elementenergy

# *Development of the Greenwich Carbon Neutral Plan:*

# *The Evidence Base*

**Royal Borough of Greenwich**

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## Abbreviations

| | | | |
|---|---|---|---|
| **ASHP** | Air-source heat pump | **LA** | Local authority |
| **BECCS** | Bio-energy with carbon capture and storage | **LGV** | Light goods vehicle |
| **BEIS** | Buildings, Energy and Industrial Strategy (Department of) | **LIP** | Local implementation plan |
| **BEV** | Battery electric vehicle | **M/LSOA** | Middle/Lower Layer Super Output Area |
| **BID** | Business Improvement District | **MEES** | Minimum energy efficiency standard |
| **CAZ** | Clean air zone | **$MtCO_2$** | 1 million tonnes of carbon dioxide |
| **CCC** | Committee on Climate Change | **NPPF** | National Planning Policy Framework |
| **CHP** | Combined heat and power | **OLEV** | Office for Low Emission Vehicles |
| **DfT** | Department for Transport | **OSS** | One-stop shop |
| **DSR** | Demand side response | **PHEV** | Plug-in hybrid electric vehicle |
| **ECO** | Energy Company Obligation | **PV** | Photovoltaic |
| **EfLSCo** | Energy for Londoners Supply Company | **RBG** | Royal Borough of Greenwich |
| **EPC** | Energy Performance Certificate | **RHI** | Renewable Heat Incentive |
| **EV** | Electric vehicle | **SPF** | Seasonal performance factor |
| **FCEV** | Fuel cell electric vehicle | **TfL** | Transport for London |
| **FTE** | Full-time equivalent | **ULEV** | Ultra low emission vehicle |
| **GGS** | Greener Greenwich Strategy | **ULEZ** | Ultra low emission zone |
| **GLA** | Greater London Authority | **UNFCCC** | United Nations Framework Convention on Climate Change |
| **$H_2$** | Hydrogen | **vkm** | Vehicle kilometre |
| **HGV** | Heavy goods vehicle | **ZEN** | Zero emission network |
| **ICE** | Internal combustion engine (conventional vehicle engine) | **ZEV** | Zero emission vehicle |
| **$ktCO_2$** | 1 thousand tonnes of carbon dioxide | **ZEZ** | Zero emission zone |

# 1 Executive Summary

## 1.1 Introduction

The Royal Borough of Greenwich (RBG) has commissioned Element Energy to develop an evidence base supporting the development of a pathway to carbon neutrality by 2030, to facilitate the ultimate creation of a Greenwich Carbon Neutral Plan. This Plan will detail how the borough intends to progress towards its stated ambition of achieving net zero emissions by 2030. In this report, a high-level menu of options for delivering carbon emissions savings is developed and some priority actions are identified from within this menu. However, the delivery of a detailed Greenwich Carbon Neutral Plan is reserved for Stage 2.

The pace of decarbonisation implied by a 2030 net zero target is very rapid and importantly goes beyond that legislated at the national level, at which a 2050 target is being pursued. The evidence base presented in this document combines detailed modelling of Greenwich's greenhouse gas emissions both for a Baseline scenario and a 'Maximum ambition' scenario, in which highly ambitious mitigating measures are assumed in line with the accelerated 2030 target. We then present a menu of policy options available to RBG to drive the deployment of these measures. There are significant policy-based, financial, technological and social challenges associated with the pursuit of such a decarbonisation as a local authority and, to some extent, RBG is inevitably limited by the pace of decarbonisation across the country at large. For example, while RBG actions can have some effect on the carbon intensity of the national electricity grid, the borough cannot alone reduce this to zero.

The accelerated timeline necessary to achieve decarbonisation by 2030 means that **progress towards this target must start immediately**. To guide this immediate action, we highlight a set of 'priority' actions. These actions do not in themselves go far enough to achieve a 2030 net zero trajectory. However, these actions will collectively achieve substantive progress towards the target, at relatively low cost, and do not involve hard trade-offs with other policy objectives. In addition, they deliver valuable learnings while keeping options open where possible, such that RBG's strategy can adapt in response to the success of initial programs and external changes, such as changes to the national policy environment and technology learning.

The learning derived from the completion of these meaningful early actions would then position RBG to make more difficult decisions involving more substantial trade-offs, such as between carbon emissions savings, cost, consumer/citizen choice and so on. To achieve the target of carbon neutrality by 2030, we suggest that **by 2023 at the very latest** RBG would need to implement a comprehensive suite of highly ambitious policies, in some cases with trade-offs of this nature, enabling the borough to further accelerate decarbonisation relative to the national 2050 target.

## 1.2 Key findings

The major emissions sources in RBG are heating and electricity demand in buildings, and road transport. In 2015 the total annual emissions were 860 kt $CO_2$ and our modelling shows that in the Baseline scenario this decreases to 628 kt $CO_2$ by 2030. These savings are predominantly due to energy efficiency improvement in buildings, a reduction in the carbon intensity of grid electricity (in line with the National Grid's "Steady State" scenario) and the uptake of some low emissions vehicles in the road transport sector. The Baseline scenario is not a 'business-as-usual' scenario. In particular, the energy efficiency improvements in buildings are relatively ambitious, including both strong national planning regulation on the new build sector and a programme of retrofits for energy efficiency improvement. For road transport emissions, modelled Baseline projections represent data on activity and fleet composition provided by Transport for London as their own 'baseline' scenario. Rail transport emissions assume changes based on the Mayor's Transport Strategy.

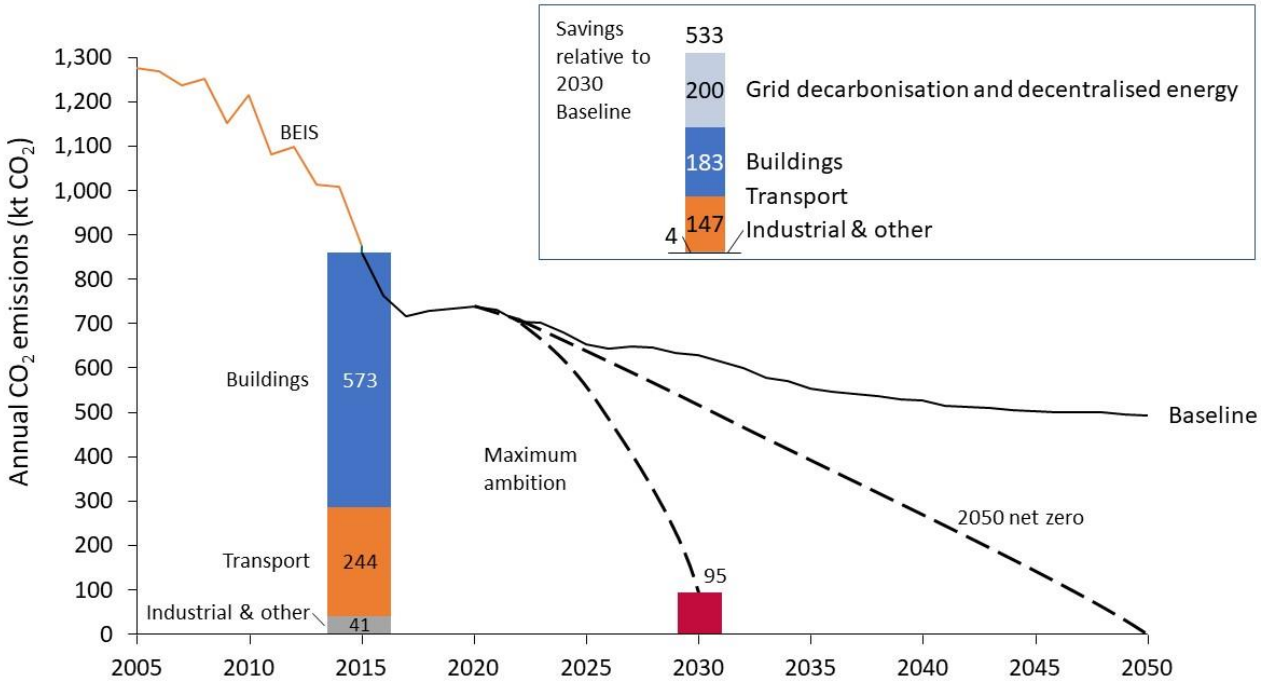
We find that after applying a highly ambitious range of mitigating measures, and assuming that the national electricity grid carbon falls to zero, the remaining emissions in 2030 could fall to 95 kt $CO_2$. This level of emissions saving requires an almost complete decarbonisation of heating in buildings –

we assume that there are no active gas boilers in the borough in 2030 except those operating in a hybrid system with a heat pump (these supply only a small minority of the heat in a building). On the transport side, highly ambitious modal shifts and uptake of low emissions vehicles within fleets are required. For example, total vehicle kilometres driven by cars are reduced by 45% relative to 2015 and battery electric vehicles make up 51% of the car fleet. Where emissions remain under the Maximum ambition scenario, this is because we could not assign realistic measures which we judged feasible based on policies which RBG could enact. The remaining emissions, after assuming full decarbonisation of the electricity grid, consist of the following:

- Buildings – 24 kt $CO_2$ from refrigerants (emitted by heat pumps and AC units) and natural gas burning by gas boilers operating in a hybrid system with a heat pump
- Transport – 44 kt $CO_2$, predominantly due to remaining ICE and hybrid ICE engines in the road transport fleet, and aviation (for which no reductions are modelled)
- Industry, waste & other – 26 kt $CO_2$, due to remaining emissions from river traffic, non-road mobile machinery, small industry and waste.

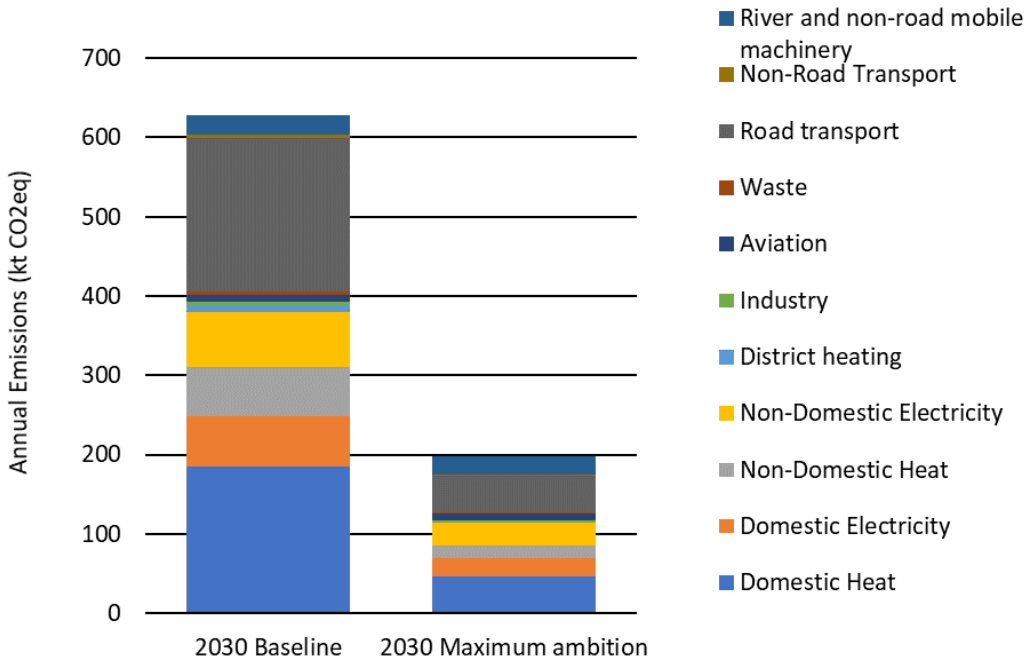
Figure 1-1 shows the Baseline emissions trajectory, alongside historic emissions taken from a BEIS data set[1] and the Maximum ambition trajectory. The inset shows the breakdown of emissions savings by sector. In Figure 1-2 the emissions in 2030 in the Baseline and Maximum ambition scenarios are shown disaggregated at a more detailed level by emissions source.

**Figure 1-1 Emissions trajectories**




[1] 'BEIS' refers to the 'BEIS, UK local authority and regional carbon dioxide emissions national statistics: 2005 to 2017' data set, which is used to provide backdated emissions for the years leading up to the Baseline modelling

**Figure 1-2 Annual emissions by source in 2030 in the Baseline and Maximum ambition scenarios, without full grid decarbonisation**




## 1.3 Recommendations for action

As an output of our detailed policy appraisal, the following actions across the 'buildings', 'transport' and 'other' sectors have been identified as priority actions:

**Buildings**:

A. Set up a 'One-stop shop' for energy efficiency and low carbon heating
B. Liaise with the GLA's Energy for Londoners team and in particular the Energy for Londoners Supply Company (EfLSCo) during its setup and operation
C. Run a major publicity campaign covering all aspects of the net zero plan
D. Explore opportunities to raise new build non-domestic carbon emissions standards above the National Planning Policy Framework
E. Initiate exemplar new build projects of LA owned or partially LA owned housing at a very high standard of energy efficiency
F. Retrofit all existing local authority owned homes and public buildings to Energy Performance Certificate (EPC) C+ energy efficiency standard.
G. Initiate low carbon heat network schemes in cost effective and heat density appropriate locations, acting alone or in a public-private partnership
H. Update the Local Plan to state that no new gas CHP used to supply heat networks can be built in Greenwich from 2021
I. Heat pump installer training and quality assurance scheme, operating through the 'One-stop Shop'
J. Install low carbon heating systems in all LA owned homes and public buildings where not assigned to a heat network
K. Lobbying of national government: undertake all lobbying set out in Table 5-2

**Transport:**

L. Introducing banded resident parking permits in proportion to emissions impact
M. Introducing new and extended controlled parking zones
N. Introducing a workplace levy

O. Reducing/removing on-street parking spaces in new developments
P. Reallocating existing parking spaces to car clubs
Q. Reducing speed limits to 20mph on all residential roads and appropriate major roads
R. Increasing provision of both public access and business EV charge points
S. Increase use of Permitted Development rights for installing charge points
T. Creating new and improving existing cycle network infrastructure throughout the borough
U. Improvement of walking routes in town centres
V. Increasing provision of bike hangars for residents and at key transport hubs
W. Providing subsidised telematics service for local van users
X. Supporting/encouraging the formation of a Business Improvement District
Y. Beginning to convert the RBG fleet to zero emission vehicles (ZEVs) where feasible
Z. Assessing the feasibility of zero emissions zones (ZEZs), access restrictions, consolidations opportunities and larger cycling infrastructure projects
AA. Encourage employers to conduct travel surveys and review transport policies to identify opportunities for modal shift
BB. Lobbying and working with stakeholders as outlined in Table 5-3, with a focus on policies that target improved public transport and cycling infrastructure networks and zero emission technologies

**Energy generation, industry, waste & other sources:**

CC. Consider opportunities for the promotion of demand side response, energy storage and smart/flexible technologies
DD. Set strict quantitative targets for waste reduction and increased recycling
EE. Consider instituting separate food waste collection and anaerobic digestion
FF. Undertake baselining of RBG's direct emissions and organise/improve data on energy procurement
GG. Assess feasibility of requiring ships to turn engines off or use anti-pollution technology while in berth

The identification of these specific policies as 'Priority' accounts for their cost, deliverability (including level of council control and specific barriers), co-benefits, and level of risk. The assessment of co-benefits pays particular attention to alignment with RBG's core strategic objectives.

High-level approximate costs and resourcing requirements have been estimated. At peak, a total of 21-38 FTE in addition to current RBG staff are estimated to be required to deliver all these priority actions across all sectors; however, this represents the maximum that will be required at any one time and several of the required posts will be on a fixed, short-term basis. We estimate an average additional requirement over the three years to 2023 of 12-17 FTE. Expenditure in the region of £160m will be required over the three years[2], with £150m of this on actions related to the buildings sector and £10m on the transport sector. However, actions accounting for £140m of this expenditure have the opportunity for cost recovery through e.g. energy service plans, and funding sources are available. Of the estimated transport costs, £3.2m is already allocated in the Local Implementation Plan for Transport.

It is envisaged that having carried out these priority actions, RBG would then make **a decision on its long-term decarbonisation strategy – and timeline – by 2023 at the latest**. This decision process would use learnings from outcomes of the priority actions and take account of national developments to decide the level of RBG ambition and the strategy for achieving this. Evidence which will inform this process includes:

- Data collection on real world efficiency of technologies
- Stakeholder feedback on proposed and implemented measures

[2] Where an action continues past 2023, a fraction of the total cost is assigned according to the proportion of the total time period elapsed by 2023.

- Effectiveness of implemented policies
- Reductions in capital and operating costs
- Changes to national policy e.g. successors to the RHI

At this key decision point, choosing to maintain a maximum level of ambition would involve the implementation of many or all of the highest ambition policies, accelerating decarbonisation ahead of national targets to keep on the trajectory displayed in Figure 1-1. This will require the implementation of a comprehensive suite of policies, many of which involve more challenging trade-offs with cost, consumer/citizen choice and other factors. A medium level of ambition would see the implementation of selected high ambition policies to accelerate decarbonisation ahead of national targets but short of 2030 target, likely hitting net zero in the 2030s. Finally, a decision to align with national targets would see Greenwich join the 2050 net zero trajectory shown in Figure 1-1, via implementation of only those actions that bring RBG in line with national and London-wide targets. It is important to note that this trajectory still requires many of the policies set out below and is by no means a 'do nothing' scenario. Figures Figure 1-3, Figure 1-4 and Figure 1-5 show the recommended timeline and RBG action plan across the three sectors, alongside key relevant national and London-wide policy plans and milestones.

### 1.4 The Maximum ambition scenario

In order to reach carbon neutral status by 2030, RBG must align its policies with the 'Maximum ambition' scenario, implementing many or all the highest ambition policies we have set out in order to decarbonise ahead of national trends. It is likely that such a pathway will come at greater cost and risk to RBG and that decisions involving significant trade-offs will be necessary. The following selection of policies included in this scenario indicates the scale of action required to put the council on the path towards the Maximum ambition scenario for 2030 emissions. However, this is not an exhaustive list and should not be interpreted as a fully-fledged carbon neutral plan. The development of such a plan is reserved for Stage 2. Using the approximate costs assigned to individual policies, an overall high-level estimate of the total investment required under the Maximum ambition scenario has been calculated. We find this required investment to be £1.6 billion over the 10 years to 2030[3]. It should be noted that for many individual policies this represents an upper bound, assuming maximum uptake of offered incentives. In addition, there would be a range of funding sources (both private and public) used to meet such an investment and the Government will need to ensure that the transition to a net-zero economy is fair and just by supporting policy with sufficient funding to avoid adverse impacts on citizens, businesses and RBG. Further, the potential for revenue generation has been neglected from some costs and some (though not all) measures are likely to pay back well within their lifetime, for example by reduced fuel bills after energy efficiency improvements.

**Buildings**

- **Energy efficiency** – Undertake the retrofitting of all LA owned homes and public buildings to take them to EPC of C or higher. This is estimated to entail a cost of approximately £85 million. Further encourage via grant funding and/or concessionary loans, as well as informational measures and a 'One-stop shop' service, the retrofit of around 40% of all existing domestic buildings to bring them to EPC C or higher, at a further cost of approximately £200 million.
- **Heat networks** – Initiate new district heating projects, acting alone or in a public-private partnership, at a capital investment cost of approximately £200 million, partially externally funded. Begin a mandatory heat zoning policy from 2022, initially for new builds and public buildings and later including all existing buildings within designated heat network areas. Phase out of the use of fossil fuel power for heat networks (e.g. gas fired CHP) by 2030.
- **Low carbon heating systems** – RBG must entirely phase out the use of gas boilers by 2030 except where used – sparingly, and only at times of peak demand – in conjunction with an electric

[3] This cost does not equal the sum of all individual costs in Tables Table 5-2,Table 5-3Table *5-4* because in some cases policy options are mutually exclusive. In addition, offsetting and large-scale renewable energy generation are not included due to their high variability in cost with style of project adopted.

heat pump as part of a hybrid system. In order to achieve this, RBG must implement a clear phased program combining both a mandate and incentives. A clear signalling of a future ban on the use of fossil fuel heating systems, including gas boilers, should be made as far in advance as possible, ideally by 2021. To meet a 2030 carbon neutral target, given the typical lifetime of a boiler is 10-15 years or more, the prevention of new gas boiler purchases is necessary from 2022/2023 at the latest to reduce the extent of early retirements (at substantial cost) to a minimum. Heat pumps and hybrid heat pumps replace gas boilers in the majority of buildings in the Maximum ambition scenario. Given the high capital cost of such replacement systems compared to a gas boiler, provision of a strong incentive is necessary. This could take the form of direct funding in the region of 50% grants for all heat pump and hybrid heat pump purchases in both domestic and non-domestic buildings and/or "top-up" funding to any successor scheme to the national Renewable Heat Incentive (RHI). Incentives must be offered as early as possible, ideally from 2021. Such incentives, which are required to achieve a greatly accelerated deployment of low carbon heating systems in Greenwich compared with the rate of rollout required to meet the national 2050 net zero target, could come at a direct cost to RBG of approximately £500 million.

**Transport**

- **Access and charging restrictions** – RBG must greatly increase the extent of parking zones, reduce the number of available parking spaces for private use and increase the cost of parking for polluting vehicles. Zero emissions zones (ZEZs) must be created within the borough at a cost of at least £25 million, and RBG must push for the area of the borough included in the ULEZ extension in 2021 to become a ZEZ.
- **Infrastructure** – cycling and walking infrastructure and cycle parking provisions in the borough must be greatly increased at a cost of between £30-50 million. River crossing with suitable cycle and pedestrian access must be sought through lobbying and/or through creation of new infrastructure at additional cost. At least 2,000 additional public access charge points must be put in place across the borough to support the required uptake of electric vehicles by 2030.
- **Uptake of zero emission vehicles (ZEVs)** – RBG must support and encourage an accelerated uptake of ZEVs among residents and local businesses to reach the ambitious levels of ZEV deployment in the Maximum ambition scenario. This must start with full conversion of RBG's own fleet by 2030, which can be supported by working with other organisations to secure large-scale, joint procurement of ZE HGVs and helping to drive the market. Given the current high capital cost of ZEVs, financial support for private individuals and local businesses is required. The scale of funding required will depend on available government grants and price parity of ZEVs by the mid-to-late 2020s; however, the cost to RBG could be up to £30-45 million.
- **Modal shift and behaviour change** – The Maximum ambition scenario requires a large decrease in private car use with a shift to walking, cycling and public transport, as well as a reduction in van and truck use through consolidation and cycle freight. These ambitious aims will be delivered in part by infrastructure developments but must be supported by mobility schemes and behaviour change campaigns. RBG must support modal shift of deliveries and services through procurement policy and lead by example in its own operations.

**Energy generation, industry, waste & other**

- **Energy generation** – Invest in large scale renewable energy projects and promote demand side response and battery storage via smart/flexible technologies. This will help to increase the share of renewables on the electricity grid and reduce the remaining carbon emissions associated with electricity consumption in 2030. To achieve zero emissions from electricity, however, approximately 805 TWh/year of renewable electricity must be fed into the grid to equal Greenwich's remaining 2030 electricity usage in the Maximum ambition scenario. Since it is highly unlikely that the borough could serve its entire electricity demand itself by 2030, even accounting for projects funded by the council outside the borough, negative emissions measures or carbon offsetting would be needed to offset the remaining emissions from grid electricity used in Greenwich (see below).

- **Waste** – Introduce strict quantitative targets for waste reduction and increased recycling to attain a 70% recycling rate and total waste mass reduction by 45% by 2030.
- **River** – Install shore-side power infrastructure at wharves and require ships to turn off engines in berth or fit anti-pollution technology.
- **Offset remaining emissions** – Even with all the proposed measures deployed, there are remaining emissions in the Maximum ambition scenario of 95 kt $CO_2$ in 2030. To achieve carbon neutrality these must be balanced by negative emissions measures in the borough and/or carbon offsetting outside the borough. Any offset used must represent real, additional, verifiable and permanent emission reductions and likely options include further investment in renewable energy provision or land use change for carbon sequestration within the UK.

**Figure 1-3 Priority actions and key decision points for measures relating to emissions from buildings**

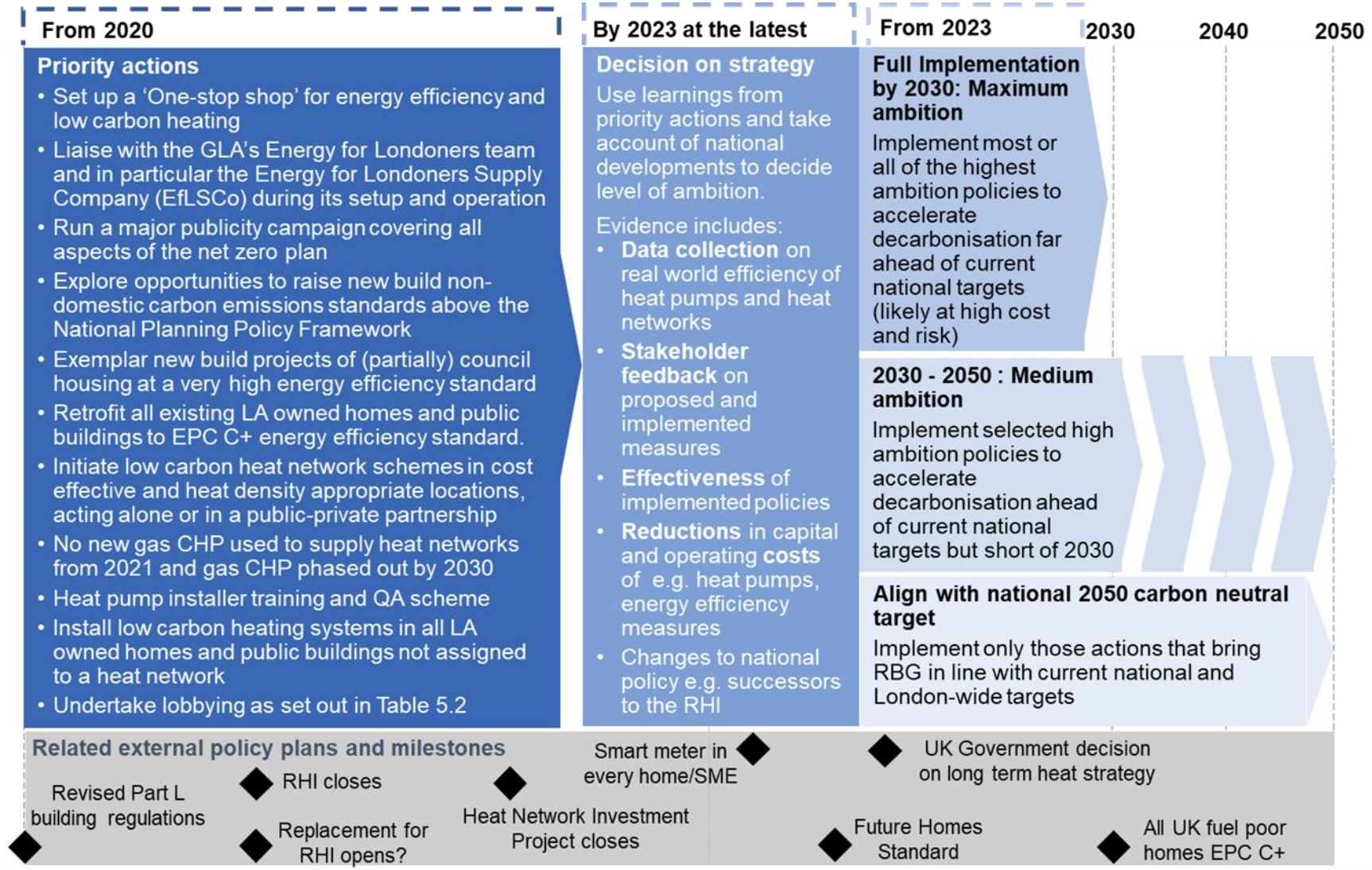


**Figure 1-4 Priority actions and key decision points for measures relating to transport**

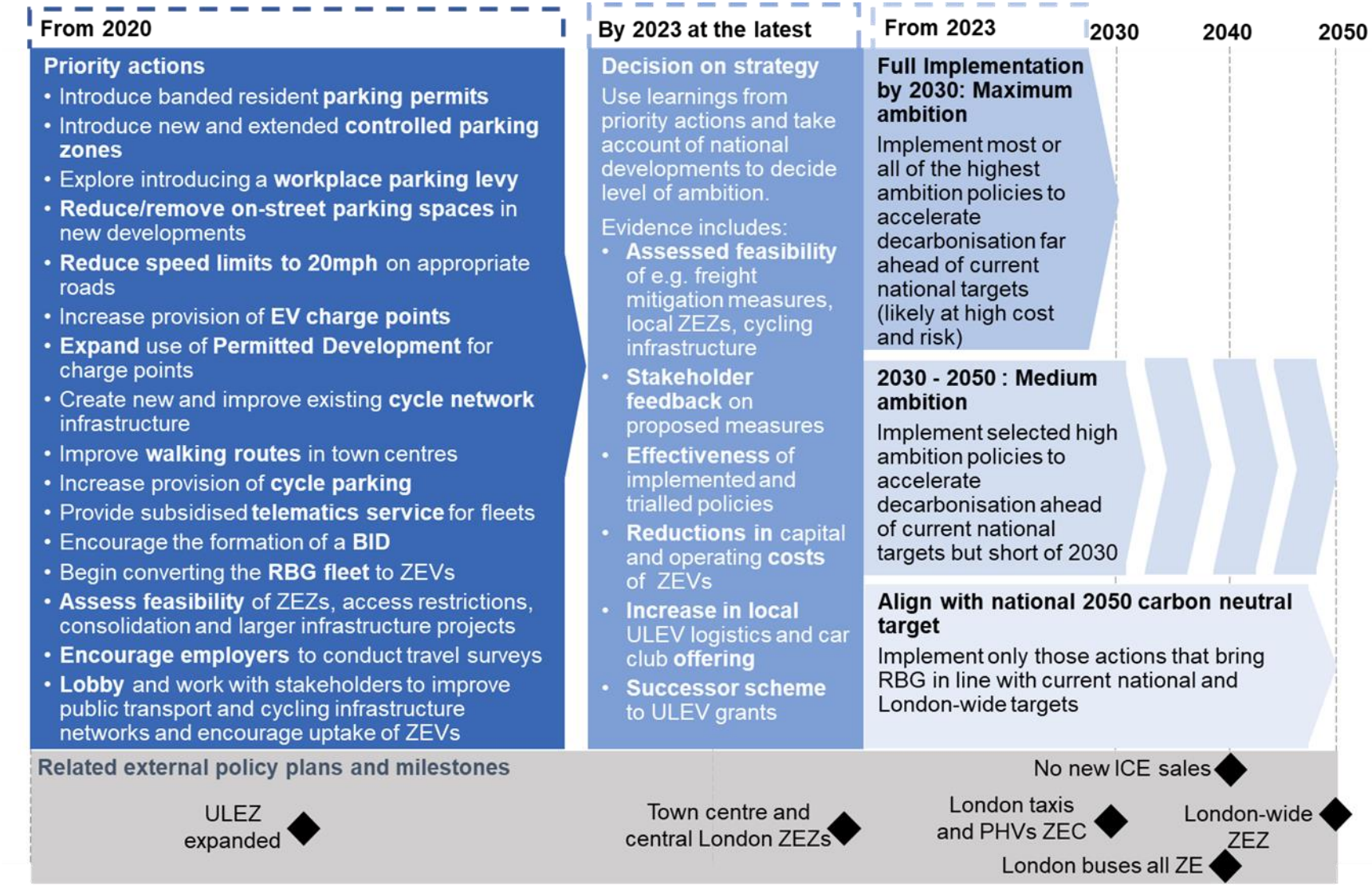
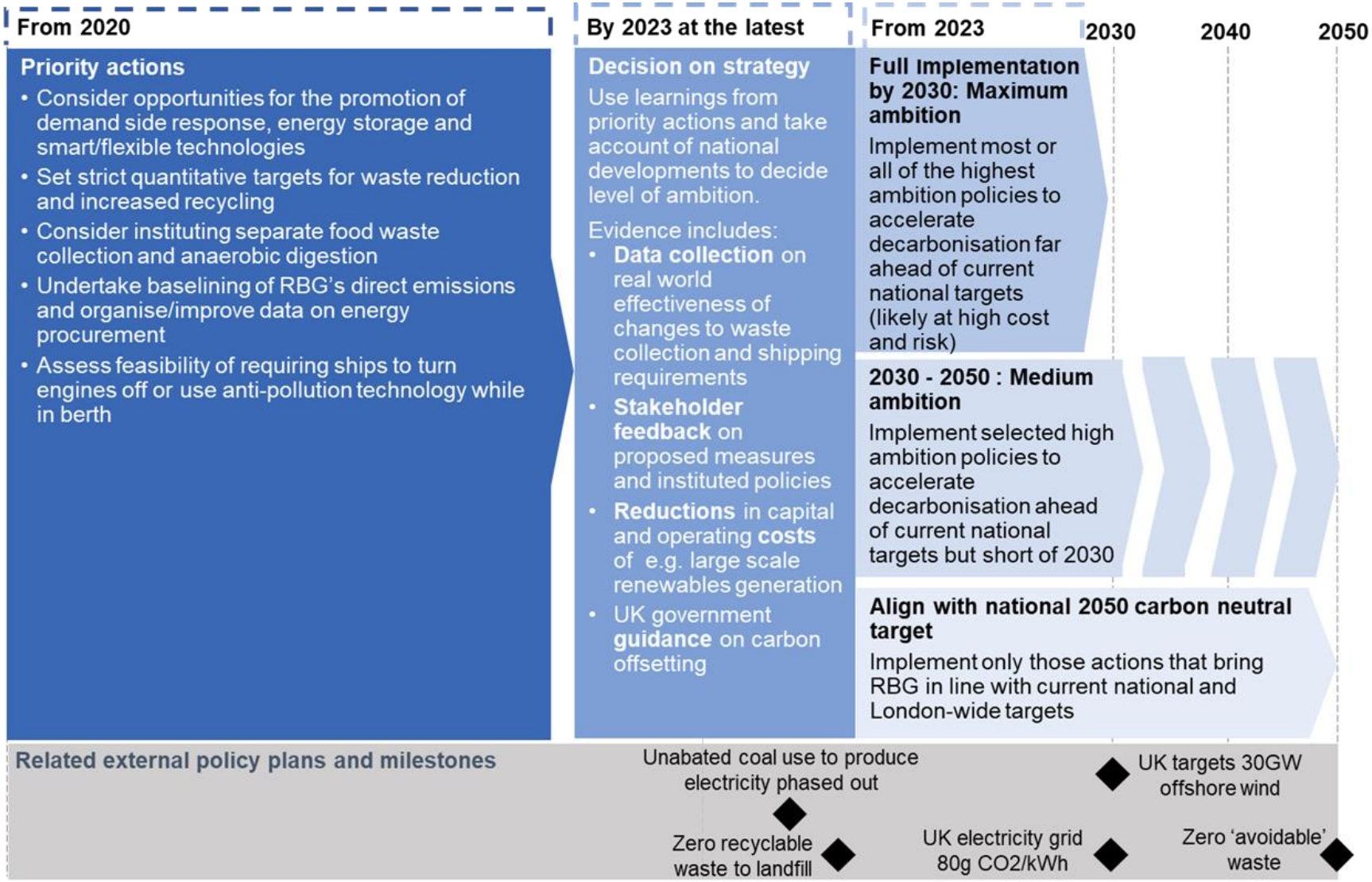


**Figure 1-5 Priority actions and key decision points for measures relating to energy generation, industry, waste & other sources**



# 2 Introduction

## 2.1 Context and objectives

The Royal Borough of Greenwich (RBG) has recently declared a Climate Emergency and has an ambition to become carbon neutral by 2030. The development of a Greenwich Carbon Neutral Plan is a necessary step in working towards this goal. This report details the results of the first of two Stages in the development of this plan, in which an evidence base on potential pathways to Carbon Neutrality by 2030 has been developed. A high-level menu of options for delivering carbon emissions savings is developed and a set of priority actions identified within this menu. However, the delivery of a detailed Greenwich Carbon Neutral Plan is reserved for Stage 2.

In preparing this evidence base we have completed a policy review, established baseline emissions and the scope of emissions inclusions, developed a maximum ambition pathway towards carbon neutral in 2030, completed an appraisal of available policy options and identified key recommendations and priority actions. Within the policy review we compare RBG's existing policy and programmes with best practice, highlighting strengths and gaps in policy, to inform the list of 'policy levers' for consideration in the Carbon Neutral Plan. Additionally, we have performed a brief assessment of best-practice examples of low carbon strategy development, planning policy and other relevant policies from other regions of the UK.

In our appraisal of policy options, we have identified a suite of policies which could be implemented to work towards the measures entailed in the Maximum ambition scenario. These policies have then been assessed in terms of cost, deliverability, associated co-benefits and risks, based on which a set of priority actions is drawn out.

In assessing the deliverability of emissions saving measures, it is important to consider the level of RBG control under which a particular change falls. While some changes, such as improving the energy efficiency of council-owned homes and corporate buildings are directly under council control, many others are only partially so. For example, they might be influenced by funding or campaigning or via collaboration with key stakeholders, such as Transport for London (TfL) or the Greater London Authority (GLA). For the purposes of our policy appraisal we consider policies to fall into one of the following categories:

- Areas RBG directly controls
- Areas RBG can mandate or strongly influence through policy
- Areas RBG can enable through funding
- Areas RBG can influence locally (and via key stakeholders)
- Areas RBG can influence or ask for nationally (and via key stakeholders)

Effecting change within areas over which RBG exercises less direct control will rely on facilitating behaviour change, working with key stakeholders and partners, leading by example and lobbying where appropriate.

## 2.2 Background: Carbon emissions and mitigation technologies

**Carbon Emissions**

The emission of greenhouse gases occurs due to a broad range of human activities including the burning of fossil fuels (for transport, heating, electricity generation, industrial processes etc.), agriculture, and land use/land use change. These greenhouse gases trap heat and make the planet warmer, causing climate change. Human activities are estimated to have caused approximately 1.0°C of global warming above pre-industrial levels so far, and in order to limit this warming to 1.5°C, net-zero

emissions globally must be reached by around 2050[4]. This is likely to require more developed countries to reduce their emissions faster than less developed ones, and there is a role to play for regional and local authorities in aiding the UK's transition. In this report, in which our quantitative analysis focuses on emissions from the energy system, rather than in agriculture and land use/land use change, 'carbon emissions' refer to emissions of carbon dioxide, the dominant driver of change in the strength of the greenhouse effect, except with regards to landfill and refrigerants emissions, for which carbon equivalent emissions are used. The units 'kt $CO_2$' are used – 1 kt $CO_2$ is one thousand tonnes of carbon dioxide. The UKs national emissions are often given in Mt $CO_2$ – million tonnes of carbon dioxide. 1 Mt $CO_2$ is 1000 kt $CO_2$.

**Energy efficiency**

Energy efficiency measures, such as cavity wall insulation or installation of low energy lighting reduce the energy demand, and therefore the carbon emissions, as well as the fuel costs, in a building.

**Heat Networks**

Heat networks, or district heating systems, use centralised energy generation to heat water and then distribute it through a network of pipes to serve multiple end users. They are most cost-effective in areas of high heat demand density. A key advantage of using heat networks over building scale technologies is that they benefit from the economies of scale and diversity of heat demand profiles across users. They can also more easily utilise waste heat sources, such as those from industry and environmental heat sources. Some sources provide the required temperature directly, while for others the source temperature is raised using heat pumps.

**Heat pumps and hybrid heat pumps**

Heat pumps are a form of electric heating where energy is extracted from the environment (usually the air or ground) to deliver heat with a high efficiency. In this report we assume that all building scale heat pumps (HPs) are air-source heat pumps (ASHP), which utilize heat in the outside air. The efficiency used in this study was 265%, based on real world UK trial data[5] for the seasonal performance factor (SPF). This high efficiency allows heat pumps to achieve very low levels of $CO_2$ emissions when combined with decarbonisation of the electricity grid. Hybrid heat pumps operate using the combination of a gas boiler with an electric heat pump. The boiler operates during times of peak demand. The hybrid system can operate in buildings with a lower level of energy efficiency, for which a heat pump alone is assumed insufficient. Capital cost is one of the key barriers to heat pump deployment, with a typical domestic heat pump, of 7 kW, costing around £7000 to install, with a potential additional cost of around £3500 for a new heat distribution and radiator system compatible with the lower heat supply temperature associated with most heat pumps.

**Conventional and low emission vehicles**

Conventional petrol or diesel vehicles use internal combustion engines (ICEs) to utilise the chemical energy in the fuels. Battery electric vehicles (BEVs) are entirely powered by rechargeable electric battery packs and an electric motor. Hydrogen fuel cell electric vehicles (FCEVs) combine hydrogen fuel with oxygen, to produce electricity to drive an electric motor. Electric vehicles (EVs) are typically more efficient than conventional ICEs, requiring less fuel to run and therefore making EVs generally cheaper to run than conventional vehicles. They produce no harmful tailpipe emissions, such as NOx and particulates and, when coupled with low carbon electricity or hydrogen sources, they enable deep decarbonisation of the transport sector. However, concerns over the distance that BEVs can travel on one charge (typically in the region of 80-250 miles for a car) and the high upfront costs compared to ICEs present challenges to EV uptake. For heavy goods vehicles (HGVs), BEV range is a particular

[4] IPCC: *Special Report: Global Warming Of 1.5 ºC*, Summary for Policymakers,
[5] *Analysis of heat pump data from the renewable heat premium payment scheme*, UCL, 2017

challenge and, although hydrogen FCEVs provide a viable option, the lower technical maturity and lack of national infrastructure currently limit this option.

