IPPR

BRIEFING NOTE

CONNECT THE DOTS

AIR QUALITY, INDUSTRIAL STRATEGY AND SMART MOBILITY

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Institute for Public Policy Research

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1.
THE PROBLEM

WHAT IS AIR POLLUTION?

Air pollution is 'the presence in or introduction into the air of a substance which has harmful or poisonous effects'.[1] The most common air pollutants are listed below (see table 1.1).

Emissions of these pollutants damage the environment and are significant determinants of human health. A large body of evidence exists that suggests air pollutants increase the prevalence of numerous health conditions, including lung cancer and asthma.

TABLE 1.1

Air pollutants and their health impacts

Pollutant name	Main sources	Health impact
Benzene	Evaporation and combustion of petroleum products	Cancer, leukaemia.
Carbon monoxide (CO)	Road transport (particularly petrol), combustion, industry – CO arises from incomplete combustion	Headaches, nausea, dizziness, affects lung performance
Heavy metals	Combustion, industrial processes	Nausea, diarrhoea, abdominal pain, irritation of eyes, nose, throat, and lungs, brain and kidney damage, asthma, respiratory diseases, lung cancer
Nitrogen Dioxide (NO2)	Transport, combustion	Lung irritation, decrease lung function, and increase chance of respiratory infections – long-term exposure is associated with low birth weight babies and excess deaths
Ozone (O3)	Reaction of hydrocarbons, NOX, and volatile organic compounds (VOCs) in sunlight	Harms lung function and irritates respiratory system; can increase incidence and severity of asthma and bronchitis – long-term exposure can lead to cardiorespiratory mortality
Particulate Matter (PM10 and PM2.5)	Transport (exhaust, tyre and brake wear), combustion, industrial processes and construction	Linked to asthma, lung cancer, respiratory and cardiovascular diseases, infant mortality and low birth weight
Sulphur Dioxide (SO2)	Combustion (coal) and road transport	Causes irritation of lungs, nose and throat, and exacerbates asthma

Source: WHO 2013

1 See for example: http://www.oxforddictionaries.com/definition/english/air-pollution

Of particular concern to human health are nitrogen dioxide (NO2) and particulate matter (PM10 and PM2.52[2]), as both are recorded at high concentrations across the UK, and because the evidence linking them to poor health is strong (Defra 2015a). Indeed, experts estimate that 29,000 'equivalent' deaths are caused annually from exposure to PM2.5 in the UK (COMEAP 2010) – a figure which increases to 40,000 when also considering the related effects of NO2 (RCP 2016). The subsequent costs to the NHS and the economy (in terms of working days lost) is estimated at more than £20 billion every year (RCP 2016).

Such impacts have led the World Health Organisation (WHO) to set out 'guideline levels' for the concentration of each pollutant (WHO 2005) (see table 2.1 below). However, in the case of PM, WHO has cautioned that, because health impacts are still found at very low concentrations, 'no threshold has been identified below which no damage to health is observed'.

TABLE 1.2

Pollutant concentration limits within the European Union

Pollutant name	Averaging period	Limit (micrograms per cubic metre, µg/m3)	Permitted exceedances (per year)	Deadline	WHO guideline levels
NO_2	1 hour	200 µg/m3	18	Jan 2010 (extended Jan 2015)	As per EU values
	1 year	40 µg/m3	N/A	Jan 2010 (extended Jan 2015)	As per EU values
PM10	1 day	50 µg/m3	35	Jan 2005 (extended Jan 2011)	As per EU values
	1 year	40 µg/m3	N/A	Jan 2005	20 µg/m3
PM2.5	1 year	25 µg/m3	N/A	Jan 2015	10 µg/m3
	1 year	20 µg/m3	N/A	Jan 2020	10 µg/m3

Source: EC 2016

Notes: Concentration limits are expressed either in the form of an annual average concentration or as a restriction on the number of 'exceedances' over shorter time periods in a whole zone.

Regardless, the WHO guidelines are generally being seen as the standard by which success can measured, and have been translated into law via the European Union's Ambient Air Quality Directive 2010 (and then into UK law through the Air Quality (Standards) Regulations 2010). This means that any area within the UK that breaches these limits is breaking both UK and EU law (pre-Brexit).

HOW IS THE UK PERFORMING?

