London Borough of Merton Climate Action Support

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Executive Summary

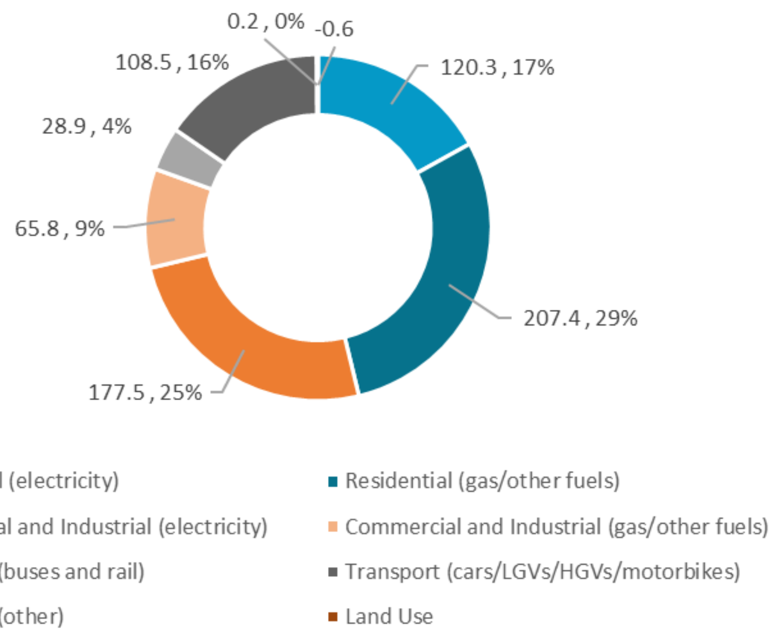
Merton Council declared a climate emergency in July 2019 and set carbon reduction targets to decarbonise the Council by 2030 and the borough by 2050. To underpin the development of Merton's Climate Strategy & Action Plan, Merton Council commissioned a series of products including greenhouse gas (GHG) inventories for the borough and council, decarbonisation pathways to reach the targets, and means to track progress towards the targets.

A scoping workshop was held with Merton Council staff in November 2019 to agree the scope of the decarbonisation target and the GHG inventory for the council, and an initial discussion on potential actions that Merton could implement to work towards meeting the 2030 council target. The workshop started discussions on the scope of the 2050 borough target, which were finalised through discussions with Merton Council.

An Excel file was developed to calculate and present the latest GHG inventories for the council and the borough. Due to the time lag of data source availability, the latest inventory year is 2017 for the borough and 2018 for the council inventory. The GHG inventories contain full references to data sources and steps describing how Merton Council staff can update the inventories in the future.

Merton Borough's direct GHG emissions for 2017 were estimated to be 708 ktCO_2e. **Figure ES.1** shows that in 2017 the largest source of emissions in the London Borough of Merton was residential building heating (29%).

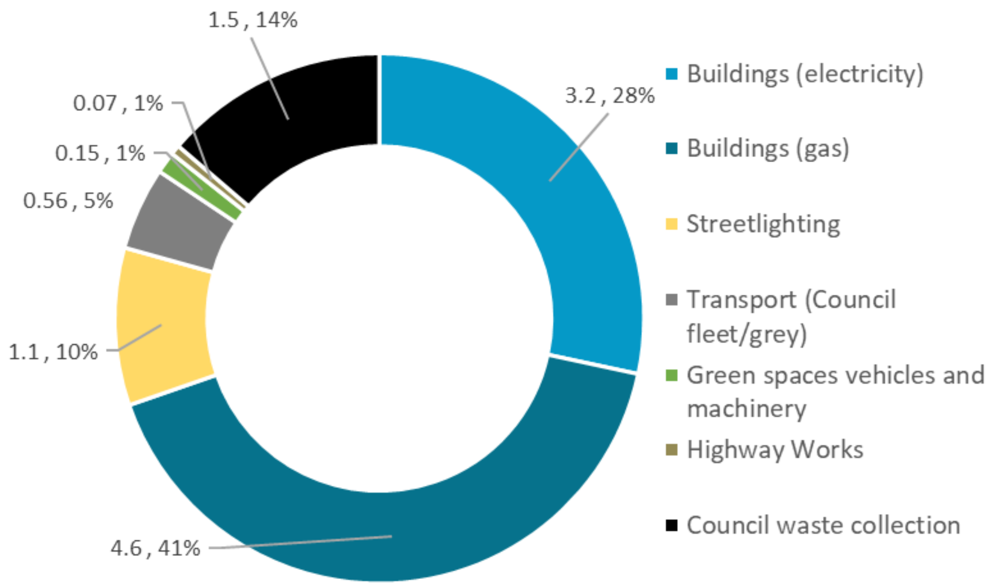
ES. 1: Estimated ktCO_2e emissions for Merton Borough in 2017



Due to lack of data, not all of Merton's indirect (scope 3) emissions are included in the inventory. A high-level estimate for further scope 3 emissions of Merton's goods and services was calculated. Using an average emissions per capita value for consumption-based emissions for European cities from C40[1], the consumption-based emissions of the borough of Merton in 2017 are estimated to be 2,617 ktCO_2e. This covers the emissions produced during the production of food, clothes and textiles consumed in Merton plus emissions from building infrastructure, aviation, private transport manufacturing, as well as production of electronic equipment and household appliances. These emissions are approximately four times the size of Merton's direct emissions. If the consumption-based emissions were included in the Merton borough GHG inventory for 2017, this would make up 79% of Merton's GHG emissions.

Merton Council's GHG emissions for 2018 were estimated to be 11.1 ktCO_2e. All of Merton Council's GHG emissions are also included in the borough inventory, where the emissions are captured through different (wider) data sources. **Figure ES.2** shows that in 2018 the largest source of emissions within Merton Council was gas consumption in buildings (41%). The scope 3 emissions included in the council inventory (specifically: transmission & distribution losses from electricity supply, council grey fleet, green spaces vehicles and machinery, highway works, waste collection by the council) were estimated to be 2.2 ktCO_2e in 2018, or 19% of the total council inventory. There are further scope 3 emissions not included in the inventory, where data from outsourced services was not available. The scope 1, 2 and 3 emissions covered in the council inventory represent approximately 2% of the borough emissions[2].

ES. 2: Estimated ktCO_2e emissions for Merton Council in 2018



An Excel file was developed for the modelling of decarbonisation pathways for the borough and the council. This is based on the Carbon Scenario Model that Aether has used for other local authority climate mitigation pathways. The tool is comprised of a carbon footprint for the council's and borough's current emissions and emission reduction trajectories up to 2030 and 2050 respectively, based on a series of carbon reduction projects represented in the model. The modelling is high level to provide a sense of the scale of actions required but there is significant uncertainty in some of the

[1] https://c40-production-images.s3.amazonaws.com/other_uploads/images/2233_WITH_FOREWORDS_-_Main_report__20190611_%281%29.original.pdf?1560286287
[2] Note that these estimates are for different years (2018 for the council inventory, and 2017 for the borough).

data and the assumptions used for the decarbonisation actions in Merton (described in **Annex 1** and the model). This approach provides transparency of methods and also flexibility so that Merton can make changes to the model in the future as plans become more confirmed and new data or information become available.

Two pathways were developed for each target; a business as usual (BAU) scenario which takes into account already committed actions but no further specific action from Merton, and a 'decarbonisation' scenario with ambitious decarbonisation actions which are required to work towards the carbon reduction targets included. A long list of potential mitigation actions was collated by Merton based on suggestions received through the Council’s public consultation on climate change, and recommendations received from Merton’s Climate Emergency Working Group. These actions were presented at a second workshop with internal and external stakeholders in February 2020 for discussion of the barriers to implementation and prioritisation.

GHG emissions are projected to decrease in the BAU scenario primarily due to already committed action at the national level to decarbonise the UK electricity grid.

Figures ES.3 and **ES.4** show the decarbonisation scenarios for the borough and the council. Specific actions included in these scenarios are summarised in **section 4.1**, **4.2** and in the model. Under this scenario it is estimated that emissions in the borough would be reduced by 91% from the baseline by 2050, and emissions from the council would be reduced by 88% from the baseline by 2030.

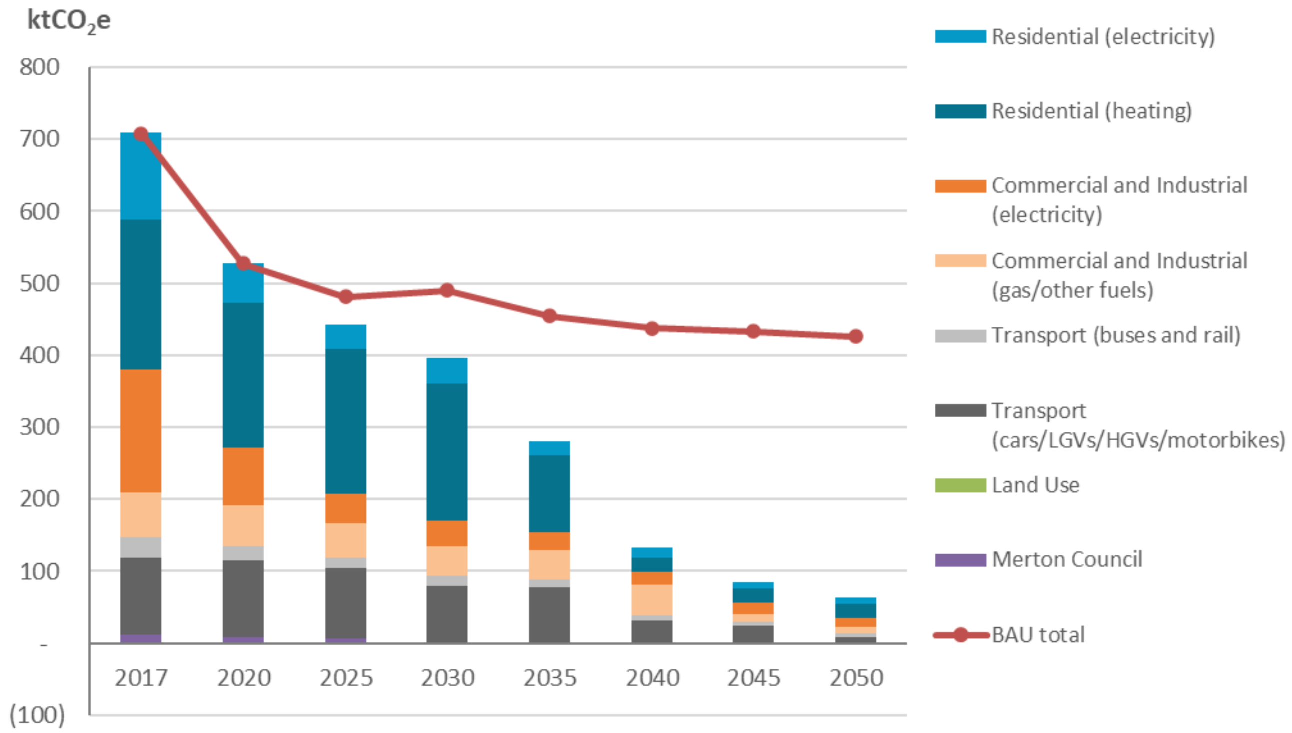
The remaining emissions in borough model by 2050 are 62 $ktCO_2e$. The remaining emissions from the council are estimated to be 1.5 $ktCO_2e$ by 2030. To satisfy the net zero target, these emissions would need to be offset each year that emissions remain.

