Chapter 4:
Air quality

AIM

London will have the best air quality of any major world city by 2050, going beyond the legal requirements to protect human health and minimise inequalities.

INTRODUCTION

Since the passage of the Clean Air Act over sixty years ago, there has been huge progress in improving air quality in London. The city now meets legal limits set by the national Air Quality Regulations[3] for most pollutants. There have been historic reductions in the levels of benzene, lead and sulphur dioxide pollution, which has greatly improved health and quality of life. This underlines the ability of effective and coordinated action to improve the air we breathe if we are bold enough to take strong action.

While the Great Smogs of the 1950s and 1960s are thankfully a thing of the past, this does not mean the problem has gone away. There is still much to be done to improve London's toxic air.

Two pollutants remain a specific concern. These are particulate matter (PM_{10}, $PM_{2.5}$ and black carbon) and nitrogen dioxide (NO_2). London is failing to meet the legal limit for NO_2. Particulate matter is damaging to health at any level and must be reduced.

Improving London's air quality requires the following actions:

- reducing exposure of Londoners to harmful pollution across London – especially at priority locations like schools – and tackling health inequality

- achieving legal compliance with UK and EU limits as soon as possible, including by mobilising action from the London boroughs, government and other partners

- establishing and achieving new, tighter air quality targets for a cleaner London, meeting World Health Organisation (WHO) health-based guidelines by 2030 by transitioning to a zero emission London

These actions reflect the importance of taking immediate action to protect public health and of raising awareness amongst Londoners. A City Hall commissioned report estimated that over 9,000 Londoners died prematurely from long-term exposure to air pollution in 2010.[4] The Mayor is committed to improving air quality as soon as possible, but recognises pollution will still be unacceptably high for a number of years due to historic policy failure and inaction, which have contributed to the scale of the problem. It is therefore necessary to reduce exposure (for example at schools) as far as possible and address the unacceptable health inequality caused by the unequal exposure to pollution by different groups.

In parallel to reducing exposure, the Mayor will take urgent action to tackle pollution to achieve legal compliance with UK and EU limits as soon as possible and in the most effective manner. This includes signature measures like introducing the Ultra Low Emission Zone (ULEZ) and transforming the bus and taxi fleets to be zero emission. This strategy

[3] Air Quality Standards Regulations 2010, SI number 2010/1001: http://www.legislation.gov.uk/uksi/2010/1001/contents/made
[4] Walton, H., Dajnak, D., Beevers, S., Williams, M. & Hunt, A. (2015), Understanding the Health Impacts of Air Pollution in London. Accessed from: http://www.kcl.ac.uk/lsm/research/divisions/aes/research/ERG/research-projects/HIAinLondonKingsReport14072015final.pdf or on the website: https://www.london.gov.uk/sites/default/files/hiainlondon_kingsreport_14072015_final.pdf

will set out a roadmap to compliance. However, this can only be achieved as quickly as possible if the London boroughs, government and others play their full part. Where available, the Mayor will use statutory powers to ensure this.

This strategy also recognises the need to go beyond legal limits, as these reflect political and economic considerations as well as health impacts. These should therefore be treated as a starting rather than an end point. WHO guidelines, meanwhile, were driven solely by the available health evidence and as a result are set much tighter for PM_{10} and $PM_{2.5}$. Achieving these more ambitious targets would provide many extra health benefits for Londoners. This strategy sets out the timescale, and the changes needed, to achieve these tighter targets.

Improving air quality also offers an opportunity to address climate change. In the past policy makers have focused on reducing carbon emissions which has resulted in unintended consequences like encouraging the use of diesel, the promotion of biomass boilers and gas engine combined heat and power systems being installed in areas of poor air quality. Instead in this strategy we are seeking to design integrated policies which deliver multiple benefits.

LONDON'S ENVIRONMENT NOW

The key evidence to support the Mayor's ambitions for London's air quality is summarised below. You can find out more about the evidence behind the policies and proposals in Appendix 2.

The WHO has published air quality guidelines, which inform the EU Air Quality Directive. These standards have been transposed into UK legislation. For more details on the legislative and policy background see Appendix 4, and for information on the main responsibilities of various organisations see Appendix 3.

Box 1 provides definitions for some commonly used terms.

BOX 1: AIR POLLUTION DEFINITIONS

What's the difference between emissions and concentrations?

London's air quality is affected by a number of factors. These include the weather, local geography and **emissions** sources from both within and outside London. Air quality is measured in **concentrations**, which are specific levels of a pollutant in a given area. Legal limits are set in relation to concentrations. Local emissions from vehicles, buildings, construction and other sources contribute significantly to air pollution in London. This is what the Mayor can most directly control and influence. That means we must understand how these emissions are being reduced to understand how effective particular policies and proposals could be. However, there is rarely a direct relationship between reducing emissions within London and reducing concentrations given the other factors at play. This is why the strategy will refer both to concentrations and emissions.

BOX 1: AIR POLLUTION DEFINITIONS (CONTINUED)

Pollutants of concern in London

Particulate matter (PM_{10} and $PM_{2.5}$): Particulate matter (PM) is a complex mix of non-gaseous material of varied chemical composition. It is categorised by the size of the particle (for example PM_{10} is particles with a diameter of less than ten micrometres (µm)). Most PM emissions in London are caused by road traffic, with exhaust emissions and tyre and brake wear being the main sources. Construction sites, with high volumes of dust and emissions from machinery are also major sources of local PM pollution. Other sources include wood burning stoves, accidental fires and burning of waste. However, a large proportion of PM comes from natural sources, such as sea salt, forest fires and Saharan dust. In addition, there are sources outside London caused by human activity. Small particles tend to be long-lived in the atmosphere and can be carried great distances. This imported PM forms a significant proportion of total PM in London.

Black carbon: This is a component of fine particulate matter ($PM_{2.5}$ and smaller). It is formed through the incomplete combustion of fossil fuels, biofuel, and biomass, and is emitted in both anthropogenic and naturally occurring soot. Black carbon also contributes to climate change. Black carbon warms the planet by absorbing sunlight and heating the atmosphere.

Nitrogen dioxide (NO_2): All combustion processes produce Nitrogen Oxide (NO_x). In London, road transport and heating systems are the main sources of these emissions. NO_x is primarily made up of two pollutants - nitric oxide (NO) and nitrogen dioxide (NO_2). NO_2 is of most concern due to its impact on health. However NO easily converts to NO_2 in the air - so to reduce concentrations of NO_2 it is essential to control emissions of NO_x

London's pollution concentrations

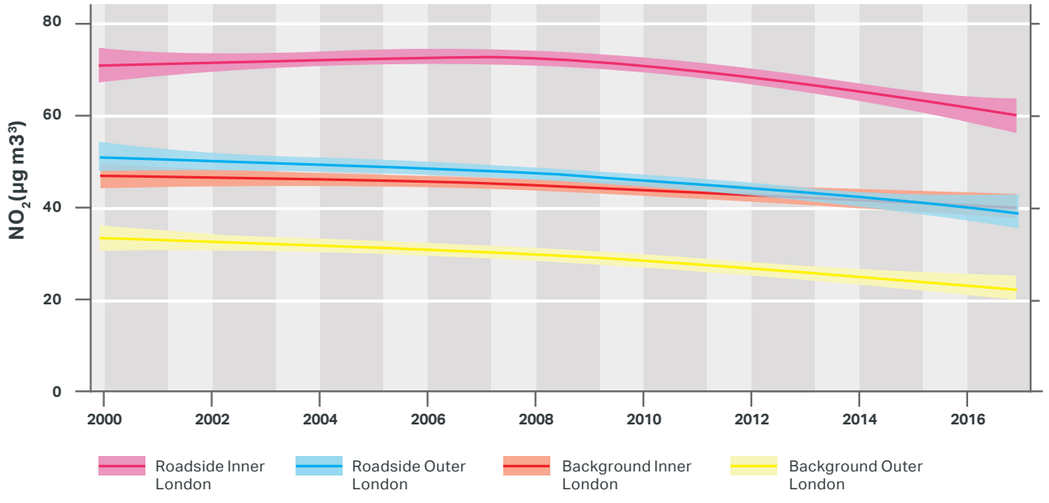
London's monitoring network offers a unique opportunity to understand trends in London's air quality. One way to view air quality monitoring data is to group monitors based on their location and distance from the roadside and look at average concentrations.

Figure 1, Figure 2 and Figure 3 show the average trend over the last decade or so for NO_2, PM_{10} and $PM_{2.5}$ concentrations, respectively, at sites in the London Air Quality Network (LAQN), grouped by type. Roadside monitors are within five metres of roads, while 'background sites' are located away from major sources of pollution.

Overall, there has been a gradual reduction in NO_2, PM_{10} and $PM_{2.5}$ concentrations at background sites in inner and outer London and at outer London roadside sites.

Inner London NO_2 roadside sites have shown a more variable trend but have seen a steeper decline from 2012. This decline is also reflected in the inner London PM_{10} and $PM_{2.5}$ roadside sites.

Figure 1: Trends in NO_2 in London – 2000 to 2016



Source: the London Air Quality Network and analysis by King's College London

Figure 2: Trends in PM_{10} in London – 2004 to 2016

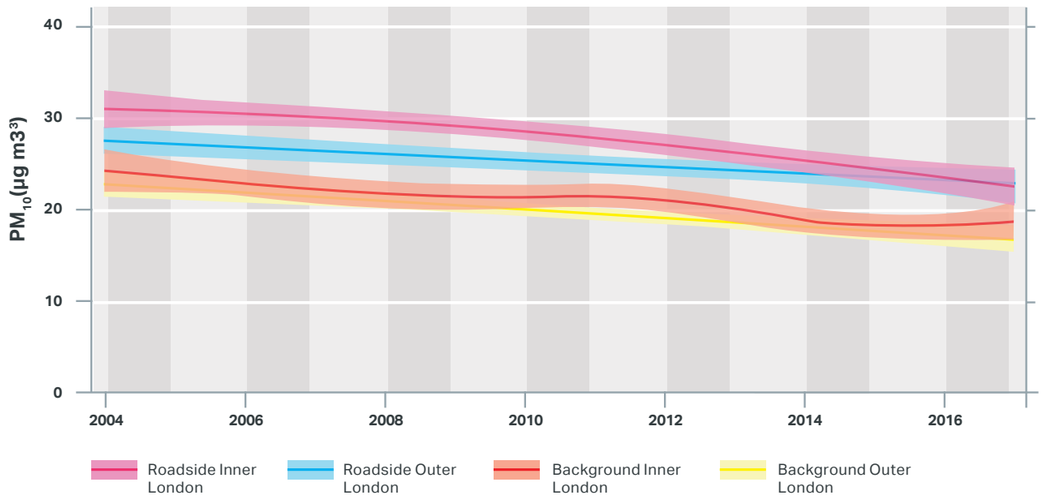
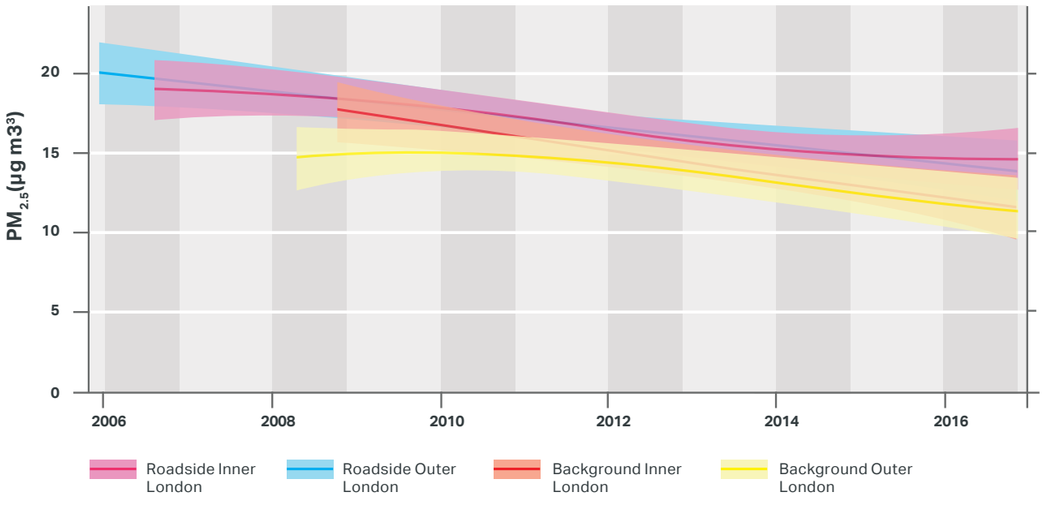


Figure 3: Trends in $PM_{2.5}$ in London – 2006 to 2016



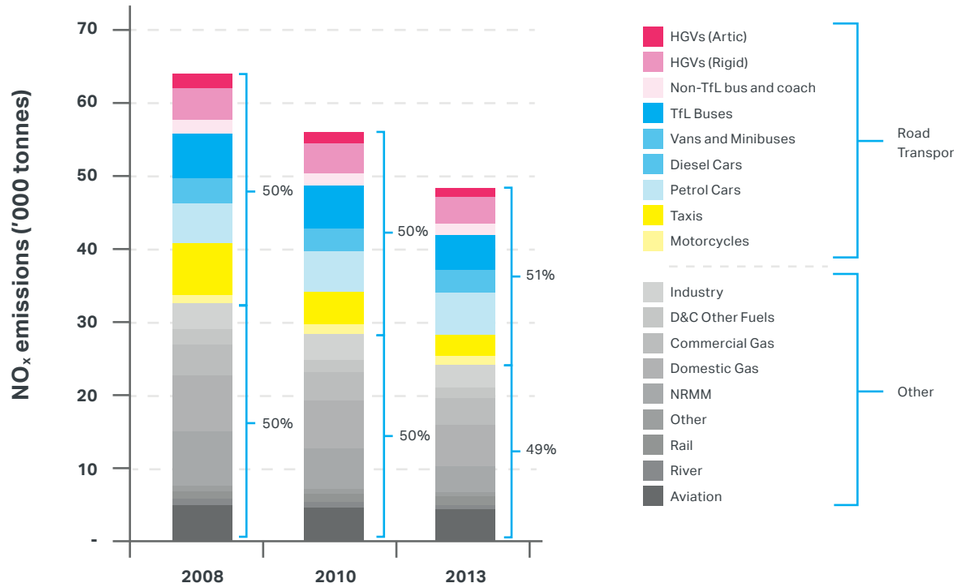
Source: the London Air Quality Network and analysis by King's College London

These reductions are important as they show, overall, that air quality is improving in London. However, the NO_2 EU annual mean limit value of 40 µg m^3 is being exceeded in many places and the PM health based guidelines are far from being met.

London's emissions

Currently around half of Nitrogen Oxides (NO_x) emissions come from road transport sources. The other half of emissions come from non-road transport sources, including construction, residential and commercial buildings, river, aviation, and industrial emissions (Figure 4). While much of the public attention remains focused on vehicles, a strategy must consider how best to tackle all of these sources. A similar breakdown also applies to PM_{10} emissions (Figure 5).

