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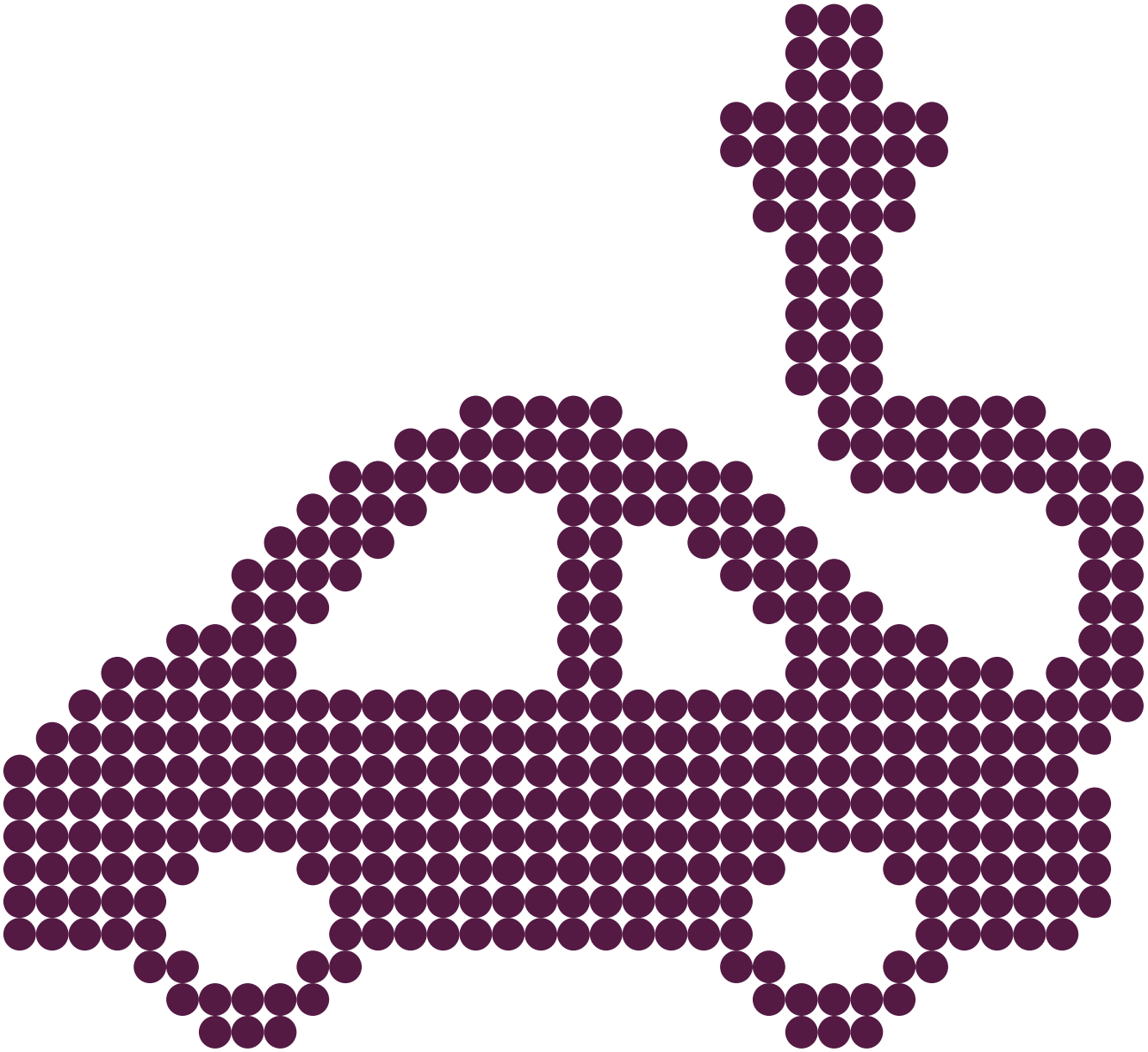

SHIFTING EMISSIONS INTO REVERSE GEAR: PRIORITIES FOR DECARBONISING TRANSPORT

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ALDERSGATE GROUP

The Aldersgate Group is a politically impartial, multi-stakeholder alliance championing a competitive and environmentally sustainable economy.

Our members include some of the largest businesses in the UK, leading NGOs, key professional institutes and politicians from across the political spectrum. We believe that economic success, both now and in the future, depends upon a political and economic framework that delivers a healthy environment and sustainable use of resources, good environmental performance at the organisational level, growth, jobs and competitive advantage in rapidly growing environmental sectors.

Our policy proposals are formed collaboratively and benefit from the expertise of our members who span a wide range of industry sectors and public interests. Our breadth and collegiate approach allows us to formulate progressive policy positions to benefit all organisations and individuals.

ORGANISATION MEMBERS

While members support this publication and provided extensive input, individual recommendations cannot be attributed to any single member and the Aldersgate Group takes full responsibility for the views expressed.

EXECUTIVE SUMMARY

Delivering deep cuts in UK surface transport emissions requires not only rapid technological change but also a significant improvement in the overall efficiency of the transport system.

UK carbon emissions have fallen by over 42% since 1990,[1] thanks mainly to actions in the power sector. Other parts of the economy now need to deliver deep emissions cuts, especially surface transport which is currently the largest emitting sector of the UK economy and one where emissions have broadly flatlined since 2008.[2]

Accelerating the transition to a zero carbon transport system would provide significant environmental, social and economic benefits. Beyond the imperative of addressing climate change, tackling road emissions will improve poor air quality, which is currently the most significant environmental risk to public health in the UK.[3] The **global zero emission vehicle (ZEV) market is rapidly growing and is projected to reach £1–2tn per year by 2030,[4] representing a sizeable export opportunity for those countries that take a lead in the manufacturing of ZEVs and the development of smart transport solutions.**

Building on the government's Road to Zero Strategy,[5] this report sets out key policies and priorities needed to deliver deep emissions cuts in surface transport, which will play a key role in meeting the UK's legally binding carbon budgets, the government's Future of Mobility Grand Challenge[6] and beyond.

This report argues that in order to significantly cut emissions, improving the overall efficiency of the transport system will be just as important as investing in new technologies and infrastructure. This means taking a whole system approach to transport, rather than treating different modes of transport in silos. Concretely, this will require the government to develop an integrated transport network strategy which brings together road and rail planning, improve the accessibility and reliability of public transport, require housing developments to be better connected to sustainable forms of transport, incentivise alternative business models to private vehicle ownership, and shift more goods onto the rail network to improve the efficiency of the freight system.

Given the significant challenges faced by the UK automotive industry following the announcements of Jaguar Land Rover, Ford, Nissan and Honda, alongside the uncertainties arising from the UK's withdrawal from the European Union, the UK cannot afford to be left behind in the global race to build clean vehicles. Building on the joint statement from the Swindon Taskforce,[7] it is essential that the government introduces tangible policies to ensure the UK is one of the most attractive places to design and manufacture zero emission vehicles and has the underlying charging infrastructure to accelerate their deployment. This should include the continued use of grants, support for innovation and fuel efficiency regulations.

This report also tackles some of the more challenging areas of decarbonisation, such as heavy commercial vehicles (HCVs) and long-distance journeys, where clean vehicle technology is not yet deployable at scale. It is therefore important that government drives greater innovation to create a range of technological options to cut emissions across the transport sector, such as trialling alternative fuels like hydrogen and biofuels, as well as expanding traditional rail electrification. Deep decarbonisation in the transport sector will also involve tackling embedded emissions by driving greater resource efficiency across the automotive industry.

The first section of the report provides context for the urgent need to accelerate transport emissions reductions, before considering what government can do to improve the efficiency of the UK transport system and enable the shift to sustainable mobility. The report then looks at how to drive greater innovation in zero emission technologies and achieve greater resource efficiency in vehicle manufacturing. Finally, the report considers how to leverage additional private sector funding through different mechanisms to deliver sustainable transport systems.

1 BEIS (February 2019) *2017 UK Greenhouse Gas Emissions, Final Figures*

2 Ibid.

3 HM Government (July 2018) *The Road to Zero*

4 Ibid.

5 HM Government (July 2018) *The Road to Zero*

6 HM Government (November 2017) *Industrial Strategy*

7 HM Government (21 February 2019) 'Joint statement following the first meeting of the Swindon Taskforce'
The Taskforce comprises of national and local government, business leaders, workers from Honda and trade unions. It is co-chaired by the Business Secretary, Leader of Swindon Council and the Chair of the Local Enterprise Partnership.

Summary of policy recommendations

To decarbonise the UK transport system and accelerate the transition to low and zero emission mobility, government should:

1. **Establish an integrated transport network strategy** by bringing together road and rail strategies to ensure that the most environmentally and economically beneficial schemes are taken forward. Government should use its upcoming response to the first National Infrastructure Commission Assessment to outline how such a co-ordinated strategy could be developed.

2. **Provide devolved, long-term funding to local and regional authorities** to improve the efficiency and environmental performance of local transport systems, in line with the funding model currently in place for Highways England and Network Rail.

3. **Ensure public transport is the most attractive form of transport for most journeys and support other forms of low carbon mobility where public transport is not viable.** This should include improving accessibility, reliability and affordability of the rail network, developing a national bus strategy to reduce the need for private vehicles, integrating car clubs within local transport systems and planning new housing developments so they are better connected to sustainable transport options.

4. **Improve the efficiency of freight transport** by moving more goods onto the UK rail network and supporting the development of Urban Consolidation Centres (UCCs) on the edge of urban areas to maximise logistic efficiency for deliveries, where goods are then loaded onto zero emission vehicles for the 'last mile'.

5. **Deliver an ambitious active travel strategy to increase the uptake of cycling and walking in urban areas** by committing long-term investment to a comprehensive, high-quality cycling and walking network and investing in a national public health communications campaign.

6. **Support local government to implement a national network of ambitious Clean Air Zones (CAZs)** by providing a strong regulatory framework and clearer guidance to set ambitious minimum common standards with respect to the charges levied on road users.

7. **Accelerate the uptake of ZEVs** by guaranteeing upfront purchase grants until EVs reach cost parity, delivering an affordable, efficient and widely accessible EV charging infrastructure, clarifying future CO_2 emission standards and incentivising the continued growth of a UK manufacturing base for ZEVs.

8. **Encourage greater innovation in more complex areas of the transport sector** where zero emission technology is not yet deployable at scale, such as for long distance journeys and HCVs, by trialling different technologies on UK roads and rail lines such as hydrogen and biofuels, as well as traditional rail electrification.

9. **Driving greater resource efficiency in vehicle manufacturing** by developing a supportive regulatory and fiscal framework to incentivise the use of more resource efficient components such as long-lasting performance tyres, the re-use and reconditioning of EV batteries for second-life appliances and a much greater use of secondary materials in vehicle manufacturing.

10. **Introduce new fiscal measures and leverage private investment to deliver sustainable transport.** This should include developing a new system of road pricing, which utilises improvements in connectivity and charges users based on distance travelled, sharing risk with the private sector to deliver better value for money on infrastructure projects, and encouraging transport authorities to diversify revenue streams to reduce reliance on central government funding.

ONE ⁘ URGENT ACTION IS REQUIRED

Decarbonising transport has proved challenging, but acting with greater urgency now will reduce long-term costs.

A well-designed, efficient transport system is an essential underpinning to a well-functioning economy and society. This is because the right transport connections in the right places improve productivity and create new economic opportunities.[8] However, these benefits have been historically accompanied by increasing air pollution and rising greenhouse gas (GHG) emissions.

