

MAYOR OF LONDON

London Net Zero 2030: An Updated Pathway

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Introduction

In 2018, the Mayor of London, Sadiq Khan, published his London Environment Strategy and 1.5°C Climate Action Plan. These set out pathways, policies and actions needed to achieve a net zero London by 2050.

Since then, the science has shown the need for even more urgent action and the stark consequences of failing to act. Recognising this urgency, the Mayor has declared a climate emergency for London and has brought forward by 20 years the target for London to be net zero by 2030. This puts London at the forefront of global cities and UK action on climate change. The 2030 net zero target is central to the London Recovery Board's Green New Deal mission.¹

To support this increased ambition, the GLA has commissioned experts at Element Energy to analyse pathways for London to reach net zero more quickly. Their report '*Analysis of a Net Zero 2030 Target for Greater London*'² and Net Zero 2030 Tool³ explore four possible pathways that London could take.

Element Energy's analysis shows that under all pathways it is possible to accelerate action and radically reduce carbon emissions with the right ambition, leadership, powers and funding. By 2030, we could cumulatively save between 13 and 48 million tonnes of carbon dioxide equivalent (MtCO₂e) compared to the previous 1.5°C pathway, increasing to between 102 and 248 MtCO₂e by 2050. As well as helping avoid catastrophic climate change, many other benefits can be realised. These include supporting tens of thousands of jobs; improving health through better air quality and more active lifestyles; reducing inequalities and improving quality of life for all.

Based on the analysis by Element Energy, this document explains the key issues, benefits and challenges from moving the target forward to 2030. It explains the Mayor's preferred pathway to achieving 2030 is the Accelerated Green pathway and the rationale for that choice. This pathway now replaces the previous trajectory in the 1.5°C Plan.

Following the publication of the Element Energy report and modelling, the GLA will discuss the implications with key stakeholders, including London boroughs, the UK Government, businesses, civil society, and Londoners. It will guide the development of policies and programmes in the GLA Group, and the work of the Green New Deal mission as part of London's recovery from COVID-19. It will help us communicate with Londoners about what

¹ GLA (2021), *A Green New Deal*. Available at: <https://www.london.gov.uk/coronavirus/londons-recovery-coronavirus-crisis/recovery-context/green-new-deal>

² Element Energy (2022), *Analysis of a Net Zero 2030 Target for Greater London*. Available at: <https://www.london.gov.uk/what-we-do/environment/climate-change/zero-carbon-london/pathways-net-zero-carbon-2030>

³ London's Zero Carbon Pathways Tool: <https://data.london.gov.uk/dataset/london-s-zero-carbon-pathways-tool>

is involved in reaching net zero. There is great public support for climate action, but we need to build public consensus around the specific policies to get us there. This report is an important contribution.⁴

The need for urgent action

Since the Mayor brought London's net zero target forward to 2030, we have seen increasing evidence of why this urgent response is needed.

Climate change is increasing the frequency and intensity of extreme weather, and climate and water-related hazards. In the summer of 2021, we saw extreme surface water flooding events in London, closing hospitals, affecting train and tube services and flooding homes and businesses. The Environment Agency has warned that we need to 'adapt or die', warning of more extreme weather that will lead to increased flooding and drought in the UK, and sea level rises of up to 78cm by the 2080s.⁵

As a global city, London has strong historic bonds with many places around the world. For example, London is home to a Bangladeshi-origin community of more than 200,000. This community creates links of friendship, family and business between our countries. In the Bangladesh capital, Dhaka, an estimated 2,000 people arrive every day displaced by flooding and tropical storms across the country. The city is increasingly vulnerable to river flooding, with low-lying informal settlements home to two-fifths of the 18 million population. Globally, the World Bank estimates that 216 million people could be displaced within their countries by 2050. By tackling the climate crisis, Londoners benefit from stronger, fairer economies, cleaner air and healthier communities, and greater equity around the world.⁶

As we grapple with the COVID-19 pandemic globally, we are reminded of the public health, environmental, ecological and economic implications of failing to tackle the climate emergency. Time is running out to keep global warming at 1.5°C or below. Above this threshold, scientists advise that climate change could unleash far more severe effects on people, ecosystems, and wildlife. The IPCC warned last year that the world has a remaining budget of 360-460 billion tonnes of CO₂ to release into the atmosphere if warming is to remain below 1.5°C this century.⁷ If current levels of emissions are maintained, the IPCC estimates that the remaining budget would be used up in around a decade.

Progress at COP26 kept alive the possibility of limiting warming to 1.5°C above pre-industrial levels – but only just. According to an initial assessment of new and updated nationally determined contributions, 2030 targets and net zero pledges, the latest

⁴ Public concern about climate change and pollution doubles to a new record level, August 2021, <https://www.ipsos.com/ipsos-mori/en-uk/public-concern-about-climate-change-and-pollution-doubles-near-record-level>

⁵ Environment Agency (2021), *Living Better with a Changing Climate – Report to Ministers under the Climate Change Act*. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1025955/environment-agency-climate-change-adaptation-report.pdf

⁶ C40 (2021), *Creating a safe and thriving future for climate migrants*. Available at: <https://www.c40.org/news/safe-thriving-future-climate-migrants>

⁷ This range would give a 50-66% chance of staying below the threshold. IPCC (2021), *Climate Change 2021 The Physical Science Basis*. Available at: https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Full_Report.pdf

commitments would achieve a 2.4°C temperature rise, at best.⁸ Meeting the 1.5°C goal means halving our global emissions by 2030.

The need to act is more compelling than ever. Individuals and organisations must do more at every level. Cities must play an important role in tackling the climate crisis. Collectively they consume huge amounts of resources such as water, electricity and fossil fuels. But cities are also great innovators, often leading the way and demonstrating that actions can be taken. The C40 network represents more than half a billion citizens and account for a quarter of global GDP. By committing to climate action and working together, cities continue to be doers and not delayers in tackling the climate crisis.

Ensuring a fair transition

Both globally and within London, the impacts of climate change will not be felt equally. Londoners with the lowest incomes and from non-white backgrounds are often most exposed to its consequences. We have a moral responsibility to collectively protect the most vulnerable in our communities and that means acting now to limit those impacts. As economists have been pointing out for decades, it also makes economic sense to act now; the cost of inaction on climate far outweighs the cost of acting now and the significant investment required in London's infrastructure would also bring multiple benefits to Londoners.

Firstly, the sooner we insulate our homes, the quicker we can bring down our energy bills, helping change the unfair reality that the most disadvantaged Londoners end up spending a disproportionate amount of their income just to heat their homes. The fuel costs of powering and heating our buildings and running our cars and transport systems currently costs London around £11.1 billion per year. According to Element Energy, by 2030 that cost could be £6.2 billion, or 44 per cent less, if we properly insulate our homes and make active travel, public transport and electric vehicles the norm for all Londoners.

