Haringey Borough Council

Climate Action Haringey – Towards a Zero Carbon Future

Climate Emergency Scenario Report

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Abbreviations

ASHP	Air source heat pump
BEIS	Department for Business, Energy & Industrial Strategy
CCC	Committee on climate change
DHN	District heat network
DHW	Domestic hot water
EPC	Energy performance certificate
EV	Electric vehicle
GLA	Greater London Authority
IPCC	Intergovernmental Panel on Climate Change
LEGGI	London energy and greenhouse gas inventory
PV	Photovoltaic
TfL	Transport for London

Executive Summary

In June 2019 Arup completed a commission to prepare a route map for Haringey Council to guide the council's efforts to reduce carbon emissions in the borough to zero by 2050. The environment in which this work was done was changing, even as the work was underway: publication of the IPCC special report on global warming in 2018; the rising profile of Greta Thunberg and Extinction Rebellion; their protests and their separate demands for international action on climate change; the declaration by the UK Government of a climate emergency in May 2019 and its commitment to deliver net zero carbon emissions in the UK by 2050 in June 2019.

In this context, following the Council's declaration of a climate emergency in March 2019, Haringey Council asked Arup to revisit our modelling work to assess whether the zero-carbon target for the borough could be achieved sooner than 2050, and what courses of action the council should follow to achieve this acceleration of emissions reduction.

This report sets out a scenario by which carbon emissions from the Borough of Haringey could be rapidly reduced. The scenario is designed to be ambitious but bounded by realistic constraints, based on research, experience, and professional judgement.

In this report we refer to the 2050 Route Map scenario from the June 2019 report as the "2050 Scenario." The new scenario presented in this report is referred to as the "Climate Emergency Scenario."

Throughout this report it is assumed that the carbon emission trajectory will only go as low as around 10% of the 2005 baseline, being as low as can be achieved given the constraints of the model, and the current government projections for national infrastructure futures. Offsetting and/or carbon capture will be required to reach zero.

To determine how fast emissions can be reduced in the Climate Emergency Scenario, we focus on the following four levers, as they impact the majority of emissions:

- Building demand for heat and power (retrofit)
- Heating supply technology (new build and retrofit)
- Transport demand (mode shift)
- Transport technology (fuel shift)

Under the Climate Emergency Scenario, the total number of retrofits achieved by 2035 remains the same as under the 2050 Scenario: 18,000 council owned homes and 86,000 privately owned homes, including 10,000 socially rented, and 32,000 privately rented properties. It assumes by 2026, a peak installation rate of 1,500 and 6,000 homes/year for council and privately-owned homes respectively. However, the change under the Climate Emergency Scenario is that the minimum energy efficiency rating is EPC B, up from EPC C under the 2050 Scenario.

The Climate Emergency Scenario for the non-domestic sector follows the same pattern as for domestic retrofit: the number and rate of retrofits remains the same as under the 2050 Scenario (4,500 buildings by 2035) but the target standard is raised from EPC C to EPC B.

A significant factor to the carbon emissions attributed to domestic buildings is the choice of heating supply technology. The Climate Emergency Scenario requires the share of gas boilers and electric heating (excluding heat pumps) to be much lower than under the 2050 Scenario. We have adopted a target of 10% of homes supplied from gas and direct electric by 2050, instead of 30% as in the 2050 Scenario. Nearly all the remaining homes will be served by heat pumps and low carbon district heating. This will require an average low carbon heat technology installation rate of 2,300 homes/year.

Under the Climate Emergency Scenario, Haringey residents would reduce the number of journeys made by petrol and diesel vehicles at a much faster rate compared to the 2050 Scenario: the number of petrol/diesel journeys would be halved by 2024, compared with 2032 under the 2050 Scenario.

This dramatic shift would be achieved by a combination of mode shift (away from cars) and fuel switching (to EVs and fuel cell vehicles). Under the Climate Emergency Scenario, the number of rail journeys is 9% higher by

2030 than under the 2050 Scenario and 17% higher by 2041. Meanwhile, uptake of electric vehicles (EVs) for private, commercial and public use is also accelerated: By 2030, almost twice the number of EVs are on Haringey's roads as under the 2050 Scenario.

Under the Climate Emergency Scenario , carbon emissions in the borough of Haringey follow the trajectory shown in Figure 1 below. Under this scenario, emissions fall by 80% of 2015 emissions by 2030, and by 90% by 2037. Beyond 2037, the available local measures are largely exhausted, with the shallow downward curve achieved mainly through the continuing reduction in the carbon intensity of the electricity grid. We therefore conclude that 2037 could be chosen as the "zero carbon" target year. These carbon reduction percentages are calculated with reference to a 2005 baseline, consistent with Haringey's Annual Carbon Reports.

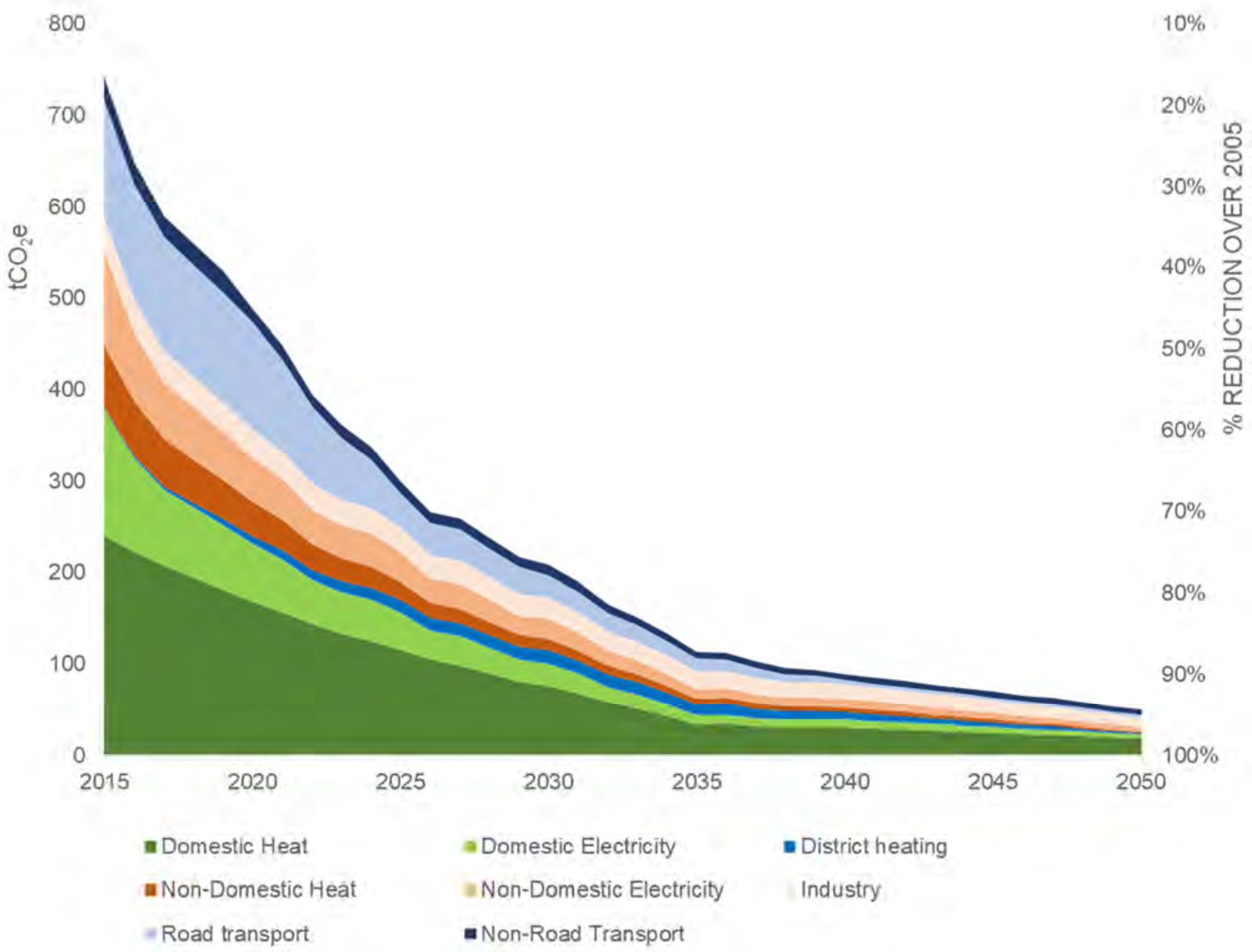

Figure 1 Climate Emergency Scenario carbon emissions trajectory

A 13-year acceleration is a significant improvement on 2050, especially when measured in terms of total emissions, where the steep decline in the early years brings a more dramatic reduction in total carbon emissions. Under the Climate Emergency Scenario, the total saving in cumulative carbon emissions over the period 2015 to 2050 is 3.2MtCO_2e, or a 28% reduction in total emissions compared with the 2050 Scenario trajectory.