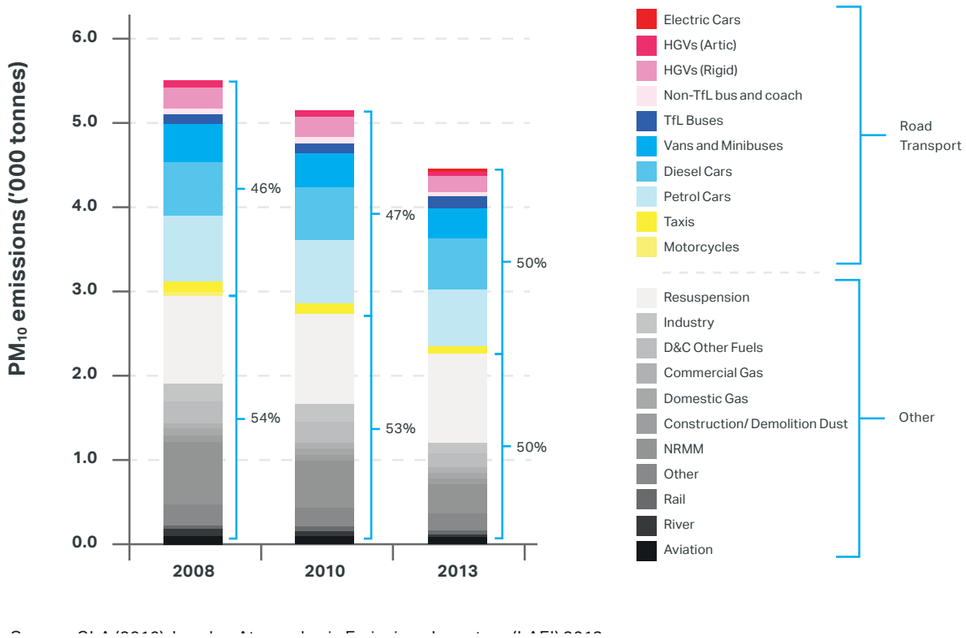
Figure 4: Emissions trend and main source categories– NO_x 2008-2013



Source: GLA (2017), London Atmospheric Emissions Inventory (LAEI) 2013 update.

Total NO_x emissions in London fell by 25 per cent over the period 2008 to 2013 (versus a 35 per cent target to 2015 in the previous air quality strategy).

Figure 5: Emissions trend and main source categories – PM_{10}, 2008-2013

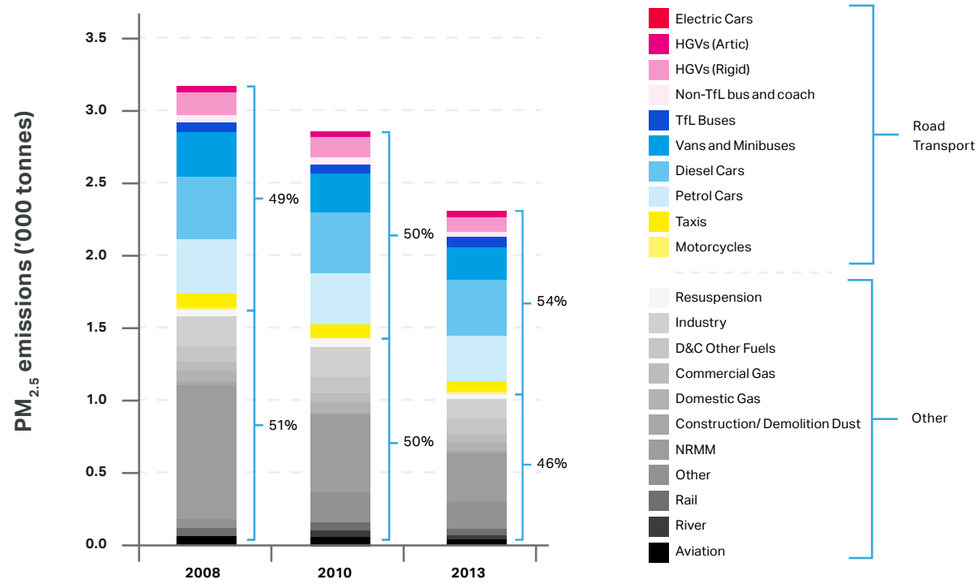


Source: GLA (2017), London Atmospheric Emissions Inventory (LAEI) 2013 update.

Total PM_{10} emissions fell by 20 per cent over the period 2008 to 2013 (versus a 31 per cent target to 2015 in the previous air quality strategy).

The source of $PM_{2.5}$ emissions in London is similar to that for PM_{10} but some sources, such as tyre and break wear are more significant.

Figure 6: Emissions trend and main source categories – $PM_{2.5}$, 2008-2013



Source: GLA (2017), London Atmospheric Emissions Inventory (LAEI) 2013 update.

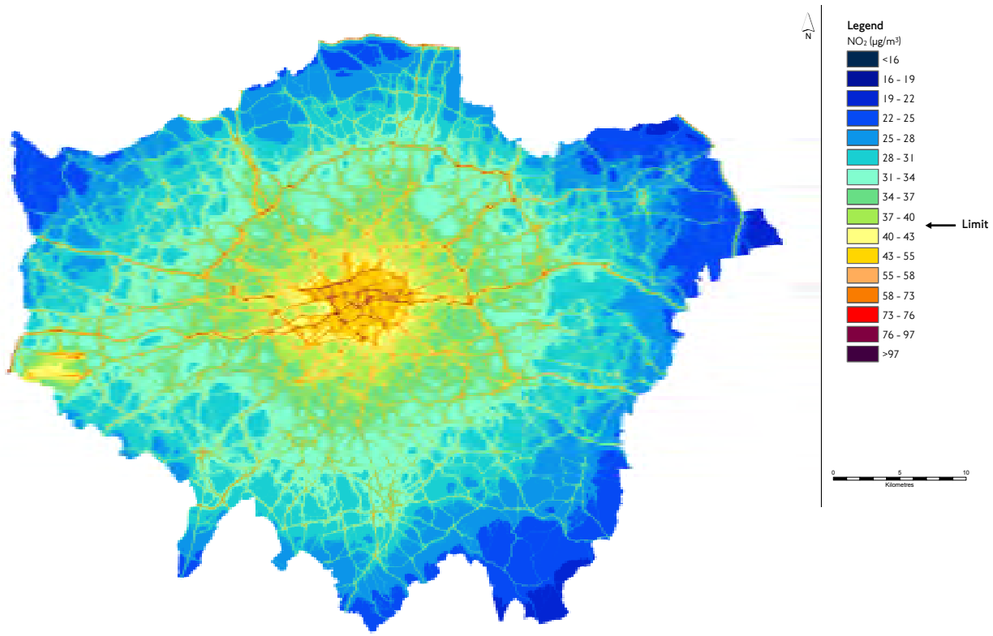
Total $PM_{2.5}$ emissions fell by 27 per cent over the period 2008 to 2013 (there was no reduction target in the previous air quality strategy).

Concentrations maps and exposure

Air quality concentration maps (Figure 7, Figure 8 and Figure 9) have been produced using the London Atmospheric Emissions Inventory (LAEI) and are validated against monitoring data. These maps show the areas of London that have the highest levels of pollution.

In 2013 roughly 1.9 million people, or 23 per cent of the city's population, were living in areas with average NO_2 concentrations above the EU limit value, mostly in central and inner London. Concentrations are still higher towards central London, with its higher density of emissions sources (Figure 7).

Figure 7: 2013 - Annual mean NO_2 concentrations



Source: GLA (2017), London Atmospheric Emissions Inventory (LAEI) 2013 Update.

Figure 8: 2013 - Annual mean PM_{10} concentrations

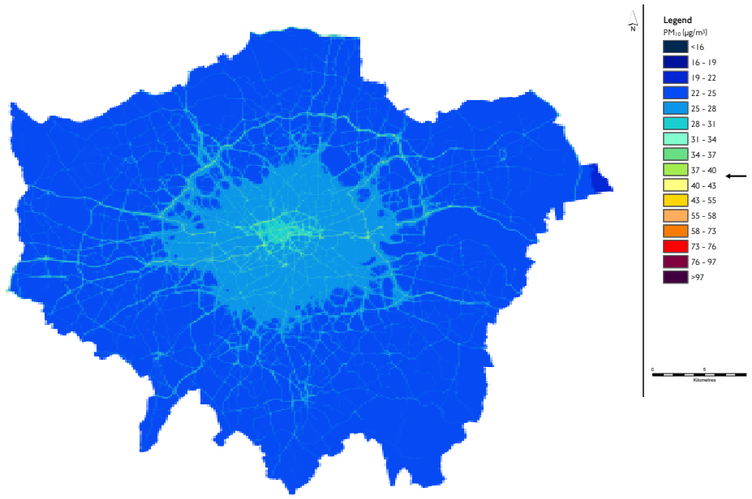
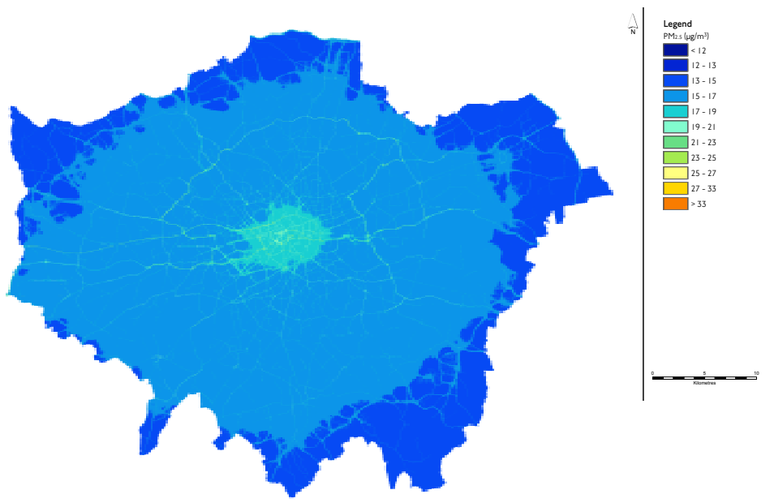


Figure 9: 2013 - Annual mean $PM_{2.5}$ concentrations



Source: GLA (2017), London Atmospheric Emissions Inventory (LAEI) 2013 Update.

Transboundary pollution

The challenge of cleaning London's air is made more difficult because a large amount of the pollution sources are not within London. The most recent analysis shows that sources outside London make the largest contribution to the estimated death risk from long-term exposure to $PM_{2.5}$ in London as a whole. This is also responsible for the majority of health effects associated with short-term exposure.

For example, 75 per cent of the cardiovascular hospital admissions associated with $PM_{2.5}$ result from pollution sources outside London, including industrial, agricultural and transport emissions from other countries. In addition, external sources are responsible for just under half of the mortality risk associated with NO_2.[5]

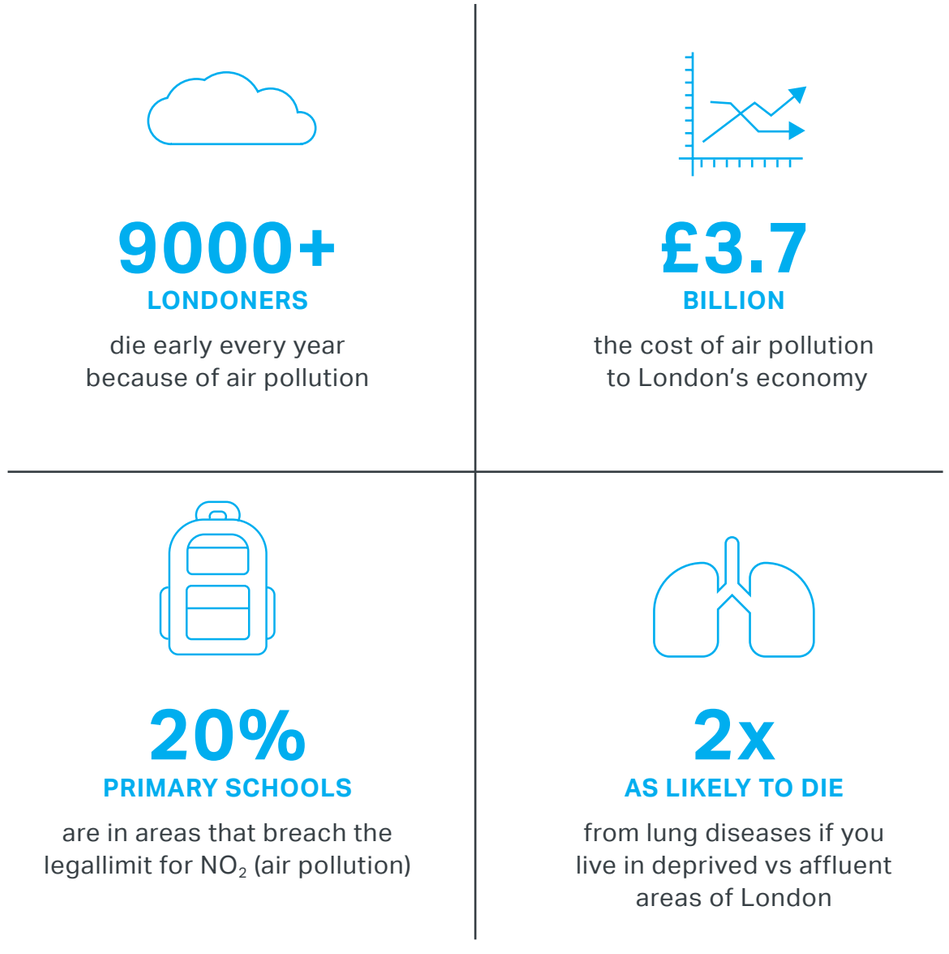
Even if all local emissions sources were removed, over half the health effects linked to London's air pollution would be felt. This is why, even as the UK leaves the EU, working closely with European partners is vital to reduce emissions across the continent.

The EU National Emissions Ceiling Directive must incorporate tighter emission limits for countries across Europe to address transboundary pollution on a quicker timescale. It is also why international action coordinated by the United Nations, including the Convention on Long-range Transboundary Air Pollution and its associated protocols, is needed to improve air quality in London.

Public health

Research has shown air pollution has a big impact on health at all life stages, from development in the womb to the end of life. A baby born in 2010 and exposed to that same level of air quality for its entire life would lose around two years of life expectancy. Mortality is not the only air pollution related health effect. In 2010, London air pollution was linked to over 3,000 hospital admissions. The economic cost of these health impacts in London is estimated as being up to £3.7bn a year (Figure 10).[6] There is also strong evidence that poor air quality affects children's lung development, and emerging evidence that improving air quality can reverse those effects. There is also increasing evidence of the link between exposure to pollution and dementia.[7]

Figure 10: Impacts of London's current air quality



Source: King's Report (2015).

[5] Walton, H., Dajnak, D., Beevers, S., Williams, M. & Hunt, A. (2015), Understanding the Health Impacts of Air Pollution in London. Accessed from: http://www.kcl.ac.uk/lsm/research/divisions/aes/research/ERG/research-projects/HlAinLondonKingsReport14072015final.pdf or on the website: https://www.london.gov.uk/sites/default/files/hiainlondon_kingsreport_14072015_final.pdf
[6] King's report 2015
[7] https://www.nature.com/tp/journal/v7/n1/abs/tp2016280a.html

Social inequality

These health impacts fall disproportionally on the most vulnerable communities, affecting the poorest, the youngest, the oldest, those with pre-existing health conditions and those from minority ethnic groups the most. Perhaps most worryingly, over 438 schools and 364 other educational institutions in London are located in areas exceeding safe legal pollution levels. People living in the most deprived areas are, on average, more likely to be exposed to poor air quality than those in less deprived areas.[8]

Tackling air pollution is not, therefore, just about the environment or about protecting public health. It is also about social justice. There is an urgent need to do more to tackle the public health inequalities associated with air pollution in London.