There are large uncertainties around estimating the investment required to implement the actions in the decarbonisation pathways. A capital cost of more than £3 billion has been estimated, which is likely to be a significant underestimate because there are some gaps in the costs estimated where data are not currently available and indirect costs have not been fully considered. Of this, £86 million is estimated to fall directly to the Council in relation to the 2030 target. For the borough wide target, the costs are largely related to improvements in buildings.

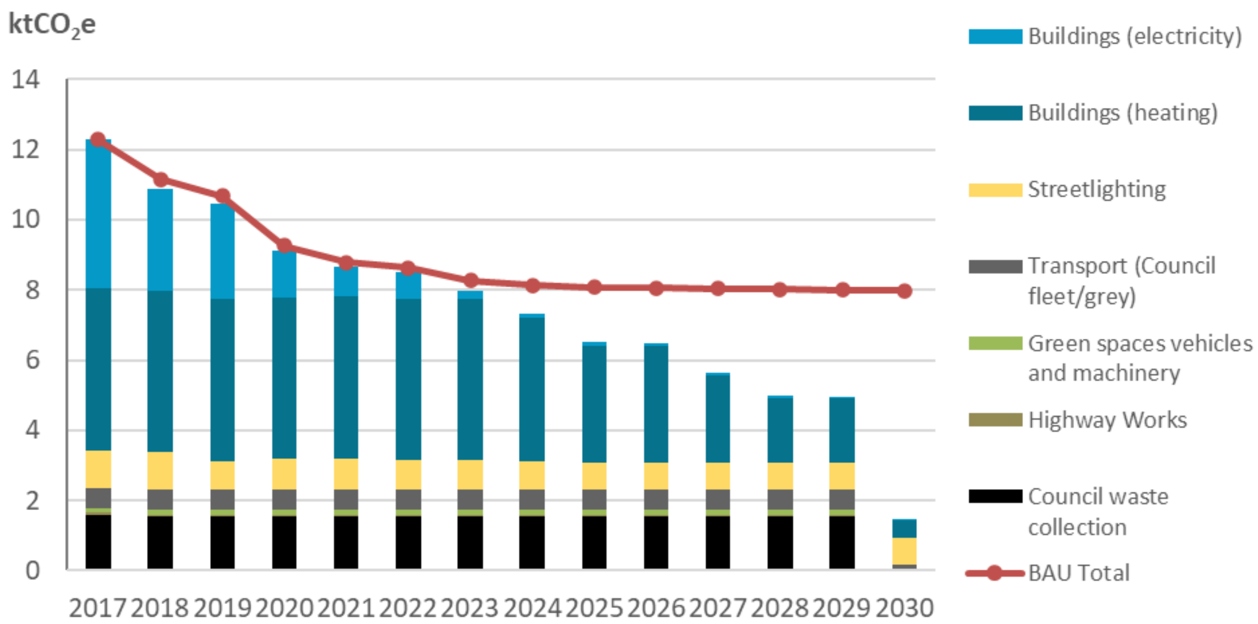
Key indicators have been proposed to allow Merton Council to track progress of decarbonisation actions across different sectors of the climate action plan. These are an accompaniment to the GHG inventories, which may have greater time-lags on data sources.

In terms of its own actions, Merton Council will need to be both ambitious and demonstrative, fully taking up its leadership role within the borough. Public engagement is crucial to the delivery of decarbonisation actions. It depends on Council officers at all levels taking on board climate objectives as well as delivering the service they have been tasked to do. Merton should engage in lobbying the GLA and central Government, both as a Council in its own right and in conjunction with partner organisations (within and outside the borough), as action will be needed across all levels of government, locally and nationally, in order to work towards the net zero targets.

ES. 3: Decarbonisation pathway for Merton Borough 2017 – 2050



ES. 4: Decarbonisation pathway for Merton Council 2017 - 2030



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Glossary

AD	Anaerobic Digestion
BAU	Business as usual
BECCS	Bioenergy with carbon capture and storage
BEIS	Department of Business, Energy and Industrial Strategy
CCC	Committee on Climate Change
CH_4	Methane
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
CROHM	Carbon Reduction Options for Housing Managers
CSM	Carbon Scenario Model
DECC	Department of Energy and Climate Change (now BEIS)
Defra	Department for Environment, Food and Rural Affairs
EFW	Energy from waste
EPC	Energy performance certificates
GHG	Greenhouse gas
GLA	Greater London Authority
HGV	Heavy goods vehicle
IPCC	Intergovernmental Panel on Climate Change
LGV	Light goods vehicle
LULUCF	Land use, land use change and forestry
Kt	Kilotonnes
kWh	Kilowatt-hours
N_2O	Nitrous Oxide
NRMM	Non-road mobile machinery
PV	Photo-voltaic
REGO	Renewable Energy Guarantees of Origin
SAP	Standard Assessment Procedure
SLWP	South London Waste Partnership
TfL	Transport for London
QA/QC	Quality Assurance and Quality Control
UNFCCC	United Nations Framework Convention on Climate Change

1 Introduction

Merton Council declared a climate emergency in July 2019 and set carbon reduction targets to decarbonise the Council by 2030 and the borough by 2050. To underpin the development of Merton's Climate Strategy & Action Plan, Merton Council commissioned a series of products including greenhouse gas (GHG) inventories for the borough and council, decarbonisation pathways to reach the targets, and means to track progress towards the targets.

The brief from Merton was to produce three outputs:

Greenhouse gas reporting

- Agree the scope and method of greenhouse gas reporting;
- Conduct a gap analysis of publicly available data and address any additional data requirements; and
- Develop any necessary additional tools (for example an excel-based calculator) to ensure consistent and robust annual reporting.

Decarbonisation pathways modelling

- Review existing data and tools needed to set a trajectory and address any additional data requirements;
- If needed, develop science-based target models for both of the decarbonisation targets to identify technically achievable decarbonisation pathways;
- Establish sector-specific trajectories, and a clear set of measures that need to happen in order to deliver the decarbonisation pathways (e.g. what needs to be done to Merton’s buildings, energy generation and use, green spaces and transport over the coming years in order to decarbonise the borough and the Council); and
- Identify, at a high level, the sorts of actions consistent with delivering these measures, alongside their associated costs and key barriers.

Tracking progress

- Scope a framework to track progress, with suitable key indicators;
- Identify suitable data sources; and
- Set out a method / tool to assess data against the key indicators, and if needed, to incorporate local data collection into broader greenhouse gas/ decarbonisation pathway tools.

The project ran between November 2019 and June 2020.

Section 2 provides detail on the data sets considered and the methodology used to develop the GHG inventories, the approach to the modelling and the scope of the decarbonisation targets. **Section 3** provides detail on the historic GHG inventories developed. **Section 4** provides detail on the scenario outputs, including discussion on barriers to implementing mitigation actions, costs, and offsetting remaining emissions. **Section 5** sets out potential indicators for tracking progress towards the net zero targets. **Section 6** contains recommendations for Merton to consider going forward.

2 Methodology

2.1 GHG Inventories

A greenhouse gas (GHG) inventory is a dataset which presents estimates of emissions of various greenhouse gases from a wide range of activities in an organisation, country or other geographical area. The standard approach to estimate GHG emissions is by multiplying activity data by an emission factor associated with the activity being measured (Equation 1).

Equation 1: Emission factor approach for calculating GHG emissions.

GHG emissions = activity data * emission factor

Emission Factor - This is the emissions per unit of activity, which usually comes from scientific literature. It is typically derived from measurement.

Activity data - This is a measure of the activity which is taking place, such as number of cows or tonnes of fuel. This data typically comes from national statistical datasets.

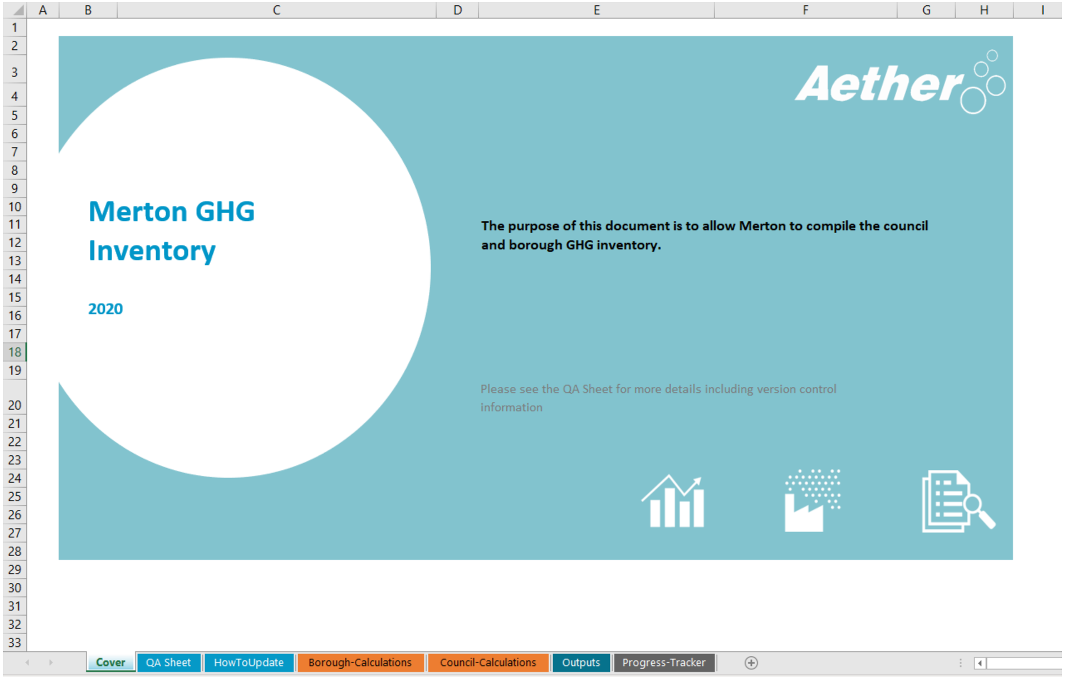
Activity data is a quantitative measure of a level of activity that results in GHG emissions taking place during a given period of time (e.g. volume of gas used, kilometres driven, tonnes of solid waste sent to landfill, etc.). An emission factor is a measure of the mass of GHG emissions relative to a unit of activity. For example, estimating CO_2 emissions from the use of electricity involves multiplying data on kilowatt-hours (kWh) of electricity used by the emission factor ($kgCO_2/kWh$) for electricity, which will depend on the technology and type of fuel used to generate the electricity.

An Excel file has been developed to contain the GHG inventories for both Merton Council and Merton Borough. These are colour-coded for transparency within the tool. Data sources are fully referenced in the calculations and within a 'How To Update' sheet in the workbook. This contains step-by-step instructions on how Merton can update the inventories in the future.