The zero-carbon route map set out in the June 2019 report represents a highly ambitious – one may say unprecedented – programme of change for Haringey. The 2037 route map indicated under this Climate Emergency Scenario aims even higher. Notwithstanding the clear and compelling science basis to justify this level of ambition, an accelerated agenda for change will face a variety of additional uncertainties and barriers, including:

- Actual versus modelled emissions in recent years
- Rate of decarbonisation of the electricity grid

- National ambition
- Scale of ambition
- Cost and quality impact from acceleration
- Technology development
- Size and quality of the supply chain
- The right technology choices in a context of uncertainty
- Carbon intensity of national infrastructure
- Inverse incentives and conflicting priorities
- Absence of tools to mandate change
- Absence of tools to support change
- Costs, payback and funding mechanisms
- Residual emissions

These barriers and uncertainties will need to be addressed through a sustained consensus and commitment to direct substantial human and physical capital for climate action, and this in turn will need the full support and participation of Haringey's communities and businesses.

1 Introduction

In June 2019 Arup completed a commission to prepare a route map for Haringey Council to guide the council's efforts to reduce carbon emissions in the borough to zero by 2050. The environment in which this work was done was changing, even as the work was underway: publication of the IPCC special report on global warming in 2018, the rising profile of Greta Thunberg and Extinction Rebellion, their protests and their separate demands for international action on climate change, declaration by the UK government of a climate emergency in May 2019 and commitment to deliver net zero carbon emissions in the UK by 2050 in June 2019.

In this context, following declaration of a climate emergency in March 2019, Haringey Council asked Arup to revisit our modelling work to assess whether the zero-carbon target for the borough could be achieved sooner than 2050, and what course/s of action the council should follow to achieve this acceleration of emissions reduction.

This brief report is a summary of that work. The report is a companion piece to the June 2019 Route Map report and should be read in that context. It is the result of a rapid assessment based on adjustments to the previous modelling and analysis, rather than a fresh modelling and analysis exercise. The conclusions presented in this report are therefore indicative and rely greatly on professional judgement about the feasibility of accelerating measures to reduce emissions. Relevant assumptions and evidence for our conclusions are made explicit in this report.

We conclude that the borough's carbon emissions could be reduced very drastically, very quickly, but the barriers and challenges to acceleration are significant. We consider the acceleration scenario to be ambitious but achievable in terms of available technology and the potential impact of the identified measures. The challenges relate largely to other drivers (or inhibitors) of change: finance, leadership, human resources, behaviour and the "buy-in" of businesses and communities in the borough. The acceleration scenario represents – even more than the previous 2050 route map – a profound change in the pace and commitment of change.

Purpose and content of this report

This report sets out a scenario by which carbon emissions from the Borough of Haringey could be rapidly reduced. The scenario is designed to be ambitious but bounded by realistic constraints, based on research, experience, and professional judgement, within the limits of the time and resources available.

The report identifies a year by which carbon emissions from the borough might reach zero (or nearly zero) and provides a summary of how Haringey Council should support delivery of the scenario, the challenges that exist and areas of uncertainty.

Much of the background work and analysis is contained in Arup's previous reports. This report should be read in conjunction with those previous reports:

- Zero Carbon Haringey: Stage 1 Technical Report, Issue 2, 18 March 2018
- Zero Carbon Haringey: Direction of Travel, Issue, 18 March 2018
- Climate Action Haringey: Towards a zero-carbon future, Final report, 14 June 2019

Approach

The numbers presented in this report are largely based on material derived from the GLA's Zero Carbon Pathway Tool, as adapted for Haringey in phase one of the Climate Action Haringey project.

Previous analysis of carbon emissions identified buildings and transport as the main sources of carbon emissions in Haringey.

The Zero Carbon model and its inputs were reviewed to understand how carbon emission reductions were delivered by the model and identify the levers available that change the outputs.

A scenario was then developed that describes a rate of change for each lever that could combine to deliver a consequential accelerated reduction in carbon emissions. The scenario components were tested through research, review and logic to determine their practicality.

Target dates for interventions were chosen as compromise between carbon benefit and deliverability. Faster interventions with sooner targets will deliver greater carbon emission reductions, both annually and cumulatively, for the good of all, while at the same time faster, sooner targets push the limits of deliverability.

The scenario definition was then used to revise the input data values to the Zero Carbon Model and in turn, determine the maximum practical rate of carbon emission reduction and the time required to reduce carbon emissions in the borough to zero.

This report does not cover every action that will deliver emission reductions. Rather, it highlights the ones that can deliver the biggest reductions in the short term.

In this report we refer to the 2050 Route Map scenario from the June 2019 report as the “2050 Scenario”. The new scenario presented in this report is referred to as the “Climate Emergency Scenario”.

Note on model & data

Our modelling is based on the Greater London Authority’s (GLA’s) Zero Carbon Pathway Tool. The tool is designed as a sector-based analysis of energy consumption and carbon emissions in London. It has been adapted to the specifics of Haringey, where Haringey specific datasets exist. Otherwise it represents the Haringey proportion (around 2%) of London’s emissions for each appropriate sector.

The GLA tool takes inputs from unlinked, external models for buildings, heat networks, solar PV deployment, transport and industry. The detailed internal working of these models is not available for review, although outputs are provided by most models at the MSOA level.[1] The transport model outputs are a single figure for borough-wide emissions for 10 different types of transport (eg. petrol/diesel car, HGV, TfL bus etc). The industry model outputs are a single figure for each of gas and electricity consumption in the borough.

Previous work on the Zero Carbon Haringey project used 2015 London Energy and Greenhouse Gas Inventory (LEGGI) data, which was published in December 2017. We have continued using this dataset to allow easy comparison with previous figures.

The 2050 trajectory delivers 647ktCO_2e of emissions in 2016. Interim LEGGI data for Haringey in 2016 was 665ktCO_2e of emissions, 2.7% behind the 2050 trajectory.

Results are based on a wide range of assumptions about future actions and behaviours that may or may not come to pass. Therefore, all analysis results are presented to two significant figures and are to be treated as approximate.

LEGGI data has been used in preference to BEIS data as the GLA Zero Carbon Pathway Tool is designed to use LEGGI data and categorises emissions in the same way. As shown in the Stage 1 Technical Report (Figure 9) the differences are typically small, and ongoing monitoring is about percent reduction, rather than absolute values.

Reaching zero

Haringey aspires to reduce net carbon emissions in the borough to zero. To reduce emissions the action plan proposed by Arup focusses on reducing demand and reducing the emissions associated with that demand through electrification of heat and transport. We are modelling a 35% reduction in building related energy demand by 2035, compared with a 2015 baseline. And we are assuming an almost total move away from combustion-based heating and vehicles.

[1] MSOA = Middle Layer Super Output Area, with a population of 3,000 – 15,000, or 1,200 – 6,000 households. Haringey has 37 MSOAs.

The Zero Carbon tool that underpins the modelling includes the projected grid carbon factors published by BEIS. According to this projection electrical energy from the grid will still contain 28gCO_2/kWh in 2050. Therefore, grid electricity used in Haringey will still generate some carbon emissions in 2050. In addition, the modelled heating strategy is broadly in line with the government's Clean Growth Strategy and gas boilers continue to be the source of heating in around 10% of domestic properties. There is recognition that this Strategy needs to be developed further to tackle heat related carbon emissions in the UK.[2]

Therefore, using this Zero Carbon tool to model future carbon emissions will show some residual emissions in 2050 as evident in Figure 7 below.

Emissions in Haringey could be reduced further with greater renewable generation in the borough. However, energy self-sufficiency is not currently practicable in densely populated urban environments. To demonstrate, around 10,000,000m^2 of PV would be required to satisfy the 2050 building related energy demands of Haringey. This equates to 700,000-900,000 optimally oriented domestic rooftop arrays, in a borough with 80,000 detached, semi-detached and terrace houses.

So long as residents and businesses in Haringey rely on national infrastructure that is itself not carbon neutral, there will be carbon emissions that are attributed to activities of the residents and businesses in Haringey. Actual net zero will be achieved in Haringey only when the national infrastructure systems on which the borough depends are also net zero.