Both plug-in hybrid electric vehicles (PHEVs) and range-extended electric vehicles (REEVs) combine an electric motor with an auxiliary power unit, typically an ICE engine. Both operate as a BEV for most or all of their journey. The ICE engine can provide support by recharging the battery or by providing supplementary power on long journeys.

BEVs and hydrogen FCEVs produce no $CO_2$ at the tailpipe and therefore are referred to as zero emission vehicles (ZEVs). Ultra low emission vehicles (ULEVs) are currently defined as vehicles that use low carbon technologies, emit less than 75 kg $CO_2$ per km from the tailpipe and are capable of operating in zero tailpipe emissions mode for at least 10 miles.[6] PHEVs and REEVs are therefore classed as ULEVs.

### 2.3 Carbon neutrality and offsetting

Carbon neutrality, or 'net zero' carbon, means balancing any emissions of carbon dioxide ($CO_2$) with the removal of an equivalent amount of $CO_2$ from the atmosphere (so called 'negative emissions' measures), or the prevention of emissions which would have occurred elsewhere (or 'offsetting'). Since the potential for removing $CO_2$ from the atmosphere is likely to be limited and potentially costly, and since carbon neutrality will need to be achieved globally, this will require the reduction of $CO_2$ emissions to very low levels, with negative emissions measures being used to balance the small amount of remaining emissions.

Other gases, such as methane, also contribute to global warming. The UK's legislated net zero target applies to all greenhouse gases, rather than just $CO_2$. In this work, where a sector's main contribution to global warming is via these other gases, for example the dominant warming effect of landfill is due to methane emissions, this contribution is included by considering the 'carbon equivalent', which refers to the mass of $CO_2$ which has the same warming effect on the planet ('global warming potential') as the mass of other gases actually emitted. This distinction is most relevant for landfill and refrigerant emissions.

Variation in the definition of carbon neutrality occurs due to the range of choices available for the scope of included emissions and the accounting methodology used. For example, choosing a 'consumption-based' rather than 'production-based' methodology can have large effects on estimated emissions.

**In this report, emissions included within the definition of carbon neutral are those arising from activity within the Royal Borough of Greenwich and from the production of energy used within the borough**. In addition, emissions from the disposal of waste generated within the borough but disposed outside of its boundaries are included. The most significant sources of emissions excluded within this definition are the embedded emissions of products and services and aviation activity of residents (aviation emissions are assigned based on airport locations using the data and methodology from the London Atmospheric Emissions Inventory).

It should be noted **that this scope of emissions inclusion produces a highly ambitious target**. Some local authorities have declared targets to reduce the emissions related to the council's own activities to zero. **RBG's target goes much further** by choosing to include all emissions within the borough within scope. It is not the intent of this report to define carbon neutrality as it pertains to RBG's target, and at times our modelling process has been constrained in the way certain emissions sources are treated by the project length rather than any fundamental information limit. We recommend that it will be necessary for RBG to specifically define the scope of emissions included within its target. This definition might treat certain emissions sources differently to this report.

[6] https://www.smmt.co.uk/industry-topics/technology-innovation/ultra-low-emission-vehicles-ulevs/

In order to be carbon neutral, any remaining emissions by 2030 must be balanced, either by negative emissions measures or by offsetting. Offsetting refers to any activity which results in the lowering of external carbon emissions (i.e. those emissions not assigned to RBG). Various kinds of offsetting are possible but some of the most popular operate via land use change (e.g. forestry) or the provision of renewable electricity. The costs associated with emissions savings are not uniform across different emissions sources and so offsetting can often be significantly cheaper than the same magnitude of direct carbon saving within RBG. This is especially true if international offsets are used. A correctly used offset has the same physical impact on climate change as the equivalent direct emissions reduction, since the state of the atmosphere is the same whether carbon dioxide is emitted in one location or another.

However, offsetting in this way is only available as an option in the near and medium term, as ultimately carbon neutrality will need to be achieved globally, meaning that emissions will need to be reduced to very low levels across all jurisdictions, with negative emissions measures required to balance any remaining emissions. As sectors of the global economy decarbonise, the supply of opportunities for offsetting diminishes, and offsetting is likely to become more expensive.

Furthermore, there is often uncertainty over the extent of emissions reductions achieved through offsetting and over whether they are truly 'additional' (i.e. whether the emissions reduction would have occurred anyway, or whether it is being 'double counted'). This is thought to be a particular issue with some international offsetting projects where verification can be more challenging.

The Committee on Climate Change (CCC) has recommended that where offsetting is used to meet the UK's 2050 target this must take place within the UK (i.e. no international offsets). The Committee on Climate Change (CCC) envisages that Bio-Energy with Carbon Capture and Storage (BECCS) will provide annual capture and storage of 75-175 $MtCO_2$ in 2050[7], reducing the need for other offsetting within the national target, such as that provided by carbon sequestration through land use change. When defining the carbon neutral target for Greenwich, RBG should define whether offsetting is allowed only within the UK, or whether to allow international offsetting is allowed, being mindful of the implications of the decision for verification of the savings actually delivered.

### 2.4 Scenarios: Baseline and Maximum ambition

Our emissions modelling utilises:

- Stock model of domestic and non-domestic buildings at LSOA level, including the breakdown by building type (detached, semi, terraced, purpose-built flat, converted flat) and tenure type
- Stock model of private cars, HGVs, buses and vans and the associated activity
- Database of bus depots

These datasets allow us to establish a baseline of emissions resulting from the following key sources buildings, transport, industry, waste and energy generation. The baseline scenario does not represent a static level of emissions; instead it represents the likely outcome given minimal change to current policies on low-carbon technologies, with the exception of energy efficiency measures, for which a high level of uptake is applied. Carbon emissions are then modelled after implementing a selection of mitigating measures to develop the Maximum ambition pathway towards Carbon neutrality in 2030. Our approach to modelling the Maximum ambition scenario involved making a range of judgements on the feasibility of mitigation measures in order to set the modelled assumptions. These are discussed in more detail in Section 5 and in the Appendix. We assumed highly ambitious reductions from each sector for which measures under the control of RBG are available but limited these reductions to what we deemed feasible given the short timescale to 2030. As such the 'Maximum ambition' scenario is a 'net zero' scenario only assuming significant use of offsetting by 2030.

[77] *Net Zero – The UK's contribution to stopping global warming*, Committee on Climate Change, may 2019: available at https://www.theccc.org.uk/publication/net-zero-the-uks-contribution-to-stopping-global-warming/ (accessed 22/10/2019)

The year 2015 is used as the starting point of our modelling, from which progress is measured against. This is for reasons of comparability, as described in Section 4.1.

# 3 Policy Context

## 3.1 National policy

### 3.1.1 *Net Zero legislation*

In June 2019 the United Kingdom passed into law, via an amendment to the Climate Change Act, a target requiring the reduction of all greenhouse gas emissions to net zero by 2050. 'Net zero' here means that any remaining emissions must be offset by measures which remove greenhouse gases from the atmosphere, such as bioenergy with carbon capture and storage. This is an increase in the level of emissions reduction required relative to the previous target of an 80% reduction by 2050 as set out in the original Climate Change Act in 2008 and is consistent with the advice given to the Government by the CCC in its report *Net Zero – The UK's contribution to stopping global warming*[8].

### 3.1.2 *Committee on Climate Change Net Zero Technical Report*

The CCC released their Net Zero Technical Report[9] in May 2019 which accompanied their advisory report *Net Zero: The UK's contribution to stopping global warming*. The technical report outlines the analysis behind their recommendations on a sector by sector basis, and details scenarios that could achieve the UK's 2050 net zero target.

Three scenarios are outlined for each sector:

- 'Core' scenario based on the government's existing commitments that is expected to result in an 80% $CO_2$ reduction by 2050;
- 'Further ambition' scenario includes options that are more challenging and on current estimates are generally more expensive than the Core options;
- 'Speculative' scenario which invokes measures that currently have very low levels of technology readiness, very high costs, or significant barriers to public acceptability.

The sectors considered are:

- Power and hydrogen
- Buildings
- Industry
- Transport
- Aviation and Shipping
- Agriculture, land use, land use change and forestry
- Waste
- F-gas emissions
- Greenhouse gas removals

Buildings, waste and transport are particularly relevant sectors in considering the capacity of local authorities to decarbonise and so a brief overview of the findings of the repot for these sectors is given below.

**Buildings**

The 'Core' measures for the buildings sector target the parts of the stock for which decarbonisation is most cost-effective and straightforward. This includes new builds, homes off the gas grid, homes

[8] *Net Zero – The UK's contribution to stopping global warming*, Committee on Climate Change, may 2019: available at https://www.theccc.org.uk/publication/net-zero-the-uks-contribution-to-stopping-global-warming/ (accessed 22/10/2019)

[9] *Net Zero – Technical Report*, Committee on Climate Change, May 2019 : available at https://www.theccc.org.uk/publication/net-zero-technical-report/ (accessed 23/10/2019)

suitable for district heating, and homes on the gas grid but without space constraints or heritage constraints (such as listed buildings and those in conservation areas). Using a mix of energy efficiency and low-carbon heating measures these homes are decarbonised in the 'Core' scenario to reduce emissions by 66 $MtCO_2e$, resulting in a remaining 20 $MtCO_2e$ from the sector in 2050. Near complete decarbonisation of non-residential buildings is achieved in the Core scenario via a combination of energy efficiency, heat networks and heat pumps. The 'Further Ambition' scenario deploys low-carbon heating technologies and energy efficiency measures in homes that are significantly harder to decarbonise. These include homes on the gas grid with space constraints and those of heritage value. The residual gas demands are met by injection of hydrogen and biomethane into the gas grid. Under the 'Further Ambition' scenario 4 $MtCO_2e$ of emissions remain from the buildings sector in 2050.

**Waste**

The 'Core' measures for the waste sector involve the diversion of five 'key biodegradable waste streams' from landfill and an increase in recycling to levels set out in previously stated ambition in England and the Devolved Administrations. Above this, the 'Further Ambition' scenario requires:

- 20% reduction in 'avoidable' food waste by 2025
- Key bio-degradable waste sent to landfill eliminated by 2025
- Increase of recycling rates to 70% by 2025
- 20% reduction in waste-water handling emissions by 2050

**Transport**

The CCC's Further Ambition scenario achieves a 98% reduction in GHG by 2050, and all measures listed below are considered necessary to achieve that goal:

- Ban on sale of conventional and PHEV cars and vans brought forward to 2035 at the latest. Regulatory approval for fossil fuel vehicles is limited to 2050.
- Zero emission HGVs must reach nearly 100% of sales by 2040. Smaller HGVs can electrify, but larger HGVs can adopt hydrogen fuel cells, or electrify with on-road catenary systems or with powerful rapid chargers.
- Assumes a 10% modal shift away from private car use.
- At least 54% of rail track-km is electrified by 2040.
- Aircraft support vehicles electrify by 2050.

In order to achieve this scenario, significant public investment into public charging networks is required. Their analysis indicates that a mixture of 22 kW, 43 kW and 150 kW chargers will be the most cost effective, with additional investment in ultra-rapid 350 kW chargers at strategic locations.

In this case, an example of a measure reserved for the 'Speculative' scenario is the creation of synthetic fuels from direct air capture $CO_2$. Measures such as this have significant technical barriers preventing adoption. The recommendations outlined in the report are in general not targeted at local authorities. However, the report highlights a number of 'softer' incentives that local authorities can implement to encourage the uptake of EVs:

- Access to bus lanes
- Free access to congestion charging zones and clean air zones
- Free parking

Local authorities are well placed to assist in the modal shift away from cars as required by the Further Ambition scenario. The report outlines that a modal shift greater than 10% will significantly reduce the financial burden of this scenario. The report advises that a significant investment in cycling infrastructure will be necessary, and that dedicated bike lanes should be physically separated from road traffic. Driving into urban centres should be discouraged, and traffic calming measures and lower road speeds should be implemented to make roads more accessible to cyclists and to limit desirability of driving. The report

highlights Seville as an example of a city with no prior cycling culture that has quickly accelerated levels of cycling through investment in high-quality infrastructure.

### 3.1.3 *Road to Zero*

In July 2018, the UK Department for Transport released a roadmap, *The Road to Zero*, outlining its strategy for decarbonising the road transport sector, as part of the Government's Industrial Strategy[10]. This featured a plan to invest nearly £1.5 billion by 2020 and several broad policy ambitions, including:

- A target of 50-70% ULEV sales in 2030 for new cars, and 40% for new vans. It also stated that the definition of ULEV is expected to be revised in 2021 to mean a vehicle with tailpipe $CO_2$ emissions of less than 50g$CO_2$/km. The current definition is less than 75 g$CO_2$/km.
- By 2040, the Government:
    - Will end the sale of new 'conventional petrol and diesel' cars and vans;
    - And expects 'the majority of new cars and vans will be zero emission' and wants all new cars and vans to be 'effectively zero emission'.
- By 2050, the Government wants 'almost' every car and van to be zero emission.

Progress against these targets will be reviewed in 2025 but in the short term, ULEV uptake will be directly supported through continuation of the Plug-in Cars, Vans, Taxis and Motorcycles grants until at least 2020, and it is stated that some form of consumer incentives will remain in place beyond 2020. In addition, the strategy commits to ensuring 25% of central government's car fleet is ultra-low emission by 2022 and 100% by 2030.

However, the strategy recognises that to encourage widespread adoption of ULEVs, recharging infrastructure must be supported, and outlines a range of measures to provide funding. The report states that 75% of cars are parked off-street and so could be charged through a home charge point. Installation of home charge points is currently supported through the Homecharge scheme offered by the Office for Low Emission Vehicles (OLEV), which is set to continue, although the grant amount will be reviewed on an annual basis as uptake increases and the market becomes self-sustaining. For the 25% of cars that are parked on-street, alternative charging infrastructure is necessary. The strategy states that all new street lighting columns, where appropriately located, should include charge points. This will be encouraged through an update of the *Well Managed Highway Infrastructure Code of Practice* and the *Network Management of Traffic Equipment Code of Practice*. The Government will also provide guidance to local Highway Authorities in England on how they might include the installation of charging infrastructure when roadworks are taking place.

### 3.1.4 *Clean Growth Strategy*

The **Clean Growth Strategy** sets out the Government's ambitions in several key areas. A selection of the policies and proposals most relevant to RBG are summarised below:

**Improving Our Homes**

- Support for home energy efficiency under the ECO extended
- Focus on fuel poor homes to be upgraded to EPC Band C by 2030
- Aspiration for as many homes as possible to be EPC Band C where cost-effective
- Strengthening of energy performance standards for energy efficiency, low carbon heating and renewable energy, in new and existing homes
- Invest in low carbon heating under a reformed RHI scheme focusing on long-term decarbonisation, including heat pumps and biomethane
- Phase out installation of high carbon fossil fuel heating in off-gas homes in 2020s
- Provide public funding to support construction and extension of heat networks

[10] The Office for Low Emissions Vehicles (2018) Reducing emissions from road transport: Road to Zero Strategy. Weblink: https://www.gov.uk/government/publications/reducing-emissions-from-road-transport-road-to-zero-strategy

**Accelerating the Shift to Low Carbon Transport**

- End the sale of all new conventional petrol and diesel cars and vans by 2040
- Support the uptake of ULEVs through a variety of schemes
- Make the UK's electric vehicle charging network one of the best in the world through investment and new powers under the Automated & Electric Vehicles Bill
- Support the uptake of low emission taxis through the Plug-in Taxi programme
- Provide funding support for retrofitting and new low emission buses
- Provide investment to increase cycling and walking for shorter journeys
- Invest in innovation in technologies including electric batteries

**Delivering Clean, Smart, Flexible Power**

- Reduce power costs for homes and businesses through measures including the smart systems plan to help consumers use energy more flexibly
- Improve the route to market for renewable generation technologies, phasing out the use of unabated coal
- Increase deployment of small-scale power generation including solar PV
- Invest in innovation in technologies including energy storage, innovative demand response and grid balancing technologies, nuclear power and renewables
- Work towards zero avoidable waste by 2050 and maximise the value extracted from resources, and publish a new Resources and Waste Strategy

**Leading in the Public Sector**

- Voluntary wider public and higher education sector carbon reduction targets
- New funding for public sector energy efficiency across the UK
- Support a local approach to reducing emissions

**Improving Business and Industry Efficiency and Supporting Clean Growth**

- Support businesses to improve their energy productivity by at least 20% by 2030
- Improve energy efficiency in new and existing commercial buildings
- Phase out high carbon fossil fuel heating in businesses off the gas grid
- Industrial Energy Efficiency scheme and new industrial heat recovery programme
- International leadership in carbon capture usage and storage (CCUS)
- Invest in research and innovation in energy, resource and process efficiency

### 3.1.5 *Industrial Strategy*

The **Industrial Strategy** identifies five key foundations on which to build local economies and help the UK to prosper[11]:

- **Ideas**; the world's most innovative economy
- **People**; good jobs and greater earning power for all
- **Infrastructure**; a major upgrade to the UK's infrastructure
- **Business environment**; the best place to start and grow a business
- **Places**; prosperous communities across the UK

Key strategies presented in the Industrial Strategy include:

**Research and Innovation**

- Invest in innovation through the new Industrial Strategy Challenge Fund
- Raise total R&D investment and increase the R&D tax credit to 12%
- Invest in education, especially in maths, science, digital and technical disciplines

[11] *Industrial Strategy: Building a Britain fit for the future*, HM Government (2017)

- Support people to re-skill through a new National Retraining Scheme

**Infrastructure**

- Support investment in transport, housing and digital infrastructure through increased investment in the National Productivity Investment Fund
- Encourage the uptake of electric vehicles via investment in charging infrastructure
- Invest in intra-city transport through the Transforming Cities fund

**Productivity**

- Increase sector productivity through Sector Deals
- Support SMEs growth and improve their productivity
- Agree on Local Industrial Strategies

### 3.1.6 *Revised National Planning Policy Framework (January 2019)*

The revised National Planning Policy Framework (NPPF) was released in February 2019 and provides a framework within which Local Plans for domestic and non-domestic development can be produced. A Local Plan is a plan for the future development of a local area, drawn up by the local planning authority in consultation with the community. All local governments in England are bound by this framework.

Local planning policy can be applied to promote cost-effective energy efficient development and will be an important policy lever. The Revised NPPF provides guidelines on the requirements that Local Plans can set for new development, and on the limits of what Local Plans can stipulate.

Current planning policy in the NPPF allows local authorities to impose restrictions on new developments both in terms of the level of energy efficiency to which buildings must be constructed and the way in which energy demand of the buildings is supplied. The Framework makes reference to the Climate Change Act 2008 in point 149, where it states that "*Plans should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, coastal change, water supply, biodiversity and landscapes, and the risk of overheating from rising temperatures (in line with the Climate Change Act 2008)*".

The NPPF suggests that the level of energy efficiency should adhere to national standards (i.e. those set out in Building Regulations). However, local authorities are able to use their existing powers under the Planning and Energy Act 2008[12] to 'impose reasonable requirements for development to comply with energy efficiency standards that exceed the energy requirements of building regulations'.

Regarding heat provision, the revised NPPF makes specific reference to decentralised energy supply and suggests that *'in determining planning applications, local planning authorities should expect new development to comply with any development plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable'.* However, the revised NPPF does not make provision for other low carbon heating systems (e.g. heat pumps, hybrid heat pumps, hydrogen and biomass boilers) to replace traditional gas boilers and direct electric heaters. Nor does the revised NPPF '*require applicants to demonstrate the overall need for renewable or low carbon energy*'.

It is worth noting that although the NPPF makes no explicit reference to the low carbon heating technologies outlined above (e.g. heat pumps), their uptake may be supported through energy efficiency clauses in Local Plans. If more stringent energy efficiency requirements are imposed on a development, only a combination of high fabric energy efficiency and efficient heating technologies, such as heat pumps, may meet these. So, the uptake of heat pumps, for example, may be supported implicitly if Local Plans require energy efficiency standards that exceed Building Regulations, as they are able to via the Energy Act.

[12] Chapter 21, Planning and Energy Act 2008

The Revised NPPF makes no specific requirement for the supply of renewable and low carbon energy; it instead requires plans to *consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development.* The role of local planning authorities in relation to renewable and low carbon energy is to *support community-led initiatives, including developments outside areas identified in local plans or other strategic policies that are being taken forward through neighbourhood planning.*

*When determining planning applications for renewable and low carbon development, local planning authorities should: a) not require applicants to demonstrate the overall need for renewable or low carbon energy, and recognise that even small-scale projects provide a valuable contribution to cutting greenhouse gas emissions; and b) approve the application if its impacts are (or can be made) acceptable. Once suitable areas for renewable and low carbon energy have been identified in plans, local planning authorities should expect subsequent applications for commercial scale projects outside these areas to demonstrate that the proposed location meets the criteria used in identifying suitable areas.*

In regard to low carbon transport infrastructure, the NPPF requires that in setting local parking standards for residential and non-residential developments, these should account for adequate provision of spaces for charging plug-in and others ultra-low emission vehicles.

### 3.1.7 *The Future Homes Standard*

Announced in March 2019, the Future Homes Standard will set minimum environmental standards for all new housing from 2025. It is suggested that the standard will ban fossil fuel based heating systems in new buildings, as part of an overall reduction in emissions relative to current new building regulations of up to 80%[13]. This is likely to mean that no new buildings would be connected to the gas grid from 2025. This would require all new homes to be fitted with low carbon heating technologies such as heat pumps, district heating or solar thermal. The eventual form and full details of the standard are not yet finalised, as the Government plans to consult on the policy over the coming years.

A consultation on a proposed 'uplift' to Part L (conservation of fuel and power) and Part F (ventilation) of the Building Regulations for new dwellings was released on the 1st October 2019[14]. This consultation sets out plans for achieving the *Future Homes Standard,* including two options for updated building regulations which would apply from 2020 and would act as a stepping stone towards the 2025 standard. Option 1 represents a 20% reduction in $CO_2$ emissions relative to current new builds and option 2 represents a 31% reduction. It is stated in the consultation that the government prefers option 2. Significantly, it is also suggested in the consultation that the power of local authorities to mandate higher energy efficiency and low carbon heat standards for new homes than is nationally mandated might be removed through an amendment to the Planning and Energy Act 2008[15]. The aim of such a change would be to increase efficiency in supply chains to facilitate the rapid changes being considered. An intention is declared to consider whether such a change to local authority powers would be more appropriate with the 2020 uplift to energy standards in Part L or with the subsequent introduction of the *Future Homes Standard*.

[13] See government press release available here: https://www.gov.uk/government/news/housing-secretary-unveils-green-housing-revolution (accessed 23/10/2019)

[14] *2019 Consultation on changes to Part L (conservation of fuel and power) and Part F (ventilation) of the Building Regulations for new dwellings,* October 2019: available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/839605/Future_Homes_Standard_Consultation_Oct_2019.pdf

[15] Paragraphs 2.27 and 2.28, *2019 Consultation on changes to Part L (conservation of fuel and power) and Part F (ventilation) of the Building Regulations for new dwellings,* October 2019

### 3.1.8 *Renewable Heat Incentive*

The Renewable Heat Incentive is a government scheme which provides funding to participants to invest in a range of technologies including biomass boilers, heat pumps and anaerobic digestion plants. It is designed to encourage households and businesses to switch from fossil fuel heating systems to renewable and low-carbon alternatives. Although the scheme is open to anyone, it is targeted at off-gas grid buildings. The scheme is due to expire, closing to new applications in March 2021 and has so far achieved a significantly lower level of uptake of low carbon technologies than expected, with 111,000 units now predicted in total as compared to an original expectation of 513,000[16]. In the domestic sector, over nearly four years to March 2018 only 60,000 appliances were installed under the RHI, compared to 6.2 million gas boilers in the same time period. The Department for Business, Energy and Industrial Strategy is now reassessing its heat strategy, having called for evidence in March 2018 towards a *Future Framework for Heat In Buildings.* This consultation made clear that the Renewable Heat Incentive will be closed in 2021 but sought views as to what form a replacement low carbon heating programme out to the 2030s ought to take. Recommendations on how RBG may be able to encourage uptake of renewable heat technologies among Greenwich residents will be partly dependent on the nature of the replacement programme.

## 3.2 Local Policy

### 3.2.1 *London Plan*

The London Plan is the overall strategic plan for London, produced by the Greater London Authority, and sets out the overall development strategy for the city. London boroughs' local development plans must be 'in general conformity' with the London Plan, so it is a key document for understanding the policy landscape which the Royal Borough of Greenwich operates within.

The current London Plan was first released in 2011 and has been updated multiple times since; with the latest publication released in January 2017. The Mayor of London is currently developing a New London Plan which underwent Examination in Public earlier in 2019. A draft version of the text is available online[17] and it is expected to be published in Feb/March 2020. **References in this section are given with respect to this July draft of the updated Plan.**

Chapter 9 of the London plan - 'Sustainable infrastructure' - covers climate change, including consideration of mitigation and waste. The target to make London a zero-carbon city by 2050 is affirmed under policy S12 *Minimising greenhouse gas emissions*. Key aspects of the approach to achieve this involve the sustainable design of new builds, retrofitting for energy efficiency of existing buildings, decentralised energy, renewable energy, and the use of innovative energy technologies. Notably, all major development is expected to be zero-carbon. A minimum carbon emissions reduction on-site of 35% beyond part L of the building regulations (see Section 3.1.7). If it demonstrated that reductions beyond this cannot be achieved on-site then a cash In lieu payment to the borough's carbon offset fund or off-site reductions can be made. Policy S12 also states that such emissions reductions should be in accordance with the Energy Hierarchy (*'be lean, be clean, be green, be seen'*).

Policy S13 *Energy Infrastructure* contains changes from previous London Plan versions which are pertinent to this work. Section 9.3.2A notes that the carbon savings from gas fired CHP are declining because of the decarbonisation of the national electricity grid and that there is increasing evidence of adverse air quality impacts. As such it is noted that existing networks will need to establish decarbonisation plans in order to be zero carbon by 2050. Part D under policy S13 states that new low-carbon CHP is only acceptable where "*there is a case for CHP to enable the delivery of an area-wide*

[16] House of Commons Committee of Public Accounts, *Renewable Heat Incentive in Great Britain*, Fortieth Report of Session 2017–19. Available at: https://publications.parliament.uk/pa/cm201719/cmselect/cmpubacc/696/696.pdf (accessed 23/10/2019

[17] July 2019 London plan draft, available at: (accessed 18/11/2019) https://www.london.gov.uk/what-we-do/planning/london-plan/new-london-plan

*heat network, meet the development's electricity demand and provide demand response to the local electricity network"*.

The waste policy set out in the London Plan has three main priorities (policy S17 and S18);

- manage as much of London's waste within London as practicable, working towards managing the equivalent of 100% of London's waste within London by 2026. This is noted to imply an increase in London's waste processing capacity.
- create positive environmental and economic impacts from waste processing
- work towards zero biodegradable or recyclable waste to landfill by 2026

The waste policy in the London Plan is set out in policies S17 and S18. S17 addresses reducing waste and supporting the circular economy. A key ambition stated under this policy is a recycling rate of 65 percent of municipal waste by 2030. It is noted that the pathway to achieving this target is set out in the London Environment Strategy (see section 3.2.3). Policy S18 declares the target that the equivalent of 100% of London's waste must be managed within London by 2026 (ie. net waste self-sufficiency). Apportionments of London's total waste to each borough for managements are given in the London Plan Table 9.2.

Key to the transport section of the London Plan is the drive for closer integration of transport and development through cooperation between local boroughs, the GLA, and TfL. Minimal guidance is provided for encouraging the uptake of low emission vehicles and the Plan instead focuses on the need to shift journeys from private cars to active and public transport modes. This is embedded into the guidance for producing local development plans, and policy T1 states that boroughs should encourage patterns of development that reduce the need to travel, especially by car.

Table 10.3 in the Plan states the maximum residential parking standards of new developments of 2 spaces per dwelling in areas with the poorest access to public transport, however in the draft update for release next year, this cap is lowered to 1.5 spaces per dwelling. The upcoming New London Plan for release early next year also states that rapid electric vehicle charging should be provided in new retail developments where parking is available, and that appropriate provision should be made for electric and ULE vehicles in office parking. It should be noted however that these parking requirements are maximum permitted values and boroughs are permitted to lower these caps at their own discretion. Hackney Borough Council for example is currently consulting on a their 'Local Plan 2033' which states that 'In order to reduce car usage and promote active travel, all new developments in the borough must be car-free'[18]. This statement looks likely to be included in their official Local Plan when published and illustrates the ambitious positions boroughs can adopt.

The Plan also outlines minimum standards for cycle parking in all new developments (Table 10.2 in the London Plan) in a bid to shift journeys from car to bike. The Royal Borough of Greenwich has been identified by the GLA as having higher than average rates of cycling, so higher standards of cycle parking apply, with new retail developments requiring double the number of short-term cycle parking and office developments requiring double the number of long-term cycle parking.

The GLA believes that buses will remain the dominant mode of public transport within London, and the Plan states that boroughs should promote bus, bus transit, and tram networks in their development plan documents by allocating road space and providing high level of priority on existing or proposed routes, and ensuring that direct and accessible walking routes are provided to stops.

In order to promote cycling and walking within London, the Plan states that boroughs should identify and implement accessible, safe and convenient direct routes to town centres for both cycling and walking.

[18] Hackney London Borough Council, 2018, *(SD01 – proposed submission local plan 2033, policy LP45)*

### 3.2.2 *Mayor's Transport Strategy 2018*

Many of the policies and aims outlined in this document are reflected in the London Plan, however in this document the Mayor outlines a number of methods that could be used to reduce transport emissions. Particularly of note for RBG is the indication in Policy 6 that such measures could include "road charging, the imposition of parking charges/ levies, […] the making of traffic restrictions/ regulations and local actions." Many of these actions will need to be taken within the borough to reduce the demand for cars in order to meet the 2030 target. Several local authorities in London are implementing Zero Emission Zones within their borders, with Hackney launching two Ultra Low Emission Streets[19], and the City of London voicing support for a central London Zero Emission Zone and introducing two local ZEZs within the square mile by 2022[20].

### 3.2.3 *London Environment Strategy*

The London Environment Strategy[21], published May 2018, sets out the GLA's response to the environmental challenges facing the city over the period 2018 to 2023. It integrates the following areas:

- air quality
- green infrastructure
- climate change mitigation and energy
- waste
- adapting to climate change
- ambient noise
- low carbon circular economy

A key ambition stated in the London Environment strategy is to make London a zero carbon city by 2050. Some notable examples of policies to aid in this ambition within buildings, transport and waste are set out below.

**Buildings**

- New developments zero carbon from 2019
- Improve energy efficiency of homes and public buildings
- 1 GW of solar capacity installed by 2030
- Deliver an energy supply company (EfLSCo)
- Trial low carbon technologies such as heat pumps

**Transport**

- All buses zero emission by 2037
- Town centre zero emission zones from 2020
- Zero emissions from road transport by 2050

**Waste**

- No biodegradable ort recyclable waste sent to landfill by 2026
- 65% municipal waste recycled by 2030
- Cut food and associated packaging waste by 50% by 2030.

[19] Hackney London Borough Council, 2019.
[20] City of London Corporation, 2019.
[21] Available at https://www.london.gov.uk/what-we-do/environment/london-environment-strategy (accessed 18/11/2019)

### 3.2.4 *London Electric Vehicle Infrastructure Delivery Plan*

Released in June 2019, the Delivery Plan outlines the current situation with electric vehicles in London, the barriers currently faced by London residents and businesses to increased EV uptake, and a list of recommendations and proposals to help overcome these challenges.

The six central challenges to delivering more EV infrastructure as outlined in the report are:

1. Ability to secure suitable charge point locations;
2. Long lead times and complexity of installation;
3. Cost of energy grid upgrades;
4. User's lack of confidence in the availability of convenient charge points;
5. Unfamiliarity with the experience of EV charging;
6. Investor uncertainty about direction of travel and desire to avoid stranded assets.

Challenges 4 and 5 are directly addressable by London Boroughs, and challenge 6 can be mitigated by adopting a strong and clear approach going forward. In discussing challenge 1 the report highlights that Boroughs have the ability to use 'Permitted Development' rights to install charge points without needing planning permission, but notes that many have been reluctant to do so.

A key priority outlined in this report is the desire to set up a new pan-London coordination body that would ensure a consistent approach for public charging infrastructure across London. A suggested first step of establishing a one-stop-shop website for Londoners to request on-street charge points is timetabled for the end of 2019. The City of Westminster currently already operate a demand-driven website like this. It is envisioned that such a body would enable the sharing of best practice within London, as well as the dissemination of data outlining customer charging behaviour and charge point usage in order to improve strategic charge point deployment.

The report also mentions the draft London Plan (discussed above) that sets out new requirements for EV charging facilities in residential developments, with 20% of parking spaces having active (fully wired, ready-to-use) chargers, with the remaining 80% of spaces receiving passive charging facilities (the underlying infrastructure to enable simple charger installation and activation in future).

Also noted in the report is the Mayor's commitment to supporting boroughs that which to implement ZEZs and to create a ZEZ in central London by 2025. Implementing strategic ZEZs throughout the RBG could significantly reduce emissions and car miles within the borough.

### 3.2.5 *Royal Greenwich Local Plan*

The Royal Greenwich Local Plan sets out plans for development of the Borough over the 15 years from 2013. It encompasses all aspects of planning, but climate change is specifically addressed, both in terms of mitigation and adaption, the latter focusing on the increased flooding risk which will face Greenwich given sea level rises. Out of 14 defined strategic objectives, 3 are particularly relevant to decarbonisation:

> D. To reduce water and energy consumption within Royal Greenwich
> E. To promote low and zero carbon developments throughout Royal Greenwich, to reduce carbon emissions and air pollution.
> M. To encourage and support the delivery of major sustainable regeneration projects within Royal Greenwich.

It is noted in the plan that significant development is expected in the borough with just under 40,000 new homes expected over the 15 years considered. Much of this development is planned to take place in the Greenwich Peninsula and Woolwich areas. The Plan recognises the Mayor's then target of 60% reduction of GHG emissions by 2025 (on 1990 levels), with this reduction in accordance with the Mayor's energy hierarchy: 'be lean' (reduce energy demand), then 'be clean' (connect to decentralised energy networks) then 'be green' (renewable energy generation incorporation).

Section 4.6 of the Local Plan covers the environment and climate change. Policy E1 covers carbon emissions, declaring the intention to reduced emissions in line with the Mayor's energy hierarchy and also that any new development requires an energy assessment. Further details taken from the supporting information to this policy are drawn out where relevant in Table 3-1 below.

The Local Plan outlines a number of policies that will influence planning decisions within the borough that pertain to reducing travel emissions and demand.

*Policy IM4 Sustainable Travel:* Outlines a commitment to improving accessibility and safety transport system within the borough. Sets the direction for development to be designed foremost for pedestrians, cyclists and public transport users, and to reduce the demand on private transport. Also commits the borough to safeguarding all footpaths and cycleways.

*Policy IM5 Freight:* Expresses aim to maximise use of rail and waterways for freight transport, as well as keeping new developments with high numbers of freight movements close to major transport routes.

*Policy IM(a) Impact on the Road Network:* Indicates the borough's intention to reduce desirability of travelling by car through speed management and traffic calming measures.

*Policy IM(b) Walking and Cycling:* Outlines commitment to provide well maintained cycle and walking routes that integrate with the existing network and take account of 'desire lines' to local amenities. Also states that sufficient cycle parking and changing and shower facilities for cyclists should be in place.

*Policy IM(c) Parking Standards:* Adopts the London Plan's standards for maximum parking provision and minimum cycle requirements. Also supports car free developments in Controlled Parking Zones and areas of good public transport coverage and indicates that in areas of on-street parking stress developments should be 'car-capped'.

### 3.2.6 *Greener Greenwich Strategy*

The Greener Greenwich Strategy (GGS) sets out RBG's response to both climate change and air pollution. It aims to promote actions which will reduce emissions of GHGs, manage impacts of climate change, enhance lives and foster sustainable growth. The strategy is not planning policy but rather outlines how the RBG itself intends to respond to climate change and also acts as a report on recent progress. An important message of the GGS is that there are many 'co-benefits' available through action on climate change, with action having the potential to further other council priorities such as wellbeing and poverty reduction. The strategy notes progress thus far on emissions reductions, stating a 17% reduction between 2010 and 2015 and reflects the further reductions required under the Mayor's targets and national and European targets – it is important to note, however, that all of these reduction targets fall well short of a trajectory to net zero in 2030. Given the importance of the wider policy context at both regional and national levels, the response set out in the Greener Greenwich Strategy targets those areas in which the council can has most influence. It considers six key areas:

1. energy supply
2. buildings and homes
3. transport
4. waste
5. natural environment
6. new development

Short (over 5 years) and long (over 20 years) term commitments are then announced across these areas, with specific action drawn out in the *Greener Greenwich Action Plan* which accompanies the GGS. Various examples of commitments and ongoing activity laid out in the GGS are discussed in section 2.3 below.

The Greener Greenwich Supplementary Planning Document contains guidance on designing and building new developments such that they meet sustainability standards. It is intended for technical use rather than for public reading. The sustainability standards involve both climate change mitigation and adaption, especially with regards to flood risk, and environmental concerns such as pollution and biodiversity. Seven key topic areas are covered: Energy, Water, Biodiversity, Materials, Waste, Flood Risk, and Pollution. As for the GGS above, where sections of the supplementary planning document are particularly relevant they are discussed in section 2.3 below.

### 3.2.7 *Local Implementation Plan for transport (LIP3)*

LIP3, which became effective in April 2019, contains the Royal Borough's transportation plan and outlines the investments the Borough is making over the next three years to achieve these objectives. The measures outlined in this report are detailed in section 3.1.1 below.

### 3.2.8 *Sharing Cities*

Sharing Cities is a Horizon 2020 funded European Union programme trialling innovative technology solutions to help achieve more efficient, lower-carbon energy and transport systems and more sustainable homes. The Royal Borough of Greenwich hosts the London demonstrator area in Peninsula and East Greenwich and as such is receiving £2.3 million of funding which will end in December 2020. Some of the trialled innovations are as follows:

**Sustainable homes and energy efficiency**

- Retrofit works are due to begin in 2019 on trial social housing blocks, improving the comfort, condition and energy efficiency of the buildings by installing wall insulation, window refurbishment/replacement, and energy saving lighting.

**Low-carbon energy**

- *Greenwich Energy Hero* launched in 2019. This project invites households to take part in demand side response through an app which offers rewards in the form of vouchers and charity donations for using less electricity when demand is highest.

**Electric vehicles**

- Assisting in delivery of electric Vehicle Car Club: Operated by Enterprise, allows residents in the Greenwich area to benefiting from access to shared low-emission cars, operated in a back-to-base model.
- Successfully trialled the use of electric cargo bikes with a local independent butcher's. 95% of their local deliveries under 5km were completed using the cargo bike, reducing their use of their diesel delivery vans.
- The successful first phase of an eBike loan scheme was delivered with over 150 local residents taking part.

**Electric vehicles charging infrastructure**

- Smart Parking sensors have been installed into coach parking bays and electric vehicle charging bays, the data will be used to analyse current operation of these bays to inform future decision making.
- They consulted residents on where locations for electric vehicle lamppost bays should be installed. 10 locations with high demand and the correct surrounding infrastructure have been chosen and installations have begun.

Data from many of the above projects is now being passed to the London City Datastore to be used for monitoring and evaluation, and in data analytics approaches. The Sharing Cities project aims to monitor the effectiveness of the innovations and if successful expand them to other European cities and across London.

### 3.2.9 *Low Emission Neighbourhood*

Greenwich West and Peninsula wards are working in collaboration with the GLA and TfL to create a Low Emission Neighbourhood within the Royal Borough, which is now at the evaluation stage. £2 million of match-funding from the Mayor of London has enabled the Borough to implement an electric vehicle car club pilot scheme, install more EV charging points, and trial a shared eBike scheme. The Borough are also considering plans to transform Greenwich town centre by redesigning a number of streets by converting carriageway space to expanded pavements and greenspace, as well as dedicated cycle lanes.

## 3.3 National infrastructure projects

**The Silvertown Tunnel** is a new twin-bore, cross-river road tunnel that will link the Greenwich Peninsula and Silvertown. The tunnel is expected to reduce congestion at the Blackwall Tunnel and enable new bus links. Traffic flow modelling by TfL estimates that emissions across the area with the Silvertown tunnel in place will be similar to the level of emissions without the tunnel;[22] however, due to changes in traffic flows, some roads will experience increased emissions whereas other will experience decreased emissions. TfL awarded the contract for construction of the tunnel in 2019, and the new tunnel is expected to open from 2025.[23]

**The Elizabeth Line** (Crossrail) is a new rail link for London running west to east, improving connectivity of rail services across London. The Abbey Wood branch in the east will run through Greenwich, with a new, step-free accessible station at Woolwich Arsenal. Once fully operational, the line will increase capacity of the public transport network by 10%.[24]

Both the Elizabeth Line and the Silvertown Tunnel are incorporated into the modelling supporting the Mayor's Transport Strategy[25] which also provides the basis for the transport modelling in this study. As such, any changes in emissions or modal shift arising from these infrastructure projects is accounted for in our recommendations.

