and Future of Transport Regulatory Review. As such, your views contributed through these consultations will also contribute to the Plan.

Working across the UK

- 6.21 Whilst the Climate Change Act 2008 and the commitment to reaching net zero by 2050 is UK-wide, some levers to cut emissions from transport may be held and best implemented by the devolved administrations in Scotland, Wales and Northern Ireland, and partners in local government. We will collaborate with leadership at all levels, acknowledging the positive steps already taken towards implementing a clean transport system.

- 6.22 Tackling climate change is a key priority for the Government, and the TDP will form part of the Government's response to the economy-wide challenge of net zero alongside further detail on our plans to reduce emissions in key sectors such as industry, energy and buildings, while seizing the economic benefits of clean growth across the country.
- 6.23 To ensure maximum impact and to realise the co-benefits available, we will be mindful of wider government policies, including transport infrastructure. We will work closely with colleagues to have consideration of wider environmental principles and government commitments, including air quality ambitions and the 25 Year Environment Plan, to ensure we do not address GHG emissions at the expense of other environmental or societal impacts.
- 6.24 We will also work with UKRI and other research and innovation partners to identify the critical science, technology, social and behavioural research, and innovation priorities, with the aim of achieving net zero in transport by 2050.

Net Zero Transport Council

- 6.25 An external advisory council will be brought together to advise on the Government's approach to transport decarbonisation. The Net Zero Transport Council will have two main roles. Firstly, to provide advice and challenge during the development of the TDP through 2020, and secondly to provide more general advice on reducing emissions from transport, particularly with regards to the longer-term technology and behavioural changes needed to deliver transport's contribution to net zero.
- 6.26 The Council will represent a wide variety of stakeholders, including each mode of transport, behavioural insights, technology, academia and environmental NGOs. Other experts on particular topics will be invited if required to specific meetings. The Council will be chaired by the Secretary of State.

Get in touch

- 6.27 You can share your views on decarbonising transport, register to receive regular updates on the progress of the Transport Decarbonisation Plan and information about the consultation workshops by emailing TDP@dft.gov.uk.
- 6.28 Or if preferable, please contact us by post, by writing to Transport Decarbonisation Plan, Great Minster House, 33 Horseferry Rd, London, SW1P 4DR.

7.

References

7. References

- ¹ IPCC (2018) Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty (online). Available at: <https://www.ipcc.ch/sr15/chapter/spm/>
- ² BEIS (2020) 2018 UK greenhouse gas emissions: final figures - statistical release (online). Available at: <https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-2018>
- ³ ONS (2019) Gross Domestic Product: chained volume measures: Seasonally adjusted £m. Available at: <https://www.ons.gov.uk/economy/grossdomesticproductgdp/timeseries/abmi/qna>
- ⁴ Compared with the previous target of at least 80% reduction from 1990 levels. This commitment has been set in legislation through an amendment to the Climate Change Act 2008 (2050 Target Amendment) Order 2019 (online). Available at: <https://www.legislation.gov.uk/ukdsi/2019/9780111187654>
- ⁵ HM Government (2017). Clean Growth Strategy (online). Available at: <https://www.gov.uk/government/publications/clean-growth-strategy>.
- ⁶ BEIS (2020) 2018 UK greenhouse gas emissions: final figures – statistical release (online). Available at: <https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-2018>
- ⁷ BEIS (2020) 2018 UK greenhouse gas emissions: final figures – statistical release (online). Available at: <https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-2018>
- ⁸ Defra (2020) Environment Bill 2020 (online) Available at: <https://www.gov.uk/government/publications/environment-bill-2020>
- ⁹ HM Government (2018) A green Future: Our 25 Year Plan to Improve the Environment (online). Available at: <https://www.gov.uk/government/publications/25-year-environment-plan>
- ¹⁰ DfT (2018) Transport Statistics Great Britain 2018 (online) Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/787488/tsgb-2018-report-summaries.pdf
- ¹¹ Jennings, N., Fecht, D. and De Matteis, S. (Grantham Institute) (2019) Co-benefits of climate change mitigation in the UK: What issues are the UK public concerned about and how can action on climate change help to address them? (online). Available at: <https://www.imperial.ac.uk/media/imperial-college/grantham-institute/public/publications/briefing-papers/Co-benefits-of-climate-change-mitigation-in-the-UK.pdf>
- ¹² DfT (2018) Transport Statistics Great Britain 2018 (online). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/787488/tsgb-2018-report-summaries.pdf
- ¹³ DfT (2019) Transport Statistics Great Britain 2019 (online). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/856146/tsgb-2019.pdf
- ¹⁴ Data taken from DfT (2019) Road Traffic Statistics (online). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/801191/tra0201.ods and BEIS (2020) 2018 UK greenhouse gas emissions: final figures – statistical release (online). Available at: <https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-2018>
- ¹⁵ Available at: <https://energysavingtrust.org.uk/blog/planes-trains-and-automobiles-%E2%80%93-carbon-emissions-compared-between-london-and-edinburgh>.
- ¹⁶ DfT (2018) National Travel Survey 2018 (online) Available at: <https://www.gov.uk/government/statistics/national-travel-survey-2018>
- ¹⁷ DfT (2018) Transport and Technology Public Attitudes Tracker – Waves 1 and 2 (online). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/752240/transport-and-transport-technology-public-attitudes-tracker-wave-1-and-2-report.pdf
- ¹⁸ DfT (2018) National Travel Survey 2018 (online). Available at: <https://www.gov.uk/government/statistics/national-travel-survey-2018>