After good progress decarbonising the power sector, government must now turn its attention to the **transport sector, which is now the largest emitting sector of the UK economy, accounting for 28% of UK GHGs in 2017.**[9]

Reducing emissions from transport will be key to meeting our legally binding carbon budgets. According to the Committee on Climate Change (CCC), surface transport emissions need to fall by around 46% between 2017 and 2030 to meet the fifth carbon budget.[10] Delivering the UK's 2050 target will require full or near-full decarbonisation of the transport system. Tackling transport emissions will also be essential to addressing high levels of air pollution, which is the most significant environmental risk to human health in the UK.[11]

This report focuses on surface transport, which is dominated by cars, light commercial vehicles (LCVs) or vans and heavy commercial vehicles (HCVs), and accounts for 87% of domestic transport emissions.[12] Despite improvements in vehicle efficiency, cars still account for 58% of all road transport emissions, similar to the 59% in 1990.[13] In 2017, 83% of passenger kilometres were made by car, van or taxi.[14]

8 DfT (October 2007) *Towards a Sustainable Transport System: Supporting Economic Growth in a Low Carbon World*

9 CCC (June 2018) *Reducing UK emissions, 2018 Progress Report to Parliament*

10 Ibid.

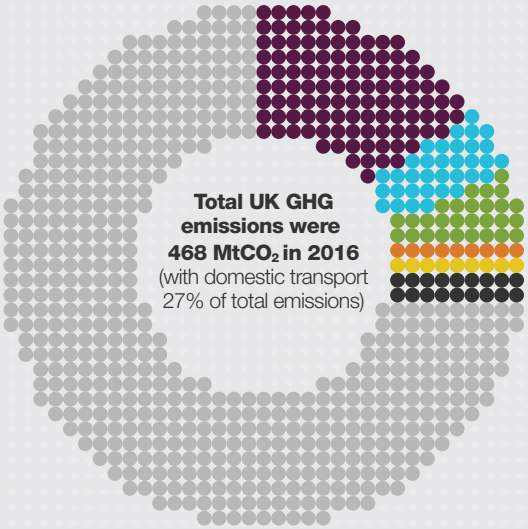
11 HM Government (July 2018) *The Road to Zero*

12 CCC (June 2018) *Reducing UK emissions, 2018 Progress Report to Parliament*

13 DfT (November 2017) *Transport Statistics: Great Britain 2017*

14 DfT (December 2018) *Transport Statistics: Great Britain 2018*

UK SECTOR EMISSIONS AS A SHARE OF TOTAL GHGS IN 2016[15]

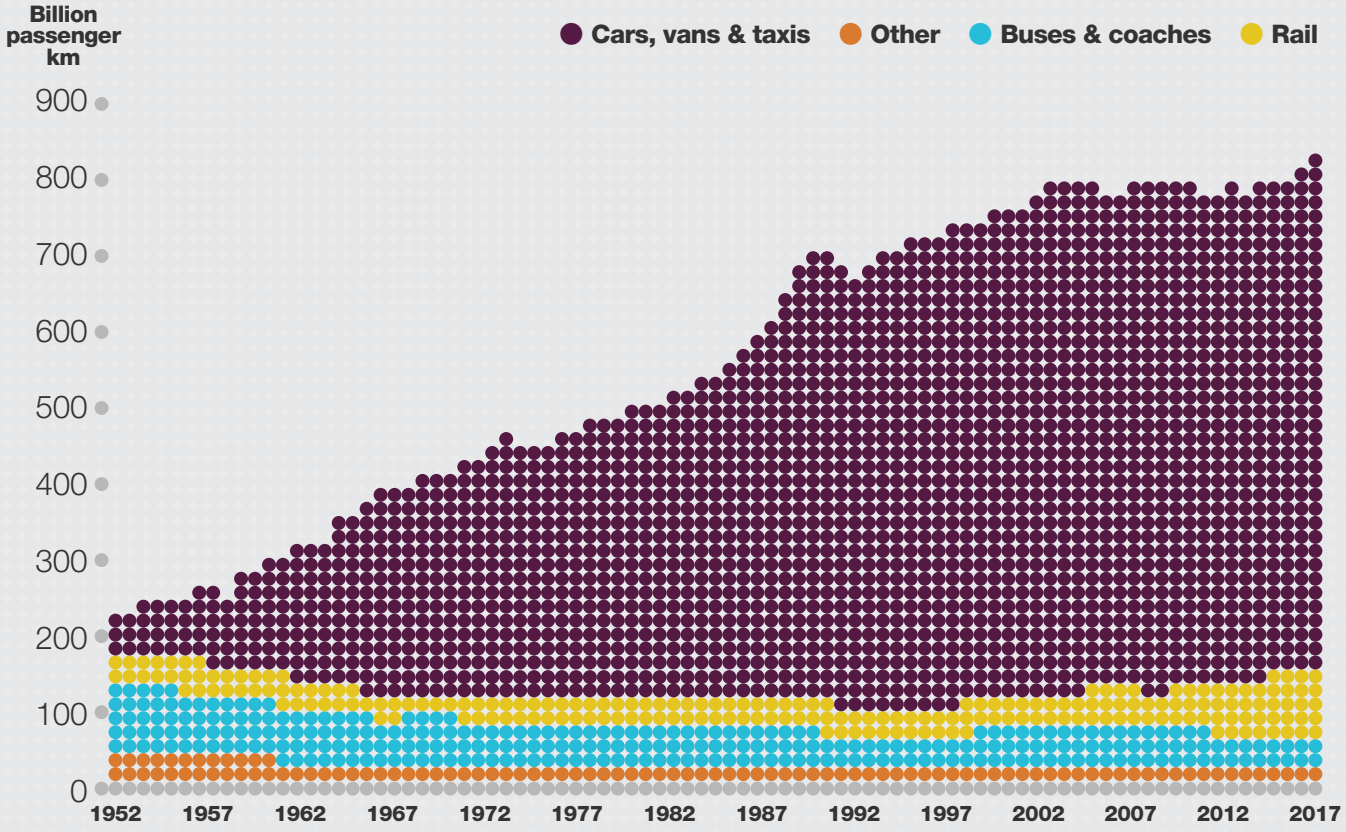


- Cars – 15%
- HCVs – 4%
- Vans – 4%
- Buses – 1%
- Rail – <1%
- Other transport – 2%
- Other sectors – 73%

15 CCC (June 2018) *Reducing UK emissions, 2018 Progress Report to Parliament.* 'Other transport' includes domestic aviation and shipping, mopeds and motorcycles, liquid petroleum gas fuelled vehicles and other road vehicle engines.

2017 TRAVEL PATTERNS

Passenger kilometres by mode, Great Britain: 1952 to 2017



Source: DfT (December 2018)
Transport Statistics: Great Britain 2018

The policy gap

The government's support for the transition to zero emission road transport, including the associated infrastructure, is set out in the Road to Zero Strategy.[16] The Strategy sets out for the first time a comprehensive vision for a cleaner road transport system and seeks to put the UK at the forefront of the design and manufacturing of ZEVs, including measures to address key financial and infrastructure barriers to the EV market. Central to the Strategy is its mission for all new cars and vans in the UK to be 'effectively zero emissions by 2040'.[17]

However, much of the Strategy focuses on technological change in road transport and does not place enough emphasis on some of the more cost-effective measures to reduce emissions across the transport system, such as changes in existing consumer behaviour away from car dependency. This is illustrated by the government's decision to prioritize road travel over rail, as it has frozen fuel duty each year since 2010/11,[18] while rail fares have risen by 42% over the same period.[19] As a result, UK motorists are more dependent on the car than ever.[20]

The CCC has advised the government that existing and newly agreed policies for road transport are insufficient to ensure the reductions in emissions necessary to meet the fifth Carbon Budget in the most cost-effective way.[21] This means that government cannot afford to look at individual forms of transport in isolation. Instead, the UK will need to harness different solutions across the system. It is therefore welcome that in recognition of these challenges, the government has made the Future of Mobility[22] one of its four grand challenges in the Industrial Strategy and has sought to collaborate with the private sector through the Automotive Sector Deal and Rail Sector Deal.

Patterns of travel are changing

There is real uncertainty in the way transport is evolving which is not fully accounted for in government traffic forecasts, which tend to focus on historical patterns of transport such as income, population growth and motoring costs. Whilst overall total distance travelled is increasing due to population growth, **on a per capita basis we travel less today than we did two decades ago – with 16% fewer trips being made than in 1996 and 10% fewer miles travelled than in 2002.**[23]

This could be because technology in transport is playing an increasing role, both in terms of its capability and how we use it. This is helping to shape new business models and mobility services away from the current regime of private vehicle ownership, towards collective or shared mobility. The coming decade is likely to see an intensification of this uncertainty.[24]

Therefore, rather than simply planning transport to meet uncertain forecasts, greater attention needs to be paid to the wider societal shifts in activities alongside technology change, such as the rise of online shopping and its impact on the freight system. **LCVs are the fastest growing source of road transport demand,** with kilometres rising by 67% in the past 20 years.[25]

The next sections of this report will explore how to shift these consumer trends and steer technological innovation away from personal vehicle dependency towards an integrated and decarbonised transport system.

16 HM Government (July 2018) *The Road to Zero*

17 Ibid.

18 BBC (03 October 2018) 'No tax rise on petrol, says Theresa May'

19 TUC Press Release (14 August 2018) 'Rail fares have risen over twice as fast as wages in past decade, finds TUC'

20 RAC (September 2018) *Report on Motoring 2018: The frustrated motorist*

21 CCC (11 October 2018) *Letter from Lord Deben on the Government's Road to Zero Strategy*

22 HM Government (November 2017) *Industrial Strategy*

23 Commission on Travel Demand (May 2018) *All Change? The future of travel demand and the implications for policy and planning*

24 Future Generations Commissioner for Wales (September 2018) *Transport Fit for Future Generations*

25 National Infrastructure Commission (December 2018) *Future of Freight: Interim report*

TWO IMPROVING THE EFFICIENCY OF THE TRANSPORT SYSTEM

Taking a whole-system approach to transport planning will help improve the efficiency of the UK's transport network.

A well-coordinated and planned transport system that makes effective use of land, taking into account accessibility of existing and future infrastructure and developments, is essential to improving the efficiency of the transport system.[26] However, at present the UK's transport system is still overwhelmingly fragmented and complex, whereby different modes of transport and regions are considered in isolation.

To improve the efficiency of the transport system so that emissions, congestion and demand for transport are minimised, central government must set a long-term, integrated vision for UK strategic transport infrastructure. Government will also need to provide complementary national policy frameworks supported by adequate funding for local government to ensure that communities and freight systems are planned to reduce vehicle mileage and congestion.

Establishing an integrated transport network strategy

Whilst the government's Transport Investment Strategy[27] provides welcome clarity on future transport investments, there is no overarching vision outlining how major transport infrastructure schemes fit within broader national policy goals, such as meeting the UK's carbon budgets.