Notwithstanding, energy demand reduction and other local actions are absolutely essential to the net zero national commitment. Haringey Council can support residents and businesses in the borough to reduce their demand, to improve the efficiency of their energy supply, and increase their local low carbon generation.

As a result, the carbon emission trajectory shown in this report goes only as low as can be achieved given the constraints of the modelling and current government projections for national infrastructure futures. Offsetting and/or carbon capture will be required to reach zero.

Offsetting of emissions through carbon capture and storage (CCS) and other forms of carbon sequestration will be required to achieve actual net zero emissions. Offsetting does not form part of the scope of this study and has not been included in the modelling. However, some indicative values are provided below to give an understanding of the spatial and financial scale of impact associated with the use of offsetting to enable Haringey to achieve actual net zero:

Offsetting emissions in 2040 through tree planting would require, for example, a broadleaf or coniferous woodland around four times the area of Haringey, or a hedgerow 92,000 km long.[3] Alternatively, at £95/tCO_2 (draft London Plan offset price), Haringey could spend £9m to offset the borough's 2040 emissions. At the more extreme end of potential future carbon prices (€250/tonne),[4] the cost could be in the order of £20 million per annum. While the woodland or hedgerow would only need to be managed and maintained to offset emissions each year, a financial payment would need to be paid yearly. Given the spatial scale of such example sequestration measures, it may be expected that the planning and delivery of offsetting projects would be the responsibility of regional or national bodies, rather than being devolved to local authorities.

[2] Uncomfortable Home Truths: Why Britain Urgently Needs a Low Carbon Heat Strategy (Policy Connect, Oct 2019)
[3] Growing food, absorbing carbon (Farm Carbon Cutting Toolkit)
[4] Government of Ireland 2019. "Climate Action Plan 2019: To Tackle Climate Breakdown.

2 Levers

The inputs to the Zero Carbon Tool model that can be changed include:

- Building heat demand (domestic & non-domestic)
- Building electricity demand (domestic & non-domestic)
- Building cooling demand (domestic & non-domestic)
- Heating supply technology (domestic & non-domestic)
- Cooling supply technology (domestic & non-domestic)
- Distributed generation capacity
- Transport demand
- Transport technology

In the model developed for the 2050 scenario, emissions associated with cooling make a very small contribution to carbon emissions in the borough (1.0% in 2015, to 1.6% in 2050) and should fall with improved insulation and well-designed retrofit. Therefore this rapid assessment exercise has not considered additional or accelerated measures specifically to reduce cooling associated emissions.

Similarly, rooftop PV generation contributes a maximum of 1% of the energy supply in Haringey by 2050 under the 2050 scenario and is not considered further as a lever for accelerating the rate of carbon emission reduction.

Heat and electricity demand in buildings are addressed by building retrofit measures and new building planning standards, but retrofit represents the much larger share of emissions and opportunities for carbon reduction.

Therefore, to determine how fast emissions can be reduced in the Climate Emergency Scenario, we focus on the following four levers, as they impact the majority of emissions:

- Building demand for heat and power (retrofit)
- Heating supply technology (new build and retrofit)
- Transport demand (mode shift)
- Transport technology (fuel shift)

Each lever represents a model input that can be varied, with consequences for the carbon emissions in the borough. For each lever, a narrative has been developed, supported by evidence and judgement, that describes the speed of change that can be achieved. These narratives combine to create a scenario and set of assumptions for the revised Zero Carbon model inputs.

The narratives are described in the following sections, one for each lever.

3 Scenario Components

Demand for heat and power in buildings

Domestic

Under the Climate Emergency Scenario, the total number of retrofits achieved by 2035 remains the same as under the 2050 Scenario: 18,000 council owned homes and 86,000 privately owned homes, including 10,000 socially rented, and 32,000 privately rented properties. It assumes by 2026, a peak installation rate of 1,500 and 6,000 homes/year for council and privately-owned homes respectively. However, the change under the Climate Emergency Scenario is that the minimum energy efficiency rating is EPC B, up from EPC C under the 2050 Scenario. This results in a further 20% potential reduction in emissions.[5]

The 2050 scenario assumes a package of interventions to achieve EPC C with the package tailored to suit the average property for a range of typical property types. To go beyond EPC C will require envelope improvements in the style of Energiesprong, as pioneered in the Netherlands. Energiesprong involves installation of an additional outer layer to the building using pre-fabricated panels. At scale (>5,000 homes per year) estimates suggest Energiesprong could be done for £35,000 per house.[6]

Energiesprong has not yet been implemented on the range of building types to match the wide range of existing Haringey housing stock, from semi-detached homes, through Victorian terraces, to housing estate apartment blocks, so applying this estimated cost across the borough is a very crude estimate. But at an average cost of £35,000 per property, implementation of Energiesprong on every existing home in Haringey would have a capital cost in the region of £4bn. Given the uncertainty of this estimate, this value should be considered as a minimum likely value.

The council home peak rate of retrofit of 1,500 homes/yr is around 25% higher than the maximum rate achieved during the Decent Homes programme in Haringey, which averaged 1,130 social homes per year over 10 years. Moreover, the target energy efficiency performance would be much higher than under Decent Homes. Such a programme target is therefore ambitious.

Reliable data on retrofit rates of private homes was not available for this study, and we were unable to find a precedent for a retrofit programme which achieved this level of building performance improvement at a similar scale. We consider such a programme technically and technologically achievable but highly ambitious in terms of supply chain capacity and willingness of owners to participate. Based on the typical lifecycle of building maintenance and major renewal, a 2035 target year represents a single renewal cycle for each property. Put another way, the Climate Emergency Scenario effectively requires that each and every domestic building retrofit, from now until 2035, delivers that home to an EPC B standard.

The year 2035 is also aligned with the national policy context, in particular the Clean Growth Strategy, and its proposed target "for as many homes as possible to be EPC Band C by 2035."[7].

Non-domestic

The Climate Emergency Scenario for the non-domestic sector follows the same pattern as for domestic retrofit: the number and rate of retrofits remains the same as under the 2050 Scenario (4,500 buildings by 2035) but the target standard is raised from EPC C to EPC B. As for all sectors discussed in this report the scale of this target is ambitious but there are international examples that suggest significant improvements are possible in a short period. The Urban Efficiency Report from C40 is one such example.[8]

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[5] Domestic energy consumption by energy efficiency and environmental impact (BEIS, 2015)
[6] Reinventing retrofit: How to scale up home energy efficiency in the UK (Green Alliance, Feb 2019)
[7] HM Government 2017. The Clean Growth Strategy: Leading the way to a low carbon future. Note that the assumption for Haringey properties is to achieve EPC B, not EPC C.
[8] Urban Efficiency II: Seven Innovative City Programmes for Existing Building Energy Efficiency, (C40, Feb 2017)

Heating supply technology

A significant factor to the carbon emissions attributed to domestic buildings is the choice of heating supply technology. The Climate Emergency Scenario requires that the share of gas boilers and electric heating (excluding heat pumps) is much lower than under the 2050 Scenario. We have set a target of 10% of homes supplied from gas and direct electric by 2050, instead of 30%. Nearly all the remaining homes will be served by heat pumps and low carbon district heating. This will require an average low carbon heat technology installation rate of 2,300 homes/year.

For comparison, France had the fastest growing heat pump market in Europe in 2018, with 275,000 heat pumps installed. The UK had just 27,000 heat pumps installed in the same year for a similar population.[9] The highest heat pump penetration rates can be found in Sweden, Estonia, Finland and Norway, with more than 25 heat pumps sold per 1,000 households per year.[10] Scaling these reference points to the number of homes in Haringey, we estimate that a heat pump installation rate of 2,250 homes/year is achievable, which supports the target set for the Climate Emergency Scenario. This rate is similar to the maximum rate of air source heat pump (ASHP) installation assumed in the National Grid Future Energy Scenario modelling.[11]

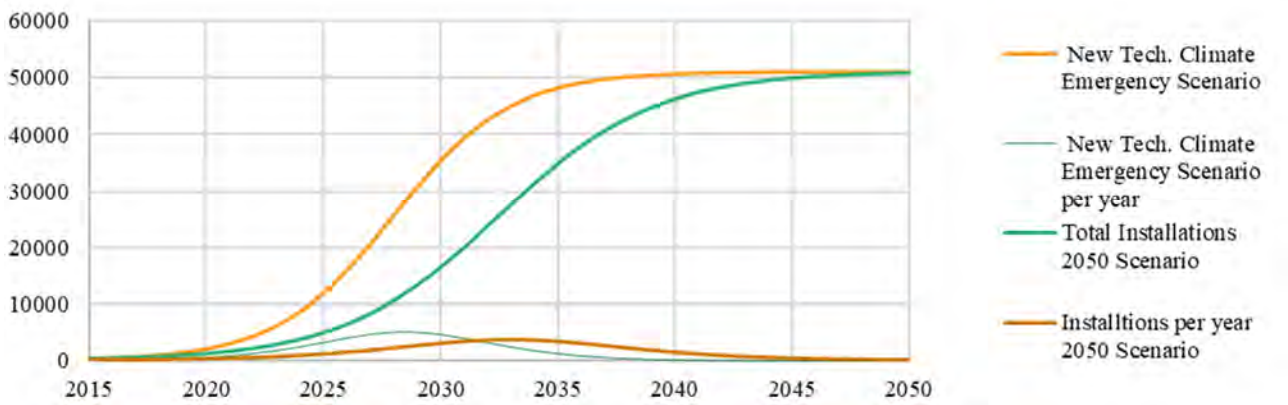

Figure 2: Installations of new energy supply technologies under the 2050 and Climate Emergency scenarios

Transport demand

Under the Climate Emergency Scenario, Haringey residents would reduce the number of journeys made by petrol and diesel vehicles at a much faster rate compared to the 2050 Scenario: the number of petrol/diesel journeys would be halved by 2024, compared with 2032 under the 2050 Scenario.