According to the government's latest draft National Air Quality Strategy for Tackling Nitrogen Dioxide, there are 31 zones across the country that are failing to comply with EU law on NO2 limit values (Defra 2017). WHO

2 Air pollutants with a diameter of 10 and 2.5 micrometres (µm) or less, respectively.

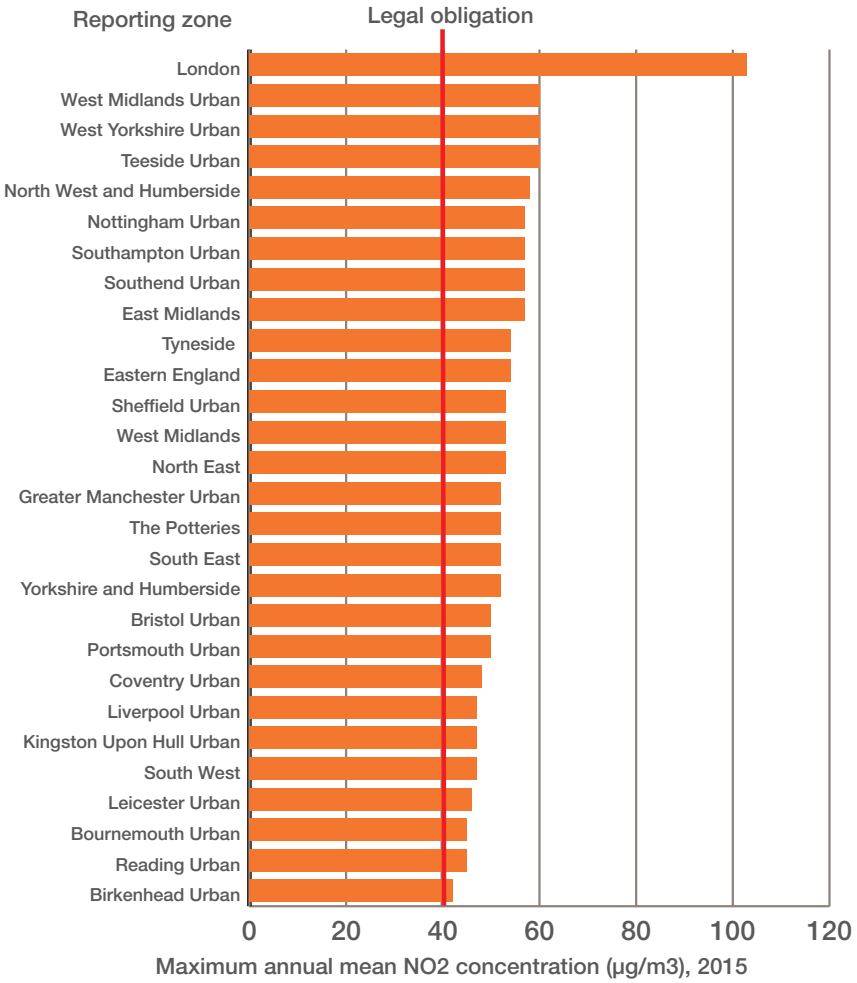
finds that there are 11 and 40 areas across the UK which are in breach of WHO safe 'guidelines' on PM10 and PM2.5 respectively (WHO 2016).

Furthermore, modelling by the Department for the Environment, Food and Rural Affairs (Defra) has previously shown that, without significant policy changes, most of the UK will remain in breach of legal limits into 2025 and beyond, with London not reaching compliance with legal limits until 2030 (Defra and DfT 2017a).

The UK is not the only country failing to comply with EU law; some other countries continue to breach concentration limits across the EU (ibid 2017). However, few countries perform as poorly as the UK in terms of the number of areas that are non-compliant, and the length of time this is likely to remain the case.

FIGURE 1.1

Areas in breach of EU limit values for NO2



Source: Defra and DfT 2017a

TABLE 1.3

Number of zones* projected to be non-compliant with the limit value for NO2 over time, assuming no additional policy interventions**

Year	2017	2018	2019	2020	2021	2022	2023
Number of zones	37	36	34	31	22	18	9
Year	2024	2025	2026	2027	2028	2029	2030
Number of zones	3	3	3	1	1	1	1

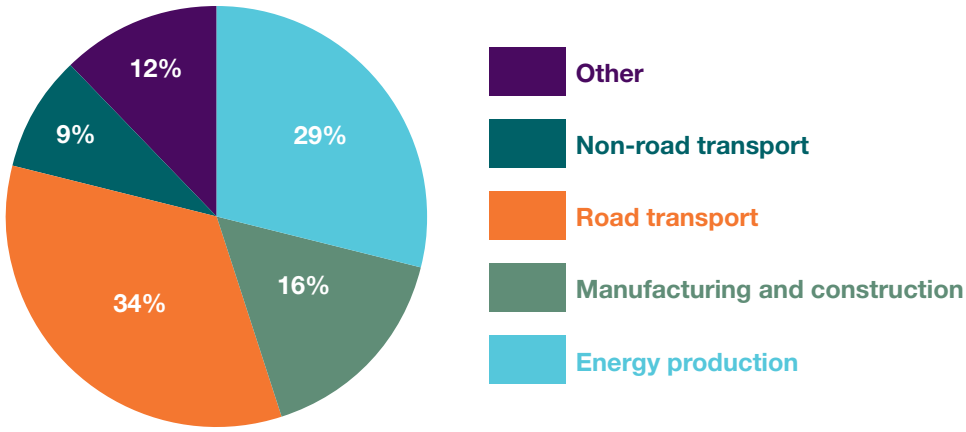
Source: Defra and DfT 2017a
*Out of the total 43 reporting zones
**These projections are based on COPERT 5 emission factors. If Euro standards are less effective than predicted (as has been the case with historical real-world operations), the number of non-compliant zones will be higher.