Climate change

Improving air quality also offers an opportunity to address climate change. In the past, policy makers have mainly focused on reducing carbon dioxide (CO_2) emissions. This has resulted in unintended consequences, like encouraging the use of diesel, and promoting biomass boilers and combined heat and power systems installation in areas of poor air quality.

In this strategy, the Mayor seeks to design integrated policies that offer multiple benefits.

One example of this is that black carbon has a higher global warming potential than CO_2. It is however possible to deliver quick wins to improve both air quality and prevent climate change. This can be done by adopting tighter $PM_{2.5}$ limits, promoting a switch to zero emission vehicles, replacing old, inefficient boilers, increasing energy efficiency of buildings, and creating a zero carbon city where energy mainly comes from renewable sources.

A review of the previous strategy, baseline and other evidence highlights several key issues to be addressed in the strategy.

Achieving legal compliance as quickly as possible

The last strategy did not reach the expected emission reductions. In part, this was due to the underperformance of Euro engine emissions standards. Targets in this strategy will need to reflect the latest evidence on vehicle emissions performance. It must set out appropriate steps by all levels of government to ensure a roadmap to compliance as quickly as possible.

Diesel vehicles, especially cars and vans

These remain the main source of road transport pollution. A comprehensive approach is required to phase out their use. Rather than a return to petrol, mode shift to sustainable forms of transport like walking and cycling wherever possible should be encouraged. Any vehicles that remain will need to transition to zero emission technology.

Tackling all sources of pollution

To achieve legal compliance as quickly as possible, all sources of pollution must be addressed. That means significantly increasing efforts in relation to non-transport sources. This is vital as the proportion of total emissions from non-transport sources is expected to increase over the lifetime of this strategy as our efforts on transport start to have an effect.

Government action

The government controls some of the most powerful policy levers to influence air quality, including fiscal incentives such as vehicle excise duty. It alone can legislate to provide new powers to tackle non-transport emission sources. Achieving legal compliance is dependent on further government action and leadership.

Maximising co-benefits between air quality and climate change policies

There is a risk that unintended consequences can arise if climate and air quality policies are developed in isolation, for example, in relation to energy and planning policy. Conversely, integrated policy design can bring benefits for both air quality and climate change, for example, by reducing black carbon emissions by switching to zero emission vehicles.

Further reductions are needed in PM_{10} and $PM_{2.5}$, particularly from transboundary pollution, tyre and brake wear and wood burning

Progress in dealing with PM emissions will stall in 2020 once exhaust emissions are significantly reduced. London is currently far from achieving WHO health-based limits for $PM_{2.5}$. One of the best ways to do this would be to reduce the number of vehicle kilometres by supporting a mode shift to walking, cycling and public transport. It will also be necessary to address wood burning-related emissions, which evidence suggests are a significant source of emissions, particularly on some of the most polluted days.

[8] King, K. & Healy, S. (2013), Analysing Air Pollution Exposure in London. Accessed from: https://www.london.gov.uk/sites/default/files/analysing_air_pollution_exposure_in_london_-_technical_report_-_2013.pdf (51 per cent of Lower Layer Super Output Areas (LSOAs) within the most deprived 10 per cent of London have concentrations above the NO_2 EU limit value. This contrasts with 1 per cent above the NO_2 EU limit value in the 10 per cent least deprived areas.)

ROLES AND LEGAL DUTIES

The Mayor

The Mayor has a legal duty to set out policies and proposals in this strategy to achieve compliance with the legally required air quality standards as quickly as possible.

The Mayor will act to improve air quality, where the Mayor or bodies within the control of the Mayor have relevant powers or resources. However, the Mayor does not have all the powers needed to improve London's air quality alone. This strategy sets out the responsibilities of all the organisations with a role to play in improving London's air quality, including the government, London boroughs and the Environment Agency.

The Mayor will help the boroughs in exercising their statutory duties to improve air quality. Where needed, the Mayor can use powers of direction to require boroughs to take steps to meet air quality objectives. These reserve powers can only be used following consultation. To support the boroughs the Mayor will operate the reformed London Local Air Quality Management (LLAQM) framework, which sets out clearly the action boroughs should be taking (Box 2).

The government

The ultimate responsibility for achieving compliance with the legally required air quality standards "as quickly as possible" lies with the government. The government is required to have an Air Quality Plan that will achieve this.

The government has unique tools available to it, such as control over fiscal incentives or the ability to legislate, which can accelerate compliance. Without a clear national plan to tackle emissions, especially from vehicles, the air in UK cities will not improve.

The government needs to give local authorities across the country extra powers to address non-transport pollution sources, to help scrap older polluting vehicles, and use fiscal and other incentives to encourage use of clean vehicles.

The London boroughs and public sector

London's boroughs have a duty to work towards achieving legal limits. They have an important role to play in addressing local pollution which is underpinned by the statutory LLAQM framework (Box 2).
There are a number of levers they can use to help. These include:

- emissions-based parking charges
- reducing pollution from new developments through planning (especially those not referred to the Mayor),
- improving the public realm for walking and cycling
- targeted measures at pollution hotspots such as vehicle restrictions and green infrastructure
- supporting installation of infrastructure to fuel zero emission vehicles

The statutory powers of the London boroughs are also important to continue to discourage antisocial burning of waste and the illegal use of wood-burning stoves. Finally, the boroughs have extensive public health duties and can play an important role in mainstreaming air quality into health-related activities.

The public sector has a wider duty to lead by example to reduce emissions and exposure to pollution, particularly in relation to its vehicle fleets, as well as to raise awareness.

BOX 2: THE LONDON LOCAL AIR QUALITY MANAGEMENT FRAMEWORK (LLAQM)

Local Air Quality Management (LAQM) is the statutory process by which a local authority is required to review the air quality within its area.
This system aims to determine if air quality objectives set within the Air Quality Regulations 2000 and the Air Quality (Amendment) Regulations 2010 are likely to be met in a certain area. It also drives improvements to achieve those objectives.
The London system used to be part of a national framework managed by Defra. However, in May 2016 the Mayor launched a bespoke system for the capital - London Local Air Quality Management (LLAQM).

This scheme was designed to encourage close working to help address this vital issue. This renewed focus on LAQM in London should help ensure that local authority air quality resources are protected, or where possible increased.

The basic statutory framework for local air quality management is via national Air Quality Regulations and Part IV of the Environment Act 1995. This remains in place and applies to London's 32 boroughs and the City of London. However, it was agreed with Defra that the relevant LAQM guidance for London should differ from the rest of the UK in recognition of the particular challenges the capital faces. London now has its own bespoke statutory policy and technical documents.

The key LLAQM requirements for boroughs are:

- to continue to monitor and assess air pollution in their areas
- to ensure an Air Quality Management Area (AQMA) is declared and in place for any locations that are exceeding air quality objectives and EU Limit Values
- to ensure that a current and relevant Air Quality Action Plan is in place for all AQMAs. The Action Plan should be updated every five years at a minimum, and progress against this should be reported annually
- to complete the annual monitoring and Action Plan update reports

LONDON WILL HAVE THE BEST AIR QUALITY OF ANY MAJOR WORLD CITY BY 2050

Current emissions sources

NO_x

Road Transport	51%
Non-road transport	11%
Built Environment	37%
Other	1%

PM_{10}

Road Transport	50%
Non-road transport	3%
Built Environment & Industry	19%
Resuspension	23%
Other	4%

$PM_{2.5}$

Road Transport	54%
Non-road transport	6%
Built Environment & Industry	30%
Resuspension	2%
Other	8%

Source: GLA (2016), London Atmospheric Emissions Inventory (LAEI) 2013 Update

Zero emission London 2050

TRANSPORT

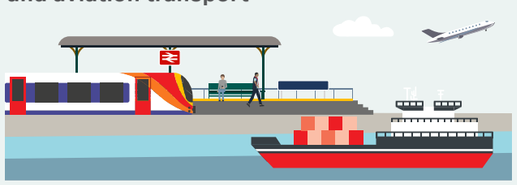
Strict new emission requirements across London (e.g. ULEZ, zero emission zone)

Mode shift to walking, cycling & public transport

All vehicles zero emission by 2050

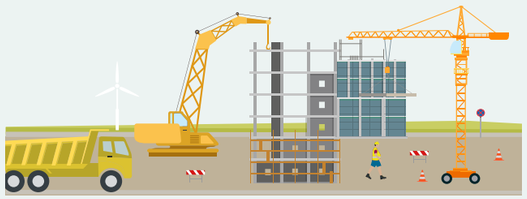
Zero emission bus fleet by 2037 and all taxis zero emission by 2033

Reduce emissions from rail, river and aviation transport

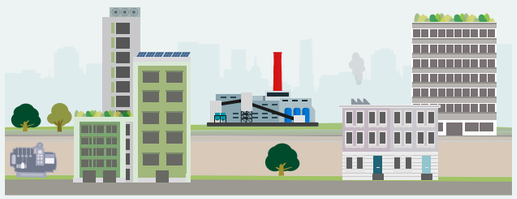


NON–TRANSPORT

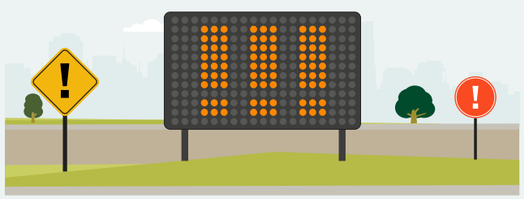
Prevent and reduce emissions from non-road mobile machinery



Reduce emissions from homes and workplaces, large scale generators, wood burning and biomass



Informing the public with alerts during high and very high pollution episodes



London Environment Strategy Objectives

EMPOWER PEOPLE TO REDUCE THEIR EXPOSURE TO POOR AIR QUALITY

MEET UK AND EU AIR QUALITY LIMITS AS SOON AS POSSIBLE

SET & ACHIEVE NEW, TIGHTER AIR QUALITY TARGETS FOR A CLEANER LONDON

"Protecting public health is at the heart of the Mayor's efforts to improve air quality."

Objectives, policies and proposals

OBJECTIVE 4.1 SUPPORT LONDON AND ITS COMMUNITIES, PARTICULARLY THE MOST VULNERABLE AND THOSE IN PRIORITY LOCATIONS, TO HELP EMPOWER PEOPLE TO REDUCE THEIR EXPOSURE TO POOR AIR QUALITY

Protecting public health is at the heart of the Mayor's efforts to improve air quality. It requires reducing exposure, including by raising awareness of the impacts of pollution and when air quality is particularly poor. The Mayor's long-term aim is to ensure concentrations are reduced to levels that are both safe and compliant. However, it is recognised that until further measures like the ULEZ are put in place there will remain times where pollution can be very poor due to historic policy failure and inaction that have contributed to the scale of the problem.

The Mayor wants to ensure that Londoners have access to the right information and, if appropriate, emergency action is taken to minimise public exposure. This objective also seeks to address the health inequality caused by the unequal exposure to pollution by different groups.

Policy 4.1.1 Make sure that London and its communities, particularly the most vulnerable and those in priority locations, are empowered to reduce their exposure to poor air quality

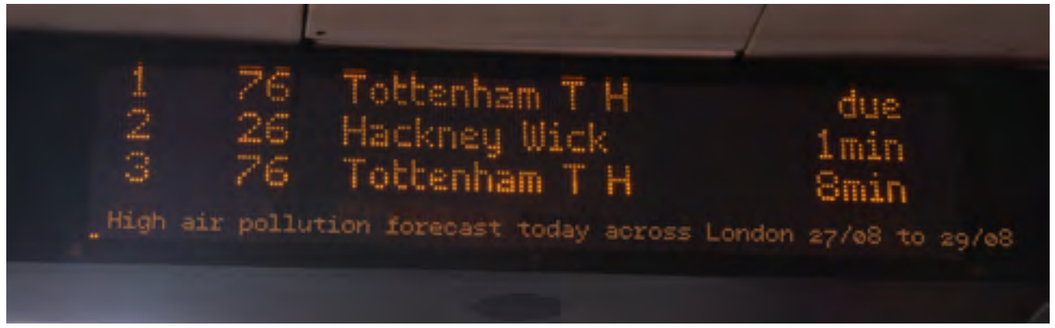
Proposal 4.1.1a The Mayor will provide better information about air quality, especially during high and very high pollution episodes, and use emergency measures where appropriate

Human health is affected by poor air quality. This is particularly true for vulnerable people like children, older people and those with pre-existing health conditions.

Timely air pollution information gives vulnerable people a chance to act to protect themselves, for example by reducing their exposure, or simply by carrying their medication. Schools, hospitals, GP surgeries, and care homes are places where those most vulnerable to the health impacts of air pollution episodes spend time and visit. The current air quality information system will be improved so that it targets these organisations and provides tailored advice. This will ensure that decision-makers have information on current pollution levels and upcoming episodes, as well as evidence-based advice on how to respond.

London-wide episodes of high pollution happen a few times each year. Very high pollution episodes are even more rare – occurring only every few years. On such occasions, it is important that Londoners are kept fully informed and can respond accordingly to minimise health impacts. The Mayor will continue to provide real time alerts during high or very high air pollution episodes by broadcasting information on bus shelters, Tube stations and on roadside signs. There will be a particular focus on reducing unnecessary private car use and other activities that contribute to pollution (Figure 11).

Figure 11: Air pollution forecast announcement



The Mayor will work with government to ensure that London has the powers needed to implement emergency measures such as short-term road closures or vehicle restrictions, where appropriate, during high pollution episodes.

Proposal 4.1.1b The Mayor will aim to do more to protect London's schoolchildren by reducing their exposure to poor air quality at school and on their journey to and from school

Reducing the exposure of schoolchildren to pollution is a priority because younger children are among the most vulnerable to its health impacts. Eight and nine-year-olds living in cities with high levels of fumes from diesel cars have up to ten per cent less lung capacity than normal.[9] More must be done to reduce exposure at schools wherever possible, and also at colleges, universities, and other educational establishments.

The Mayor will actively encourage London boroughs to use the funding available to them through TfL for Local Implementation Plans to improve air quality and reduce exposure, especially around schools and on journeys to and from school. To support this, City Hall will implement a schools audit programme to identify steps London boroughs can take to reduce exposure.

Proposal 4.1.1c Through the London Plan the Mayor will consider policies that mean new developments are suitable for use and for their particular location, taking into account local air quality

Through the new London Plan, the Mayor will consider policies that seek to reduce exposure to existing poor air quality through design or mitigation strategies. These are vital where new development will be used by large numbers of people who are particularly vulnerable to poor air quality, like children or older people.

In addition, a requirement to consider the overall suitability of a site (and its design layout) for the proposed end use in terms of exposure to pollution will be considered in the new London Plan.