Secondly, it's going to be a really big job to insulate all our homes, but this brings a massive opportunity in terms of jobs for Londoners. This analysis estimates 56,000 jobs will be needed by 2025 just in insulating our homes, installing heat pumps, district heating and energy management. Further jobs will be created through supply chain for these activities and other net zero actions set out in the report. Through his control over the adult skills budget the Mayor is doing all he can to ensure Londoners will be ready to take advantage of the jobs created by the transition to net zero.

And thirdly, the transition to cleaner transport will improve the health of Londoners with fewer deaths from toxic air pollution. If we get this right and show other cities how to do this, we can collectively limit the impacts of a warming climate. For Londoners, this will mean less incidents of extreme flooding and extreme heat.

⁸ 90% probability, projected temperatures are 2.5°C (range: 2.3°C–2.8°C) and 2.4°C (range: 2.2°C–2.7°C), UNEP (2021) *Addendum to Emissions Gap Report 2021*. Available at: <https://wedocs.unep.org/bitstream/handle/20.500.11822/37350/AddEGR21.pdf>

However, as costs of living continue to rise, we must ensure that these benefits are targeted at those who are most vulnerable, and that the costs of delivery are fairly distributed. Low income Londoners should not bear the brunt of the cost of climate change action. To ensure we do this in a fair way that does not worsen the cost of living crisis, we need government and the private sector to provide much greater levels of investment in London's and the planet's future. This will ensure that we maximise the positive benefits for the most vulnerable and make London a fairer place in the process.

Which pathway to net zero?

Element Energy has modelled four pathways to net zero emissions, as shown in the diagram below. They take into account key constraints such as the rate at which vehicles are bought and sold, the availability of low carbon hydrogen and the rate at which heating systems are typically replaced in buildings. In the diagram below, they are contrasted with a baseline scenario and the previous net zero by 2050 Patchwork pathway. Scenarios which reduce emissions more quickly result in lower cumulative GHG emissions.

The High Hydrogen and High Electrification pathways result in slightly lower residual emissions in 2030 than proposed by the UK Government. They vary in the extent to which our homes are largely heated by heat pumps (High Electrification) or hydrogen boilers (High Hydrogen). The No Constraints pathway is the most aggressive scenario, with the lowest residual emissions of all scenarios. Its realisation would require Government to take significant large-scale interventions almost immediately. The Accelerated Green pathway sits between these two in terms of residual emissions and in the long term would see significant electrification of the heating system but with hydrogen playing an important role at strategic sites across London.

The Element Energy report does not propose a preferred scenario. However, it does provide the Mayor and GLA with the information needed to take an informed position. The Mayor considers it important to identify a preferred route as it will need to be delivered in the next eight years.

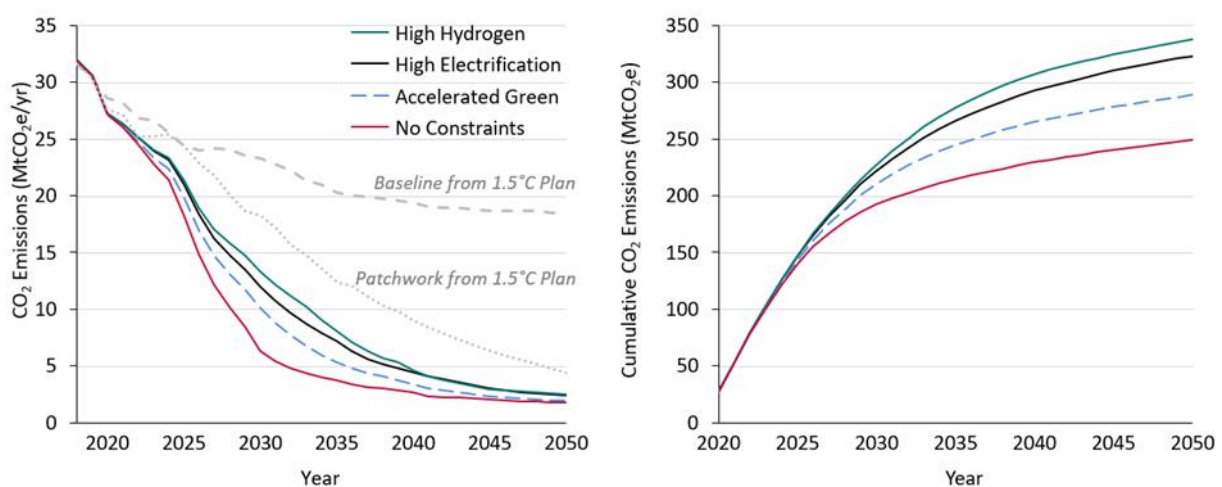


Figure 1: Annual (left) and cumulative (right) emissions over time for each scenario; Baseline from 1.5°C Plan included in annual emissions graph for comparison. Source: Element Energy Report (2022).

While all scenarios are ambitious, the most aggressive scenario, “No Constraints”, requires immediate actions that are not feasible in the current national context. For

example, delivering the “No Constraints” scenario would require scrappage of rigid diesel HGVs more than 15 years old starting now in 2022, and scrappage of gas boilers more than ten years old from 2024. In this scenario it would likely be far more difficult to shield lower income Londoners from the disproportionate costs of the transition, making it a less fair scenario than the others.

Accelerated Green, the next most ambitious pathway, is therefore considered the **preferred pathway** for achieving net zero emissions by 2030 as it balances urgency, ambition, social justice and deliverability. It is considered deliverable if London’s key institutions (e.g. the GLA, the London Boroughs, London’s businesses, Anchor Institutions etc.) can quickly access the funding and powers needed and work together towards agreed goals. Delivering on this pathway will require co-ordinated action from the Mayor, boroughs, communities, businesses, financiers and the public sector. Every Londoner will have a role to play.

In particular, the UK Government will need to play a major role in achieving this pathway. The Mayor is calling on the Government to make bolder policy and funding commitments to support London and other cities that are striving to achieve their net zero ambitions with urgency. Examples of actions required include: greater investment in local public transport, supporting bus electrification to reduce car use, promoting active travel, ensuring London receives its fair share of national funding schemes for retrofit and setting tighter standards on energy efficiency for existing buildings, and/or devolving the powers and funds to set and enforce these standards locally.

Existing action laying the groundwork

The Element Energy report outlines the types of actions and policies needed to deliver the Accelerated Green pathway. These are all familiar. Almost all of the technologies required already exist but not always at the scale needed. Timescale is also a challenge as the pathways require significant funding to be secured quickly, the supply chain and number of jobs to be scaled up, and training and skills to be expanded rapidly.