## 3.4 Policy Strength evaluation and comparisons to best practice

In the following table, examples of RBG policies across a range of themes are presented and compared to current best practice, alongside recommendations for action. **It is important to note that neither the current best practice examples nor the recommendations for action in the following table should be interpreted as defining a set of policies sufficient to meet carbon neutrality by 2030**. The required scale of deployment of decarbonisation measures to meet a 2030 carbon neutral ambition will not be achieved through incremental shifts in policy and will likely require sweeping changes and very substantial investment. The suggested actions below are intended to identify means for RBG to strengthen policy towards current best practice – the range of additional (even more ambitious) policies and actions that will be needed to deliver carbon neutrality by 2030 are presented in Section 5.2.

[22] *The effects of the Silvertown Tunnel*, TfL; Note that reported emissions modelling focuses on NOx expected in 2021 with and without the introduction of the tunnel
[23] https://tfl.gov.uk/travel-information/improvements-and-projects/silvertown-tunnel (accessed 19th November 2019)
[24] http://www.crossrail.co.uk/route/ (accessed 19th November 2019)
[25] *Mayor's Transport Strategy: Supporting Evidence Outcomes Summary Report* (2017) Mayor of London and TfL

**Table 3-1 Comparison of RBG's policy with current best practice, and selected recommended actions**

| Theme | Description | Suggested actions to improve policy | Current best practice example |
|---|---|---|---|
| Heat Networks | Part (ii) of Core Strategy Policy E1 Carbon Emissions requires all developments with a gross floor area greater than 500sqm or residential development of five or more units to connect to an existing decentralized energy network, or where this is not available to either provide a site wide network or for the future connection to a network. The Greener Greenwich SPD provides further guidance on the various energy sources that can be used for decentralized low carbon energy networks.<br><br>Policy SI3 Energy Infrastructure of the new London Plan supports the development of energy masterplans for large scale development locations (including Opportunity Areas and Town Centres) and sets out the borough Development Plans should identify the need for, and suitable sites for, any necessary energy infrastructure requirements as well as the potential for existing heating and cooling networks to expand and proposed locations for future networks. Part D of the policy sets out the hierarchy for selecting the heat source for communal systems for major developments in Heat Network Priority Areas (as identified on the London Heat Map website). | • As part of the Core Strategy review, energy masterplans should be developed for the borough's five Opportunity Areas, prioritising the expansion of the existing network in Woolwich beyond the Royal Arsenal and the development of masterplans for Charlton Riverside and Thamesmead. As part of this work, it will be critical to identify suitable sites for energy centres within both Opportunity Areas, and consideration should also be given to the potential for the networks to capitalise on their relative proximity waste management facilities in Lewisham and Bexley.<br><br>• Planning policy which requires connecting new builds to heat networks can be instrumental in their development, given that the guarantee of heat demand reduces the initial risk to developers. However, such mandatory connection is unfeasible when there are no such available networks. In order to overcome this coordination problem, public sector led projects or public-private partnerships can be important in facilitating heat networks. The feasibility of such projects should be explored by RBG. | • Islington Council[26] and the City of London. Best practice is represented by borough level development plans and SPDs that already comply with the new London Plan policies. |
| Renewable energy generation | The third requirement within the London Plan's approach to minimizing greenhouse gas emissions (Policy SI2 in the new London Plan) is 'be green': maximise opportunities for renewable energy by producing, storing and using renewable energy on-site. The new London Plan sets more stringent targets in relation to renewable energy generation than the current London Plan, moving from a | • The council should consider investing in a large scale, council led renewable energy project. Appropriate sites could, in principle, be located outside the borough if no suitable sites are identified within the borough. This could act as an opportunity for offsetting any remaining emissions before such time as the electricity grid is fully | • *Solar Together London* is a programme aiming to help Londoners to install solar PV on their homes at an affordable price via group buying[27]. Thus far, 624 homes have received panels. The programme is supported by 13 London boroughs but not Greenwich. |

[26] *A supplement to Islington Environmental Design Planning Guidance: Guidelines for connecting to heat networks. Part1 - A guide for developers and building owners,* 2015. Accessed at: https://www.islington.gov.uk/~/media/sharepoint-lists/public-records/energyservices/information/adviceandguidance/20192020/20190828connectionsguidancepart11.pdf (22/10/2019)

[27] More information is available at: https://www.london.gov.uk/what-we-do/environment/energy/solar-together-london (accessed 21/10/2019)

| Theme | Description | Suggested actions to improve policy | Current best practice example |
|---|---|---|---|
| | percentage-based target for solar technologies to a requirement for maximizing on-site electricity and heat production from solar technologies.<br><br>The Royal Borough began a solar PV programme in 2015 to install panels on Royal Borough owned sheltered and residential blocks, with 7 blocks covered as of 2016.<br><br>RBG does not currently own or operate any large scale renewable energy projects.<br><br>Demand side response is not considered in current RBG policy. The *Greenwich Energy Hero* project, launched under the Sharing Cities programme and described in section 2.2.7 aims to increase demand side response capability in the borough. | decarbonised, so long as the project can be shown to be 'additional'. Such projects also have the potential to generate revenue for the Council. See the Avonmouth wind farm best practice example.<br>• RBG should work with the GLA to consider how flexibility in the demand for electricity across the borough can be promoted. This is an important enabling measure for the incorporation of intermittent renewable generation into the grid.<br>• Review the progress of the *Greenwich Energy Hero* project to take learnings and consider whether the successes can be continued or scaled up after the Horizon 2020 funding ends.<br>• Consider the implementation of battery storage, either small-scale building-level storage or large-scale grid-connected storage, alongside Council generation and/or demand assets where economically viable, as a means of increasing the benefit of renewable energy generation to the grid.<br>• Liaise with the GLA on the work of the *Energy for Londoners Supply company*, considering the potential for RBG to assist in encouraging residents to switch to this supplier.<br>• Consider joining the group of boroughs in the *Solar Together London* project.<br>• Review the progress of the borough's solar PV programme and work with stakeholders to understand key lessons learned in order to inform development of future policy. | • Durham County Council, Local plan, Policy 3.15: "Renewable energy technologies will be encouraged on-site. Where opportunities for viable installations have been identified, it is expected that such installations would go forward as part of the development."<br>• Avonmouth, Bristol – 2 council owned 2.5MW wind turbines were commissioned and built in 2013 on a disused oil tank site in Avonmouth[28]. A solar farm was later added on the same site. The project is a commercial investment in renewable energy and the energy produced is sold via a power purchase agreement to the supplier *Bristol Energy*, which is a municipal electricity supplier set up by the council.<br>• Forest Heath district council in Suffolk bought the 12.4 MW Toggam Farm solar farm, in Lakenheath in 2016 for £14.5 million, which then became one of the largest council-owned solar farms in the country. A business case was made on the basis of expected returns on investment through selling generated power into the grid. |
| Energy efficiency retrofits | Core Strategy Policy H5 expects residential refurbishments/conversions to attain the 'excellent' BREEAM energy efficiency standard for Domestic Refurbishment. Where retrofitting requires planning permission, Policy SI2 of the new London Plan sets out that development involving major refurbishment should aim to meet the requirements of the policy. | • Consider facilitating the delivery of retrofits through borough-based Home Improvement Agencies (HIAs).<br>• Explore opportunities to partner with local banks to provide low cost financing for retrofits.<br>• Consider expanding on the energy efficiency expectations associated with refurbishment in the review of the Core Strategy. See the Cambridge City Council best practice example. | • Cambridge City Council, Local Plan 2014: "Applications for extensions to existing dwellings and/or the conversion of ancillary residential floorspace to living accommodation should be accompanied by cost-effective improvements to the energy efficiency of the existing dwelling. The requirements of this policy will apply where the following measures have not already been implemented:<br>○ cavity wall insulation; |

[28] Further information is available at https://www.bristol.gov.uk/policies-plans-strategies/avonmouth-wind-turbines-project (accessed 22/10/2019)

| Theme | Description | Suggested actions to improve policy | Current best practice example |
|---|---|---|---|
| | The GGS contains objectives to improve energy efficiency in both domestic and council corporate buildings.<br><br>The borough is carrying out energy efficiency improvements to up to five council blocks in the East Greenwich area as part of the European Horizon2020 smart cities programme.<br><br>Following pilots at Barnfield Estate and John Wilson Street, the *Greenwich Homes Standard* will continue to define the standard at which the council's housing stock is maintained.<br><br>The GGS contains a commitment to replace all 22,000 street lights in the borough with more energy efficient LED from 2016 and to explore opportunities to incorporate 'smart technologies' which might, for example, increase the light sensitivity of timing to save energy. | • Consider creating a stakeholder engagement group to advise residents who own private housing on the availability of financing, trustworthy builders and the most appropriate measures for their homes. See 'Plymouth energy Community' best practice example. | ○ loft insulation of 150mm or more (in non-converted roof spaces);<br>○ the replacement of F and G rated boilers with an A-rated condensing boiler;<br>○ heating controls upgrade; and<br>○ draught stripping of external doors and letter boxes."<br>• *Plymouth Energy Community* – This community energy group was started in 2013 by Plymouth Council with control immediately passed to a board of volunteer directors. The group advices residents on energy efficiency measures and energy concerns more generally, as well as helping qualifying residents to access grants. It has also sold community shares to fund solar roof projects and a 4.1MW PV array. In order to facilitate the effective running of the group without direct council involvement, a 'service level' agreement required the council to provide staffing expertise to the group where needed. |
| New build planning | London Plan Policy SI2 *Minimising greenhouse gas emissions* states that major developments should be net zero-carbon, including:<br>• A minimum on-site reduction of at least 35% beyond 2013 Building Regulation<br>• 10% of this reduction to be achieved through energy efficiency measures for residential development, and 15% for non-residential development<br>• That when it is clearly demonstrated that the zero-carbon target cannot be fully achieved on-site, any shortfall is provided through a contribution to the carbon offset fund or off-site is a deliverable project is identified<br>• That boroughs must establish a carbon offset fund | • As part of the Core Strategy review, consider if there is potential include additional requirements which go beyond the new London Plan policies, such as a higher minimum on-site reduction and consider whether a stepped carbon offset payment could be used to appropriately incentivise on-site reduction measures.<br>• Demonstrate low and zero carbon homes using RBG assets by building 'exemplar' developments. *Passivhaus* standards provide a useful benchmark against which to consider these developments. Such 'exemplar' projects will become more important as a remaining lever available to RBG if restrictions on the ability to mandate standards for new builds higher than the national | • Cambridge City Council[29]: "Any planning application(s) for development will be supported by an Energy Statement presenting passive energy demand reduction measures adopted in the masterplan, options for further reducing demand through building designs, and options for efficiently supplying heating and cooling to buildings. The Statement(s) will include a preliminary feasibility study identifying opportunities for incorporating building-integrated or standalone renewable and low carbon technologies and, where appropriate, opportunities for 'exemplar' energy efficiency projects and consideration of smart grid approaches."<br>• Goldsmith Street, Norwich - This is the UKs largest Passivhaus development, as of June 2019. 93 Passivhaus certified homes were built as Norwich City Council owned |

[29] Supplementary Planning Document for the land north of Cherry Hinton. Note that in this case, an SPD is not strictly speaking a policy but instead a guidance document, so may not be a binding requirement on the developer. Source: Cambridge City Council, South Cambridgeshire District Council. Supplementary Planning Evidence approved for adoption with the Local Plan (March 2018). Weblink: https://www.cambridge.gov.uk/media/2375/land-north-of-cherry-hinton-spd-final-draft-low-resolution.pdf

| Theme | Description | Suggested actions to improve policy | Current best practice example |
|---|---|---|---|
| | • The minimisation of unregulated emissions (not covered by Building Regulations)<br>Additionally, referable applications should calculate whole life-cycle carbon emissions | standards do come into force. See Goldsmith Street, Norwich best practice example.<br>• Explore opportunities for public-private partnerships, perhaps operating through special purpose vehicles (SPVs), which might allow council-led development at a larger scale, bringing greater influence over the carbon emissions performance of new buildings in the borough. | social housing at a construction cost of just under £15 million. An important aspect was the careful selection of construction method to ensure repeatability, facilitating potential future up-scaling.<br>Ashton Rise, Bristol - In partnership with construction firm Willmott Dixon, Bristol City Council is building 133 homes in a mixed development which will feature low carbon heating via ground source heat pumps connected to a shared loop array of boreholes. 53 homes are to be socially rented and council owned with the rest sold by the council on the private market. Work is due to be completed in 2021. |
| Decarbonising heat in existing buildings | Low Carbon heat networks - see above.<br><br>Electrification of heating can involve heat pumps or electric resistive heating but the former provide heat with higher efficiency and hence lower carbon emissions. As set out in the *Future of Heating* white papers[30], heat pumps are likely to play a significant role in facilitating the electrification of heating. The *Local Plan* does not address heat pumps or heat electrification specifically. However, the potential for the development of an innovative water source heat pump using heat from the Thames is being | • See 'New build planning' for recommendations on promoting low carbon heat in new buildings.<br>• Consider the potential for RBG to promote uptake of the Renewable Heat Incentive scheme among residents in order to encourage the installation of heat pumps and solar thermal panels in homes, including owner-occupied and privately rented homes. However, it should be noted that the RHI is due to expire in 2021 and has historically been insufficient to encourage uptake at scale[31]. As discussed in section 2.1.8, RBG policy in this area will be dependent on the nature of the eventual successor scheme, but financial incentives beyond national programmes might be required to ensure a rapid uptake rate of renewable heat technologies in existing buildings.<br>• Review progress of the European Smart Cities 2020 Thames water source heat pump project and consider ways to drive this project forward if deemed viable.<br>• There is limited scope for autonomous action by RBG on hydrogen boilers and the required large infrastructure associated with using hydrogen for heat. In this area, lobbying might be successfully used at a London or | • See 'New build planning' for best practice on renewable heat obligations for new builds |

[30] *The future of heating: meeting the challenge* and *The future of heating – Evidence*, Department for Energy and Climate Change, March 2013: available at https://www.gov.uk/government/publications/the-future-of-heating-meeting-the-challenge (accessed 23/10/2019)

[31] See the Element Energy report '*An evidence based strategy for delivering zero carbon heat in Bristol*', section 6.3, Priority action 4, for a discussion of the insufficiency of RHI incentives to promote uptake on the scale required for rapid decarbonisation of heating. Available at: (accessed 23/10/2019) https://www.bristol.gov.uk/documents/20182/3368102/An+evidence+based+strategy+for+delivering+zero+carbon+heat+in+Bristol.pdf/39cb877b-6de0-c2d0-9865-d8cc4c8d599c

| Theme | Description | Suggested actions to improve policy | Current best practice example |
|---|---|---|---|
| | investigated by RBG under the European 2020 Smart Cities programme.<br><br>Solar Thermal is not specifically addressed in the *Local Plan* or the *Greener Greenwich Strategy.*<br><br>Hydrogen heating, via hydrogen boilers or for industrial use, is not specifically addressed in the *Local Plan* or the *Greener Greenwich Strategy.*<br><br>Anaerobic digestion and biomethane are not addressed as potential decarbonised heat sources in local policy, although a site for an anaerobic digestion facility is sought by the borough (see 'Waste' row). | national policy level in order to encourage the deployment of this method of low carbon heating. | |
| Waste | London Plan Policy SI7 *Reducing waste and supporting the circular economy* and Policy SI8 *Waste capacity and net waste self-sufficiency* set out how London will reduce resource use, increase resource efficiency and manage its waste sustainability. A key means of achieving this is incorporating circular economy design principles into the design of developments, and Policy D1B enshrines this approach.<br><br>As the sub-regional level, Greenwich plans its waste management through the South East London Joint Waste Planning Group, which produces and maintains the South East London Joint Waste Technical Paper. Due to the existing and potential future capacity at waste sites in Bexley and Lewisham, it is not necessary to Greenwich to identify additional waste management sites to meet it apportionment in the London Plan, however existing sites remain safeguarded by the London Plan. | • Adopt quantitative targets for increase in recycling rate and decrease in total waste per person. A rapid increase in recycling is required to bring Greenwich in line with leading local authorities.<br>• Consider producing a dedicated waste management strategy including measures for engaging residents in order to change behaviour and for reducing total waste production in accordance with the waste hierarchy. See the Bristol City Council best practice example.<br>• Consider instituting separate food waste collections and sourcing commercial partners to allow for anaerobic digestion of the collected food waste. A suitable site for the anaerobic digestion plant should be considered within the borough to minimise transport distances; if necessary, the plant may need to be located outside of the borough, in which case the lifecycle emissions impact of this should be carefully considered. Opportunities to exploit joint procurement with neighbouring boroughs to increase negotiating power with waste management companies | • The East Riding of Yorkshire had the highest recycling rate of any LA in the England in 2016/17[34]. In its *Environmental Statement* 2016/17[35] it sets out a clear numerical target to achieve an "internal recycling, reuse and composting rate above 65% by 2020".<br>• Two anaerobic digestion sites, operated by the private company Agrivert at Wallingford and Cassington, receive all the collected food waste in four Oxfordshire district councils, generating 4.5 MW of electricity in total and producing fertiliser. In order to divert food waste to such a facility it is necessary to collect it separately from garden waste. The City of Oxford Council ran a campaign in 2017 to make residents aware of the change required to the way their food waste was disposed. Actions included handing out free food waste bin liners and "no food waste" stickers to be put on garden waste bins during visits to households. In addition, food waste recycling leaflets were circulated and discussions held with residents. |

[34] Local Authority Collected Waste Management Statistics, https://data.gov.uk/dataset/5aea1caf-3e38-4d57-b321-ba34eb762b6e/local-authority-collected-waste-management-statistics
[35] 2016/17 Environmental Statement, East Riding of Yorkshire Council, https://www.eastriding.gov.uk/council/plans-and-policies/all-plans-policies-and-strategies/

| Theme | Description | Suggested actions to improve policy | Current best practice example |
|---|---|---|---|
| | Two thirds of the household waste collected in the borough is incinerated[32]. This occurs at the SELCHP Energy recovery facility, Lewisham, which produces 35MW of electricity fed into the national grid. Since 2014, this plant has additionally provided district heating to Southwark residents.<br><br>The borough is also seeking a site for anaerobic digestion to handle kitchen/garden waste[33].<br><br>The GGS notes a set of ongoing actions and commitments around waste, including:<br>• The inclusion of small Waste Electrical and Electronic Equipment (WEEE) recycling at kerbside<br>• Investment in 'Euro VI' standard refuse collection vehicles, with the commitment to replace the whole fleet by 2020.<br>• Replacement of two diesel vehicles with electric vans, with the commitment to install EV charging infrastructure at the Birchmere Centre.<br>• Ongoing development of a new communications plan, conforming to WRAP best standards.<br>• RBG is working to increase the levels of recycling from business, with 1000 businesses signed up with the council's business waste and recycling service at the time of writing | should be explored. The increased scale might make feasible the private development of anaerobic digestion or other waste to power plants (see Oxfordshire best practice example). | • Bristol City Council published *Towards a Zero Waste Bristol: Waste and Resource Management Strategy* in April 2016[36]. This affirms the waste hierarchy and a long-term ambition to be a 'zero waste' city. In the shorter term it commits to quantitative targets including the reduction of residual household waste per person to below 150kg per year by 2025. This would be the lowest amount of any UK Core city. |
| Industry, SMEs & commercial | No relevant decarbonisation policies pertaining to SMEs and the commercial sector were identified in RBG policy documents. | • The Mayor's Energy Efficiency Fund is a £500 million fund which provides financing of low carbon infrastructure through loans and equity investments. The fund is available to SME's for development on commercial sites. RBG should aim to facilitate access to this fund amongst local SMEs. | |

[32] *Southeast London joint waste technical paper*, Produced by the Southeast London Joint Waste Planning Group (SELJWPG), December 2017
[33] Supporting point 4.8.13, Local Plan
[36] https://www.bristol.gov.uk/documents/20182/33395/Towards+a+Zero+Waste+Bristol+-+Waste+and+Resource+Management+Strategy/102e90cb-f503-48c2-9c54-689683df6903

| Theme | Description | Suggested actions to improve policy | Current best practice example |
|---|---|---|---|
| Public transport | Small scale bus priority areas on 6 lengths of road.<br><br>Improve accessibility of bus stops.<br><br>Contributing, through contributions secured from development, to new public transport including Crossrail and a range of new or more frequent bus routes.<br><br>Lobbying TfL to improve transport links within the borough, particularly intra-borough bus links. | • Extension of bus priority areas to increase speed of bus transit time relative to private vehicle.<br>• Support use of public transport through funded Oyster card/mobility pass.<br>• Working with the Greater London Authority, TfL and providers to secure new public transport services for major development areas, e.g. DLR and Bus Rapid Transit to the Thamesmead and Abbeywood Opportunity Area. | **Mobility scheme, Birmingham**<br>In the context of the upcoming Clean Air Zone (CAZ), Birmingham is setting up a mobility scheme to encourage people to use public transport instead of their car. Individuals who travel into the CAZ for work, have a non-CAZ compliant car and earn under £30,000 p.a. will be eligible to choose from:<br>• £1,000 mobility credit<br>• Scrapping their car and getting £2,000, either as mobility credit or against the purchase of a CAZ compliant car.<br>The mobility credit will be added to the Swift card, the regional transport card that includes, tram, buses and trains.<br><br>**Employer-funded public transport, France**<br>In France, it is a legal requirement for the employer to pay 50% of public transport cost of the employee (or public shared vehicles such as the Barclays bike equivalent, Vélib). This appears on the pay slip but is not taxed[37].<br><br>**Multi-modal mobility service, Montpellier**<br>The EMMA mobility card allows customers to use the tramway, shared bicycles, car sharing, and car and bike parks in the city with a single subscription. The service also includes an itinerary and schedule calculator across all modes.[38]<br>**Bus rapid transit network, Metz[38]**<br>Two METTIS rapid transfer lines operate in the city, carrying up to 2,400 passengers per hour per direction in the morning rush hour. New 24 metre articulated buses travel in dedicated lanes and are assigned priority at traffic lights, allowing a high frequency, high volume service (every 5 min). Contactless ticketing and the introduction of three park and ride facilities contribute to high usage of the network. |

[37] https://droit-finances.commentcamarche.com/faq/2033-frais-de-transport-remboursement-par-l-employeur
[38] https://www.cohesion-territoires.gouv.fr/sites/default/files/2019-07/mobility_gb.pdf

| Theme | Description | Suggested actions to improve policy | Current best practice example |
|---|---|---|---|
| | | | **Improved public transport network, Vitoria-Gasteiz[39]**<br>The bus network was reduced from 17 lines to nine with new itineraries, timetables and improved frequencies. New bus stops were introduced in 146 locations and more resources and information were provided at all bus stops. Buses were given priority at traffic lights, and bus lanes and queue jumpers at busy junctions were introduced. Users can access the whole city with a maximum of two transfers and journey times are comparable to a private car. |
| Active travel | Invest £1.8m over the next three years in cycling schemes including development of 8 local cycle routes, and associated parking. Cycle routes planned for 2019/20 will include segregated cycle lanes (step cycle track), narrower car carriageways, and bus stop bypasses.<br><br>Implementing Greenwich town centre Liveable Neighbourhood scheme, reassigning road space from cars to pavements and dedicated cycle ways.<br><br>Significantly increasing cycle parking for residents and at key destinations, including rail stations.<br><br>Planning a network of Primary Cycle Routes to ensure that improvements to cycling routes focus on high connectivity and ease of use to encourage uptake.<br><br>Publicity campaigns to promote active travel, with a focus on schools within the borough.<br><br>Establish Streetscape Guidance Document to define the required level of service for active transport by street type. | • Consider schemes to encourage community involvement and active travel schemes.<br>• Broader, large scale, behaviour change campaigns. | **Waltham Forest**<br>Developed a Cycle Action Plan and 2020 Vision for Cycling[40] to implement Mini-Holland funding (£27m from TfL) to improve conditions for cycling in the Borough. Over 5 years, the borough has delivered 22km of segregated cycle lanes, 40 modal filters to prevent rat-running, improvement of road junctions, and installation of 300 bike hangars for residents and 7 station cycle hubs. A fund of £20,000 is available per year to community projects (up to £2,500 per project) that encourage walking and cycling. Residents were consulted throughout scheme design.<br><br>**City Fringe ZEN**<br>Established in 2012 as a partnership between the London Boroughs of Hackney, Islington, and Tower Hamlets, the Zero Emissions Network (ZEN) offers free advice and services to businesses and residents in the City Fringe area to help them switch to low emission energy and travel options. The Network provides services such as free trials of electric vehicles and cargo bikes, to cycle training and repair courses, and workplace energy audits. They also offer a range of financial support such as a £2,000 workplace grant to improve walking and cycling facilities, as well as a number of promotional offers for joining local car clubs. So far 31 polluting vehicles have been switched |

[39] Civitas case study
[40] Waltham Forest Council 2015

| Theme | Description | Suggested actions to improve policy | Current best practice example |
|---|---|---|---|
| | | | for electric ones and 117 private vehicles have been given up for car club memberships. The ZEN has garnered widespread praise and was awarded an additional £200,000 by the Department for Environment, Food and Rural Affairs' Air Quality Grant scheme earlier this year. A similar scheme with funding support from the Mayor's Air Quality Fund is to be set up in Hammersmith. |
| Discouraging private vehicle use | Development of new and extended Controlled Parking Zones.<br><br>Installation of modal filters to reduce through car traffic, making routes more desirable for active travel users due to reduced competition for road space.<br><br>Modal Filters: introduce a LIP funded programme to address rat running and introduce 'modal filters', to create Low Traffic Neighbourhoods across Royal Greenwich.<br><br>Significantly increasing enforcement against illegal parking.<br><br>Developing a new Parking Strategy to better align with current policy, best practice and the Council's wider transport and environmental strategies, including:<br>• Considering introducing a levy on workplace parking – this would encourage drivers to consider alternative transport modes as well as raise money to fund other programmes (this could include the provision of subsidised travel passes).<br>• Considering variable charging for parking based on emissions. | • Work with TfL to explore permanently closing more through routes within local towns in the Borough. Discouraging private vehicle use for short local trips will push residents to active and public transport modes, which can help justify additional capital investments into these modes within the Borough.<br>• Adopt a more ambitious position on reducing private parking spaces in new developments.<br>• Consider implementing strategic Zero Emissions Zones throughout the borough, with the support of the Mayor's office as outlined in the London Electric Vehicle Infrastructure Delivery Plan.<br>• Considering where 20mph zones may be appropriate on non-residential streets. | **Ghent, Belgium**<br>In 2017 Ghent implemented a 'Circulation Plan', carving the city centre up into six wedge districts and banned cars from travelling between districts. This has resulted in a 13% reduction in rush hour car traffic, and a 39% reduction in cars on the most popular streets in the inner city[41]. Space freed up from cars has been reallocated to widened cycle lanes and bus corridors, as well as improvements to the public realm.<br><br>**Nottingham City Council**<br>Nottingham introduced a Workplace Parking Levy in 2012, which charges employers £415 per parking space provided to employees. 8/10 employers currently pass this cost onto employees who use the spaces, providing another incentive to use the city's public transport links. A similar scheme is being considered by the London Borough of Hounslow as a means of funding new Overground links between Brentford, Southall, and Syon Lane.<br><br>**London Borough of Hackney**<br>Hackney's upcoming 'Local Plan 2033' stipulates that all new developments in the borough must be car free, and that all proposals for, or including, new public car parks will be refused. Additionally, sites that are redeveloped must significantly reduce their parking provision under these proposals. |

[41] Ghent City Council, 2018.

| Theme | Description | Suggested actions to improve policy | Current best practice example |
|---|---|---|---|
| | Expanding coverage of 20mph zones, with an ongoing programme working towards total coverage of residential areas within the borough. | | |
| Electric Vehicles | A significant expansion of chargers in 2020-21, building on strong growth to-date, Including support for the roll out of Source London electric vehicle charging points, lamp post charging and rapid chargers.<br><br>Developing a new Parking Strategy to better align with current policy, best practice and the Council's wider transport and environmental strategies. Including considering variable charging for parking based on emissions. | Implementation of the recommendations outlined in the London Electric Vehicle Infrastructure Delivery Plan (discussed above). For example:<br>• Supporting the creation of a new pan-London coordination body to ensure a consistent approach for public charging infrastructure;<br>• Increased use of Permitted Development rights for installing charge points;<br>• Creation of Zero Emission Zones within the Borough. | **London Borough of Islington**<br>Fully electric vehicles are entitled to free parking permits. For non BEVs pricing depends on vehicle emissions.<br><br>**City Fringe ZEN**<br>See above.<br><br>**City of Westminster**<br>Westminster has the highest number of charge points per capita in the UK, with 1.47 per 1,000 population. Residents are also able to request a new charge point to be installed in lamp columns near their home.<br><br>**Milton Keynes**<br>Thanks to OLEV funding, Milton Keynes Council has been able to install over 200 standard and rapid charging points throughout the city. |
| Vehicle sharing | Supporting the development of the car club network, including marketing and other campaigns to promote uptake. Reviewing our existing car club model and testing the feasibility of new car club models including floating and point to point. | • Consider allowing additional car clubs to operate within the Borough, and to extend the current programme with Enterprise's electric vehicles. RBG could also join the growing number of London Boroughs granting Zipcar permission to operate their "free-floating" Flex service within the Borough.<br>• Consider extending the vehicle sharing offer to businesses by advertising the current TfL van scrappage scheme that is open to sole traders, charities and micro businesses. They give £3,500 for each non-ULEZ compliant van scrapped [42]. Third parties offer promotions[43] : for instance, Zipcar offers a match funding (if recipients use the fund towards a Zipcar account, Zipcar adds £3,500 | **Berlin, Germany**<br>The number of car sharing users in Berlin has grown from 180,000 people in 2010 to 2.46 million in early 2019[44]. A number of private car clubs operate within the city, with VW launching their WeShare service earlier this year with a fleet of 1,500 e-Golf cars. WeShare follows the "free-floating" model of competitor car2go which allows users to park their car in any legal parking spot throughout the city.<br><br>**City Fringe ZEN**<br>See above. |

[42] https://tfl.gov.uk/modes/driving/ultra-low-emission-zone/scrappage-scheme?cid=scrappage-scheme
[43] https://tfl.gov.uk/modes/driving/third-party-promotions
[44] Techcrunch, 2019.

| Theme | Description | Suggested actions to improve policy | Current best practice example |
|---|---|---|---|
| | | too). Enterprise also has an offer. RBG could add to this, but would as well need to encourage car club operators to bring vans into the Borough. | |
| Freight | Developments generating high volume of freight movement to be located close to major transport routes.<br><br>Supporting proposals that increase proportion of freight transported by rail or water, including safeguarding of key wharves and railheads. | • Lead by example, by assessing the scope for modal shift or consolidation of council deliveries.<br>• Consider building on RBG's existing experience with cycle freight to develop a strategy to encourage modal shift of freight to cycles where possible, including: making space for logistics hubs (such as underutilised car parks), considering cycle freight needs in cycle infrastructure, and incorporating cycle freight plans into new developments.[45]<br>• Support and encourage the integration of cycle logistics with river and rail transport where appropriate, for example through integrating distribution hubs at wharves and stations.<br>• Raise awareness among companies of available grants to support use of rail and waterways, such as Mode Shift Revenue Support and the Waterborne Freight Grant.[46] | **City of London**<br>Following a review of council-owned assets, policies to encourage cycle freight are included in City of London's Draft Transport Strategy (Proposal 38), including development of three micro-distribution hubs within underutilised car parks. The council also carried out their own loading bay survey to assess the potential for modal shift.<br><br>**Amsterdam, Netherlands**<br>DHL operate an integrated boat-to-bike system to enable deliveries in and out of the city centre by canal boat, with the first and last mile carried out by cargo bike.[47]<br><br>**Utrecht, Netherlands**<br>Catering supplies are delivered to 60 businesses along the river by electric-powered boat (the "beer boat", funded from the council's air quality budget.[48]<br><br>**London Boroughs Consolidation Centre**<br>The London Boroughs of Camden, Enfield, Islington and Waltham Forest established a consolidation centre for council deliveries, now used by up to 41 suppliers and resulting in a 46% reduction in the number of vehicle trips delivering to council sites.[49] |

[45] *Cycle Logistics Study* (2019) Element Energy for Cross River Partnership
[46] Department for Transport note that the current schemes run until 2020 and it is not currently clear whether they will be replaced or continued
[47] http://cargobikefestival.blogspot.com/2017/10/boat-bike-dhls-multi-modal-amsterdam.html
[48] Eltis Case Study
[49] TfL Case Study

# 4 Baseline emissions modelling

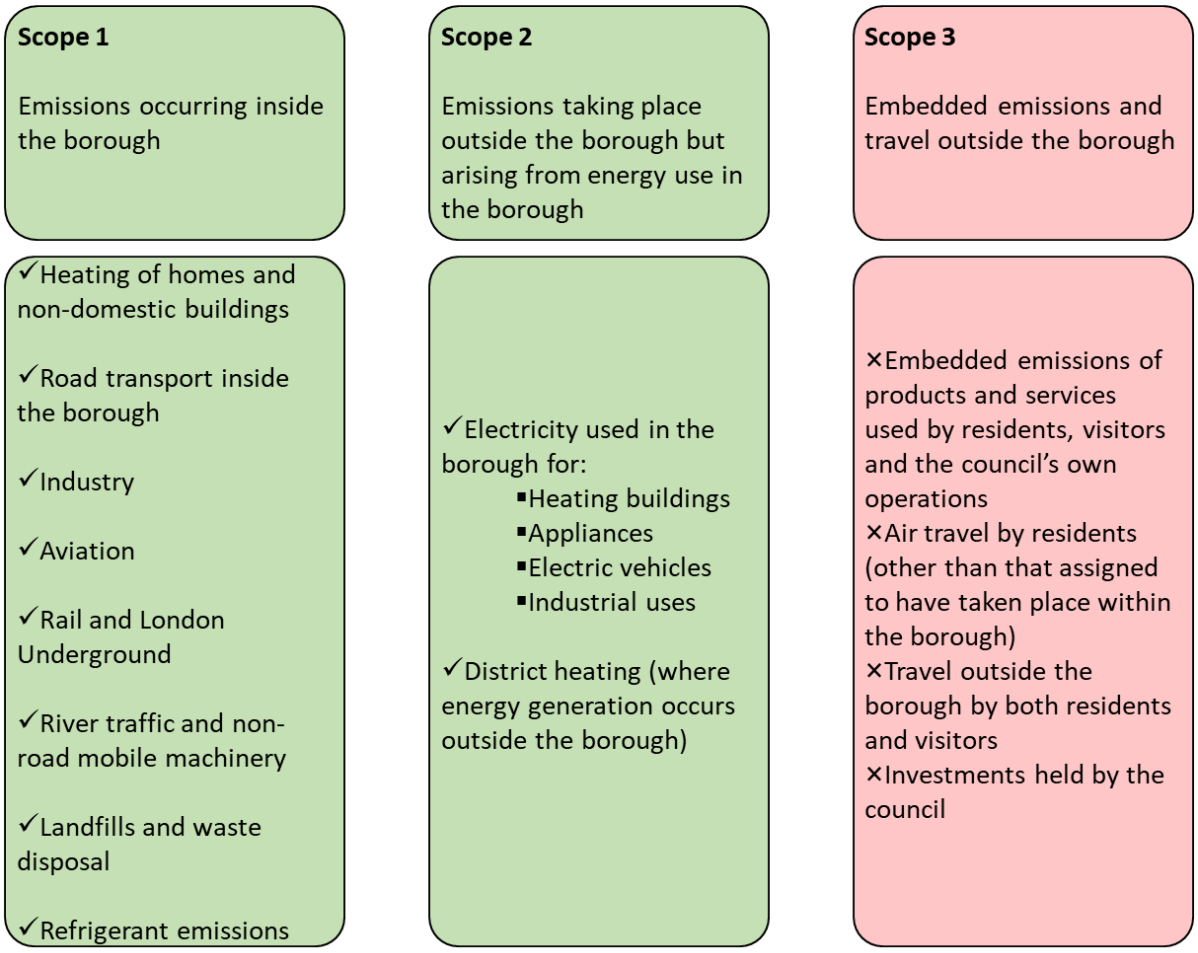
## 4.1 Modelling methodology and scope of emissions inclusions

Figure 4-1 below presents a summary of the emissions sources currently included in the Baseline. The analysis covers a wide range of emissions sources. These are categorised here as follows.

- **Scope 1**: Emissions occurring directly occurring inside the borough.
- **Scope 2**: Emissions taking place outside the borough arising from energy use in the borough (this mainly covers emissions from electricity demand in the borough, but also emissions from district heating where the heat is generated outside the borough).
- **Scope 3**: Other emissions taking place outside the borough, covering embedded emissions and travel outside the borough.

The analysis currently excludes most forms of 'Scope 3' emissions (embedded emissions) but it is recognised that actions to address these emissions must be considered as part of wider climate change ambition strategies. These aspects are addressed qualitatively in Section 5.2.5. A summary of the modelling methodology applied for each emissions sector is given in the appendix in Table 7-1.

**Figure 4-1 Schematic showing the inclusions and exclusions of emissions sources**




The year 2015 is used as the baseline against which progress is measured and as the starting point of our modelling, both for the Baseline scenario and for the Maximum ambition scenario. This allows straightforward comparison with the London Environment Strategy, which states the ambition to

become 'zero carbon' by 2050, using 2015 as its baseline year. Further, it brings our modelling in line with the GLA's Zero Carbon Pathways Tool, which can be used as a comparison[50].

Emissions covered by the UK's carbon budgets and 2050 net zero targets are those related to activities which occur within the UK's territorial borders (plus aviation and shipping). These are known as 'territorial' or sometimes 'production-based' emissions. Considering only these emissions is the standard accounting approach internationally and is required by the United Nations Framework Convention on Climate Change (UNFCCC) for country emissions inventories. This approach has the advantages of avoiding the risk of double counting emissions and of mapping most closely onto available policy levers. It is the approach taken in this work primarily for the latter reason; RBG control is greatest over those emissions directly taking place within the borough. The other broad approach to emissions accounting is a 'consumption-based' emissions approach. In this case, emissions involved in the production of goods and services are allocated to the location in which they are consumed. Consumption based estimates of UK wide emissions are produced by the Department for Environment, Food and Rural Affairs, but are more uncertain than the production-based estimate because of the detailed dependence on supply chains and production methods associated with goods imported from the rest of the world. Consumption-based emissions were estimated to be approximately 60% higher than production-based emissions for the UK in 2016[51]. It is likely that a similar (or larger) difference would be found between the two methods for Greenwich. In general, consumption-based approaches produce larger emissions values than production-based approaches for large cities, since more goods tend to be imported into cities than are produced there[52].

## 4.2 Comparability with other standards and datasets

**BEIS – *Emissions of carbon dioxide for Local Authority areas* dataset**

The Department for Business, Energy and Industrial Strategy (BEIS) produces annual local authority emissions data[53] as a subset of its national Greenhouse Gas Inventory (GHGI). The UK National Atmospheric Emissions Inventory and BEIS's National Statistics of energy consumption for local authority areas provide the main input data sources for these statistics. All emissions included in this national inventory are allocated to Local Authorities on an end user basis, except aviation, shipping and military transport. As in our modelling energy use emissions are allocated to the end users, such as buildings electricity use, rather than to the power stations themselves. The emissions identified as Scope 3 in Figure 4-1 are not included. This BEIS data set has a total emissions value of 856 kt $CO_2$ for the Royal Borough of Greenwich in 2015.

**SCATTER – Carbon Disclosure Project report**

SCATTER is a local authority focused emissions tool developed in a collaboration between Anthesis Group, Nottingham City Council, BEIS, Greater Manchester Combined Authority and the Tyndall Centre for Climate Research at the University of Manchester. The tool aims to allow local authorities and cities to standardise their greenhouse gas reporting and align with international frameworks. The SCATTER approach considers emissions which align broadly with the emissions identified as Scope 1 and Scope 2 in Figure 4-1. Scope 3 emissions from aviation are included on a resident activity basis, rather than using airport locations (as in our modelling). An inventory for Greenwich was generated using the SCATTER tool as part of the Carbon Disclosure Project using the 'GHG Protocol for cities'

[50] The Zero Carbon Pathways Tool allows interactive modelling of London's emissions assuming London-wide changes to energy systems and energy efficiency of buildings, and is available at (accessed 18/11/2019) https://data.london.gov.uk/dataset/london-s-zero-carbon-pathways-tool.
[51] *Reducing UK emissions: 2019 Progress Report to Parliament*, Committee on Climate Change, July 2019
[52] See, for example, the C40 cities report 'Consumption-based GHG emissions of C40 cities', March 2018
[53] Available at (accessed 20/11/2019) https://data.gov.uk/dataset/723c243d-2f1a-4d27-8b61-cdb93e5b10ff/emissions-of-carbon-dioxide-for-local-authority-areas

methodology[54]. This inventory finds total emissions of 1100 kt $CO_2$ per year in 2017. This figure is larger than the value in the BEIS dataset described above (and our baseline value) predominantly due to the significantly larger (Scope 3) emissions from aviation derived in this approach.