Policy 4.1.2 Improve the understanding of air quality health impacts to better target policies and action

Proposal 4.1.2a The Mayor will produce and maintain the London Atmospheric Emissions Inventory (LAEI) to better understand pollution sources in London

To tackle air pollution effectively, it is necessary to understand its sources. The Mayor will produce and maintain the LAEI. This will help us understand the key emissions sources and how they contribute to poor air quality, both now and projected into the future. It will be used to calculate health impacts, exposure and health inequalities.

[9] https://www.kcl.ac.uk/lsm/research/divisions/aes/research/ERG/research-projects/EXHALE.aspx

Proposal 4.1.2b The Mayor will work with boroughs to safeguard the existing air quality monitoring network and enhance it by exploiting new technologies and approaches such as personal and localised monitoring

Through the LLAQM framework, boroughs are required to monitor and report on local air quality. The GLA, TfL, and London boroughs fund and maintain one of the most extensive automatic monitoring networks of any world city. This is supplemented with additional monitoring.

It is one of the ways in which local authorities play a crucial role in helping to understand and address air pollution. Their high quality monitoring data helps us to understand the long-term trends in air pollution. It is used to validate the comprehensive pollution modelling provided by the Mayor through the London Atmospheric Emissions Inventory (LAEI).

The Mayor will continue to oversee this monitoring network and will ensure sites crucial for understanding long-term trends or measuring the impact of local measures are not removed or moved. The Mayor will use statutory powers to

do this, as well as working with boroughs to enhance monitoring networks where possible. Particular areas of focus are increasing the number of long-term NO_2 diffusion tube monitoring, especially in air quality focus areas. Another is identifying opportunities for additional $PM_{2.5}$, black carbon and ultra fine particle monitoring. The Mayor will work with boroughs and others to encourage innovation in monitoring.

It is getting easier for people and groups to buy personal and relatively low-cost monitoring systems. These can be valuable tools, but knowing how best to use and locate the monitors is vital if the results are to provide meaningful information. It is also important to understand the limitations of monitoring equipment and how best to interpret and publish results. The Mayor will offer guidance and advice on how air quality is monitored in London, and help people understand what type of equipment is available.

The Mayor will also establish a process for accrediting monitors for different purposes.

OBJECTIVE 4.2 ACHIEVE LEGAL COMPLIANCE WITH UK AND EU LIMITS AS SOON AS POSSIBLE, INCLUDING BY MOBILISING ACTION FROM LONDON BOROUGHS, GOVERNMENT AND OTHER PARTNERS

Alongside reducing exposure, the Mayor will take urgent action to tackle pollution to achieve legal compliance with UK and EU limits as quickly and effectively as possible. However, legal compliance can only be achieved if the London boroughs, government and others also play their full role and take ambitious action.

This objective addresses existing emissions from transport as well as emissions from non-transport sources. It sets out what both the Mayor and others need to do to achieve legal compliance as quickly as possible. However, the main responsibility for ensuring that compliance is achieved rests with government. They can use unique tools, such as control over fiscal incentives, which can accelerate compliance.

Road traffic is often the biggest cause of poor air quality in places where people live and work. Diesel is the most significant source of NO_x emissions, which contribute to illegal levels of NO_2. The reason for this is partly because of the under-performance of some Euro Standards for diesel vehicles over time (see Box 3). There are major discrepancies between official emission measurements and real-world vehicle performance in urban environments. There are also issues with the sheer number of vehicles on London's roads, which causes congestion and exacerbates pollution. The introduction of 'real-world' testing into the 'Euro 6' European vehicle-type approval process will mean that, on average, new vehicles are far less polluting than previous models. This is particularly so for heavier transport like lorries.

The Mayor is committed to policies that support phasing out fossil fuels, especially diesel, and encourage take up of zero emission vehicles in London. The Mayor will encourage a shift to more sustainable travel like walking, cycling or public transport throughout London too.

"The Mayor is committed to policies that support phasing out fossil fuels, especially diesel, and encourage take up of zero emission vehicles in London.

This also contributes to the Mayor's wider ambitions including:

- all taxis and private hire vehicles to be zero emission capable by 2033
- all TfL buses to be zero emission by 2037
- all newly registered road vehicles driven in London to be zero emission by 2040
- London's entire transport system to be zero emission by 2050

These efforts are supported by the wider policy framework in the draft Mayor's Transport Strategy which promotes further mode shift, tackles congestion and encourages freight consolidation. This section should be read alongside the draft Mayor's Transport Strategy.

The section also looks at non-road transport sources, including construction, buildings, the river and aviation, before setting out the action that needs to be taken by others – especially government – to achieve full compliance as quickly as possible.

BOX 3: WHY PRIORITISE THE PHASING OUT OF DIESEL VEHICLES?

Diesel vehicles are the single biggest cause of NO_x emissions. Any strategy to improve air quality must consider how to address these.

Rapid dieselisation of the fleet was caused by previous government policy which incentivised low CO_2 emitting vehicles through the vehicle excise duty and company car tax regimes. These powerful levers encouraged manufacturers to invest in the development of diesel technology – an attractive solution for consumers, which has historically delivered better fuel economy and improved durability when compared to petrol.

However, it is widely acknowledged that the real world emissions performance of diesel vehicles did not match that achieved in laboratory tests. This problem is in part a failure in the legislation to make the type-approval emissions test rigorous enough and a poor response by regulators who were aware of the issue for some time.

This has also been compounded by the revelations that at least one manufacturer has deliberately used test beating software on their diesel vehicles, whilst others may be taking steps to 'bend the rules'.

A landmark study by the International Council for Clean Transportation demonstrated that technologies exist to reduce emissions from vehicles but they are not being employed consistently by manufacturers. Although EU legislation lowered NO_x permitted emissions for diesel cars by 85 per cent between 2000 (Euro 3) and 2014 (Euro 6), average on-road emission levels only decreased about 40 per cent over the same period.

In general, diesel vehicles emit more NO_x than petrol equivalents and the capital still has a legacy fleet of older diesel vehicles capable of emitting high levels of PM emissions (prior to the EU mandating diesel particulate filters from 2011). It is therefore unsurprising that diesel cars are currently the highest contributor to road transport NO_x and $PM_{2.5}$ emissions in London.

The latest emissions standard for heavy duty engines (Euro VI), which includes on-highway verification, has started to alleviate these shortcomings. For example, TfL has seen a 90 per cent reduction in NO_x emissions between Euro V and Euro VI buses.

Unfortunately, similar on-road verification introduced for cars and vans, known as 'real driving emissions' is yet to be seen. The introduction of real driving emissions has potential to create parity between petrol and diesel vehicles. However, it has been plagued by delays and for many this is seen as too little too late, with legislation not taking full effect until 2021. Even then, overly generous conformity factors have been introduced to allow for error margins.

This means some of the newest trucks on the road are expected to have emissions of NO_x and PM better than some family cars. The introduction of independent testing, such as the Mayor's Cleaner Vehicle Checker, will help to alleviate this issue by creating transparency and improving consumer confidence.

In all, the Mayor strongly believes that government must deliver effective national incentives exclusively under their control (such as taxation and scrappage) to discourage diesel while these vehicles remain more polluting. Longer-term, the Mayor is committed to policies that support phasing out all fossil fuels and accelerating the uptake of zero emission vehicles in London to deliver further improvements in air quality.

Policy 4.2.1 Reduce emissions from London's road transport network by phasing out fossil fuelled vehicles, prioritising action on diesel, and enabling Londoners to switch to more sustainable forms of transport

Proposal 4.2.1a The Mayor will promote and prioritise more sustainable travel in London including walking, cycling and public transport, as part of the Healthy Streets Approach

It is now clear that much of the poor air quality in London is linked to private car use. This is not only during periods of high pollution, but every day. Dependence on cars also has negative health, congestion, business and community impacts. As part of the Healthy Streets Approach, the Mayor wants to encourage people to walk, cycle and use public transport instead.

In order to keep London moving, improve air quality and reduce carbon, Londoners' dependency on cars must be reduced. Analysis suggests that three quarters of journeys now made by car could be done on foot, by bicycle or by public transport. Such a shift also encourages Londoners to lead a more active and healthy lifestyle. In addition, it creates a more attractive city in which to live, visit and do business. It is also an effective way of tackling emissions as it helps to address those from tyre and brake wear as well as from exhausts. That means reducing the number of kilometres driven will have a greater impact overall on PM_{10} and $PM_{2.5}$.

Proposal 4.2.1b The Mayor, through TfL, will clean up the bus fleet by phasing out fossil fuels, prioritising action on diesel, and switching to zero emission technologies

A more sustainable approach to transport in inner and outer London will require a big increase in the number of journeys made by bus. Good bus services are fundamental to making people less reliant on cars and supporting London's sustainable growth. However, it is essential that these journeys are delivered by a clean bus fleet. This is part of the Mayor's commitment to lead by example. Figure 12 sets out the action to be taken to clean up the bus fleet.

"All TfL buses will meet the Euro VI diesel standard for NO_x and PM by 2020"

In line with the draft Mayor's Transport Strategy, TfL buses will be expected to meet the following requirements:

- all new double-deck buses will be hybrid, electric or hydrogen from 2018
- all double-deck buses in central London will be Euro VI and hybrid by 2019
- all TfL buses meet the Euro VI diesel standard for NO_x and PM by 2020
- all new single-deck buses will be zero emission from 2020
- the whole bus fleet will be fully zero emission by 2037 at the latest. This means making the most of London's world-leading reputation for the take up of electric and hydrogen technology in the bus fleet

As these improvements are delivered the cleanest buses will be prioritised along the most polluting routes using Low Emission Bus Zones.

Figure 12: Cleaning the TfL bus fleet

		NOW	2020	2025	2030	2035	2037
Bus procurement and retrofit		Retrofit of existing double decks to Euro VI standards TfL will buy only electric or hydrogen double decks	TfL will buy only electric or hydrogen single decks	TfL will buy only electric or hydrogen double decks			
Bus fleet in central London	single-deck		All single decks electric or hydrogen				All TfL buses electric or hydrogen
	double-deck		All double decks Euro VI and hybrid			80% of double decks electric or hydrogen	
Bus fleet in inner and outer London	single-deck			50% of single decks electric or hydrogen	90% of single decks electric or hydrogen	All single decks electric or hydrogen	
	double-deck		All double decks meet Euro VI standard as a minimum	More than 85% of double decks hybrid, electric or hydrogen	60% of double decks hybrid; 40% electric or hydrogen	20% of double decks hybrid; 80% electric or hydrogen	

Proposal 4.2.1c The Mayor, through TfL, will reduce emissions in the taxi and private hire fleet by phasing out fossil fuels, prioritising action on diesel, and switching to zero emission technologies

For too long, the taxi trade has been restricted to diesel vehicles. The Mayor wants the capital's taxi fleet to be the greenest in the world. To phase out diesel, all newly licensed taxis will be required to be zero emission capable from 2018.

The recent sharp increase in private hire vehicles means they must take a lead and accelerate the uptake of Ultra Low Emission Vehicles (ULEVs). However, policies affecting the taxi and private hire vehicles industries must take into consideration the costs and operating models of each industry. The Mayor will encourage and quicken the take up of zero emission capable taxis by working with the trade to create an action plan. The Mayor will provide a mixture of financial incentives, infrastructure and regulation (including maintaining a taxi age limit, currently set at 15 years). The aim is to achieve a minimum of 9,000 such vehicles in the fleet by 2020.

The Mayor will also require all new private hire vehicles to meet continually improving minimum emission standards as set out in the draft Mayor's Transport Strategy. When combined, this will achieve an entirely zero emission capable taxi and private-hire fleet by 2033 at the latest.

Proposal 4.2.1d The Mayor aims to reduce emissions from private and commercial vehicles by phasing out and restricting the use of fossil fuels, prioritising action on diesel

The Mayor will further accelerate the uptake of cleaner vehicles in London by bringing forward and expanding the ULEZ.

The Mayor alone does not have the legal power to ban diesel vehicles (or any other vehicles) across London. The Mayor can, however, apply charges to vehicles on a number of grounds, including addressing congestion and emissions. Charging has been shown to be very effective at influencing behaviour. This includes promoting a shift to more sustainable modes of travel via the Congestion Charge and reducing the number of polluting vehicles in London via the Low Emission Zone.

The Mayor, through TfL, will keep under review existing and planned road user charging schemes, including the Congestion Charge, Low Emission Zone, ULEZ and the Silvertown Tunnel schemes, to ensure they prove effective in furthering or delivering the policies and proposals of the draft Mayor's Transport Strategy.

The Mayor will also consider the development of the next generation of road user charging systems. These could replace schemes such as the Congestion Charge, Low Emission Zone and ULEZ. More sophisticated road user charging and/or workplace parking levy schemes could be used to contribute to achieving the policies and proposals in the draft Mayor's Transport Strategy, including mode share, road danger reduction, environmental objectives, reducing congestion on the road network, and supporting efficient traffic movement. In doing so, the Mayor will consider the appropriate technology for any future schemes, and the potential for a future scheme that reflects distance, time, emissions, road danger and other factors in an integrated way.

Road user charging schemes will include (subject to the development of detailed proposals and consultation) introducing the central London ULEZ standards and charges in 2019. There will also be an Emissions Surcharge on the Congestion Charge from October 2017 until the introduction of the ULEZ.[10]

The Mayor proposes (subject to the development of detailed proposals and consultation) that the ULEZ is expanded to Inner London by 2021 for light vehicles (cars, vans, minibuses and motorbikes), covering an area up to the North / South Circular. It is also proposed that by 2020 the ULEZ is expanded London-wide for heavy vehicles, which will result in only an estimated one per cent of road length in Outer London remaining in exceedance of the NO_2 limit values in 2025: primarily on the North Circular and around Heathrow (which is a matter for national policy).