The Mayor’s 2018 1.5°C Climate Action Plan has set us on the right path to achieve net zero, and the GLA has already implemented a range of programmes and policies to support this:

- **Planning:** London is the only major city in the UK to have a zero carbon homes and commercial buildings standard for new development through the London Plan. Through our planning powers we go well beyond national requirements, securing carbon savings 46 per cent above National Building Regulations in 2020. Where developers cannot achieve further onsite reductions they must offset emissions, expected so far to provide nearly £90m of funding to London boroughs for their climate activities.
- **Mode shift:** The Mayor has made significant strides in increasing the number of trips completed by foot, cycle and public transport. Since the start of the pandemic alone, the London Streetspace Programme has introduced 322 School Streets, 89

Low Traffic Neighbourhoods and 101 km of trial cycle lanes across London, encouraging mode shift and getting people out of their cars.

- **Electric vehicles:** The Mayor has delivered more than 300 rapid charge points. London now has over 7,000 charge points, 30 per cent of all the charging points in the UK.
- **Zero emission bus fleet:** London has over 550 electric buses, the largest fleet in the Western Europe with a further 400 on order. By the end of 2022, 10 per cent of the bus fleet is expected to be zero emission. Further progress on the Mayor's objective for a net zero bus fleet by 2030 is contingent on the Government providing a fair, long-term sustainable funding deal for TfL.
- **Ultra Low Emission Zone:** Following the success of the central Ultra London Emission Zone (ULEZ) scheme, which resulted in 44,000 fewer older, more polluting, non-compliant vehicles driving in the zone every day, the ULEZ has been extended to the north and south circular roads since October 2021. Carbon dioxide emissions from cars and vans in the zone is expected to reduce by 5 per cent in the first year. This is on top of the 6 percent reduction in CO₂ emissions in the central London ULEZ area since 2019.
- **Mayor's Energy Efficiency Fund:** The Fund was launched in 2018 and has mobilised over £310 million of public and private capital enabling projects including heat networks and electric vehicle charging infrastructure. In November 2021 the Mayor committed a further £30 million of GLA funds that could support a further £150 million of investment over the next two years.
- **Green New Deal Fund:** The Mayor announced £10 million of Green New Deal Funding in November 2020 to support environmental projects which will secure around 1,000 jobs for Londoners.
- **Retrofit:** Since 2020, the Mayor's retrofit programmes have helped secure funds totalling more than £221 million from government schemes supporting improvements to homes and public buildings. The Retrofit Accelerator – Workplaces has improved over 500 public sector buildings since 2016, saving over 20,000 tonnes of carbon and 73 MWh of energy each year.
- **Renewables:** The £6m Local Energy Accelerator programme is supporting public and private sector organisations to develop local renewables and locally generated district energy networks. The Mayor's Solar Together London programme is now in the fourth phase and has signed up 3,000 homeowners to have solar PV installed through the group-purchasing programme. To date 1,000 residents have already had their systems installed, totalling 4.31kW of solar PV and saving over 1,000 tonnes of CO₂e. Since 2017 the London Community Energy Fund has allocated over £1m across four phases to support 86 projects across 26 boroughs; together the projects are projected to save over 2,500 tonnes of CO₂e and deliver an additional 8MW of solar PV if they all progress to installation.

The GLA works closely with partners in delivering these actions. Through the London Recovery Board it is working with London Councils on the retrofit of the capital's housing stock, aiming for London's average home to be EPC B rated by 2030.⁹ TfL has recently published London's 2030 Electric Vehicle Infrastructure Strategy. The GLA also works with London's energy network operators to ensure activities are coordinated and that energy systems serve Londoners and support the achievement of the Mayor's net zero trajectory.

London has made good progress in reducing its emissions. Between 2000 and 2018, London achieved a 58 per cent reduction in workplace greenhouse gas emissions, a 40 per cent reduction in emissions from homes, and a 7 per cent reduction in emissions from transport.^{10,11} For the last four years, London has been rated "A" by CDP on environmental transparency and action. In 2021, the Mayor was elected as the global chair of C40 cities, a global network of almost 100 megacities committed to achieving the 1.5°C target and collectively halving emissions by 2030.

Implications of the pathway

But there will need to be a huge acceleration in the pace of change to realise the 2030 ambition. As the Element Energy report shows (see Appendix 1), there needs to be a significant scaling up in the numbers of buildings being retrofitted and at a faster speed; a massive shift to clean heat technologies in our homes and businesses, and a drastic reduction in the distance travelled in fossil fuel vehicles. For example, the Accelerated Green pathway estimates the need for:

- Nearly 40 per cent reduction in the total heat demand of our buildings, requiring over 200,000 homes to be retrofitted each year;
- 2.2 million heat pumps in operation in London by 2030;
- 27 per cent reduction in car vehicle km travelled by 2030.

These ambitions are challenging. The previous trajectory in the 1.5°C Plan said that by the mid-2020s, 160,000 homes would need to be retrofitted each year, 900,000 heat pumps would need to be installed by 2030 and a 12 per cent reduction in car vehicle km travelled be achieved by 2030.

As other sectors' emissions have reduced, transport has become responsible for an increasing proportion of London's emissions: 25 per cent of the city's carbon emissions now come from road transport. London's goal to be net zero by 2030 is only possible if transport emissions are reduced. The scale of reductions required – a 27 per cent reduction in vehicle kilometres according to the 'Accelerated Green' scenario – is only possible with some form of road user charging.

⁹ London Councils (2021), *Retrofit London Housing Action Plan*. Available at: <https://www.londoncouncils.gov.uk/our-key-themes/environment/climate-change/retrofit-london-housing-action-plan>

¹⁰ This is despite a growing population and unlike other parts of the UK does not include a de-industrialisation period, as this was largely complete in London before 1990.

¹¹ London Energy and Greenhouse Gas Inventory (LEGGI), interim 2018 figures. Available at: <https://data.london.gov.uk/dataset/leggi>

Such a system could abolish all existing road user charges – such as the Congestion Charge and ULEZ - and replace them with a simple and fair scheme where drivers pay per mile, with different rates depending on how polluting vehicles are, the level of congestion in the area and access to public transport. Subject to consultation, it is likely there would be exemptions and discounts for those on low incomes and with disabilities, as well as consideration around support for charities and small businesses.

The Mayor recognises that London could benefit from more sophisticated types of technology to introduce this kind of simple, fair road user charging scheme and has therefore asked Transport for London to start exploring how it could be developed. However, it's clear the technology to implement such a scheme is still years away from being ready.

Given the urgency of the climate crisis and the damaging impact of toxic air pollution, the Mayor believes bold action must be taken now. That's why the Mayor is considering a number of policies that could be ready within the next few years to encourage Londoners and those who drive within London to shift from polluting cars to public transport and sustainable active travel, such as walking and cycling, and electric vehicles where necessary.