WHAT IS CAUSING THE AIR POLLUTION PROBLEM?

The causes of air pollution are many and complex, with significant contributions from gas combustion (including cookers and central heating boilers), as well as rail and air transport. However, one of the primary causes is road transport.

FIGURE 1.2

Breakdown of UK national average NOx roadside concentration into sources, 2015



Source: Defra and DfT 2017a

Cars, buses and lorries accounted for around 34 per cent of nitrogen oxide (NOx) emissions, and 14 and 13 per cent of PM10 (particulate matter) PM2.5 respectively in 2015 (Defra and DfT 2017a). However, this rises significantly when we consider concentrations at the roadside, where road transport contributes some 80 per cent of NOx concentrations (see figure 1.2).

The main source of road transport based pollution – making up over three quarters of emissions in total – are diesel vehicles. This increase in diesel-related emissions is driven largely by two main factors.

1. A growing proportion of the fleet is made up of diesel vehicles in the UK, from 1.6 million (7 per cent) in 1994, to more than 10.7 million (over 36 per cent) today (DfT 2016).
2. Diesel engines have failed to deliver the expected reductions in emissions under real world driving conditions compared to test conditions, with some studies showing that Euro 6 diesels produce between two and a half and seven times the published standard when driven on the road (Weiss et al 2011, Transport and Environment 2016).

WHAT HAS THE GOVERNMENT BEEN DOING ABOUT IT?

Awareness of the air pollution problem has been growing among the public and policymakers, but both national and local government have yet to respond with adequate measures to address the challenge.

As a result, in 2015 the UK Supreme Court ordered the government to introduce measures within the national action plan for NO2 to meet compliance across air pollution zones in the shortest time possible (UKSC 2015).

To meet this requirement, Defra produced a new plan for improving air quality in the UK. This included the introduction of 'clean air zones', in which the most polluting vehicles may face additional charges and regulation (with severity of charges and types of vehicles included dependent on the scale of their breach of EU limits).

Clean air zones

A clean air zone is 'an area where targeted action is taken to improve air quality and resources are prioritised and coordinated in a way that delivers improved health benefits and supports economic growth' (Defra 2017).

Any local authority can implement a clean air zone to address a local air quality issue. However, following a consultation in 2015, the UK government modelled NO2 levels across the UK, which indicated which areas might need to implement a charging clean air zone to achieve compliance with legal limits for nitrogen dioxide. This led to five cities – Birmingham, Derby, Leeds, Nottingham and Southampton – in addition to London exploring the implementation of such a zone.

Clean air zones fall into two categories.

1. Non-charging clean air zones: These are defined geographic areas, used as a focus for action to improve air quality. This action can take a range of forms, including:
   - exploring innovative retro fitting technologies and new fuels
   - buying ultra low emission vehicles (ULEVs), and encouraging local transport operators to do the same
   - encouraging private uptake of ULEVs by ensuring adequate charge points

- encouraging use of public transport, cycling, walking, park and ride schemes and car sharing
- improving road layouts and junctions to optimise traffic flow, for example by considering removal of road humps
- working with local businesses and neighbouring authorities to ensure a consistent approach.

2. Charging clean air zones: These are zones where, in addition to the above, designated vehicles are required to pay a charge to enter or to move within the zone, if they are driving a vehicle that does not meet the particular standard for their vehicle type in that zone. Depending on the extent of the air pollution problem in the city, these zones may include different vehicles (set out in the table below).

TABLE 1.4

Charging clean air zone classes which local authorities may choose to deploy

Charging clean air zone class	Vehicles potentially included
A	Buses, coaches, taxis and private hire vehicles
B	Buses, coaches, heavy goods vehicles (HGVs), taxis and private hire vehicles
C	Buses, coaches, HGVs, large vans, minibuses, small vans/light commercials, taxis and private hire vehicles
D	Buses, coaches, HGVs, large vans, minibuses, small vans/light commercials, taxis and private hire vehicles, cars, motorcycles and mopeds

Source: Defra and DfT 2017a

However, while these plans did bring forward the date of compliance for many UK cities, Defra modelling suggested that, even with these changes, the majority of cities in the country would only reach compliance in 2025 or beyond (Defra and DfT 2017a). Under this plan, these zones also only covered a small number of areas. Many additional areas that were still failing to comply with UK and EU law were not required to take further action.