- ¹⁹ DfT calculation based on BEIS (2020) 2018 UK greenhouse gas emissions: final figures – statistical release (online). Available at: <https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-2018> and DfT (2019) Road Traffic Statistics, TRA0101 (online). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/801185/tra0101.ods
- ²⁰ BEIS (2020) 2018 UK greenhouse gas emissions: final figures – statistical release (online). Available at: <https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-2018>
- ²¹ European Automotive Manufacturers Association (2020) New Passenger Car Registrations by Fuel type in the European Union (online). Available at: https://www.acea.be/uploads/press_releases_files/20190206_PRPC_fuel_Q4_2019_FINAL.pdf
- ²² DfT (2019) Vehicles Statistics 2019, VEH0130 (online). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/853461/veh0130.ods
- ²³ Bloomberg New Energy Finance (2017). The Latest Bull Case for Electric Cars: the Cheapest Batteries Ever (online). Available at: <https://www.bloomberg.com/news/articles/2017-12-05/latest-bull-case-for-electric-cars-the-cheapest-batteries-ever>
- ²⁴ Estimated from data on provision of off-street parking at domestic dwellings provided in MHCLG's English Housing Survey 2015. Figures do not exist for the whole of the UK.
- ²⁵ DfT (2019). National Travel Survey Table NTS0908 (online). Available at: www.gov.uk/government/uploads/system/uploads/attachment_data/file/550507/nts0908.xls
- ²⁶ DfT (2018) The Road to Zero (online). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/739460/road-to-zero.pdf
- ²⁷ DfT (2019) Road Traffic Statistics, TRA0101 (online). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/801185/tra0101.ods
- ²⁸ DfT (2018) Transport Statistics Great Britain 2018, TSGB0303 (ENV0103) (online). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/761499/env0103.ods
- ²⁹ UK Energy Research Centre (2019) Review of Energy Policy 2019 (online). Available at: <http://www.ukerc.ac.uk/publications/rep19.html>
- ³⁰ Public research carried out by Go Ultra Low in Sept 2019
- ³¹ DfT (2018) Transport and Technology Public Attitudes Tracker – Waves 1 and 2 (online). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/752240/transport-and-transport-technology-public-attitudes-tracker-wave-1-and-2-report.pdf
- ³² SMMT (2019) Car Registrations data (online). Available at: <https://www.smmt.co.uk/vehicle-data/car-registrations/>
- ³³ Office of Low Emission Vehicle analysis based on zapmap data. Available at: <https://www.zap-map.com/statistics/>
- ³⁴ Electric Vehicle Homecharge Scheme offers 75% (capped at £500, inc. VAT) off the total capital costs of the chargepoint and associated installation costs. DRS offered to 75% (capped at £1,000 including VAT) off the total capital costs of the chargepoint plus associated installation costs.
- ³⁵ DfT (2019) Vehicles Statistics 2019, VEH0130 (online). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/853461/veh0130.ods
- ³⁶ Regulation (EU) 2019/631 of the European Parliament and of the Council of 17 April 2019 setting CO2 emission performance standards for new passenger cars and for new light commercial vehicles, and repealing Regulations (EC) No 443/2009 and (EU) No 510/2011 (Text with EEA relevance.) (online). Available at: <http://data.europa.eu/eli/reg/2019/631/oj>
- ³⁷ BEIS (2020) 2018 UK greenhouse gas emissions: final figures – statistical release (online). Available at: <https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-2018>
- ³⁸ DfT (2019) Transport Statistics Great Britain 2019 (online). Available at: <https://www.gov.uk/government/statistics/transport-statistics-great-britain-2019>