This has affected the way the government made the case for its latest Road Investment Strategy package worth £28.8bn.[28] The latest investment package suggests the government is chiefly responding to the current problem of traffic congestion, rather than considering alternative transport and travel infrastructure investment options together, so as to promote the transport schemes that deliver the greatest environmental and economic benefits. This is despite evidence suggesting that building new roads can create new traffic, commonly referred to as 'induced demand for road travel' – essentially, build it and they will come – and is likely to have a greater impact for capacity improvements in urban areas or on already congested routes.[29]

That is why the government's commitment to respond in full to the National Infrastructure Assessment, through a comprehensive National Infrastructure Strategy,[30] is a real opportunity to improve the delivery of an integrated UK transport system. **The Strategy should bring together national road and rail strategies to set out a clear, long-term national vision, including investment priorities, to ensure that the most beneficial schemes are taken forward, based on emission savings and whether they meet the government's wider national policy objectives**. This holistic approach to transport would also improve consistency and integration between national and local transport networks by setting out a clear intention to decarbonise UK surface transport.

26 Mayor of London (March 2016) *The London Plan: Transport*

27 DfT (July 2017) *Transport investment strategy*

28 HM Government (October 2018) *Budget 2018*

29 WSP & RAND Europe (May 2018) *Latest evidence on induced travel demand: An evidence review*

30 HM Treasury (October 2018) *Interim Response to the National Infrastructure Assessment*

NORDHAVNEN: A FIVE MINUTE CITY[31]

With its unique positioning and area covering the size of 625 football grounds, Nordhavnen (or Nordhavn) in Copenhagen, Denmark, aims to become the sustainable city of the future.

To promote liveability and sustainability, Nordhavnen has been designed as a '5 minute city' making it possible to reach shops, institutions, work places, cultural facilities and public transport within 5 minutes' walk from any point in the district. The district is being planned so that it is more attractive to walk, cycle and use the metro than to use a car.

During the next 50 years, Nordhavnen is to be extended to accommodate 40,000 inhabitants and 40,000 workplaces. The area will be serviced by an elevated metro track and a bicycle network which together create a green artery. The elevated track functions as a cover for the bicycle motorway, so that cyclists will be able to stay dry all year round in all weathers.

Ramboll is consultant for the overall city development

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31 Ramboll 'Nordhavnen – International role model for sustainable urban development' https://bit.ly/2QS7Yuk [accessed 17 November 2018]

Planning communities around sustainable transport

Accommodating the scale of expected population growth without increasing traffic on the already congested UK transport network will be a huge challenge. However, changing the design and distribution of space by making it possible to reach shops, institutions, work places and cultural facilities from accessible public transport with ease can reduce transport emissions by leading to fewer or shorter trips by private car.[32]

Research conducted by Transport for New Homes highlighted a lack of sustainable transport integrated into new housing developments, whereby homes are being built around car-based living, rather than access to adequate public transport or walking and cycling infrastructure.[33] Whilst the revised National Planning Policy Framework (NPPF) does recognise the wider benefits of 'promoting sustainable transport',[34] local authorities are under pressure to meet the central government's housing targets, rather than accounting for the proximity of new homes to local services and employment opportunities.[35] **It is essential that local authorities have the powers to ensure house builders contribute to local infrastructure and services as part of new developments, and are given the resources to promote more sustainable forms of transport which reduce the need for private vehicles.**

Moving demand and congestion out of urban areas

Local Clean Air Zones

Given the localised nature of air pollution limits and targets set by the EU's Ambient Air Quality Directive,[36] municipal governments are increasingly playing an important role in shaping demand for clean vehicles and improving air quality. As a result, many cities are bringing forward new regulation in the form of Clean Air Zones (CAZs) to restrict the most polluting vehicles from entering designated urban areas, by charging specified classes of vehicles that do not comply with minimum emissions standards. This includes the new Ultra Low Emission Zone (ULEZ) in London, which will charge non-compliant vehicles entering the city centre from April 2019.[37]

However, currently there is considerable uncertainty around where these CAZs will be introduced and there is a lack of consistency with respect to charging levels, as well as the exemptions, sunset periods and support packages introduced alongside them.

Despite the Department for Enviornment, Food and Rural Affairs' (Defra) own technical report indicating that charging zones offer the fastest and most effective route to improve air quality, the government requires local authorities to demonstrate that all other measures will fail to achieve the necessary results before introducing a charging zone.[38] This creates delays and the risk that there could be a patchwork of different CAZs developing across the UK which operate with differing effectiveness.

Therefore, to ensure greater harmonisation across major UK cities, and to ensure that CAZs deliver urgent pollution and transport emissions reduction across the country, **government should support local authorities to implement a national network of ambitious CAZs.** This includes providing a strong regulatory framework and clearer guidance to set ambitious minimum common standards with respect to charging levels, whilst ensuring that exemptions and sunset periods are limited to where they are truly needed. Given that small and medium-sized enterprises (SMEs) will be particularly affected by such regulation, government should offer financial support to enable these companies to switch to cleaner forms of transport.

32 The World Bank (14 August 2012) 'Urban Transport and Climate Change'

33 Transport for New Homes (July 2018) *Project summary and recommendations*

34 MHCLG (July 2018) *National Planning Policy Framework*

35 Transport for New Homes (July 2018) *Project summary and recommendations*

36 Directive (EU) 2008/50 of the European Parliament and Council on Ambient Air Quality

37 Mayor of London (03 November 2017) 'Ultra-Low Emission Zone will start in 2019 to tackle air'

38 Defra (July 2017) *UK Plan for tackling roadside nitrogen dioxide concentrations: Technical report*

Consolidating freight deliveries

The growth of LCV demand over the last 50 years, associated with the rise of e-commerce, retail and food, poses a serious issue to increasing congestion and emissions, particularly in urban areas.[39] Failing to plan for growing demand for freight can result in logistics operators sprawling further from the centres of towns, cities and from their end customers, which increases delivery mileage, emissions and congestion.[40]

Urban Consolidation Centres (UCCs) are warehouses located on the edge of urban areas where deliveries from a variety of retailers are consolidated by destination to maximise logistics efficiency, ensuring that delivery vehicles aren't driving around half full.

UCCs offer important opportunities to make significant emissions savings by reducing the number of kilometres travelled and ultimately reducing total emissions, particularly if the goods are then loaded onto zero emission vehicles for the 'last mile'. Better targeted delivery stops and consolidation of deliveries in inner and outer city hubs has the potential to reduce mileage by up to 47%.[41]

However, the widespread use of UCCs face challenges of scale and cost, as they currently rely on public subsidies through grants or local authority assistance in order to be economically viable.[42] To make them viable and achieve sufficient scale, **local authorities should work with neighbouring authorities, freight operators and local businesses to consider the benefits of establishing regional consolidation and distribution centres within their wider regions.**

National government should also explore collaborative procurement amongst other government departments, public bodies and local organisations so that the benefits of UCCs can be scaled up. Combining more efficient deliveries could result in cost savings which could be achieved through reduced operational activities for both the receiver and the logistics providers.

39 CCC (2018) *Reducing UK emissions: 2018 Progress Report to Parliament*

40 National Infrastructure Commission (December 2018) *Future of Freight: Interim Review*

41 CCC (2018) *Reducing UK emissions: 2018 Progress Report to Parliament*

42 The Independent Transport Commission (May 2017) *How can we improve urban freight distribution in the UK? Challenges and solutions*

Moving road freight onto rail

Freight demand is rapidly expanding, along with the expectation for it to be faster, more convenient and cost effective. Road freight is also a major contributor of surface transport emissions, as Heavy Commercial Vehicles (HCVs) account for 17% of GHG emissions from road transport, while making up just 5% of vehicle miles.[43]

Transferring road freight onto rail, where there is adequate demand for this service to be efficient, can play a significant role in reducing transport emissions, as it has been estimated that **an average freight train removes the equivalent of up to 76 HCVs from the roads.**[44] Research commissioned by Campaign for Better Transport and sponsored by the Department for Transport (DfT) demonstrated that upgrading rail routes out of the two largest container ports, Southampton and Felixstowe, could remove 2,000 large HCVs off the road each day.[45] Moreover, Network Rail estimates that the rail freight sector delivers £1.7bn in economic benefits that are then distributed across the country.[46]

The government should therefore **expand rail freight by investing in targeted rail freight upgrades to increase capacity, particularly for key routes, such as to large container ports.** This should be complemented by the procurement of new efficient, low carbon rolling stock and the expansion of rail electrification.

43 DfT (February 2017) *Freight Carbon Review 2017*

44 Arup (September 2016) *Future Potential for Modal Shift in the UK Rail Freight Market*

45 MTRU (2017) *Impact on congestion of transfer of freight from road to rail on key strategic corridors*

46 Network Rail: https://bit.ly/2TkwLJ6 [accessed 17 November 2018]

THE REGENT STREET CONSOLIDATION SCHEME[47]

The West End of London is one of the world's most renown retail destinations and is home to many household brands. As such, it experiences heavy road congestion which results in an unpleasant shopping environment for visitors.

It was discovered that retail deliveries were uncontrolled, causing unnecessary congestion and road blockages during peak retail periods. Therefore, a delivery solution was needed to reduce traffic but drive footfall, and that would allow retail staff to return their focus to selling.

The solution from The Crown Estate was the establishment of a single consolidation centre. This inexpensive and efficient consolidation scheme brings together consumables from all suppliers to one easily accessible point outside the congestion charging zone, combining deliveries with other West End companies to streamline a previously complex and inefficient system into a simple and effective one. As a result, **the system has reduced vehicle movements to participating stores by up to 85%**, with over 35 retailers already participating in the scheme.

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47 Clipper in association with The Crown Estate (2016) *Regent Street Delivery Consolidation Scheme*

THREE: ENABLING THE SHIFT TO SUSTAINABLE TRANSPORT

Encouraging sustainable travel choices by providing individuals with tangible alternatives to private vehicles is essential to reducing transport emissions.

Substantial transport emissions reductions are possible by changing existing travel behavior of individuals and encouraging them to make better use of public transport and sustainable mobility. This is highly cost-effective for individuals and governments.[48] Central to this is making sustainable mobility as economically attractive, practical and viable as owning a private car.

Given that an estimated **33% of UK drivers are more dependent on their car now than a year ago due to the deterioration in public transport services,**[49] the government must improve the provision of public transport and cleaner forms of travel. In particular, given that 72% of journeys in urban areas are short distance (under five miles), local government will be essential to the delivery.[50]

Empower local authorities to deliver sustainable transport systems

Currently, only London and (to some extent) Manchester are empowered to transform their local transport systems. Since 2010, the government has made progress devolving powers and funding to newly created city-region elected mayors in several areas of England outside of London. This has enabled elected Mayors to develop their own long-term, integrated transport strategies that reflect their own economic, social and environmental goals. At the same time Sub-national Transport Bodies (SNTBs) are also emerging as a new way to bridge the gap between national and local projects to ensure there is an effective regional voice in the planning and delivery of transport improvements. The continued engagement of SNTBs will be very important to be able to identify and address particular characteristics of its local area.

However, **outside of London few city regions have developed integrated transport strategies as they do not have the resources or powers to implement them.** As a result, transport investment in London and the South East is considerably higher than the rest of UK.[51] Not only is urban transport under-funded in many UK cities and towns, the way in which it is funded is highly complex, short-termist and subject to numerous ad hoc funding competitions.[52]

Whilst the government's Transforming Cities Fund does improve on previous funding arrangements, giving mayors more flexibility over their capital funding allocations over a four-year period, it is not a replacement for long-term stable funding which includes stable revenue, as well as capital funding.[53] **In a survey by the Local Government Association, the majority of Councils in England said that a lack of sufficient revenue spending and uncertainty over continued levels of funding was stopping them from investing in sustainable transport.**[54]

Stable revenue funding in particular is needed for bus services and also pays for planners and staff to develop and implement major local transport projects.[55] This short-term approach also inhibits the design and development of local transport projects which could improve overall efficiency, provide better value for money and encourage passengers to switch to more sustainable modes of transport.