This led many environmental groups to conclude that the plans are still inadequate, and in November 2016 the government lost their second case in the supreme court, with the court ordering them to re-draft the air quality plan. This was published in consultation form in May 2017 (Defra and DfT 2017b). It sets out a range of possible additional options to reduce air pollution, including an expansion of the number of clean air zones to 27 and a scrappage scheme. However, it is worth highlighting that it does not commit government to implementing these measures.

WHERE NEXT?

It is our view that the scale of the air pollution problem in the UK requires a bolder and more holistic approach. The evidence from places like London (Laybourn-Langton et al 2016) is that, to deliver the kind of improvements needed in air quality, two significant shifts will be needed in the way we travel.

1. A move away from diesel vehicles towards petrol and, ultimately, hybrid and electric alternatives.
2. A move away from private cars towards car sharing schemes, public transport, walking and cycling.

Achieving this transition will be difficult. It took nearly two decades for diesel cars to grow from a small minority of the fleet to two in every five cars on the road today. We now need to reverse this trend, and in a considerably shorter period of time than it took us to get to the current status quo. Evidence from cities that have managed it suggests that modal shift in transportation requires significant commitment from policy makers, as well as upfront investment in public transport.

Yet there is little doubt that the prize is worth it. Not only could these shifts save thousands of lives by reducing air pollution, they could also drive improvements in two of the government's other transport objectives: a reduction in congestion, which is estimated to cost the UK economy over £61.8 billion over the next decade (INRIX 2016), and a reduction in road-based CO2 emissions, which currently make up a quarter of all UK emissions (DECC 2014).

However, delivering on this potential will require a bold new approach to the air pollution problem. Government will have to reach for all the available tools in its policy arsenal, including providing incentives to drive behaviour changes amongst businesses and individuals.

We will now explore the central tenets of such an approach.

2.
A NEW APPROACH

JOINING THE DOTS

At the heart of a new strategy on air pollution should be the assumption that air pollution provides government with an opportunity to be seized, rather than just a risk to be managed. Over recent decades, politicians have been concerned about the political implications of additional regulations and costs on diesel drivers.

However, while the government are right to recognise that such measures are needed, it may not necessarily be the case that this will result in a public outcry. Indeed, there is growing public support for action on air pollution (Quilter-Pinner and Laybourn-Langton 2016), and interventions such as the new ULEZ in London prove that bold policies do not necessarily lead to adverse political effects.

Moreover, these 'sticks' are only a political threat if they are not juxtaposed against appropriate 'carrots', in the form of financially attainable alternatives to diesel vehicles; either alternative vehicles, or other forms of transport and the support to make the transition between the two. Achieving this is much more likely if government looks beyond just traditional air pollution policy – which is heavy on 'sticks' and light on 'carrots' – and draws on a much wider set of policy tools.

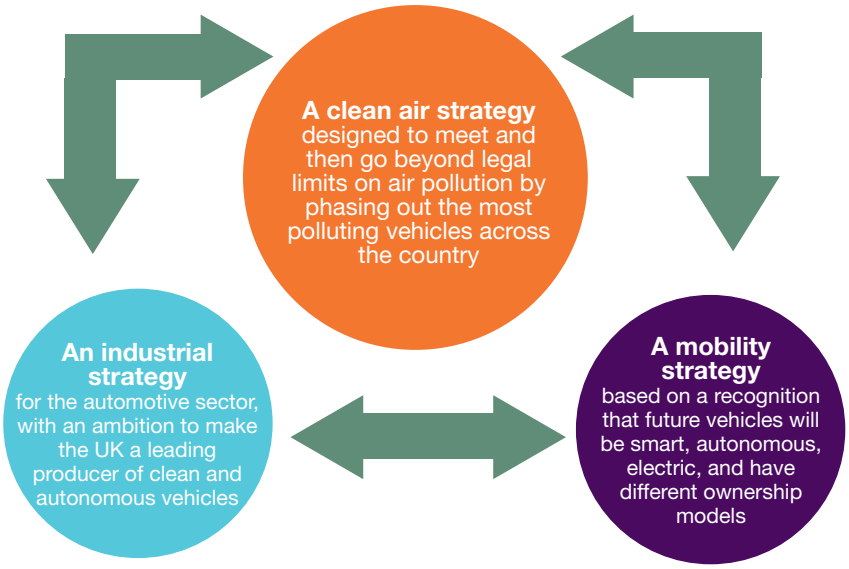
Two tools in particular are worth considering.