The potential approaches under consideration are:

- Extending the ULEZ even further to tackle more of the dirtiest vehicles: extending the current zone beyond the north and south circular roads to cover the whole of Greater London, using the current charge level and emissions standards.
- Modifying the ULEZ to make it even more impactful in reducing emissions: building on the existing scheme by extending it to cover the whole of Greater London and adding a small clean air charge for all but the cleanest vehicles.
- A small clean air charge: a low-level daily charge across all of Greater London for all but the cleanest vehicles to nudge behaviour and reduce the number of short journeys by car
- Introducing a Greater London boundary charge, which would charge a small fee to non-London registered vehicles entering Greater London, responding to the increase in cars from outside London travelling into the city seen in recent years.

The Mayor and TfL will now begin a period of consultation with Londoners, local government and businesses about the way forward to achieving the clean, green and healthy future London and the world desperately needs.

All options under consideration would be subject to full equality impact assessments, with mitigations and exemptions put in place for Londoners on low incomes and with disabilities a key focus of any scheme development. Subject to consultation and feasibility, the chosen scheme would be implemented by May 2024.

Other policies are also needed, to encourage a shift to sustainable modes of transport and accelerate the switch to electric vehicles (which, despite recent growth, account for just 2

per cent of registered vehicles in London at present).¹² Though much cleaner, electric vehicles also emit pollution through brakes and tyres, making the shift to public transport, walking and cycling crucial in the future.

The increase in electricity demand due to the electrification of heating and transport will also pose implications for the energy network. Demand Side Response (DSR) measures can reduce peak electricity demand by 10 per cent. Without DSR, the scenarios could require reinforcement of up to 20 per cent of London's primary substations by 2030, and up to 50 per cent by 2050, depending on the technology mix used.

The decarbonisation of the electricity grid to date means that many of the easier, centralised actions to reduce emissions from buildings have already been taken. Element Energy's analysis shows that cutting building emissions further will require no more replacement gas boilers from 2026 and insulating our homes to enable an average EPC B rating after a shift to low carbon heating technologies. And we need to recognise that while accelerating the shift to electric vehicles is needed, this will not be enough. To reduce transport emissions adequately we will need a further big increase in active travel and public transport usage, a reduction in personal car use, while switching to electric vehicles for those journeys that remain.

Many of these actions are beyond the Mayor's powers, but the challenge this decade is to use the influence and power of City Hall to work with partners at local and national levels to accelerate as much activity as possible. This preferred pathway will have major implications for delivery across London and we will continue to engage on these with stakeholders in the months to come.

¹² London's 2030 Electric Vehicle Infrastructure Strategy: <https://tfl.gov.uk/ruc-cdn/static/cms/documents/london-2030-electric-vehicle-infrastructure-strategy-december-2021.docx>

The benefits of climate action

Whilst the Mayor knows that the 2030 target will require concerted strong and effort from Government, businesses and ultimately Londoners themselves, there are very strong arguments for accelerating action:

(1) Avoiding the dangerous impacts of climate change

There is well-established evidence on the economic and social benefits of taking climate action sooner rather than later.¹³ Inadequate action to date means we are seeing more warming than previously expected and the estimated costs associated with climate change (e.g. flooding or storm damage) over the century are now higher than they were just a few years ago.¹⁴ The costs of adapting to a warmer climate increase with every year of delay.

According to the OECD, globally the benefits of avoiding damage caused by climate change and extreme weather could add 5 per cent to global GDP in G20 countries alone by 2050.¹⁵ Insurer SwissRe calculates that failing to act could cost as much as \$23 trillion annually.¹⁶

Acting sooner will reduce London's total contribution to climate change. The Element Energy analysis shows that accelerating London to net zero by 2030 could save an additional 151 MtCO_{2e} for our preferred pathway, compared to the previous 2050 target (equivalent to a 34 per cent reduction in cumulative emissions).

The worst impacts of climate change will fall on those least able to adapt, both globally and in London.¹⁷ It is therefore our social responsibility to those most vulnerable to take as rapid action as possible without loading disproportionate cost burdens onto those less able to pay.

(2) Supporting Jobs and Skills

The London Recovery Board – co-chaired by the Mayor and London Councils – aims to double the size of London's green economy to £100 billion by 2030. London's low carbon environmental goods and services sector (green economy) already contributes more to

¹³ Stern, N. H. (2007), *The economics of climate change: the Stern review*. Cambridge, UK, Cambridge University Press.

¹⁴ Sanderson, B. M. and O'Neill, B. C (2020), *Assessing the costs of historical inaction on climate change*, *Scientific Reports* volume 10, Article number: 9173

¹⁵ OECD (2017), *Investing in Climate, Investing in Growth*. OECD Publishing, Paris, <https://doi.org/10.1787/9789264273528-en>

¹⁶ Swiss Re Institute (2021), *The Economics of Climate Change: No action is not an option*. Available at: <https://www.swissre.com/dam/jcr:e73ee7c3-7f83-4c17-a2b8-8ef23a8d3312/swiss-re-institute-expertise-publication-economics-of-climate-change.pdf>

¹⁷ GLA and Bloomberg Associates (2021) *Climate Risk Mapping*. Available at: <https://data.london.gov.uk/dataset/climate-risk-mapping>

London's economy than the construction and manufacturing sectors combined, employing around 317,000 people across 14,000 businesses in 2019/20.¹⁸ The sector covers a range of disciplines and sectors including green finance, professional services, renewable energy, waste management, low carbon transport and building technologies.

Climate action not only creates the need for new services in retrofit, green travel and low carbon business, but also an opportunity for Londoners to take on these roles. Through the London Recovery programme's 'Helping Londoners into Good Work' mission, the Mayor is developing a green skills academy. This will provide a high-quality training offer that builds London's skills base to meet the growing demand for green jobs. The Adult Education budget is also targeting funding to directly support London's recovery from the social and economic impacts of COVID-19, in line with the recovery missions including the green new deal.

Box 1: Energy Efficiency, heating and energy management

The Accelerated Green scenario could support 56,000 direct jobs in 2025 and an average of 41,000 per year over the decade in energy efficiency, heat pump deployment, district heating development, and on-site energy generation and management alone.

The Accelerated Green pathway sees the need for 2.2 million heat pumps in London by 2030. Currently, there are around 260,000 heat pumps operating in the UK, mainly in off-gas grid locations and they represent around 1 per cent of the UK heating technology market.¹⁹ However, the number operational in London is currently much smaller, with just 521 domestic Renewable Heat Incentive (RHI) applications having been made for air source heat pumps from April 2014 to November 2021,²⁰ the lowest of any region in the UK by far. However, the Mayor is using his planning powers to drive greater uptake. In 2020, over 10,000 new homes and 77 per cent of non-residential floorspace that were approved for development included heat pump technologies.²¹

The Element Energy analysis finds that in 2028 alone London will need to install 284,000 heat pumps.²² Currently, around 31 per cent of the UK's sales of air source heat pumps and 41 per cent of ground source heat pumps are manufactured in the UK.²³ By using this technology, there is an opportunity to support the UK's own manufacturing base in locations such as Cornwall, Livingston and West Yorkshire. To support the required growth, more will need to be done to ramp up the number of qualified heat

¹⁸ GLA (2020), *London Low Carbon Sector Interim Report*. Available at: <https://www.london.gov.uk/what-we-do/london-low-carbon-sector-interim-report-2020>

¹⁹ BEIS (2020), *Heat pump manufacturing supply chain research project*. Available at: <https://www.gov.uk/government/publications/heat-pump-manufacturing-supply-chain-research-project>

²⁰ <https://www.gov.uk/government/statistics/rhi-monthly-deployment-data-november-2021>

²¹ GLA (2021), *Towards a net zero carbon London: Energy Monitoring Report 2020*. Available at: www.london.gov.uk/sites/default/files/energy_monitoring_report_2020.pdf

²² For comparison, the previous 2050 pathway saw lower peak levels of heat pump installation of 146,000 per year being reached later, in the 2030s.