## 4.3 Summary Results

### 4.3.1 *Baseline emissions in 2015*

In 2015 the total emissions for RBG were calculated to be 860 kt $CO_2$. This is 2% of the total for Greater London, as calculated in Element Energy's GLA modelling[55]. The most significant sources are domestic and non-domestic heat and electricity use, and road transport. The following tables and figure detail the contributions of various sources to these total emissions at two different levels of disaggregation.

**Table 4-1 Emissions breakdown by sector in 2015**

| | Emissions (kt $CO_2$eq/year) | Percentage of total |
|---|---|---|
| *Homes* | 348.86 | 41% |
| *Workplaces* | 265.89 | 31% |
| *Transport* | 244.50 | 28% |
| ***Total*** | **859.25** | **100%** |

**Figure 4-2 Emissions breakdown by source in 2015[56]**

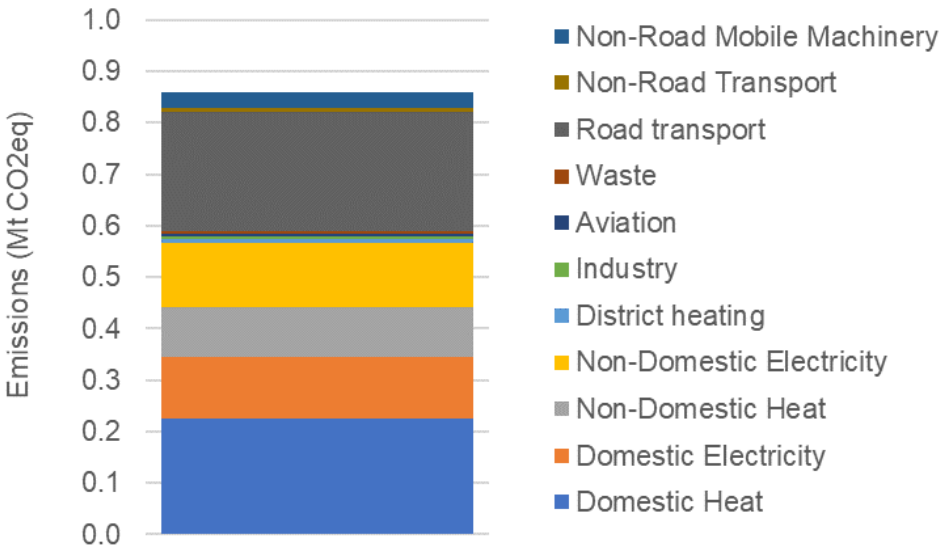



**Table 4-2 Emissions breakdown by source in 2015**

| | **ktCO2** | **Percentage of total** |
|---|---|---|
| *Domestic Heat* | 225.7 | 26% |
| *Domestic Electricity* | 119.1 | 14% |
| *Non-Domestic Heat* | 95.7 | 11% |
| *Non-Domestic Electricity* | 125.7 | 15% |

[54] See GHG Protocol for Cities: An Accounting and Reporting Standard for Cities, available at https://ghgprotocol.org/greenhouse-gas-protocol-accounting-reporting-standard-cities

[55] See Element Energy report for the Greater London Authority & C40 Cities: *London's Climate Action Plan: WP3 Zero Carbon Energy Systems*, September 2018

[56] 'Non-road Mobile Machinery' includes emissions arising from river traffic.

| | | |
|---|---|---|
| *District heating* | 7.3 | 0.9% |
| *Industry* | 5.1 | 0.6% |
| *Aviation* | 6.7 | 0.8% |
| *Waste* | 4.6 | 0.5% |
| *Road transport* | 232.0 | 27% |
| *Non-Road Transport* | 5.8 | 0.7% |
| *Non-Road Mobile Machinery* | 31.5 | 3.7% |
| ***Total*** | 859.2 | 100% |

### 4.3.2 *Total emissions trajectory*

The Baseline scenario sees a reduction in total $CO_2$ emissions, mainly before 2035 after which further reductions are slower in pace. The projected total annual emissions are 494 kt $CO_2$ in 2050 and the cumulative emissions up to this point are 21800 kt $CO_2$. Major contributors to this decrease in emissions are energy efficiency increases in buildings, the decarbonisation of grid electricity and the road transport sector. Energy efficiency increases in buildings are modelled using input data from prior work by Arup which provides heat demand projections to 2050 across different tenure types (eg. Existing Local Authority owned domestic buildings). These projections assume an ambitious retrofitting program and high standards of energy efficiency for new builds (see Section 4.3.4). The reduction and subsequent increase in emissions associated with electricity use around 2017 (for example in Figure 4-4, left) is caused by the same shape occurring in the underlying data on carbon intensity of the electricity grid (see Section 4.3.4).

**Figure 4-3 Annual emissions trajectory to 2050 for the baseline scenario**

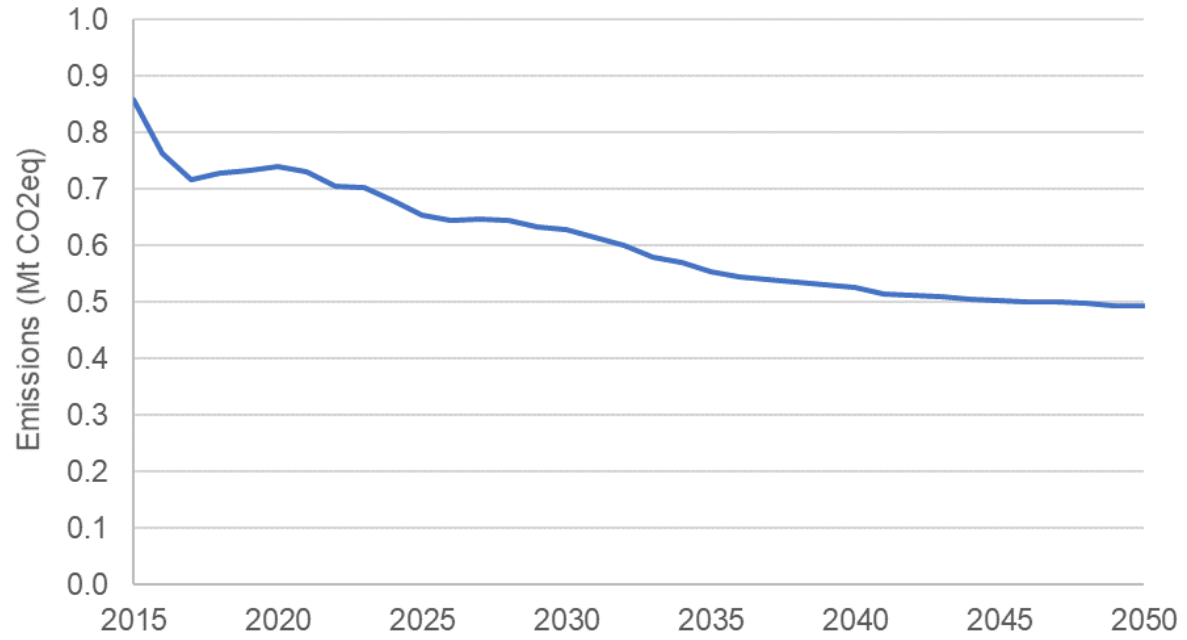



**Figure 4-4 Annual emissions by sector to 2050**

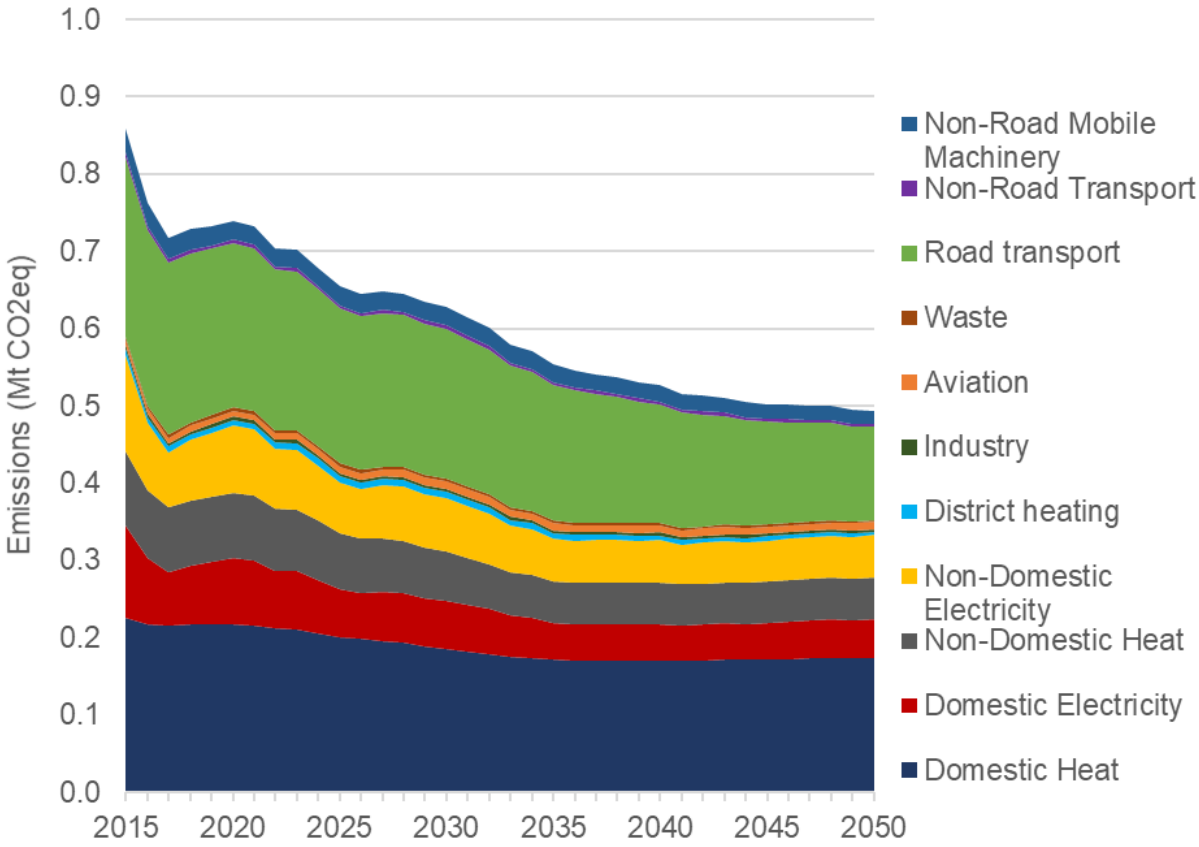
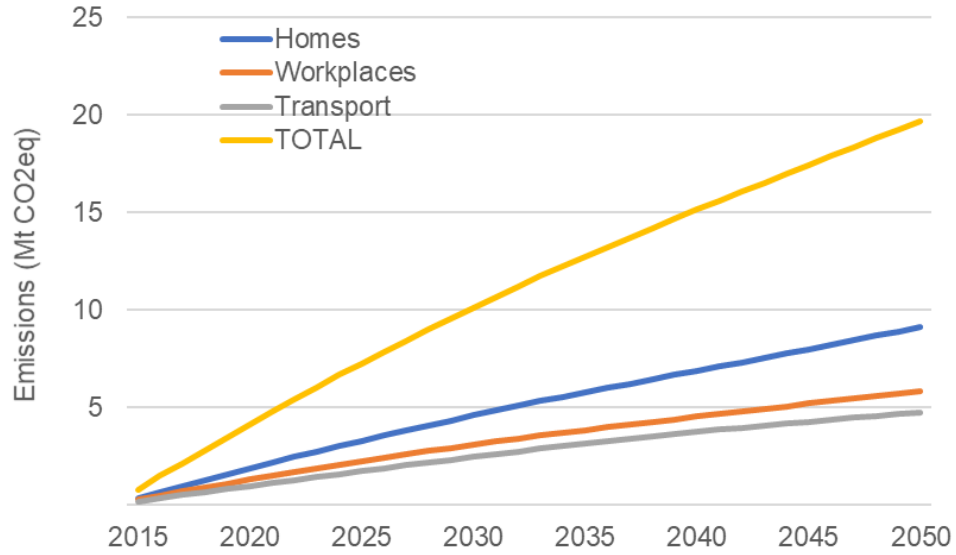


**Figure 4-5 Cumulative emissions**




### 4.3.3 *Remaining emissions in 2030*

In the Baseline scenario, $CO_2$ emissions fall by 27% over the period 2015 to 2030, to 628 kt $CO_2$ per year in 2030. The remaining emissions are associated with similar sources as in 2015, but with transport accounting for a slightly higher share of the total, and workplaces slightly less. A more detailed breakdown of the changes in emissions sources between 2015 and 2030 under the baseline scenario is given in table 3-4.

**Table 4-3 Breakdown of remaining emissions by sector in 2030**

| | Emissions (kt $CO_2$eq/year) | Percentage of total |
|---|---|---|
| *Homes* | 254.20 | 40% |
| *Workplaces* | 166.23 | 26% |
| *Transport* | 207.60 | 33% |
| ***Total*** | **628.04** | **100%** |

**Figure 4-6 Remaining annual emissions by source in 2030**

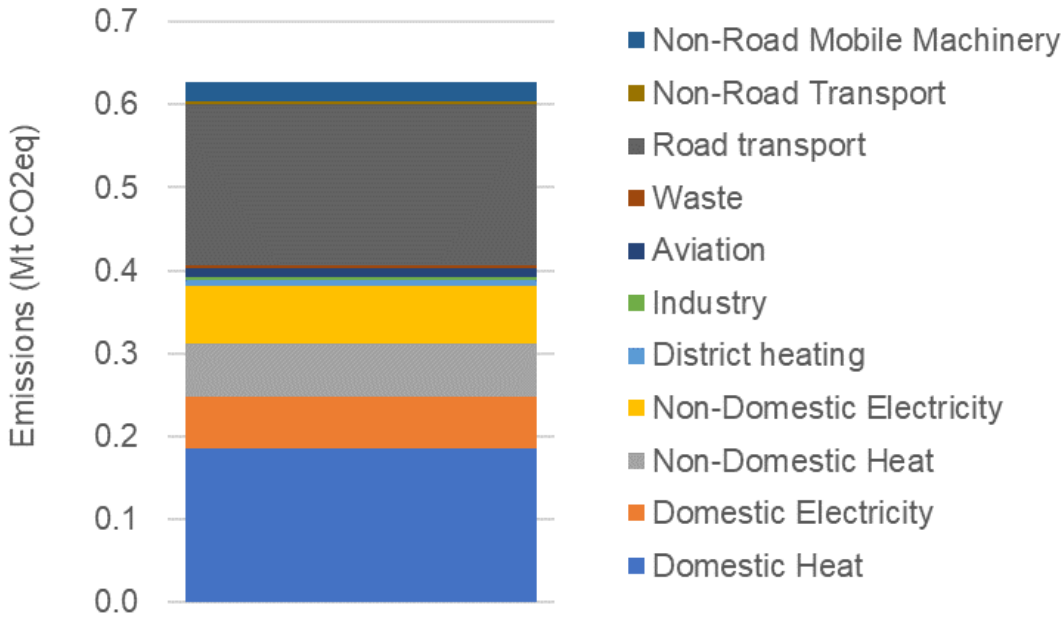



**Table 4-4 Emissions breakdown by source in 2015 and 2030**

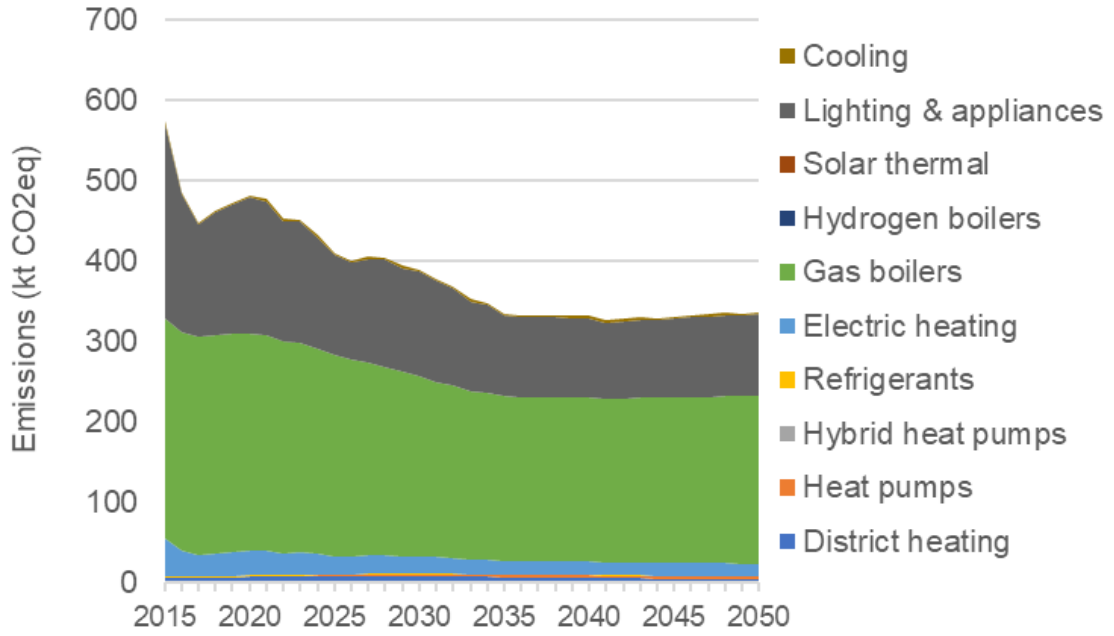
| | Emissions (kt $CO_2$/year) | | Percentage of total | |
|---|---|---|---|---|
| | 2015 | 2030 | 2015 | 2030 |
| *Domestic Heat* | 225.7 | 185.1 | 26% | 29% |
| *Domestic Electricity* | 119.1 | 63.1 | 14% | 10% |
| *Non-Domestic Heat* | 95.7 | 62.8 | 11% | 10% |
| *Non-Domestic Electricity* | 125.7 | 69.5 | 15% | 11% |
| *District heating* | 7.3 | 8.5 | 0.9% | 1.4% |
| *Industry* | 5.1 | 3.8 | 0.6% | 0.6% |
| *Aviation* | 6.7 | 9.1 | 0.8% | 1.5% |
| *Waste* | 4.6 | 3.6 | 0.5% | 0.6% |
| *Road transport* | 232.0 | 194.2 | 27% | 31% |
| *Non-Road Transport* | 5.8 | 4.3 | 0.7% | 0.7% |
| *Non-Road Mobile Machinery* | 31.5 | 24.0 | 3.7% | 3.8% |
| ***Total*** | **859.2** | **628.0** | **100%** | **100%** |

### 4.3.4 *Buildings*

Heating and electricity use in buildings generated 573 kt $CO_2$ in 2015, 67% of the total emissions for Greenwich. Of this, gas boilers account for the majority of $CO_2$ emissions in from buildings, with lighting and appliances the second largest source. In the Baseline scenario there is little deployment of heat pumps or district heating and so energy demand and emissions associated with these technologies remains low. Figure 4-11 demonstrated this fact: gas boilers dominate the heat supply in both domestic and non-domestic buildings in 2030. The dominant effects modelled in the Baseline scenario are an increase in the energy efficiency of buildings, the decarbonisation of the electricity grid, and growth in building numbers. Figure 4-7 shows the modelled trajectory for emissions for buildings. The rapid fall

and subsequent rise in emissions from electric heating and lighting & appliances around 2017 occurs because the carbon intensity of the grid follows this historic trajectory in the dataset used.

**Figure 4-7 Emissions from heating and electricity use in all buildings in the Baseline scenario**




**Energy Efficiency**

The baseline scenario assumes the Arup 'central' scenario for heat demand in buildings. This choice was made in order to better isolate the impact of low-carbon technologies in the comparison to the Maximum ambition scenario. This scenario was designed to represent an ambitious but achievable retrofit programme combined with strong planning regulation on the new build sector. It includes a 50% reduction in domestic appliance energy demand and an 80% reduction in domestic lighting energy demand per building by 2050. The average heat demand of an existing property reduces by around 30% by 2050. This modelled improvement in energy efficiency of the building stock occurs mostly in the 2020s and early 2030s, causing the distinctive drop in energy demand during this period seen in Figure 4-9 and Figure 4-10, which show the proportion of heat demand disaggregated by tenure type in domestic and non-domestic buildings.

Figure 4-10 must be interpreted with the caveat that the assignment to tenure types presented here occurs via a conversion from a different tenure classification system which assumed London wide averages in order to make the conversion. The 'Public Sector' category in Table 3-5 represents the addition of the 'Education', 'Health' and 'Government' categories. The data does not allow a direct extraction of only non-domestic buildings owned by RBG for emissions or energy use and so the addition of these categories is used as a proxy for this.

See section 3.1 of the Element Energy report *London's Climate Action Plan: Zero Carbon Energy Systems*[57] for further information on energy efficiency modelling, including discussion of the type of policy required to achieve these changes. Further information is available in the Arup report *CAP Technical Assistance for London Work Package 2 – Zero Carbon Building Policies*[58].

[57] September 2018, available at (as of 25/10/19): https://www.london.gov.uk/sites/default/files/element_zero_carbon_energy_systems_report.pdf
[58] Available at (as of 25/10/19): https://www.london.gov.uk/sites/default/files/arup_building_energy_efficiency_report.pdf

**Electricity Grid Decarbonisation**

In the Baseline scenario the Carbon intensity (in units of kg $CO_2$ per kWh) of the electricity grid is set equal to the National Grid *Future Energy Scenarios* 'Steady State' scenario. This carbon intensity falls until around the late 2020s, after which it is remains roughly constant as decarbonisation stalls. The lower emissions value in 2017 than in the preceding and following years for 'lighting and appliances' in the right hand chart of Figure 4-8 occurs because the same pattern is found in this 'Steady State' grid carbon intensity scenario.

**Growth in numbers of buildings**

The number of buildings is not directly projected; instead, spatial heat demand projections (by LSOA), taken from previous Arup modelling (see 'Energy efficiency' above) are used to model growth, from which buildings numbers can be calculated using London-wide averages of heat demand per building for each tenure type. This growth continues out to 2050 and is the source of the rise in energy demand and slight rise in emissions from gas boilers and lighting & appliances between 2035 and 2050.

**Local authority owned homes**

Local authority owned homes represent around 20% of heat demand in domestic buildings in 2015. This proportion decreases slightly over the projected period, as shown in Figure 3-8. The proportion of heat demand is roughly equal to the proportion of LA owned homes (23% in 2015) in the borough. Table 4-5 shows the heat demand of each tenure type across domestic and non-domestic sectors in 2015.

**Figure 4-8 Annual energy use in domestic (left) and non-domestic (right) buildings**

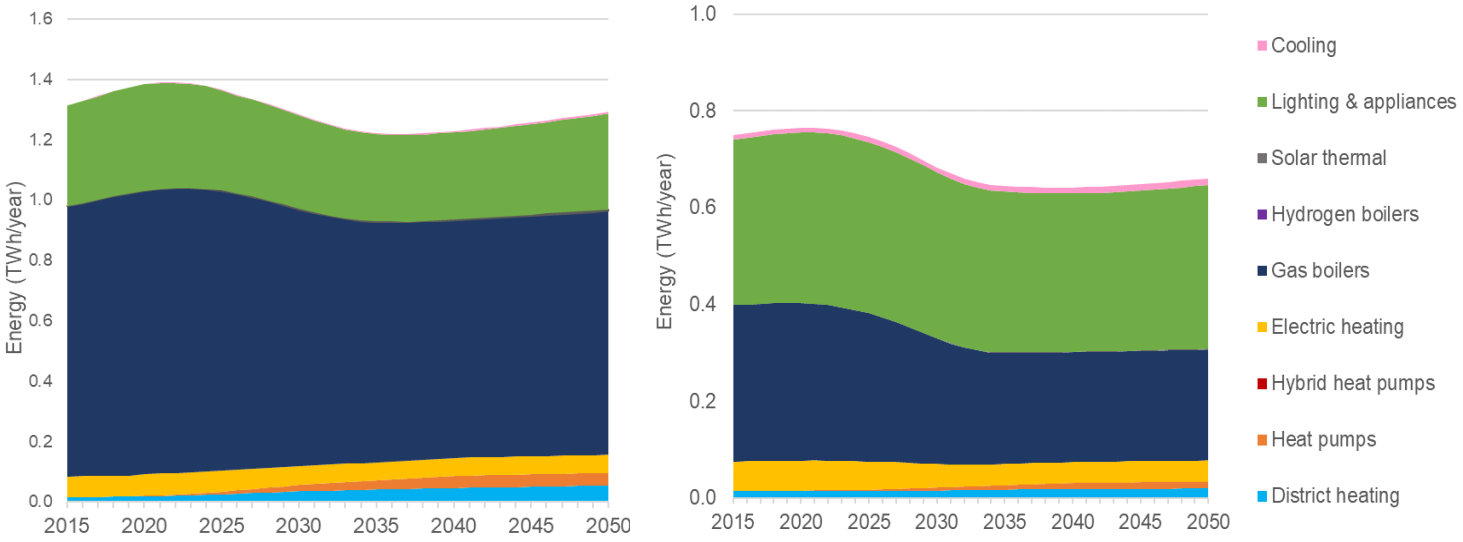



**Figure 4-9 Heat energy demand in domestic buildings by tenure type**

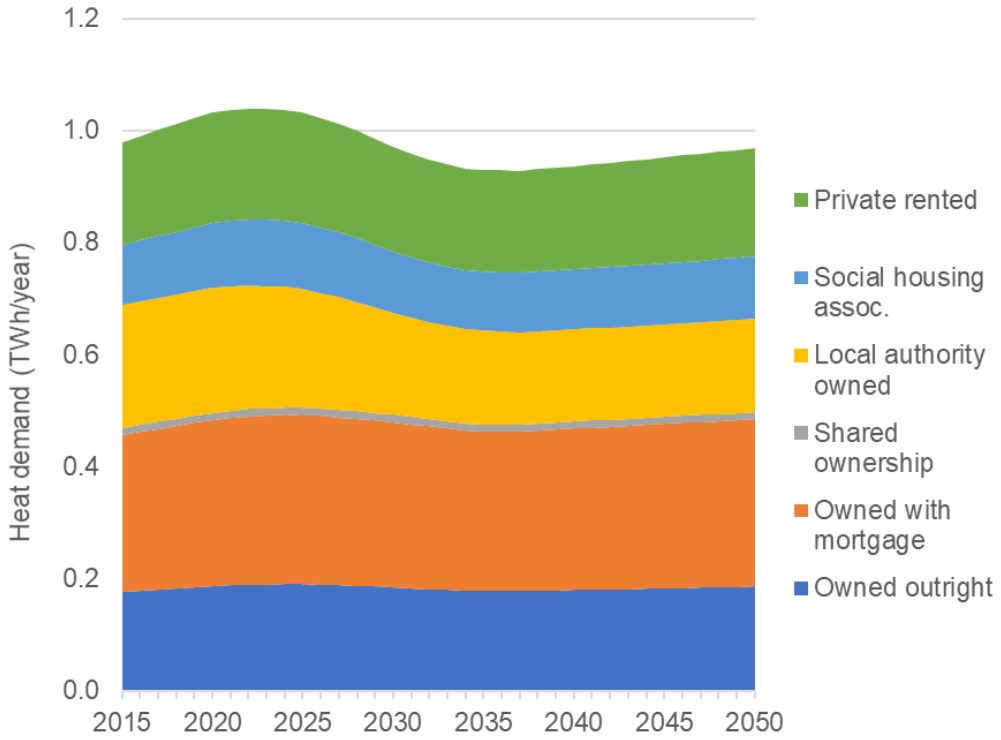


**Figure 4-10 Heat demand in non-domestic buildings by tenure type**

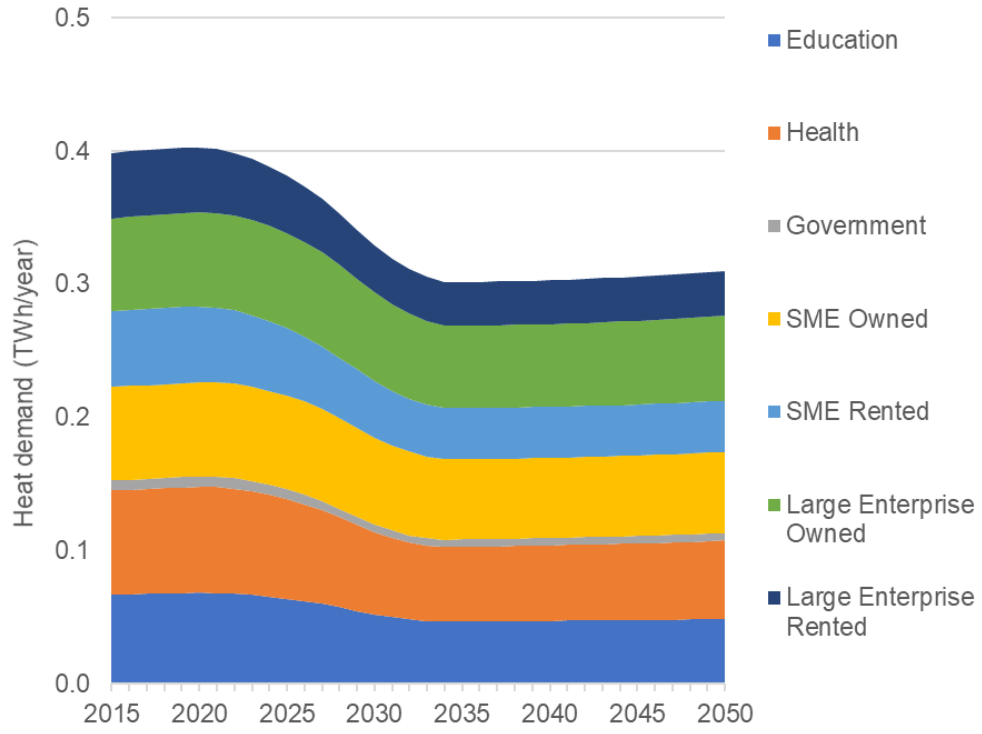
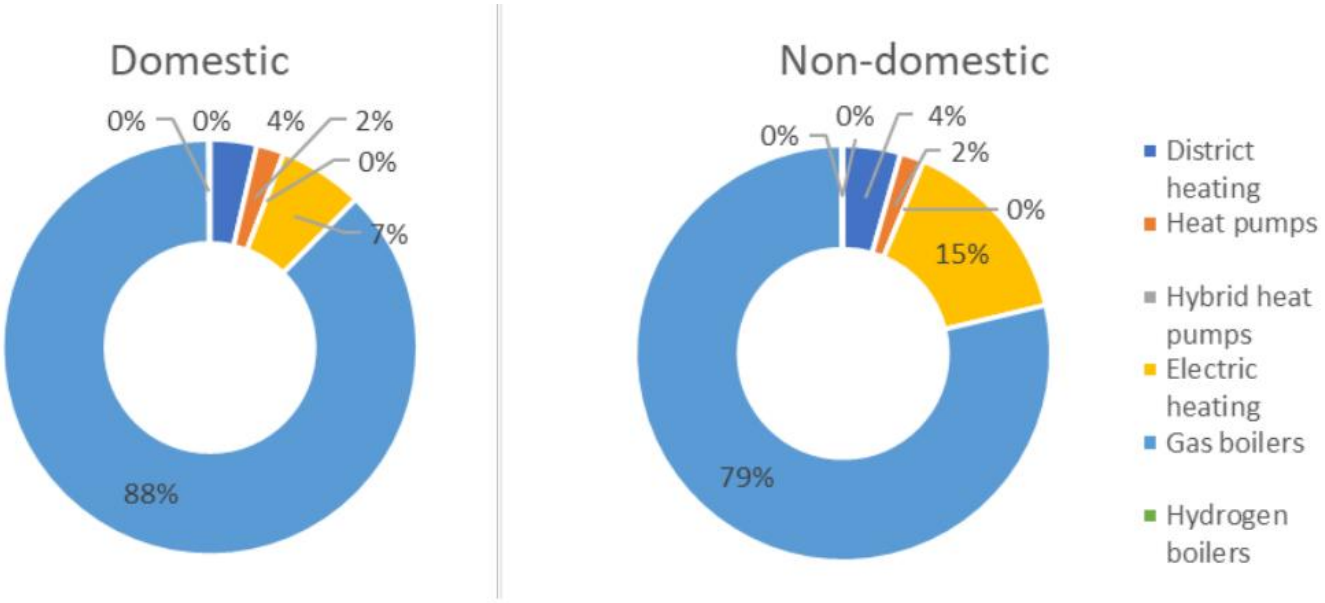



**Table 4-5 Heat demand in 2015 by tenure**

| | Energy (GWh/year) | Percentage of total |
|---|---|---|
| *Owned outright* | 177 | 18% |
| *Owned with mortgage* | 279 | 29% |
| *Shared ownership* | 12.8 | 1% |
| *Local authority owned* | 220 | 22% |
| *Social housing assoc.* | 107 | 11% |
| *Private rented* | 184 | 19% |
| ***Total domestic*** | **979** | **100%** |
| | | |
| *Education* | 67.0 | 17% |
| *Health* | 78.1 | 20% |
| *Government* | 7.6 | 2% |
| *SME Owned* | 70.0 | 18% |
| *SME Rented* | 57.1 | 14% |
| *Large Enterprise Owned* | 69.6 | 17% |
| *Large Enterprise Rented* | 49.2 | 12% |
| *Public Sector* | 153 | 38% |
| ***Total non-domestic*** | **399** | **100%** |

**Figure 4-11 Heat supplied by heating system in 2030 in the Baseline scenario**




### 4.3.5 *Transport*

Transport accounts for 29% of emissions in 2015 and road transport alone accounts for 27%. Fleet composition changes among cars and buses are the dominant source of reductions in emissions from road transport. There is some uptake of hybrid and electric vehicles in the baseline scenario, but this occurs mainly after 2030. Emissions from aviation and rail do not see significant change over the projected period.

Emissions from road transport are affected by activity level (vehicle kilometres for each vehicle type) and by the carbon intensity of that activity, which changes due to modelled uptake of low carbon powertrains, such as battery electric vehicles (BEVs). In both cases, modelled projections represent data provided by Transport for London as their own 'baseline' scenario. Activity level increases are minor and the modelled uptake of electric, hydrogen and hybrid vehicles has a larger effect, causing an overall reduction in road transport emissions over time. Buses see a large decrease in emissions due to significant modelled uptake of battery electric and hybrid electric vehicles in the Transport for London fleet over the 2030s and 2040s.

**Figure 4-12 Energy use by transport type (left) and transport powertrain (right)**

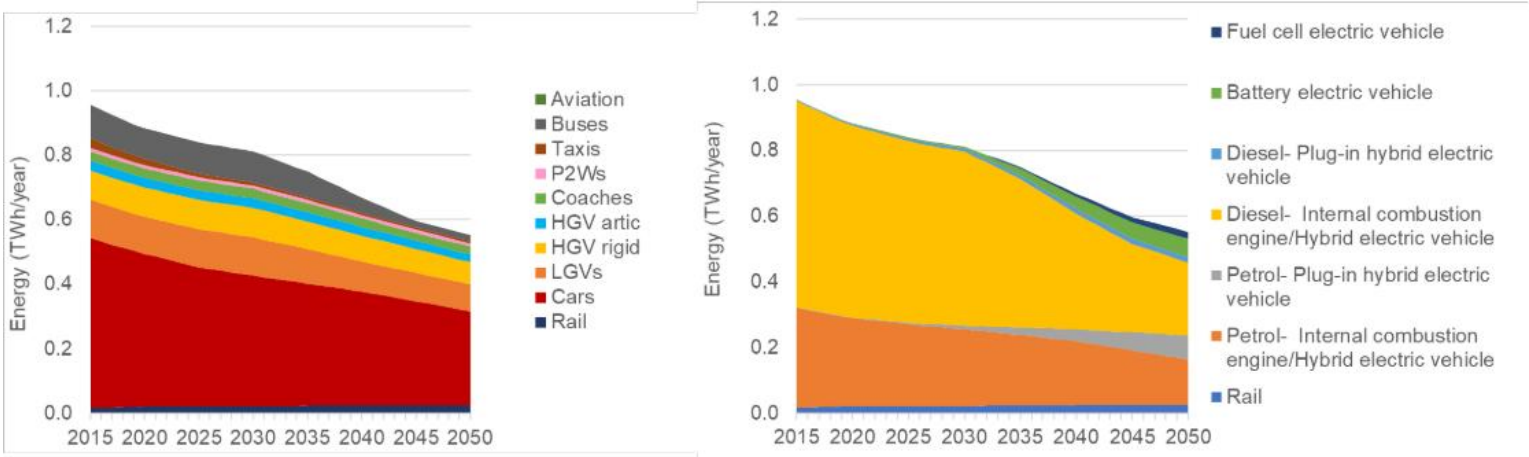
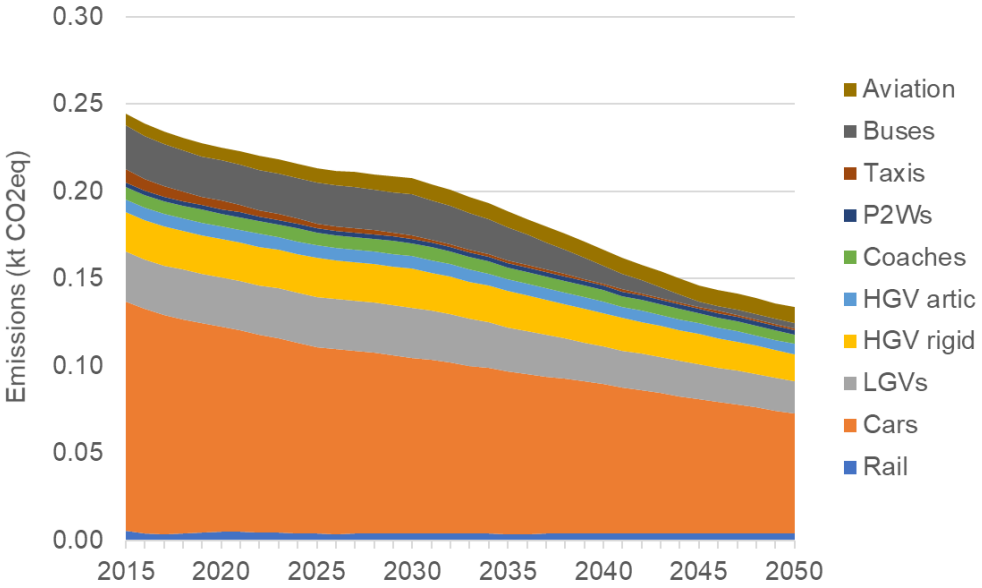


**Figure 4-13 Emissions by vehicle type**




### 4.3.6 *Industry, waste & other*

This sector includes small and large industry, non-road mobile machinery (predominantly construction machinery), river and waste. In total these account for 5% of emissions in 2015. Non-road mobile machinery is the majority of this, accounting for 3% of total emissions. Waste is 0.5% of $CO_2$ emissions. Only 2.7% of waste collected in Greenwich currently goes to landfill but this generates the largest single proportion of total waste emissions because of the high emissions factor associated with the conversion of biogenic waste to methane in landfill sites. A reduction of total waste (excluding composting) by 50% is assumed by 2050 as a 'low ambition' Baseline scenario for waste reduction. Emissions associated with recycling increase because the proportion of municipal waste which is recycled increases from 33% up to 65% by 2050 in line with the Committee on Climate Change's 'core ambition' in this area.

# 5 Development of the Maximum ambition 2030 scenario

## 5.1 Summary results

The range of measures assumed in the Maximum ambition scenario achieve a 69% reduction in emissions relative to the 2030 baseline and a 77% reduction relative to 2015. If full electricity grid decarbonisation is assumed by 2030 then a further reduction in emissions is achieved, of 85% in total relative to 2030 and 89% relative to 2015. While electricity grid carbon intensity is not under RBG control, it can be influenced by the supply of renewably generated electricity. Measure 1 under 'Energy generation, industry, waste & other' in Table 5-1 concerns this renewable energy generation. It is assumed that if RBG installs enough renewable energy provision to power the equivalent of its own electricity use then it would be justified in neglecting the physical power station emissions associated with its energy use because these renewable installations would act as offsets. This neglect of such emissions is equivalent to assuming within the modelling that the grid becomes fully decarbonised by 2030.