1. **Industrial policy**, which has experienced a comeback post-Brexit, and is explicitly targeting a 'transition to a low-carbon economy' and the promotion of ultra low emission vehicles. These options could help provide alternatives to diesel vehicles, while also increasing support for action from the car industry.
2. **Smart mobility and transport policy**, which is in the throes of a technological transformation. This has the potential to provide a viable alternative to private vehicle ownership, and therefore facilitate greener transportation and modal shift (Laybourn-Langton 2017).

It is our hypothesis that if the government can effectively integrate these areas with more traditional air pollution policy – such as road pricing and regulation – it could improve the UK's ability to achieve, and then go beyond, compliance on air pollution laws. Moreover, it could also be that action in these policy areas would improve other environmental and economic outcomes.

FIGURE 2.1

A holistic policy approach is needed to overcome the air quality problem



Author's analysis

WHAT IS INDUSTRIAL STRATEGY?

The UK's decision to leave the European Union looks likely to lead to a lengthy and profound economic shock. Against this backdrop, 'industrial strategy' has become a buzzword for politicians looking to ensure the UK is able to 'control its own destiny'. Commentators have argued that it can address everything from low productivity to low pay; from the unbalanced nature of the British economy to the decline in British manufacturing and exports.

Approaches to industrial strategy are founded on the idea that the state can intervene in parts of the economy to help promote specific objectives. Historically, these objectives have been predominantly economic, with a focus on developing specific industries, particularly manufacturing. However, more recently it has been broadened to include both commercial and social or environmental aims (Mor 2017).

There have been a number of approaches to industrial strategy. Historically, the term has been synonymous with 'command-and-control' state intervention: supporting incumbent manufacturing industries through subsidies, planning agreements with large firms to attempt to secure investment commitments over the long term, and public ownership of firms (Coates 2014).

However, this is just one incarnation of industrial policy. More recently, countries with developed economies and a history of public intervention in the private sector, such as Germany and France, have adopted a model of 'coordinated capitalism' (Coates 2014), acting to support and develop their existing industrial bases while remaining economically open and non-protectionist.

Meanwhile, in the US, the government has adopted what could be termed a 'liberal capitalism plus' approach: it tends to restrict its interventions to very targeted (but significant) support for early-stage innovation. This is unlikely to 'shift the dial' on the structure of the economy, but it can tackle specific market failures and develop a niche in particular nascent technologies (Mazzucato 2013). These alternative models are investigated in more detail in the table below.

TABLE 2.1

An industrial strategy typology

Type of industrial strategy	Policies it implies in practice	How success could be measured
Command and control: interventions to support incumbent industries	• Public ownership of firms (including through nationalisation) • Planning agreements with individual firms to secure commitments on future investment and job creation • Sector-specific subsidies to encourage investment • State rescue of struggling firms	• GDP/GVA growth (both national and regional) • Business investment Manufacturing sector growth • Employment (national and regional) • Exports
Coordinated capitalism: nurturing and building on existing supply-side strength	• Public investment banks that provide finance to small and medium-sized businesses • (In Germany's case) a strong regional dimension to public investment decisions, through a network of regional public banks State ownership of companies (e.g. France's ownership of EDF and SNCF; Germany's ownership of Deutsche Bahn and part-ownership of Volkswagen)	• GDP/GVA growth (both national and regional) • Business investment • Sectoral diversity • Employment (national and regional) • Productivity growth • Wage growth • Exports
Liberal capitalism plus: public intervention limited to nurturing innovation, in normal times	• State-run research programmes • Public research and innovation institutions that have an ongoing dialogue with business and universities to develop an understanding of which interventions would be most effective • Public investment in early-stage research identified as promising/ essential • State rescue of firms in extreme circumstances	• Short-term: innovation activity (patents, or reductions in specific process or production costs) • Over the long-term: GDP growth; productivity; wages
Liberal capitalism: government standing aside to foster growth	• Horizontal policies: – Stable macroeconomic frameworks – Low business taxation – Tax reliefs on investment and research – Deregulation – Favourable business environment (e.g. high-quality infrastructure; skilled workforce)	• GDP growth • Business startups and churn • Business investment • Employment

Colebrook 2016

It is as yet unclear what the UK's approach to industrial strategy will be. The government published a consultation on its upcoming industrial strategy in January, with a final version expected in the summer. It seems likely that this will see the UK government make the move away from a purely 'liberal capitalist' approach towards something more akin to the US or European models, but it is not clear how far along this road it will go.

HOW CAN INDUSTRIAL STRATEGY HELP DRIVE IMPROVEMENTS IN AIR QUALITY?

IPPR has previously set out the following objectives that industrial strategy should seek to achieve in the UK (Colebrook 2017).

1. To spur innovation to boost productivity, pay and the quality of work.
2. To 'level up' growth and productivity in the regions and nations of the UK.
3. To grow the UK's manufacturing capabilities.
4. To put the UK on track to meet its climate and wider environmental targets.