- ³⁹ BEIS (2020) 2018 UK greenhouse gas emissions: final figures – statistical release (online). Available at: <https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-2018>
- ⁴⁰ DfT (2019) Local bus vehicle distance travelled, BUS0203: Vehicle distance travelled (miles and kilometres) on local bus services by metropolitan area status and country: Great Britain, annual from 1970)
- ⁴¹ BEIS (2020) 2018 UK greenhouse gas emissions: final figures – statistical release (online). Available at: <https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-2018>
- ⁴² BEIS (2020) 2018 UK greenhouse gas emissions: final figures – statistical release (online). Available at: <https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-2018>
- ⁴³ DfT (2019) Travel Survey Great Britain Modal Comparisons, TSGB0101 (online). Available at: <https://www.gov.uk/government/statistical-data-sets/tsgb01-modal-comparisons#travel-to-work?>
- ⁴⁴ Office of Rail and Road (2018) Rail emissions 2018-19 Annual Statistical Release (online). Available at: <https://dataportal.orr.gov.uk/media/1531/rail-emissions-2018-19.pdf>
- ⁴⁵ Internal DfT analysis
- ⁴⁶ ORR (2019) Passenger rail usage 2018-19 Q4 statistical release (online) Available at: <https://dataportal.orr.gov.uk/media/1569/passenger-rail-usage-2018-19-q4.pdf>
- ⁴⁷ Rail Industry Decarbonisation Taskforce (2019) Final Report to the Minister for Rail (online). Available at: <https://www.rssb.co.uk/-/media/Project/RSSB/Platform/Documents/Public/Public-content/Research-and-Technology/rail-industry-decarbonisation-taskforce-final-report-for-the-minister-for-rail-july-2019-final.pdf?la=en>
- ⁴⁸ DfT analysis. 70% of passenger vehicles are electric, and electric trains are used on the busiest parts of the network.
- ⁴⁹ Internal DfT analysis
- ⁵⁰ Figures from 2017-2018 minus 2016-2017 passenger CO₂e. ORR (2018) Rail infrastructure, assets & environmental 2017-18 Annual Statistical Release (online). Available at: <https://dataportal.orr.gov.uk/media/1526/estimates-of-passenger-and-freight-energy-consumption-and-co2-emissions-table-2101.xlsx>
- ⁵¹ BEIS (2020) 2018 UK greenhouse gas emissions: final figures – statistical release (online). Available at: <https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-2018>
- ⁵² ORR (2019) Annual passenger kilometres (Table 12.2) (online). Available at: <https://dataportal.orr.gov.uk/statistics/usage/passenger-rail-usage/>
- ⁵³ BEIS (2020) 2018 UK greenhouse gas emissions: final figures – statistical release (online). Available at: <https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-2018>
- ⁵⁴ BEIS (2020) 2018 UK greenhouse gas emissions: final figures – statistical release (online). Available at: <https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-2018>
- ⁵⁵ BEIS (2020) 2018 UK greenhouse gas emissions: final figures – statistical release (online). Available at: <https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-2018>
- ⁵⁶ BEIS (2020) 2018 UK greenhouse gas emissions: final figures – statistical release (online). Available at: <https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-2018>
- ⁵⁷ ICAO (2019) CORSIA States for Chapter 3 State Pairs (online). Available at: <https://www.icao.int/environmental-protection/CORSIA/Pages/state-pairs.aspx>
- ⁵⁸ IATA (2019) Fact Sheet: CORSIA (online) Available at: <https://www.iata.org/contentassets/fb745460050c48089597a3ef1b9fe7a8/corsia-fact-sheet.pdf>
- ⁵⁹ European Commission (2020) Reducing emissions from aviation (online). Available at: https://ec.europa.eu/clima/policies/transport/aviation_en
- ⁶⁰ BEIS (2020) 2018 UK greenhouse gas emissions: final figures – statistical release (online). Available at: <https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-2018>