Figure 1 shows the cover page of the GHG inventory tool for Merton. The sheets of the tool are as follows:

- **QA Sheet** – containing meta-data on version control, authors, quality assurance checks
- **How To Update** – containing steps on how to update the inventories and tracker in future iterations, as well as full references for data sources
- **Borough-Calculations** – containing activity data, emission factors and emissions calculations for the borough of Merton
- **Council-Calculations** - containing activity data, emission factors and emissions calculations for Merton Council
- **Outputs** – containing summary figures of the inventories
- **Progress-Tracker** – containing the indicators for tracking decarbonisation progress for Merton alongside the inventories

Figure 1: Structure of Merton's GHG Inventory tool



2.2 Modelling approach

This GHG emission trajectory study for Merton Council has been undertaken using the Carbon Scenario Model (CSM). Originally developed for use by local authorities (funded by Resource Efficient Scotland and Sustainable Scotland Network[3]), this Excel based tool has been adapted by the project team to provide a bespoke modelling solution for Merton. The CSM has been used to compile emission reduction trajectories up to 2030 for the council emissions and up to 2050 for the borough emissions, based on a series of carbon reduction actions represented in the model. This approach provides transparency of methods and also flexibility so that Merton Council can make changes to the model in future as plans become more confirmed and new data or information become available.

Within the model, emissions are disaggregated by sector (e.g. transport, domestic, industrial/commercial) and by "fuel" type (e.g. electricity, gas, road fuels). This allows for the identification of key emission sources, and for the impact of decarbonisation actions on sectors to be displayed in model outputs.

The initial set up of the model required input of the carbon footprint for the borough of Merton and Merton Council together with an estimate of a future emission projection assuming no further action is taken. Assumptions for the baseline scenario are summarised in **section 2.2.1** and **Annex 1**. This is the emission baseline projection upon which the scenario is built. It demonstrates the remaining gap to becoming carbon neutral in 2030 and 2050 and defining the key emitting sectors where additional action is needed.

[3] https://sustainablescotlandnetwork.org/resources/carbon-footprint-and-project-register-tool

Carbon reduction actions identified were entered into the model and potential savings calculated. These form the potential decarbonisation pathways for the borough and the council.

The modelling approach was guided by the following principles:

- Provide full transparency of methods and data input. This involves full documentation of assumptions in the tool which has been handed over to Merton. The assumptions behind each decarbonisation action are included within the model workbook.
- Incorporate flexibilities in the modelling, allowing carbon mitigation actions to be 'switched on and off' for scenarios as commitments evolve.
- Consider uncertainty and risk which are inherent in any projection scenario. The model allows for documentation of uncertainty.

The outputs of the modelling are:

- Calculated greenhouse gas emissions for future years to 2050.
- Estimates of emissions reductions achieved by a wide variety of potential actions.
- The costs and monetary savings as a result of those actions on an annual basis to 2050.

The actions have been allocated to differing start dates to indicate when the major actions may need to happen, which involved some judgement about how quickly these changes might occur. The actions in the model are not all the same as the actions in the Merton Climate Strategy and Action Plan, but nevertheless there is a read across between the two sets of actions that provides an understanding of the likely impact and cost of the actions and roughly how fast changes need to be made to achieve the targets.

However, the modelling approach used is a relatively simple one, and has required assumptions and estimation to be made of both current and future carbon emissions and activities related to them. This included best estimates based on expert judgement to fill gaps where no reliable data were available. The model outputs need to be treated as indicative and the cost data are incomplete because of a lack of easily available data for some actions.

2.2.1 Business As Usual scenario set-up

The base year GHG inventory is projected forward in time, assuming no further action is taken in the council or borough, to produce the Business as Usual (BAU) scenario. The changes in the baseline emission profile are therefore as a response to pressures and actions from outside the borough, such as the national process of decarbonising electricity generation, changes in population, growth forecasts for traffic, changes in technology etc. These assumptions are provided within the model and listed in **Annex 1** of this report. This provides a basis on which to calculate the effect on GHG emissions of actions taken within the borough.

The BEIS 2018 energy projections[4] have been used as the basis of the baseline projection, using the published Existing Policies Scenario. This includes the predicted impacts of energy efficiency and other policies on national emissions. The impact of

[4] https://www.gov.uk/government/publications/updated-energy-and-emissions-projections-2018

these changes has been calculated as a pattern of percentage change for future years for each main source in the Merton model. It should be noted that any projections of this nature that extend decades into the future are likely to be associated with significant uncertainty and subject to adjustments as the evidence-base improves and unforeseen technology and behaviour changes arise. Nevertheless, the key drivers include:

- **National electricity grid factor:** this is, in effect, the progressive decarbonisation of grid electricity in the UK, as renewable energy sources overtake carbon-based generation. This is being driven by a range of Government policies. The future grid electricity factors used in the model were published in the Treasury Green Book supplementary appraisal guidance on valuing energy use and greenhouse gas (GHG) emissions.[5]
- **Energy efficiency and new technologies**: the BEIS projections take account of national policies related to the uptake of new technologies and the replacement of products with new ones that are more efficient. However, the Merton baseline does not account for electrification of road vehicles. This is to prevent a double count of impacts because these are included specifically in the decarbonisation scenario. Energy efficiency actions in the decarbonisation scenario extend beyond those included in the BEIS projections.
- **Population and housing forecasts**: an increasing population will increase energy demand directly, as well as driving increases in service provision and thus the emissions of Merton Council and other public sector organisations. The BEIS energy projections include the impact of population change. The growth projection used by BEIS have been compared with Merton's own housing growth projections and found to follow a very similar level of increase. It is assumed that growth beyond 2025 does not create further demand for gas because of buildings policies already in place.

2.2.2 Decarbonisation scenario set-up

The decarbonisation scenario builds upon the business-as-usual scenario. This means that all scenarios have the same base assumptions, such as the decarbonisation rate of the electricity grid and population growth. Individual decarbonisation actions are added with emissions savings estimated annually from the year of implementation. These are detailed in **sections 4.1** and **4.2**.

2.3 Scope of the targets

2.3.1 Definitions

In line with Merton Council's resolution, the term "decarbonisation" is used in this report to mean the same as becoming "carbon neutral" or "net zero carbon": the balancing of carbon emissions against carbon removals and/or carbon offsetting with the net result being zero. "Net zero" is used in this report as shorthand to cover the net balancing of the main greenhouse gases: carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). The global warming potentials of CH_4 and N_2O are used to calculate the equivalent warming to CO_2, to allow the estimation of total GHG effects on the atmosphere in one unit, CO_2-equivalent, or CO_2e.

[5] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/794737/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal-2018.pdf

As defined by the Committee on Climate Change (CCC), a net-zero (i.e. carbon neutral) target requires “deep reductions in emissions, with any remaining sources offset by removals of CO_2 from the atmosphere (e.g. by afforestation)”. This removal requires either the purchase of carbon offsets[6] or direct carbon removal through additional carbon removal and storage (“sequestration”) activity on an organisation’s estate (see **section 4.6** for a discussion on offsetting).

2.3.2 Geographical and temporal scope

Setting the geographical and temporal boundaries is relatively straightforward at a high level:

- The geographical boundary is the area covered by the Merton Borough Council administrative area. Emissions from Merton Council’s own estate and activities are included and calculated as a subset of those emissions.
- The year for the inventories is determined by the latest available data from the relevant sources; 2017 for the borough inventory, and 2018 for the council inventory[7].
- The baseline for the decarbonisation scenarios data is 2017. The council scenarios are modelled within the borough scenario, so the data is aligned to the same time periods. 2018 data has been used for baseline for the council emissions, applied to both 2017 and 2018.
- The target year is 2030 for the council target, and 2050 for the borough target.

The borough GHG inventory covers the 2017 calendar year. This is due to the timing of the release of the data sources used; the BEIS sub-national fuel use data sets for 2018 are published at various times across 2020, with the last set concerning ‘other fuels’ not available until September 2020. The latest year for the council GHG inventory is 2018, as the council data are already available. Some of this data covers the financial year of 2018/19 but is allocated to the calendar year 2018 to be consistent with other data sources. All of the emissions covered by the council inventory are included in the borough inventory. The council emissions data is included in the borough inventory but is included within different (larger) data sources. There may be some inconsistencies between the two inventories. For example, the methodology used to estimate GHG emissions from waste collection vehicles in the council inventory likely includes emissions from the vehicles’ travel to waste processing plant outside of the borough, which would not be captured in the HGV emissions data set used in the borough inventory. However, any discrepancies are unlikely to have a significant impact on the results due to the small relative contribution of emission by the council within the borough.

2.3.3 Operational scope

The most widely used set of standards for local or regional carbon accounting are those produced under the Greenhouse Gas Protocol. Of particular relevance to this project is the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories[8], otherwise known as the GHG Protocol for Cities. This standard describes the emission sources and “scopes” which should be considered as part of a city-wide carbon

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[6] Where a project for reduction in greenhouse gas emissions is funded in order to compensate for emissions made elsewhere

[7] Some data sources for the council inventory are available on a financial year basis only. Where the data relates to 2018/19 financial year, this has been allocated to the 2018 calendar year inventory.

[8] https://ghgprotocol.org/greenhouse-gas-protocol-accounting-reporting-standard-cities

accounting process; the definition of the three scopes is shown in **Table 1**, below. Therefore, a key consideration in defining what a decarbonised Merton looks like is the extent to which the definition includes all scopes and how the boundary is set.

Table 1 Scope definitions

Scope	Merton Council	Borough of Merton
Scope 1	Emissions from sources owned or controlled by the council.	GHG emissions from sources located within the borough boundary.
Scope 2	Emissions from the consumption of purchased electricity, steam or other sources of grid-generated energy. Includes electricity supply to the Council's operational buildings and streetlights.	GHG emissions occurring as a consequence of the use of grid-supplied electricity, heat, steam and/or cooling within the borough boundary.
Scope 3	Emissions that occur indirectly from council activities, outside the control of the council (e.g. the Council's procured services).	All other GHG emissions that occur outside the borough boundary as a result of activities taking place within the borough boundary.

For the council, indirect emissions (scope 3) far outweigh scope 1 and 2 emissions and are the most challenging to both quantify and address (see **section 3.3**). Some scope 3 emissions of the council target are scope 1 or 2 emissions of the borough target. For example, emissions from waste collection vehicles are scope 3 for the council as a procured service, but the fuel use will be included as scope 1 emissions in the borough. Due to the data sources used there is no double counting.

The GHG Protocol Accounting and Reporting Standard for Cities also sets out a series of principles, which are consistent with other standards under the GHG Protocol series, and which are intended to guide GHG accounting towards a fair and accurate account of GHG emissions. These are:

- **Relevance**: The reported GHG emissions shall appropriately reflect emissions occurring as a result of activities and consumption patterns of the city. The inventory will also serve the decision-making needs of the city, taking into consideration relevant local, subnational, and national regulations. The principle of relevance applies when selecting data sources and determining and prioritising data collection improvements.
- **Completeness:** cities shall account for all required emissions sources within the inventory boundary. Any exclusion of emission sources shall be justified and clearly explained.
- **Consistency:** emissions calculations shall be consistent in approach, boundary, and methodology. Using consistent methodologies for calculating GHG emissions enables meaningful documentation of emission changes over time, trend analysis, and comparisons between cities.
- **Transparency:** activity data, emission sources, emission factors, and accounting methodologies require adequate documentation and disclosure to enable verification. The information should be sufficient to allow individuals outside of the inventory process to use the same source data and derive the same results. All exclusions shall be clearly identified, disclosed and justified.
- **Accuracy:** The calculation of GHG emissions shall not systematically overstate or understate actual GHG emissions. Accuracy should be sufficient enough to give decision makers and the public reasonable assurance of the integrity of

the reported information. Uncertainties in the quantification process shall be reduced to the extent that it is possible and practical.