48 CCC (June 2018) *Reducing UK emissions: 2018 Progress Report to Parliament*

49 RAC (September 2018) *Report on Motoring 2018: The frustrated motorist*

50 DfT (July 2018) *Future of Mobility: a call for evidence*

51 House of Commons Library (February 2018) *Transport Spending by Region*

52 Urban Transport Group (September 2018) *Policy Futures for urban transport*

53 DfT (March 2018) *Transforming Cities Fund: Call for Proposals*

54 Local Government Association (May 2018) *Sustainable Travel Survey Results*

55 Urban Transport Group (September 2018) *Policy Futures for urban transport*

Instead of relying on catch-all capital grants, government should devolve enhanced long-term capital and revenue to local authorities to allow them to deliver integrated transport strategies. The government should consider devolving budgets, similar to Highways England and Network Rail, which would comprise of five-year settlements. This would allow local leaders to deliver transport projects over a longer period as a replacement for DfT and other grants for local infrastructure. As the National Infrastructure Commission recommends, this funding should also be available to smaller cities and large towns, with a population of 100,000 or more to reflect the higher infrastructure needs of denser urban areas and the point at which capacity constraints become more pressing.[56]

To ensure this delivers significant reductions in transport emissions, national government should consider requiring all integrated transport strategies to meet stringent carbon emissions targets which would incentivise investment in sustainable transport. Local leaders would then be held to account on whether their strategy would result in emissions savings.

Improving local bus services

Bus transportation is the most used form of public transport, accounting for 59% of all passenger journeys, followed by 21% of passenger journeys made by rail,[57] yet buses are responsible for just 1% of all GHG emissions in the UK.[58] However, bus usage is falling and it is now at its lowest level in a decade.[59] Campaign for Better Transport attributes this to a 45% reduction in funding for local authority supported bus services in England and Wales since 2010–11.[60] These supported bus services are subsidised by local authorities, which usually operate in rural or suburban areas where there is often no alternative form of public transport. Funding for local bus services is also further constrained by the statutory duty administered by councils to provide the national 'free bus pass' scheme, which was underfunded by an estimated £652m in 2017/18.[61] As a result many local bus services have become less financially viable, leading to service reductions.[62]

Whilst the 2017 Bus Services Act will enable local authorities outside London to improve their local bus services granting them powers to franchise networks of bus services in the same way that London does, without adequate funding bus services will continue to face significant pressures.

Government should therefore commit to a national bus strategy which includes enhanced long-term funding to increase bus usage, that would place a higher social and environmental value on bus transportation. This strategy would help focus funding and policy, set performance standards, target investment in zero emission technologies and bring the industry together to deliver smart solutions to support isolated communities, such as trialling demand-responsive transport. Leading figures in the industry have also signaled their support for a national bus strategy.[63]

56 National Infrastructure Commission (July 2018) *National Infrastructure Assessment*

57 DfT (November 2017) *Transport Statistics Great Britain 2017*

58 CCC (June 2018) *Reducing UK emissions, 2018 Progress Report to Parliament*

59 Guardian (15 October 2018) 'Fall in local bus journeys to 12-year low prompts talk of crisis'

60 Campaign for Better Transport (June 2018) *Buses in Crisis: A report on bus funding across England and Wales 2010–2018*

61 Local Government Association (09 February 2019) 'Nearly half of all bus routes at risk as funding gap for free bus pass reaches £650 million'

62 Ibid.

63 Politics Home (01 October 2018) 'Go-Ahead: A national strategy is required to safeguard the future'

Restoring confidence in a low carbon UK rail network

Rail has the lowest carbon intensity per passenger mile of any form of transport and is therefore critical to decarbonisation[64] — particularly if it is electrified. However, public confidence in the railways has been severely dented in recent years by high levels of delays, cancellations and failures across the industry to deliver vital infrastructure upgrades and new rolling stock.

This has been caused by several issues including a failure across multiple parties, from the regulator (Office of Road and Rail) to the DfT, to identify fundamental risks and manage them.[65] This is in part a consequence of the complexity of the UK's disaggregated railway system, made up of private train companies operating on publicly-owned and managed infrastructure with competing commercial interests.[66] The issue has been further compounded by recent failings in the way the UK contracts out the operation of its passenger services.[67] The government should use the forthcoming Rail Review[68] to provide a comprehensive analysis of the challenges facing the industry and to highlight the wholesale structural changes to governance and regulation required.

Rail electrification offers major environmental benefits, with carbon emissions 20–30% lower than those from diesel trains, alongside improved capacity and reliability.[69] However, whilst other major countries are electrifying their major rail routes, the UK government cancelled three electrification schemes due to escalating costs.[70] In contrast to its European neighbours the UK has a much lower percentage of its railway electrified at 42% than the Netherlands (76%), Italy (71%) and Spain (61%).[71] Whilst electrification is costly, the repeated stalling and starting of electrification projects in the UK, together with inaccurate cost estimates, has only increased costs and added uncertainty in the sector.

The government should set out a comprehensive plan of how it intends to decarbonise the rail sector, as it has done with the Road to Zero Strategy. The government should build on the recent Rail Sector Deal[72] to present a package of measures to meet the government's 2040 diesel phase out date. This should include working with Network Rail and across industry to develop an appropriate specification for rail electrification on heavily used parts of the network, alongside developing zero emission technologies and targeted investment.

Showing bold leadership on active travel

Whilst public transport is the most efficient means of moving people over longer distances, **active transport in the form of cycling remains the cheapest and least disruptive way to improve transport capacity quickly.[73]** Active travel also has considerable public and mental health benefits, which helps support wider policy goals to tackle obesity, depression and anxiety, and can help prevent and manage chronic health conditions.[74] Sustrans, a transport charity, has estimated that between 2017 and 2040, cycling could avert 34,000 long term health conditions, saving the NHS £319m.[75]

64 DfT (October 2018) *Rolling Stock Perspective*

65 ORR (September 2018) *Inquiry into May 2018 network disruption*

66 House of Commons Transport Select Committee (November 2018) *Rail timetable changes: May 2018*

67 BBC (16 May 2018) 'Why has East Coast Mainline hit the buffers again?'

68 DfT and Rt Hon Chris Grayling MP Oral Statement to Parliament (11 October 2018) 'Rail Review'

69 The Railway Industry Association (April 2018) *Electrification briefing*

70 Railway Technology (13 June 2018) 'Will the UK ever get electrification back on track?'

71 Institution of Mechanical Engineers (February 2018) *Decarbonising Rail: Trains, energy and air quality*

72 HM Government (December 2018) *Industrial Strategy: Rail Sector Deal*

73 Andrew Gilligan (July 2018) *Report for National Infrastructure Commission: Running out of Road: Investing in cycling in Cambridge, Milton Keynes and Oxford*

74 We are cycling UK (August 2017) 'Health and Cycling' https://bit.ly/2AOZehK [accessed 04 December 2018]

75 Sustrans (January 2019) *Bikelife: Transforming Cities, the potential of everyday cycling*

The government has an ambition to make walking and cycling the 'natural choices for shorter journeys', or as part of a longer journey.[76] To support this ambition, the government made over £1bn available to local bodies which 'may' be spent on cycling or walking between 2016 and 2021.[77] However, only £314m of the funding was ringfenced for the purpose and, outside of London, available funding is on a steep downward trajectory over the five years, from £2.16 per person in 2016/2017, including budget for the Cycle City Ambition Grant and the Sustainable Travel Access Fund, to just 37p in 2020/21, with funding only budgeted to Highways England.[78] This compares to more than £35 per person spent on cycling in Copenhagen, where the Danish government has invested in a network of segregated cycle routes since 2004.[79]

This is because cycling is not seen as an important part of the transport mix, including mass transit between towns and cities. As a result, cycling has not been supported with serious funding.[80] The UK government should change this mindset, especially in terms of the important role cycling can play in improving the efficiency of 'last mile' deliveries. As such, whilst it is welcome that the government has made funding available to support the purchase of e-cargo bikes, helping businesses switch from polluting vans to zero emission bikes, the government must also ensure that there is adequate cycling infrastructure.[81] Following the 2018 Budget and confirmation that an extra £3.5bn is being made available to councils for local major road routes, **the government should ensure that new cycling infrastructure is built alongside any new local road route or road capacity upgrades.**[82]

The government should also strengthen the next Cycling and Walking Investment Strategy by investing in hard infrastructure, such as separate safe cycling and walking infrastructure, as part of the government's forthcoming comprehensive spending review.

Encouraging new technological travel platforms

Mobility as a Service

Technological advancements are influencing how we access and use transport, particularly in regards to the use and ownership of private vehicles. Mobility as a Service (MaaS) is a term used to describe digital services, often smartphone apps, through which people can access a range of public, shared and private transport, using a system that integrates planning, booking and paying for travel.[83] For example, the Whim app is being tested in partnership with Transport for the West Midlands,[84] (see case study) and Viaqqio's NaviGoGo app is being trialled in Dundee and North Fife.[85]

76 DfT (April 2017) *Cycling and Walking Investment Strategy*

77 Ibid.

78 The Bicycle Association, British Cycling, Cycling UK, Living Streets, The Ramblers and Sustrans (October 2018) *Written evidence submitted to the Transport Select Committee's Active Travel inquiry*

79 The Guardian (28 January 2019) 'Improving UK cycling could save the NHS £319m'

80 Andrew Gilligan (July 2018) *Report for National Infrastructure Commission: Running out of Road: Investing in cycling in Cambridge, Milton Keynes and Oxford*

81 DfT (10 September 2018) 'Funding boost for green last mile delivery'

82 HM Government (October 2018) *Budget 2018*

83 House of Commons Transport Select Committee (December 2018) *Mobility as a Service inquiry*

84 Whim (04 April 2018) 'Be Part of the Midlands transport revolution' https://bit.ly/2s3ln82 [accessed 20 February 2019]

85 Intelligent Transport (11 July 2017) 'New web application for young travelers in Scotland'

HASSLE-FREE URBAN TRAVEL WITH WHIM

Whim is part of MaaS Global, a Finnish company that integrates and optimises different modes of existing transport. Whim offers a single access point to different travel options across a city, including bus, urban rail, car hire, taxis and cycle hire, through a smartphone app – billed as 'the Netflix of transportation'.[86]

Users can pay a monthly subscription fee to access these services or can choose pay-as-you-go. In Helsinki, where Whim was first introduced in 2016, more than 70% of users now travel by public transport.

By removing the hassle of using public transport, which often requires users to look across different platforms for timetabling, possible routes and payments, Whim aims to provide an alternative to owning a car and enable easy and sustainable mobility. Following the success of Whim in Helsinki, MaaS has launched in several cities in Europe, including Antwerp and Birmingham and the West Midlands region in April 2018. It now aims to operate in 60 countries or 100 cities in five years.

Ramboll has been key in the early success of MaaS, preparing business plans and providing extensive planning expertise, an important element of the MaaS concept.