The last of these core objectives makes industrial policy directly relevant to the government's obligation to reduce air pollution. It gives the government the ability to intervene to promote sectors that will help the UK achieve its air pollution and carbon reduction objectives, while disincentivising those economic activities which hinder positive outcomes in these areas.

One particularly relevant opportunity for industrial strategy identified by the government is the electric vehicle (EV) market in the UK. EVs emit no air pollutants through tailpipe exhaust, and therefore have a direct benefit on air quality. They also have lower associated carbon emissions than the average diesel or petrol equivalent. And, as the carbon intensity of electricity falls over the coming years, this differential will increase.

The maturity of this market has seen Britain attract and retain investment from leading global firms, including the recent £325 million investment in a new EV plant in Coventry, by Chinese automotive firm Geely (Shankleman 2017). The government has an ambition for the UK to be the best place in the world to develop, manufacture and use zero emission vehicles. Accordingly, it has committed to ensuring all new cars and vans produce zero emissions by 2040, and is providing over £850 million in investments into the low emission vehicle market and domestic industry (DfT 2015). Overall, the government's interventions into low and zero emissions transport is, according to the Office for Low Emission Vehicles, believed to be 'one of the world's most comprehensive packages of support for the sector' (OLEV 2017).

These strategic interventions have seen vehicle registrations grow by 145 per cent between 2014 and 2016, and, in 2016, the UK was the largest market in the EU for ultra low emission cars (EAMA 2017). More investment is needed, particularly in bringing down the cost of vehicles, developing charging infrastructure and in developing battery storage – all areas which are under consideration around the future of industrial strategy (OLEV 2017). Indeed, the government has committed to investing an additional £4.7 billion up to 2020/21 on research and development; this includes the new Industrial Strategy Challenge Fund,

which will support the development of battery technologies (DBEI 2017). Such strategic intervention in these markets could meet all four of the objectives listed above.

Previous IPPR research on the topic has also set out some initial ideas on how this might be achieved (Colebrook 2017).

- Spending on enabling infrastructure to encourage new investment in the low carbon economy.
- Subsidy of green consumer products (for example, electric cars) and scrapping polluting products (diesel cars) to encourage mass adoption.
- Use of public procurement as a source of demand for low-carbon products and processes.
- Policy stability to improve investors' certainty.

WHAT IS SMART MOBILITY?

Developments in digital technology have precipitated an era in which people and resources can be connected directly, without interactions being mediated by third parties. In transport, these developments have enabled the rise of new models of personal transport services, as well as accelerating the uptake of existing ones. Digital platforms – be it smartphone apps or websites – facilitate peer-to-peer transactions between those seeking information on or access to transport and the providers of such a service, and are increasingly affecting the pre-digital model of transport access and use in major cities around the world.

A number of emergent technological innovations are worth highlighting.

- **Journey planning platforms:** Websites and apps allow users to identify the most efficient means to move from one point to another within an urban environment, by providing real-time data and planning functions for public and private transport modes. Efficiency is usually defined in terms of cost and time, though other variables are available, and often journeys are made inter-modally.
- **On-demand taxi and private hire services:** These services facilitate peer-to-peer transactions between passengers and vehicle drivers, lowering transaction costs and increasing the utilisation rate of vehicles. The most well-known example of this is Uber.
- **Car clubs:** These allow rental of shared vehicles on a pay-per-use basis. They offer an alternative to private vehicle ownership - with cars only used when they are demanded and deemed the most efficient means of transportation. Recent innovation within the sector has exploited digital technology to influence user behaviours, including adaptive demand pricing.

Together these 'mobility' solutions – especially if joined by high quality and easily accessible public transport – could enable increasingly efficient transportation between destinations, utilising all transport mode systems instead of a choice between competing systems (ACUK 2011).

HOW CAN SMART MOBILITY HELP DRIVE IMPROVEMENTS IN AIR QUALITY?

In principle, new mobility services made possible by digital technology could impact on:

- the number, efficiency, reliability and affordability of journeys
- the number of vehicles on the road, their occupation levels and fuel mix
- the availability and physical accessibility of different transport modes across time and space.

In turn, changes in each of these areas will have a net effect on levels of public and active transport use.

In principle, new mobility services could, as a network, act to complement existing efforts to achieve more sustainable transport and travelling behaviours. Together, the availability of an array of new shared vehicle services, public and active transport, and journey planner platforms that allow ease of interaction with this system, could provide a seamless and integrated mobility ecosystem within urban environments. This would help reduce air pollution, congestion and CO2 emissions, and improve the liveability of cities.

Case study: Lisbon

A recent study in Lisbon by the International Transport Forum (ITF) modelled the impact of replacing all car and bus trips with shared vehicle trips, including shared taxis, 'taxibuses' and public transport, providing a system in which private ownership was no longer necessary (ITF 2016). The study found that this system required 3 per cent of the cars to make the same trips in 24 hours because of higher utilisation and occupancy rates.