Complying with these principles will provide a very high standard of GHG accounting. It also sets a very high bar in terms of the level of resource required simply to collect and verify data, resource which could be diverted towards planning and implementation of carbon reduction actions. The GHG Protocol for Cities acknowledges this, stating that "a city will need to make important decisions in terms of setting the inventory boundary, choosing calculation methods, deciding whether to include additional scope 3 sources, etc. Trade-offs between the five principles above may be required based on the objectives or needs of the city." Nor do the principles fully take into account the complexities of accounting for a region, in this case a borough, within a larger city. Some further guidance towards the application of the GHG Protocol scopes within this project, are shown in **Table 2**, below.

This will in effect create three types of sources and their associated data:

- Sources which are clearly "in scope", are important, and for which a reasonable level of data are available. This will include total electricity consumption and fossil fuel use within the Merton area;
- Sources which are clearly out of scope, either because they are sources which are not of significance in Merton, such as agriculture or industrial process emissions, or are minor and are best considered as sources outside the borough;
- Sources which are important but for which data are either unavailable or so uncertain that it becomes virtually impossible to show progress, and thus are not useful for making decisions or the development of actions. Such sources need to be acknowledged and discussed, and actions to address them are within the scope of the Merton climate action plan as a whole. However, they may not be included in the GHG inventory. This could include activities such as the goods purchased by residents and businesses within the Borough, or the transport generated by activities outside the Borough (e.g. flights taken by Merton residents).

Table 2 Further principles for data inclusion and exclusion for the council / borough inventory

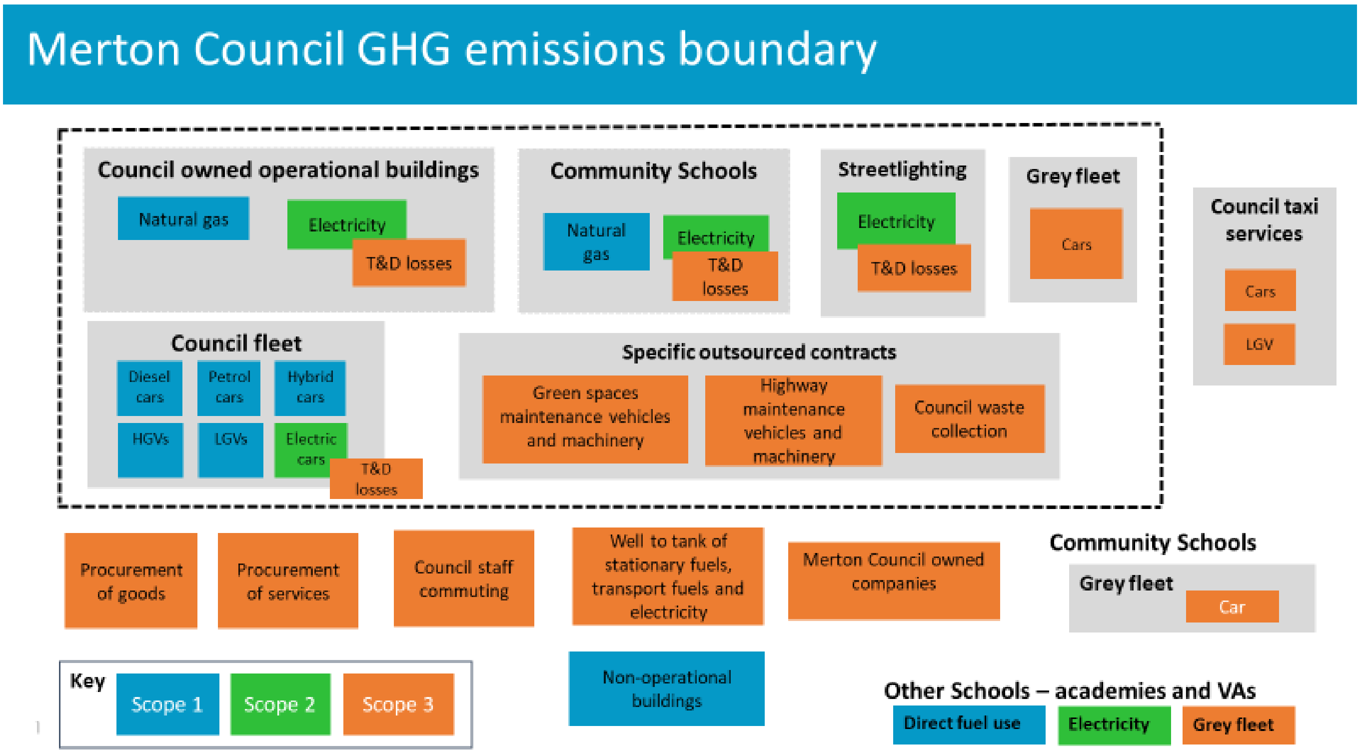
Reasons for including data within the GHG boundary	Reasons for excluding data from the GHG boundary
The emission source occurs within the administrative boundary of Merton Council / the borough of Merton	The emission source has no available dataset and estimation methods will not benefit the decision-making
The quantity of activity data for the emission source is controlled by an organisation/individual within the administrative boundary of Merton Council / the borough of Merton	The emission source clearly belongs to a different geographical region and they are better placed to account for it
An organisation/individual within the geographical region has a significant level of control over the emission source even though it occurs outside the administrative boundary of Merton Council / the borough of Merton	The emission source makes up a very small proportion of overall emissions AND it is very time consuming or difficult to collect activity data

A workshop was held in November 2019 with cross-department colleagues from Merton Council to discuss the scope of the Council 2030 target and inventory. This discussion continued into 2020 with Merton Council officers to finalise the scopes for both targets. This is presented in

Figure 2.

It should be noted that Merton Council has taken a wide view on what to include in their council target, including several large scope 3 emissions sources that other councils may exclude. Colleagues within Merton Council felt strongly that if the council has influence over the emissions sources, such as outsourced services of waste collection and highway maintenance, then the council should take some responsibility for the emissions and include the estimates within their inventory. Activities included within the black dashed line are those included in the council inventory.

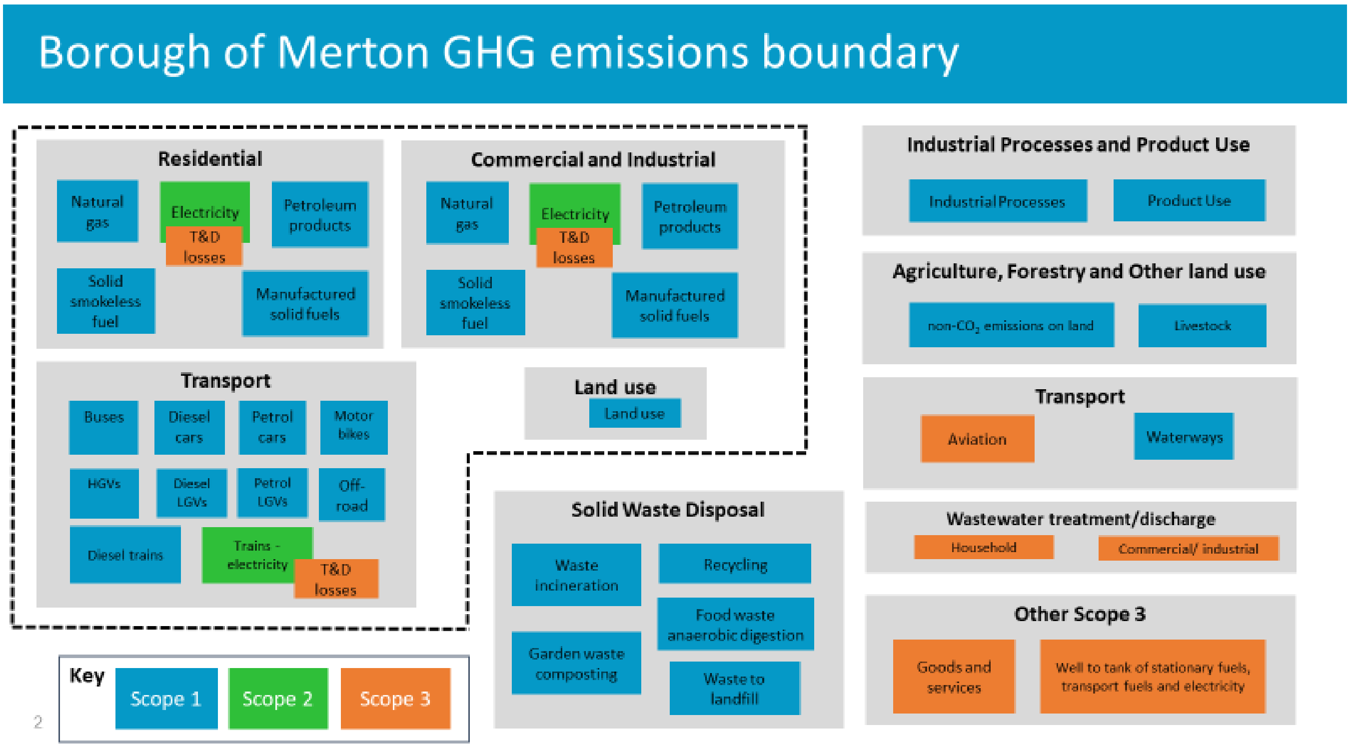
Figure 2: Emissions boundary for Merton Council GHG inventory and 2030 target



Note: T&D losses refers to the transmission and distribution losses from electricity supply.

The scope of the Merton borough inventory and 2050 target was discussed with Merton Council following the first workshop. This is presented in **Figure 3**. Activities included within the black dashed line are those included in the inventory.

Figure 3: Emissions boundary for Merton Borough GHG inventory and 2050 target



Note: T&D losses refers to the transmission and distribution losses from electricity supply. Transport HGVs includes council waste collection vehicles.

2.3.4 Exclusions from scope for this project

As noted in **section 2.3.3**, there are some sources which cannot be quantified to an acceptable level of certainty, either because data do not exist or because the data are not available at a borough level. Such sources have been addressed in Merton's climate action plan but have not been included in the current GHG inventory. There are also a number of sources which are not significant within Merton. Based on this and on the guiding principles set out in **section 2.3.3**, the following datasets have been excluded from the project boundary for modelling purposes:

Excluded due to lack of data and insignificance

- **Aviation:** emissions from aviation are typically assigned to the location of the departure/arrival airport. With no commercial airports in Merton this is not a significant source of emissions. Travel to airports from Merton could be considered under Merton's climate action plan but reliable data do not exist to enable it to be fully modelled (the part of journeys to airports that occur within Merton are already included).
- **Non-CO_2 emission sources from land and livestock**: Such as methane emissions from farm animals and nitrous oxide from soils. These are minor sources in Merton, but it is important to consider this in terms of upstream emission from food production.
- **Industrial and Chemical Product Use**: Emissions of concern in this sector are fluoro-carbons used in electronics production, refrigerants in cooling systems and lubricants/paraffin waxes for non-energy products, none of which are likely to be a significant source in Merton and data are scarce and uncertain.