© Ramboll

86 Ramboll Ingenuity (11 June 2018) 'Keeping cities on the move'

MaaS could transform the way people travel in both urban and rural areas, and could result in more effective management of travel demand and lead to reduced road congestion, improved air quality, healthier travel choices and increased efficiency in transport networks.[87] However, there is also the potential for unintended negative consequences, such as increasing the number of journeys, or even a shift away from public transport.[88]

To ensure the success of MaaS, local authorities or lead regulated operators should oversee the development, deployment and co-ordination of MaaS in their local areas, supported by an appropriate policy framework from central government. This regulatory framework should include the ability to reward passengers or users for making sustainable choices, such as traveling by public transport or bike-share, by offering discounts through the payment platform.

In this sense the uptake of MaaS could help to benefit public transport directly, driving increases in revenues and helping to redirect funding and investment back to core public transport services.[89] This would help ensure that any new mobility services complements rather than competes with existing public transport and active travel.

Shared mobility

Technology has also helped to pave the way for shared mobility, which could provide a financial and practical gateway to leaving car ownership behind. Although the precise number varies across different geographical locations, it is widely considered that **car sharing reduces overall GHG emissions by reducing the number of vehicles on the road and vehicle kilometres driven.**[90] Furthermore, evidence suggests that car sharing in the form of car clubs can encourage a behavioural shift towards sustainable forms of transport which complements public transport.[91]

For example, Zipcar is a car sharing company with 250,000 members, growing by 33% per year. In London Zipcar added over 300 EVs into their fleet in the summer of 2017. Within three months, over 6,000 Londoners made over 20,000 shared EV trips, normalising EV driving and creating greater market demand for charging infrastructure. With sufficient government support for the car sharing sector, Zipcar hopes to deliver 9,000 EVs in London by 2025 which could reduce privately owned cars by 120,000 and result in 821 million fewer miles driven and 160,000 fewer tonnes of CO_2 emitted annually.

To help boost the shared mobility market and reduce transport emissions, **the government should update its procurement framework so that all departments, agencies, local authorities and public bodies investigate whether they can save money and reduce their transport emissions by replacing their fleets with membership of an existing car club scheme.** For example, in 2010, a successful pay-as-you drive pilot by Croydon Council found that it could deliver savings in associated car costs and a reduction in employee CO_2 emissions by 36%.[92]

Car sharing and MaaS should play a central role in the government's Future of Mobility Grand Challenge. **Government should therefore encourage local authorities to integrate MaaS and car-sharing within local transport systems,** and consider financial grants for community-led car clubs in isolated parts of the UK, where public transport is not viable.

87 House of Commons Transport Select Committee (December 2018) *Mobility as a Service inquiry*

88 The Transport Systems Catapult (July 2017) *Mobility As A Service: Exploring the opportunity for Mobility as a Service*

89 Ibid.

90 Transport & Environment (June 2017) *Does sharing cars really reduce car use?*

91 ComoUK (April 2017) *Carplus annual survey of car clubs: 2016/17 London*

92 Zipcar (22 July 2013) 'Croydon Council cuts employee car usage in half with Zipcar'

FOUR: SECURING LEADERSHIP IN THE MANUFACTURE AND TAKE UP OF CLEAN VEHICLES

Large scale deployment of a variety of innovative technologies will be key to decarbonising the transport system.

The scale of technological change across the automotive industry, from the engines that power them to the way they are controlled and the attitudes to owning them, will see more change in the next ten years than it has in the previous 100 years.[93] **No single technological solution is currently readily available to decarbonise all forms of transport, which means that a variety of technological options need to be explored.**

Innovation will therefore be essential to developing new solutions and improving the efficiency of existing technologies. This requires government support for the private sector in developing new products and solutions, due to high costs and risks involved. **Government should provide incentives to prioritise the roll out of near-term low emission technologies and ensure that innovation, which offers potential in the long-term, is also supported.**

Given the significant challenges facing the UK automotive industry, from the rapid transition to new technologies and the uncertainties arising from the withdrawal from the EU, the UK cannot afford to be left behind in the global race to build clean vehicles, a market projected to reach £1–2tn per year by 2030.[94] It is therefore essential that the government builds on the UK's globally established manufacturing base to ensure that the UK is one of the most attractive places to design and manufacture low and zero emission vehicles through the continued use of grants, support for innovation and regulatory certainty.

UK businesses are well placed to take the lead in automotive and battery manufacturing, creating high quality, well-paid jobs across the supply chain. While these technologies are nearly or fully commercially mature, their large-scale deployment is still being curbed by limited charging and refuelling infrastructure, high production costs and purchase costs relative to internal combustion engine vehicles. Government will therefore need to provide the right support to enable individuals and businesses to make the switch to sustainable forms of transport and ensure cleaner forms of mobility remain competitive.

Accelerating the take-up of clean vehicles

Development of reliable and accessible charging infrastructure is key to growing the EV market and encouraging businesses and individuals to make the switch to low and zero emission vehicles. **In a survey of 507 fleet managers, 82% cited 'better charging infrastructure' as making them more likely to incorporate EVs within their fleet.**[95] However, despite the government's ambition to create one of the best EV infrastructure markets in the world, as set out in its Road to Zero Strategy,[96] the UK's existing EV charging network has been characterised as lacking in both size and geographical coverage, both in terms of public charge points and fast charging points,[97] particularly for the 40–50% of UK homes that do not have access to off-street parking.[98]

93 HM Government (January 2018) *Industrial Strategy: Automotive Sector*

94 HM Government (July 2018) *The Road to Zero*

95 BT Fleet Solutions (2017) *Operational Fleet Insight: The 2017/18 Report*

96 HM Government (July 2018) *The Road to Zero*

97 House of Commons BEIS Select Committee (October 2018) *Electric vehicles: driving the transition*

98 Ibid.

Whilst the development of reliable and accessible national charging infrastructure will not be straightforward, government ambition should be to **enable the roll out of charging infrastructure sufficient to allow consumer demand to reach close to 100% of electric new car and van sales by 2030.**[99] The government should work through the Electric Vehicle Energy Taskforce,[100] government delivery arms, such as the Office for Low Emissions Vehicles and ChargePlace Scotland, together with local authorities and businesses, to trial new technologies and approaches to deliver sufficient charging infrastructure.

Building charge points is also a significant opportunity for the private sector, as it can add value to a business by attracting and retaining customers.[101] Retail giant Tesco announced a new partnership with Volkswagen that will create the largest EV retail market in the UK, with the rollout of more than 2,400 EV charging bays across its 600 stores over the next three years. This deal will provide a 14% increase in the number of public charging bays in the UK.[102]

Ensuring a frictionless charging experience will be important for EV uptake, so an EV owner doesn't require a membership or subscription to use charging infrastructure. For example, EV drivers using Vattenfall's InCharge mobile app or charge card can charge at any InCharge charging point on a pay-as-you-go basis and Vattenfall is planning to make roaming agreements with other operators or driver service providers in the UK. **The UK government should make full use of its powers to standardise and ensure interoperability of public charge points,** including payment systems, improving access to information about charge points and requiring smart charging capabilities.

Beyond consumer EVs, for freight businesses one of the most pressing issues is the ability to simultaneously charge a large fleet of EVs. This can be extremely expensive as it can use up to ten times as much power as typical home charging and puts significant demand spikes on the external power network.[103] Due to the capacity limitation on the local grid the integration of more EVs could require costly upgrades to ensure demand can be met.

Smart grid solutions which use a combination of physical grid reinforcements and smart charging (which allows loads to be adjusted throughout the day), with innovative vehicle to grid technologies could play a major role in providing greater capacity and could offer substantial cost savings.[104] **The government should continue to provide financial and technical support through Innovate UK[105] to allow businesses to trial and deploy smart grid solutions on large sites and depots.**

99 NIC (July 2018) *National Infrastructure Assessment*

100 Low Carbon Vehicle Partnership (11 September 2018) 'Electric Vehicle Energy Taskforce set up to tackle energy sector opportunities and impacts associated with the rise of electric vehicles'

101 The Climate Group (February 2019) *Business driving demand for electric vehicles*

102 Business Green (30 November 2018) 'Tesco plots UK electric vehicle charger surge'

103 UPS (19 March 2019) 'Cutting Edge Deployment of Advanced Technology Vehicle & Charging Signals Shift Away from Reliance on Combustion Engine'

104 House of Commons BEIS Select Committee (October 2018) *Electric vehicles: driving the transition*

105 HM Government (12 July 2018) 'Creative new ways to charge electric vehicles: apply for funding'

SMART ELECTRIC URBAN LOGISTICS

UPS, UK Power Networks and Cross River Partnership, with funding from the government's Office for Low Emission Vehicles, have deployed an innovative new charging technology in London that can recharge an entire fleet of EVs without the need for an additional expensive upgrade to the power supply grid.

The system adopts an 'intelligent' approach to charging by spreading the load throughout the night so that the depot's building can use the power it needs to run its logistics (lights, sortation machinery and IT) and ensure that all EVs are fully charged by the time they are needed in the morning, whilst never exceeding the maximum power available from the grid.

This is achieved by combining a variety of solutions including conventional power grid upgrade, smart grid, on-site energy storage with batteries and (potentially in the future) local power generation (including using solar energy generated on facility roof tops).

This will allow UPS to increase the number of EVs operating from its central London site from the current limit of 65 to 170.[106]

© UPS

106 Cross River Partnership (2018) Smart Electric Urban Logistics https://bit.ly/2HnaTKP [accessed 01 February 2019]

Another significant barrier to market penetration of EVs is their high upfront purchase price compared to petrol and diesel vehicles, despite lower service and maintenance costs, better fuel economy and lower taxes across the full vehicle life.[107] **Clear and stable fiscal incentives to address this price barrier in the short to medium term will be vital to driving greater demand.** This includes ensuring that the plug-in car grant continues into the 2020s until EVs reach cost parity (which is not expected until 2024).[108] Tax regimes including the Company Car Tax, VAT, and support schemes must also be aligned to promote purchasing EVs to support fleet and business sales which account for over half of the new car market,[109] with greater visibility on future available funding to boost confidence. **To ensure there is adequate supply of EVs, the government should also consider further regulatory measures, such as introducing mandatory sales targets.** These issues have been explored in greater depth in a separate Aldersgate Group briefing, *Driving ambition: accelerating the transition to zero emission vehicles.*[110]

The key role of standards and regulations

Stringent regulations on vehicle emissions are a powerful lever for improving performance and motivating innovation. The EU's legally binding vehicle emission standards regime has incentivised carmakers to introduce Ultra Low Emission Vehicles (ULEVs) and has generated cumulative design and innovation improvements, including in lightweighting, tyre compounds, aerodynamics and transmission, greatly diversifying the value chain leading to an increase in direct and indirect jobs in the UK.[111] The steady increase in ambition of these EU standards coupled with the UK government's approach to Company Car Tax, National Insurance and Corporation tax allowances, along with the sliding scale of Vehicle Excise Duty (VED) linked to emissions standards has led engine manufacturers and car designers to invest billions in research and development.[112]

As the UK leaves the EU, the government's commitment to adopt at least the same CO_2 targets for new passenger cars and vans post 2020/21 should be reinforced by a more rigorous testing regime. **Beyond this, the UK automotive sector rapidly needs clarity as to whether the UK will remain part of the EU framework or continue to introduce at least as strong a set of regulations at the national level.**

Building a world-leading manufacturing base

Despite the significant challenges it is currently facing, the UK's established automotive industry has important strengths, manufacturing 1.67m cars in 2017 and accounting for 14.6% of the UK's total export goods worth £44bn.[113] It is to date a major part of the UK economy, accounting for roughly 4% of national GDP and providing 814,000 jobs across the UK, 169,000 of which are directly employed in manufacturing.[114] UK vehicle manufacturing also plays a major role for UK regions outside of London and the South East, employing over 30,000 people in the North East.[115] **In 2016, a fifth of all EVs sold in Europe were produced at just one Nissan plant in Sunderland.**[116]

Recent announcements from Jaguar Land Rover, Ford, Nissan and Honda create a huge challenge for the UK's automotive industry but a bold, tangible and reliable zero emission vehicle policy agenda could help provide much needed impetus to the industry.