**Figure 5-1 Total annual emissions in the Baseline and Maximum ambition scenarios**

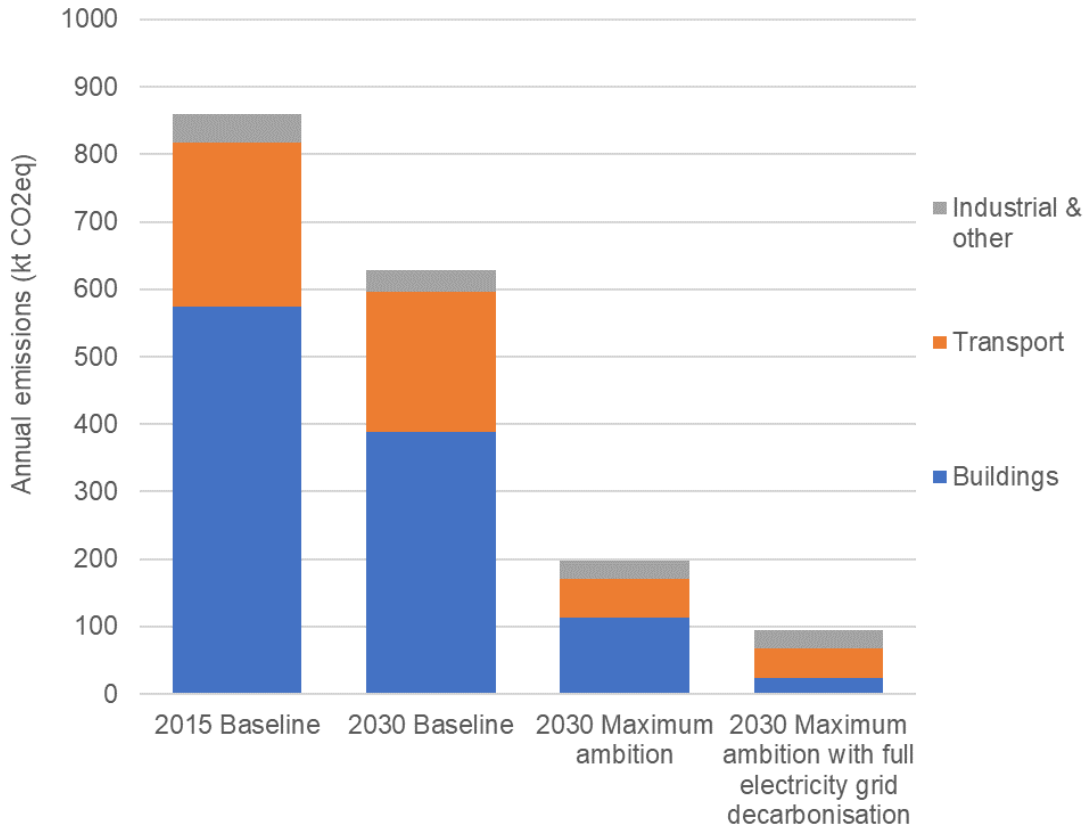



Figure 5-2 and Figure 5-3 show the emissions savings resulting from the measures modelled in both buildings and transport sectors. The limited list of mitigating measures for emissions from the 'industrial & other' category means a similar diagram has not been presented in this case.

For emissions from buildings, the order in which measures are applied is important for assigning savings; for example of grid decarbonisation happens first then there is no associated saving of installing a heat pump rather than direct electric heating, since the advantage of the former is that it produces the same heat output using less electricity. In this work, savings are calculated by applying measures in the order shown in Figure 5-2; first limited electricity and gas grid decarbonisation occurs to bring these in line with national targets, next energy efficiency measures are applied which reduce the overall heating demand, then the remaining heat is assigned amongst low carbon heating

technologies, and finally full electricity grid decarbonisation is applied. The 'other' category in Figure 5-2 includes solar thermal, solar PV, and changes to the amount of electric heating used. While the increased supply of district heating amounts to a small emissions saving compared to the installation of heat pumps, this should not be taken to imply that it is an unimportant measure. Unlike individual building level technologies, district heating uptake is limited in the modelling by the feasible speed of development given the large infrastructure projects required. The provision of district heating would continue to grow beyond 2030 as a large proportion of the buildings in areas considered viable for district heating are not modelled to be connected by this date. Similarly, the large savings attributed to heat pumps reflect the fact that very ambitious assumptions are made for their deployment. These assumptions would come at a high capital cost but are not fundamentally limited by the speed of completion of complex projects and so are the most realistic way to model a transition to close to zero building emissions by 2030. In a pathway to a later date for net zero, heat pumps would account for a smaller fraction of savings and district heating a larger one.

For transport, the modelled measures target both significant reductions in vehicle use (reductions in vehicle kilometres (vkm)) and accelerated uptake of ULEVs. In Figure 5-3, emissions reductions are assigned to vkm reduction ahead of uptake of ULEVs, representing a reduction in overall fleet size with a subsequently smaller required uptake of ULEVs to achieve decarbonisation. The Additional modal shift category in Figure 5-3 refers to reductions in vkm from powered two wheelers (P2Ws) and taxis.

**Figure 5-2 Reductions in emissions from buildings due to measures modelled**

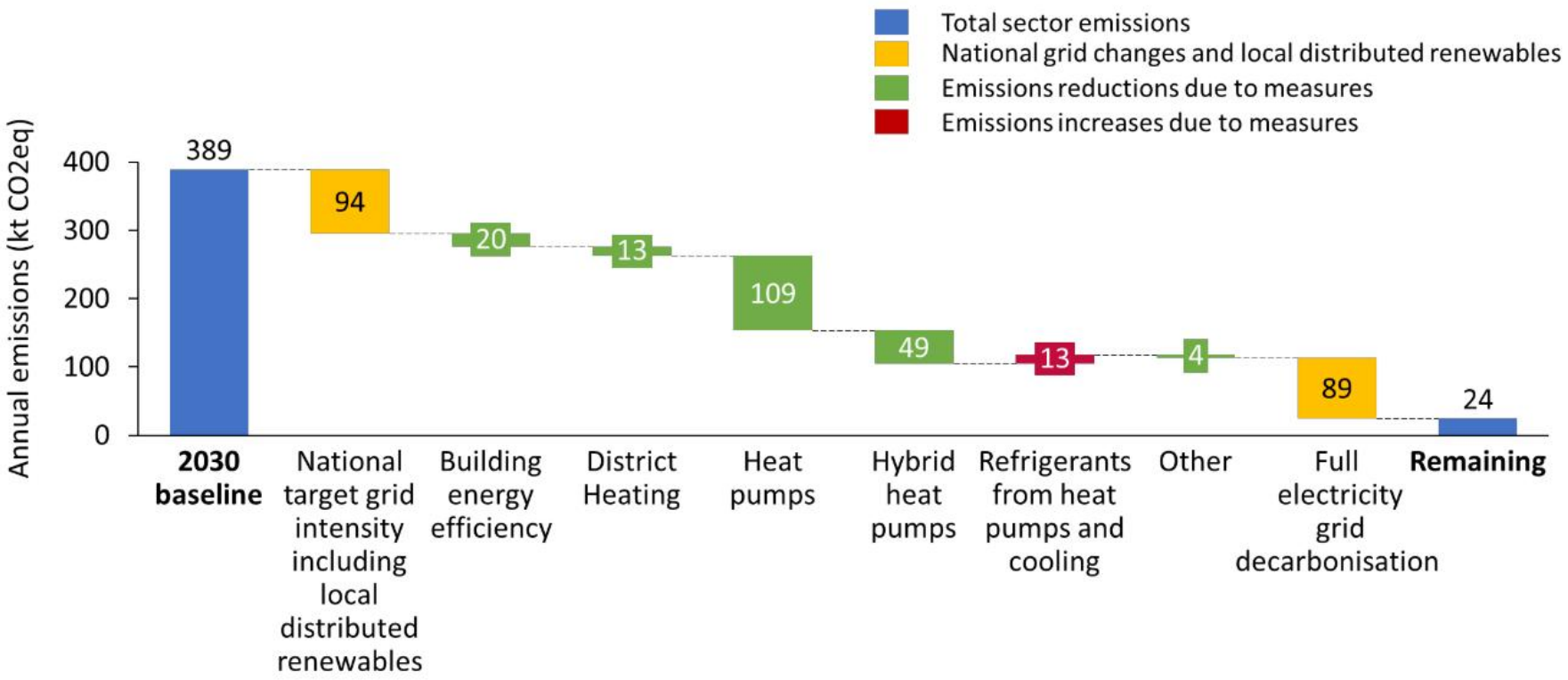
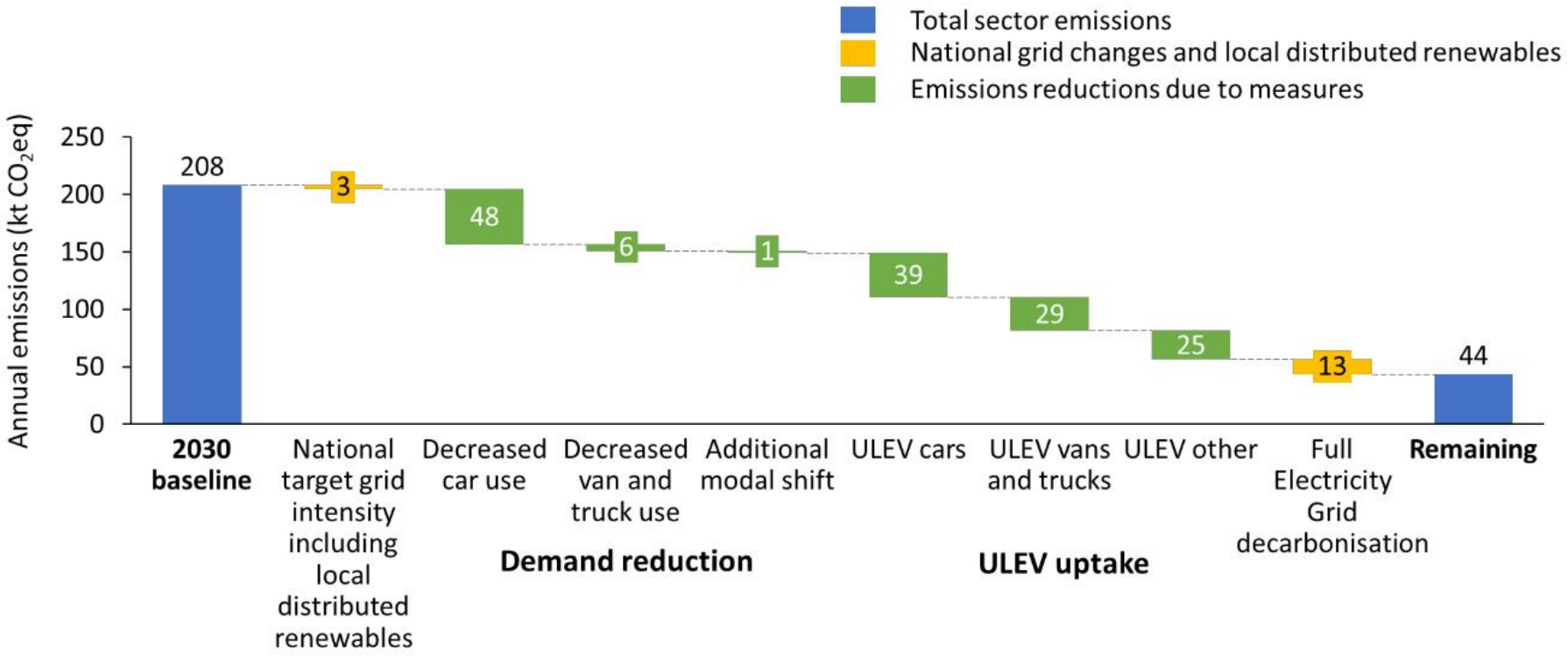


**Figure 5-3 Reductions in emissions from transport due to measures modelled**



### 5.1.1 *Measures modelled*

**Table 5-1 Measures modelled in the Maximum ambition scenario and associated emissions savings**

| No. | Measure | Ambition modelled in 2030 | Comment on range | $CO_2$ savings ($ktCO_2$) |
|---|---|---|---|---|
| ***Buildings*** | | | | |
| 1 | **Increase energy efficiency of new domestic buildings**[59]<br>a) Owner occupied<br>b) Local authority owned<br>c) Social housing association<br>d) Private rented | Further improvements to the energy efficiency of new domestic buildings to achieve, from 2021, nearly zero carbon when combined with renewable heating. | This involves bringing forward improvements in carbon emissions standards for new buildings planned to be implemented nationally by 2025 – that is, the Future Homes Standard, in which homes are expected to be nearly zero carbon – to the earliest date possible, here assumed to be 2021. | Energy efficiency measures collectively – 22[60] |
| 2 | **Increase energy efficiency of new non-domestic buildings**<br>a) Public<br>b) SME owned/rented<br>c) Large enterprise owned/rented | Further improvements to the energy efficiency of new non-domestic buildings to achieve, from 2021, nearly zero carbon when combined with renewable heating. | This is a substantial increase in ambition at the national level, as the Future Homes Standard for 2025 is not currently expected to cover non-domestic buildings. | |
| 3 | **Increase energy efficiency of existing domestic buildings**<br>a) Owner occupied<br>b) Local authority owned | Reduction of total heat demand in existing homes:<br>a) Owner occupied homes – by 16%<br>b) Local authority owned homes - by 30% | While this measure leaves a significant minority of homes less efficient than the EPC C rating, it still represents an ambitious target; increasing the efficiency of existing homes requires large capital expenditure on retrofits and is often limited by level of engagement by residents. Further in the private rented sector there is the | |

[59] Energy efficiency here and below refers both to thermal and electrical energy and would be achieved by a combination of fabric improvements, new appliances and low energy lighting.
[60] This is calculated by reducing the total heat demand while maintaining the baseline deployment of heating technologies. It also includes a slight additional reduction in emissions from direct electric heating facilitated by the reduced heat demand.

| No. | Measure | Ambition modelled in 2030 | Comment on range | $CO_2$ savings ($ktCO_2$) |
|---|---|---|---|---|
| | c) Social housing association<br>d) Private rented | c) Social housing association homes – by 29%<br>d) Private rented – by 23%[61]<br><br>This represents the retrofitting of 41% of existing domestic buildings to take the proportion of homes which are EPC C rated or higher in the borough to 58%.<br><br>All local authority owned and social housing association homes are retrofitted up to EPC rating C or higher by 2030. | problem of misalignment of incentives between tenants, who receive the benefits of energy efficiency, and landlords, who pay for installations. | |
| 4 | **Increase energy efficiency of existing non-domestic buildings**<br>a) Public<br>b) SME owned/rented<br>c) Large enterprise owned/rented | Reduction of total heat demand in existing non-domestic buildings:<br>a) Public – by 38%<br>b) SME – by 27%<br>c) Large enterprise – by 25%<br><br>This represents the retrofitting of 34% of existing non-domestic buildings to take the proportion which are EPC C rated or higher to 69%.<br>The larger change in public buildings represents a more ambitious assumed set of measures in this case. | While this measure leaves a significant minority of non-domestic buildings less efficient than the EPC C rating, it still represents an ambitious target; increasing the efficiency of existing buildings requires large capital expenditure on retrofits and is often limited by the speed of action of individual businesses and property owners. | |

[61] Private rented homes start slightly more energy efficient in 2015 than owner occupied (68% versus 77% below EPC C). However, retrofitting measures are assumed to reach a greater proportion of these buildings by 2030 because of the greater capacity to enforce landlord MEES. Although Social housing association and local authority owned homes start with the highest energy efficiency in 2015 (49% below EPC C), the most ambitious measures are assumed in this case to create a comparatively large decrease.

| No. | Measure | Ambition modelled in 2030 | Comment on range | $CO_2$ savings ($ktCO_2$) |
|---|---|---|---|---|
| 5 | **High deployment of heat networks**, powered by a combination waste heat sources and water, air and ground source heat pumps. | 8000 new[62] and 5000 existing homes are served by heat networks by 2030. A further 1400 non-domestic buildings (200 new and 1200 existing) are also connected by 2030. The higher proportion of existing buildings connected in the non-domestic case reflects the stricter connection policies assumed in this case. Heat networks provide 8% of total domestic heat and 11% of non-domestic.<br>No gas CHP operates by 2030. Air and ground source heat pumps supply 69% of the heat, with rivers (water source heat pumps, with sewer heat mining and building and commercial heat rejection providing most of the remainder. | This is an ambitious upper limit given the long timescales and complexity of heat network development projects. | 13 |
| 6 | **High deployment of heat pumps in new builds** | All new builds not served by a heat network are fitted with a heat pump. This is approx. 22000new domestic and 1500 new non-domestic buildings. | This is an ambitious target and is likely to represent an upper limit. | 16[63] |
| 7 | **High deployment of heat pumps in existing buildings** | All existing buildings which receive an EPC rating of C or higher are fitted with a heat pump if they are not served by a heat network by 2030.<br>71,000 homes and 3100 non-domestic buildings are fitted with a heat pump by 2030. Heat pumps supply 62% of the | This is an ambitious target and is likely to represent an upper limit. | 81[64] |

[62] Numbers of new domestic buildings are scaled to match RBG's projection of approx. 30,000 new builds by 2030.
[63] This includes savings as a result of fewer fossil fuel heating systems and a small amount of extra emissions due to refrigerants.
[64] See footnote for policy 6.

| No. | Measure | Ambition modelled in 2030 | Comment on range | $CO_2$ savings ($ktCO_2$) |
|---|---|---|---|---|
| | | domestic and 38% of the non-domestic heat demand in 2030. | | |
| 8 | **Some deployment of solar thermal** | Solar thermal installations provide 0.1% of heat demand in Greenwich in 2030. This represents 260 domestic and 30 non-domestic installations | It is assumed that solar thermal does not currently represent a cost-effective means of achieving large scale zero carbon heating and as such the deployment modelled is limited | 0.01 |
| 9 | **Accelerated Solar PV deployment on buildings** | 17 GWh/year of electricity is supplied by domestic PV in 2030 and 4 GWh/year by non-domestic. These values are 13 and 12 times larger than the current PV supply values, respectively. | It is assumed that widespread PV installations on buildings is not a cost-effective means to decarbonise electricity use and so only a relatively small fraction of electricity is provided in this way. | Savings due to distributed renewable generation are assigned to the background decarbonisation of the national grid, which assumes the uptake of such technologies. |
| 10 | **High level of hybrid heat pump deployment** in buildings not achieving EPC C+ rating. | Those buildings which are not sufficiently energy efficient to receive a heat pump in 2030 are heated either through electric heating or using a hybrid heat pump, with the latter taking the majority share.<br><br>Hybrid heat pumps provide 27% of domestic heat and 46% of non-domestic heat in 2030. This requires the installation of 19,000 hybrid heat pumps in owner occupied and privately rented | This is an ambitious target and is likely to represent an upper limit. | 49 |

| No. | Measure | Ambition modelled in 2030 | Comment on range | $CO_2$ savings ($ktCO_2$) |
|---|---|---|---|---|
| | | homes (none in social housing), and 1700 in non-domestic buildings. | | |
| 11 | **No active gas boilers in 2030**, except where operating in combination with a hybrid heat pump. | There are assumed to be no gas boilers providing heat in any building type in 2030 except as part of a hybrid heat pump system, in which gas boilers are assumed to contribute 15% of heat. | This is an ambitious target and is clearly the upper limit.<br><br>It is likely that at least some gas boilers might remain in a few harder to treat homes, especially in the private rented and owner-occupied sectors.; | Savings attributed to replacement technologies |
| 12 | **No heat networks served by natural gas (including CHP) in 2030**. No new gas CHP heat networks from 2021. | The proportion of heat network power generated by gas CHP drops from 2021 down to zero by 2030. | The lifetime of gas turbine CHP plants (around 25 years) means that this involves significant losses associated with early writing off of installations. As such it as an ambitious measure. | Savings attributed to replacement technologies |
| **Buildings: Baseline emissions in 2030 ($ktCO_2$)** | | | | **389** |
| | | **Savings due to implementing national target electricity and gas grid carbon intensities ($ktCO_2$)** | | **93** |
| | | **Savings due to the 12 measures listed above ($ktCO_2$)** | | **182** |
| **Buildings: Remaining emissions in 2030 in Maximum ambition scenario with national target grid carbon intensities ($ktCO_2$)** | | | | **114** |
| | | **Savings due to full decarbonisation of the electricity grid ($ktCO_2$)** | | **90** |
| **Buildings: Remaining emissions in 2030 in Maximum ambition scenario with full grid decarbonisation ($ktCO_2$)** | | | | **24**[65] |
| | | | | |
| ***Transport*** | | | | |
| 1 | **Reduction in resident car ownership and use** | 45% decrease in vkm from 2015 level | This is a highly ambitious target and is likely the upper limit that can be achieved through all available measures. | 48 |
| 2 | **Reduction in car vkm from non-residents** | | | |

[65] Remaining emissions are due to refrigerants, mostly arising from heat pumps, (14kt) and gas boilers operating in hybrid heat pump systems (10kt)

| No. | Measure | Ambition modelled in 2030 | Comment on range | $CO_2$ savings ($ktCO_2$) |
|---|---|---|---|---|
| 3 | **Decreased use of vans and trucks** | 10% decrease in vkm from LGVs and HGVs compared to Baseline 2030 (3% increase in LGV vkm and 9% decrease in HGV vkm compared to 2015)[66] | This likely represents an upper limit for modal shift of LGVs to cycle freight and requires action to counteract projected increases in vehicle traffic. | 6 |
| 4 | **Increase uptake of zero emissions vehicles** | Zero emission share:<br>Cars: 51% (100% BEV)<br>LGVs: 70% (90% BEV)<br>Rigid HGVs: 62% (100% BEV/REEV)<br>Artic HGVs: 18% (90% BEV/REEV)<br>P2W: 68% (100% BEV)<br>Taxis: 70% (93% BEV/REEV)<br>Buses: 100% (82% BEV) | This represents an acceleration of wider London ambition by 10 years. Although this leaves a number of ICE and hybrid vehicles in the fleet, this is an ambitious target and represents the likely upper limit of uptake, particularly for cars.[67] | 93 |
| 5 | **Increase modal shift to public transport** | 31% decrease in P2W vkm compared to 2015 and 13% decrease in taxi vkm compared to 2015).<br>Note that modal shift to cars included in Measure 1. | For P2Ws this represents an acceleration of wider London ambition by 20 years. For taxis, this represents the expected upper limit of potential modal shift.[68] | 1.4 |
| 6 | **Encourage modal shift to walking and cycling** | | | |
| 7 | **Reduce emissions impact of rail and aviation** | None modelled | These emissions are outside of RBG control | — |
| **Transport: Baseline emissions in 2030 ($ktCO_2$)** | | | | **208** |
| **Savings due to implementing national target electricity and gas grid carbon intensities ($ktCO_2$)** | | | | **3** |
| **Savings due to the 7 measures listed above ($ktCO_2$)** | | | | **148** |
| **Transport: Remaining emissions in 2030 in Maximum ambition scenario with national target grid carbon intensities ($ktCO_2$)** | | | | **57** |
| **Savings due to full decarbonisation of the electricity grid ($ktCO_2$)** | | | | **13** |
| **Transport: Remaining emissions in 2030 in Maximum ambition scenario with full grid decarbonisation ($ktCO_2$)** | | | | **44** |
| | | | | |

[66] A 10% decrease is estimated based on expected upper limits for modal shift of light goods vehicles (LGVs) to cycle freight and additional savings from consolidation and discouraging use of local roads.
[67] Based on projected sales of EVs in Europe relative to the share of the market that Greenwich represents.
[68] Based on TfL analysis of trips by transport mode.

| No. | Measure | Ambition modelled in 2030 | Comment on range | $CO_2$ savings ($ktCO_2$) |
|---|---|---|---|---|
| ***Energy generation, industry, waste & other*** | | | | |
| 1 | **New renewably generated electricity fed into national grid** | The carbon intensity of the electricity grid is modelled to fall to zero in the Carbon Neutral scenario with 'fully decarbonised electricity grid'. This assumes that Greenwich builds enough renewable capacity to power its own electricity use **and** that the rest of the UK does the same. | | Included for individual sectors above. For the 'industrial, waste & other' sector alone - 1 |
| 2 | **Reduction in total waste production** | | | 2 |
| 3 | **Increase proportion of waste to recycling and decrease proportion to landfill** | 70% recycling rate and total waste mass reduction by 45% by 2030. 35% reduction in food waste collected in the 'mixed food & garden stream. | | |
| 4 | **Reduce emissions from industry** | None modelled, except that associated with electricity grid decarbonisation | | — |
| 5 | **Reduce emissions from river and non-road mobile machinery** | 25% reduction in emissions from river transport relative to the 2030 baseline. No reductions modelled for NRMM beyond that already included in the baseline | River transport emissions reductions are modelled as a 50% reduction in emissions at berth; however, this estimate is highly uncertain. Emissions due to non-road mobile machinery are dominated by the construction industry and are modelled to fall by 37% between 2015 and 2030 as a result of improved engine standards[69]. | 2 |
| **Industry, waste & other: Baseline emissions in 2030 ($ktCO_2$)** | | | | **31** |
| | | **Savings due to implementing national target electricity and gas grid carbon intensities ($ktCO_2$)** | | **1** |
| | | **Savings due to measures 2-5 listed above ($ktCO_2$)** | | **4** |

[69] Since 1st September 2015 NRMM used on any **major** development site in Greater London has been required meet stage IIIA of the EU Directive 97/68/EC5 and NRMM used on any development must meet stage IIIB. See '*The control of dust and emissions during construction and demolition,* supplementary planning guidance, July 2014'.

| No. | Measure | Ambition modelled in 2030 | Comment on range | $CO_2$ savings ($ktCO_2$) |
|---|---|---|---|---|
| **Industry, waste & other: Remaining emissions in 2030 in Maximum ambition scenario with national target grid carbon intensities ($ktCO_2$)** | | | | **27** |
| **Savings due to full decarbonisation of the electricity grid ($ktCO_2$)** | | | | **1** |
| **Industry, waste & other: Remaining emissions in 2030 in Maximum ambition scenario with full grid decarbonisation ($ktCO_2$)** | | | | **26** |
| | | | | |
| ***Total*** | | | | |
| **Total: Baseline emissions in 2030 ($ktCO_2$)** | | | | **628** |
| **Savings due to implementing national target electricity and gas grid carbon intensities ($ktCO_2$)** | | | | **97** |
| **Savings due to all measures listed above ($ktCO_2$)** | | | | **335** |
| **Total: Remaining emissions in 2030 in Maximum ambition scenario ($ktCO_2$)** | | | | **198** |
| **Savings due to full decarbonisation of the electricity grid ($ktCO_2$)** | | | | **104** |
| **Total: Remaining emissions in 2030 in Maximum ambition scenario with full grid decarbonisation ($ktCO_2$)** | | | | **95** |

### 5.1.2 *Buildings*

In the Maximum ambition scenario, there are no active gas boilers in 2030 except those operating alongside a heat pump in a hybrid system (in this case the gas boiler is assumed to contribute 15% of the heat demand). This means the dominant source of $CO_2$ emissions in the Baseline scenario is removed. The replacement of gas boilers with renewable heating systems contributes emissions savings of 160 kt $CO_2$ per year in 2030. The reduction in emissions from lighting and appliances occurs because of the reduced electricity grid carbon intensity assumed in the maximum ambition. If full decarbonisation of the electricity grid is assumed, the remaining emissions from buildings are made up of refrigerants (mostly from heat pumps and a small amount from cooling systems) and gas burning in hybrid heat pump systems. Heat pumps and hybrid heat pumps dominate the supply of heat in 2030; together they supply 88% of heat in domestic properties and 76% in non-domestic. There is an accelerated deployment of heat networks, but this is constrained both by the density of heat demand and by the short timescale available to build the associated heat network infrastructure. It is assumed that only LSOAs with a heat demand density above a certain value will be suitable for connection to a heat network and that the suitable projects develop quickly (see buildings policies 12 and 14 in Table 5-2).

**Figure 5-4 Emissions from heating and electricity use in buildings in Baseline and Maximum ambition scenarios**

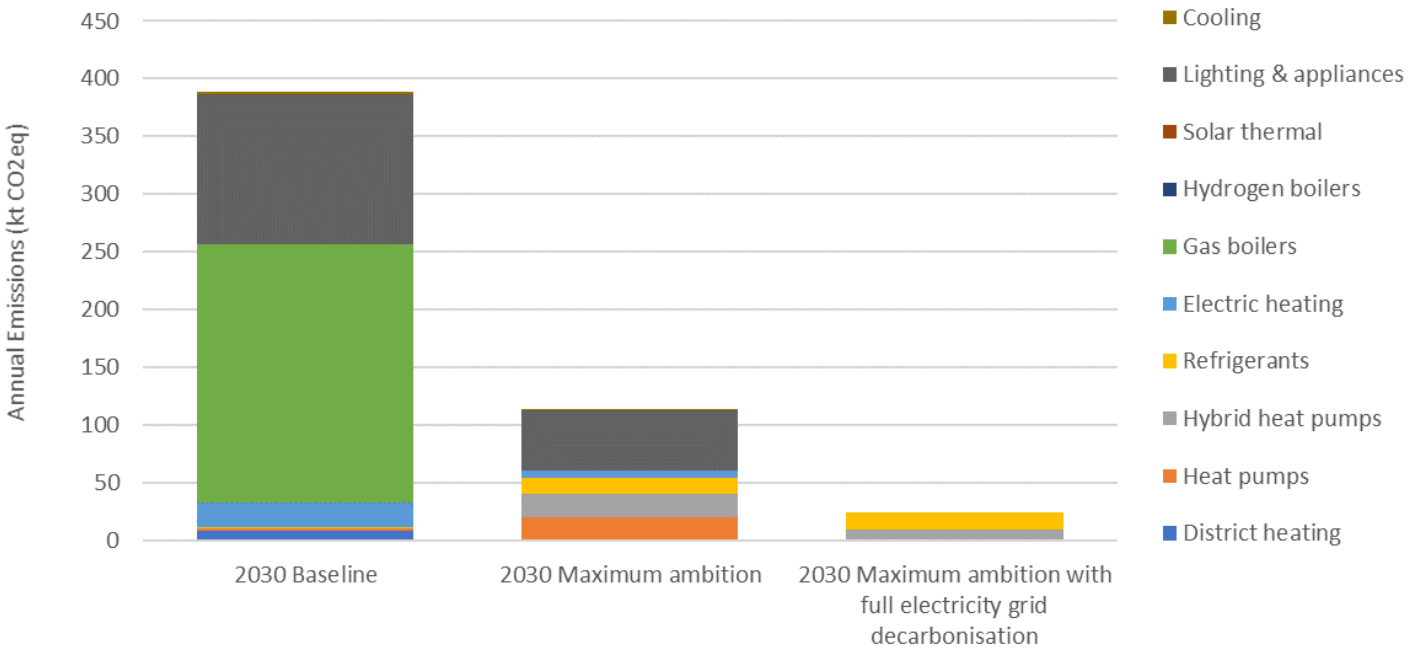
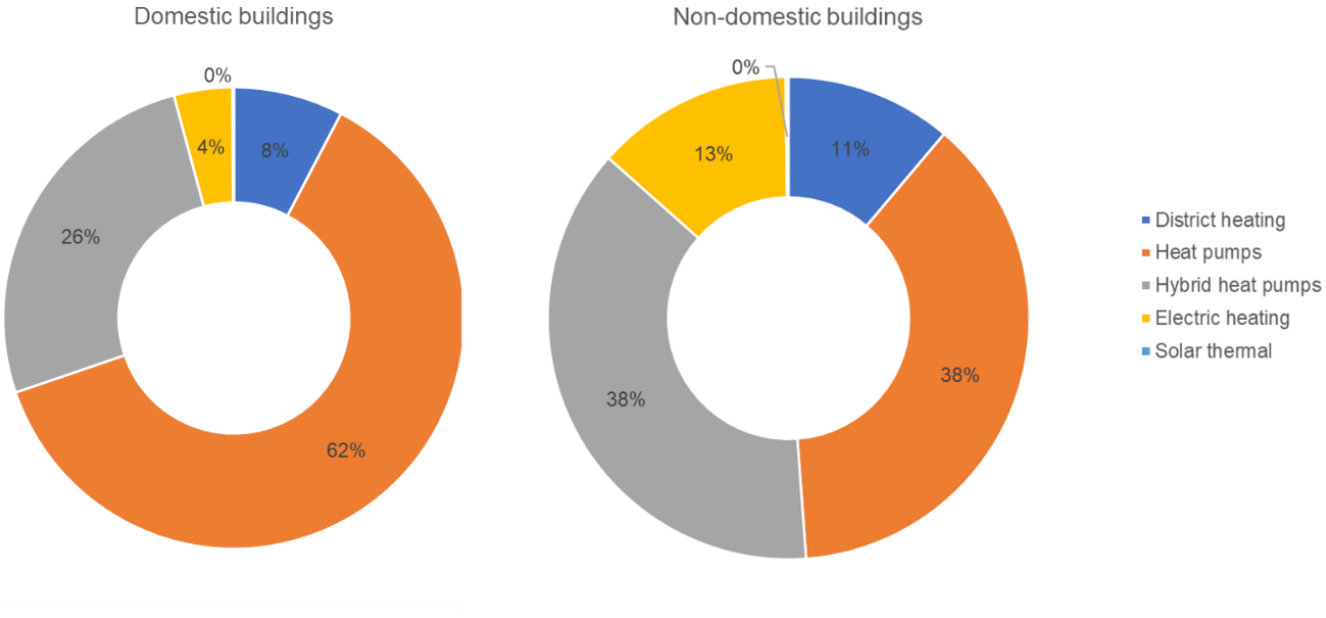


**Figure 5-5 Proportion of heat demand supplied by technology in the 2030 Maximum ambition scenario**



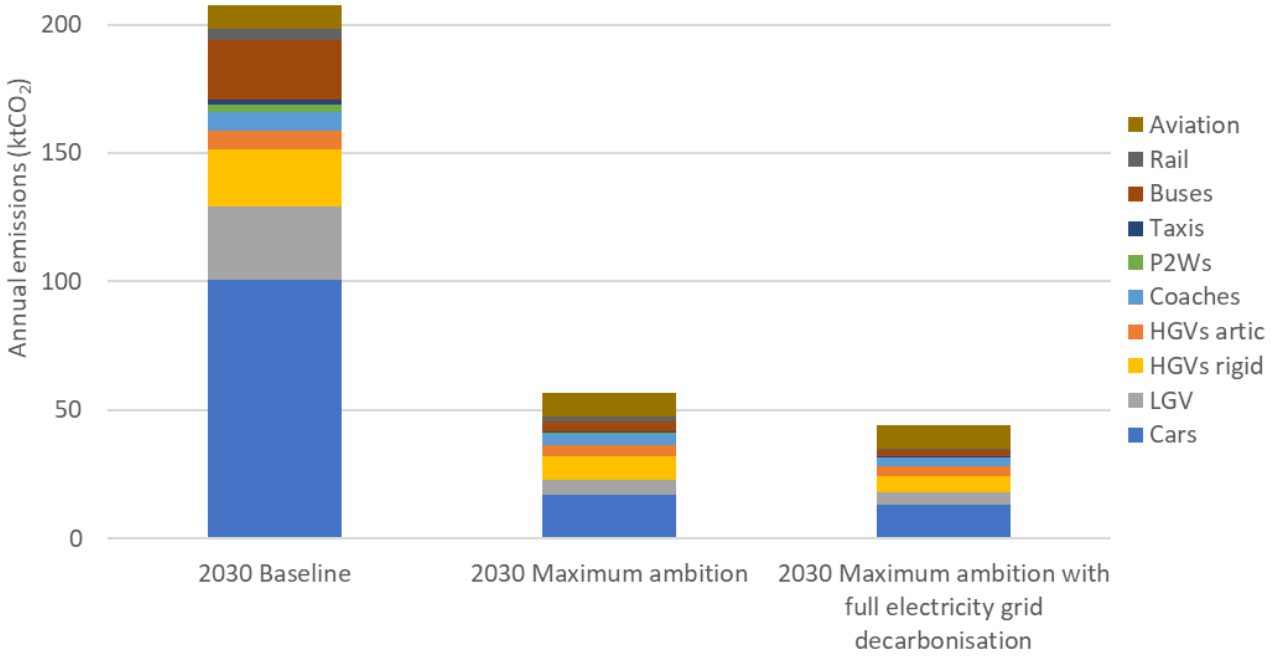

### 5.1.3 *Transport*

The largest reductions in emissions in the Maximum ambition scenario are due to reductions in car use and uptake of ULEVs across the fleet, in line with the dominance of ICE engines in the Baseline 2030 fleet and private car use as the largest source of emissions (Figure 5-6**).** The remaining emissions in 2030 are due to remaining ICE and hybrid ICE engines as well as indirect emissions through grid electricity for BEVs.

The modelled uptake of ULEVs in road transport represents a highly ambitious degree of fleet replacement, taking into account limitations in the availability and affordability of vehicles over the next ten years. The majority of ULEV uptake is either PHEVs, REEVs[70] or BEVs with very limited uptake of FCEVs; only low proportions of FCEVs are assumed in the LGV, HGV, taxi and bus fleets. Buses are the only vehicle type to be fully decarbonised, representing an acceleration of the targets set out in the MTS by 10 years. Just over a third of all vkm are travelled by ZE powertrains (Figure 5-7) with just over half of cars and over two thirds of LGVs fully decarbonised.

[70] Modelled as operating in electric mode for travel within RBG

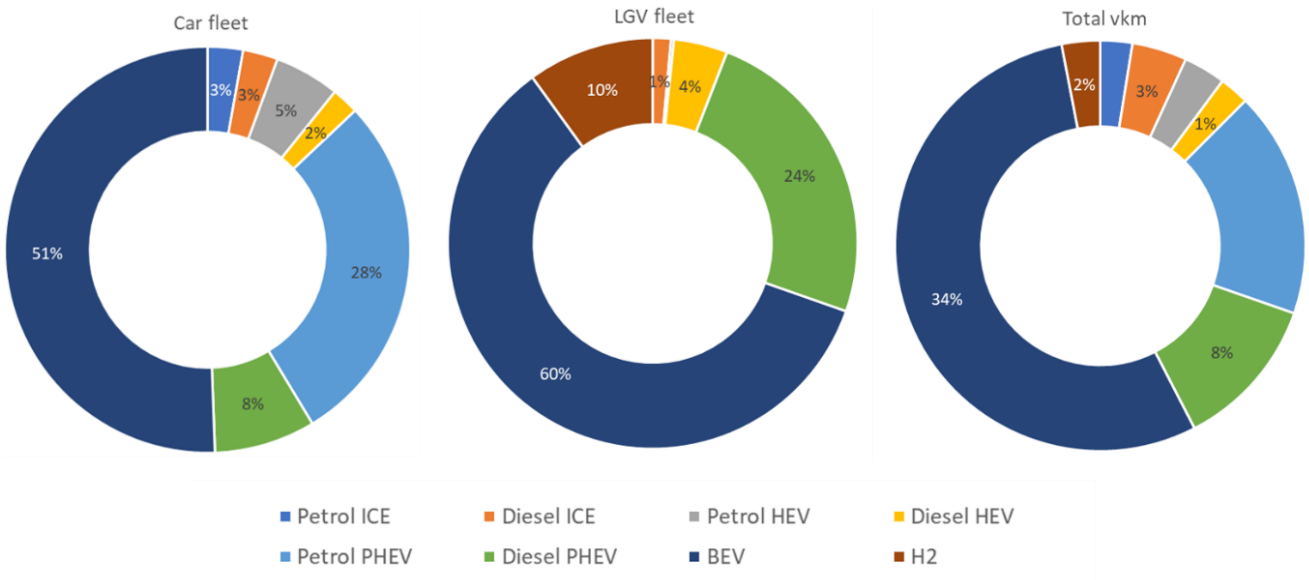
**Figure 5-6 Emissions from transport in the Baseline and Maximum ambition scenarios**




Due to constraints in the uptake of ULEVs, large reductions in vkm are required to achieve significant emissions reductions. As detailed in Table 5-1, reductions in car use represent the likely upper limit of modal shift through available means, including car sharing, and improved cycling, walking and public transport infrastructure. Reduction in van and truck use represents the likely upper limit of demand reduction through high deployment of freight mitigation strategies such as consolidation and modal shift to cycles, foot, and rail and river.

Rail and Aviation emissions are primarily outside of RBG's control and therefore no measures to directly reduce emissions in these sectors are modelled. Reductions in rail emissions in the 2030 Maximum ambition scenario are due to decarbonisation of the electricity grid.

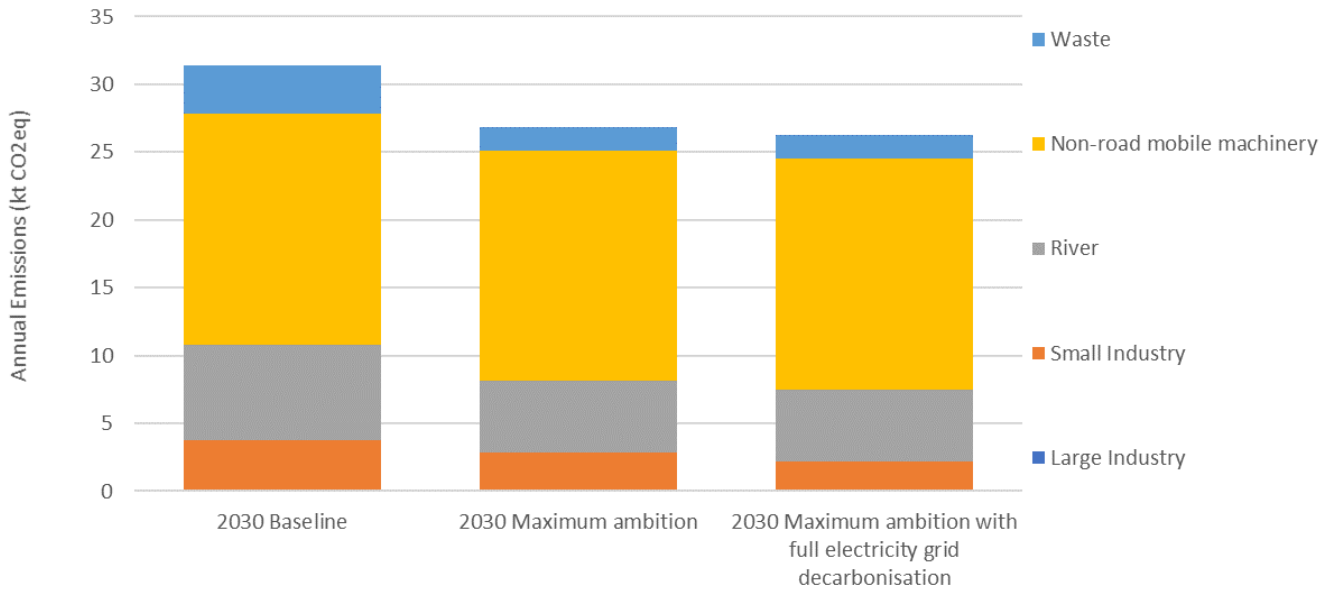
**Figure 5-7 Proportion of selected vehicle fleets and total road transport vehicle kilometres (vkm) by powertrain in 2030 under the Maximum ambition scenario**



### 5.1.4 *Industry, waste & other*

A significantly smaller reduction in emissions is achieved by the modelled measures across the remaining sectors of industry, waste, river and non-road mobile machinery. These sectors are a small fraction of Greenwich's emissions, accounting for 5% of the 2030 Baseline. The smaller scale of emissions savings reflects a lower degree of council control in these sectors. However, the waste sector does fall under significant council control and as such ambitious measures result in a 52% reduction in emissions relative to the 2030 Baseline. Full decarbonisation of the electricity grid makes little difference to the remaining emissions in the Maximum ambition scenario because the dominant power sources in these sectors are diesel and natural gas.