This dramatic shift would be achieved by a combination of mode shift (away from cars) and fuel switching (EVs and fuel cell vehicles). Under the Climate Emergency Scenario, the number of rail journeys is 9% higher by 2030 than under the 2050 Scenario and 17% higher by 2041. Meanwhile, uptake of electric vehicles (EVs) for private, commercial and public use is also accelerated: By 2030, almost twice the number of EVs are on Haringey's roads as under the 2050 Scenario.

It is noted that due to the increase in mode shift (from car to active transport and public transport journeys), the total number of EVs modelled under the Climate Emergency Scenario is lower than under the 2050 Scenario.

9 Market Overview (European Heat Pump Association, May 2019)
10 Heat Pumps: Tracking Clean Energy Progress (International Energy Agency, May 2019)
11 Future Energy Scenarios: Data Workbook, worksheet 4.12, Community Renewable Scenario (National Grid, July 2019)

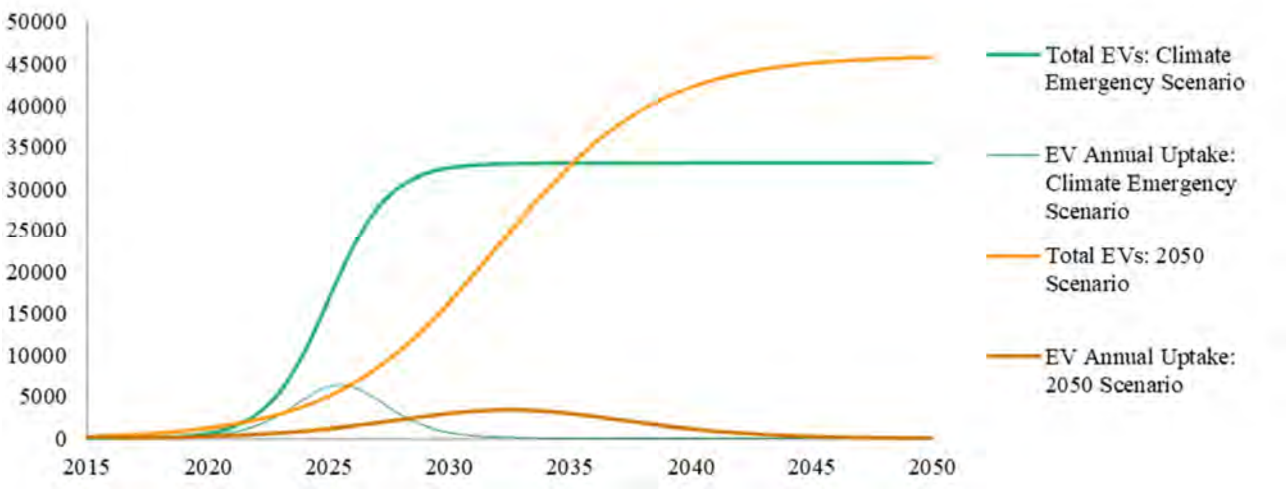

Figure 3: Uptake of EVs for both the 2050 and Climate Emergency scenarios

The consequences for EV charging infrastructure are shown in Table 1 below, with the split between slow/fast and rapid based on TfL's estimates.[12] Our modelling indicates that double the number of EV chargers would be needed by 2030 under the Climate Emergency Scenario, compared with the 2050 Scenario. In the later decades, the required number of charging points is lower than under the 2050 Scenario.

Table 1 Number of EV charging points required in Haringey

	2030		**2041**		**2050**	
Charger type*	**Slow to Fast**	**Rapid**	**Slow to Fast**	**Rapid**	**Slow to Fast**	**Rapid**
2050 Scenario	550 - 750	35 - 65	3,000 - 4,500	200 - 400	4,000 - 5,600	270 - 480
Climate Emergency Scenario	1,000 - 1,500	70 - 120	2,000 - 3,000	150 - 260	3,000 - 4,000	200 - 350

*Output capacity of chargers: Slow = 3kW; Fast = 7kW - 22kW; Rapid = 50kW or greater

The accelerated modal shift under the Climate Emergency Scenario results in a dramatic decrease in emissions from road transport in the short-term which is enabled because the infrastructure required for EV chargers can be deployed relatively quickly. In contrast, emissions from non-road transport increases in later decades as the number of passenger-kilometres increases. This is shown in Figure 4, and the original transport emissions trajectory from the 2050 scenario is shown in Figure 5.

[12] Mayor sets out plans for London's electric vehicle future (GLA, June 2019)