107 Hagman,J., et al. (2016) 'Total cost of ownership and its potential implications for battery electric vehicle diffusion', *Research in Transportation Business & Management*

108 Bloomberg NEF (2018) *Electric Vehicle Outlook*

109 Fleet News (5 January 2018) 'Diesel new car registrations down and fleet registrations fall in 2017'

110 Aldersgate Group (September 2018) *Driving ambition: accelerating the transition to zero emission vehicles*

111 BuroHappold Engineering (December 2017) *Help or Hindrance? Environmental Regulations and Competitiveness*

112 Aldersgate Group (January 2017) *Amplifying Action on Resource Efficiency: UK edition*

113 HM Government (July 2018) *The Road to Zero*

114 SMMT (2017) *UK Automotive Priorities: Securing the Strength of the UK Automotive Industry/2017–22*

115 North East Local Enterprise (January 2017) *More and better jobs: The North East Strategic Economic Plan*

116 Green Alliance (March 2018) *How the UK can lead the electric vehicle revolution*

The UK government has pledged £246m to support the development of next generation batteries through the Faraday Battery Challenge alongside a new £106m R&D funding package and industry-led investment plans totalling £500m.[117] Such investment in R&D is hugely beneficial to the automotive sector as it helps to generate economic opportunities across the supply chain and reduce production costs for battery electric vehicles. However, the UK is not alone in recognising the potential of this sector. In 2017, Germany overtook the UK for the first time in EV sales and China manufactured half of all EVs sold globally.[118]

Against this backdrop, the UK must act now and build on its position as a global leader and ensure the UK remains a strong manufacturing base for EVs and a centre for low carbon transport innovation. This includes ensuring that the right policy measures and support is in place to spur innovation, where barriers inhibit private sector investment, as detailed above.

Developing alternative fuels for long distance transport

Low and zero emission alternatives to carbon-based fuels will be required to decarbonise the transport system. This is because while battery electric vehicles are now well placed to deliver the bulk of decarbonisation for cars and vans, at present the technology is not readily available for heavy-duty vehicles (e.g. buses, trains and lorries). Innovation will therefore be necessary to start transitioning from conventional fuel to fuels that are less energy intensive.

This will be key to decarbonising the UK road freight sector where moving to rail is not possible (see chapter 2). Road freight contributed £11.9bn to the UK economy in 2015,[119] but accounted for 17% of emissions from road transport, despite making up just 5% of vehicle miles.[120]

Renewable biomethane compressed natural gas (CNG) derived from waste can offer promising CO_2 savings of up to 85% when compared to diesel.[121] Such technology represents an important transitional technology that can be scaled up to replace diesel in HCVs.[122] One of the most effective measures to support the uptake of biomethane derived from waste fuel technology would be to **allow businesses to claim Enhanced Capital Allowances (ECA) for investing in new plant or machinery associated with renewable biomethane CNGs beyond the first year of use.**

117 HM Government (18 September 2018) 'Zero Emission Vehicle Summit'

118 Green Alliance (March 2018) *How the UK can lead the electric vehicle revolution*

119 DfT (February 2017) *Freight Carbon Review 2017*

120 Ibid.

121 Resource (30 July 2018) 'Waitrose to run HGV Fleet on Biomethane'

122 CCC (November 2018) *Biomass in a low-carbon economy*

LOW EMISSION GAS TRUCKS

John Lewis Partnership developed a strategy to decarbonise its fleet, initially focusing on the heavy trucks which create 70% of the fleet's carbon emissions, by progressively replacing diesel trucks with ones running on biomethane created from waste. By 2028, all 500 John Lewis and Waitrose heavy trucks will be running on biomethane, saving 49,000 tonnes of CO_2 per year. These vehicles have a nominal 500 miles range.

With 60 of these trucks in service covering over 10 million miles to date, the use of these vehicles has transitioned from trial to full scale rollout. The majority of the vehicles are based at Leyland and deliver a carbon reduction of over 80% when measured on a 'well to wheels' basis. The vehicles have proved very reliable and are popular with drivers, who are proud of the concept and praise the quietness of the engine and the clean fuelling method.

The trucks cost around 25% more than a diesel equivalent, with a payback period of around two years (dependent on miles driven). Trucks are kept for over seven years, enabling a sound business case.

The main filling station used is at Leyland, close to a John Lewis Partnership distribution centre and access to the M6. The biomethane gas is sourced from food and food processing waste and injected into the gas grid. It is accounted through Renewable Transport Fuel Certificates (RTFC's) to certify it as biomethane and ensure accurate reporting.

For deep decarbonisation, hydrogen fuel cell vehicles (FCEVs) could play an important role for HCVs and potentially for longer-range journeys on the road and rail networks, where the need to store and carry large amounts of energy is greater.[123] If the technology is proven on the railways, hydrogen trains could offer a strong complement to rail electrification without the need for electrical infrastructure, as hydrogen powered trains could be refuelled at rail depots.[124] This is a major reason why the government considers alternative-fuel trains powered entirely by hydrogen are a 'prize on the horizon'[125] and has plans to introduce this technology on the UK rail network as early as 2022.[126]

In order to establish the practicality of switching to hydrogen fuels, trials and pilot projects will be essential to understanding and developing a business case. For example, Birmingham City Council approved a scheme to pilot at least 20 new cleaner, zero emission hydrogen-fuelled buses.[127] This is an important step towards the roll out of supporting charging infrastructure and will help bring the costs down. **The UK government should continue to work with the Train Operating Companies, Network Rail and UK rolling stock operating companies to trial hydrogen trains on rail routes which are unlikely to benefit from rail electrification** as part of any comprehensive plan to decarbonise the rail sector. There is also a need to **demonstrate that hydrogen production from carbon capture and storage (CCS) can be sufficiently low carbon and cost effective** to play a significant role in transport and other possible uses in heat and industry.

To further accelerate innovation for zero emission HCVs, the European Commission has recently published proposals that manufacturers selling new HCVs into the EU market will face regulatory limits on their fleet average CO_2 emissions.[128] **As the UK leaves the EU, the UK should remain in step with the EU's proposed CO_2 emission standards for new HCVs.**

Preparing for transformative and disruptive technologies

The rapid pace of technological change is bringing about further improvements and greater degrees of automation across different forms of transport. For example, the development of less mature technologies, such as connected and automated vehicles (CAVs) and wireless charging roads will have wider implications for road design and digital connectivity, while early-stage innovations like Hyperloop have the potential to dramatically transform longer distance travel.

123 CCC (November 2018) *Hydrogen in low-carbon economy*

124 Ibid.

125 DfT (February 2018) *Let's raise our ambitions for a cleaner, greener railway*

126 The Daily Telegraph (07 January 2019) 'Hydrogen fuel cell trains to run on British railways from 2022'

127 Birmingham City Council (23 October 2017) 'Cleaner hydrogen buses to be given green light'

128 European Commission (17 May 2018) COM/2018/284 Proposal for a Regulation of the regulation of the European Parliament and of the Council for setting the emission performance standards for new heavy-duty vehicles

Research commissioned by DfT points to considerable economic opportunities in CAV technology, estimating **that the UK CAV market could be worth £28–52bn by 2035.**[129] The government also anticipates that connectivity and automation could improve traffic flows through traffic control optimisation, resulting in reductions in transport emissions.[130] However, automation will need to be carefully managed to avoid adding to congestion, as one of the unintended consequences of automation could be increased demand in road use.[131] In this context road user pricing might prove essential alongside vehicle automation (see chapter 6).

Government should continue to explore the application of new technologies coming to market and the potential for behaviour changes and demand for transport. In terms of infrastructure, government will need to plan ahead for the way roads are managed and designed. Furthermore, as CAVs are expected to transmit large amounts of data at high speeds to infrastructure or even other connected vehicles, government will need to improve 5G connectivity across the UK's strategic road network. Regulations around new forms of transport will have to build in a degree of flexibility to avoid stifling innovation.

129 Transport Systems Catapult (July 2017) *Market forecast for Connected and Autonomous Vehicles*

130 HM Government (July 2018) *The Road to Zero*

131 WSP (2017) *New Mobility Now*

CHARGING WHILE YOU DRIVE

A number of companies have been developing and trialling electrified roads. Siemens' eHighway system, whereby trucks are supplied by power from an electrified overhead line, has been operating on a private road outside of Berlin since 2010 and is now being used on public roads in Sweden and Germany.[132] This system is twice as efficient as conventional internal combustion engines and is based on Siemens' long-term experiences in rail electrification. The system could be an important low carbon mobility solution to decarbonise freight transportation as it could be integrated on heavily used routes, such as between ports and industrial estates.

eRoadArlanda is one of several projects in the Swedish Transport Administration's pre-commercial procurement of innovation for the development of electrified roads. It is based on conductive technology that use an electric rail installed in roads to power and recharge vehicles during their journey. Procurement of the electrified road commenced in June 2013 with a five-year project consortium of Swedish industry, including PostNord, Sweden's airports and Vattenfall. The goal of the project is to generate knowledge, experience and decision data that is conducive to the creation of a platform for the electrification of larger transport routes in Sweden. The STA believes that electrified road transport can cut emissions by 80 to 90%.

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132 Siemens (April 2017) *eHighway: solution for electrified road freight transport*

FIVE: DRIVING GREATER RESOURCE EFFICIENCY IN VEHICLE MANUFACTURING

Decarbonising transport also requires a step change in resource efficiency, driven by ambitious extended producer responsibility requirements, product standards and innovation support policies.

The vehicle manufacturing industry is already undergoing a transformational shift, moving away from internal combustion engine models and private car ownership. In this context, the industry must also consider how to **move towards more resource efficient business models, where the production process and the different components involved in car manufacturing favour material re-use and recycling.**

Replacing combustion engines with EVs can only achieve partial decarbonisation. Considering the embedded emissions and resources used across the lifetime of each component of a vehicle (batteries, bodywork and tyres) is also vital: **an estimated 46% of the lifecycle emissions of battery electric vehicles come from the production phase.**[133] Moreover, disposing of the same materials at the end of life can generate further emissions (see Michelin tyres case study).