- ⁶¹ DfT calculations based on the past and projected active travel spending profile & the expected cost per car vkm removed, as found in the Local Sustainable Transport Fund meta evaluation.
- ⁶² Stages is the unit of measurement of a journey. For example, walking from home to a station would be one stage.
- ⁶³ DfT (2020) Walk to School Outreach factsheet (to be published)?
- ⁶⁴ DfT (2020) Cycling Cities Ambition Intervention in Greater Manchester factsheet (to be published)
- ⁶⁵ DfT (2019) Road Traffic Statistics, TRA0101 (online). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/801185/tra0101.ods
- ⁶⁶ DfT (2018) Transport Statistics Great Britain 2018 (online). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/787488/tsgb-2018-report-summaries.pdf
- ⁶⁷ BEIS (2020) 2018 UK greenhouse gas emissions: final figures – statistical release (online). Available at: <https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-2018>
- ⁶⁸ BEIS (2020) 2018 UK greenhouse gas emissions: final figures – statistical release (online). Available at: <https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-2018>
- ⁶⁹ DfT (2018) Road traffic statistics (online). Available at: <https://www.gov.uk/government/statistical-data-sets/road-traffic-statistics-tra#traffic-volume-in-miles-tra01>
- ⁷⁰ Committee on Climate Change (2018) Reducing UK emissions – 2018 Progress Report to Parliament (online). Available at: <https://www.theccc.org.uk/wp-content/uploads/2018/06/CCC-2018-Progress-Report-to-Parliament.pdf>
- ⁷¹ BEIS (2020) 2018 UK greenhouse gas emissions: final figures – statistical release (online). Available at: <https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-2018>
- ⁷² Regulation (EU) 2019/1242 of the European Parliament and of the Council of 20 June 2019 setting CO₂ emission performance standards for new heavy-duty vehicles and amending Regulations (EC) No 595/2009 and (EU) 2018/956 of the European Parliament and of the Council and Council Directive 96/53/EC (online). Available at: <https://eur-lex.europa.eu/eli/reg/2019/1242/oj>
- ⁷³ DfT (2018) The Road to Zero (online). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/739460/road-to-zero.pdf
- ⁷⁴ Regulation (EU) 2019/1242 of the European Parliament and of the Council of 20 June 2019 setting CO₂ emission performance standards for new heavy-duty vehicles and amending Regulations (EC) No 595/2009 and (EU) 2018/956 of the European Parliament and of the Council and Council Directive 96/53/EC (online). Available at: <https://eur-lex.europa.eu/eli/reg/2019/1242/oj>
- ⁷⁵ Regulation (EU) 2019/1242 of the European Parliament and of the Council of 20 June 2019 setting CO₂ emission performance standards for new heavy-duty vehicles and amending Regulations (EC) No 595/2009 and (EU) 2018/956 of the European Parliament and of the Council and Council Directive 96/53/EC (online). Available at: <https://eur-lex.europa.eu/eli/reg/2019/1242/oj>
- ⁷⁶ BEIS (2020) 2018 UK greenhouse gas emissions: final figures – statistical release (online). Available at: <https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-2018>
- ⁷⁷ BEIS (2020) 2018 UK greenhouse gas emissions: final figures – statistical release (online). Available at: <https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-2018>
- ⁷⁸ BEIS (2020) 2018 UK greenhouse gas emissions: final figures – statistical release (online). Available at: <https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-2018>
- ⁷⁹ DfT (2019) Road Traffic Statistics, TRA0101 (online). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/801185/tra0101.ods
- ⁸⁰ DfT (2018) The Road to Zero (online). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/739460/road-to-zero.pdf
- ⁸¹ Regulation (EU) 2019/631 of the European Parliament and of the Council of 17 April 2019 setting CO₂ emission performance standards for new passenger cars and for new light commercial vehicles, and