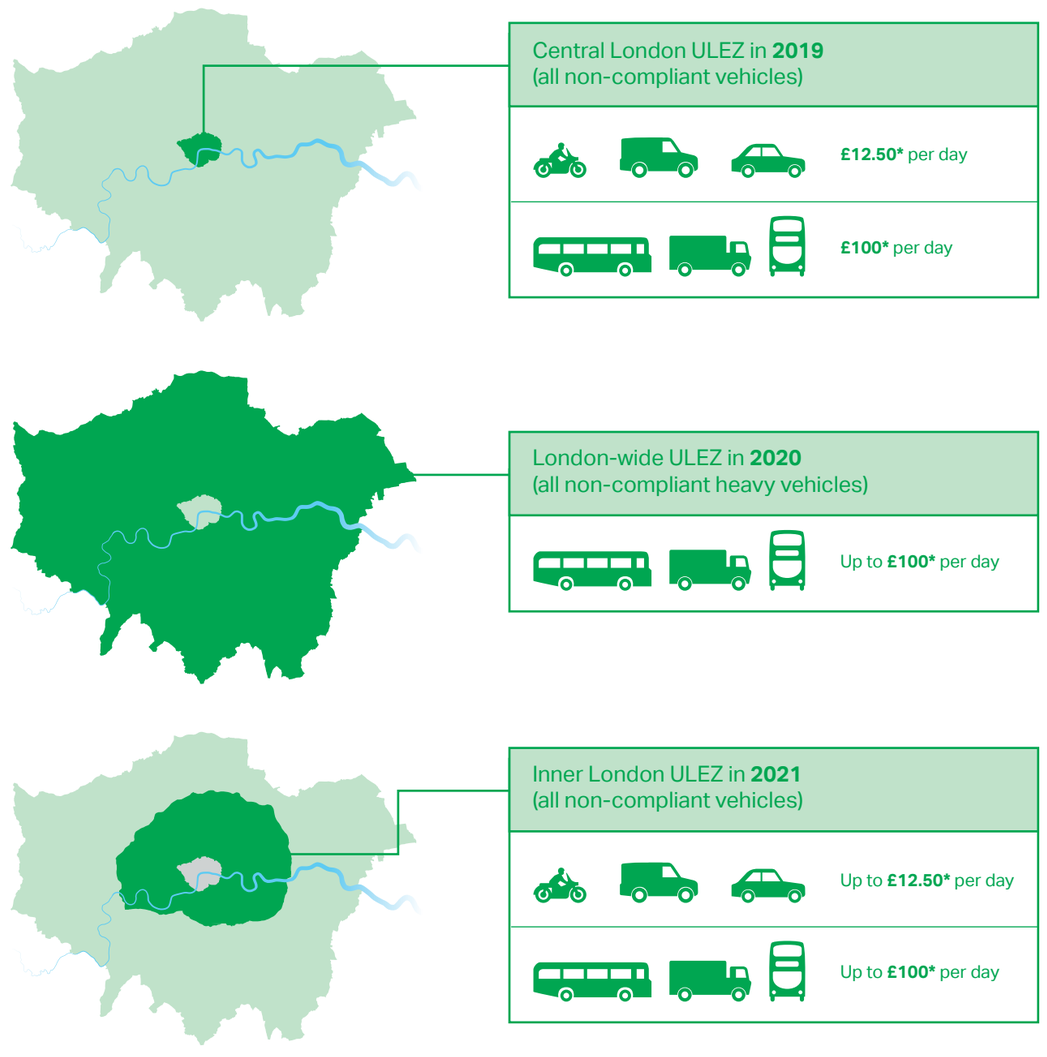
[10] There are slightly different arrangements for residents of the central London area, who will remain subject to the T-charge while the ULEZ resident sunset period is in effect.

The expansion of the ULEZ for light vehicles to Outer London would affect an additional 1.7 million households. Furthermore, there is no appropriate boundary road for a wider zone that incorporates the north circular other than the greater London boundry.
It is likely that targeted local measures such as local road closures, vehicle restrictions or other interventions could be equally effective and as likely to bring this remaining one per cent of road length into compliance, and in a quicker timeframe. The Mayor will keep the situation under review and consider what measures will be most effective and likely to secure equivalent compliance on those Outer London roads in the shortest time possible.

The Mayor will also work with boroughs to explore borough-level restrictions on fossil-fuelled vehicles, prioritising diesel vehicles (for example diesel surcharges on resident parking permits), and initiatives to incentivise ultra low emission vehicles.

The Mayor will take steps to develop a Cleaner Vehicle Checker that will help members of the public understand the emissions impact of their diesel cars and vans. The government should also introduce a complementary national car labelling scheme to raise awareness about the differential pollution emissions from vehicles at the time of purchase (including for second hand vehicles).

Figure 13: ULEZ proposals to be consulted on



ULEZ standards: petrol – Euro 4; Diesel – Euro 6/VI; Motorcycle and L-Cat – Euro 3
* ULEZ charge levels are indicative only to refer to the current scheme proposals.

"London's freight accounts for over ten per cent of $PM_{2.5}$ emissions and around a fifth of traffic in the capital."

Proposal 4.2.1e The Mayor aims to reduce emissions from freight through encouraging a switch to lower emission vehicles, adopting smarter practices and reducing freight movements through better use of consolidated trips

Almost all of London's freight is carried by road, using diesel vehicles. This activity accounts for over ten per cent of $PM_{2.5}$ emissions[11] and around a fifth of traffic in the capital.[12] In the morning peak, freight traffic is around a third of the total traffic in central London.

London's freight movement is also growing in an inefficient way. Many deliveries of non-time critical goods are unnecessarily made at congested times of the day. Lorries and vans are often less than half full. It is estimated as many as two in every three delivery slots are missed.[13] This means repeat trips, which cause even more congestion and emissions. The Mayor will work with London Councils on possible changes to the London Lorry Control Scheme, which controls the movement of heavy goods vehicles at night and at weekends, so that the scheme can reduce emissions of air quality pollutants and CO_2, as well as minimising noise and encouraging safer vehicle design.

The Mayor will take steps to develop a Cleaner Vehicle Checker to help fleet operators understand the emissions of their diesel cars and vans, and will work with industry to set out a clear plan to phase out fossil fuels. This is vital, especially amongst heavier specialist vehicles, which are often more challenging to switch to cleaner alternatives. The plan will help better understand alternative fuels, and how they can be used to bridge the transition towards zero emission technologies.

The Mayor has set a number of targets to cut emissions and reduce the amount of freight movement in central London. This includes reducing construction traffic by five per cent by 2020, and reducing the number of freight trips during the morning peak by ten per cent by 2026.

This can be achieved by:

- stimulating the supply, and increasing the take up, of low emission commercial vehicles through regulatory, procurement and pricing incentives
- making the most efficient use of vehicles by developing a strategic consolidation and distribution network to protect industrial land and reduce the impact of freight and servicing trips on London's streets (Box 5 describes a low emission freight pilot)
- examining other ways in which freight can be delivered and moved around. For example, using cargo bikes and motorbikes for shorter, smaller deliveries in central London and town centres, and making better use of river and rail services.

[11] Transport statistics Great Britain 2013
[12] NO_x emissions in Greater London LAEI 2010
[13] Online Shopping Report conducted by ICM on behalf of the GLA in August 2015

BOX 4: CROWN ESTATE REGENT STREET CONSOLIDATION

London's West End is a very popular shopping area and is home to many household name brands. However, research revealed that 73 per cent of consumers found the experience exhausting and overwhelming, while 63 per cent complained of being jostled. A delivery solution was required that helped reduce traffic but drive footfall, and that would allow retail staff to return their focus to selling.

The retailers on Regent Street and in the West End have worked with Clipper Services to bring together deliveries despatched from a single consolidation centre. The centre brings together consumables from all suppliers to one easily accessible point, combining deliveries with other West End companies to streamline a previously complex and inefficient system into a simple and effective one. It also releases extra in-store floor space for retail.

As a result, there has been a 77 per cent reduction in vehicle movements in the area. There has also been an improvement in air quality, with 8 kg less particulate matter emitted each year within central London; the equivalent of an average car driving more than 6,200 times around the M25.

BOX 5: GLA AND GNEWT LOW EMISSION FREIGHT PILOT AND TFL'S LOCITY INITIATIVE

The GLA and Gnewt Cargo (a leading SME with a proven logistics operator who specialises in electric vehicles), have secured circa £1.1m from Innovate UK to run a low-emission freight and logistics trial for larger commercial freight vehicles from April 2017 to 2019. This will trial freight collections using large zero emission vehicles and test their commercial viability with the aim of encouraging the widespread introduction of low and zero emission vehicles to other commercial fleets operating in London and across the UK.

Through TfL's LoCITY initiative, the Mayor is increasing the supply and uptake of low emission commercial vehicles and associated infrastructure which will help businesses transition to cleaner vehicles.

Proposal 4.2.1f The Mayor will work with stakeholders to understand the barriers to deploying ultra low emission auxiliary power units on vehicles and encourage further take up in London

Secondary engines or, auxiliary power units, are used on some vehicles mostly to provide refrigeration for cool or frozen food deliveries.

Although they are generally small, these engines commonly run on 'red diesel'[14] and are regulated to a much lower standard than the main vehicle engine. There are ultra low emission alternatives available, but they are not widely used. The Mayor will work with stakeholders to understand the barriers to deployment, and promote the use of cleaner auxiliary power units when possible. This will include considering the appropriate tax treatment of 'red diesel', so that a switch to ultra low emission technologies can be financially incentivised.

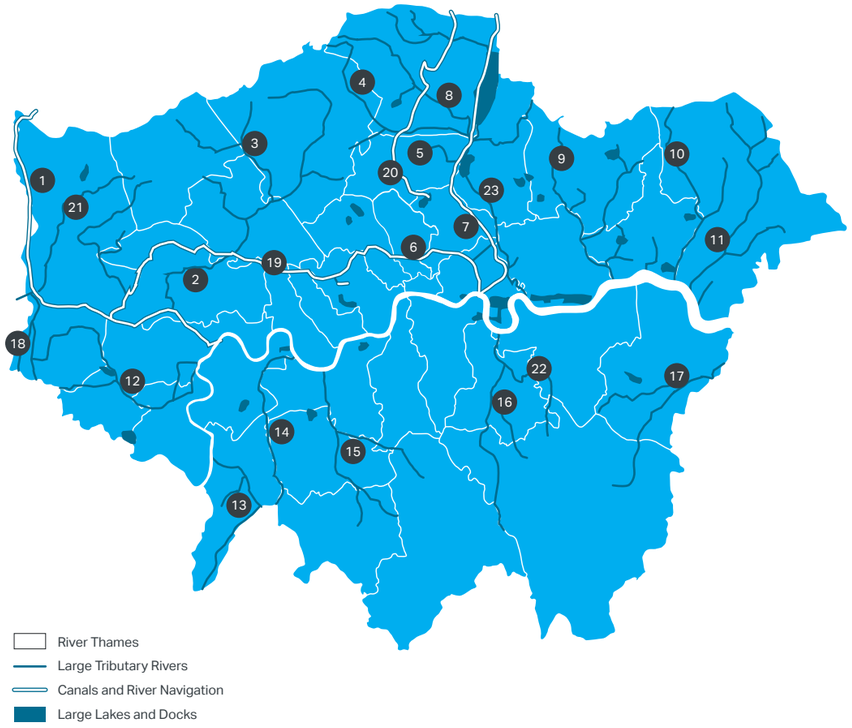
Policy 4.2.2 Reduce emissions from non-road transport sources, including by phasing out fossil fuels

Proposal 4.2.2a The Mayor will work with government and relevant groups to reduce emissions from activity on London's waterways

London's waterways are multifunctional assets and the Mayor will work to promote their protection and water-related use, benefitting the environment as well as the health and well-being of Londoners. The term 'waterways' does not only refer to the River Thames, its tributary rivers and canals, but also to other water spaces including docks, lakes and reservoirs (Figure 14). This network of linked waterways is of cross cutting and strategic importance for London. Every London borough contains some waterways – 17 border the Thames and 15 contain canals.

[14] Red diesel is a dyed fuel that incurs a lower tax than ordinary transport diesel

Figure 14: London's waterways



1. Grand Union Canal
2. River Brent
3. Silk Stream
4. Pymmes Brook
6.5. Moselle Brook
6. Regents Canal
7. Lee Navigation
8. Salmons Brook
9. River Roding
10. River Rom
11. Ingrebourne River
12. River Crane
13. Hogsmill River
14. Beverley Brook
15. River Wandle
16. Ravensbourne River
17. River Cray
18. River Colne
19. Paddington Arm
20. New River
21. River Pinn
22. River Quaggy
23. River Lea

Note: Not all tributaries are shown

Source: GLA (2016), The London Plan: The Spatial Development Strategy for London (consolidated with alterations since 2011).

Emissions from vessels and residential boats can contribute to local air pollution. These sources contribute a small but significant part of London's total pollutants and CO_2 emissions. The Port of London Authority wants to increase the number of river users to 20 million by 2035. Reducing the number of vehicles and making more use of the waterways will help improve air quality along London's busy and congested streets. The Mayor supports increased use of waterways for freight and passenger services as well as leisure uses. However, emissions need to be carefully managed to ensure the problem does not just shift from one source to another.

The Mayor has no powers to control emissions from the river or from shipping, but has asked government to improve the fragmented regulatory system to enable a single regulator through a new Clean Air Act or other legislation. This will ensure that emissions from vessels using London's waterways are reduced as far and as quickly as possible.

The Mayor recognises that there are specific challenges for river and canal vessels, and will work with all the relevant parties to ensure that strategies to address air pollutants and CO_2 emissions are proportionate and possible. This includes navigation authorities, industry representatives, waterways interests group and experts, plus London borough representatives. The Mayor will collaborate with the Port of London Authority, TfL, and other stakeholders to develop a robust, evidence based strategy.

The Mayor will lead by example, for instance by bringing the new low emission Woolwich Ferry into service as quickly as possible. The Mayor will also support demonstrator projects for new technologies, such as retrofit equipment or other low emission technologies.

The Mayor will also support any proposals to use wharves as freight consolidation centres as part of London's strategic consolidation and distribution network.

To enable cleaner vessels to use the waterways, the Mayor will encourage new and refurbished wharves, piers and canal moorings to generate renewable power onsite. Where appropriate, shore power or refuelling facilities for low emission fuels should be provided for all vessels moored onsite. Provision of shore power will be most encouraged at residential moorings. The Mayor will also work with wharf and pier operators to help introduce tiered fees for the cleanest vessels, similar to the Port of London Authority's Green Tariff scheme.

Proposal 4.2.2b The Mayor will work with government and other partners to seek reductions in emissions from aviation activity in London and the south east particularly from Heathrow

Adequate airport capacity serving a wide range of destinations is vital to helping London stay competitive in a global economy. At the same time, the aviation industry must play its part in improving the health and quality of life for those living and working near London's airports.

Aviation contributes around 2.5 per cent of London's monitored greenhouse gas (GHG) emissions.[15] If this sector fails to decarbonise, by 2050 these emissions would make up over 20 per cent of London's total. If unmanaged, emissions from the proposed Heathrow expansion are likely to increase by around a third.

The Mayor opposes any airport expansion in London unless it can show that there is no unacceptable impact on air quality and that GHG emissions are minimised. This will include:

- demonstrating airport expansion will not cause new exceedances of the UK air quality standards or increase of existing areas of exceedance
- demonstrating airport expansion will not increase exposure to pollution where improvements in local or regional air quality have been, or will be, secured by other Mayoral, local or national policies
- demonstrating airport development or expansion has incorporated Air Quality Positive principles and other Mayoral policies to minimise the impact of development, including impacts during the construction phase
- demonstrating that any airport expansion ensures that London's contribution to aviation emissions reduce in line with recommendations to meet national GHG emission targets.
- the Mayor working with airports in London to develop their climate action plans and determine how they will minimise net emissions. It may be possible to establish an offsetting fund where reductions in GHG emissions cannot be met onsite

Airports that are not proposing to expand, or are only proposing to increase passenger numbers without expanding their infrastructure, should continue to review their operations. They must identify options to reduce their impact on air quality both on and offsite, and take these steps to do so as soon as possible.

The impacts of expansion of Heathrow Airport on ambient noise are covered in Chapter 9.

Proposal 4.2.2c The Mayor will work with government and other partners to seek reductions in emissions from rail transport and at stations

London's rail network is a huge consumer of electricity. Therefore, making rail more efficient and electrifying lines will be essential for meeting the Mayor's zero carbon ambition. It will also replace diesel transport and the associated harmful air pollution emissions. By 2050, all rail lines in London should be electrified as part of Network Rail's investment programme. Electrification of more of the network (for example connections to the Gospel Oak line and services to Marylebone) is also needed to provide the necessary capacity increase in London.