²³ BEIS (2020), *Heat pump manufacturing supply chain research project*. Available at: <https://www.gov.uk/government/publications/heat-pump-manufacturing-supply-chain-research-project>

pump engineers. The Heat Pump Association have estimated that the Government's ambitions will require 44,000 installers (an increase from 1,800 currently).

This means that investment to decarbonise our buildings not only helps avoid dangerous climate change but can greatly stimulate our economy and create thousands of new job opportunities for Londoners. The wider supply chain benefits would also see jobs created outside of London, enabling the capital to contribute to economic recovery around the UK.

Box 2: Jobs in transport

While the net zero analysis does not make assessments for the transportation sector, the size of the opportunity can be illustrated from other sources. The European Association of Electrical Contractors (AIE) estimate that 200,000 permanent jobs will be created in the electric vehicles sector in Europe, with around 57 per cent of jobs supporting the installation, operation and maintenance of electric vehicle charging points. London's expected share of jobs supporting charging infrastructure is around 4,560. The Local Government Association estimates a total of approximately 9,000 direct jobs in London associated with low carbon transport in 2030 (2,502 in alternative fuels and 6,619 in low emissions vehicles and infrastructure). The London Cycling Campaign (LCC) has estimated that there could be as many as 25,000 jobs in London alone from the cycling sector.

In addition, creating an environment which encourages a switch to zero emission vehicles will indirectly stimulate industries manufacturing electric vehicles, including electric buses and taxis, and their associated supply chains.

The Mayor's net zero target could also play an important role in stimulating UK supply chains. Electrifying London's bus fleet by 2030 could drive substantial bus orders in manufacturing locations such as Ballymena, Scarborough, Falkirk and Yorkshire, representing a gross investment into bus manufacturing of £4 billion and supporting 3,000 jobs. Because of the Mayor's policies to incentivise the accelerated take up of electric vehicles, the new London Electric Vehicle Company taxi plant has created more than 1,000 jobs in the West Midlands.

(3) Reducing inequality and raising living standards for all

Delivering net zero by 2030 can improve the quality of life for the most vulnerable Londoners. If done right, prioritising home energy efficiency can help support lifting people out of fuel poverty. Cutting greenhouse gas emissions by reducing the use of polluting vehicles, encouraging active travel and the use of public transport will also improve air quality. This will be particularly beneficial to poorer Londoners who are most likely to live in areas of poor air quality.²⁴

²⁴ Communities which have higher levels of deprivation or a higher proportion of people from a Black, Asian or Minority Ethnic background are more likely to be exposed to higher levels of air pollution. However, thanks to the Mayor's policies,

Considering the impacts on the most vulnerable in our society is vital for all climate actions, to ensure we have a just transition. By promoting green skills training and routes to employment for Londoners, we can develop employment opportunities for young or unemployed Londoners, and those that need to transition away from sectors incompatible with a net zero future.

(4) Public health benefits

Climate action can also have public health benefits. For example, London's Ultra Low Emission Zone has been an important mechanism for tackling air quality as well as reducing GHG emissions and has significant public health impacts. A study from Imperial College London found that London's toxic air contributed to the deaths of more than 4,000 Londoners in 2019.²⁵ More than half a million people in London are registered with asthma and two-thirds of sufferers say that their condition is made worse by poor air quality. The health benefits of the Mayor's policies, including the ULEZ and its expansion, will save the NHS and social care system almost £5 billion and prevent more than one million air pollution related hospital admissions over the next 30 years.²⁶

Reaching net zero by 2030 will require an increase in active travel modes, such as walking and cycling. Staying physically active is essential for good health and wellbeing and it is one of the most accessible and inclusive forms of physical activity. There is a well-established link between physical inactivity and obesity, and the increased risk of cardiovascular disease, diabetes and some cancers. Physical inactivity is not only linked to obesity, it is also one of the top ten causes of all disease and disability in England.

Making homes more energy efficient and tackling emissions from heating will also bring other health benefits in terms of indoor air quality, reduced fuel poverty and warmer homes. Research reveals a relationship between cold homes and anxiety and depression.²⁷ National Energy Action estimate the costs to the NHS from treating illnesses caused by cold homes costs around £1.3 billion every year. Typically, the greatest social and economic costs of cold homes are borne by the most vulnerable,²⁸ with fuel poverty exacerbating inequalities. Black, Asian and Minority Ethnic households are twice as likely to be fuel poor than white households and the impacts on health are greater for older people and young children.

including the central Ultra Low Emission Zone, the 'exposure gap' between the most and least deprived areas has narrowed by up to 50 per cent since 2013. Logika Air Quality Noise Consultants (2019), *Air pollution and inequalities in London: 2019 update*. Available at: <https://www.london.gov.uk/WHAT-WE-DO/environment/environment-publications/air-pollution-and-inequalities-london-2019>

²⁵ GLA (2021), *New Imperial study on Mayor's air quality policies*. Available at: <https://www.london.gov.uk/press-releases/mayoral/new-imperial-study-on-mayors-aq-policies>

²⁶ Logika Air Quality Noise Consultants (2019), *Air pollution and inequalities in London: 2019 update*. Available at: <https://www.london.gov.uk/WHAT-WE-DO/environment/environment-publications/air-pollution-and-inequalities-london-2019>

²⁷ Marmot Review Team (2011), *The health impacts of cold homes and fuel poverty*. Available at: <http://www.instituteofhealthequity.org/resources-reports/the-health-impacts-of-cold-homes-and-fuel-poverty/the-health-impacts-of-cold-homes-and-fuel-poverty.pdf>

²⁸ *Ibid.*

Climate change means London is experiencing hotter drier summers and warmer wetter winters. Every degree increase over 20 degrees Celsius raises ambulance call outs by one per cent.²⁹ In 2020, Public Health England estimated there were 488 excess deaths in London in during Summer heatwaves.³⁰ Taking action to mitigate climate change and adapt London to its consequences is essential to the wellbeing of Londoners.