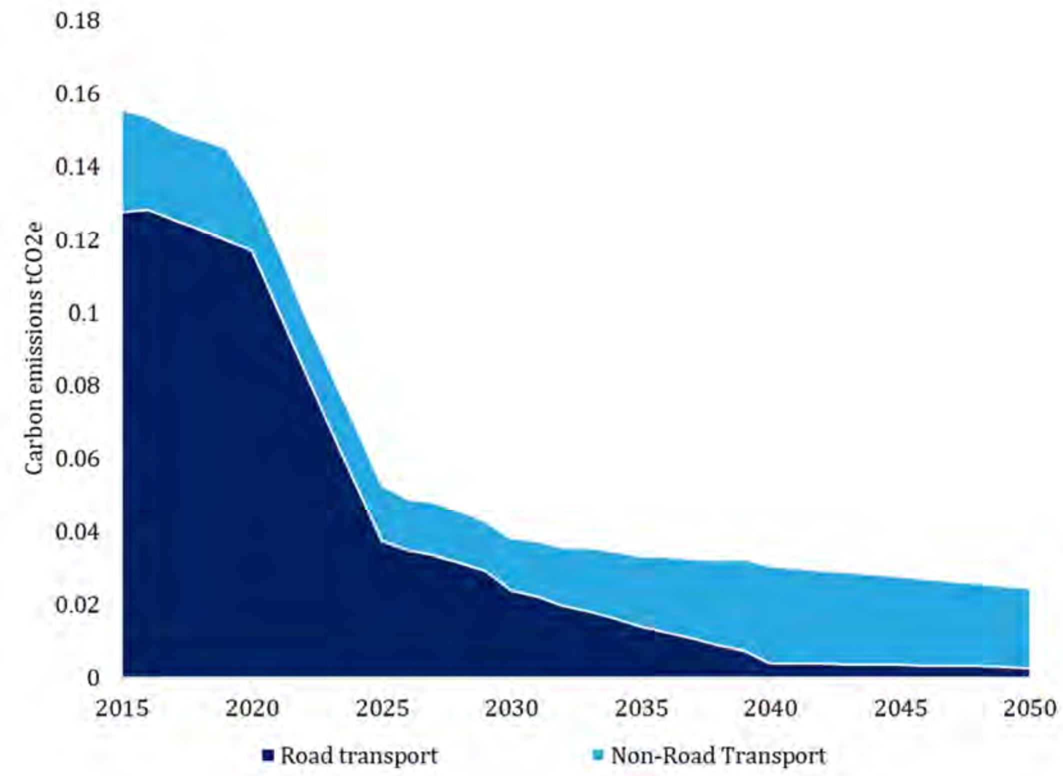

Figure 4: Haringey Climate Emergency scenario, transport emissions

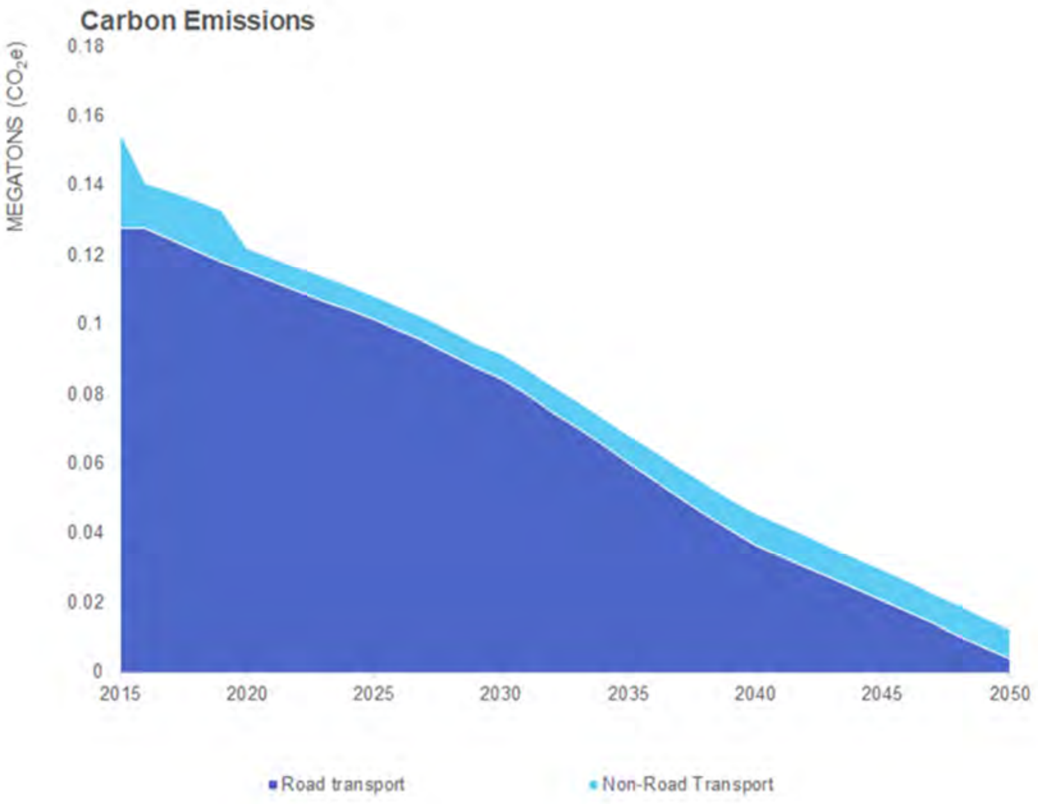

Figure 5: Haringey 2050 Scenario, transport emissions

For comparison, Oslo has a target to achieve zero-emissions transport within the city by 2030. Oslo has the highest electric vehicle share of any major metropolitan area in the world, with electric vehicles accounting for 33% of new vehicle sales in 2016. The city provides a number of incentives including free public charging for normal charging (3.6 kW).

Oslo had nearly 3,000 total charge points installed by 2016, of which 161 were fast charge points. The city provided €2m funding for 400 charge points to be installed between 2008-2011, after which 200 new charge points were installed per year from 2013 to 2017.[13]

A number of European cities have also achieved notable reductions in car trips over the last two decades. Vienna achieved a 4% mode shift away from private road vehicles between 2010 and 2012. Zurich reduced its car share of trips from 35% to 28% between 2005 and 2012. In Paris, the car share of trips reduced from 16% in 2010 to 13% in 2013. In Helsinki the share of car trips was at a very low level of 19% in 2000, increased to an intermediate high of 31% in 2008, but managed to shrink back to 22% in 2014, indicating a 6% drop per year in car trip reduction.[14]

The primary policies used to deliver these reductions include the following:

- Parking pricing, restrictions, information and enforcement
- Road user charges
- Planning and regulation of transport services
- Electrification of urban transport
- Car sharing, car-pooling and ride-sharing
- Pedestrian-orientated and car-free zones
- Pro-cycling policies.

It is generally acknowledged that improving bicycle infrastructure results in increased mode share of bicycles – "*build it and they will come*" – however research has shown that whilst this can be applicable, there are three other contextual factors that are important in ensuring success:[15]

1. **The location of facilities along usable commuting routes** – i.e. building infrastructure to meet the greatest potential demand.
2. **Overall network connectivity** – small sections of high quality bicycle lanes are unlikely to have a significant impact unless they are part of a good overall network. Even a short interruption in good cycle infrastructure that forces cyclists to join fast-moving traffic can put users off.
3. **Amount of publicity and promotion** – comparing Chicago and Salt Lake City, Chicago had much better success and this is likely to have been at least partly due to the fact that new cycling facilities were added in combination with a multitude of other efforts by city planners and advocates to advertise and promote their use.

In London, two thirds of all car journeys made are less than 5km in distance[16] (roughly a 20 minute cycle ride), and of those around half are less than 2km in distance (and could be cycled in less than 10 minutes). This indicates that up to two thirds of all car journeys could be made by active means (cycling/walking). Even if we take into account that there may be other reasons that using a car is necessary (e.g. carriage of goods or health /disability reasons) and account for mode shift to public transport, we propose that Haringey could halve its car mode share by 2030. Alongside uptake of electric vehicles, we consider this to be consistent with the Climate Emergency Scenario target of halving petrol/diesel car mode share by 2024.

[13] Electric Vehicle Capitals of the World: Demonstrating the path to electric drive (The International Council on Clean Transportation, March 2017)
[14] Traffic & Mobility Management Incl. Modal Split: Measures to manage transport, modal split changes (Soot Free for the Climate)
[15] The Impact of Bicycling Facilities on Commute Mode Share (Minnesota Department of Transportation, Aug 2008)
[16] Roads Task Force – Technical Note 14: Who travels by car in London and for what purpose? (TfL)

Mode share change in Paris

Driving within Paris city limits has dropped about 45% since 1990,[17] with cycling increasing by 10-fold over the same period. Just in the period between 2005 and 2012, mode share of private vehicles dropped from 35% to 28% and is expected to drop to 24% by 2020.[18]

The city has demonstrated a persistent drive from successive mayors to achieve this, with recent policies and plan much more ambitious than predecessors.

Cutting traffic speeds, banning older cars, instigating alternative driving days or total driving bans during pollution peaks, reducing on-street parking and redistributing urban space away from private vehicles and allocating more space for pedestrians and cyclists are all strategies that the city has employed to achieve this reduction in car use.[19,20] 400 miles of bicycle lanes were created between 2001 and 2014, alongside introduction of the Velib bikeshare programme. The current Mayor, Anne Hidalgo has been described as being '*responsible for "some of the most systematically anti-car policies of any major world city*"'[19].

Figure 6 Paris cycle success: *Photo by Spencer Davis on Unsplash*

[17] The Automotive Liberation of Paris (CityLab, Jan 2018)
[18] Traffic & Mobility Management Incl. Modal Split: Measures to manage transport, modal split changes (Soot Free for the Climate)
[19] The Automotive Liberation of Paris (CityLab, Jan 2018)
[20] The Cars that Ate Paris (CitLab, March 2017)

4 Zero Carbon Year

Under the Climate Emergency Scenario components described in the preceding chapter, carbon emissions in the borough of Haringey follow the trajectory shown in Figure 7 below. Under this scenario, emissions fall by 80% of 2015 emissions by 2030, and by 90% by 2037. Beyond 2037, the available local measures are largely exhausted, with the shallow downward curve achieved mainly through the continuing reduction in the carbon intensity of the electricity grid. We therefore conclude that 2037 could be chosen as the "zero carbon" target year. These carbon reduction percentages are calculated with reference to a 2005 baseline, consistent with Haringey's Annual Carbon Reports. Historical emissions leading to the trajectory are shown in Figure 8.