The modelling suggested that this would lead to a 34 per cent fall in CO2 emissions, as well as reductions in air pollution, with higher utilisation also leading to faster turnover of vehicles, and thus more rapid clean technology penetration. Congestion dropped to negligible levels, enabling higher and more equitable access to healthcare, jobs and education. Moreover, smaller vehicle fleets meant that the parking requirement fell by 95 per cent, providing enormous opportunities for spatial renewal to increase liveability.

However, these network effects could also be negative, undermining efforts to realise more sustainable travelling behaviours by, for example, cannibalising public and active transport, as travellers increasingly opt for low-cost, on-demand private hire. In this world, the optimisation of vehicle hires and on-demand taxi options provide cheap alternatives to almost all other travel modes. Accordingly, action on pollution and congestion could be undermined, leading to impaired outcomes in these areas.

Recent IPPR research has argued that urban centres, such as London, that are affected by new mobility developments are at a tipping point, and that decision makers need to decide how to react to these changes (Laybourn-Langton 2017). Indeed, the pace and reach of technological change is such that a window of opportunity currently exists in which action can be taken by governments at all levels in the UK to ensure that

the positive potential of these services is realised. The chance of negative path dependency is intolerably high without action in this parliament.

Previous IPPR research (ibid) has also suggested a number of policy initiatives to ensure this opportunity is taken, which include the following.

- The creation of an explicit market framework for new mobility markets which would set the conditions by which providers operate and integrate with existing transportation options.
- Enabling the sharing and integration of data from different providers and forms of transportation through the creation of local (and potentially national) state coordinated data hubs (such as TFL in London). This should sit alongside the creation of locally integrated smart charging systems (like Oyster).
- Investment in the public transport network, including bike sharing schemes as well as busses, trains, trams and underground services (as applicable). This would likely require new sources of investment to be located.

3.
WHERE NEXT?

CONNECT THE DOTS

The scale of the UK's air pollution problem demands a bold response from government. Obviously, as a bare minimum, this response should include all necessary policy interventions to bring the UK back into compliance with EU and UK law on pollution levels in the shortest possible timeframe.

However, the reality is that these policy interventions will necessarily involve increasing the cost of using polluting vehicles such as diesel cars. This has often led policy makers to shy away from intervention, something which is clearly no longer tenable.

As such, this paper is calling for policy makers to 'connect the dots' between air pollution policy and wider government interventions, with a particular focus on smart mobility and industrial strategy. In doing so, we believe the government can turn air pollution from a political risk into an economic, social and environmental opportunity for the UK.

What would a joined up approach look like? This paper has made the case for an integrated strategy across three key areas of policy.

1. **Air quality policy:** Government should use legislation, regulation and road pricing to progressively phase out diesel cars across the UK (and, ultimately, all private cars in city centres), in order to clean the air and speed up the shift to cleaner vehicles and alternative forms of transport.
2. **Industrial strategy:** Government should invest in the research, design and commercialisation of new clean vehicles – including an increasing research and development spend, and tax reductions for industry – and provide a financial incentive for consumers to buy them (a smart scrappage scheme), in order to increase supply of green vehicles while reducing the cost of them.
3. **Smart mobility and transport policy:** Government should raise more revenue for roads, and use this to invest in public transport and the infrastructure needed create a favourable climate for more efficient travel – including modal shift and reduced car usage – in the UK's cities. This should include the use of smart mobility solutions.

Over the coming months, IPPR will be launching a new Clean Air and Roads Task Force. This will aim to set out in more detail what such a strategy would look like, and to work with government and local politicians to drive forward specific policy interventions in these areas.

NEXT STEPS

In the meantime, DEFRA has an opportunity to use its upcoming air quality plan as a way of signalling this new, more ambitious direction of travel. As such, we recommend that the government uses it to do the following.

1. Make an explicit pledge to phase out diesel cars over the coming years – and formally investigate even more ambitious targets – as part new national legislation.

The evidence is increasingly clear that the only way for the UK to reach compliance with EU and UK law, and dramatically improve air quality related health outcomes in the coming years, is the wholesale phase out of diesel vehicles (Quilter-Pinner and Laybourn-Langton 2016). Researchers are increasingly coming to a similar conclusion regarding all vehicles powered by a combustion engine, in order to meet the CO2 targets set out by the Paris Agreement (Rostrom et al 2017).

Other countries have started to act on this knowledge; both Norway and the Netherlands have stated their intentions to ban the sale of new petrol and diesel vehicles by 2025,[3] in contrast to the UK's existing soft target of achieving the same thing by 2040. Meanwhile, many other large cities – including Paris, Madrid, Athens and Mexico City – have already stated their intentions to ban the use of diesel vehicles in the near future (Harvey 2017). The UK's most ambitious city – London – is only currently focussing on additional charges to the oldest diesel vehicles.