²⁹ Mahmood, M. A. et al. (2017), *Impact of Air Temperature on London Ambulance Call-Out Incidents and Response Times*. Available at: https://mdpi-res.com/d_attachment/climate/climate-05-00061/article_deploy/climate-05-00061.pdf

³⁰ Public Health England (2020), *Heatwave Mortality Monitoring Report: 2020*. Available at: <https://www.gov.uk/government/publications/phe-heatwave-mortality-monitoring/heatwave-mortality-monitoring-report-2020>

The cost of action

The Element Energy analysis can be used to compare the cumulative costs to 2050 of the Accelerated Green pathway (reaches net zero in 2030) with the cumulative costs to 2050 of the original patchwork pathway (reaches net zero in 2050). As shown in Table 1 below, the total cumulative investment is approximately the same, but as shown in Figure 1 above, there are clear carbon benefits from acting more quickly, with the Accelerated Green pathway resulting in a cumulative saving of 150 MtCO_{2e} emissions when compared with London's previous net zero pathway.

Table 1: Investment associated with each decarbonisation pathway. Investment costs are discounted.³¹

Metric	High Electrification	High Hydrogen	Accelerated Green	No Constraints	Patchwork (2050)
Total cumulative investment costs to 2050 (£bn)	291	285	294	293	287

These costs do not account for the natural replacement cycle for infrastructure, so it should not be assumed that all of these costs represent additional investment. However, 'doing nothing' is not an option, as our infrastructure (including home heating, cars, public transport, electricity networks) will need to be replaced or upgraded over time anyway.

With a 2030 target, the costs of the transition are front loaded. Taking action to tackle London's carbon emissions will require substantial investments in capital infrastructure across our buildings, energy networks and transport systems. The Accelerated Green scenario requires at least **£75 billion of investment between now and 2030 in infrastructure** and £108 billion in total to 2050. Infrastructure investment continues after 2030 and takes account of natural replacement cycles, the continued rollout of low carbon heating solutions, retrofit and electric vehicle charging to support the growing electric vehicle (EV) fleet. The infrastructure investment will not solely be borne by London's government or the public purse. Delivery of the net zero ambition will require the GLA to work with local and national government, utilities, business, finance institutions and Londoners to find the right funding mechanisms to support the infrastructure that is needed. High levels of finance and new business models will need to be mobilised extremely quickly to enable the level of action needed, which is why the Mayor is planning

³¹ Discounted costs give the value of future costs as they would be valued today and is common practice in economic evaluations.

to create a London Climate Finance Facility, supported by private institutions, with the aim of mobilising greater sums of finance over the decade.

Bringing forward that investment does create clear benefits, as identified above. Some of these are difficult to put a monetary value on, so this is not a cost-benefit analysis. For example, phasing out fossil fuels will bring down exposure to air pollution, bringing significant health benefits and saving money for the National Health Service and to the economy. Similarly, London as an innovator can benefit from supporting fast growing green industry sectors, supporting economic growth and jobs.

The investment will also lead to more efficient energy systems, reducing the costs of fuel to drive our economy and city. The fuel costs of powering and heating our buildings and running our cars and transport systems currently costs London around £11.1 billion per year. According to Element Energy, by 2030 that cost could be £6.2 billion or 44 per cent less if we invest in the infrastructure needed. This is particularly important given the current context of soaring energy prices.

Who will fund this transition?

These costs will need to be paid for via a combination of routes including government capital expenditure (at all levels of government), utility bills, private finance as well as individuals that are able to invest directly. Any decisions regarding funding the transition must be just, ensuring that all Londoners can participate in the transition to net zero and that vulnerable groups or communities are not disproportionately impacted. Provisions will need to be made to make sure that decision makers distribute the costs in the fairest way possible while protecting the most vulnerable and those on the lowest incomes. The UK government needs to accelerate investment to meet its legally-binding 2050 net zero target:

- The Climate Change Committee (CCC) stated in its Sixth Carbon Budget report to the UK Government³² that low carbon investment must scale up to around £50 billion per year by 2030, if the UK is to deliver its 2050 net zero ambitions. Between 2022 and 2030 the CCC has estimated that around £356 billion must be invested across the UK economy in its infrastructure. London's fair share of this investment amounts to **£48.3 billion between now and 2030**.
- Government has committed around £12 billion nationally to support heat networks, retrofit, heat pumps, electric vehicles and charging and cycling and walking infrastructure across over the next 4 years. Additionally, the UK Infrastructure Bank has up to £12 billion of finance to support levelling up and climate change and a further £10 billion available as guarantees. Assuming those commitments are maintained over the decade we have estimated that it could total just under £50 billion by 2030. A fair share of that funding and finance would equate to just under **£7 billion** for London across the decade.

³² Climate Change Committee (2020) Sixth Carbon Budget. Available at: <https://www.theccc.org.uk/publication/sixth-carbon-budget/>

Commitments from Government and others in line with CCC recommendations will be an essential part of supporting London's ambitions. But even if London were to secure its fair share of the overall UK investment that the CCC says is needed to deliver the UK's 2050 target, then an additional estimated £27 billion would be needed to deliver London's more ambitious 2030 target. This will need to be primarily secured through private finance and capital investment across the decade.

The Mayor's Energy Efficiency Fund (MEEF) is currently supporting investments into London energy efficiency projects. To date the Fund has secured over £310 million of investment. The Mayor announced in November 2021 a further £30 million of funds into MEEF, which will secure around an additional £150 million of private sector investment over the next two years. The Mayor is also exploring other routes to mobilise private sector investment such as a GLA Group-wide power purchase agreement, securing new renewable infrastructure. The scale and speed of activity required to hit the 2030 target means that even greater levels of financing will be needed. The Mayor is also exploring options for creating a London Climate Finance Facility with the aim of mobilising greater sums of private finance over the decade.

Residual emissions in 2030

While the Mayor's immediate priority is reducing emissions to reach net zero by 2030, Element Energy's analysis shows, even the most ambitious pathway would not achieve absolute zero carbon emissions by then. There will be some residual emissions, higher by the target date, than the 10 per cent previously anticipated for 2050. For example, the national electricity grid will not be zero emission by this point, unless the government accelerates its plans to decarbonise the grid much faster than currently envisaged. Some fossil fuelled vehicles will still be on our roads. Some offsetting will be needed to get to net zero emissions. It is only with the expected development of direct air carbon capture technologies in coming decades that cities like London and countries like the UK will be able to reduce their emissions to net zero without using current offsetting approaches such as afforestation and reforestation.

The Accelerated Green pathway has 22 per cent residual emissions in 2030 (i.e. a reduction in emissions of 78 per cent relative to 1990). These residual emissions are largely comprised of remaining gas use in buildings, non-zero emission vehicles (including planes) and emissions from electricity. Whilst the No Constraints scenario results in fewer residual emissions in 2030, this scenario is not considered deliverable in the timeframe required. The High Hydrogen and High Electrification scenarios have higher levels of residual emissions in 2030 as they are less ambitious. For comparison, if the UK meets its targets, it will have 32 per cent residual emissions by 2030.