Adopting more resource efficient business models can deliver a reduction in waste and emissions whilst driving financial gains. A 2017 Aldersgate Group report found that an ambitious shift to greater resource efficiency in the UK would see a total net gain in Gross Value Added (GVA) of £9.1bn by 2030, whilst also creating new jobs for businesses involved in reuse, repair, remanufacturing and rental.[134] Greater resource efficiency can also help reduce supply risks: the UK imports all raw materials for batteries[135] (such as cobalt) leaving its manufacturers exposed to sudden price shocks and supply interruption,[136] particularly given the unstable nature and serious human rights issues of some of the top raw material exporting countries.[137]

However, **there are currently numerous regulatory, financial and technical barriers to resource efficiency in the UK,** as previous Aldersgate Group reports have set out. For example, it can be cheaper to use raw materials than good quality secondary materials due to the cost of reprocessing. Advanced recycling facilities are very capital intensive, whilst until now the narrow legal interpretation of 'waste' has often meant that recoverable materials are not being re-used. Adapting business models to become more circular can be seen as a high-risk strategy due to their innovative nature, requiring a great deal of technical support.[138]

133 Ricardo for Low Carbon Vehicle Partnership (12 September 2018) 'Understanding the life cycle GHG emissions for different vehicle types and powertrain technologies'

134 Aldersgate Group (January 2017) *Amplifying resource efficiency: UK edition* (quoting studies from Suez & Eunomia (September 2016) & WRAP, LSDC, GLA and LWARB (December 2015)

135 Green Alliance (2018) *Completing the circle: Creating effective UK markets for recovered resources*

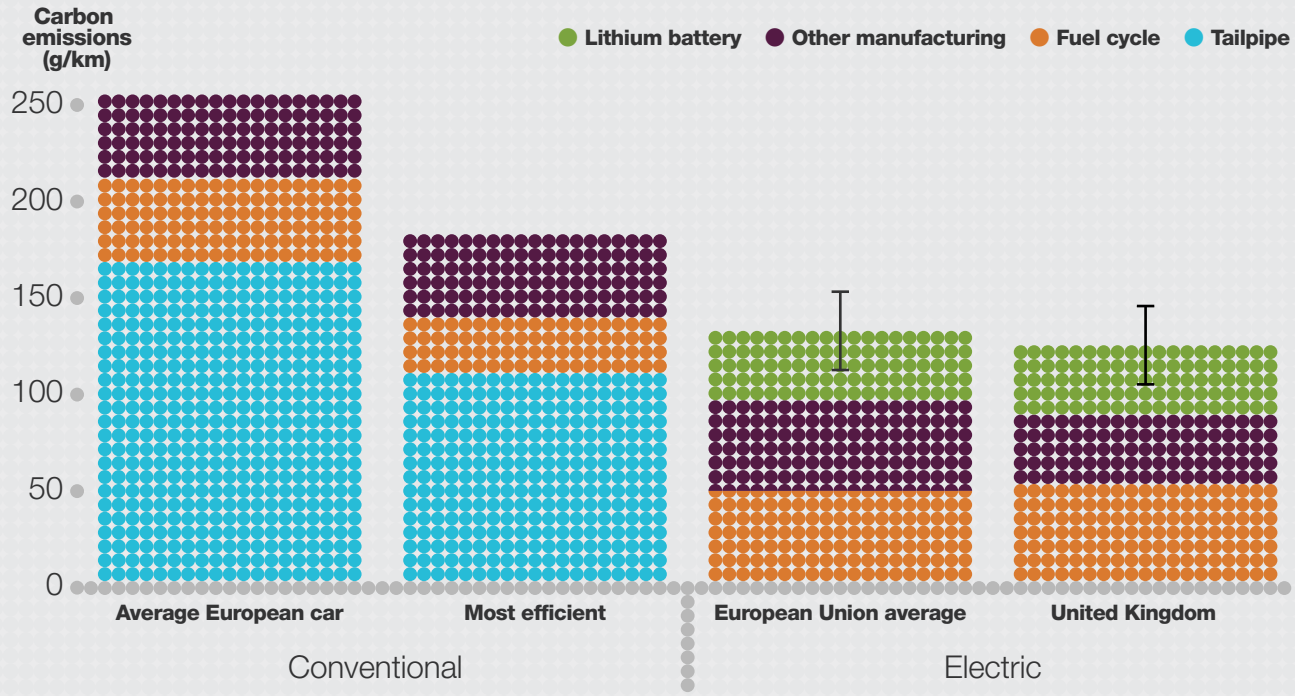
136 FT (08 November 2018) 'Cobalt's supply shock a painful warning to carmakers'

137 European Commission (May 2015) *Commission staff working document: Report on Raw Materials for Battery Applications*

138 Aldersgate Group (January 2019) *Beyond the 2019 elections: maintaining momentum on resource efficiency*

LIFECYCLE GHG EMISSIONS ELECTRIC VEHICLE VS INTERNAL COMBUSTION ENGINE

While EVs have much lower lifetime emissions than comparable ICEs, grid decarbonisation and greater resource efficiency in the manufacturing process is needed to reduce emissions further.



Source: ICCT (Feb 2018)
Effects of battery manufacturing on electric vehicle life-cycle greenhouse gas emissions.

Opportunities for a more resource efficient supply chain

There are real opportunities for efficiencies across the vehicle manufacturing supply chain. For example, Novelis, the world's leading aluminium manufacturer has partnered with Jaguar Land Rover on REALCAR (REcycled ALuminium CAR), a project to boost the amount of recycled aluminium used in vehicle manufacturing by up to 75% by 2020, partly funded by Innovate UK. Aluminium recycling uses up to 95% less energy than primary aluminium production, cutting direct production emissions and reducing transport emissions associated with importing virgin materials. Jaguar Land Rover reclaimed over 50,000 tonnes of aluminium scrap in the 2015/16 financial year, preventing the release of 500,000 tonnes of CO_2 as a result.[139]

Solutions also exist to recover certain materials from batteries such as copper. However, with the volume of rare earth materials expected to triple with the growth of EV uptake, the development and sustainable production of batteries must be a matter for rapid innovation.[140] As part of its bid to become a world leader in battery-related production lines and services through the Automotive Sector Deal and the Faraday Battery Challenge,[141] **the UK also has an opportunity to become a global leader in supply chains to recondition, recycle and remanufacture EV batteries,** particularly recovering cobalt from batteries, as waste battery stock increases over time.

Doing so can also help solve some of the UK's system-wide decarbonisation challenges. Upon retirement, EV batteries could still retain 70–80% of their initial capacity.[142] Nissan, Renault, BMW & BYD are already exploring how second life batteries can be used, for example as stationary home batteries and to manage smart electricity grid demand, as demonstrated by the Smart Electric Urban Logistics project piloted by UPS (see chapter 4).

Policy priorities for a resource efficient vehicle manufacturing industry

Government policy has a key role to play in removing barriers to greater resource efficiency, especially by introducing measures that incentivise manufacturers to design products to make them more durable, repairable and that facilitates the recovery and re-use of critical components. The UK government has recognised this imperative and released a Resources and Waste Strategy in December 2018,[143] where it reiterated its commitment to doubling resource productivity by 2050.

139 The Manufacturer (28 April 2018) 'Recycling landmark caps Jaguar XE anniversary'

140 Euractiv (19 September 2018) 'Rethinking transport: Driving Europe towards sustainable mobility'

141 HM Government (2 March 2018) 'Faraday battery challenge: Industrial Strategy Challenge Fund' [accessed 04 February 2019]

142 IDTechEx (August 2018) *Second-life Electric Vehicle Batteries 2019–2029*

143 HM Government (December 2018) *Our waste, our resources: a strategy for England*

The Strategy recognised the importance of policy measures targeting the design stage of products, including in relation to vehicles, tyres and batteries. However, policy development is still at an early stage and upcoming policy detail needs to build on the EU's End-of-Life Vehicle Directive.[144] This Directive requires a minimum of 95% of each vehicle by weight to be recovered at the end of its life and for manufacturers to maintain a collection system in which last owners can deliver their vehicles free of charge. This represents an increase of 10% on the previous target which was introduced in 2006.[145] However, the government's Strategy reported that as of 2016, the UK had achieved an overall recovery rate of 92%, below the EU requirement.[146]

As the government further develops its Resources and Waste Strategy, policy priorities to drive greater resource efficiency in car manufacturing should include:

- **Extended producer responsibility:** using the review of the End-of-Life Vehicle regulations in 2021 to incentivise greater material re-use in car manufacturing and using the review of the batteries regulations in 2020 to incentivise battery re-use, both in vehicles and as second life batteries;[147]
- **Product standards:** building on the commitment in the Strategy to introduce product standards on resource efficiency to set ambitious minimum durability, re-use and recycling criteria for batteries and tyres;
- **Supporting innovation:** building on the Faraday Challenge to ensure UK manufacturers are provided with sufficient innovation funding to improve the sustainability of vehicle batteries by making them fit for re-use;
- **Fiscal mechanisms and public procurement:** using the levers of public procurement and fiscal mechanisms to encourage demand for resource efficient vehicles and vehicle components. This may include adjusting fiscal rates such as VAT on batteries, tyres or cars with higher recycled content, or increasing taxation on primary resource use, such as finite rare earth metals for batteries.[148]

144 Directive (EU) 2005/64 of the European Parliament and Council on 26 October 2005 on the type-approval of motor vehicles with regard to their reusability, recyclability and recoverability and amending Council Directive 70/156/EEC

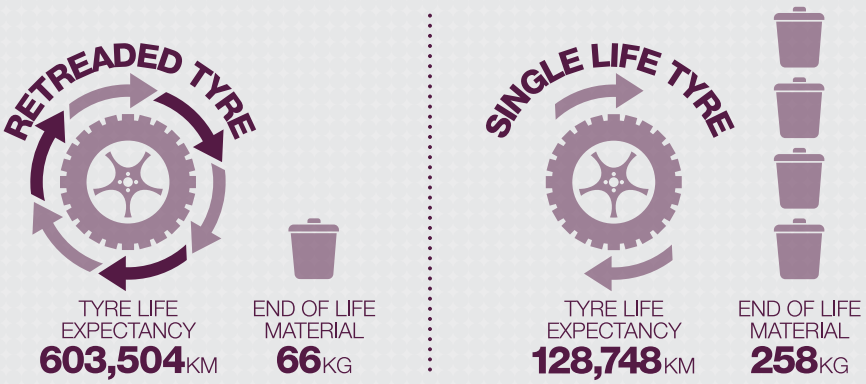
145 SMMT (2018) *2018 UK Automotive Sustainability Report*

146 HM Government (December 2018) *Our waste, our resources: a strategy for England*

147 Ibid.

148 Government Office for Science (December 2017) *From waste to resource productivity*

MAXIMISING THE LIFETIME OF RUBBER TYRES THROUGH CIRCULAR ECONOMY



With the right regulatory framework, manufacturers can design safe products with sustainable mobility in mind. This means fighting against planned obsolescence and offering long-term performance products which represent savings for consumers and a reduction in raw materials consumption.

Currently, motorists are recommended to replace their tyres after 1.6mm of wear, however there are some in the industry that advocate a shift towards tyre replacement at 3mm. This is despite tests suggesting that this does not provide a safety guarantee for the user. If industry was allowed to shift towards a tyre replacement at 3mm, the environmental impact would be considerable. Applied across the EU this would result in an annual 35% increase in waste generation and raw material consumption, the destruction of an additional 5,700 hectares of primary forest for rubber production, an additional 6.6m tonnes CO_2 generated and additional energy use of 32,800 GWh for manufacturing.[149]

Incentives for retreading tyres, a recycling process whereby worn tyres are refurbished through a replacement of the tread on an old casing, would also have a significant positive impact on the environment. A retreaded tyre reuses 85% of the original tyre and offers a similar life expectancy. Each time a truck tyre is retreaded, 30kg of rubber, up to 20kg of steel and 60kg of CO_2 emissions are saved.[150]

In 2012, retreads represented 50% of UK replacement truck tyre sales. In 2016, that figure had fallen to 35% due to a significant increase in cheap imports of single life tyres from Asia. The design and manufacturing quality of these imported tyres mean they cannot be retreaded and has resulted in a significant increase in waste: an estimated 500,000 additional end-of-life truck tyres now appear in the UK every year, which are typically exported for incineration in developing countries, releasing 160,000 tonnes of CO_2 every year.