The government should use their upcoming air quality plan to signal their intention to be a world leader on action to address air pollution, by making an explicit pledge to phase out the use of diesel cars in all major urban areas by 2025, and to ban them completely thereafter as part of a new Clean Air Act (ClientEarth 2016). They should also commit to formally investigating an even broader and more ambitious target, looking at all combustion engine based vehicles as part of the industrial strategy to be incorporated in the upcoming Vehicle Technology and Aviation (VTA) Bill.

2. Mandate the creation of a network of new clean air zones, covering all major urban areas in the UK.

The technical annex to the government's recent consultation document modelled the creation of 27 new CAZs across the UK (Defra and DfT 2017a). These zones were assumed to be of the minimum class (see figure x in chapter 1) necessary to bring the area into compliance. This resulted in 15 new zones equivalent to London's Ultra Low Emission Zone (ULEZ), which include regulation and charges on private diesel cars as well as busses and goods vehicles[4]. The result of this intervention over and above the base scenario (no policy action) would be to bring an additional 13 zones - 28 out of a possible 37 in total - into compliance by 2021.

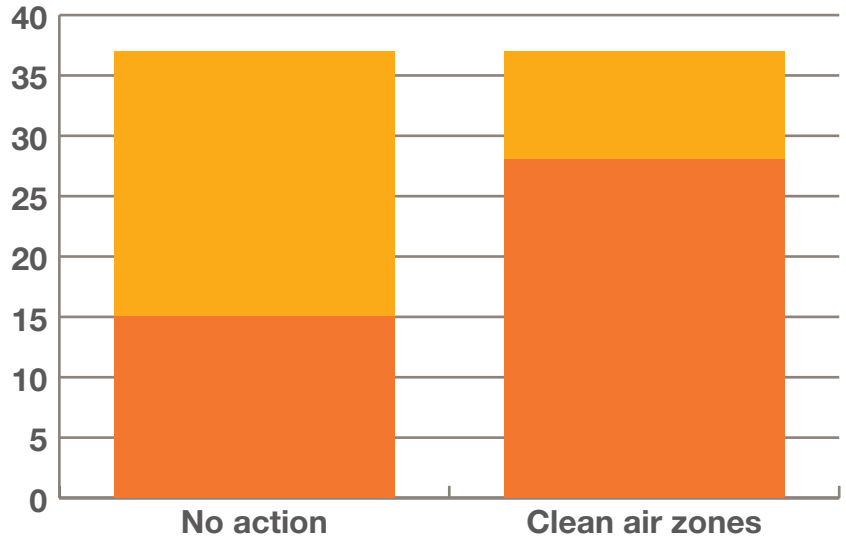
This would be a significant step in the right direction. We therefore believe that the government should mandate all 27 of these areas to move forward with these plans. However, we believe that these zones should and could be brought in by earlier; potentially 2019, as planned in London, rather than 2020. Moreover, in recognition of the fact that there are 'no safe levels' of air pollution, there should be an ongoing review of the vehicles included in these new zones, with the inclusion of Euro 6 diesel cars by 2025 as a natural next step.

3 IPPR will be undertaking further research to establish whether this timeframe is achievable in the UK.

4 In total, this modelling assumed four, three, five and fifteen cities required a Class A, Class B, Class C and Class D CAZ respectively.

FIGURE 3.1

Number of zones brought into compliance by 2021



Source: Defra and TFL, 2017

3. Utilise industrial strategy – in particular the creation of a new smart scrappage scheme – to incentivise business and individuals to drive improvements in air quality.

The government must balance more ambitious 'sticks' in the form of regulation, as set out above, with significant 'carrots', for both consumers – of which there are 11.4 million who currently drive diesel cars – and industry, who produce and make their profits from these vehicles. A good first step in looking to join air quality policy and industrial strategy would be to introduce a significant new scrappage scheme for diesel vehicles, and combine this with a significant extension to the government's plug-in car grant (Topham 2015).

The government's technical annex to their recent air quality plan consultation modelled both these options, finding that they had a noticeable – but ultimately limited – impact on air quality (Defra and DtT 2017). This is partly because they would only impact on a small proportion of vehicles on the road. However, it is also because the scrappage scheme proposed by the government is not 'smart'. For example, eligibility is not restricted to air pollution hotspots (for example, linked to clean air zones) and the most polluting diesel cars. In addition, the incentives created only allow people to spend money on new cars, rather than public transport as proposed by IPPR previously (Quilter-Pinner and Antink, 2017). This support should also be targeted towards only those on the lowest income (so as to address the regressive nature of regulation on diesel cars). Such a scheme was recently proposed and modelled by the Mayor of London (TFL 2017).

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