The Element Energy report estimates the cost of offsetting residual emissions in 2030 could range from £634 million to £4.2 billion in the Accelerated Green pathway, depending on the price of carbon and approach to offsetting. Over the coming years, we will work with other global cities, including with C40, and with UK Government to help ensure we have in place by 2030, or earlier, an ethical approach to any offsetting that may be required.

Other cities with net zero by 2030 targets are also investigating how to deal with their residual emissions.³³ For example, Copenhagen has a target to be carbon neutral by 2025 but will have residual emissions at that point.³⁴ Bristol also has a 2030 target and recognises the likely need to offset residual emissions in its Bristol One City Climate Strategy.³⁵ Given the immediate priority on reducing emissions, it plans to review offsetting requirements later in the decade.

³³ C40 (2019), *Defining carbon neutrality for cities and managing residual emissions: Cities' perspective and guidance*. Available at: https://www.c40knowledgehub.org/s/article/Defining-carbon-neutrality-for-cities-and-managing-residual-emissions-Cities-perspective-and-guidance?language=en_US

³⁴ Bundgaard, K. (2021), *CPH2025 Climate Plan*. Available at: https://www.f-s-u.ch/wp-content/uploads/2021/04/11_Bundgaard.pdf

³⁵ Bristol One City (2020), *One City Climate Strategy*. Available at: <https://www.bristolonecity.com/wp-content/uploads/2020/02/one-city-climate-strategy.pdf>

Of course, London's work won't stop in 2030. We will keep striving to reduce residual emissions as quickly as possible. The Accelerated Green pathway should reach 10 per cent residual emissions in 2037 and around 5.5 per cent residual emissions by 2050.³⁶ In this period, the grid will continue to decarbonise, we will complete the transition to clean vehicles and make our buildings carbon-free.

³⁶ This is lower than the 10 per cent residual emissions in the LES 2050 Patchwork pathway due to more ambitious assumptions taken e.g. higher level of energy efficiency facilitating a bigger switch away from gas boilers, reducing the increase in demand from aviation etc.

What happens next?

We are in a decade of action. Whilst vital work had already started under the previous 2050 target, the Mayor's commitment to make London a net zero carbon city by 2030 means we must work at a greater scale and pace than ever before.

As the Mayor only has powers to address less than half of London's emissions, he will continue to make the case to the government to accelerate its action on climate change and to support London in doing so.

This analysis from Element Energy has provided the data for the Mayor to indicate Accelerated Green as the preferred pathway to deliver the 2030 net zero target.

This will require large scale transformation by 2030, requiring new approaches, greater coordination, faster action, citizen buy-in, the devolution of powers and funding from national government, and substantial flows of private sector capital.

As part of London's recovery and the Green New Deal mission, activity by all of London's key stakeholders is underway to create a green recovery and double the size of London's green economy this decade. We will build on this work programme and continue to work with the members of the London Recovery Board and other London stakeholders in 2022 to develop detailed delivery plans.

The GLA will use this analysis to engage key stakeholders across London, the UK and national government on how they can together achieve net zero emissions by 2030, and to build public consensus around the urgent changes needed to tackle climate change and achieve a green economy.

Appendices

Appendix 1: Summary of key outcomes and examples of potential policies and measures proposed in the Element Energy Report to support delivery of the Accelerated Green pathway³⁷

		Key target outcomes	Examples of policies and actions to support delivery
Buildings			
Energy Efficiency		<ul style="list-style-type: none"> Average domestic space heating demand brought to 65 kWh/m² Average total heat demand savings of 37% across domestic buildings (space heating and hot water) and 39% across non-domestic buildings by 2030 compared with 2020 	<ul style="list-style-type: none"> Rollout of supportive measures for all tenure types, including action plans, delivery models, financing and funding, supportive planning policy (including enforcement of energy efficiency standards) and lobbying Support of supply chain through training and early communication of requirements
Low-Carbon Heating	General	<ul style="list-style-type: none"> 60% of domestic heating systems are low carbon by 2030 	<ul style="list-style-type: none"> Funding, financing and support to address financial barriers ramped up to peak levels by 2026 Zoning of heat to define areas to prioritise for each heating technology Communication of plans to give confidence to the installer industry to build the skills and supply chain Review planning policies to remove potential barriers
	Heat pumps	<ul style="list-style-type: none"> 2.2 m heat pumps installed by 2030 280 k heat pumps installed annually at the peak deployment 	

³⁷ Element Energy (2022), *Analysis of a Net Zero 2030 Target for Greater London*. Available at: <https://www.london.gov.uk/what-we-do/environment/climate-change/zero-carbon-london/pathways-net-zero-carbon-2030>

	District heating	<ul style="list-style-type: none"> • 460 k domestic district heating connections installed by 2030 	<ul style="list-style-type: none"> • Lobby for rebalancing of gas and electricity energy taxation to incentivise low carbon heating
	Phase out of fossil fuel heating systems	<ul style="list-style-type: none"> • Fossil fuel heating systems banned from new developments from 2025 • Fossil fuel heating system replacements banned from 2026, with exceptions in areas expected to remain connected to grid (using biomethane) 	<ul style="list-style-type: none"> • Planning requirements for new developments to have low-carbon heating systems from 2025 • Mandate preventing fossil fuel heating system replacements, with exceptions in appropriate locations
	Solar PV on rooftops	<ul style="list-style-type: none"> • 1.5 GW by 2030; 3.9 GW by 2050 	<ul style="list-style-type: none"> • Increased ambition in action to support rooftop solar, such as through increasing ambition for GLA and other public sector stock, additional financial support, strengthening planning support, and support for community energy projects
	Hydrogen	<ul style="list-style-type: none"> • 0.2 TWh of hydrogen used in district heating by 2030 	<ul style="list-style-type: none"> • Secure supply of hydrogen for use in peaking boilers and FC CHP by working with local production projects • Zoning of heat to identify strategic sites and communication with DNOs
Transport			
	Modal Shift	<p>By 2030</p> <ul style="list-style-type: none"> • 27% reduction in car vkm relative to 2018 • 2% growth in van vkm relative to 2020 • 0% growth in HGV vkm relative to 2018 • Limited recovery of air travel demand by 2030 following COVID-19 levels (reaching 50% of 2018 levels) • Aviation growth beyond 2030 limited to 85% of 2018 levels by 2050 	<ul style="list-style-type: none"> • Introduce London-wide road user charging by the mid-late 2020s • Traffic and parking control measures, such as changes to parking supply and pricing, in line with MTS but accelerated by 10 years – meeting the majority of MTS aims by 2030 • Co-location of services, housing and employment in selected areas to reduce travel need by 2030 • Measures meeting MTS aims for road space reallocation to public, shared and active travel infrastructure, accelerated by 10 years • Significant improvement in public transport offering by 2030, with likely focus on acceleration of bus network improvements to compensate for slower rollout of rail and other public transport modes