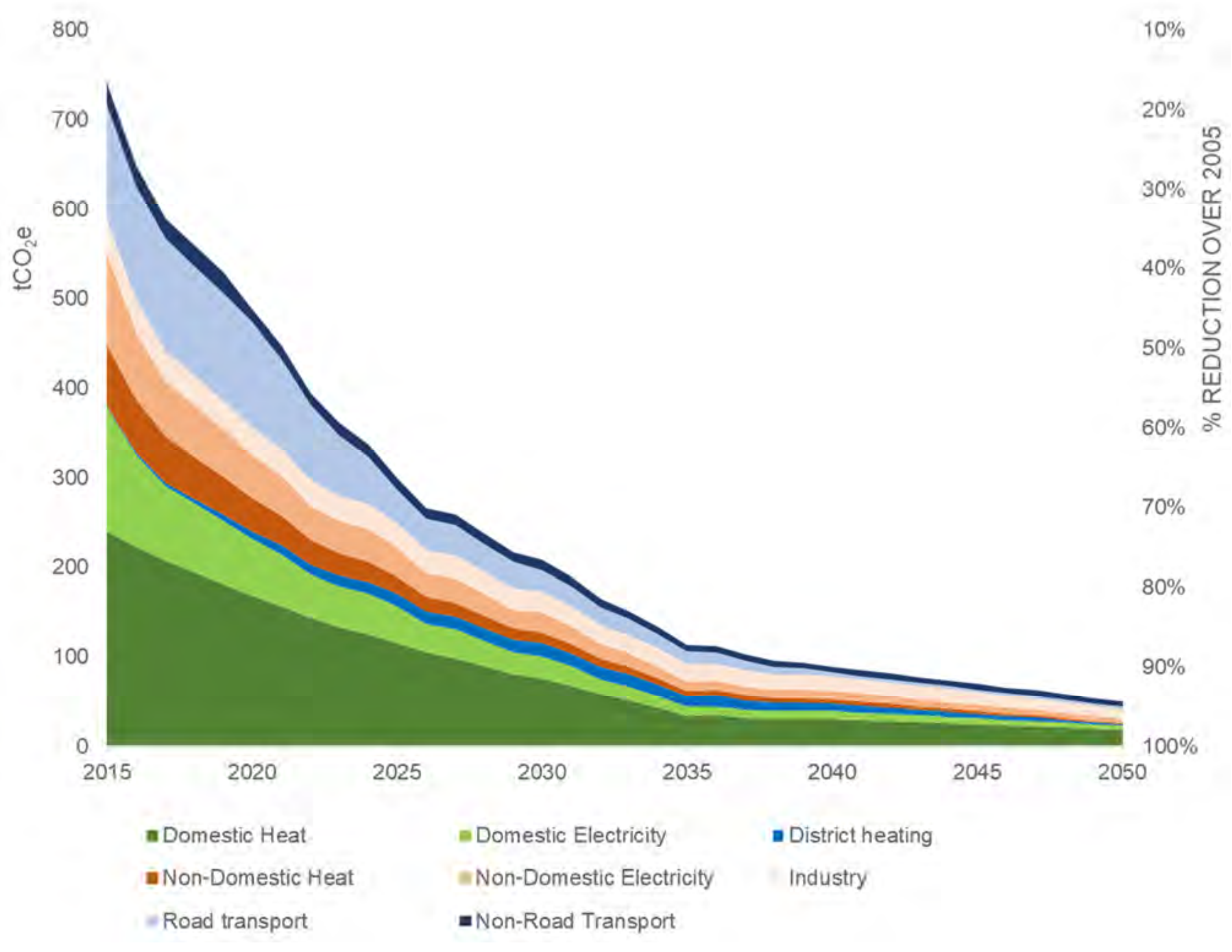

Figure 7 Climate Emergency Scenario carbon emissions trajectory, with breakdown by sector

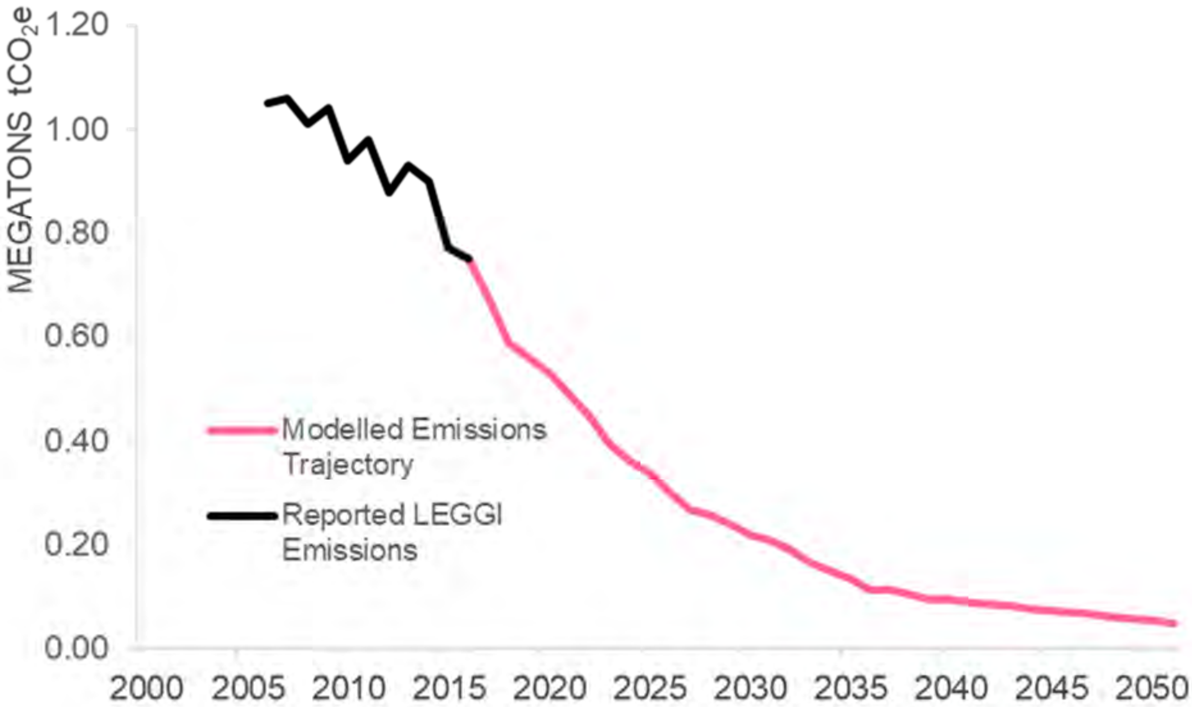

Figure 8 Climate Emergency Scenario carbon emissions trajectory, with reported emissions from 2005

A 13-year acceleration is a significant improvement on 2050, especially when measured in terms of total emissions, where the steep decline in the early years brings a more dramatic reduction in total carbon emissions. Under the Climate Emergency Scenario, the total saving in cumulative carbon emissions over the period 2015 to 2050 is $3.2MtCO_2e$, or a 28% reduction in total emissions compared with the 2050 Scenario trajectory.

5 Actions

The June 2019 Route Map report identifies twenty actions for the Council to deliver and/or drive the measures needed to meet the 2050 zero carbon target. For the Climate Emergency Scenario, we have reviewed each action and identified what would need to change to meet the 2037 zero carbon target. Where possible we have provided updated quantification of the action, such as faster rates of deployment, more staff resources or higher total or annual costs. The proposed changes are set out Table 2 below. Full details of each action are provided in the June 2019 report and are not repeated here.

Table 2 Haringey Action Plan changes under the Climate Emergency Scenario

Action ref	Action	Change from 2050 Scenario Route Map	Reasoning	Implications of change
HOMES				
H1	Programme of deep retrofit of all council owned social housing	Same number of properties targeted but level of improvement (and therefore heat demand reduction) increased from EPC C to EPC B. Ramped up faster, with peak installations of 1,500 homes per year by 2026.	The same number of properties would be targeted so average improvement needs to increase to bring overall savings down faster.	A delivery programme would need to be launched immediately. To reach peak installations in 2026, a programme start date by 2021 would be expected with rapid piloting, capturing lessons learned to ensure scaled approach has best chance of success. Cost of retrofit per unit will be higher to achieve EPC B.
H2	Programme of technical advice on energy efficiency for all domestic property owners & occupiers	Same number of properties targeted but level of improvement (and therefore heat demand reduction) increased from EPC C to EPC B. This will increase the range of retrofit interventions required at each property.	The same number of properties would be targeted, but at increased pace and ambition - average improvement needs to increase to bring overall savings down faster.	If peak retrofits need to reach 6,000 homes in 2026, assuming an engagement effectiveness factor of around 20%,[21] engagement peak needs to reach 28,000 in 2026. Cost of retrofit per unit will be higher to achieve EPC B.
H3	Funding assistance to support delivery of energy efficiency in privately owned properties	Same number of properties targeted but level of improvement (and therefore heat demand reduction) increased from EPC C to EPC B. This will increase the cost and therefore pot of funding required.	The same number of properties would be targeted, but at increased pace and ambition - average improvement needs to increase to bring overall savings down faster. .	Cost of retrofit per unit will be higher to achieve EPC B.
H4	Enforcement of national regulations	No change	National regulations so impact assumed to remain the same for the purposes of this report.	n/a