**Figure 5-8 Emissions from industry & other in the Baseline and Maximum ambition scenarios**



## 5.2 Policy appraisal matrix

### 5.2.1 *Buildings*

**Table 5-2 Buildings policies**

| No | Policy | Cost | Resources | Barriers | Risks | Key stakeholders | Co-benefits |
|---|---|---|---|---|---|---|---|
| ***Energy efficiency and general policies*** | | | | | | | |
| 1 | Set up a 'One-stop shop' for energy efficiency and low carbon heating to act as a single point of contact for residents and businesses, offering tailored information and advice on appropriate measures and the available funding, and linking customers with trusted suppliers, to greatly simplify the process of installing these measures. This policy builds on RBG's involvement in a GLA 'able to pay' retrofits programme expected to launch in January 2020. More detail on the activities of the proposed One-stop shop are given in the main text.<br><br>**Immediate start**<br>**Relevant measure(s): 3,4,6,7,8,9,10**<br>**Current RBG policy strength[71]: 1** | Approx. £3 million[72] | 3-5 FTE including an experienced programme manager, supported by a project manager.[73] | Active collaboration with other providers of similar services is necessary to prevent doubling up of effort and confusing customers. | Engagement fails to meet high levels required.<br><br>An incomplete service rolled out as a 'one-stop shop' might alienate the most interested residents/businesses. | Residents, SMEs, local suppliers of heating technologies and building companies | Health – warmer homes, reduced mould and damp and improved indoor air quality due to better ventilation all potentially contribute to improved health, especially for children, the elderly and those with pre-existing health problems[74].<br><br>Economic – possible benefits to local suppliers of retrofits and low carbon heating technology installers. Also, reduced long-term fuel bills would increase disposable income of residents. |

[71] Measured on a scale of 1-3, 1=weak, 2=moderate, 3=strong.

[72] This funding covers the running costs of the 'One-stop shop' but not the financial support given to residents and businesses. The RE:NEW project has been involved in improving the energy efficiency of 130,000 homes in London over 10 years and so is of a similar scale to the required level of engagement achieved by the One-stop shop. RE:NEW has a total budget of £2.8 million, of which three-quarters had been spent as of the 2013 phase 3 review. See 'RE:NEW Phase 3 Programme Evaluation, A final report by Regeneris Consulting', December 2016, available at (accessed 05/11/2019) https://www.london.gov.uk/sites/default/files/renew_evaluation_-_final_report.pdf.

[73] The majority of the budget is likely to be staff costs (other costs are mainly information resources eg. website, leaflets). Over 10 years £2-2.5m of the £3million might cover 3-5 FTE.

[74] See, for example: Breysse, J., Jacobs, D. E., Weber, W., Dixon, S., Kawecki, C., Aceti, S., & Lopez, J. (2011). Health Outcomes and Green Renovation of Affordable Housing. Public Health Reports, 126(1_suppl), 64–75. https://doi.org/10.1177/00333549111260S110

| No | Policy | Cost | Resources | Barriers | Risks | Key stakeholders | Co-benefits |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| 2 | Liaise with the GLA's Energy for Londoners team and in particular the Energy for Londoners Supply Company (EfLSCo) during its setup and operation. The EfLSCo and surrounding GLA staff could potentially take on the role of the 'One-stop Shop' described above, with support from the boroughs. If so, RBG should coordinate and support this initiative rather than set up a competing scheme which risks fragmenting and confusing customers. The supply company might actively reach out to its customers to present tailored offers across their energy use and help overcome information barriers. In addition, the supply company might offer price incentives to encourage emissions reductions from customers. This policy builds on RBG's involvement in a GLA 'able to pay' retrofits programme expected to launch in January 2020.<br>**Begin liaising immediately**<br>**Relevant measure(s): 3,4,6,7,8,9,10**<br>**Current RBG policy strength: 1** | Less than £3 million, depending on the level of support RBG provides to GLA | Negligible, or up to 1FTE depending on the level of RBG involvement | As a new company, EfLSco is unlikely to be willing to take on work perceived as risky in the near future. | Such limited action might fail to result in a service extensive enough to spur the scale of procurement required.<br><br>The London wide service of EfLSco may not meet the needs of Greenwich residents/businesses given the more rapid changes required in Greenwich if other boroughs do not match the 2030 target. | EfLSco, residents and local businesses | See policy 1.<br><br>The economic benefits to local suppliers are likely to be more limited in a scheme administered at a London-wide level |
| 3 | Run a major publicity campaign covering all aspects of the net zero plan, with particular focus on getting stakeholders onside where costs will fall on them and/or changes are mandated. See section 0<br>**Immediate start** | See Section 5.2.4 | See Section 5.2.4 | None | The campaign might fail to reach a high proportion of residents. In particular, the campaign may miss vulnerable | All residents, SMEs | Co-benefits assigned to the measures facilitated through this campaign |

| No | Policy | Cost | Resources | Barriers | Risks | Key stakeholders | Co-benefits |
|---|---|---|---|---|---|---|---|
| | **Relevant measure(s): All**<br>**Current RBG policy strength: 2** | | | | residents such as the fuel poor and elderly.<br><br>The national policy landscape relating to energy efficiency and low carbon heating in buildings is likely to evolve fairly quickly in the 2020s, meaning that any publicity campaign may become outdated quite quickly. This could be managed by undertaking frequent reviews and updates to the campaign when needed. | | |
| 4 | Explore opportunities to raise new build non-domestic carbon emissions standards above the NPPF. New builds in Greenwich must be almost 'zero carbon' from 2021 with no new fossil fuel heating systems, given that lifetimes would have to be cut short since these cannot be operating in 2030.<br>**From 2021**<br>**Relevant measure(s): 2,5,6,8,9,11**<br>**Current RBG policy strength: 2** | Negligible | Approx. 1 FTE to cover the significant new areas of Core Strategy update and prepare/project manage the supporting evidence | It is possible that future national legislation will prevent such action from local authorities, as has been suggested in the domestic case (see Section 3.1.7). | The scope of such increased obligations is likely to be limited.<br><br>Increased obligations on developers might reduce the number of new build projects and raise prices. | Developers | |

| No | Policy | Cost | Resources | Barriers | Risks | Key stakeholders | Co-benefits |
|---|---|---|---|---|---|---|---|
| | | | base collection. This 1 FTE covers polies 4, 13 and 14. | | | | |
| 5 | Initiate exemplar new build projects of LA owned or partially LA owned housing at a very high standard of energy efficiency (eg. Passivhaus), acting alone or in a public-private partnership. See 'New build planning' best practice example in Table 3-1. **Complete by 2023** **Relevant measure(s): 1(b)** **Current RBG policy strength: 1** | Approx. £15-50 million investment[75] depending on scale (RBG could retain ownership of all homes or choose to sell some). See 'New build planning' best practice examples in Table 3-1. | 1 FTE programme manager. Architects and developers would be contracted to carry out the project | An appropriate site for development must be found. | RBG would be taking on some risk to capital. | Local developers | Health – see policy 1 Equity – Council control over allocation of the houses allows targeting at low income households, and in particular at residents living in fuel poverty and/or vulnerable residents. |
| 6 | Initiate 10 whole house net zero energy retrofits on existing social housing as a pilot project, following the 'Energiesprong' approach[76]. Homes with high levels of disrepair and/or occupied by fuel poor | Approx. £500,000 to £1 million[77] for the pilot project, however | Approx. 1-2 FTE over 2 years[78] | Low | The capital expenditure for RBG is liable to rise by up to a factor of two without part | Social housing providers and residents, local suppliers of retrofits | Health – see policy 1 Equity – Council control over selection of houses receiving improvements allows the policy to be targeted at fuel poor |

[75] This is total build cost rather than additional costs relative to a normal build project. For comparison, Norwich council spent £15 million on 93 homes in the Goldsmith Street project. The range here reflects that a larger project is desired.
[76] See, for example the GLA Energy Leap project. More information is available at (accessed 06/11/2019) https://www.energiesprong.uk/
[77] The Energy Leap project, (see MD2080 Energy Leap Project report, February 2017, https://www.london.gov.uk/decisions/md2080-energy-leap-project) retrofitted 10 homes at a total capital cost of £800,000, with around half of this payed by the GLA and half by boroughs and housing providers. A further $170,000 of grant funding was secured from the Carbon Neutral Cities Alliance to cover staffing, marketing and other expenditures.
[78] The GLA Energy Leap project covered staffing expenses (and other project running costs) to retrofit 10 homes with circa £140,000

| No | Policy | Cost | Resources | Barriers | Risks | Key stakeholders | Co-benefits |
|---|---|---|---|---|---|---|---|
| | residents could be selected in order to target the works at those most in need.<br>Use the project to demonstrate feasibility and better understand what incentives are needed to provide a business case for such retrofits to be attractive to other tenure types including owner-occupiers and private rented. On successful completion, consider offering incentives of the type identified to other tenure types and scale up to deliver a much larger whole house retrofitting project in local authority owned housing.<br>**Immediate start, complete by 2021**<br>**Relevant measure(s): 3(b), 3(c)**<br>**Current RBG policy strength: 1** | there is the possibility to recoup capital costs by turning tenants' energy bills into 'energy service plans'. This means that fuel cost savings are paid back to RBG to recover the initial investment. | | | financing by housing providers and grant funding. Following completion, the pilot does not lead to more widespread uptake of deep retrofits. | | residents and/or those living in homes with high levels of disrepair. |
| 7 | Retrofit all existing local authority owned homes and public[79] buildings to EPC C+ energy efficiency standard.<br>**By 2030**<br>**Relevant measure(s): 3(b)**<br>**Current RBG policy strength: 2** | Approx. £80 million. For LA owned homes and £5 million for public buildings. However as above there is the potential to recoup this investment by recovering a | Approx. 1-3 FTE staff to procure and manage the appointed contractor(s) during the project | Disruption to residents as a result of building work might create opposition | The large scale of the project brings risks of overspend and delays. | LA owned housing residents, users of public buildings, local suppliers of retrofits | Health – see policy 1<br>Equity – lower income residents will be benefited most given their overrepresentation amongst those living in local authority owned homes. |

[79] 'Public' here refers to any buildings classified as 'Health', 'education' or 'government', whether owned by RBG or not.

| No | Policy | Cost | Resources | Barriers | Risks | Key stakeholders | Co-benefits |
|---|---|---|---|---|---|---|---|
| | | portion of fuel bill savings.[80] A Potential funding source is the Mayor's energy efficiency fund, procured via the RE:NEW programme. | | | | | |
| 8 | Lobby national government to increase the landlord Minimum Energy Efficiency Standard (MEES) obligation from EPC E to EPC C and to consider reformulating this legislation as a maximum carbon emissions standard. The associated payment cap would then need to be increased as required. In addition, lobbying should also request stricter enforcement of the MEES and the provision of adequate resourcing for doing so.<br><br>**Begin immediately**<br>**Relevant measure(s): 3(d)**<br>**Current RBG policy strength: 1** | Negligible | 1 FTE to cover all lobbying on buildings policies. This would be spread across various senior members of the council and also includes time spent gathering evidence bases and advising senior | Opposition from landlords is expected as this would represent a significant capital expenditure. | Lobbying is not reliably effective | National government, private landlords and tenants | Health – see policy 1 |

[80] Arup modelling for the report *CAP Technical Assistance for London Work Package 2 – Zero Carbon Building Policies* finds a cost of £1.5 billion to retrofit all London LA owned housing to EPC C+. 5% of this housing is in Greenwich. Public buildings costs are extracted from the modelling in a similar way.

| No | Policy | Cost | Resources | Barriers | Risks | Key stakeholders | Co-benefits |
|---|---|---|---|---|---|---|---|
| | | | members by other council staff. | | | | |
| 9 | Mandate strict carbon emissions standards for landlords on private rented homes in Greenwich, in line with the lobbied for changes in policy 8. Some financial assistance to landlords might well be required, potentially subject to means testing; for example, RBG might institute grants of up to 50% of the cost of necessary retrofits on private landlord owned properties up to an energy efficiency standard of EPC C or of the cost of any installed heat pump, hybrid heat pump or other low carbon heating system. Stricter and better resourced enforcement would also be necessary for such a policy; the enforcement of current landlord MEES is limited, partly due to a lack of resourcing at LA level[81], and with a higher standard and therefore more non-compliant properties, this problem will be compounded.<br><br>**From 2021**<br>**Relevant measure(s): 3(d)**<br>**Current RBG policy strength: 1** | Up to approx. £40-85 million[82], but highly dependent on the nature of the grant scheme and on uptake. | Approx. 1-2 FTE staff to administer the scheme | Opposition from various stakeholders would be expected. It might be politically unfeasible to pursue a policy which offers financial incentives to landlords in this way.<br><br>Opposition from tenants due to the disruption involved. | A full grant might be necessary in order to cause rapid uptake from landlords given the misalignment of incentives between landlords (who pay for retrofits) and tenants (who pay fuel bills). As a result, this measure risks insufficient uptake despite the large capital expenditure.<br><br>Such unilateral action is likely to be very difficult if other local boroughs do not pursue similar policies. There is a risk of significant falls in house | Private landlords and tenants | Health – see policy 1 |

[81] See the RSM report for the Committee on Fuel Poverty: '*Enforcing the enhancement of energy efficiency regulations in the English private rented sector*', June 2019

[82] The cost of retrofitting all private rented properties up to an energy efficiency of EPC C+ (extracted from modelling) is approx. £80 million, with up to a further £90 million on heat pump and low temperature heating system installations in 9000 properties.

| No | Policy | Cost | Resources | Barriers | Risks | Key stakeholders | Co-benefits |
|---|---|---|---|---|---|---|---|
| | | | | | prices associated with the decreased attractiveness of letting property in Greenwich versus the surrounding area. | | |
| 10 | Offer concessionary low interest loans by partnering through banks and/or building societies, to support domestic and non-domestic energy efficiency retrofits and heat pump installations. Special arrangements should be made for SMEs, within the limits set by EU state aid legislation[83]. Access to these loans would be arranged via the 'One-stop Shop'.<br>**From 2021**<br>**Relevant measure(s): 1(a),2,3(a),4,6**<br>**Current RBG policy strength: 1** | Cost of offering the concessionary loans expected to be approximately 10% of the cost of the measures installed, and as such could be up to £80 million depending on uptake[84] | Approx. 1-3 FTE | Loans are most viable for well-off residents, especially those who own their own home without a mortgage. However, less than 25% of homes in Greenwich are in this category. | Payback period for energy efficiency retrofits can be lengthy[85], and low interest loans alone may not be sufficient to drive consumer uptake. | Banks and building societies, homeowners (both complete and mortgaged) | Health – see policy 1<br>Economic – Lowered long-term operating costs for SMEs would be beneficial to local businesses. |
| 11 | Directly fund 50% grants for energy efficiency retrofits for owner occupied homes.<br>**From 2021**<br>**Relevant measure(s): 3(a)**<br>**Current RBG policy strength: 1** | Up to approx. £50 million[86], assuming full upgrade of | 1-3 FTE | This would represent a significant transfer of wealth to residents who | Grants are likely to be taken up by many who would otherwise have acted based on | Owner occupier residents | Health – see policy 1 |

[83] See UK government guidance on state aid: https://www.gov.uk/guidance/state-aid
[84] The total capital cost of retrofits for energy efficiency and heat pumps across all tenure types is approx. £800 million
[85] Upgrading from EPC E to EPC C can reduce annual costs by £650, see *Call for Evidence: Building a Market for Energy Efficiency, BEIS,* 12th October 2017.
[86] This is 50% of the total cost extracted from modelling.

| No | Policy | Cost | Resources | Barriers | Risks | Key stakeholders | Co-benefits |
|---|---|---|---|---|---|---|---|
| | | stock to EPC C+. | | own their own homes, which might be opposed on equity grounds given that these will on average be higher income residents. | only a low interest loan. | | |
| ***Heat networks*** | | | | | | | |
| 12 | Initiate heat network schemes in cost effective and heat density appropriate locations as identified in the *Energy Masterplan*[87], acting alone or in a public-private partnership. Such heat network schemes must be low carbon, and as such can source heat from:<br>• Waste heat (via a water source heat pump)<br>  ○ Power and Industrial<br>  ○ Transformers<br>  ○ Rivers<br>• Heat rejection from buildings (HVAC)<br>• Commercial heat rejection | £200 million investment[90] | Consultancy to undertake a feasibility study and Detailed Project Developmen t. Approx. 1-3 FTE staff to procure and manage the appointed contractor(s) during the project. | Long construction and payback timeframes. Heat networks powered by waste heat using heat pumps are a relatively novel technology with limited precedent in the UK[91]. There is significant uncertainty | Risk to capital investment if scheme fails. Predictions of demand are uncertain. Air quality can be worsened if the heat network uses a combustion-based CHP plant, this is particularly the case for reciprocating engine based plants, commonly used for smaller installations, | Residents, heat network experts, developers | Health – An improvement in air quality due to reduced emissions of nitrogen oxides and particulates is achieved where combustion-based power sources are avoided |

[87] Royal Borough of Greenwich Energy Masterplan, Prepared by Parsons Brinckerhoff for Royal Borough of Greenwich, November 2014
[90] This cost is calculated in our model. For context, the Wandsworth Riverside Quarter development installed an Aquifer Thermal Energy Storage (ATES) system to supply heating (backed up by gas boilers and a gas CHP) and cooling to 504 apartments with an investment cost of £2 million. Funding sources are available and are discussed in Section 6.3.2.
[91] See the *Element Energy* and *Carbon Alternatives* report for the Department of Energy & Climate Change: 'Heat Pumps in District Heating', 2016.

| No | Policy | Cost | Resources | Barriers | Risks | Key stakeholders | Co-benefits |
|---|---|---|---|---|---|---|---|
| | • Air and ground source heat pumps<br>• Biogas CHP[88]<br>• Gas CHP, with offsetting via biomethane injection into the national gas grid[89]<br><br>waste heat sources via a heat pump.<br>**Further develop heat network feasibility studies immediately, complete projects by mid-2020s**<br>**Relevant measure(s): 5**<br>**Current RBG policy strength: 2** | | | around national policy.<br>Pricing policy must be carefully designed to prevent consumers from losing out due to the natural monopoly of the heat network. | whether powered by gas, biogas or biodiesel[92]. | | |
| 13 | Update the Local Plan to state that no new gas CHP used to supply heat networks can be built in Greenwich from 2021. It should be noted that this is a significant deviation from the advice laid out in the *Energy Masterplan* (Section 11.4), which suggests that gas CHP be installed out to 2025-2030 in order to allow rapid development. If the Greenwich Power Station (which currently provides backup power generation for the London Underground) is developed as the main heat source for a future large scale, cross-borough network, as suggested in the *Energy* | Negligible | See policy 4. There will be a need to negotiate with developers over eg. connection policies | There is the potential for opposition from suppliers and developers.<br>While not instantaneous, the short time period over which this change must be brought in risks affecting existing development plans. | This could reduce the number of heat networks built if developers are not made sufficiently confident in low carbon alternatives to gas CHP. | Developers | Health – An improvement in air quality due to reduced emissions of nitrogen oxides and particulates is achieved if combustion-based power sources are avoided. |

[88] Biomass CHP is also possible but assumed not viable due to air quality considerations.
[89] Offsetting in this way is only valid if the biomethane is *additional*. Such offsetting is administered by the Green Gas Certification Scheme (GGCS).
[92] See *'Pilot study on the air quality impacts from Combined Heat and Power in London'*, Ricardo Energy Environment, report for the Greater London Authority, September 2018

| No | Policy | Cost | Resources | Barriers | Risks | Key stakeholders | Co-benefits |
|---|---|---|---|---|---|---|---|
| | *Masterplan,* it must use a renewable power source such as biogas[93].<br>**Update Plan immediately**<br>**Relevant measure(s): 11**<br>**Current RBG policy strength: 1** | | | | | | |
| 14 | Work towards a mandatory connection policy where a heat network is available, via the Local Plan through 'heat zoning'.<br>new builds - starting 2022<br>existing public buildings – starting 2022<br>all existing buildings – starting 2023<br>**Relevant measure(s): 5**<br>**Current RBG policy strength: 1** | Negligible | See policy 13 | Opposition from both developers and residents is possible. The latter might view the associated pricing plans and lack of choice as unfavourable. | If developers are wary of this requirement, it may result in fewer new developments being built. | Residents, developers | Air quality – see policy 12 |
| 15 | Promote industrial heat recovery by encouraging and supporting applications from local industries to the government's 'Industrial Heat Recovery Support Programme'<br>**By 2023**<br>**Relevant measure(s): 5,11**<br>**Current RBG policy strength: 1** | Negligible | Low | There are a limited number of such waste heat sources because of the lack of large-scale industry in Greenwich. | | Residents, local businesses and industry | Health – Facilitating greater use of waste heat sources in favour of combustion-based sources has an associated reduction in air pollution.<br><br>Economic – facilitating access to the national incentive scheme might provide financial benefits to local businesses. |
| ***Low carbon heating technologies*** | | | | | | | |

[93] Alternatively, an equal amount of biomethane could be produced offsite and injected into the national gas grid (administered via the Green Gas Certification Scheme), such that the local CHP is natural gas fired but an equal amount of natural gas burning is avoided elsewhere in the country.

| No | Policy | Cost | Resources | Barriers | Risks | Key stakeholders | Co-benefits |
|---|---|---|---|---|---|---|---|
| 16 | Lobby national government for tightened $CO_2$ standards for new builds – these must be a 'zero carbon' standard in order to encourage close to 100% uptake of heat pumps or other low carbon heating technology in both domestic and non-domestic buildings and very high levels of energy efficiency[94]. To match the scenario presented here, for domestic buildings these would need to bring forward the timescale set out in the provisional Future Homes Standard from 2025 to 2021 at the latest (see Section 3.1.7. For non-domestic buildings an equivalent of the Future Homes Standard is required which must go significantly beyond the current National Planning Policy Framework.<br><br>Simultaneously explore opportunities to mandate such new standards via the local plan.<br>**Begin immediately**<br>**Relevant measure(s): 6,7,8,9**<br>**Current RBG policy strength: 1** | Negligible | 1 FTE for all lobbying (see policy 8) | The recently published consultation on the Future Homes Standard (see Section 3.1.7) suggests that the scale of emissions reductions from new builds legislated for is likely to be lower than required until at least 2025.<br><br>Raised standards may be opposed by developers, especially given the short timescale implied for dramatic changes. | Speed of increase to national standards is unlikely to be high enough without a significant change in national approach, for which lobbying may prove insufficient.<br><br>Such a tightening of standards might raise the price of completing new developments, with impacts on the property market, including affordable housing costs. | National government, house builders | Health – gas boilers providing domestic and non-domestic heat are a major source emissions of nitrogen oxides contributing to poor outdoor air quality. Uptake of low carbon heating technologies would reduce these emissions and improve air quality. |
| 17 | Lobby national government for significantly tightened $CO_2$ emissions standards for heating system replacements in existing buildings. | Negligible | 1 FTE for all lobbying (see policy 8) | Such policy would be a step change away from current | Lobbying is not reliably effective. | National government, suppliers of gas boilers, residents | Health – see policy 16 |

[94] For domestic buildings this is close to an acceleration of the Future Homes Standard to 2021. However, this standard does not apply to non-domestic buildings.

| No | Policy | Cost | Resources | Barriers | Risks | Key stakeholders | Co-benefits |
|---|---|---|---|---|---|---|---|
| | The level of ambition must amount to a near ban (either directly or via mandated maximum emissions) on new gas boilers in any building from 2021, as any heating system installed from that point is likely still to be operating by 2030.<br>**Begin immediately**<br>**Relevant measure(s): 5,6,9**<br>**Current RBG policy strength: 1** | | | national legislation, according to which gas heating will be allowable even in new buildings until 2025 – there is no policy at national level on banning gas boilers in existing buildings. | | | |
| 18 | Heat pump installer training and quality assurance scheme, operating through the 'One-stop Shop'<br>**Begin immediately**<br>**Relevant measure(s): 6,9**<br>**Current RBG policy strength: 1** | Included in the 'One-stop Shop' | Included in the 'One-stop Shop' | Low | A low number of installers operating in the borough would cause the quality assurance scheme to lack competition. | Heat pump installers and manufacturing companies | Health – see policy 16 |
| 19 | Lobby the national government to design a successor scheme for the Renewable Heat Incentive from 2021 which is capable of driving uptake of renewable heating across almost all buildings by 2030, in line with the ambition of RBG (and many other local authorities).<br>Via approaches such as the 'One stop shop' described above, promote the national scheme widely and encourage residents and business to avail of the national funding support.<br>**Begin lobbying immediately** | Negligible | 1 FTE for all lobbying (see policy 8) | The current national target for net-zero is 2050. As such, national support schemes for renewable heating are likely to be designed with a view to achieving full deployment of renewable | As a result of the later net-zero target date of 2050 nationally, there is a risk that any national renewable heating support scheme(s) will not be capable of driving uptake of renewable heating across almost all buildings in | Residents, local businesses, national government | Health – see policy 16 |

| No | Policy | Cost | Resources | Barriers | Risks | Key stakeholders | Co-benefits |
|---|---|---|---|---|---|---|---|
| | **Relevant measure(s): 6,7,8,9**<br>**Current RBG policy strength: 1** | | | heating by that date rather than by 2030. | Greenwich by 2030. There is therefore a risk that this policy falls short of achieving RBG's target. | | |
| 20 | Install low carbon heating systems in all LA owned homes and public sector buildings where not connected to a heat network or in a location likely to be assigned to a heat network in the future[95]. These heating systems will be predominantly heat pumps in buildings which are sufficiently energy efficient and hybrid heat pumps elsewhere.<br>**By 2030**<br>**Relevant measure(s):**<br>**Current RBG policy strength: 1** | Approx. £270 million for LA owned homes and £20 million for public buildings. As for policy 7, costs might be recouped over the long term by taking a portion of the reduction in fuel bills. | Approx. 1-3 FTE staff to procure and manage the appointed contractor(s) during the project | Disruption to residents as a result of building work might create opposition | The large scale of the project brings risks of overspend and delays. | LA owned housing residents, users of public buildings, local suppliers of retrofits | Health – see policy 1<br>Equity – lower income residents will be benefited most given their overrepresentation amongst those living in local authority owned homes. |
| 21 | Offer "top-up" funding to the Renewable Heat Incentive and any national successor scheme (from 2021) for Greenwich residents and businesses, in order to drive faster and more widespread uptake than that envisaged by the national government. The form and level of | Approx. 10-30% of the total investment cost in renewable heating systems – | Specialist consultancy is likely be required to develop the scheme. | Significant administrative burden of both designing and implementing such a scheme. | Setting the price point of the subsidy too high risks unnecessary expenditure. Setting it too low risks lack of | Residents, local businesses | Health – see policy 16 |

[95] It is important that this occurs after the locations of future heat networks are assigned, as council owned buildings can be valuable anchor loads to ensure early use of heat networks as they are developed.

| No | Policy | Cost | Resources | Barriers | Risks | Key stakeholders | Co-benefits |
|---|---|---|---|---|---|---|---|
| | additional support required would need to be carefully considered and would depend on the details of the support offered through the national scheme. For example, the top-up funding could take the form of grant support on the order of 10-30% of the upfront cost, or a low interest (concessional) loan or some other form.<br>**From 2021**<br>**Relevant measure(s): 6,7,8,9**<br>**Current RBG policy strength: 1** | approx. £50 to £150 million[96]. | | | uptake at the required scale. Requirement to combine two sources of funding adds complexity both for the consumer and for the RBG scheme administrator, bringing some risk of failure to achieve the desired uptake.<br><br>The national RHI successor scheme might fail to be sufficiently generous as to allow a "top-up" of this kind to facilitate the required uptake. | | |
| 22 | Implement a clear phased program combining a mandate and incentives to result in zero active gas boilers in any buildings in the borough from 2030, except where operating as part of a hybrid heat pump system. To be fair and effective, such a policy must involve: | Up to approx. £500 million [97] | A team of 5-10 FTE staff with leadership from experienced project managers | Even with a 50% grant, the remaining capital costs of £3500-£5000 will prevent many residents from making the | The grant may well be insufficient to spur the required rapid uptake, despite the large capital expenditure. | Owner occupier residents, private landlords, local businesses, housing associations | Health – see policy 16 |

[96] The total capital cost is renewable heating system cost is assumed dominated by the £500 million heat pump cost below.
[97] 50% of £7000 per heat pump + £3500 for a low temperature heating system (if required) in close to 100,000 buildings. This cost assumes full uptake in all viable buildings and so is an upper bound.

| No | Policy | Cost | Resources | Barriers | Risks | Key stakeholders | Co-benefits |
|---|---|---|---|---|---|---|---|
| | • A clear signalling of the eventual banning of the use of gas boiler heating systems from 2030 as far in advance as possible, ideally by 2021.<br>• Provision of a strong incentive for the uptake of low carbon heating technologies such as heat pumps. Eg. by direct funding of 50% grants for all heat pump and hybrid heat pump purchases in both domestic and non-domestic buildings and/or “top-up” funding to any successor scheme to the national RHI. Incentives must be offered as early as possible, ideally from 2021.<br>• Prevention of new gas boiler purchases from 2022/2023 in order to reduce the extent of early write-offs as far as possible.<br>• Enforcement of the gas boiler ban from 2030 via inspections and punitive measures (eg. fines).<br>**Begin program in 2021, no active gas boilers in 2030**<br>**Relevant measure(s): 6,7,10**<br>**Current RBG policy strength: 1** | | | required purchases.<br><br>Opposition from residents and local businesses would be expected given the unfamiliarity and changed user experience of systems which do not use a gas boiler. | Given uptake levels are highly uncertain, the total spend is also uncertain.<br><br>Those must vulnerable, especially the elderly and low-income households are often the most likely to be missed by the associated information campaign and thus left uninformed about the changes.<br><br>The goodwill of residents around RBG’s climate change action as a whole is at risk if advice is not given in a clear and consistent fashion, with appropriate measures in place to prevent significant financial burdens falling on | | |

| No | Policy | Cost | Resources | Barriers | Risks | Key stakeholders | Co-benefits |
|---|---|---|---|---|---|---|---|
| | | | | | residents. It is vital that the policy does not shift over time once announced, given the need for residents/businesses to plan and take advantage of incentives many years in advance | | |

### One-Stop Shop for energy efficiency and low carbon heating

Existing building stock dominates energy use out to 2030 and so reduction of heat and electricity demand via energy efficiency improvements and the conversion of fossil fuel heating systems into low or zero carbon systems are vital components of decarbonisation. Significant barriers to the highly accelerated uptake of energy efficiency measures and low carbon heating deployment described in Table 5-1 are presented by the lack of consumer confidence in such measures and the time and effort required to undertake them. In order to overcome this barrier, it is recommended that RBG sets up a 'One-stop shop' (OSS) which will advise residents and businesses, supporting them through their whole journey from considering making improvements to their property to completing a project. Various 'one-stop shop' schemes have been successfully implemented across the European Union[98]. Such schemes can be advantageous both for clients (residents/businesses) and for retrofit suppliers. On the client side, it is very difficult for a non-expert to make fully informed decisions because of the large number of combinations of options, the unfamiliarity of suppliers and the complex regulatory landscape. In addition, if grants or funding are available, significant research and time investment are likely to be required to secure them. Given the large costs associated with the decisions made, lack of complete confidence can prevent action. The OSS can take these decision processes away from the client and act as a trusted adviser. On the supplier side, working with the OSS is advantageous because it increases the rate of retrofits, bringing work to the supplier, and because the OSS can supply information more efficiently than individual clients, reducing the need for repeat visits and time investment in information provision. RBG might assign a team of energy efficiency and low carbon heating experts to set up the OSS, liaising with the existing home improvements team at RBG, as a not-for-profit financial facilitator.

The OSS will:

- Act as intermediary between residents/businesses and local SME suppliers of retrofit and low carbon heating installations (practitioners).

[98] *One-stop-shops for energy renovations of buildings, Case studies, JRC Science for Policy Report, EU Commission, 2018.* Available at (accessed 05/11/2019) https://e3p.jrc.ec.europa.eu/sites/default/files/documents/publications/jrc113301_jrc113301_reportononestopshop_2017_v12_pubsy_science_for_policy_.pdf

- Quality vet these practitioners and publish lists of trusted and recommended practitioners.
- Perform grant assessments, advising residents/businesses on their eligibility for financial aid.
- Advice residents/businesses on the appropriate measures for their property type and financial position, using local knowledge of property types to increase efficiency.
- Pass client information on to practitioners and aid in the drawing up of contracts by agreeing technical specifications.

### 5.2.2 *Transport*

**Table 5-3 Transport policies**

| No | Policy | Cost | Resources | Barriers | Risks | Key stakeholders | Co-benefits |
|---|---|---|---|---|---|---|---|
| ***Access and charging*** | | | | | | | |
| 1 | Introduce banded resident parking permits in proportion to emissions impact, including increase in cost above current price for ICE cars and discount for ULEVs[99]<br>**By 2021**<br>**Relevant measures:** 1, 4<br>**Current RBG policy strength:** 2 | ~£50k[99] initial investment for scheme<br><br>Ongoing costs are covered by revenue from parking charges | Negligible – implemented within current team | • Resistance from permit holders<br>• High upfront ULEV costs for consumers | • Low income households disproportionately affected<br>• Loss of revenue in future years | Residents | Health – improved air quality where ICE cars are reduced<br><br>Traffic – Reduced local traffic where cars are removed |
| 2 | Introduce new and extended controlled parking zones<br>**By 2025**<br>**Relevant measures:** 1, 2<br>**Current RBG policy strength:** 2 | £568k over 3 years already allocated in LIP<br><br>Up to £1.1m additional spend required to reach full ambition[100] | Up to 1 FTE to oversee rollout | • Resistance from stakeholders | • Reduced visitors to the area | Residents, visiting drivers | Traffic – Reduced local traffic and congestion, particularly through removal of vkm travelled by cars searching for parking |

[99] Based on the Croydon parking plan Croydon implement 5 bands with a 30% increase above previous parking charges for those in Band 3, which covers majority of current permit holders; 50k capital expenditure for setup fee and ongoing expenditure (£110k per annum) estimates 3 permanent posts to deliver the scheme.
[100] Based on an estimated 14-20 new CPZs required to cover all major areas (Element Energy analysis) and approximately 2 CPZs per annum covered by current funding level (RBG figures)

| No | Policy | Cost | Resources | Barriers | Risks | Key stakeholders | Co-benefits |
|---|---|---|---|---|---|---|---|
| 3 | Explore the introduction of a workplace parking levy<br>**By 2022**<br>**Relevant measures:** 1, 2, 5, 6<br>**Current RBG policy strength:** 2 | Negligible<br>Ongoing costs funded by revenue from levy | 0.5-1 FTE to administer the scheme. | • Resistance from businesses | • Cost passed on to employees, disproportionately impacts low income households<br>• Increased parking pressure in non-controlled parking zones around workplaces | Local businesses, GLA | Health – improved air quality<br><br>Traffic – Reduced traffic where commuting journeys are replaced by public transport |
| 4 | Reduce/remove on-street parking spaces in new developments<br>**Immediate**<br>**Relevant measures:** 1<br>**Current RBG policy strength:** 3 | — | — | • Resistance from stakeholders | • Limited access for those reliant on cars<br>• Reduced number of visitors to the area | Residents, developers | Health – improved air quality<br><br>Traffic – Reduced local traffic through cars searching for parking spaces |
| 5 | Reallocate existing parking spaces to car clubs (extent depends on car club model)[101]<br>**Begin immediately**<br>**Relevant measures:** 1, 2<br>**Current RBG policy strength:** 2 | 15k over 3 years already allocated in LIP, primarily for TMO costs; estimated to deliver 5 vehicles per year[102]<br><br>Extent of further ambition will need to be assessed based on demand | <1 FTE to manage car club procurement, TMOs and implementation | • Resistance from residents, SMEs and visitors | • Reduced number of visitors to the area | Residents, car club providers, local businesses | Health – improved air quality, particularly where EVs are used by car clubs<br><br>Traffic – Reduction in local traffic through cars searching for parking spaces |

[101] Car clubs using the "free floating" model would not require dedicated bays, whereas back-to-base vehicles would require dedicated spaces.
[102] Element Energy analysis, based on pre-LIP and current car club vehicle numbers

| No | Policy | Cost | Resources | Barriers | Risks | Key stakeholders | Co-benefits |
|---|---|---|---|---|---|---|---|
| 6 | Reduce speed limits to 20mph on all residential roads and appropriate major roads<br>**Trials of major roads by 2022, full implementation by 2025**<br>**Relevant measures:** 1, 2, 6<br>**Current RBG policy strength:** 2 | £250k already allocated in LIP<br><br>Up to additional £500k required to reach 100% of residential roads[103] | 1-2 FTE to manage the scheme | • Resistance from road users | • Redirection of traffic to other routes and/or boroughs | Residents, local businesses | Health – Safer streets for pedestrians and cyclists |
| 7 | Create ZE-only access to town centres for deliveries during peak hours<br>**By 2023**<br>**Relevant measures:** 3, 4<br>**Current RBG policy strength:** 1 | £1-2m[104] | 1-2 FTE to manage consultation, design, funding application and implementation | • Resistance from freight organisations<br>• Resistance from road users<br>• Resistance from local businesses | • Disproportionately affects vulnerable residents and SMEs<br>• Redirects traffic to other roads and/or boroughs<br>• Potential relocation of businesses to other boroughs | Residents, local businesses, freight sector, TfL | Traffic – Reduced congestion and traffic in town centres<br><br>Health –Safer streets for pedestrians and cyclists if traffic is reduced; reduced noise pollution of trucks and vans; Improved air quality |
| 8 | Extend planned Liveable Neighbourhoods to town centre ZEZs<br>**By 2025**<br>**Relevant measures:** 1, 2, 3, 4, 6<br>**Current RBG policy strength:** 2 | £25m[105] | 2 FTE to manage consultation, design, funding application and implementation | | | Residents, local businesses, freight sector, TfL<br><br>Wider consultation also required to be open to all visitors to the area and interested parties | |
| 9 | Create borough-wide ZEZ for cars, LGVs and buses, ZE capable for HGVs<br>**By 2030**<br>**Relevant measures:** 1, 2, 4, 6<br>**Current RBG policy strength:** 1 | £100s of millions – for example, the Congestion Charge Zone cost £230m to implement over an area half the size of RBG[106] | 2-3 FTE to manage consultation, design, funding application and implementation | | | | |
| ***Infrastructure*** | | | | | | | |

[103] Element Energy analysis of RBG data

[104] Estimated assuming only design, implementation of traffic orders, signage, and enforcement; based on costs of Liveable Neighbourhood scheme

[105] Estimated assuming ZEZs implemented at Eltham, Greenwich (included in LIP3), Thamesmead, Plumstead and Woolwich, with cost equivalent to implementation of Greenwich town centre Liveable Neighbourhood and adjusted for larger areas and additional requirements for charging (£5.4m)

[106] https://www.eltis.org/discover/case-studies/central-london-congestion-charging-scheme-uk

| No | Policy | Cost | Resources | Barriers | Risks | Key stakeholders | Co-benefits |
|---|---|---|---|---|---|---|---|
| 10 | Strategic closing of local roads to motorised vehicles<br>**Fully implement by 2030**<br>**Relevant measures:** 1, 2, 3, 6<br>**Current RBG policy strength:** 3 | £200k already allocated in LIP for modal filters on residential streets.<br><br>£300k additional funding required to reach full potential[107] | 1-2 FTE to manage consultation, design, funding application and implementation | • Resistance from freight organisations<br>• Resistance from road users<br>• Resistance from local businesses | • Redirects traffic to other roads and/or boroughs<br>• Impacts delivery of goods to local businesses in the immediate area | Residents, local businesses | Health – Safer streets for pedestrians and cyclists if traffic is reduced; Improved air quality |
| 11 | Increase provision of both public access and business EV charge points<br>**Begin immediately,** with full provision **by 2030**<br>**Relevant measures:** 4<br>**Current RBG policy strength:** 2 | £105k already allocated in LIP to support roll out of Source London;<br><br>Estimated £1m to reach public charge point provision required to meet ambition modelled (2,200 charge points) | <1 FTE to liaise with procurement framework stakeholders (TfL and London Councils) and businesses | • Finding space<br>• Degree of influence in installation of charge points on private land<br>• Reallocation of pavement space for on-street provision | • Power demand exceeds possible grid capacity, triggering lengthy and costly grid upgrades | Residents, local businesses, charge point providers, UKPN, TfL, London Councils | Economy – Greater attraction of EV users to visit the area; customers stay for longer in areas with EV charging points |
| 12 | Expand use of Permitted Development rights for installing charge points to include rapid charge points and hubs<br>**Begin immediately**<br>**Relevant measures:** 4<br>**Current RBG policy strength:** 3 | Negligible | — | • Perceived visual impact of charge points | | Charge point providers, residents | |
| 13 | Create new strategic river crossings suitable for pedestrians and cyclists<br>**By 2030**<br>**Relevant measures:** 6<br>**Current RBG policy strength:** 1 | £20m[108] | 1 FTE manager; architects and developers will need to be contracted; in | • Limited potential revenue stream to fund costs | • Insufficient use to justify costs | TfL, Tower Hamlets and/or Newham Councils | Health – increased active travel; improved safety of pedestrians through reduced |