		<ul style="list-style-type: none"> • Support consolidation of freight and make use of sustainable solutions for last mile deliveries in selected areas, such as through funding, financing and working with freight operators • Review inclusion and support for aviation in recovery and growth with the aim of minimising growth beyond 2020 (COVID) levels • Lobby for limits to further expansion of airports, e.g. through a review of the Airports National Policy Statement • Encourage business to agree a high level of commitment to reduce air travel
Zero emission road transport	<ul style="list-style-type: none"> • Share of vkm by ZEVs by 2030 <ul style="list-style-type: none"> ○ Cars: 46% ○ Vans: 34% ○ All HGVs: 14% • End to ICE sales <ul style="list-style-type: none"> ○ Cars: 2030 ○ Vans: 2030 ○ Rigid HGVs: 2035 • Zero emission TfL bus fleet by 2030 	<ul style="list-style-type: none"> • Emission zones ramped up post-2030 • Measures to encourage uptake in high mileage vehicles such as enhanced licencing requirements for taxis, PHVs and car clubs, and encouraging company car EV adoption • Accelerate deployment of public EV charging network (34,000 EVCPs by 2030) • Lobby for national public HGV charging/refuelling infrastructure by 2040 • Lobby for enforcement of ban on petrol and diesel ICE vehicle sales • Coordinate aggregated demand (joint purchasing) across fleets • Funding for zero emission bus uptake by 2030
Other fuels	<ul style="list-style-type: none"> • 5% blending of synthetic aviation fuel (SAF) by 2030 	<ul style="list-style-type: none"> • Lobby for high uptake targets for SAF (at least 5% blending by 2030 and 50% by 2050)
Infrastructure		
Electricity Grid	<ul style="list-style-type: none"> • Infrastructure upgrades to mitigate localised increases in peak demand 	<ul style="list-style-type: none"> • Engage early and regularly with DNOs and key stakeholders to share data and plans
Hydrogen	<ul style="list-style-type: none"> • 1.0 TWh of hydrogen delivered to London by 2030 	<ul style="list-style-type: none"> • Secure supply for strategic use of hydrogen

Appendix 2: Assumptions used in investment analysis

Government sources of Funds (announced)

Sources: Net Zero Strategy³⁸, UK Heat and Buildings Strategy³⁹, ECO 4 consultation⁴⁰, UKIB Framework Document⁴¹, CSR 2020⁴²

Grants/Funds	Announced	Assumed to 2030	Country
Heat networks	£338m over 3 years	£1,014m	England
Home Upgrade Grant	£950m over 3 years	£2,850m	England
Social Housing Decarbonisation Scheme	£800m over 3 years	£2,400m	England
Public Sector Decarbonisation Scheme	£1,425m over 3 years	£4,275m	England and UK reserved institutions in Scotland, Wales & NI
Boiler upgrade	£450m over 3 years	£1,350m	England
ECO 4	£4,000m over 4 years	£9,000m	UK
Heat Pumps Innovation	£60m	£60m	UK
Zero Emission grants and EV Infrastructure (existing)	£1,900 over 3 years	£4,500m	England
Zero Emission grants and EV Infrastructure (announced in CS20)	£620m	£1,860m	England
Automotive Transformation Fund	£1,000m	£1,000m	UK
Cycling and Walking Infrastructure in towns and cities	£2,000m over 5 years	£3,600m	England
Finance			
UK Investment Bank Equity	£5,000m	£5,000m	UK; funds support net zero and levelling up
UK Investment Bank Optional Equity (from debt management office)	£7,000m	£7,000m	UK; funds support net zero and levelling up
UK Investment Bank Guarantees	£10,000m	£10,000m	UK; funds support net zero and levelling up
London fair share	£3,698m	£6,777m	Based on population

³⁸ UK Net Zero Strategy 2021. Available at: <https://www.gov.uk/government/publications/net-zero-strategy>

³⁹ UK Heat and Buildings Strategy 2021. Available at: <https://www.gov.uk/government/publications/heat-and-buildings-strategy>

⁴⁰ ECO 4 Consultation. Available at: <https://www.gov.uk/government/consultations/design-of-the-energy-company-obligation-eco4-2022-2026>

⁴¹ UK Investment Bank Framework Document. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/994437/UK_Infrasructure_Bank_Framework_Document.pdf

⁴² Comprehensive Spending Review 2020. Available at: <https://www.gov.uk/government/publications/spending-review-2020-documents/spending-review-2020>

Appendix 3: Direct jobs supported to 2030 across the four pathways

Total jobs in thousand FTE		2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
All sectors	High Electrification	8	13	30	47	55	54	52	50	42	36	31
	High Hydrogen	8	13	29	44	51	49	46	42	35	29	23
	Accelerated Green	9	14	31	49	57	58	59	55	45	40	34
	No Constraints	9	15	36	55	66	69	69	65	58	52	46

Source: Element Energy, 2022 – London Net Zero 2030 Tool⁴³

⁴³ London's Zero Carbon Pathways Tool: <https://data.london.gov.uk/dataset/london-s-zero-carbon-pathways-tool>

Direct jobs supported by intervention to 2030 across the four pathways

Jobs in thousand FTE per sector												
Year	Scenario	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Energy Efficiency	All Scenarios	2	5	18	31	37	34	30	26	18	11	6
Heat Pumps	High Electrification	1	2	4	5	7	8	10	12	12	12	12
	High Hydrogen	1	2	2	2	3	3	4	4	5	5	4
	Accelerated Green	1	2	4	7	9	12	14	14	12	12	12
	No Constraints	1	3	9	13	16	20	20	20	20	19	18
Heat Networks	High Electrification	4	4	5	5	6	6	6	7	7	7	8
	High Hydrogen	4	4	5	5	6	6	6	7	7	7	8
	Accelerated Green	4	4	5	6	6	6	10	10	10	11	11
	No Constraints	4	4	6	7	8	10	14	14	15	15	16
Hydrogen boilers⁴⁴	High Hydrogen	-	-	-	-	-	-	-	-	-	-	-
	No Constraints	-	-	-	-	-	-	-	-	-	-	-
On-site Energy/Storage/Smart systems	All Scenarios	1	3	4	5	5	5	5	5	6	6	5

Source: Element Energy, 2022 – London Net Zero 2030 Tool⁴⁵

⁴⁴ Widespread deployment of hydrogen for heating in buildings (either hydrogen boilers or hybrid heat pumps) is not considered viable before conversion of the gas grid. While some areas of the gas grid may be able to begin conversion in the early 2030s, full grid conversion is not expected before the 2040s.

⁴⁵ London's Zero Carbon Pathways Tool: <https://data.london.gov.uk/dataset/london-s-zero-carbon-pathways-tool>

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