The Mayor, through TfL, will investigate opportunities to decarbonise TfL-controlled rail services, with the aim of achieving a zero carbon network by 2030. This will include pursuing options to power services through local renewable generation in London and using procurement options to increase the provision of renewable energy.

[15] Defined as emissions from aviation sources up to 1km above the ground

As well as electrifying all rail lines by 2050, further measures will include new energy-efficient trains on the Elizabeth line from 2017 and from the mid-2020s on the Piccadilly, Waterloo & City, Bakerloo and Central lines. This will allow for faster, more frequent service on the lines, with as little as possible additional energy required.

Specific air quality issues at stations like Paddington and Marylebone should be addressed by Network Rail and the rail operating companies under government guidance. The Mayor has no power to tackle these. However, through TfL, the Mayor will work with government, Network Rail and others to resolve local air quality problems as soon as possible.

Policy 4.2.3 Reduce emissions from non-transport sources, including by phasing out fossil fuels

Proposal 4.2.3a The Mayor will work with government, TfL, the London boroughs, the construction industry and other users of Non-Road Mobile Machinery (NRMM), such as event organisers, to prevent or reduce NRMM emissions

NRMM is a diverse sector, including construction machinery, generators, and industrial equipment. This policy is primarily aimed at construction, roadworks, events and similar uses. Trains, as well as river and canal vessels, are dealt with separately in earlier proposals.

Engines used in NRMM are subjected to progressive emissions limits by the EU, similarly to road vehicles, meaning that newer machines are far less polluting than older ones. However, these standards are further behind those applied to road vehicles and there has historically been greater flexibility in their application.

NRMM used in the construction and infrastructure building sectors currently accounts for approximately seven per cent of NO_x and eight per cent of PM_{10} emissions in London. As emissions from road transport fall, these sectors are expected to grow as a proportion of London's total emissions.

The diversity of the NRMM sector means that different approaches may be necessary for different users. The Mayor's planning powers are currently being used to create an NRMM Low Emission Zone with minimum emission standards.

"Non-road mobile machinery used in the construction and infrastructure building sectors currently accounts for approximately seven per cent of NO_x and eight per cent of PM_{10} emissions in London."

These are based on European 'stages', which are similar to emission standards for vehicles. The applicable standards are stage IIIB on construction sites in central London, and stage IIIA in the rest of London currently. These will tighten to stage IV and IIIB respectively in 2020. The Mayor will review the NRMM Low Emission Zone standards to ensure that they deliver the largest possible improvements. The Mayor wants stronger enforcement powers to ensure that these standards are consistently met across London, and has asked the government to legislate to provide these.

The Mayor will lead by example through the GLA group. Emissions from NRMM construction and maintenance activities will, where appropriate, meet or exceed the standards set out by the NRMM Low Emission Zone. The Mayor will also work with other major infrastructure developers, such as Network Rail, Thames Water, National Grid and High Speed 2 (HS2), so they incorporate these as minimum emissions standards. Working with the Environment Agency, Defra and the London boroughs, the Mayor will seek to incorporate NRMM emissions standards into environmental permits. The Mayor will also promote the use of zero and ultra low emission technology, such as fuel cell, hybrid or electric machines to reduce emissions and carbon impacts from NRMM.

As well as setting requirements for minimum emissions standards, the Mayor will develop a new enhanced website to make participation in the NRMM Low Emission Zone as straightforward as possible and set up a Green Machines NRMM positive recognition scheme to promote best practice in reducing emissions and encourage innovation.

Proposal 4.2.3b The Mayor will work with industry and other partners to seek reductions in emissions from construction and demolition sites

Construction and demolition sites, including roadworks, can be a significant contributor to local particulate levels if they are not well managed. These projects can last a long time and many can happen in the same area. This means these emissions can significantly affect the health of local residents, unless they are properly controlled and managed.

It is important to develop and share best practice to support and improve the measures the construction sector already puts in place. Similarly, the understanding of how monitoring can be used on construction sites to inform the operators when additional measures are required must be improved.

To do this, the Mayor will maintain guidance on managing dust and other emissions on construction sites, as well as using planning powers. The Mayor will continue to support the London Low Emissions Construction Partnership and similar projects to research and develop the best dust-control techniques for construction sites. Voluntary approaches will be promoted to control the problem at sites or in areas where the Mayor has no statutory powers.

Proposal 4.2.3c The Mayor aims to improve London's air quality by reducing emissions from homes and workplaces, including through energy efficiency programmes

Over 70 per cent of the energy used in homes and workplaces is for space and hot water heating, some 90 per cent of which is currently met using gas-fired boilers which emit harmful NO_x emissions and contribute to air pollution in London. NO_x emissions from commercial gas use are expected to grow significantly as a proportion of London's emissions. In central London NO_x emissions will increase from 30 per cent in 2013 to 38 per cent in 2020.

Installing an efficient boiler or renewable heating technology can be a cost-effective way to cut NO_x emissions, CO_2 emissions and energy bills. The Mayor's Energy for Londoners programme will support the transition from old inefficient gas boilers to ultra low NO_x gas boilers and low carbon (and low-pollution) heating alternatives such as heat pumps. This will help make London's air cleaner.

Following the London Boiler Cashback Scheme, the Mayor will deliver a new three-year (2017-2020) commercial boiler scrappage initiative to help provide incentives to install more efficient gas and renewable heating systems. The Mayor will evaluate this scheme and the London Boiler Cashback and Better Boilers schemes. This will help inform the development of future initiatives to provide more efficient and low NO_x boiler replacements. The Mayor's energy efficiency programmes, such as RE:NEW and RE:FIT, will also help to removing inefficiency heating systems which contribute to poor air quality.

Proposal 4.2.3d The Mayor will work with government to seek reductions in emissions from large scale generators producing power for commercial buildings in London

There is evidence that diesel generators installed as emergency backup power sources in offices and other buildings are increasingly being used to meet peak electricity demand from the grid. This is because the grid now struggles to match supply with demand. The government does not impose any controls on the emissions from most of these generators. However, they have the potential for significant negative impacts if their use continues to grow.

Even where they are used only for short amounts of time, old or poorly located generators can have a major impact on local air quality.

Current Defra proposals to introduce emissions limits for generators over one megawatt in capacity will not affect existing generators until at least the mid-2020s. Generators that run for less than 500 hours a year will not be affected. These new controls do not go far enough or fast enough to protect the health of Londoners.

The Mayor will use planning powers to prevent the creation of new diesel powered 'generator farms' in London and ensure the impacts of any new emergency generators in buildings are minimised. To help this the Mayor will work with health authorities and others to raise awareness of the impacts of the use of diesel generators on air quality.

The Mayor will work with the Department for Business, Energy and Industrial Strategy and Defra to seek market reforms and discourage the use of emergency generators in the Short-Term Operating Reserve and capacity markets. The Mayor will encourage Defra to apply more robust standards, and give the Mayor the powers to regulate this sector in London.

The Mayor will also work with the retrofit industry and generator owners to develop effective and install effective retrofit solutions for existing generators as soon as possible. Where applicable, retrofit for emergency generators could be supported by the Mayor's retrofit programmes.

Proposal 4.2.3e Through the London Plan the Mayor will consider policies to reduce the impact of new industrial and waste sites on local air quality. The Mayor will also work with regulators and industry to reduce emissions from existing sites and will address the antisocial burning of waste and the inappropriate use of bonfires

The Environment Agency is responsible for licensing, inspecting and enforcing heavy industrial processes (known as 'Part A') and waste sites in London. It will be a crucial partner in managing emissions from these installations. London boroughs lead on licensing, inspecting and enforcing 'Part B' sites.

Some waste and industrial activities have the potential to cause local dust and particulate pollution by the nature of the work that they undertake.

The potential for these sites to cause pollution can be greatly reduced by moving dusty activities indoors. Working indoors can also have other benefits, such as reducing the amount of water used for dust suppression.

Through the London Plan, the Mayor will consider developing a policy supporting appropriate enclosure of polluting (or dusty) activities on waste sites to mitigate and avoid adverse effects on human health including poor air quality and noise pollution.

The Mayor will work with the Environment Agency and the London boroughs to seek reductions in emissions from existing potentially polluting industrial and waste sites on GLA or TfL-owned land by encouraging them to be enclosed as soon as possible. The Mayor will also work with the regulators to support and promote the enclosure of existing sites, especially where there are existing problems with pollution.

Policy 4.2.4 The Mayor will work with the government, the London boroughs and other partners to accelerate the achievement of legal limits in Greater London and improve air quality

Proposal 4.2.4a The Mayor will use the London Local Air Quality Management (LLAQM) framework to assist and require boroughs to exercise their statutory duties to improve air quality and will exercise statutory powers as required

London's boroughs have an important role to play in addressing local pollution. The statutory basis for local authority air quality obligations is Part IV of the Environment Act 1995. This requires that London boroughs monitor and review pollution. Where they exceed standards, they must declare an Air Quality Management Area and put in place an action plan detailing how they will tackle the problem.

The levers under the control of the London boroughs include:

- emissions-based parking charges
- reducing pollution from new developments through the planning system (especially those that are not referred to the Mayor)
- improving public realm for walking and cycling
- rolling-out targeted measures at pollution hotspots
- integrating air quality into their public health duties
- supporting new infrastructure for fuelling zero emission vehicles

As set out in the draft Mayor's Transport Strategy, TfL will offer boroughs support, including for the development and administration of traffic demand management schemes and through Local Implementation Plans (LIPs) to support the delivery of the Healthy Streets Approach.

Borough statutory powers can be used to continue to discourage the anti-social burning and illegal use of wood-burning stoves to reduce smoke annoyance and health impacts.

The Mayor will help boroughs in carrying out the exercise of their statutory duties to improve air quality. Through the reformed LLAQM framework there are clearer requirements for the boroughs. The Mayor will continue to provide coordination, tools, templates, support and funding. The Mayor will also improve information sharing and promote best practice by publishing an annual report on borough achievements and provide advice, information and workshops.

The Mayor will recognise borough efforts to improve air quality through awarding Cleaner Air Borough status. This will be reviewed annually, together with criteria that reflect the increased ambition of this strategy. The Mayor will also support boroughs and businesses to deliver local projects through the Mayor's Air Quality Fund, including at least five borough Low Emission Neighbourhoods and five business Low Emission Neighbourhoods.

Under the LLAQM framework the Mayor can direct boroughs and require them to take steps to meet the air quality objectives. These reserve powers can be used following consultation.

Proposal 4.2.4b The Mayor will work with the government to achieve full legal compliance with UK and EU limits as soon as possible

Comprehensive and coordinated action is needed at a national level to achieve legal limits as quickly as possible. The government has unique tools available to do this – the ability to promote legislation, change fiscal incentives, raise revenue and take national action. The measures set out below would help accelerate compliance.

The Mayor calls on the government to take the following action:

- **introduce a powerful new twenty-first century Clean Air Act** to entrench the right to breathe clean air and tackle pollution in London once and for all. This legislation could provide the framework for action, bringing the law up to date to cope with the massive air quality challenges that London faces today. In the context of the UK's intention to leave the EU it should provide a legally enforceable right to clean air and the government could introduce new powers to better regulate all emissions sources, not just road transport, and empower local authorities

- diesel is the biggest and most problematic source of NO_x emissions. A credible national air quality plan needs to accelerate the pace at which this fuel is no longer used, both in transport and non-transport uses. A **national vehicle scrappage fund** is essential if compliance costs to people and businesses of such action is to be minimised. It is only right that the government provides this help, given that national fiscal policy has encouraged dieselisation over many years, meaning many people bought polluting vehicles in good faith

- **a national retrofit certification scheme** to further reduce compliance costs to businesses to meet new emission standards and build on the work that has been done with London's bus fleet

- **a targeted retrofit fund for HGVs, buses, coaches and other specialist vehicles** (such as ambulances, fire brigade vehicles and refuse vehicles)

- **vehicle excise duty, capital allowances and other fiscal reforms** are also needed to reduce emissions and promote the uptake of zero emission vehicles

- **fiscal reform should be complemented by a national car labelling scheme** to raise awareness about the differential pollution emissions from vehicles at the time of purchase (including for second hand vehicles)

- **more electric vehicles and charging infrastructure** needs to be unlocked by addressing structural power grid barriers and providing additional funding through the Office for Low Emission Vehicles

- **a commitment to providing the necessary funding to convert all UK black taxis to zero emission capable models by 2025 at the latest** and scrapping older diesel taxis. Higher rate vehicle excise duty on taxis must also be removed so as not to make it harder for taxi drivers to purchase zero emission capable models

- **preventing the illegal removal of diesel particulate filters** through enhanced MOT testing and spot checks

- the Mayor is already contributing more resources to improve air quality in London, but it must be recognised that this comes at a high cost in terms of other priorities. government should recognise that London's air quality challenges are linked to a national problem and provide financial support for the Mayor

- **additional funding for other local authorities** should also be made available. The current £3m available as part of Defra's air quality grants programme is supposed to support measures across the UK and is woefully insufficient both nationally and for London, given the scale of the challenge

- government is also uniquely place to **provide enhanced public information**, especially during air pollution episodes by utilising national communication infrastructure and working closely with the media, e.g. pollution updates on weather bulletins

- **allow London planning policy to take precedence over national planning policy**. Changes that resulted from the government's Housing Standards Review could potentially complicate London's ability to enforce existing emission standards on residential developments. Taking into account London's growth, this could offset emissions reduction delivered by schemes such as the ULEZ.
It is essential the Department for Communities and Local Government (DCLG) protect regional and local authorities' ability to set appropriate air pollutant emission standards for new developments, such as the 'Air Quality Neutral' requirements included in the London Plan or new approaches like 'Air Quality Positive', which is explained in more detail under the following objective

- **provide new powers for construction**, including stronger enforcement powers against Non Road Mobile Machinery (NRMM) both on and off construction sites

- **provide new powers and improved coordination for river and maritime vessels**, including having a single regulatory authority for the Thames and London tributaries and introduce minimum emissions standards

- **deliver a national boiler scrappage scheme** to tackle emissions from residential and commercial properties particularly targeted at those on low incomes (to tackle fuel poverty) and for the premises of Small and Medium-sized Enterprises

- **revitalise smoke control zones and address wood burners** through a new fit-for-purpose testing regime and information on appropriate technology/ fuels for smoke control zones at point of sale

Proposal 4.2.4c The Mayor will work with European institutions, other European cities and city networks on efforts to minimise transboundary pollutions

As noted above, the challenge of cleaning London's air is made tougher because over half of the pollution experienced is not created here.

This is why, even as the UK leaves the EU, close working with European partners through sharing best practice and coordinated action is required. This will help drive reductions in emissions across the continent and accelerate delivery of the National Emissions Ceiling Directive.

To do this the Mayor will work with European institutions, other European cities and city networks to ensure that transboundary pollution affecting London is minimised and ensuring strong source control measures and regulations are adopted at EU-level.

"The challenge of cleaning London's air is made tougher because over half of the pollution experienced is not created here."

"The Mayor is setting a course to achieve new ambitious targets, in line with current WHO health-based guidelines, particularly for $PM_{2.5}$."