Michelin also runs a tyre leasing programme for transit vehicles and trucking fleets, called Fleet Solutions. It offers a 'pay by the mile' service which creates an incentive to ensure that tyres are as efficient and long-lasting as possible, so that Fleet Solutions can maximise profit against each tyre leased.[151] At the end of the tyre's life, the material can then be easily reclaimed and reused.

149 EY (June 2017) *Planned obsolescence is not inevitable*

150 Aldersgate Group (January 2019) *Beyond the 2019 elections: maintaining momentum on resource efficiency*

151 Michelin (2017) *Movin' On 2017: The Minutes*

SIX FINANCING LOW CARBON TRANSPORT INFRASTRUCTURE

The scale and urgency required to decarbonise transport will require long-term vision matched with long-term funding.

The Transport Investment Strategy committed to spend over £61bn on transport investment between 2015/16 and 2020/21.[152] However, longer-term funding levels are unclear and may not be sufficient, as transport infrastructure takes place alongside other competing government priorities and increasing demand for mobility systems. It is therefore essential to explore alternative sources of funding for investment in transport infrastructure and services. This can come through a number of taxation or revenue-raising mechanisms, or working with the private sector to reduce the burden on taxpayers and passengers.

Exploring new opportunities for fairer road pricing

Changes to the way drivers pay for their roads are inevitable as fuel duty taxes will decline with the impending shift from liquid fuels to electric power. The think tank Policy Exchange has calculated that if Britain succeeds in meeting its targets for reducing carbon emissions from road transportation, **fuel duty revenues would be between £9bn and £23bn lower in 2030 than the Office for Budget Responsibility is assuming.**[153] Whilst past and present governments seem reluctant to consider new ways of charging for the use of the UK's strategic roads, it is generally accepted that a new approach will be needed in the future to manage increasing congestion and reduce emissions.

Developments in vehicle connectivity present a new opportunity to design a sustainable alternative that improves on the current road tax regime. Up to the minute data could allow for charging road users **based on distance travelled and measured at a particular time of the day, managing demand for travel.** This could ensure congestion is managed more efficiently and that roads are paid for fairly. Such a levy or fee for road use could influence a proportion of road users to change their driving or travel behaviour to better manage the demand for the use of road space.

Building a social consensus will be essential for the success of any future road tax regime. Therefore, government must signal to individuals and businesses the direction of travel it is likely to take and consult fully.

152 DfT (July 2017) *Transport Investment Strategy*

153 Policy Exchange (26 June 2017) 'Cutting road tax emissions could cost billions in lost taxes'

Land value capture: Community Infrastructure Levy (CIL)

Local funding for infrastructure can strengthen local accountability, sharpen the incentives for scheme designers to maximise local benefits and even improve the fairness of the funding.[154]

The CIL is a levy charged per square meter of net additional development. It allows local authorities in England and Wales to fund transport infrastructure such as cycle lanes or the purchase of electric buses.[155] As such the developers are a direct beneficiary and will benefit from an uplift in value associated with better public and active transport infrastructure. Crossrail, a new high capacity railway for London and the South East of England, has been part funded by the CIL and is estimated to create £5.5bn in additional value to residential and commercial real estate along the route between 2012 and 2021.[156]

Currently, local authorities may work together with neighbouring authorities, Local Enterprise Partnerships and other stakeholders to support strategic thinking in the use of the levy and linking it to growth planning for the wider area. **To maximise the efficacy of the CIL, central government should allow different local authorities,working through Sub-National Transport Bodies or together with their local elected mayors, to pool collective revenue and build funding capacity to deliver sustainable transport projects.** This may be usefully augmented by locally defined and ringfenced business rates, so local businesses benefitting from better conditions (such as higher footfall in a pedestrianised area) are investing in their surroundings.

Maximising private sector collaboration

Leveraging private investment is an important financing mechanism to deliver high-quality transport projects and can reduce the overall costs of infrastructure for consumers, taxpayers and local authorities. **Collaboration between the public and private sector can offer a safe and sustainable long-term investment opportunity with reasonable returns for private investors, sharing out risk between the public and private sector and achieving efficiencies,** if projects are well planned and risks are appropriately managed.[157]

154 National Infrastructure Commission (July 2018) *National Infrastructure Assessment*

155 HM Government (12 June 2014) 'Community Infrastructure Levy' https://bit.ly/2MqEB36 [accessed 19 November 2018]

156 Crossrail (January 2018) *Property Impact Regeneration Study*

157 International Finance Corporation (2017) *Creating Markets for Climate Business: An IFC Climate Investment Opportunities Report*

Such collaboration does not provide a means of avoiding public subsidy for major transport infrastructure projects, but can instead reduce the need for subsidies. Government should therefore develop appropriate funding mechanisms to leverage private capital for co-investment for clean transport infrastructure, which provides a transparent assessment of the costs and savings to ensure it is manageable and proportionate to the benefits the infrastructure provides.

Public intervention can be particularly effective for leveraging private finance through guarantee mechanisms.[158] **Guarantees against potential financial loss can mitigate investment risk in a range of ways, making projects more attractive and/or lowering the cost of investment.** They can be offered on construction risk – for example, the Thames Tideway Tunnel, where the government will provide compensation to investors if the project is discontinued – or on demand risk, such as the Contract for Difference renewable energy auctions which guarantee a certain revenue per kilowatt hour of generation, ensuring a stable revenue stream for investors for up to 15 years. If administered with robust assessment criteria and oversight, such guarantee mechanisms enable financing of large infrastructure projects at an acceptable cost for consumers and may (in the case of Thames Tideway) only be called upon if needed. If these risks do not materialise, there is no exposure for taxpayers, and the infrastructure is financed entirely by the private sector.[159]

Diversifying revenue streams

Transport authorities and operators could also consider diversifying revenue streams, if given appropriate revenue raising powers. For example, Hong Kong's Mass Transit Railway Corporation (MTR) uses a 'rail and property' model. Making the most of the city's high urban density, the MTR owns malls and properties or takes a cut of property development fees above and around public transportation stations to capitalise on captured audiences and leases out retail units within the stations where there is guaranteed footfall. In fact, less than one third of its revenue comes from local transport operations.[160] **Profits from real estate subsidise extension and maintenance costs of transport operations, increasing reliability and reducing cost for customers:** single fares on the underground cost around 40p–£2, and fare increases are limited by regulations linking inflation and profits.[161] The HK Government is a majority shareholder and grants MTR land development rights as compensation for the cost of building railway networks. Whilst the high urban density and relatively modern nature of Hong Kong's transport system means that this model cannot be transferred wholesale, there are some lessons to be taken in finding different ways of generating revenue to reduce reliance on central government funding, and integrating transport links with shops, workplaces and leisure destination, as demonstrated by the Nordhavnen development in Copenhagen (see chapter 2).

158 Aldersgate Group (March 2018) *The new normal: increasing investment in the UK's green infrastructure*

159 Tideway (January 2018) *Tideway Green Bond Framework*

160 South China Morning Post (08 March 2018) 'MTR reveals 64% rise in net profit to HK$16.8 billion, buoyed by earnings from property development'

161 The Atlantic (10 September 2013) 'The Unique Genius of Hong Kong's Public Transportation System'

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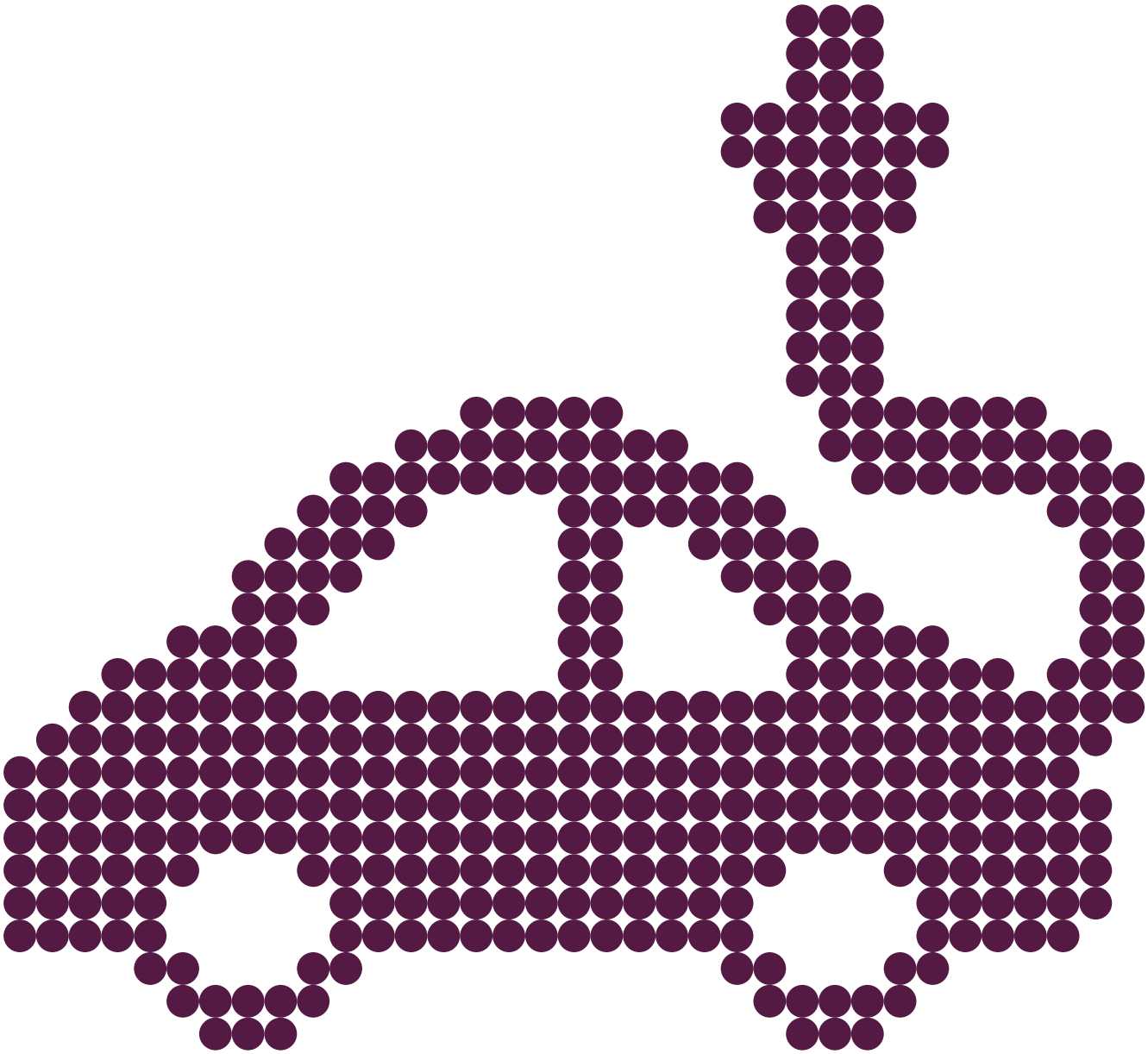

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