[21] Based on the number of registered customers that translated to units receiving a grant, as described in the Green Deal Communities project presentation slides about SmartHomes, by ECD Architects, April 2016

Action ref	Action	Change from 2050 Scenario Route Map	Reasoning	Implications of change
H5	Planning policies that demand ambitious carbon emission reductions new and redeveloped homes	No change	Policies already in place and 2050 plan focused on improved application/enforcement.	n/a
WORKPLACES				
W1	Engagement with professional networks to increase prioritisation of CO_2 reduction in commercial decision making	No change to programme timing/costs, but ambition of impacts increases.	All businesses in the borough planned to be engaged within 3-5 years of present (so by 2024) which is early enough that ambitious retrofits can be prioritised within existing timeline. Key thing is that ambition of impacts (and consequent communication of prioritisation) needs to increase.	The programme will to need well qualified and highly motivated staff to inspire businesses to be even more ambitious, and also to keep up with cutting edge opportunities for effective, ambitious commercial retrofit. Deeper engagement and/or higher qualified staff could imply more staff resources at higher cost per person.
W2	Funding assistance to support delivery of energy efficiency measures in commercial premises	Same number of properties targeted but level of improvement (and therefore heat demand reduction) increased from EPC C to EPC B.	EPC B should be achievable for a significant number of commercial properties in Haringey with the right approach.	Cost of retrofit per unit will be higher to achieve EPC B.
W3	Engagement with large enterprises and emitters to support large-scale projects and high-profile action	No change to programme time/cost. Could increase ambition of the high-profile action to align with other aims (e.g. specifically demonstrating possibility of retrofitting buildings to EPC B)	The timing and scale of the original action is consistent with the measures in the Climate Emergency Scenario.	n/a
W4	Engagement with public bodies to support energy efficiency improvements in public buildings	No change in timing but more staff resources may be needed to raise the effectiveness of engagement (ie. engagement that results in more action).	Additional resources could be required to achieve deeper engagement needed to drive higher/faster ambition.	Deeper engagement and/or higher qualified staff could imply more staff resources at higher cost per person.

Action ref	Action	Change from 2050 Scenario Route Map	Reasoning	Implications of change
W5	Action to improve energy efficiency and reduce energy consumption in council owned buildings	No change in timing but more staff resources may be needed to increase the effectiveness of the action (ie. engagement that results in more action).	Additional resources could be required to achieve deeper engagement needed to drive higher/faster ambition. It is understood that for much of the council's own non-residential estate, implementation may be limited by existing lease conditions. However in these instances Actions W1 and W2 are still relevant, and the council should make efforts to improve energy efficiency whenever new contracts are agreed.	Deeper engagement and/or higher qualified staff could imply more staff resources at higher cost per person.
W6	Planning policies that demand ambitious carbon emission reductions in new and redeveloped workplaces	All new and redeveloped workplaces are assumed to be net zero from 2020	Policies already in place and 2050 plan focused on improved application/enforcement.	n/a
TRANSPORT				
T1	Engagement with Haringey residents to encourage mode shift towards public and active transport choices	Intensify programme by using same equivalent staff hours but instead of programme end date in 2030, programme ends in 2024. Assumed to begin in 2021 (a more ambitious pilot should be carried out and evaluated in 2020).	Number of vehicle journeys by petrol/diesel vehicles have to halve by 2024 instead of 2032, meaning engagement programme needs to happen much quicker. Assumed that equivalent time/effort required but within shorter timeframe, so equivalent staff time and programme costs overall but higher annual costs.	Annual cost increases to £655,000 based on 19 FTE per year. Pilot programme will need to be planned, implemented and evaluated within 18 months in parallel with making arrangements for scaled-up programme to enable 2021 start date.
T2	Programme to improve active transport infrastructure	Intensify programme by using same spending and staff hours but instead of programme end date in 2030, programme ends in 2025. Assumed to begin in 2021.	The modelling cannot provide a quantified link between active transport infrastructure and active transport mode share. However, given that number of petrol/diesel vehicle journeys needs to halve by 2024 instead of 2032, we have assumed that the same infrastructure needs to be delivered by the earlier date.	Annual cost (capex + programme management) increases to £16m, based on same overall programme costs condensed from ten year programme into four year programme.
T3	Policies to that penalise private car use through parking charges based on fuel type/emissions etc	No change to programme timing, length or cost, but expect that ambition of programme should increase in recognition of removing all combustion engine cars from roads by 2040 (which means based on lifetime of car, no new combustion vehicles purchased beyond 2030).	To instigate a set of more ambitious parking policies should not take any longer but will require increased ambition in planning. Actions T1, T2, and T5 have been brought forward and should provide the infrastructure required to positively support this shift.	n/a

Action ref	Action	Change from 2050 Scenario Route Map	Reasoning	Implications of change
T4	Programme to incentivise move to low and zero emission vehicles by residents and businesses	Doubling of effort to programmes that incentivise move to zero-emissions vehicles.	Twice the number of EVs expected to have replaced combustion engine vehicles by 2030.	No change to annual cost, but programme to run for further 3 years (2020-2025) to boost uptake to 2030.
T5	Action to expand provision and accessibility of EV charging infrastructure	Substantial increase in programme delivery and investment requirement.	Increased number (around four times the 2050 scenario number) of EV charging points/infrastructure required	Capital cost to 2030 remains similar (~£8m) based on using an increased proportion of lower-cost (slow/fast) chargers supplemented with rapid charging points. However overall, to 2050, capital expenditure required exceeds £20m. Average annual installation costs highest between 2020 and 2030 at £750,000 per year.
ENERGY				
E1	Potential for large scale renewable generation in the Lee Valley through wind turbines and PV	No change	This action was already as ambitious as could be reasonably expected within the timeframe.	n/a
E2	Programme to encourage installation of distributed renewable generation through roof mounted PV	Increase target from 9,500 installations to 20,000, being 25% of houses in the borough (Note: not included in modelling, would reduce emissions in 2050 by 0.4%)	20,000 installations likely to saturate the suitable installation locations for rooftop PV in the borough.	Capital cost increases to £59m. Rate of installation must double, along with capacity of supply chain.
E3	Policies to support appropriate installation of and connection to district heating networks	Prioritise heat network connection to the future North London Waste Authority's planned Energy Recovery Facility and other low-carbon heat sources wherever possible.	These are the lowest carbon local sources of heat available to Haringey and will accelerate carbon reduction to the greatest degree. (Note: Modelling for the Climate Emergency scenario has not considered additional or faster heat network delivery.)	Expansion of EfW as heat supply to district heat networks will accelerate lower carbon emissions associated with heat networks.
E4	Programme of technical advice to encourage and support residents and businesses and local supply chains to adopt heat pumps	Programme to be brought forward (peak installations in late 2020s rather than 2030s) and with increased overall ambition (resulting in just 10% homes remaining heated by traditional gas/electric by 2050).	Greater support (funding / engagement) needed to achieve the faster and higher adoption rate in the Climate Emergency Scenario.	Additional £200m on top of original £440m capital investment required into the installation of heat pumps. Total programme costs remain the same (remains a five-year delivery programme – assumed to begin in early/mid-2020s).

6 Barriers and Uncertainties

The 2050 Scenario set out in the June 2019 report represents a highly ambitious – one may say unprecedented – programme of change for Haringey. The 2037 route map indicated under this Climate Emergency Scenario aims even higher. Notwithstanding the clear and compelling science basis to justify this level of ambition, an accelerated agenda for change will face a variety of barriers and uncertainties. In this section we provide a discussion of these uncertainties and barriers. The focus here is on the differences from the 2050 route map, and the discussion focuses on the additional or greater hurdles associated with the 2037 route map. The 2050 report provides additional discussion of barriers and uncertainties, all of which will also be relevant to the accelerated route map.

Uncertainties

Actual versus modelled emissions in recent years

As previously noted, we have retained 2015 as the model baseline year, to enable comparison with the 2050 Scenario. While we have not changed the numbers for the years now in the past (i.e. 2015-2019), the numbers in the model incorporate what were expected or modelled reductions in carbon emissions which may not in fact have occurred.

Interim LEGGI data is now available for the year 2016. According to these figures, carbon emissions in Haringey were 670ktCO_2e, which is 28ktCO_2e more than the figures in the model, or around 4.3% higher. Assuming that the years 2017-2019 have continued to diverge from the model trajectory, the target dates referenced in this report could not be achieved without an even steeper rate of decline than shown in the trajectory.