Policy 4.2.5 The Mayor will work with other cities (here and internationally), global city and industry networks to share best practice, lead action and support evidence-based steps to improve air quality

While London is a leader in many environmental fields, it does not have a monopoly on wisdom. The Mayor is open to sharing best practice with other cities. Maintaining existing international partnerships will be crucial to doing this. One practical example of this work is the reductions achieved in price premiums for hybrid buses by hosting an International Zero Emission Bus Summit and coordinating a Clean Bus Declaration. This was signed by 26 global cities.

OBJECTIVE 4.3 ESTABLISH AND ACHIEVE NEW, TIGHTER AIR QUALITY TARGETS FOR A CLEANER LONDON BY TRANSITIONING TO A ZERO EMISSION LONDON BY 2050, MEETING WORLD HEALTH ORGANISATION HEALTH-BASED GUIDELINES FOR AIR QUALITY

The Mayor recognises that cleaning up London's air is about more than just meeting legal compliance. It is about making London a leading global city and an attractive place to live, visit and do business. The Mayor is therefore setting a course to achieve new ambitious targets, in line with current WHO health-based guidelines, particularly for $PM_{2.5}$.

Achieving this will require action beyond London. As set out above, transboundary pollution from outside London is currently responsible for the majority of the health effects associated with $PM_{2.5}$. Clearly any route map to meeting current WHO guidelines will require considerable coordinated European-wide action. The EU National Emissions Ceiling Directive sets a legally binding requirement for a 49 per cent reduction in $PM_{2.5}$ levels by 2030 compared to 2005 levels across Europe. This will be a significant 'down payment' on achieving the WHO guidelines and gives an important context for the action set out below.

Policy 4.3.1 The Mayor will establish new targets for $PM_{2.5}$ and other pollutants where needed. The Mayor will seek to meet these targets as soon as possible, working with government and other partners

Proposal 4.3.1a The Mayor will set new concentration targets for $PM_{2.5}$, with the aim of meeting World Health Organisation guidelines by 2030

Legal limits in the UK for some pollutants are unambitious, especially for ultra fine particulate matter, black carbon and $PM_{2.5}$. There is significant evidence for the health impacts of $PM_{2.5}$ as a part of PM_{10} and evidence also shows negative impacts on health, even below legal EU limits. Setting bold, achievable concentration limits for London, and a pathway to meeting these, will ensure that London is aligned with the latest WHO recommendations. It will also have a positive effect on the health of Londoners. The measures set out elsewhere, while they will help achieve legal compliance, will not be enough to achieve these tighter limits. That is why further action is proposed below.

Using the latest evidence the Mayor will set new emission limits for full compliance with WHO for $PM_{2.5}$ to be achieved by 2030. This will continue to drive improvement in air quality after legal standards are met, protecting public health and supporting the Mayor's wider vision for a zero carbon London. The understanding of the relationships between pollution and health is constantly evolving and this may require new targets for other pollutants to be set in the future.

As part of the Mayor's commitment to achieving the WHO guidelines by 2030, the Mayor will also join the Breathe Life consortium, led by the WHO and United Nations Environment Programme, so that London can work with other cities and countries around the world needed to develop the technologies and tackle the transboundary contribution needed to ensure that these exacting guidelines are met.

Policy 4.3.2 The Mayor will encourage the take up of ultra low and zero emission technologies to make sure London's entire transport system is zero emission by 2050 to further reduce levels of pollution and achieve WHO air quality guidelines

Proposal 4.3.2a The Mayor, through TfL, will ensure all taxis and private hire vehicles are zero emission capable by 2033 and the bus fleet is entirely zero emission by 2037

The plan for zero emission transport aims for London's taxis and private hire vehicles to be zero emission capable by 2033 and TfL's bus fleet to be entirely zero emission by 2037 at the latest. This means making the most of the capital's world-leading reputation for the uptake of hybrid, electric and hydrogen technology in the bus and taxi fleets.

Proposal 4.3.2b The Mayor, working in partnership, will reduce emissions from fleet vehicles in the GLA group, the London boroughs and the wider public sector by switching to zero emission capable vehicles

It is important that the GLA group, and more broadly the public sector in London, leads by example in the take up of ultra low emission vehicles. The GLA group has an important

role in demonstrating the viability of technologies on a broader scale and influencing the market. For example, the London Fire Brigade has an all-electric support car fleet. It also has a number of ultra low emission cars to attend emergency incidents and other brigade business across the capital.

Across the world, cities have started to set dates after which their operational fleets will not be allowed to procure or lease vehicles which are not zero exhaust emission (either electric or hydrogen).

The Mayor will work with TfL, the Metropolitan Police Service and the London Fire Brigade to achieve compliance with the ULEZ and work towards:

- all cars in GLA group support fleets being zero emission capable by 2025
- all new cars and vans (less than 3.5 tonnes) in GLA group fleets, including response vehicles, being zero emission capable from 2025
- all heavy vehicles (greater than 3.5 tonnes) in GLA group fleets being fossil fuel-free from 2030
- zero emission GLA group fleets by 2050

The wider public sector, including London boroughs and the NHS, will also be expected to lead by example and adopt similar dates.

Proposal 4.3.2c The Mayor, working with government, TfL, the London boroughs and industry will aim for London's entire transport system to be zero emission by 2050

It will only be possible to achieve WHO air quality guidelines, deliver further improvements in public health and bring about a zero carbon city by 2050 if all vehicles are zero emission by that date. TfL must take significant steps to achieve zero emission transport and encourage uptake of ultra low and zero emission technologies, with public fleets taking a lead.

The government's approach of incentivising the use of diesel vehicles to achieve CO_2 savings has meant that local air quality has suffered. Rather than simply seeking to reverse this dieselisation, air quality and climate change must be considered together. This means a clear direction towards ULEVs to avert the adverse impacts of a rush back to petrol.

ULEVs include battery electric vehicles, plug-in hybrid vehicles, range-extended electric vehicles, and hydrogen fuel cell electric vehicles. For heavier vehicles, alternative fuels that show clear reductions in air pollutant and CO_2 emissions may be used as a bridging technology to zero emissions by 2050.

The Mayor will help ensure ULEVs are the best choice for any Londoner or London business needing to use a car or a van. The aim is that all new cars and vans being driven in London should be zero emission by 2040 at the latest. Freight activity in London also contributes towards poor air quality and carbon emissions. Through programmes like LoCITY, TfL will work with the freight industry to overcome the barriers to adopting cleaner vans and HGVs.

To succeed in making the transition to ULEVs, a major expansion in electric charging and hydrogen infrastructure is required. This includes meeting the need for rapid charging to support zero emission capable taxis, private hire vehicles and commercial vehicles, and working with boroughs and private operators to provide on-street residential charging. TfL and City Hall will work with

"London's entire transport system to be zero emission by 2050."

boroughs and industry to understand the long-term need for residential charging. As well as standalone stations, hydrogen refuelling systems and charging infrastructure can, and should, be integrated into existing refuelling stations.

Where fleets such as buses or waste trucks provide their own refuelling systems they should consider how this could also be made available to the public or other businesses. This can either be through local agreements or via publicly accessible facilities at the site perimeter. The GLA group will lead by example in doing this for example at fire station forecourts.

Bringing in ULEVs will require a significant change to London's energy systems. We must ensure the supporting supply infrastructure is in place, while maximising CO_2 benefits. The Mayor will work with TfL, government and stakeholders to ensure systems are upgraded. Plans will be put in place to manage the energy demand associated with the transition to ULEVs.
This will help London's energy system accommodate and manage the increased demand associated with this transition.

To facilitate this, government must invest to ensure the grid and energy network is capable of hosting large numbers electric vehicles. Robust planning regulations at a national level would also strengthen local requirements for infrastructure in new developments, making electric vehicles a convenient choice for residents and businesses.

To progress hydrogen alternatives to existing internal combustion engine vehicles, the Mayor has worked with industry, academics and other stakeholders through the Hydrogen London Partnership which has demonstrated both transport (refuelling infrastructure, cars, vans, buses) and non-transport applications of the technology (energy for buildings and mobile generators) through a number of projects.

Going forward the Mayor will seek to integrate hydrogen technology into the zero and alternative fuels plan for London transport infrastructure, alongside electric. This is a normalisation phase which will support the development of mechanisms towards mass introduction and use of hydrogen fuel cell technologies.

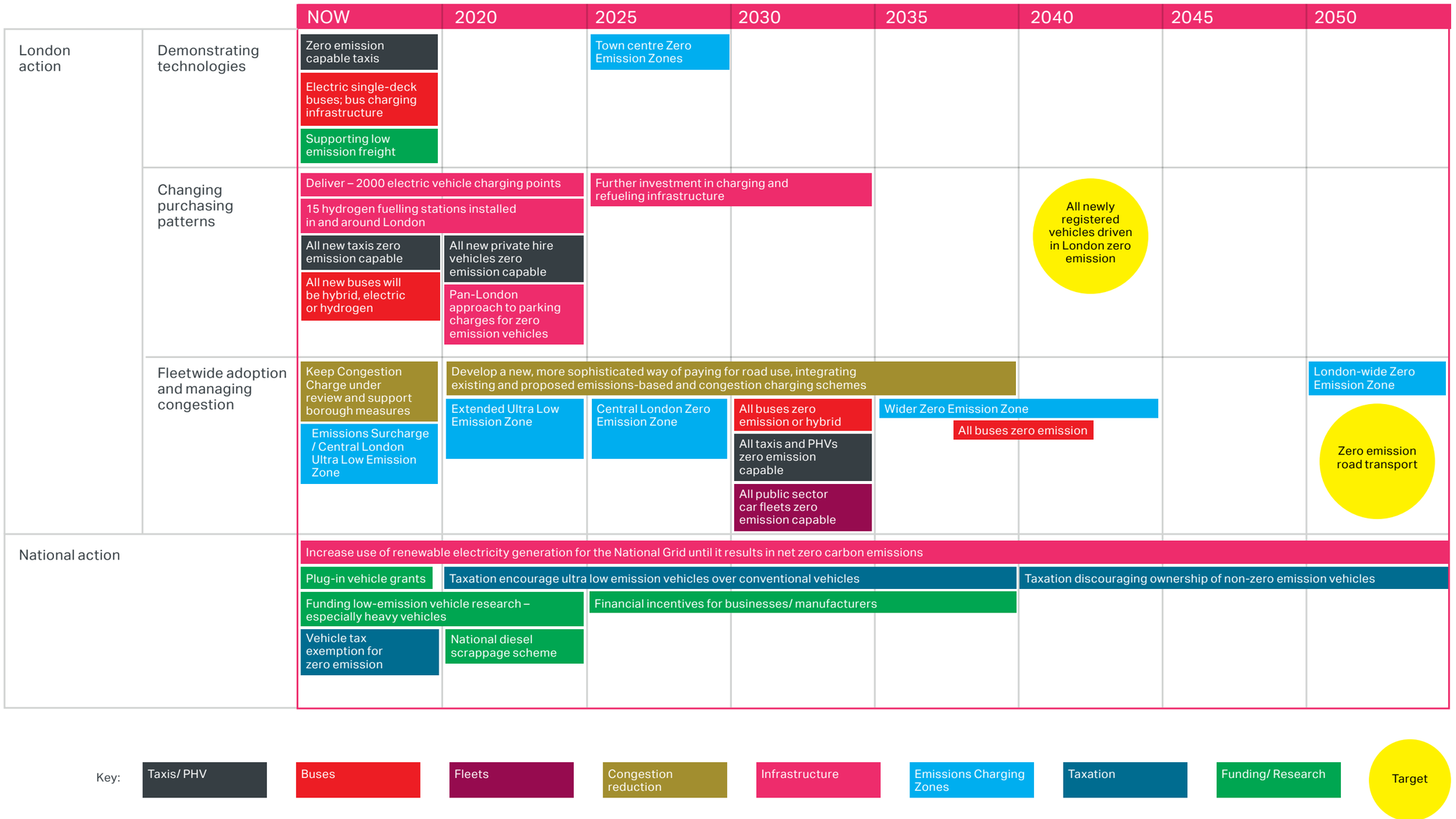
Proposal 4.3.2d The Mayor, through TfL and the boroughs, and working with government, will implement local zero emission zones in town centres and aim to deliver a central London zero emission zone from 2025, as well as broader congestion reduction measures, to pave the way to larger zero emission zones in inner London by 2040 and then London-wide by 2050 at the latest

As well as incentives and supporting infrastructure to encourage a move to ULEVs, it will also be necessary to use disincentives to phase out fossil fuel vehicles altogether. In addition to the proposed earlier introduction and expansion of ULEZ, tightening emission standards by implementing a network of zero emission zones would help reduce total CO_2, NO_x and $PM_{2.5}$ emissions. This would send a clear signal that the city is moving towards a fossil fuel-free future.

A zero emission zone is likely to subject non zero emission vehicles driven within it to road user charges (similar to ULEZ or LEZ) and/ or other vehicle prohibitions or restrictions. Creating zero emission zones will be an essential part of the move towards zero emission transport. The Mayor wants to start this transition where pollution and exposure is worst so will seek to deliver central London and town centre zero emission zones from 2025, before creating a zero emission zone in inner London by 2040 and a London-wide zone by 2050 (Figure 15).

This proposal, including the vehicles and area it applies to, charge levels and hours of operation, discounts and exemptions[↱] or other restrictions, will be developed in the next few years. Schemes will be subject to statutory consultation before being introduced.

Figure 15: Roadmap to zero emission road transport



TfL (2017)

Proposal 4.3.2e The Mayor will work with the industry and other partners to seek solutions to reduce emissions from tyre and brake wear

By 2030, an estimated 90 per cent of PM emissions from road transport will be from tyre and brake wear.[16] If $PM_{2.5}$ levels are to be improved, this needs to be significantly reduced.

The first step to achieving this will be a reduction in total vehicle kilometres by supporting a shift to walking, cycling and public transport and more efficient delivery and servicing. Promoting more efficient eco-driving can also help. New technologies, including the use of properly designed regenerative braking have the potential to reduce emissions. The Mayor, working with government, manufacturers and other partners will support and accelerate research into the development and uptake of technologies to tackle tyre and brake wear. This includes regenerative braking, and providing advice on more efficient driving.

Policy 4.3.3 Phase out the use of fossil fuels to heat, cool and maintain London's buildings, homes and urban spaces and reduce the impact of building emissions on air quality

Proposal 4.3.3a Through the new London Plan, the Mayor will consider policies so that all new large-scale developments in London are 'Air Quality Positive', and maintain Air Quality Neutral requirements for all other developments

London's growth and redevelopment should contribute to delivering improvements in air quality now and into the future.

All major developments are already, and will continue to be, required to be Air Quality Neutral. Emission benchmarks have been produced for buildings' operations and transport requirements based on the latest technology (including its effectiveness and viability). Developments that meet or improve on these benchmarks are considered to avoid any increase in NO_x and PM emissions across London as a whole and are therefore 'Air Quality Neutral'. By ensuring major developments meet this minimum requirement London's growth can be accommodated without undoing other improvements in air quality. The Mayor will continue to keep these benchmarks under review to ensure that they remain fit for purpose.