[107] Based on 15% of eligible areas treated per year (45% over 3 years)
[108] Based on estimated cost of Greenwich Foot Tunnel in current prices (£15m) and cost of Millennium Bridge (£18.2m in 1998).

| No | Policy | Cost | Resources | Barriers | Risks | Key stakeholders | Co-benefits |
|---|---|---|---|---|---|---|---|
| | | | the short-term, more resources will be needed to apply for funding | | | | illegal use of cycles in foot tunnels |
| 14 | Create new and improved cycle network through the borough, reallocating road space and delivering high connectivity and ease of use<br>**By 2025**<br>**Relevant measures:** 6<br>**Current RBG policy strength:** 2/3 | £18-30m over ten years to deliver full network[109] | 2-3 FTE to manage network development and implementation, including funding applications | • Resistance from road users | • Cycle route accessibility is not matched by developments in neighbouring boroughs<br>• Fewer visitors to the borough | TfL, residents, local businesses, cycle associations | Health – Improved air quality where cars are replaced; increased active travel |
| 15 | Improvement of walking routes in town centres<br>**Begin immediately**<br>**Relevant measures:** 6<br>**Current RBG policy strength:** 3 | £400k over 3 years already allocated in LIP | 1-2 FTE to manage the scheme | • Resistance from road users | • Low risk unless road reallocation is included | Residents, local businesses, TfL, GLA | Health – Safer travel for pedestrians |
| 16 | Increase provision of cycle parking for residents and high-quality long-stay parking at key transport hubs<br>**Begin immediately with full implementation by 2025**<br>**Relevant measures:** 6<br>**Current RBG policy strength:** 2/3 | £20k per annum already allocated in LIP, providing approximately 50 bike hangars<br><br>Retrofitting all existing developments to meet the Draft London Plan standards would require | <1 FTE to oversee rollout | • Lack of space or loss of space providing other source of revenue (e.g. parking spaces)<br>• Resistance from car owners who park on-street | • Insufficient modal shift despite provision | Residents | Health –increased active travel |

[109] Based on current RBG estimates of £600-1m per year to deliver approximately 1 mile of network per year and an estimated 20 miles primary network and 20 miles local network, with 50% of primary network required to be delivered by TfL on TLRN roads.

| No | Policy | Cost | Resources | Barriers | Risks | Key stakeholders | Co-benefits |
|---|---|---|---|---|---|---|---|
| | | approximately 200,000 spaces on housing developments, costing between £7-15m;[110] however, this represents an upper limit and the required provision should be determined in response to ongoing assessment of demand,<br><br>Cycle hubs at key transport locations is estimated to cost an additional £5m.[111] | | | | | |
| ***Funding and support*** | | | | | | | |
| 17 | Provide replacement grant for ULEV purchase among residents and local | Up to £33m over 5 years[113] | 2 FTE to establish all application | • Limited funding to cover grants and | • Insufficient uptake despite grants | Residents, local businesses | Health – Improved air quality |

[110] Based on the proportion of spaces in bike hangers ranging between 5-15% (between the current provision of publicly available spaces in Greenwich and Lambeth, respectively as detailed in TfL data). Costs assume an allocation of £2,000 per bike hangar and £30 per standard U-stand, with 6 spaces per hangar and 6 spaces per U stand.
[111] Based on one major hub (several thousand spaces) at the new Crossrail station and smaller hubs (100 spaces) at 3-5 locations; pricing as given in *Typical Costs of Cycling Interventions* (2017) DfT
[113] Based on the maximum grant taken up by 50% of modelled uptake of ZE vehicles (8,000 cars, 1,000 LGVs and 825 P2W), assuming price parity of ULEVs with ICE in the mid 2020s; 50% of vans assumed to be privately owned, based on DfT statistics.

| No | Policy | Cost | Resources | Barriers | Risks | Key stakeholders | Co-benefits |
|---|---|---|---|---|---|---|---|
| | businesses after Government scheme ends[112]<br>**By 2022**<br>**Relevant measures:** 4<br>**Current RBG policy strength:** 1 | | processes; potential software costs may also be required if applications are managed by external software provider<br><br>1 FTE to manage applications[114] | administration of the scheme<br>• Availability of infrastructure limits uptake<br>• Supply of ULEVs | • Low income households still unable to afford upfront cost<br>• State Aid rules preventing scheme or limiting its scope | | Equity – lowers the barrier for purchase of ZEVs |
| 18 | Provide interest-free loans for ULEV purchases among residents[115]<br>**By 2022/23**<br>**Relevant measures:** 4<br>**Current RBG policy strength:** 1 | Up to £16,000 per loan for cars and £4,000 per loan for P2Ws[116]<br><br>Total cost of loans estimated to be in the region of £45m, dependent on rate of uptake and repayment;[117] Loan repayments cover part of cost of | See Policy 19 for potential setup costs.<br><br>1 FTE to manage applications[114] | | • Buyers default on loans<br>• Low income households still unable to afford cost of purchase over repayment period | Residents, finance providers | |

[112] Up to £3,500 for cars, £1,500 for motorcycles, £8,000 for vans and up to £500 for installation of charge points. This assumes the national grant ends by 2021
[114] Based on processing of up to 10,000 applications over 5 years and assumptions of time required for providing helpdesk support and processing applications
[115] As implemented in Scotland, with up to £35,000 available for purchase of cars and £10,000 for motorcycles and scooters; repayment term 6 years. Detailed on the Energy Agency website
[116] Based on 7% interest rate and 20% contingency for default
[117] Assuming the council requires external financing to cover 35% of loans with the remaining funded through repayments (based on similar proposed scheme, confidential information); based on 50% of modelled uptake of ZE vehicles (8,000 cars and 825 P2W) taking up the loan

| No | Policy | Cost | Resources | Barriers | Risks | Key stakeholders | Co-benefits |
|---|---|---|---|---|---|---|---|
| | | ongoing loan provision | | | | | |
| 19 | Provide mobility credit for low income residents, applicable for public transport and shared transport options (such as car clubs, bike share and cargo bike hire schemes). Higher credits can be provided in return for scrappage of an ICE car to incentivise modal shift or ULEV uptake<br>**By 2022/23**<br>**Relevant measures:** 1, 4, 5<br>**Current RBG policy strength:** 1 | £4m in mobility payments without scrappage[118] and up to £8m in scrappage, although this is likely to be an upper limit[119] | See Policy 19 for potential setup costs.<br><br>1-2 FTE to manage applications.[120] | • Limited funding to cover grants and administration of the scheme | • Future public transport price rises either increase costs or limit benefit of scheme<br>• Insufficient switch to public and shared transport despite grants | TfL, mobility service providers | Equity – Mitigates income inequality of modal shift |
| 20 | Provide grants for residents for purchase of ebikes<br>**By 2022/23**<br>**Relevant measures:** 6<br>**Current RBG policy strength:** 1 | Between £100,000 and £600,000, depending on size of grant and uptake[121] | <1 FTE to manage applications | | • E-bikes purchased by residents but not used | Residents | Equity – Encourages wider uptake of cycling (e.g. among older age groups)<br><br>Health – increased active travel |
| 21 | Provide cargobike hire for residents and SMEs<br>**Trial by 2021,** rollout of full scheme **by 2022/23** if successful<br>**Relevant measures:** 3, 6<br>**Current RBG policy strength:** 1**/2** | £5k investment per cargo bike plus ~£200 per year maintenance costs; for example, £15-25k investment for | Up to 0.5 FTE to administer scheme, depending on demand | | • Insufficient uptake to support continuation of scheme | Residents, SMEs, cargo bike providers | Economic – Can help SMEs grow their business offering (enabling delivery where |

[118] Based on modelled switch in car journeys (20,000 cars reduced) and assumed proportion of eligible participants (46% in jobs earning below £30,000) and journeys suitable for shift to public transport (46% based on TfL data), with £1,000 mobility credit paid per participant
[119] Based on modelled switch in car journeys (20,000 cars reduced) and assumed proportion of eligible participants (46% in jobs earning below £30,000) and journeys suitable for shift to public transport (46% based on TfL data), with £2,000 scrappage paid per participant
[120] Based on up to 4,000 applications over 1 year of support and assumptions of time required for providing helpdesk support and processing applications
[121] Based on an uptake of *ca* 600 grants over a year, with a grant size of between £200-1,000; uptake based on 0.2% of the population, in line with uptake of an ebike scheme in France https://www.bicycleassociation.org.uk/wp-content/uploads/2019/07/The-Case-for-a-UK-Incentive-for-E-bikes-FINAL.pdf

| No | Policy | Cost | Resources | Barriers | Risks | Key stakeholders | Co-benefits |
|---|---|---|---|---|---|---|---|
| | | a fleet of 3-5 cargo bikes | | | | | otherwise not affordable)<br><br>Traffic – Reduced need for business parking where vans or cars can be replaced; Reduced traffic and congestion |
| 22 | Provide subsidised telematics service for local van users and fleets to enable them to assess their suitability for switch to ULEVs<br>**By 2022/23**<br>**Relevant measures:** 4<br>**Current RBG policy strength:** 1 | £2-10 per tracked vehicle;[122] estimated upper limit of total costs in the region of £10,000's if all local vans use the service | <1 FTE to set up service, manage applications and implement scheme | | | Telematics providers, local businesses | Health – Improved air quality |
| 23 | Build on personalised travel planning experience to create behaviour change campaign<br>**By 2021**<br>**Relevant measures:** 6<br>**Current RBG policy strength:** 3 | £195k over 3 years already allocated in LIP | 1 FTE to manage the scheme, | • No barriers identified | • Campaign not reaching the targeted audience | Residents, local businesses and employees | Health – Increased active travel where possible |
| 24 | Fund community schemes that promote active travel as for example implemented by Waltham Forest (described in Table 3-1)<br>**From 2022/23**<br>**Relevant measures:** 6<br>**Current RBG policy strength:** 1 | £20,000 per annum | 0.5 FTE to manage applications over application period (assumed to be 1-2 months) | • Availability of funding to provide the grants | • Insufficient long-term impact of schemes | Residents, community organisations | Health – Increased active travel where possible |
| ***Mode shift/behaviour change*** | | | | | | | |

[122] Element Energy previous research

| No | Policy | Cost | Resources | Barriers | Risks | Key stakeholders | Co-benefits |
|---|---|---|---|---|---|---|---|
| 25 | Support pick-up and drop-off points for parcel delivery<br>**Begin immediately**<br>**Relevant measures:** 3<br>**Current RBG policy strength:** 1 | Negligible | Negligible | • Lack of space | • Insufficient use to significantly reduce van traffic | Residents, logistics companies | |
| 26 | Support/encourage formation of one or more business improvement districts (BIDs).<br><br>A BID provides a platform through which local businesses can improve the environment in the area and implement best practice operating procedures. They provide an opportunity to setup preferred suppliers networks and consolidation opportunities for deliveries. There is also the possibility of using business-owned land or facilities for microdistribution/consolidation if council facilities are not available.<br>**By 2021**<br>**Relevant measures:** 3<br>**Current RBG policy strength:** 1 | Negligible | < 1 FTE to liaise with businesses, support application and provide ongoing input as required | • Lack of interest from businesses | • Potential need for administration by borough | Local businesses | Economic – Improved conditions for businesses in the area, for example through collective buying power |
| 27 | Investigate feasibility of establishing consolidation and microconsolidation centres in existing areas of high delivery activity and within new developments/opportunity areas, including combining rail/river freight with last-mile delivery where appropriate.<br>Carry out consultation **by 2021**; full implementation where feasible **by 2025**<br>**Relevant measures:** 3<br>**Current RBG policy strength:** 2 | Up to £50k for consultation | 1 FTE for fixed term to oversee consultation and feasibility study | • Loss of space that could generate alternative revenue<br>• Lack of interest from/suitability for businesses<br>• Limited areas with sufficient business density | • Insufficient uptake from businesses to sustain commercial operation<br>• Potential to have to fund part or all of running costs, up to £2m per year per centre[123] | Local businesses, logistics companies, developers, cycle logistics providers, FTA | Traffic – Reduced congestion<br><br>Health – Improved air quality |

[123] *Freight Consolidation Feasibility Study* (2019) TfL

| No | Policy | Cost | Resources | Barriers | Risks | Key stakeholders | Co-benefits |
|---|---|---|---|---|---|---|---|
| 28 | Work with car clubs to increase shared van offering for SMEs **Consultation with SMEs and car clubs by 2021**<br>**Relevant measures:** 3<br>**Current RBG policy strength:** 1 | Negligible | <1 FTE | • Increased cost for car club<br>• Competition for use/space | • Unsuitable for SMEs needs<br>• Need to provide subsidy to encourage use | Car clubs, SMEs | Economic – Can help SMEs increase their business offering |
| 29 | Require car clubs to only offer EVs<br>**By 2025**<br>**Relevant measures:** 4<br>**Current RBG policy strength:** 1 | Negligible | Negligible | • Cost of vehicles for car clubs<br>• Availability of charge points, especially rapid charging<br>• Range and compatibility with charge points outside RBG | • Reduced car club offering in the area | Car clubs | Health – Improved air quality |
| 30 | Encourage employers to conduct travel surveys and review transport policies (such as advertising cycle to work schemes), working towards encouragement to part or fully fund public transport where appropriate levels of modal shift are expected to be achieved[124]<br>**By 2022/23**<br>**Relevant measures:** 1, 5<br>**Current RBG policy strength:** 1 | Negligible | Negligible | • Resistance from businesses | • Relocation of businesses to other boroughs<br>• SMEs disproportionately impacted | Local businesses | Equity – Mitigates income inequality of modal shift |
| ***RBG fleet and services*** | | | | | | | |
| 31 | Fully convert RBG fleet to ZEVs, including consideration of shortening lease length to allow for the latest EV technology to be | £8m increase over ICEs between 2019 and 2026 | Negligible – already accounted for in | • ZE vehicles unavailable or | • High incidence of vehicles off road for some vehicles due to | ULEV OEMs | Health – Improved air quality |

[124] Based on official labour market statistics (https://www.nomisweb.co.uk/), there are 4 businesses with greater than 250 employees in the borough. These businesses may be a suitable early target for modal shift measures.

| No | Policy | Cost | Resources | Barriers | Risks | Key stakeholders | Co-benefits |
|---|---|---|---|---|---|---|---|
| | incorporated within the fleet as it becomes available<br>**By 2030**<br>**Relevant measures:** 4<br>**Current RBG policy strength:** 2/3 | Up to £6m estimated between 2026 and 2030, but likely to be lower due to cost reductions in ZE models | fleet management team | insufficient for needs | early adoption of developing technology<br>• Lower service offer for specialised vehicles due to lower market offer | | Economic – Helps to drive supply, particularly for HGVs that have a smaller offering; reduced running costs for RBG fleet |
| 32 | Shift council deliveries to cycle freight where possible<br>**By 2022/23**<br>**Relevant measures:** 3<br>**Current RBG policy strength:** 2/3 | Minimal | 1 FTE over short term (less than 1 month) to carry out assessment; negligible ongoing requirement | • Extent of potential for modal shift | • Complex delivery strategies where only part of requirement is met by cycle freight | | Health – Improved air quality; increased active travel of logistics personnel<br><br>Economy – Drives local cycle freight offering where services are outsourced |
| 33 | Implement large-scale and/or joint procurement with other boroughs, councils and HGV fleets for ZE HGVs and vans to drive supply[125]<br>**From 2025**<br>**Relevant measures:** 4<br>**Current RBG policy strength:** 1 | Minimal (cost of vehicles included in fleet conversion) | <1 FTE to liaise with stakeholders/ collaborators | • Limited experience<br>• Lack of existing collaborative purchasing groups | • Insufficient buying power to generate supply<br>• OEMs unable to meet demand despite group buying offering | Boroughs, OEMs, logistics operators, national councils | Health – Improved air quality<br><br>Economy – Helps to drive supply, particularly for HGVs that have a smaller offering; |
| 34 | Require ULEV transport in council service tenders<br>**By 2025** | Minimal | — | • Limited offering among service providers | • Increased costs due to limited pool of suppliers; however, | | Health – improved air quality |

[125] As implemented by a consortium of fleets in Switzerland – the $H_2$ Energy consortium in Switzerland is a partnership between truck operators and Hyundai to deliver at least 1,600 $H_2$ trucks by 2025, with the first trucks arriving in 2020.

| No | Policy | Cost | Resources | Barriers | Risks | Key stakeholders | Co-benefits |
|---|---|---|---|---|---|---|---|
| | **Relevant measures:** 4<br>**Current RBG policy strength:** 1/2 | | | | service costs of logistics operators are not significantly higher for low emission delivery | | |
| ***Lobbying/collaboration*** | | | | | | | |
| 35 | Lobby for ULEZ to be ZEZ for cars and vans by 2030<br>**Begin immediately**<br>**Relevant measures:** 1, 2, 4, 6<br>**Current RBG policy strength:** 1 | — | 1 FTE as part of wider Carbon Neutral team | • Resistance from road users | • If unsuccessful, reduced potential for $CO_2$ reduction | TfL, GLA, London Councils | Health – Improved air quality<br><br>Traffic – Reduced local traffic |
| 36 | Lobby for ULEZ to extend to portion of South circular within borough boundaries<br>**Begin immediately**<br>**Relevant measures:** 1, 2<br>**Current RBG policy strength:** 1 | | | • Difficult to implement charging in isolation<br>• Resistance from road users | • Redirection of traffic to local roads | TfL | |
| 37 | Engage with TfL and fleets to support the transition of emergency vehicles to ULEVs by 2030<br>**Begin immediately**<br>**Relevant measures:** 4<br>**Current RBG policy strength:** 1/2 | | | • Availability of ZE emergency vehicles | • No specific risks identified | TfL, emergency services | Economy – Helps to drive the market for vehicles |
| 38 | Work with TfL and GLA to expand public transport network, particularly in areas of low access to public transport such as in the south of the borough<br>**Begin immediately**<br>**Relevant measures:** 1, 5<br>**Current RBG policy strength:** 3 | | | • Limited funding and resources to prioritise RBG routes | • Delay in delivery impacts degree of modal shift | TfL, GLA, London Councils | |
| 39 | Lobby TfL to implement ULEV-only access for Silvertown and Blackwall tunnels<br>**Begin immediately**<br>**Relevant measures:** 4<br>**Current RBG policy strength:** 1 | | | • Reduced revenue from road users to repay development cost | • If unsuccessful, limits potential for influence over through-traffic | TfL, GLA, London Councils | Health – improved air quality where ULEVs are encouraged |

| No | Policy | Cost | Resources | Barriers | Risks | Key stakeholders | Co-benefits |
|---|---|---|---|---|---|---|---|
| 40 | Lobby TfL to allow for high quality cycle access at key river crossings, such as Silvertown tunnel<br>**Begin immediately**<br>**Relevant measures:** 6<br>**Current RBG policy strength:** 1 | | | • Could be considered unsafe | • Proximity of cyclists to traffic in absence of segregated lanes | | Health – improved active travel where modal shift to cycling is facilitated |
| 41 | Lobby City airport to convert to zero emissions technologies<br>**Begin immediately**<br>**Relevant measures:** 7<br>**Current RBG policy strength:** 1 | | | • Availability of low and zero emissions technologies | • If unsuccessful, very little potential for borough influence over aviation emissions | City airport, airlines | Health – improved air quality over the borough |
| 42 | Work with TfL and GLA to accelerate the switch to ZE buses<br>**Begin immediately**<br>**Relevant measures:** 4<br>**Current RBG policy strength:** 1/2 | | | • Availability and supply rate of ZE buses<br>• Availability of infrastructure at garages | • Delay in delivery reduces potential for $CO_2$ reduction | TfL, GLA | Health – Improved air quality |

### 5.2.3 *Energy generation, industry, waste & other*

**Table 5-4 Energy generation, industry, waste & other policies**

| No | Policy – *including start date indication* | Cost | Resources and funding | Barriers | Risks | Key stakeholders | Co-benefits |
|---|---|---|---|---|---|---|---|
| ***Offsetting*** | | | | | | | |
| 1 | Invest in large scale renewable electricity generation projects to feed into the national grid. Approx. 805 GWh/year of electricity must be fed into the grid to equal Greenwich's electricity usage. Demand side action via the promotion of smart/flexible technologies | Variable depending on method of generation chosen. There would be a large up-front capital investment, | Approx. 3-5 FTE staff (depending on scale chosen) to procure and manage the appointed contractor(s) during the project | The large scale required means this policy would involve complex infrastructure projects with coordinated action | The capital cost is highly uncertain for such a large set of projects.<br>RBG would take on the risk to investment associated with | The National Grid, UK Power Networks, developers of solar PV farms and wind turbines | Economic – potential long-term income source for the council |

| No | Policy – *including start date indication* | Cost | Resources and funding | Barriers | Risks | Key stakeholders | Co-benefits |
|---|---|---|---|---|---|---|---|
| | should also be explored (see policy 2 below).<br><br>**Complete by 2030**<br><br>**Relevant measure(s): 1**<br><br>**Current RBG policy strength[126]: 1** | but with the potential to be profit making in the medium to long term.[127] | | from multiple stakeholders | failure to deliver expected energy production or with significant changes to electricity wholesale prices | | |
| 2 | RBG should work with the GLA to consider how flexibility in the demand for electricity (i.e. demand response) across the borough can be promoted. This is an important enabling measure for the incorporation of intermittent renewable generation into the grid. The implementation of thermal and battery storage, either small-scale building-level storage or large-scale network-connected storage should also be considered as a means of increasing the benefit of renewable energy generation to the grid. This policy builds on learnings from the *Greenwich Energy Hero* project (see Table 3-1)<br><br>**Begin immediately**<br><br>**Relevant measure(s): 1**<br><br>**Current RBG policy strength: 2** | Encouraging demand side response without battery storage – negligible | 0.5 FTE | Demand side response requires behaviour change from residents/ local businesses. | None | Residents/local businesses, building level home battery storage system providers, UK Power Networks | None |

[126] Measured on a scale of 1-3, 1=weak, 2=moderate, 3=strong.
[127] Approx. £50-80 per MWh for Large scale solar PV and onshore wind, for projects commissioned in 2020. Lifetime for solar PV is assumed 25 years and for onshore wind 24 years, giving a cost of approx. £1.6million per GWh/year generated. For context, two wind turbines at Avonmouth owned by Bristol city council were predicted to produce 14GWh/year with an estimated set up cost of £9 million, for which the council secured a loan. These costs were expected to be recouped in less than twenty years. See Local Government Association press release at https://www.local.gov.uk/bristol-city-councils-wind-turbines (accessed 12/11/2019)

| No | Policy – *including start date indication* | Cost | Resources and funding | Barriers | Risks | Key stakeholders | Co-benefits |
|---|---|---|---|---|---|---|---|
| 3 | Explore opportunities for offsetting remaining emissions. Any offset used must represent real, additional, verifiable and permanent emission reductions. Quality assurance (for example as provided by the 'Gold Standard') and due diligence are vital to avoid wasting resources. Options for projects include, among others:<br>• Renewable energy (in the UK or potentially internationally)<br>• Energy efficiency<br>• Afforestation, avoided deforestation or other land use change<br>• Destruction of industrial pollutants such as hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs)<br>• Containment or combustion of methane generated by landfills or farm animals (using an anaerobic digestion plant)<br>• Direct purchase and subsequent retirement of emissions allowances within trading schemes such as the EU Emissions Trading Scheme.<br><br>**From 2030**<br>**Relevant measure(s): N/A**<br>**Current RBG policy strength: 1** | Highly variable depending on the offsetting method chosen | 1-2 FTE. Specialist consultancy is likely be required to develop an offsetting plan which does not rely on private companies and which completes all necessary due diligence. | Offsetting has been the subject of some controversy, and historic projects, especially in international land use, have been found to fall short of their claimed emissions reductions and/or cause harm to local people. It can be difficult to ensure that emissions savings are truly additional and permanent. | Offsetting is likely to become more expensive over time as more of the lower cost measures to reduce emissions are taken up.<br><br>One motivation for pursuing a net zero policy is to demonstrate that it is possible and share learnings with policy makers from the rest of the UK and internationally. A reliance on offsetting negates this benefit.<br><br>It can be difficult to assess the merits of projects, and if RBG takes on project operations itself, rather than paying a private company to do so, it bears the risk of underperformance in emissions reduction. | The Gold Standard Foundation, BEIS | Many international offsetting projects have significant health and economic co-benefits for local communities and this is a requirement for eligibility for Gold Standard certification. |
| ***Waste*** | | | | | | | |

| No | Policy – *including start date indication* | Cost | Resources and funding | Barriers | Risks | Key stakeholders | Co-benefits |
|---|---|---|---|---|---|---|---|
| 4 | Produce a waste management strategy containing strict quantitative targets for reduction in total waste per person and increase of proportion sent to recycling.<br>**From 2021**<br>**Relevant measure(s): 2,3**<br>**Current RBG policy strength: 2/3** | Negligible | 0.5-1 FTE over a year | Resident behaviour change is key to success | None | Residents, waste collection service | Economic – Reduced council expenditure on waste collection |
| 5 | Consider instituting a separate food waste collection service and sourcing commercial partners to operate anaerobic digestion of the collected food waste.<br>**From 2021**<br>**Relevant measure(s): 3**<br>**Current RBG policy strength: 2** | Unknown | 0.5 FTE to manage external procurement | Resident behaviour change is key to success | There is the potential for wasted expenditure of resident behaviour does not change to use the new service | Residents, waste collection service | None |
| ***Council emissions*** | | | | | | | |
| 6 | Undertake baselining of RBG's direct emissions (from council assets and LA owned homes). Organise current energy procurement (monitoring, billing, tracking) and associated contracts in order to better understand emissions and increase energy use data quality. This baselining is expected to establish specific groups of buildings (both corporate and LA owned housing) which are most appropriate for energy efficiency improvements and installations of low carbon heating systems and as such is an enabling measure for Buildings policies 6, 7 and 20.<br>**Begin immediately** | Negligible | 0.5 FTE | None | None | Energy suppliers | Equity - Identification of LA owned housing which performs worst on energy efficiency might facilitate targeting improvement at residents most in need, especially the |

| No | Policy – *including start date indication* | Cost | Resources and funding | Barriers | Risks | Key stakeholders | Co-benefits |
|---|---|---|---|---|---|---|---|
| | **Relevant measures: Buildings measures 3(b), 6, 7, 10**<br>**Current RBG policy strength: 1** | | | | | | vulnerable and fuel poor. |
| ***River emissions*** | | | | | | | |
| 7 | Require infrastructure for shore-side power to be installed at wharves<br>**By 2030**<br>**Relevant measures: 5**<br>**Current RBG policy strength:** 1 | Negligible | <1 FTE to liaise with stakeholders | • Mix of frequency requirements among ships<br>Lack of ships fitted with compatible technology | • Loss of access to grid capacity if low demand from ships<br>• High electricity peak demand<br>• Potential need to fund upgrade in part or full to incentivise (estimated at up to £5m per site but highly uncertain)[128] | Ship operators, UKPN, PLA | Health – Improved air quality around wharves |
| 8 | Require ships to turn engines off or use anti-pollution technology while in berth<br>**By 2022/23**<br>**Relevant measures: 5**<br>**Current RBG policy strength:** 1 | Negligible | Negligible | Limited options for reducing emissions | Discourages river freight | Ship operators, PLA, wharf operators | Health – improved air quality |

[128] Based on $180 million invested by Californian government for upgrade of 25 berths and ports.

### 5.2.4 *Publicity campaign*

To enable and support delivery of the policies outlined in Sections 5.2.1 to 5.2.3, a major publicity and engagement campaign that targets all key stakeholders is recommended. To reach a wide audience and to clearly communicate the council's vision, the campaign should include an accessible and easy to understand webpage, a targeted social media campaign and visible borough-wide advertising. Community and business engagement events will also be crucial in order to reach as wide an audience as possible.

The key priorities should be to:

- **Outline the Council's ambition and delivery strategy**, including all measures being taken and how the relevant stakeholders will potentially be affected (such as businesses, residents, visitors to the borough, logistics companies etc).
- **Describe the low carbon technology and behaviour change options available** to relevant groups that can help to deliver the Council's ambition. Links to supportive measures such as the behaviour change campaign and the One Stop shop should be incorporated to help empower groups to make informed choices.
- **Advertise and describe the different schemes and initiatives available** to help different groups transition to low carbon options. This should include both external schemes (such as the TfL scrappage scheme for vans, European funding schemes for modal shift in logistics, and ECO funding for eligible residents) and all initiatives directly resulting from the measures implemented through the campaign (such as, grants or loans for vehicles and buildings, telematics services for fleets and joint procurement opportunities for fleets). This ensures that individuals and businesses are aware of the full costs after incentive schemes have been accounted for and provides a means of targeting harder to reach groups who may be difficult to contact through traditional channels.
- **Provide details and maps** of key infrastructure including charge points, car clubs, other shared mobility schemes and cycling routes across the borough.

A suggested timeline for the publicity campaign could consist of three key periods:

**Initial setup (6 months):** Focusing on brand development, website design, website content preparation and stakeholder engagement planning, with supporting social media and marketing presence. This stage is estimated to cost in the region of £300,000 – 400,000.[129]

**2020-2025:** While RBG's strategy is in development and during the early phases of rollout, marketing, social media presence and stakeholder engagement activities will be the most intensive. Progress against targets will need to be monitored and fed-back into the communication strategy, and website information will need to be continuously kept up to date. The cost of these activities is estimated to be in the region of £150,000-300,000 per year over 5 years.

**2025-2030:** Stakeholder engagement and community events are expected to be less frequent during this period, with costs mainly associated with maintaining up to date website information and monitoring progress. Costs may be expected to reduce to closer to £50,000 – 100,000 per year.

Resourcing of 3-5 FTE is already accounted for in the One stop shop, and 1 FTE is already allocated to the behaviour change campaign. While external providers may be used to create content and manage website and media presence, at least 1 FTE will be required throughout the period from now to 2030 to manage the campaign, with up to 1 additional FTE during the most intense period of engagement (2020-2025).

[129] Based on Element Energy experience for a local authority campaign.

### 5.2.5 *Actions to address embedded emissions*

As outlined in Figure 4-1 (page 43), embedded (Scope 3) emissions include all those associated with products and services supplied to the borough – often referred to as 'consumption-based emissions' – as well as travel outside the borough by residents and employees, and investments held by the council. Since London has a primarily consumption-based emissions profile,[130] actions to address these emissions have great importance. While the embedded emissions in products and services consumed by residents and businesses are largely out of RBG's control, there are a range of actions that RBG can take to reduce embedded emissions in the products and services the council itself procures, and some supporting actions that it can take to influence embedded emissions more widely. As described further below, these include supporting sustainable land use, reducing the embedded emissions of products and services, reducing the embedded emissions of buildings and committing to divestment away from funds that support fossil fuel industries.

**Land use**

Net storage of carbon by trees and carbon-rich ecosystems is recognised as playing an important role in climate change mitigation, as well as providing co-benefits of flood protection and temperature regulation within cities. Greenwich currently has more than 50 parks and green spaces, including the Royal Arsenal Gardens located on former industrial land. Preservation and potential extension of these spaces is a necessary means of contributing to carbon sequestration within the borough.

Outside the borough, RBG can contribute to forestation and restoration projects through offsetting measures or through initiatives such as the Cities4Forests programme[131].

**Products and services**

Food and drink contributed to almost 10% of London's consumption-based emissions in 2010.[132] Addressing the embedded emissions of agriculture and land use outside the borough as well as those of transporting goods are important actions that RBG can take.

Cities and local authorities can take action to address embedded agricultural emissions through promoting healthier, more plant-based diets, and reducing food waste. For example, beef and dairy was estimated to contribute to 40% of consumption emissions in the city of Copenhagen, and these emissions are being addressed through procurement practices that favour lower beef and dairy consumption and high environmental standards.[130] The London Food Strategy states the Mayor's aim to reduce food waste by 50% by 2030 and encourages boroughs to tackle food waste and food surplus and to increase the amount of local, seasonal and sustainable food they buy.

Embedded emissions in the transportation of goods will partially be addressed through favouring low carbon transport within the borough, as outlined in Section 5.2.2. Widening procurement requirements to consider the whole transport chain will further address these emissions.

**Buildings**

Low carbon construction practices that focus on the use of timber and recycled materials can reduce the embedded emissions of buildings by 10-20% with no additional cost, but have been demonstrated to achieve up to 80% reductions for individual projects.[130] In addition to reducing embedded carbon, procurement that supports low carbon construction for local projects can also deliver co-benefits of driving the supply chain, influencing land use (for timber supply) and reducing transport and construction-based direct emissions within the borough.

[130] *City consumption: The new opportunity for climate action* (2018) Green Alliance
[131] https://cities4forests.com/about/
[132]https://www.london.gov.uk/sites/default/files/assessing_londons_indirect_carbon_emissions_2010_2014.pdf

**Divestment of pension funds**

The Mayor has committed to divestment of pension funds away from fossil fuels and towards clean energy projects.[133] To achieve this, the London Pension Fund Authority (LPFA) has agreed a climate change policy that sets out its commitment to no longer consider new investments in companies involved in oil, coal and gas extraction and to divest existing assets away where possible.[134] Several London boroughs, including Waltham Forest, Southwark, Hackney and Hammersmith & Fulham have also announced their intentions to divest their pension funds. However, it is acknowledged that this is challenging to achieve for many boroughs, since some of their assets are invested through the London Collective Investment Vehicle (CIV),[135] including RBG.

To enable more cities and local authorities to divest, the Mayor is co-chairing the C40 Cities Divest/Invest Forum to share knowledge and best practice.[136]

**Recommended actions**

Carrying out an assessment to fully understand the scale and main sources of Scope 3 emissions for the borough is an important first step to inform RBG's strategy going forward. Further actions that RBG can take are summarised in Table 5-5.

**Table 5-5 High-level summary of actions that RBG can take to address embedded emissions**

| Target sector | Actions |
|---|---|
| **Land use** | • Preserve green spaces within the borough and consider expanding or creating new space<br>• Consider supporting forestation or peatland restoration projects elsewhere within the UK, potentially through offsetting measures |
| **Products and services** | • Reduce food waste within the borough in line with the Mayor's target of 50% by 2030<br>• Promote healthier, plant-based diets through behaviour change campaigns, community engagement and through council procurement practices<br>• Commit to the highest standards of environmental practices in procurement and favour local, seasonal goods<br>• Require low carbon transport throughout the supply chain of goods and services |
| **Buildings** | • Support low carbon construction for local projects |
| **Investments** | • Work with the pension fund provider to develop a climate change policy that actively seeks divestment away from fossil fuels<br>• Work with CIV, together with other London boroughs, to promote divestment of pooled investments |

[133] https://www.london.gov.uk/what-we-do/environment/climate-change/zero-carbon-london/divestment-and-green-investment
[134] LPFA Climate Change Policy
[135] Waltham Forest news item July 2019
[136] https://www.c40.org/press_releases/fossil-fuel-divestment-city-partnership-network

# 6 Action plan & recommendations

## 6.1 Timeline

Following its declaration of Climate Emergency, the Royal Borough of Greenwich has committed to making the borough carbon neutral by 2030. This reflects a substantially accelerated timeline for emissions reduction relative to the UK Government's target for the UK as a whole to achieve carbon neutrality by 2050.

Meeting RBG's ambition of becoming carbon neutral by 2030 will require commitment to a wide range of ambitious actions that go beyond current national policies and are likely to entail greater cost and additional risk to the council. This will rely on coordinated action from RBG, businesses, communities, other boroughs, GLA, TfL and national government.

Due to the urgency of the required emissions reductions, **RBG must take substantive action now** to put the council in a strong position to reach carbon neutrality; however, to support an informed decision on RBG's long-term strategy, further information regarding technology performance, developments in national policy and consumer response to policies and technologies is needed. Short-term actions should therefore focus on those that both support substantial emissions reduction and serve to build an evidence base of the effectiveness and feasibility of more ambitious policy solutions.

**The short-term, priority actions we have identified for RBG** include those which are relatively low cost, provide relatively large benefits, and do not involve hard trade-offs with other policy objectives. These actions aim to keep options open where possible so that RBG's strategy can adapt in response to external changes, such as changes to the national policy environment and technology learning. In addition, learnings through small-scale trials and studies will put RBG in a better position to make decisions which may involve more significant trade-offs (between carbon emissions savings, cost, consumer/citizen choice and so on).

For RBG to meet its 2030 ambition, **decisions will need to be taken by 2023 at the latest** on the level of ambition of RBG's long-term strategy and the precise form of the policies that will be put in place

## 6.2 Options appraisal summaries

To define the level of ambition of the policies listed in section 5, each policy was assessed on five central criteria:

1. **Costs, resources and funding requirements:** Total costs estimated to be less than £100,000 over the full time period of policy implementation were considered 'low'. Costs to the council between £100,000 and £20 million are considered 'medium' where significant external funding is not available, as are capital investments greater than this which can be expected to be recovered through revenue generation for the council, or which provide valuable assets (e.g. new LA owed homes). It is important to note that this method of assigning costs means that several policies, such as retrofitting all LA owned homes and public buildings to a high level of energy efficiency, have high outright capital costs (£85 million) but are nevertheless judged 'medium' based on the potential for costs to be recouped over the long term. Outright costs to the council greater than several £20 million without clear potential for revenue generation or a valuable resulting asset for the council are considered 'high'.
2. **Deliverability:** Deliverability was primarily determined by the level of council control, according to the following categories:
    - Areas RBG directly controls – **High deliverability**
    - Areas RBG can mandate or strongly influence through policy – **Medium deliverability**
    - Areas RBG can enable through funding – **Medium deliverability**
    - Areas RBG can influence locally (and via key stakeholders) – **Low deliverability**

- Areas RBG can influence or ask for nationally (and via key stakeholders) – **Low deliverability**

However, where clear barriers exist which significantly reduce the deliverability of a policy then the assignment was revised down.

3. **Co-benefits:** The strength of co-benefits associated with each policy was assessed, with particular emphasis placed on those co-benefits which align with the council's high-level priorities as set out in the corporate plan[137]. The co-benefits identified are categorised in Section 5.2 under the themes 'Health', 'Economic' and 'Equity'. Consideration is given both to the type of co-benefit and to the likely scale of benefit associated with a successful delivery of each policy.

4. **Risks:** Overall risk ratings were assigned by consideration of the risk of a policy not achieving its goal, the risk of negative effects on other council objectives regardless of whether a policy achieves its goal, and risks to capital associated with large investments. For actions primarily involving lobbying, the primary risk considered is the risk and likelihood of the action not achieving the policy outcome, rather than the inherent risk to the council of lobbying itself (which is low).

5. **$CO_2$ impact:** We have assigned a semi-quantitative $CO_2$ impact score based on the estimated effect of each policy. This score cannot be fully quantitative since, while measures have associated modelled $CO_2$ savings, several policies contribute to a single measure and the contribution of each policy towards the total savings of the relevant measure is uncertain. In order to draw a distinction between policies, we have broadly estimated the scale of the contribution; any policy we feel contributes savings on the order of 10kt $CO_2$ per year or above is labelled 'high'. The distinction between 'low' and 'medium' is a qualitative one, based on estimating the likely scale of impact, although we used a guiding threshold value of 3kt $CO_2$ for the maximum 'low' emissions savings per year. Policies are assigned an 'enabling' $CO_2$ impact when do not in themselves create a 'medium' or 'high' emissions savings but are required for the completion of a separate action which does create such savings.

The assessment of each policy against these criteria is summarised in Table 6-1,Table 6-2 and Table 6-3. Actions identified as priority actions, either in full or in part, are highlighted in these tables.