Excluded due to lack of data

- **Off-road vehicles**: non-road transport and non-road mobile machinery. Data are limited and uncertain. Given the transient nature of e.g. construction equipment, the impact of actions taken at a borough level are unlikely to be representable in forecasts (i.e. to 2050). Nevertheless, construction is a high-profile activity within London and could be considered as part of Merton's climate action plan. This source is captured within the Merton council inventory through the relevant outsourced contracts (currently limited to the maintenance of green spaces and highways), but there will be other sources within the borough that are outside the scope of the council. If non-road mobile machinery is included within the BEIS Local Authority CO_2 data sets in the future, then Merton could include this source.
- **Waste processing**: whilst the emissions due to the collection of waste by the Council are included in the inventories and modelling, the emissions from the processing of waste are not. Initial estimates were explored during the development of the model but the emission factors for some waste processing streams were considered too uncertain to be a useful inclusion in the model. The South London Waste Partnership (SLWP) is setting up a working group with the four SLWP boroughs (Croydon, Kingston, Merton and Sutton) to agree an approach for baselining emissions from the Beddington Energy Recovery Facility (ERF), to agree how to split emissions across the boroughs, and to develop a strategy for reducing these emissions in the future.
- **Scope 3 emissions not already included**: see below.

Some scope 3 emissions can be estimated but are not included in the inventory because the methodology to estimate them uses high-level proxy data, which in future years would not reflect any changes in activity within Merton. A category of emissions which are difficult to quantify are those related to the **procurement of goods and services**. A full accounting of all goods and services purchased within Merton is likely to result in carbon emissions which far outweigh all other sources (potentially by an order of magnitude)[9]. These consumption-based emissions are discussed in **section 3.3**.

Scope 3 emissions are included as far as possible for Merton Council's inventory. Scope 3 emissions that are included in the council inventory include:

- Transmission & distribution losses from electricity supply
- Collection of household and commercial waste in Merton by Merton council (i.e. not all private commercial & industrial waste in the borough)
- Green spaces maintenance vehicles and machinery
- Highway works
- Council grey transport fleet

Including these sources will help prevent "carbon leakage" where services are outsourced (or brought back in-house) in the future. To include emissions from all outsourced scope 3 emissions sources would require the collection of data from contractors who may not be contractually obliged to provide such data and may regard it as commercially sensitive. Some scope 3 emissions sources which are not currently included in the council inventory include emissions from other Council contracts

[9] The C40 Cities report on urban consumption shows the extent of indirect emissions resulting from cities, which it describes as "consumption-based" but which are analogous to scope 3: https://c40-production-images.s3.amazonaws.com/other_uploads/images/2270_C40_CBE_MainReport_250719.original.pdf?1564075036

including Council adult social care and taxi services, staff commuting, and activities funded by pensions and investments. If data are obtained on such activities in the future, estimates can be included in the inventory. To ensure time-series consistency, any additions to the inventory should be added in for historical years as well. If historical data is not available, extrapolation or proxy methods could be used.

2.4 Input Data

Data were collected from both national data sets and directly from Merton Council. **Tables 3 and 4** summarise the data sources used for the council and borough GHG inventories. Detailed references are provided in the "How to Update" sheet of the inventories.

Emission factors for both the council and the borough GHG inventory are taken from "UK Government GHG Conversion Factors for Company Reporting"[10] for the applicable sources and years. For data sources in the council inventory which relate to the 2018/19 financial year, the 2018 emission factors are applied.

The uncertainty of the data from the data sources in **Tables 3 and 4** vary. In general, specific local data sets, such as metered electricity consumption from the council's buildings, will have a lower uncertainty than national data sources disaggregated to the borough level, such as domestic solid fuel consumption.

Table 3: Data sources for the Council GHG inventory

Data Source	Sector	Description
DECC GHG Report 2018-19 (received from Merton Council)	Energy	Electricity and gas consumption for council owned operational buildings and community school buildings, and electricity consumption for streetlighting, all in KWh.
DECC GHG Report 2018-19 (received from Merton Council)	Transport	Distance travelled by the council vehicle fleet, by fuel type and vehicle type.
Council staff survey (received from Merton Council)	Transport	Distance travelled by council staff for work trips (grey fleet).
Council Waste Tonnages Summary 2018-2019	Waste	Tonnes of commercial waste collected by the council and recycled or sent to energy from waste (EFW) plant.
Waste Data Flow figures from the South London Waste Partnership (SLWP)	Waste	Tonnes of residential waste collected by the council sent to landfill, EFW, recycled, composted or used in anaerobic digestion.
FM Conway (received from FM Conway)	Highway works	Direct emissions from the vehicle operations of FM Conway on highway maintenance in Merton through fuel consumption. Not including the use of red diesel in machinery as that data was not available.
ID Verde (received from Merton Council)	Green spaces maintenance and vehicles	Emissions from the vehicles (on and off-road) and machinery from operations of ID Verde for green spaces maintenance in Merton, through fuel consumption data.

[10] https://www.gov.uk/government/collections/government-conversion-factors-for-company-reporting

Table 4: Data sources for the borough GHG inventory

Data Source	Sector	Description
Department for Business, Energy and Industrial Strategy (BEIS): 'Sub-national electricity sales and numbers of customers'	Grid electricity; domestic economy 7, domestic standard and non-domestic	This dataset provides energy consumption data for domestic and commercial electricity use in the borough of Merton.
Department for Business, Energy and Industrial Strategy (BEIS): 'Sub-national weather uncorrected gas sales and numbers of customers'	Natural gas; domestic and non-domestic	This dataset provides energy consumption data for domestic and commercial gas use in the borough of Merton.
Department for Business, Energy and Industrial Strategy (BEIS): 'Sub-national estimates of non-gas, non-electricity and non-road transport fuels'	Petroleum, coal and manufactured solid fuels consumption	This data set provides consumption data for other fuels, non-gas and non-electricity for domestic, commercial, industrial and non-road transport use in the borough of Merton.
Department for Business, Energy and Industrial Strategy (BEIS): 'Road transport energy consumption at regional and local authority level'	Borough bus travel, Borough diesel car travel, Borough petrol car travel, Borough motorbike travel, Borough HGV, Borough LGV diesel and Borough LGV petrol	This dataset provides fuel consumption data (diesel and petrol) for road vehicles in the borough of Merton.
Department for Business, Energy and Industrial Strategy (BEIS): 'UK local authority and regional carbon dioxide emissions national statistics'	Borough emissions from land use	This dataset provides net CO_2 emissions from land use, land use change and forestry for the borough of Merton from which emissions can be estimated.
Greater London Authority: 'London Energy and Greenhouse Gas Inventory (LEGGI), 2017'	Merton passenger diesel, passenger electric, freight diesel, London underground, London tram (kWh)	This dataset provides rail KWh for passenger and freight rail for the borough of Merton. This includes data for the London underground, trams, and national rail sections within the borough of Merton.

A note on waste data and emissions

The scope of emissions from waste differs slightly between the council and borough inventories. For the council inventory the waste emissions relate only to the collection of waste through the contracted service provided by the council. This is estimated through applying BEIS carbon factors based on the tonnage of waste collected because data on fuel used by refuse trucks is not available but will be sought in future years. This is a scope 3 emissions source for the council. For the borough inventory the emissions from waste collection (all waste collection in the borough, not just waste collected by the council) are a scope 1 source and are already included through the borough-wide data source from BEIS on road transport through HGV use, and so are included in the transport sector. Emissions from waste processing are not currently included, pending investigation of emissions from the energy from waste plant (see **section 2.3.4**).

3 GHG Inventories

3.1 Merton Borough GHG Inventory

Merton Borough's GHG emissions for 2017 were estimated to be 708 ktCO_2e. Emissions by sector are presented in **Figure 4** and **Table 5**. The most significant emissions source is the residential sector, comprising 46% of total emissions from residential heating and electricity use.

Figure 4: Estimated ktCO_2e emissions for Merton Borough in 2017

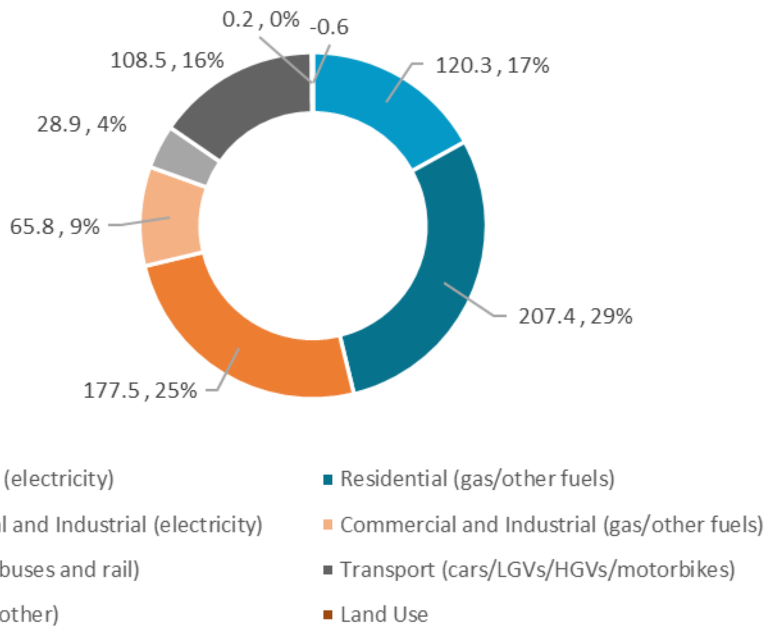


Table 5: Estimated ktCO_2e emissions for Merton Borough in 2017

Sector	2017 (kt CO_2e)	% of total emissions
Residential (electricity)	120.3	17%
Residential (gas/other fuels)	207.4	29%
Commercial and Industrial (electricity)	177.5	25%
Commercial and Industrial (gas/other fuels)	65.8	9%
Transport (buses and rail)	28.9	4%
Transport (cars/LGVs/HGVs/motorbikes)	108.5	15%
Transport (other)	0.2	0.03%
Land use	-0.6	-
Total	**708.0**	

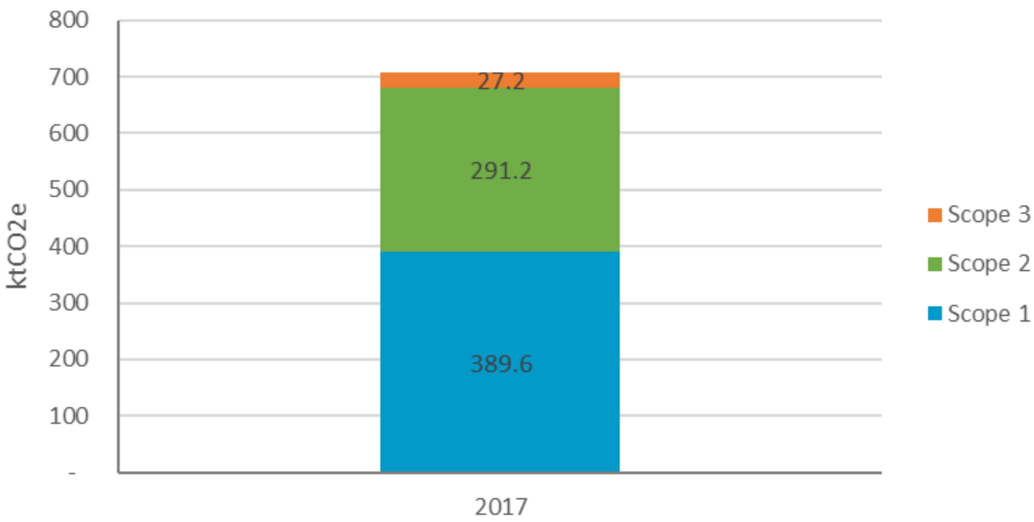
The sources of emissions in Merton are numerous and dominated by the use of natural gas for heating and electricity for heating and lighting homes, businesses, and other buildings such as hospitals and schools. There is also a large contribution from transport, which is dominated by emissions from private road transport. There are no significant industrial emission sources in Merton. Emissions from the collection of waste material are included in the transport emissions from HGVs.