- repealing Regulations (EC) No 443/2009 and (EU) No 510/2011 (Text with EEA relevance.) (online). Available at: <http://data.europa.eu/eli/reg/2019/631/oj>
- ⁸² BEIS (2020) 2018 UK greenhouse gas emissions: final figures – statistical release (online). Available at: <https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-2018>
- ⁸³ DfT (2019) Future of Mobility: Urban Strategy (online). Available at: <https://www.gov.uk/government/publications/future-of-mobility-urban-strategy>
- ⁸⁴ ORR (2019) Rail emissions 2018-19 Annual Statistical Release (online). Available at: <https://dataportal.orr.gov.uk/media/1531/rail-emissions-2018-19.pdf>
- ⁸⁵ ORR (2019) Freight Rail Usage, (Impact on Road Haulage, Table 13.8) (online). Available at: <https://dataportal.orr.gov.uk/media/1699/impact-on-road-haulage-table-138.xlsx>
- ⁸⁶ ORR (2019) Freight Rail Usage 2018-19 Q4 Statistical Release (online). Available at: <https://dataportal.orr.gov.uk/media/1257/freight-rail-usage-2018-19-quarter-4.pdf>
- ⁸⁷ ORR (2019) Freight Rail Usage (Number of Freight Train Movements) (online). Available at: <https://dataportal.orr.gov.uk/media/1456/freight-moved-table-137.xlsx>
- ⁸⁸ ORR (2019) Freight Rail Usage (Freight Moved, Table 13.7) (online). Available at: <https://dataportal.orr.gov.uk/media/1456/freight-moved-table-137.xlsx>
- ⁸⁹ Rail Industry Decarbonisation Taskforce (2019) Final Report to the Minister for Rail (online). Available at: <https://www.rssb.co.uk/-/media/Project/RSSB/Platform/Documents/Public/Public-content/Research-and-Technology/rail-industry-decarbonisation-taskforce-final-report-for-the-minister-for-rail-july-2019-final.pdf?la=en>
- ⁹⁰ Rail Industry Decarbonisation Taskforce (2019) Final Report to the Minister for Rail (online). Available at: <https://www.rssb.co.uk/-/media/Project/RSSB/Platform/Documents/Public/Public-content/Research-and-Technology/rail-industry-decarbonisation-taskforce-final-report-for-the-minister-for-rail-july-2019-final.pdf?la=en>
- ⁹¹ DIT (2019) Promoting the UK's world-class global maritime offer: Trade and Investment 5-year plan 2019 (online). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/833816/Maritime_5-year_Plan_Accessible.pdf
- ⁹² IMO (2009) Second IMO GHG Study 2009. Available at: <http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Documents/SecondIMOGHGStudy2009.pdf>
- ⁹³ BEIS (2020) 2018 UK greenhouse gas emissions: final figures – statistical release (online). Available at: <https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-2018>
- ⁹⁴ BEIS (2020) 2018 UK greenhouse gas emissions: final figures – statistical release (online). Available at: <https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-2018>
- ⁹⁵ BEIS (2020) 2018 UK greenhouse gas emissions: final figures – statistical release (online). Available at: <https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-2018>
- ⁹⁶ BEIS (2020) 2018 UK greenhouse gas emissions: final figures – statistical release (online). Available at: <https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-2018>
- ⁹⁷ IMO (2015) Third IMO Greenhouse Gas Study 2014. Available at: <http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Documents/Third%20Greenhouse%20Gas%20Study/GHG3%20Executive%20Summary%20and%20Report.pdf>
- ⁹⁸ IMO (2015) Third IMO Greenhouse Gas Study 2014. Available at: <http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Documents/Third%20Greenhouse%20Gas%20Study/GHG3%20Executive%20Summary%20and%20Report.pdf>
- ⁹⁹ Cames, M., Graichen, J., Siemons, A. and Cook, V. (Öko-Institut) (2015) Emission Reduction Targets for International Aviation and Shipping. Available at: [http://www.europarl.europa.eu/RegData/etudes/STUD/2015/569964/IPOL_STU\(2015\)569964_EN.pdf](http://www.europarl.europa.eu/RegData/etudes/STUD/2015/569964/IPOL_STU(2015)569964_EN.pdf)
- ¹⁰⁰ DfT (2019) Transport Statistics Great Britain 2019 (online). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/856146/tsgb-2019.pdf