[137] Royal Borough of Greenwich, corporate plan 2018-2022, available at (accessed 13/11/2019) https://www.royalgreenwich.gov.uk/info/200222/policies_and_plans/748/corporate_plan_-_our_vision_and_priorities

**Table 6-1 Buildings options appraisal summary**

| No | Policy | Cost & resource | Delivera -bility | Risks | Co-benefits | $CO_2$ impact | Priority action |
|---|---|---|---|---|---|---|---|
| 1 | Set up a 'One-stop shop' for energy efficiency and low carbon heating | Medium | High | Low | High | Enabling | Yes |
| 2 | Liaise with the GLA's Energy for Londoners team and in particular the Energy for Londoners Supply Company (EfLSCo) during its setup and operation, such that with help from the boroughs it might take on part of the 'One-stop Shop' role described above | Low | High | Medium | Medium | Enabling | Yes |
| 3 | Run a major publicity campaign covering all aspects of the net zero plan | Medium | High | Low | Medium | Enabling | Yes |
| 4 | Explore opportunities to raise new build non-domestic carbon emissions standards above the NPPF | Low | Medium | Low | High | Low | Yes |
| 5 | Initiate exemplar new build projects of LA owned or partially LA owned housing at a very high standard of energy efficiency | Medium | High | Medium | High | Enabling | Yes |
| 6 | Initiate 10 whole house net zero energy retrofits on existing social housing as a pilot project, following the 'Energiesprong' approach | Medium | High | Medium | High | Enabling | Yes |
| 7 | Retrofit all existing local authority owned homes and public buildings to EPC C+ energy efficiency standard. | Medium | High | Low | High | Medium | Yes |
| 8 | Lobby national government to increase the landlord Minimum Energy Efficiency Standard (MEES) obligation and consider reformulating it as a carbon standard | Low | Medium | High | Low | Low | Yes |
| 9 | Mandate carbon emissions standards for privately rented homes and provide associated financial aid for landlords in the form of grants. | High | Low | Medium | Low | Medium | No |
| 10 | Offer concessionary low interest loans by partnering through banks and/or building societies, to support domestic and non-domestic energy efficiency retrofits and heat pump installations | High | High | Low | Medium | High | No |

| No | Policy | Cost & resource | Delivera -bility | Risks | Co-benefits | $CO_2$ impact | Priority action |
|---|---|---|---|---|---|---|---|
| 11 | Directly fund 50% grants for energy efficiency retrofits for owner occupied homes. | High | Medium | Medium | Low | High | No |
| 12 | Initiate low carbon heat network schemes in cost effective and heat density appropriate locations, acting alone or in a public-private partnership | High | Medium | Medium | Medium | Enabling | Yes |
| 13 | Update the Local Plan to state that no new gas CHP used to supply heat networks can be built in Greenwich from 2021. | Low | Medium | Medium | High | Medium | Yes |
| 14 | Work towards a mandatory connection policy where a heat network is available, via the Local Plan through 'heat zoning' | Low | Medium | Medium | Medium | Medium | Yes |
| 15 | Promote industrial heat recovery by encouraging and supporting applications from local industries to the government's 'Industrial Heat Recovery Support Programme' | Low | High | Medium | Medium | Low | No |
| 16 | Lobby national government for highly tightened $CO_2$ standards for new builds | Low | Low | High | High | Medium | No |
| 17 | Lobby national government for significantly tightened $CO_2$ emissions standards for heating system replacements in existing buildings | Low | Low | High | High | High | No |
| 18 | Heat pump installer training and quality assurance scheme, operating through the 'One-stop Shop' | Low | High | Low | Low | Medium | Yes |
| 19 | Lobby the national government to design a more ambitious successor scheme for the Renewable Heat Incentive from 2021 | Low | Medium | Medium | Medium | Medium | No |
| 20 | Install low carbon heating systems in all LA owned homes and public buildings where not assigned to a heat network | High | High | Low | Medium | High | Yes |
| 21 | Offer "top-up" funding to the Renewable Heat Incentive and any national successor scheme (from 2021) for Greenwich residents and businesses | High | Medium | Medium | Medium | High | No |
| 22 | Phased program to replace all gas boilers with low carbon heating systems, including strong funding incentives | High | Medium | High | Medium | high | No |

**Table 6-2 Transport policy options appraisal summary**

| No | Policy | Cost & resource | Delivera-bility | Risk | Co-benefits | $CO_2$ impact | Priority action |
|---|---|---|---|---|---|---|---|
| 1 | Introduce banded resident parking permits in proportion to emissions impact | Low | High | Medium | Medium | Low | Yes |
| 2 | Introduce new and extended controlled parking zones | Medium | High | Low | Low | Medium | Yes |
| 3 | Explore introduction of workplace parking levy | Low | High | Medium | Low | Low | Yes |
| 4 | Reduce/remove on-street parking spaces in new developments, immediate | Low | High | Low | Low | Medium | Yes |
| 5 | Reallocate existing parking spaces to car clubs (extent depends on car club model) | Low | High | Low | Low | Medium | Yes |
| 6 | Reduce speed limits to 20mph on all residential roads and appropriate major roads | Medium | High | Low | Low | Low | Yes |
| 7 | Create ZE-only access to town centres for deliveries during peak hours | Medium | Medium | Medium | High | High | Feasibility |
| 8 | Extend planned Liveable Neighbourhoods to town centre ZEZs | Medium | Medium | Medium | High | High | Feasibility |
| 9 | Create borough-wide ZEZ for cars, LGVs and buses, ZE capable for HGVs | High | Low | High | High | High | No |
| 10 | Strategic closing of local roads to motorised vehicles fully implement | Medium | High | Medium | High | Medium | No |
| 11 | Increase provision of both public access and business EV charge points | Medium | Medium | Low | Medium | High | Yes |
| 12 | Expand use of Permitted Development rights for installing charge points to rapid charge points and hubs | Low | High | Low | Low | Medium | Yes |
| 13 | Create new strategic river crossings suitable for pedestrians and cyclists | High | Low | Medium | Medium | Medium | Feasibility |
| 14 | Create new and improved cycle network through the borough | High | Medium | Medium | High | Medium | Yes |
| 15 | Improvement of walking routes in town centres | Medium | High | Low | High | Low | Yes |
| 16 | Increase provision of bike hangars for residents and high quality long-stay cycle parking at key transport hubs | Medium | High | Low | Medium | Low | Yes |

| No | Policy | Cost & resource | Delivera-bility | Risk | Co-benefits | $CO_2$ impact | Priority action |
|---|---|---|---|---|---|---|---|
| 17 | Provide grants for ULEV purchase among residents and local businesses | High | Medium | Medium | Medium | High | No |
| 18 | Provide interest-free loans for ULEV purchases among residents | High | High | Medium | High | High | No |
| 19 | Provide public transport mobility credit and scrappage scheme for low income residents | Medium | Medium | Medium | Medium | High | No |
| 20 | Provide grants for residents for purchase of ebikes | Medium | Medium | Medium | Medium | Low | No |
| 21 | Provide cargobike hire for residents and SMEs | Low | Medium | Low | High | Low | No |
| 22 | Provide subsidised telematics service for local van users | Low | High | Low | Low | Medium | Yes |
| 23 | Build on personalised travel planning experience to create behaviour change campaign | Medium | High | Low | Medium | Low | No |
| 24 | Fund community schemes that promote active travel | Medium | High | Low | Medium | Low | No |
| 25 | Support pick-up and drop-off points for parcel delivery immediate | Low | Medium | Low | Medium | Low | No |
| 26 | Support/encourage formation of one or more Business Improvement Districts | Low | Medium | Medium | Low | Enabling | Yes |
| 27 | Investigate feasibility of establishing consolidation and microconsolidation centres in existing areas of high delivery activity and within new developments/opportunity areas, including combining rail/river freight with last-mile delivery where appropriate. | Low | Medium | Medium | Low | Medium | Yes |
| 28 | Work with car clubs to increase shared van offering for SMEs immediate | Low | Medium | Medium | Low | Low | No |
| 29 | Require car clubs to only offer EVs | Low | High | Medium | Low | Medium | No |
| 30 | Encourage employers to conduct travel surveys and review transport policies, working towards part or fully funded public transport where modal shift can be achieved | Low | High | Low | Low | Enabling | Yes |
| 31 | Convert RBG fleet to fully ZEV | Medium | Medium | Medium | Low | Medium | Start |
| 32 | Shift council deliveries to cycle freight where possible | Low | Medium | Low | Medium | Low | No |
| 33 | Implement large scale and/or joint procurement with other boroughs, councils and HGV fleets for ZE HGVs and vans to drive supply . | Low | Medium | Medium | Low | High | No |
| 34 | Require ULEV transport in council service tenders | Low | Medium | Medium | Low | Medium | No |

| No | Policy | Cost & resource | Delivera-bility | Risk | Co-benefits | $CO_2$ impact | Priority action |
|---|---|---|---|---|---|---|---|
| 35 | Lobby for ULEZ to be ZEZ for cars and vans | Low | Low | Medium | Low | High | No |
| 36 | Lobby for ULEZ to extend to portion of South circular within borough boundaries | Low | Low | Medium | Low | High | No |
| 37 | Engage with TfL and fleets to support the transition of emergency vehicles to ULEVs by 2030 | Low | Low | Low | Low | Low | Yes |
| 38 | Work with TfL and GLA to expand public transport network | Low | Medium | Low | Low | High | Yes |
| 39 | Lobby TfL to provide ULEV-only access for Silvertown and Blackwall tunnels | Low | Medium | Low | Low | High | Yes |
| 40 | Lobby TfL to allow for high quality cycle access at key river crossings, such as Silvertown tunnel | Low | Low | Medium | Low | Medium | Yes |
| 41 | Lobby City airport to convert to zero emissions technologies | Low | Low | Low | Low | Low | Yes |
| 42 | Work with TfL and GLA to accelerate switch to ZE buses | Low | Low | Low | Low | High | Yes |

**Table 6-3 'Energy generation, industry, waste & other' options appraisal summary**

| No | Policy | Cost & resource | Delivera-bility | Risks | Co-benefits | $CO_2$ impact | Priority action |
|---|---|---|---|---|---|---|---|
| 1 | Invest in large-scale renewable energy generation projects | High | Medium | Medium | Low | High | No |
| 2 | Consider opportunities for the promotion of demand side response, energy storage and smart/flexible technologies | Low | Medium | Low | Low | Enabling | Yes |
| 3 | Offset remaining emissions | High | Medium | High | Medium | High | No |
| 4 | Set strict quantitative targets for waste reduction and increased recycling | Low | High | Low | Medium | Low | Yes |
| 5 | Consider instituting separate food waste collection and anaerobic digestion | Medium | High | Medium | Low | Low | Yes |
| 6 | Undertake baselining of RBGs direct emissions and organise/improve data on energy procurement | Low | High | Low | Medium | Enabling | Yes |
| 7 | Require infrastructure for shore-side power to be installed at wharves | Low | Medium | Medium | Medium | Low | No |
| 8 | Require ships to turn engines off or use anti-pollution technology while in berth | Low | Medium | Medium | High | Low | Feasibility |

## 6.3 Priority actions

### 6.3.1 Summary of priority actions

The identified priority actions include all those already included in part or in full in current RBG policy as well as further priority policies and feasibility assessments required to inform long-term strategy decisions.

The following actions have been identified as priority:

**Buildings**:

A. Set up a 'One-stop shop' for energy efficiency and low carbon heating
B. Liaise with the GLA's Energy for Londoners team and in particular the Energy for Londoners Supply Company (EfLSCo) during its setup and operation
C. Run a major publicity campaign covering all aspects of the net zero plan
D. Explore opportunities to raise new build non-domestic carbon emissions standards above the National Planning Policy Framework
E. Initiate exemplar new build projects of LA owned or partially LA owned housing at a very high standard of energy efficiency
F. Retrofit all existing local authority owned homes and public buildings to EPC C+ energy efficiency standard.
G. Initiate low carbon heat network schemes in cost effective and heat density appropriate locations, acting alone or in a public-private partnership
H. Update the Local Plan to state that no new gas CHP used to supply heat networks can be built in Greenwich from 2021
I. Heat pump installer training and quality assurance scheme, operating through the 'One-stop Shop'
J. Install low carbon heating systems in all LA owned homes and public buildings where not assigned to a heat network
K. Lobbying of national government: undertake all lobbying set out in Table 5-2

**Transport:**

L. Introducing banded resident parking permits in proportion to emissions impact
M. Introducing new and extended controlled parking zones
N. Introducing a workplace levy
O. Reducing/removing on-street parking spaces in new developments
P. Reallocating existing parking spaces to car clubs
Q. Reducing speed limits to 20mph on all residential roads and appropriate major roads
R. Increasing provision of both public access and business EV charge points
S. Increase use of Permitted Development rights for installing charge points
T. Creating new and improving existing cycle network infrastructure throughout the borough
U. Improvement of walking routes in town centres
V. Increasing provision of bike hangars for residents and at key transport hubs
W. Providing subsidised telematics service for local van users
X. Supporting/encouraging the formation of a BID
Y. Beginning to convert the RBG fleet to ZEVs where feasible
Z. Assessing the feasibility of ZEZs, access restrictions, consolidations opportunities and larger cycling infrastructure projects
AA. Encourage employers to conduct travel surveys and review transport policies to identify opportunities for modal shift
BB. Lobbying and working with stakeholders as outlined in Table 5-3, with a focus on policies that target improved public transport and cycling infrastructure networks and ZE technologies

**Energy generation, industry, waste & other sources:**

CC. Consider opportunities for the promotion of demand side response, energy storage and smart/flexible technologies
DD. Set strict quantitative targets for waste reduction and increased recycling
EE. Consider instituting separate food waste collection and anaerobic digestion
FF. Undertake baselining of RBG's direct emissions and organise/improve data on energy procurement
GG. Assess feasibility of requiring ships to turn engines off or use anti-pollution technology while in berth

### 6.3.2 Resources and funding for priority actions

The estimated RBG resourcing requirements (in FTE) and potential sources of funding for the priority actions are summarised in Table 6-4. A total of 21-38 FTE in addition to current RBG staff are estimated to be required to deliver all policies across all sectors; however, this represents the maximum that will be required at any one time and several of the required posts will be on a fixed, short-term basis. The average resourcing requirement over the whole period 2020-2023 is 12-17 FTE. The approximate expenditure associated with the set of priority actions is estimated at £160m over the three years[138], with £150m of this on the buildings sector and £10m on the transport sector. However, policies accounting for £140m of this expenditure have the opportunity for cost recovery through e.g. energy service plans. Of the estimated transport costs, £3.2m is already allocated in the Local Implementation Plan for Transport.

Longer-term funding options for more ambitious measures include those detailed in Table 6-4 as well as sources such as BEIS, UK Research and Innovation (UKRI) and Innovate UK funding calls. For example, the Industrial Challenge Strategy Fund can support actions to deliver Local Industrial Strategy.

**Table 6-4 Breakdown of estimated resources for priority actions across sectors, and potential funding sources**

| Sector | Project type | RBG resources (FTE) | Funding sources |
|---|---|---|---|
| **Buildings** | Energy efficiency | 3-5 | • Mayor of London's Energy Efficiency Fund (MEEF)[139]. The GLA RE:NEW programme can aid in procurement of this funding for homes and RE:FIT can aid for non-domestic buildings.<br>• RBG's existing carbon offset fund (small compared to the scale of public sector retrofits required)<br>• Warmer Homes scheme (GLA) – for low income residents<br>• Energy Company Obligation (ECO)[140]<br>• European funding (or UK replacement schemes post-Brexit)[141] |
| | Heat networks | 1-3 | • Heat Networks Delivery Unit (BEIS)[142] |

[138] Where an action continues past 2023, a fraction of the total cost is assigned according to the proportion of the total time period elapsed by 2023.
[139] A £500m fund over 20 years to invest in projects in the Local Authority, NHS, Registered Providers, Education (Higher and Further), Charity, Voluntary, ESCo and SME sectors.
[140] https://www.ofgem.gov.uk/environmental-programmes/eco
[141] Such as the European Regional Development Fund, to be replaced by a UK Shared Prosperity Fund following Brexit
[142] At least 67% of Techno-economic feasibility and Detailed Project Development for a large local district heating scheme can be funded this way

| | | | |
|---|---|---|---|
| | | | • Heat Networks Investment Project (HNIP)[143]<br>• The GLA's Decentralised Energy Enabling Project (DEEP)[144] |
| | Low carbon heating | 1-3 | • Renewable Heat incentive (RHI)[145]<br>• Cleaner heat Cashback (GLA) – for SMEs[146]<br>• Warmer Homes scheme (GLA) – for low income residents<br>• European funding (or UK replacement schemes post-Brexit) |
| | Communications | 3-6 | • Can be funded as part of wider funding scheme |
| **Transport** | Infrastructure | 9-13 | • On-street Residential Chargepoint Scheme (ORCS)<br>• Workplace Charging Scheme[147]<br>• LIP funding<br>• S106<br>• Council revenue (e.g. parking fines/permits)<br>• Liveable Neighbourhoods funding<br>• Mayor's Air Quality Fund<br>• European funding (or UK replacement schemes post-Brexit) |
| | Local schemes & policies | 2-4 | • LIP funding<br>• S106 |
| | Financial support | 0-1 | • Can be funded as part of wider funding scheme |
| **Waste & other** | Feasibility | 0 | N/A |
| | Local schemes & policies | 1-2 | N/A |
| **All** | Lobbying & collaboration | 1 | N/A |
| | **Total** | **21-38** | |

### 6.4 Action plan

The recommended timeline and RBG action plan across all sectors is summarised in the Figures below, alongside key relevant national and London-wide policy plans and milestones. It is expected that RBG will decide on its strategy for 2030 and beyond by 2023 at the latest, based on the learnings and evidence base developed through implementation of the priority actions between now and then. The least ambitious level of action for RBG shown is that required to align with London and national policy targets, reaching net zero by 2050. However, we note that this is far from a 'business-as-usual' scenario and will still entail a wide range of highly ambitious actions, albeit over a less accelerated timescale

[143] At the construction stage, capital grant and low interest loan support is available
[144] A £3.5 million project which funds non-capital work related to decentralised energy projects. Such work includes heat mapping/energy master planning, feasibility studies, business case development, procurement and commercialisation.
[145] Current scheme closes to applications in 2021 and future policy is uncertain
[146] 35% grant funding of new renewable heat installations; closes in 2020
[147] For eligible businesses, charities and public sector organisations

than required to achieve carbon neutrality by 2030. An important distinction between this case and the more ambitious scenarios is that it does not require Greenwich to go beyond the actions taken elsewhere in the country and could rely to a greater extent on national policy changes. The highest level of action, the Maximum ambition scenario, requires most or all of the actions listed in section 5.2, with emissions reductions in 2030 approaching the maximum achievable, likely at greater cost and additional risk to RBG.

**Figure 6-1 Schematic diagram showing the action plan and associated timeline**

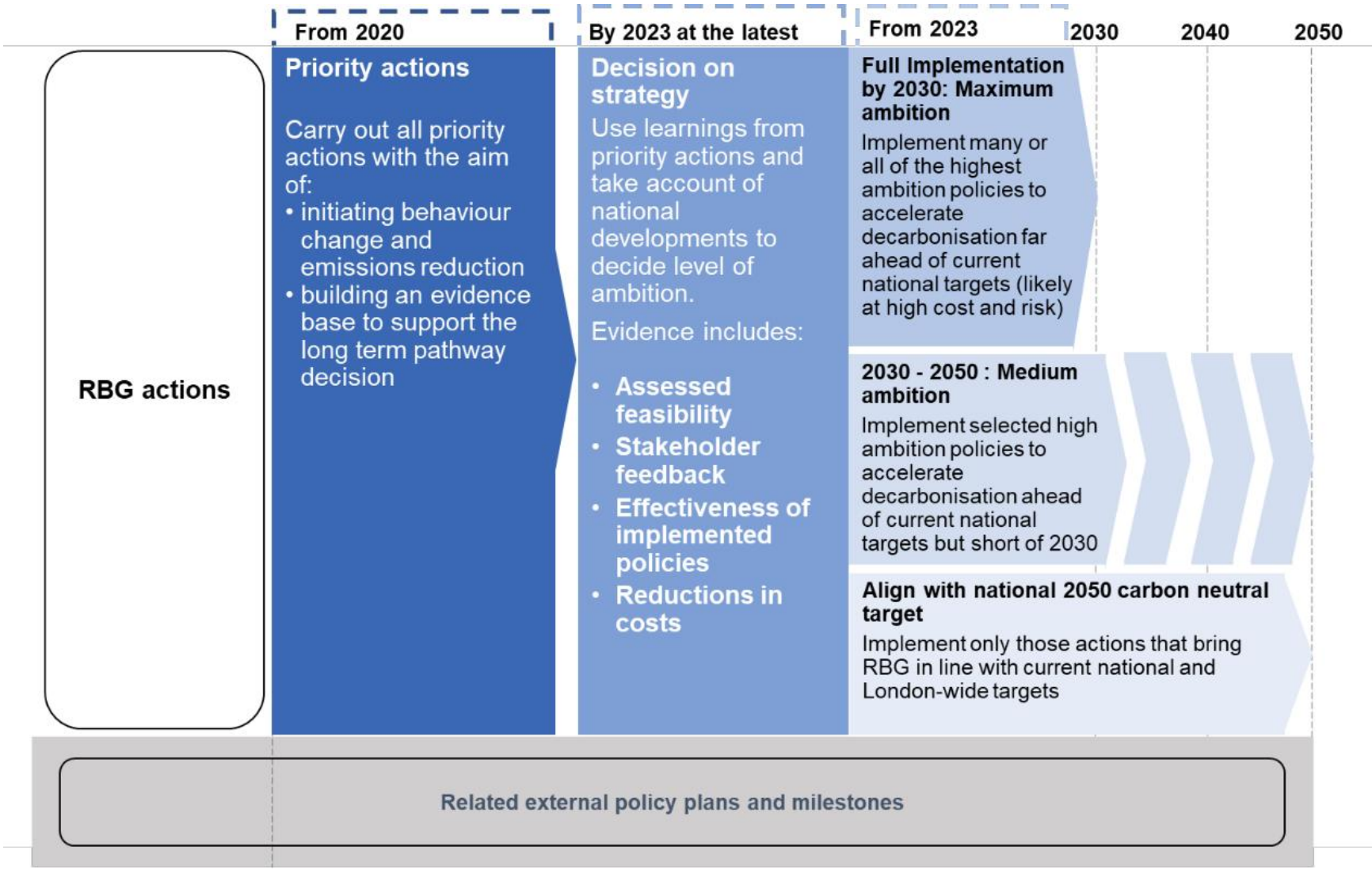


**Figure 6-2 Priority actions and key decision points for measures relating to emissions from buildings**

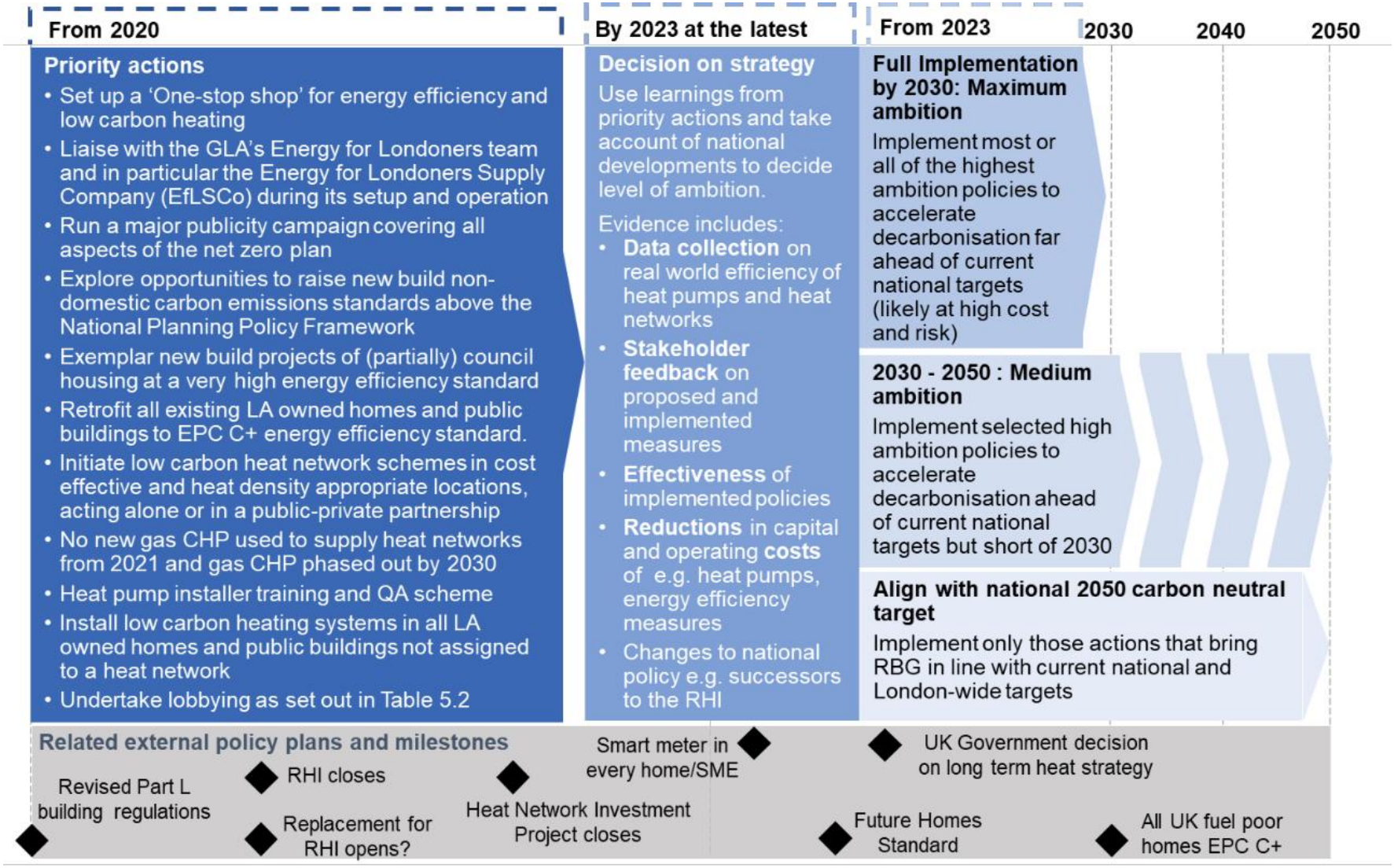


**Figure 6-3 Priority actions and key decision points for measures relating to transport**

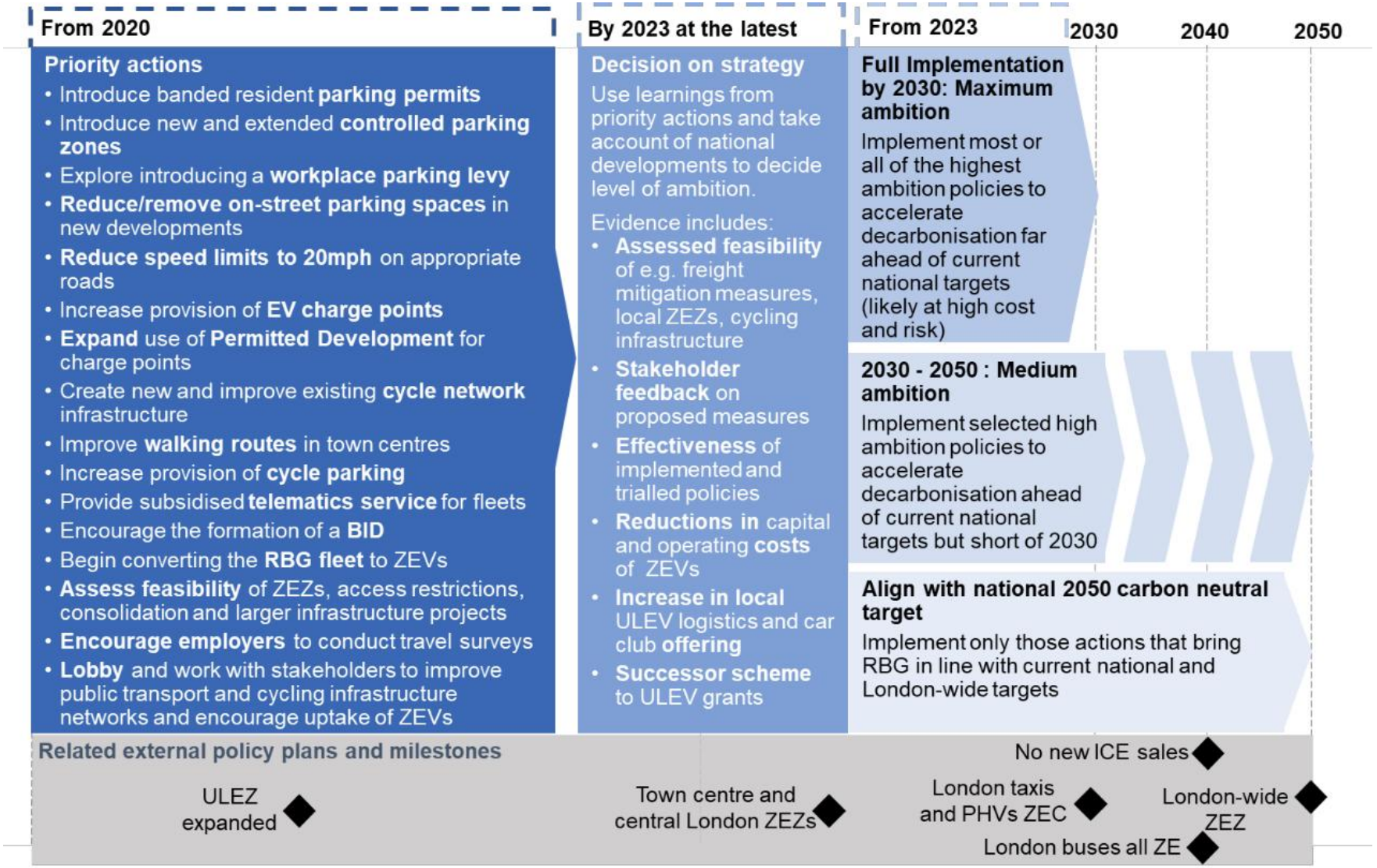
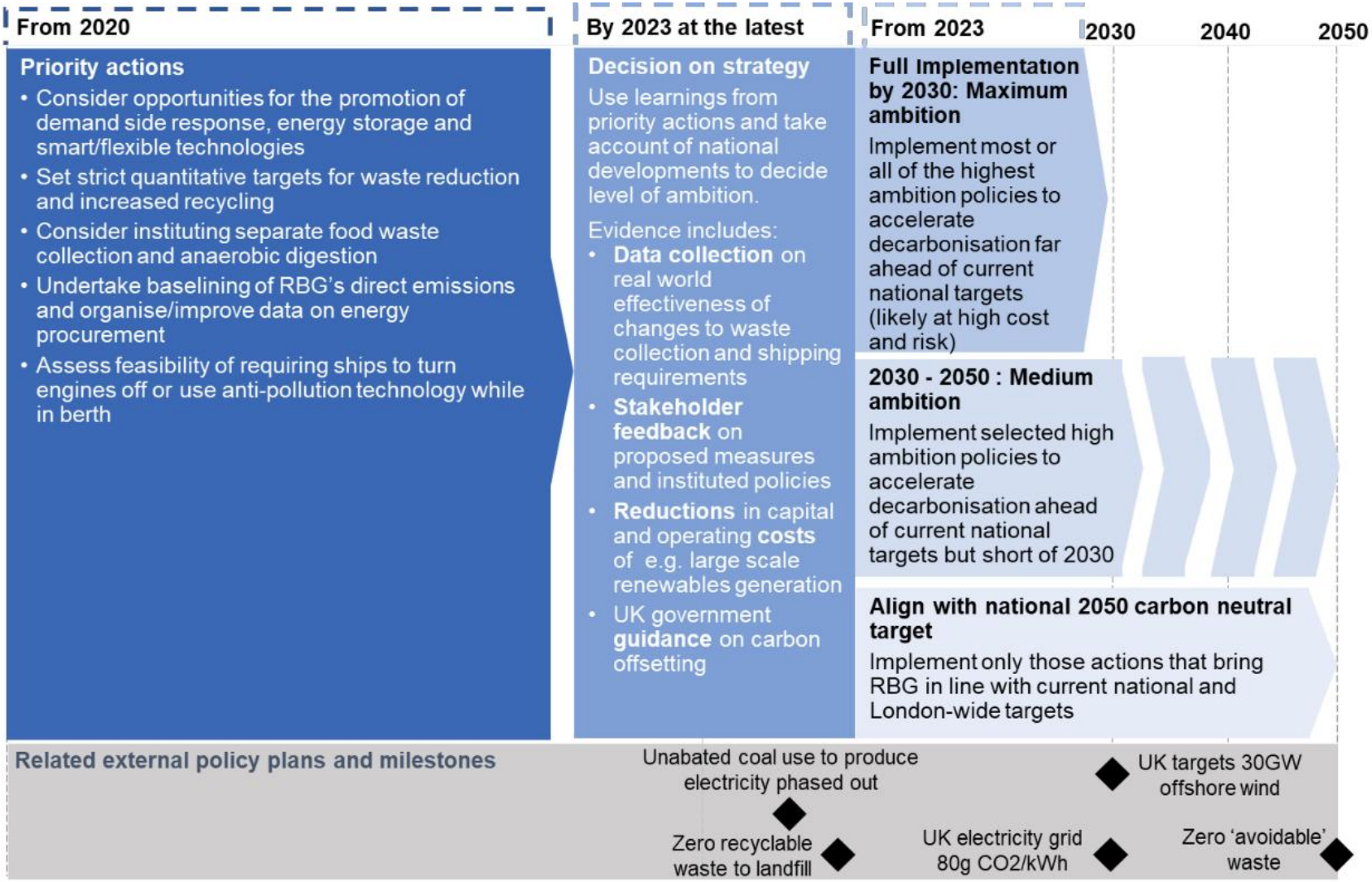


**Figure 6-4 Priority actions and key decision points for measures relating to energy generation, industry, waste & other sources**



# 7 Appendix

## 7.1 Modelling methodology

### Table 7-1 Summary of modelling methodology by sector

| ***Emissions Source*** | **Sub-sources** | **Modelling Approach** |
|---|---|---|
| *Buildings* | Tenure types, modelled at LSOA level, are as follows:<br>*Domestic*<br>• Owned outright<br>• Owned with mortgage<br>• Shared ownership<br>• Local authority owned<br>• Social housing association<br>• Private rented<br>*Non-domestic*<br>• Education<br>• Health<br>• Government<br>• SME Owned<br>• SME Rented<br>• Large Enterprise Owned<br>• Large Enterprise Rented | Existing GLA models (both spatial and non-spatial) used in the creation of the EE report *Low Carbon Energy Systems* were leveraged and adapted to Greenwich.<br><br>Data on the number and mix of buildings in Greenwich is taken directly from the GLA models. The number of buildings (total and in each tenure) can be further refined with data on Council homes and RBG Corporate buildings.<br><br>Measures included in the modelling:<br>*Demand side –*<br>• Energy efficiency retrofits<br>• Low energy lighting and appliances<br>• Higher new building energy/emissions standards<br>• Smart controls<br><br>*Supply side –*<br>• Deployment of heat pumps and hybrid heat pumps (including consideration of tenure type and energy efficiency standards)<br>• Heat networks (modelled spatially, considering appropriate heat sources in the borough)<br>• Green gas/hydrogen |
| *Transport* | Vehicle types included:<br>• Road vehicles<br>  ○ Cars<br>  ○ Motorcycles<br>  ○ Light goods<br>  ○ Heavy goods<br>  ○ Buses and coaches<br>  ○ Other vehicles<br>• Trains<br>• Aviation | Road transport is modelled by using the existing GLA model of Transport emissions projections at the London-wide level, and deriving the share of emissions in Greenwich, by vehicle type, from London Atmospheric Emissions Inventory 2016 (LAEI) data giving vehicle activity in kilometers travelled. Fleet stock projections are used in line with the London wide predictions made in the existing GLA model.<br><br>Rail emissions data are extracted at a Greenwich level from Transport for London modelling.<br><br>Aviation emissions are modelled as in the Zero Carbon Model (ZCM): The London-wide total is divided between boroughs according to aviation emissions data in the LAEI. The LAEI data is calculated based on airport activity in the borough, including flight paths during take-off and landing. |
| *Industry* | • Large Industrial<br>• Small Industrial<br>• River<br>• Non-road mobile machinery | Large and small industry are modelled as in the ZCM, in which borough level data is taken from a Ricardo AEA study.<br><br>RBG is to supply maps of businesses and detailed data on the type and number of businesses is available from |

| | | |
|---|---|---|
| | | the NOMIS data store. The potential for refining industrial emissions using this information will be considered.<br><br>River and Non-road mobile machinery will be included in a similar way as for aviation above. The London wide total is extracted from the ZCM and LAEI data is used to assign a proportion to Greenwich. |
| *Energy Generation* | • Solar PV | Energy generation by solar PV is extracted from the GLA solar model at borough level. For the purpose of visualising the results, it is then subtracted from the electricity use by buildings category. |
| *Embedded Carbon of products and services* | • Products and services used by residents and visitors to the borough<br>• Those used in the course of RBG council operations. | Qualitative information on RBG's procurement strategy is provided and a comparison to best practice, along with recommendations for possible actions, will be completed. |
| *Waste* | • Landfill<br>• Recycling<br>• Incineration<br>• Food waste to compost<br>• Garden waste to compost | RBG has provided a figure for the total mass of waste collected 2018/19 and the shares going to landfill, recycling and incineration. Emissions are calculated based on projections for both the reduction of total waste collected and for the proportions assigned to different streams. Emissions factors are used to convert tonnes of waste to each stream to kg CO2eq. These factors are taken from BEIS/DEFRA 'Greenhouse gas reporting: conversion factors 2019'. |
| *Council pension fund investments* | | A comparison to best practice, along with recommendations for possible divestment opportunities, will be completed. |

Figure 7-1 shows the modelling process used to generate the Baseline and Maximum ambition scenarios. The boxes marked 'Input from GLA WP3' refer to existing models from previous Element Energy work for the Greater London Authority[148], as well as to the GLA's own 'heat models', which were leveraged in the creation of the new Greenwich Deployment model during this work. Figure 7-2 shows the interrelation between previous Element Energy and GLA models and the methodology which generated the 'Deployment' and 'Spatial Distribution' models. These models were leveraged during this work to generate modelling for Greenwich only.

[148] See the Element Energy report *London's Climate Action Plan: Zero Carbon Energy Systems*

**Figure 7-1 Schematic of modelling process**

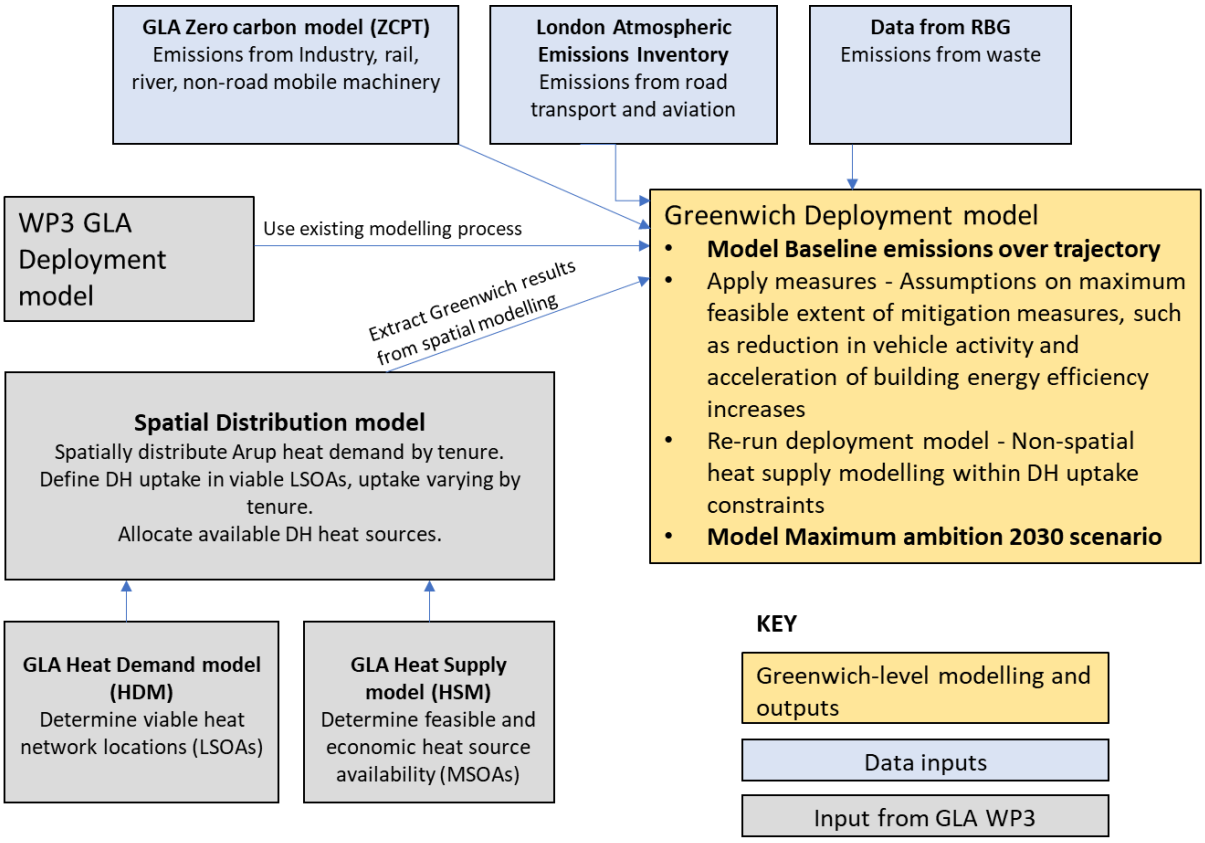


**Figure 7-2 Model map showing the modelling methodology used during the previous Element Energy project for the GLA**