Land use emissions estimates are derived by the Centre for Ecology & Hydrology (CEH), who model estimates of the sequestration of CO_2 by land use change and the net loss or gain of CO_2 from soils and vegetation for the UK national and sub-national GHG emissions inventories[11]. At the local authority scale, the highest emissions are generally related to conversion of grassland to crops or buildings, and the highest removals of emissions are usually forest growth and conversion of cropland to grassland. Land use and land use change in Merton is currently a small net sink of CO_2; 0.6 ktCO_2e. This reduced the 2017 emissions from 708.6 ktCO_2e to 708.0 ktCO_2e (0.08% reduction).

Figure 5 shows the borough's 2017 GHG emissions split by scope. The estimated scope 3 emissions of the borough included in the inventory are 10% of the total borough's GHG emissions inventory. The scope 3 emissions included in the borough inventory are currently the transmission and distribution losses from electricity supply.

The scope 3 emissions of the council inventory (see **section 3.2**) are defined as scope 1 emissions of the borough (except for the transmission and distribution losses of electricity) as they relate to fuel combustion within the borough's boundaries. See **section 3.3** for discussion on the magnitude of other scope 3 consumption-based emissions not included in the inventory.

Figure 5: ktCO_2e emissions for Merton Borough, 2017, by scope



[11] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/812153/LULUCF_Local_Authority_mapping_report_2017.pdf

3.2 Merton Council GHG Inventory

Merton Council's GHG emissions for 2018 were estimated to be 11.1 $ktCO_2e$. Emissions by sector are presented in **Figure 6** and **Table 6.** The most significant scope 1 emissions source is gas consumption in the council's operational buildings and community schools.

Figure 6: Estimated $ktCO_2e$ emissions for Merton Council in 2018

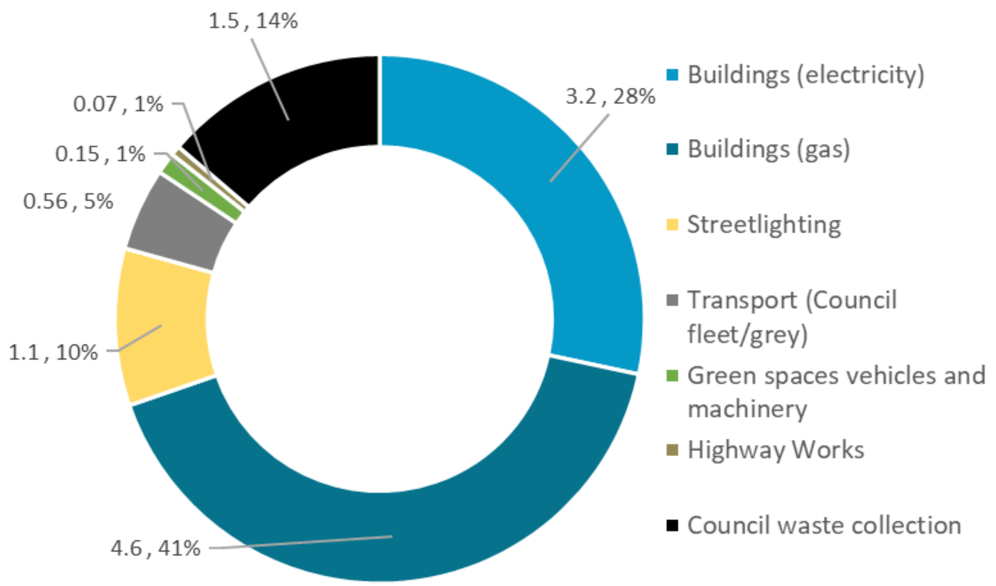


Table 6: Estimated $ktCO_2e$ emissions for Merton Council in 2018

Sector	2018 ($ktCO_2e$)	% of total emissions
Buildings - electricity	3.2	28%
Buildings - gas	4.6	41%
Streetlighting	1.1	10%
Transport (council fleet/grey fleet)	0.56	5%
Green spaces maintenance vehicles & machinery	0.15	1.3%
Highway works	0.07	0.6%
Council waste collection	1.5	14%
Total	**11.1**	

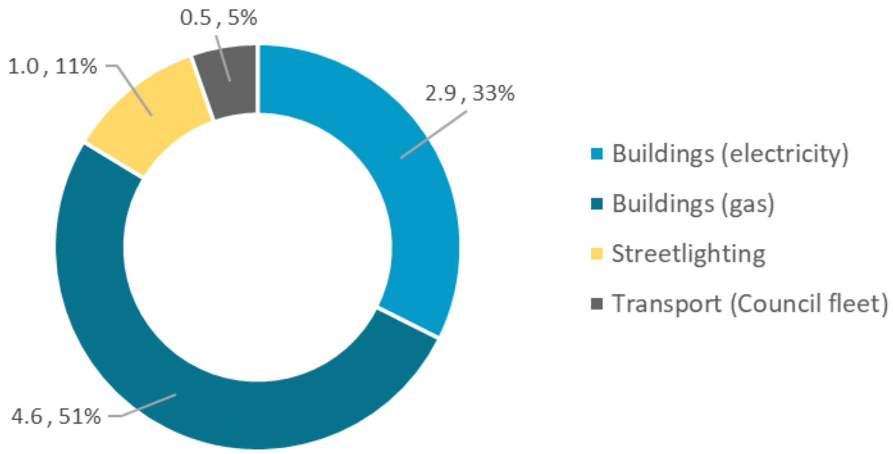
Merton Council has included a range of scope 3 emissions sources within their GHG inventory that other councils may not:

- Transmission and distribution losses of purchased electricity (in commercial buildings, schools, streetlighting, electric vehicles in the council fleet)
- Collection of residential and commercial waste within Merton, by Merton Council
- Highway maintenance (currently provided by FM Conway)
- Maintenance related to green spaces (currently provided by ID Verde)

- Grey fleet – emissions from council staff using their own vehicles for council activities

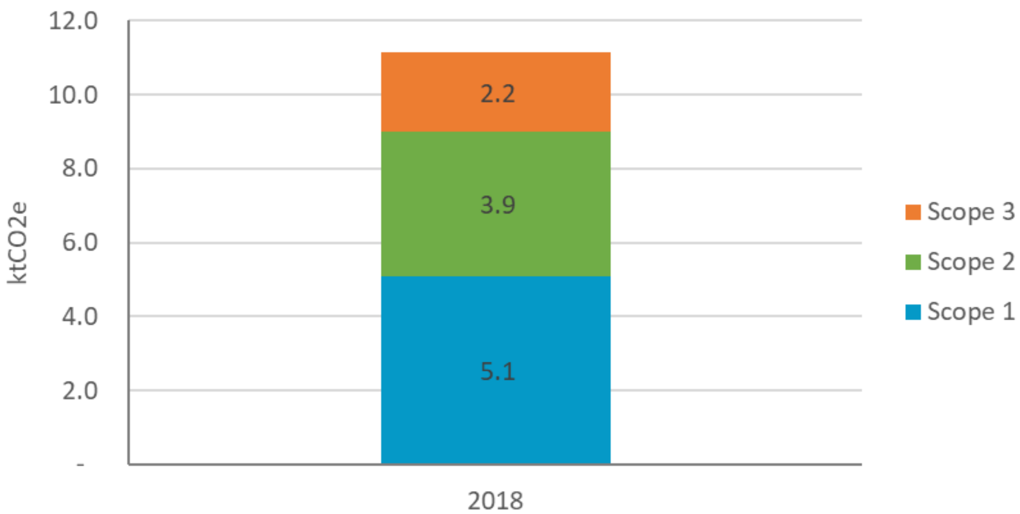
Figure 7 shows the direct (scope 1 and 2) emissions of Merton Council for 2018, which were estimated to be 9.0 $ktCO_2e$. This is consistent with previous reporting on GHG emissions by the council.

Figure 7: Estimated scope 1 and 2 emissions ($ktCO_2e$) for Merton Council in 2018



Merton Council's GHG emissions for 2018 are shown in **Figure 8** split by scope. The estimated scope 3 emissions of the council included in the inventory are 19% of the council's scope 1-3 emissions. Some scope 3 emissions sources which are not currently included in the council inventory include emissions from adult social care, staff commuting, other outsourced contracts (besides the waste collection, green spaces maintenance and highways maintenance currently included) and activities funded by pensions and investments. If data were to be obtained on these sources, then the proportion of scope 3 emissions in the council's inventory would likely rise significantly.

Figure 8: $ktCO_2e$ emissions for Merton Council, 2018, by scope



3.3 Scope 3 consumption-based emissions

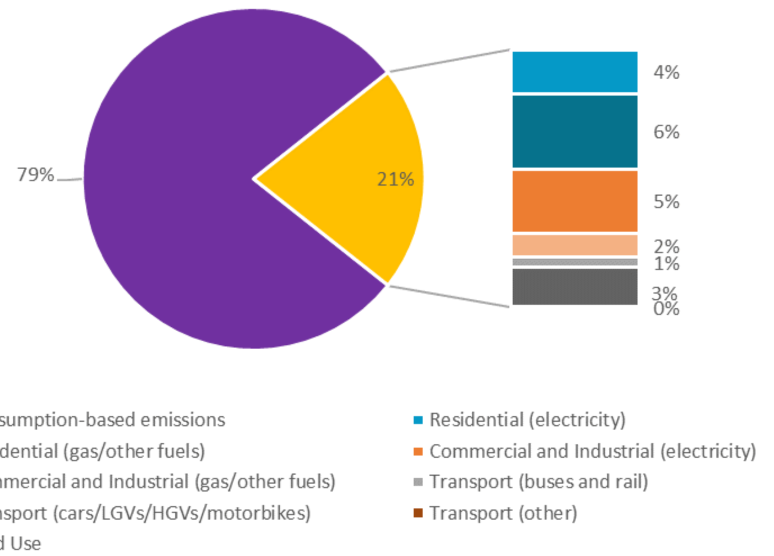
Merton Council's climate action plan also aims to influence other "consumption based" scope 3 sources of GHG emissions which cannot be accurately estimated or included in the inventories, due to resource constraints or lack of data. These sources are not emissions produced directly within Merton but are influenced by the purchasing and consumption habits of Merton's population and businesses. High-level proxy estimations can be made to assess the magnitude of the emissions but these have not been included in the modelling described in this report because any actions taken in Merton to affect these emissions would not necessarily be reflected in future versions of the data.