Larger developments have the potential to go further and boost local air quality by effective design and integration into the surrounding area. For instance by the provision of low or zero emission heating and energy, or improvements to public transport, walking and cycling infrastructure, Air Quality Positive developments will make sure that emissions and exposure to pollution are reduced.

The Mayor will provide guidance for developers on the most effective approach to take to ensure a development is Air Quality Positive and will review and update the guidance as required. This will ensure the best approaches to Air Quality Positive development are used in London.

Proposal 4.3.3b Through the new London Plan, the Mayor will consider new policies on heat and power provision to make sure CO_2 and pollution targets are achieved in a coordinated way with no air quality disbenefits

The Mayor has set ambitious long-term targets to both reduce harmful pollution emissions and to become a zero carbon city. In the past, some policies have had the result of addressing one of these issues to the detriment of the other. The Mayor's energy policies will take a holistic approach to overall emissions while ensuring no air quality disbenefits.

Through the London Plan the Mayor will consider a hierarchy for energy systems that contributes towards improving air quality. In particular, while combined heat and power systems (CHP) can have benefits in terms of carbon emissions, gas engine CHP plant usually gives rise to higher emissions of NO_x and/or PM10 emissions than ultra-low NO_x gas boilers, even when abatement equipment is used.

[16] London Atmospheric Emissions Inventory 2013

Therefore in preparing his London Plan, the Mayor will consider whether, in areas which exceed legal air quality limits, the policy should prevent emissions from energy production plant, including from CHP, that would exceed those of an ultra-low NO_x gas boiler. Energy production plant used in other areas should meet all relevant emission standards (which may require abatement equipment) as considered by the new London Plan, as well as not causing unacceptable local impacts on air quality.

To better understand the pollution impact of existing CHP systems in London the Mayor will develop a new CHP register which will be reflected in future versions of the London Atmospheric Emissions Inventory.

Proposal 4.3.3c The Mayor, working with London's boroughs and other partners, will seek to reduce emissions from wood and other solid fuel burning in London

Wood burning stoves have become increasingly popular in recent years. These small stoves are not generally subject to planning controls. Wood burning in urban areas can contribute significantly to local pollution. Nearly all London boroughs have declared their whole areas to be Smoke Control Zones, under the Clean Air Act 1993. Wood and coal are not allowed to be burnt as a fuel in these areas, unless the appliance being used has been tested to ensure that it can burn wood without creating smoke. Defra maintains a register of 'exempt' appliances on its website, but it is thought that many Londoners are unaware that they live in a Smoke Control Zone and are installing non-exempt appliances.

The Mayor will work with manufacturers and suppliers to ensure the right information is given to Londoners at the point of sale to ensure only the cleanest appliances and fuels are used. At the same time borough councils will be encouraged to enforce the existing rules on the use and sale of smokeless fuels and exempt appliances. The Mayor will work with Defra to ensure that the rules are kept up to date and as simple as possible to comply with. This could include banning the sale of non-smokeless fuels in London or improved labelling.

The Mayor will also continue to work with Defra to improve the standards and testing for smokeless fuels and exempt appliances to make sure they are effective at reducing emissions of particulate matter. Where new standards, such as 'ecolabel ready' come into force the Mayor will seek to make sure that they are introduced as rapidly as possible in London.

Policy 4.3.4 Work to reduce exposure to indoor air pollutants in the home, schools, workplace and other enclosed spaces

Proposal 4.3.4a The Mayor, through educational materials, campaigns and the planning system will raise awareness about indoor air quality

People spend a large part of their life at homes, offices, schools, day care centres, public buildings, health care facilities or other private and public buildings. That is why the quality of indoor air is an essential factor of healthy life and people's wellbeing. Anyone can potentially be affected by poor indoor air quality but some groups are more vulnerable to the health effects of that exposure, for example, the elderly or children or those with pre-existing health conditions.

The statutory air quality standards cover only outdoor (ambient) air quality. However, outdoor air pollution enters the buildings through the building envelope (including windows and doors) or via the ventilation system. Many studies showed that there is a link between the outdoor concentrations of NO_2 and PM and indoor air quality, especially in areas with poor air quality. There are also indoor sources of pollution which contribute to poor indoor air quality.

The Mayor will work with partners to develop protocols and tools for planners and the building design industry to improve indoor air quality in existing buildings. The Mayor will also work with partners to develop understanding and raise awareness about the issues of indoor air quality in London.

Proposal 4.3.4b The Mayor, through TfL, will conduct further research into the health risks of particulate matter on the London Underground network and take appropriate measures to mitigate the adverse effects of any risks found where practicable

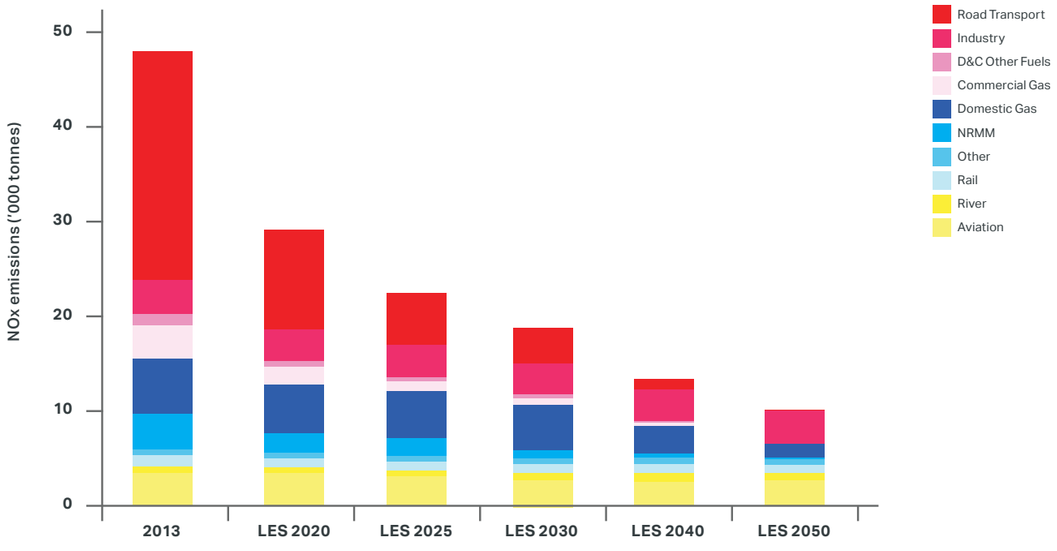
Improving London's air quality extends to the London Underground network. Comprehensive research has concluded that concentrations of particulate matter (PM) – caused in part by train wheel and brake wear – are high in some parts of the Tube network. This PM is, however, of a very different composition to the air above ground. The increasing use of electric braking systems and regular cleaning on the network help to reduce concentration levels.

There is no room for complacency on this matter, however, particularly as the understanding of the effects of air quality on health develops. The Mayor will ensure that TfL carries out further dedicated research into the risks posed to customers and staff by the Tube's air quality. It will also take action in response to any new issues, supported by robust and compelling evidence.

ACHIEVING COMPLIANCE WITH LEGAL POLLUTION LIMITS

As set out above, the Mayor wants London to achieve compliance with legal limit values as soon as possible and then wants London to go beyond these limits to deliver further improvements in public health. In particular, the Mayor wants London to achieve WHO's recommended targets for $PM_{2.5}$ by 2030. This strategy sets out policies and proposals to help achieve this.

Figure 16: Emission trend and main source categories for NO_x 2013-2050, reflecting London Environment Strategy



Source: GLA (2017), London Atmospheric Emissions Inventory (LAEI) 2013 Update

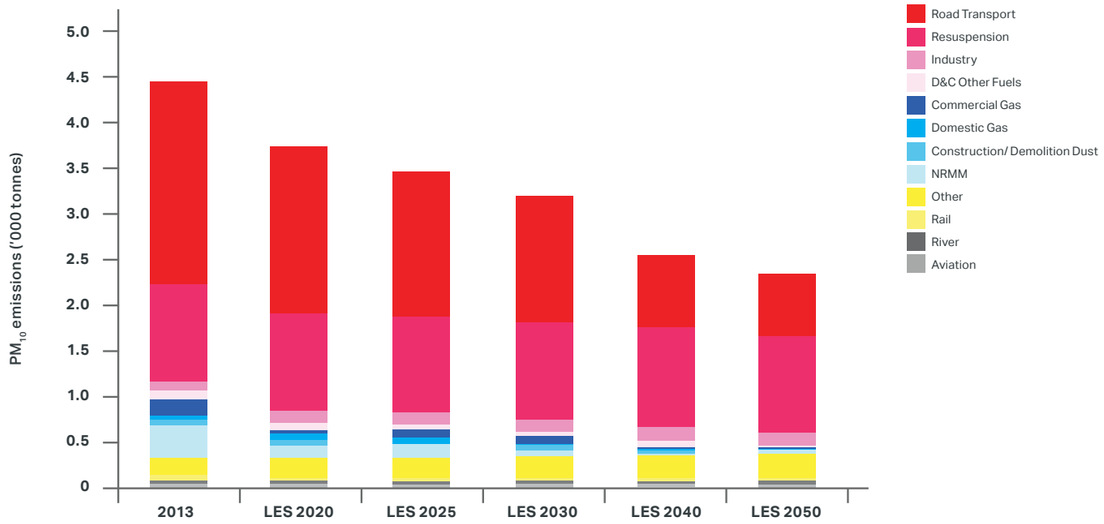
The interim graphs below summarise the impact on emissions of measures in this strategy to be delivered by the Mayor through the GLA and TfL. These emissions reductions are essential to delivering long-term health benefits across London by improving air quality through continuing reduction in exposure to pollution. Concentration modelling will be included in the final version of this strategy.

As can be seen in Figure 16, compared to a 2013 baseline, for NO_x a 40 per cent reduction is expected by 2020, a 53 per cent reduction by 2025, a 61 per cent reduction by 2030 and a 79 per cent reduction by 2050.

The action being taken by the Mayor is important and capable of achieving NO_2 limit value compliance in London. However, compliance will only be achieved as quickly as possible if all levels of government take full and effective action using the complete range of the powers and resources available to them in a way that has the greatest likelihood of success by mutually reinforcing action taken at any one particular level. This strategy sets out in policy 4.2.4 the additional action the Mayor believes government and London's boroughs need to take to achieve compliance in as short a time as possible. In particular, central government has a crucial role to play as it has unique powers – the ability to promote legislation, change fiscal incentives, raise revenue and take national action.

In July 2017 the government published its final NO_2 Air Quality Plan for the UK to address the current NO_2 infraction. It announced it expected to publish a new Air Quality Strategy for the UK in 2018. It is the Mayor's view that the final NO_2 Air Quality Plan does not include sufficient additional committed national measures or other support to help achieve compliance in London as quickly as possible. Compliance could be achieved sooner if the measures requested by the Mayor had been included. The Mayor will continue lobbying the government to implement the measures that he believes are required. Further announcements regarding government action are expected to be made at the Autumn Budget 2017 and the Mayor will reflect these in the final version of this strategy.

Figure 17: Emission trend and main source categories for PM_{10} 2013-2050, reflecting London Environment Strategy

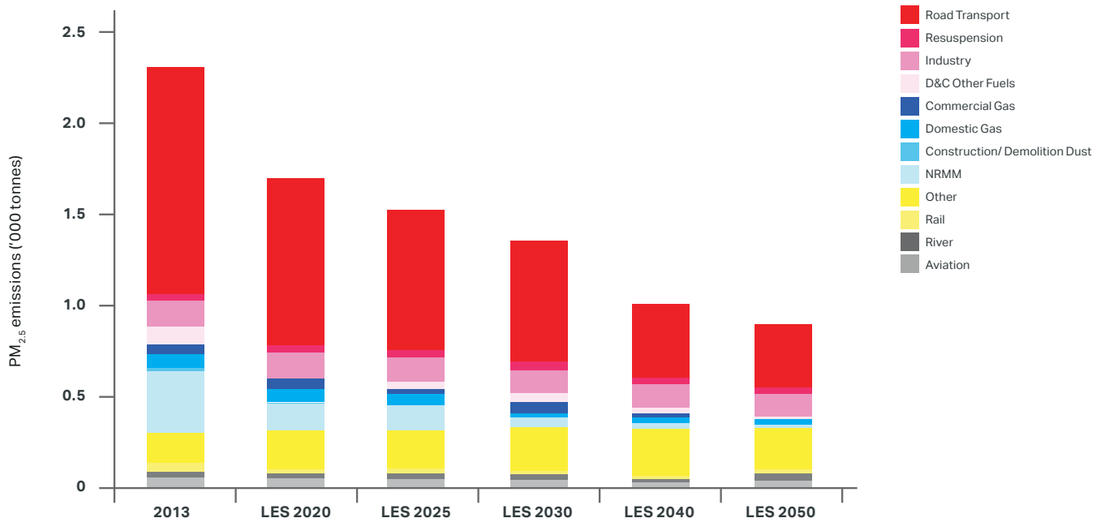


Source: GLA (2017), London Atmospheric Emissions Inventory (LAEI) 2013 Update

For PM_{10}, compared to a 2013 baseline, Figure 17 shows we expect a 15 per cent reduction by 2020, a 22 per cent reduction by 2025, a 28 per cent reduction by 2030 and a 47 per cent reduction by 2050. These reductions should mean that legal limit values continue to be met and further reductions which will be beneficial for health will be delivered.

"For NO_x, compared to a 2013 baseline, a 40 per cent reduction is expected by 2020,a 53 per cent reduction by 2025, a 61 per cent reduction by 2030 and a 79 percent reduction by 2050."

Figure 18: Emission trend and main source categories for $PM_{2.5}$ 2013-2050, reflecting London Environment Strategy



Source: GLA (2017), London Atmospheric Emissions Inventory (LAEI) 2013 Update

Finally, for $PM_{2.5}$, compared to a 2013 baseline, Figure 18 shows a 26 per cent reduction is expected by 2020, a 34 per cent reduction by 2025, a 41 per cent reduction by 2030 and a 61 per cent reduction by 2050.

These are significant reductions which will help achieve the WHO $PM_{2.5}$ guidelines. However, as roughly half the sources of $PM_{2.5}$ come from outside London fully meeting the WHO guidelines by 2030 will also require complementary and coordinated national and European wide action.

"For $PM_{2.5}$, compared to a 2013 baseline, a 26 per cent reduction is expected by 2020, a 34 per cent reduction by 2025, a 41 per cent reduction by 2030 and a 61 per cent reduction by 2050.'

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CONSULTATION QUESTIONS: AIR QUALITY

1. Do you agree that the policies and proposals outlined will meet the Mayor's ambitions for air quality in London and zero emission transport by 2050? Is the proposed approach and pace realistic and achievable, and what further powers might be required?
2. Do you agree with the Mayor's policies and proposals to raise Londoners' awareness of the impacts of poor air quality?
3. Do you agree with the Mayor's policies and proposals to safeguard the most vulnerable from poor air quality?
4. Would you support emergency measures, such as short-term road closures or vehicle restriction, during the periods of worst air pollution (normally once or twice a year)?
5. Do you agree with the proposed approach to reducing emissions from non-transport sources (including new buildings, construction equipment, rail and river vehicles and solid fuel burning)?
6. Please provide any further comments on the policies and programmes mentioned in this chapter.

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