- ¹⁰¹ DfT (2019) Sea passenger statistics: all routes 2018 (online). Available at: <https://www.gov.uk/government/statistics/sea-passenger-statistics-all-routes-2018-final>
- ¹⁰² DfT (2019) Transport Statistics Great Britain 2019 (online). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/856146/tsgb-2019.pdf
- ¹⁰³ Maritime UK (2019) State of the maritime nation report 2019 (online). Available at: <https://www.maritimeuk.org/media-centre/publications/state-maritime-nation-report-2019/>
- ¹⁰⁴ DfT (2019) Promoting the UK's world-class global maritime offer: trade and investment 5-year plan (online). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/833816/Maritime_5-year_Plan_Accessible.pdf
- ¹⁰⁵ Maritime UK (2019) State of the maritime nation report 2019 (online). Available at: <https://www.maritimeuk.org/media-centre/publications/state-maritime-nation-report-2019/>
- ¹⁰⁶ DfT (2019) Maritime 2050 - Navigating the Future (online). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/773178/maritime-2050.pdf
- ¹⁰⁷ IMO (2018) Initial IMO Strategy on reduction of GHG emissions from ships (online). Available at: <http://www.imo.org/en/OurWork/Documents/Resolution%20MEPC.304%2872%29%20on%20Initial%20IMO%20Strategy%20on%20reduction%20of%20GHG%20emissions%20from%20ships.pdf>
- ¹⁰⁸ DfT (2019) Clean Maritime Plan (online). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/815664/clean-maritime-plan.pdf
- ¹⁰⁹ This assessment covered hydrogen, ammonia, methanol and Bio-LNG production technologies only.
- ¹¹⁰ Frontier Economics, E4tech and UMAS (2019) Reducing the Maritime Sector's Contribution to Climate Change and Air Pollution. Economic Opportunities from Low and Zero Emission Shipping. A report for the Department for Transport. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/815666/economic-opportunities-low-zero-emission-shipping.pdf.
- ¹¹¹ DfT (2019) Transport-Technology Research Innovation Grants (T-TRIG) 2019 (Online). Available at: <https://www.dft.gov.uk/innovation-grants/innovation-grants/t-trig/>.
- ¹¹² Frontier Economics, UMAS and CE Delft (2019) Reducing the Maritime Sector's Contribution to Climate Change and Air Pollution. Scenario Analysis: Take-up of Emissions Reduction Options and their Impacts on Emissions and Costs. A Report for the Department for Transport. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/816018/scenario-analysis-take-up-of-emissions-reduction-options-impacts-on-emissions-costs.pdf
- ¹¹³ BEIS (2020) 2018 UK greenhouse gas emissions: final figures – statistical release (online). Available at: <https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-2018>
- ¹¹⁴ DfT (2019) Renewable fuel statistics 2018, April to December: Final report (online). Available at: <https://www.gov.uk/government/statistics/renewable-fuel-statistics-2018-april-to-december-final-report>
- ¹¹⁵ Calculation based on DfT modelling
- ¹¹⁶ DfT (2019) Renewable fuel statistics 2018, April to December: Final report (online). Available at: <https://www.gov.uk/government/statistics/renewable-fuel-statistics-2018-april-to-december-final-report>
- ¹¹⁷ HM Government (2017). Clean Growth Strategy (online). Available at: <https://www.gov.uk/government/publications/clean-growth-strategy>.
- ¹¹⁸ Committee on Climate Change (2019) Net Zero The UK's contribution to stopping global warming (online). Available at: <https://www.theccc.org.uk/publication/net-zero-the-uks-contribution-to-stopping-global-warming/>
- ¹¹⁹ Committee on Climate Change (2019) Net Zero – The UK's contribution to stopping global warming (online). Available at: <https://www.theccc.org.uk/publication/net-zero-the-uks-contribution-to-stopping-global-warming/>
- ¹²⁰ DfT (2019) Future of Mobility: Urban Strategy (Online). Available at: <https://www.gov.uk/government/publications/future-of-mobility-urban-strategy>

¹²¹ HMG Industrial Strategy (2017) https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/664563/industrial-strategy-white-paper-web-ready-version.pdf