Scope 3 consumption-based emissions relate to the embedded emissions in the consumption of goods and services within Merton. The C40-Arup report "The Future of Urban Consumption in a 1.5C World"[12] considers six key consumption categories:

- Food
- Clothing and textiles
- Building infrastructure construction
- Electronic equipment and household appliances
- Private transport (manufacturing of)
- Aviation

C40 has estimated that for European cities, the average emission per capita for all of the consumption-based emissions is 12.7 tCO_2e/capita (2017) but a split of emissions by the above sources is not available. For Merton, with a 2017 population of 206,052[13] this would represent consumption emissions of 2,617 $ktCO_2e$. If this were included in the Merton borough GHG inventory for 2017, this would make up 79% of GHG emissions. **Figure 9** shows the split of embedded consumption emissions (purple) versus the rest of the GHG inventory for the borough (yellow).

Figure 9: GHG inventory for Merton Borough, 2017, incl. consumption-based emissions ($ktCO_2e$)



[12] https://www.arup.com/perspectives/publications/research/section/the-future-of-urban-consumption-in-a-1-5c-world

[13] https://www.ons.gov.uk/datasets/mid-year-pop-est/editions/time-series/versions/4

4 Decarbonisation Pathways

4.1 Pathway to 2050 Borough net zero target

The baseline projection for the borough carbon footprint is from 2017. Results suggest that even without local carbon reduction projects considered, Merton Borough emissions will decrease by 40% by 2050. This is largely driven by the decarbonisation of the electricity grid through the deployment of more renewable electricity generation, which is predicted to reduce emissions from non-domestic and domestic electricity by up to 90% by 2050. Emission decreases are also seen from car travel, other transport and waste. Increases in emissions are estimated for some sectors; borough bus travel, domestic natural gas (in the short term) and other domestic heating, reflecting changes in travel behaviours and population changes.

Table 7 provides a summary list of the actions that have been quantified and included in the borough decarbonisation scenario modelling. The actions are sorted by potential order of implementation, starting with the "easier" actions. The assumptions behind each action have been documented within the model and in the case of the residential sector in **Annex 1** of this report.

The decarbonisation scenario estimates that implementation of the combination of all quantified actions would result in a reduction of 91% in CO_2e emissions for the borough by 2050 from the 2017 base year, to 62.0 ktCO_2e in 2050. This represents an 85% reduction in GHG emissions by 2050 compared to the 2050 business as usual scenario.

Figure 10 shows the impacts of these estimated savings on emissions to 2050. The business as usual (BAU) scenario total emissions are shown in **Figure 10** for comparison. Residual emissions will need to be offset to achieve net zero.

It should be noted that, while the pattern of emission reductions described provides a useful indication of the potential impacts of the actions overall, there have been various assumptions made for each action. These include the potential activity change resulting from the action, how this translates into carbon emission reductions and the level of uptake/penetration of the action. There is a high level of uncertainty around the emission savings estimates, especially with actions that are modelled to occur across multiple decades. Wherever possible, the project team has drawn on robust and publicly available data sources to support the quantification of the actions and all of the assumptions have been documented. Nevertheless, expert judgement has been used in cases where data were not found, and any assumptions have been tested with the Council.

Figure 10: Decarbonisation pathway for Merton Borough, 2017 – 2050

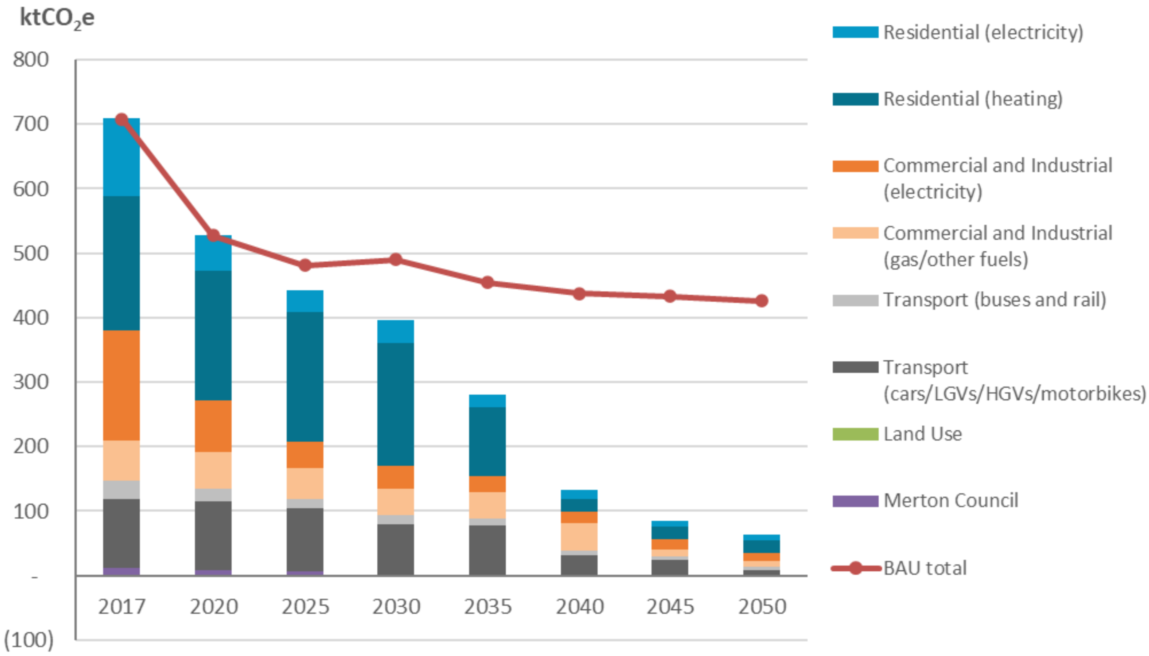


Table 7: Actions and associated carbon savings included in the Borough modelling

Sector	Action Description	Action Code*	2050 potential annual savings ($ktCO_2e$)
Buildings and energy	Council actions on buildings	CE1-CE8	4.53
	Enhance energy efficiency in the commercial & industrial sector	CI1 & CI2	24.3
	Other methods to reduce non-domestic gas use e.g. biogas, hydrogen, replacement with heat pumps by 2040	CI3	33.3
	Enhance energy efficiency of non-council public buildings	PS1 & PS2	2.01
	Housing - Lower cost packages of energy efficiency measures	H1	21.3
	Housing - High cost packages of retrofit measures to target zero carbon	H2	171.6
	Domestic PV - 2020s expansion	H3	0.92
	Domestic PV - 2030/40s maximisation using all suitable roofs	H4	1.86
	Phase out use of domestic and industrial solid fuels (coal and smokeless coal)	H10	1.35
Transport	Council actions on own and outsourced fleets	T5	2.20
	Reducing commuting car traffic	T1	0.94
	Increasing use of electric cars (20% of fleet by 2030)	T3	14.7
	Improve walking and cycling infrastructure in 2020s	T4	5.74
	Cleaning the bus fleet by 2037	T6	4.00
	100% electric taxis through taxi licensing by 2030	T10	1.01

Sector	Action Description	Action Code*	2050 potential annual savings ($ktCO_2e$)
	School travel plans	T11	0.23
	Rationalise suppliers of goods & services to the council	T12	0.11
	Rationalising distribution in borough	T13	3.91
	Maximise cycling potential from 2030s	T14	4.58
	Increasing electrification of cars and vans by 2040	T15	37.9
	Full electrification of cars and vans by 2050	T16&T17	30.7
Green spaces	Planting 800 trees per year	L1	0.0004
		Total savings in 2050 ($ktCO_2e$)	**367.1**

Note: *Action codes refer to references in the Carbon Scenario Model. They are not always sequential.

4.2 Pathway to 2030 Council net zero target

The baseline for the decarbonisation scenarios data is 2017. The council scenarios are modelled within the borough scenario, so the data is aligned to the same time periods. 2018 data has been used for the baseline for the council emissions, applied to both 2017 and 2018. Results suggests that even without local carbon reduction projects considered, Merton council emissions will decrease by 35% by 2030. This is largely driven by the decarbonisation of the grid, which reduces emissions from council building electricity use by up to 81% by 2030. Emission decreases are also seen from car travel, other transport and waste. Increases in emissions are estimated for some sectors; natural gas (in the short term) and other heating, reflecting changes in travel behaviours and population changes.

Table 8 provides a summary list of the actions that have been quantified and included in the council decarbonisation scenario modelling. The actions are sorted by potential order of implementation, starting with the "easier" actions. The assumptions behind each action have been documented within the model. The decarbonisation scenario estimates that the result of the combination of all quantified actions would result in a reduction of 88% in CO_2e emissions for the Council by 2030 from the 2017 baseline, to 1.5 $ktCO_2e$ in 2030. This represents an 81% reduction in GHG emissions by 2030 compared to the 2030 business as usual scenario. Residual emissions will need to be offset to achieve net zero.

Figure 11 shows the impacts of these estimated savings on council emissions to 2030. The business as usual (BAU) scenario total emissions are shown in **Figure 11** for comparison. It should be noted that, while the pattern of emission reductions described provides a useful indication of the results of the actions overall, there have been various assumptions made for each action. These include the potential activity change resulting from the action, how this translates into carbon emission reductions and the level of uptake/penetration of the action. This leads to a high level of uncertainty around the emission savings estimates, especially with actions that are modelled to occur further into the future. Wherever possible, the project team has drawn on robust and publicly available data sources to support the quantification of the actions and all of the assumptions have been documented. Nevertheless, expert judgement has been used in cases where data were not found.