Decarbonisation of the electricity grid

The updated modelling retains the same projected carbon intensity trajectory for the national electricity grid as for the 2050 Scenario modelling. This means that the emissions impact of accelerated adoption of heat pumps will be dampened by the higher emissions intensity of the grid in the early years. This is reflected in the model.

National ambition

The current national ambition, as set out in key policy documents such as the Clean Growth Strategy, and existing legislation such as minimum energy efficiency standards for privately rented buildings, has been used to inform the assumptions of what wider national action, incentives and policies are likely to apply.

We have therefore not included speculation of what aspects of the original actions may be different if national ambition significantly increased (or decreased) from what is set out in current literature. If future legislation and regulations supported a faster adoption of home energy efficiency, a cleaner grid or very different transportation this could act as a catalyst. It would reduce the barriers that exist from the lack of penalty for inaction (or inadequate action) by those who have the capacity to act.

Scale of ambition

The scale of ambition represented by the Climate Emergency Scenario is unprecedented. Although there are case studies demonstrating great results in many areas, there are yet to be examples of all areas covered at once, at this scale and speed. As a result there is lack of experience and precedent in the management and delivery of this scale of change; in the business models, in the funding mechanisms, in the skills and capacity of the relevant supply chains, in the project management.

Cost and quality impact from acceleration

The expression "more haste less speed" captures an intuitive principle that going faster brings increased risks of failure or adverse impacts. Assuming that accelerated rates of deployment are achieved (e.g. retrofits and heat pumps), associated challenges and barriers include:

- Rushed jobs and/or less qualified installers make poor quality installations, resulting in a "performance gap" between modelled and actual energy consumption and carbon emissions
- Increased costs in line with market economy principles (rising demand pushes prices up)
- Reputational impact from reports of poor performance and customer dissatisfaction, leading potentially to a consumer backlash and a deceleration in the deployment rate.

Technology development

Most of the technologies required for the Climate Emergency Scenario are available on the market, although some – notably EVs and heat pumps – have low penetration in the UK. Meanwhile there is still considerable room for improvement in materials, techniques and know-how for effective deep building retrofit. Early adoption in Haringey could mean higher costs than under the 2050 Scenario.

One example of this is shown in the falling costs of deep retrofit following the Dutch Energiesprong approach. The cost of the first Energiesprong pilot in the Netherlands was approximately £100,000 (€130,000) per home,[22] but the first UK pilot in Nottingham was able to reduce costs to £65,000 per home,[23] and with increased scale in the future the cost is expected to drop to around £35,000 per home.[24]

Size and quality of the supply chain

The acceleration of action will need supply chains to be able to supply, install and service the works and equipment associated with a low carbon future. Businesses will invest over time in production capacity (capital and staff investment) in response to demand, but acceleration may mean that compromises occur to meet demand. Alternatively, as a leader in climate action Haringey could attract businesses and workers from further afield. So long as Haringey is one among a few early actors, the pool of suppliers could be regional or national. If the Climate Emergency Scenario were extended across the country, the pressure on supply chains would be dramatically higher, and would represent an absolute constraint on the acceleration rate.

The right technology choices?

An active national debate is taking place as to the right mix of energy infrastructure for a low carbon future. Electricity, heat networks, hydrogen and gas each have strengths and weaknesses and it is not possible at this time to state with confidence exactly where we will end up. Whilst some measures are clear no-regret or low-regret options, an accelerated delivery programme increases the risk of stranded assets or abortive investments if a different energy infrastructure pathway is adopted in the future.

Barriers

Carbon intensity of national infrastructure

Where Haringey relies on national infrastructure which emits greenhouse gases, Haringey's emissions will remain above zero. It is not practicable for Haringey to disconnect from this infrastructure; therefore there is a need for national government to push for faster and further reductions in carbon emissions associated with operation of

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[22] Reinventing retrofit: How to scale up home energy efficiency in the UK (Green Alliance, Feb 2019)
[23] Energiesprong - The Dutch system that could rescue Britain's social housing (CIBSE Journal, June 2018)
[24] Reinventing retrofit: How to scale up home energy efficiency in the UK (Green Alliance, Feb 2019)

national infrastructure, in particular the national electricity grid and a plan for decarbonising the nation's heat supplies.

Inverse incentives and conflicting priorities

Existing policy and regulatory mechanisms in the built environment that demonstrate climate change mitigation priorities are not fully aligned and so limit the effectiveness of those mechanisms which are designed to reduce energy use and carbon emissions. For example:

- Energy efficiency improvements in a non-domestic property increase the value of the property and result in higher business rates which may discourage property owners from making energy efficiency improvements. Business rate structures should be reviewed so that energy efficiency improvements are encouraged.
- Exceptions from the rule to encourage housing development allow domestic properties to be developed under permitted development without full planning scrutiny which allows such properties to avoid meeting carbon emission targets. Permission for change in use applications should include minimum energy efficiency performances requirements commensurate with new buildings.
- Conservation area or listed building status restricts the interventions that are permitted on properties, may increase the cost, or prevent the implementation of energy saving measures. Constraints in conservation areas and on listed buildings should be reviewed to allow measures that improve energy efficiency. The modelling for this report assumes the same treatment for all buildings, regardless of conservation or heritage status.
- Funding mechanisms for public buildings that split capital and operational budgets make it difficult to adopt solutions that deliver energy efficient solutions that have a higher capital cost, despite long-term potential operational savings. Budget structures should be reviewed to allow transfers between capital and operational budgets to encourage capital expenditure that will reduce operational costs.

Absence of tools to mandate change

As mentioned above, the scale of change required is unprecedented and as such will require major and rapid social and behavioural change. Currently there are limited statutes or policies that mandate improvements to existing properties, and those that exist are not sufficiency ambitious or easy to enforce. For example:

- A requirement for an EPC certificate shows the energy performance of a property at the point of purchase but there are no minimum ratings, or any incentive to improve a rating, beyond the associated energy saving, which may come at considerable cost. Minimum energy performance standards for all properties at the time of change of ownership, with rapidly increasing minimum standards should be implemented to ensure improvement of the energy performance of existing homes in the private sector.
- Minimum energy efficiency standards have recently been imposed on the private rented sector however the minimum standard of EPC E is a long way below the target performance and incentives to comply are weak. Effective incentives and penalties are required that enable local authorities to enforce minimum energy efficiency standards in the private rented sector, together with rapidly increasing minimum standards.

Absence of tools to support change

Not only should legislation mandate action, legislation should also support action. As above, there activities that would support carbon emission reductions at a small scale and tools to mandate these activities would facilitate more bottom up action. For example:

- Mandating data collection on energy in use and associated health and wellbeing measures would support planning for energy efficiency upgrades and capture of co-benefits.
- Inclusion of some or all of scope 3 greenhouse gas (GHG) emissions in carbon reporting would encourage further action down the supply chain of a reporting business.

Costs and funding mechanisms

Costs of deep retrofit are substantial and payback periods can be long or they may not pay back at all on a strict financial assessment basis given today's prices and policies. The net cost of retrofit gets higher as the retrofit standard gets higher. Therefore there is a need for commercial and financial mechanisms to facilitate financing where property owners are unable or unwilling to pay themselves for a required retrofit. Proposals exist, for instance, for a system where a loan is made, paid for at the time of sale of a property such as the Local Authority Revolving Fund proposed by UKGBC.[25]

Residual emissions

All carbon action plans expect a quantum of unavoidable, residual emissions that are not practical, or cost effective to avoid. Therefore carbon offsetting and/or sequestration will be required to effectively remove CO_2 from the atmosphere and there is an urgent need to support concerted research and development into practical and cost effective carbon capture and storage technologies.

Reflections by the Committee on Climate Change

As a final point, the Committee on Climate Change (CCC), in its recent Net Zero Carbon report, provides a thoughtful reflection on the barriers and challenges to acceleration of carbon reduction. The Committee's points include the following:

- Capital stock turnover – even once the market moves to low-carbon technologies it still takes time to turn over the capital stock so that these are used by all users, e.g. vehicles and boilers
- Need for fully integrated local policy and implementation with cross-departmental collaboration
- Ensuring businesses respond requires strict enforcement and incentive schemes, some policies have not delivered the desired business response
- Engaging the public to act and improving people's awareness of newer technologies
- Determining how the transition will be funded and the impact on energy bill payers and motorists
- Ensuring a just transition – transition must be perceived as fair by the public and vulnerable workers and consumers should be protected
- Development of infrastructure - expansion of the capacity of existing grids (e.g. strengthening electricity distribution grids to support electric vehicles and heat pumps). The lead-times for planning and delivering this infrastructure constrains the deployment rate of technologies.

[25] Regeneration and Retrofit (UKGBC, October 2017)