Figure 11: Decarbonisation pathway for Merton Council, 2017 – 2030

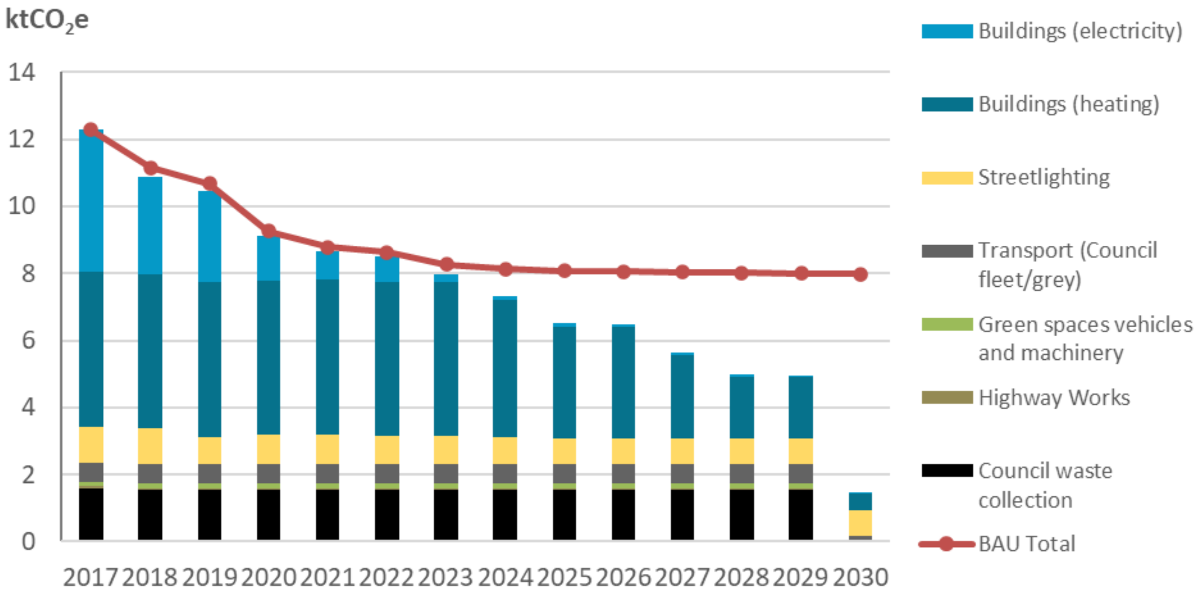


Table 8: Actions and associated carbon savings included in the Council modelling

Sector	Action Description	Action Code*	2030 annual savings ($ktCO_2e$)
Buildings and energy	Replace old streetlights with LEDs	CE1A	0.09
	Replace old building lights with LEDs	CE2	0.14
	Energy saving awareness raising among council staff	CE4	0.02
	Insulation and heating upgrades (other buildings, not Civic Centre)	CE5	0.77
	Insulation and upgrades to current heating systems in the Civic Centre	CE6	0.04
	Switch gas to electric heating in the Civic Centre	CE7A	0.63
	Switch gas to electric heating in other operational buildings (not Civic Centre)	CE7B/C/D	0.93
	Switch gas to electric heating in community schools	CE7E/F/G	1.73
	Increasing deployment of renewables on council buildings	CE8	0.02
Transport	All electric council owned fleet	T5A	0.46
	All electric council outsourced fleet (green spaces maintenance)	T5B	0.13
	All electric council outsourced fleet (highway works)	T5C	0.06
	All electric waste collection fleet by 2030	T5D	1.49
Total savings in 2030 ($ktCO_2e$)			**6.5**

Note: *Action codes refer to references in the Carbon Scenario Model. They are not always sequential.

4.3 Indicative Investment Costs

An initial estimate has been made of the investment costs required for the actions in the decarbonisation scenario. There were some gaps in data available therefore, expert judgement by the project team has been used for actions where published sources of data were not found. , The most significant gaps are those for actions requiring new technologies such as replacement of natural gas with new fuels, for which cost estimates are not available. The cost estimated are marginal capital costs, undiscounted and do not include maintenance or administration of actions or revenue costs. Overall, the estimates of capital costs, cost savings and carbon impacts should be considered as indicative and more work is needed to provide a robust cost estimate for each of the actions described.

Despite these limitations, a capital cost of more than £3 billion has been estimated for the implementation of actions in the decarbonisation scenario (see **Table 9**). This is likely to be a significant underestimate because there are some gaps in the costs estimated where data are not currently available and indirect costs have not been fully considered. Of the above costs estimated, £86 million is estimated to fall directly to the Council in relation to the 2030 target. For the borough wide target, the costs are largely related to improvements in buildings. There will therefore need to be significant and sustained action by a range of other stakeholders, such as private homeowners, landlords and businesses in the borough. Lobbying and partnership work by the Council is an important way in which Merton Council can take action to identify funding opportunities and to enable this investment.

Set against these investment costs, there will be a benefit in terms of lower energy costs for the people and businesses of Merton. Based on the modelling undertaken, this amounts to a saving of £2.2 billion by 2050. Again, this is likely to be an underestimate because not all actions have been quantified in terms of costs and savings. These savings do not include the avoided additional costs of dealing with worse effects of climate change, nor of the co-benefits from these actions such as improved health and job creation (see below), nor the benefits of actions felt outside the borough. So, whist on the face of it, the initial investment seems not to payback over time according to the estimates presented here, the full set of benefits are likely to far outweigh the initial investment cost.

Table 9: Estimates of costs and savings related to actions for the 2030 and 2050 targets

Action plan area	Sub-category	2030 annual savings ($ktCO_2e$)	2050 annual savings ($ktCO_2e$)	Action estimated investment cost (£M)	Action cost saving to 2030 (£M)	Action cost saving to 2050 (£M)
Buildings and energy	**Buildings total**	**66**	**261**	**2,789**	**199**	**1,632**
	Buildings and energy - council	4.4	4.5	72	5	17
	Buildings and energy -housing	22.9	197	2,679	29	836
	Buildings and energy - other buildings	38.8	59.9	38	165	779
Transport	**Transport total**	**29.6**	**106**	**293**	**44**	**536**
	Transport - council	2.1	2.2	14	1.0	21
	Transport - borough wide	27.4	104	293	44	536
Green spaces		0.0004	0.0004	2.4	-	-
Total		**95.6**	**367.1**	**3,099**	**244**	**2,189**

4.4 Co-benefits of actions

There will also be considerable co-benefits accrued as a result of taking significant action to reduce GHG emissions in Merton. These include:

- **Improvements to health and wellbeing** as a result of improved air quality and safer streets, increased activity from people walking or cycling more, reduced fuel poverty from more energy efficient homes and healthier diets
- **Improved equity and social cohesion** through focusing on the most vulnerable in society, such as action to alleviate fuel poverty or create access to green spaces
- **Economic benefits** through reduced expenditure on energy as well as the creation of a wealth of economic opportunities and jobs
- **Increased resilience of cities and their communities** to future changes in energy prices and energy systems, as well as a potential increase in the resilience of communities and infrastructure to the impacts of climate change

These co-benefits have not been quantified or monetised or included in **Table 9**. However, the Committee on Climate Change's report *Net Zero: The UK's contribution to stopping global warming* suggests that the fully monetised co-benefits associated with achieving net zero emissions on a national basis would "*partially or possibly even fully offset the [estimated] resource costs*".

4.5 Barriers to Implementation

Some of the actions included in the modelling of decarbonisation pathways require quite radical deviation from the status quo. Some of the actions currently have very high costs, uncertainties around technology readiness, significant barriers to public acceptability, or require action outside of Merton Council's direct control.

Matching emission sources with the most appropriate tier of governance: the generation of electricity, fuels for road transport and fossil fuel (natural gas) for heating remain the key sources of CO_2 emissions in the UK. For road fuels: while Merton Council could work to increase the uptake of zero emission vehicles, it cannot change the national road fleet nor the quality of fuel sold, both of which rest with national (and international) policy. Managing demand for energy within the borough does come within the Council's sphere of influence but decarbonising the national electricity and gas grids are beyond the scope of what can be done in Merton. However, Merton could increase the deployment of local renewable energy to reduce the borough's consumption of grid electricity if the local projects supply Merton directly, or to help decarbonisation of the grid electricity if the local projects connect to the grid.

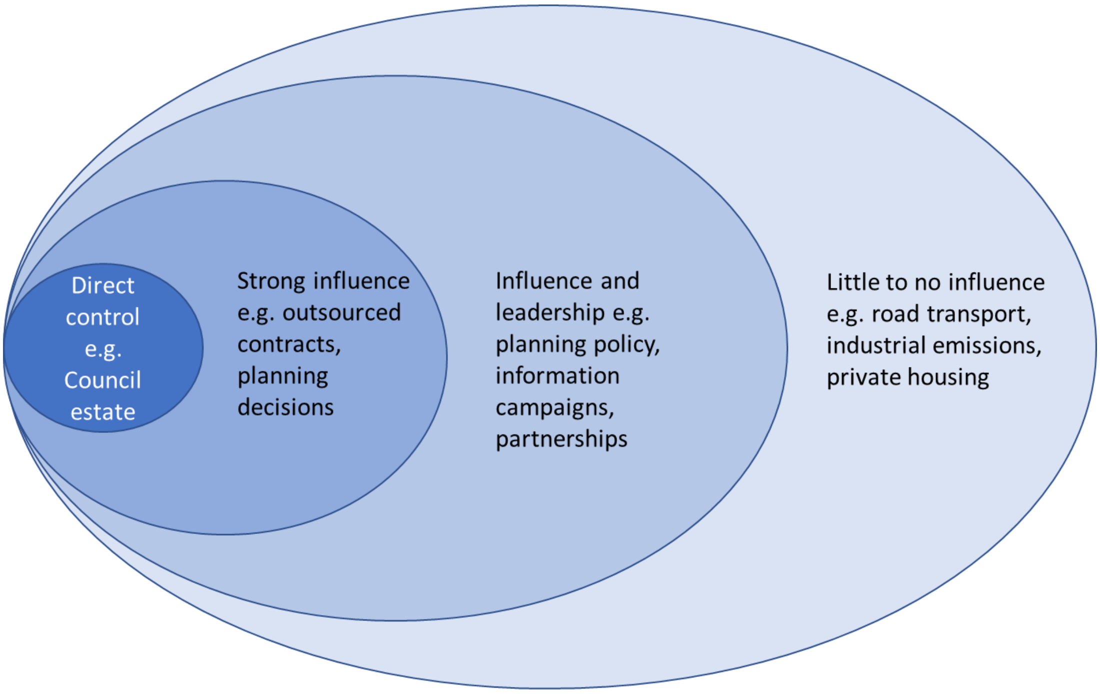
Mismatch between the Council's ambition and national timescales: the UK Government has committed to achieving carbon neutrality at a national level by 2050. In its report on the potential pathways to achieving this, the Committee on Climate Change made clear that even on this timescale, radical action is needed to reduce carbon emissions. It is already accepted that nationally controlled policies, such as grid decarbonisation, will not achieve full carbon neutrality by 2030. Therefore, carbon offsetting will still be necessary in 2030 in relation to electricity use for the council to meet its own carbon neutral target even if their fossil fuel use is entirely replaced.

The limits of Council control: the Council is clearly a major actor in Merton and has a strong role in both influencing activities within the borough and providing leadership on climate change issues. However, there are limits to this level of control and influence and there is a spectrum of control ranging from direct control, e.g. over the Council's own estate, through to no control, e.g. over personal choices made by residents, businesses and service providers in terms of what car they drive, what energy they use and what they throw away. Many of the actions in the decarbonisation pathway for the borough target require individuals and businesses to make wide spread behaviour changes and investments that may have large up-front costs, such as buying an electric car or e-bike instead of a petrol car, or installing solar PV to their roofs. This variation in control and influence is illustrated in **Figure 12.**

Data availability and the quantification of borough level emissions: it is not possible to quantify all of the emission sources in the borough, either because the data do not exist or they are not available at the borough scale (and there are no appropriate approximation methods). This does not mean that such emission sources are not addressed by Merton's climate action plan, but it does mean that their impact, and the effectiveness of actions to address them, cannot be modelled to an acceptable level of certainty. This includes Merton's consumption-based emissions (discussed in **section 3.3**) which Merton cannot directly control but can potentially influence the emissions through purchasing decisions.

These factors in combination mean that achieving carbon neutrality within the Council by 2030 and the borough by 2050 will require extensive and positive action from a wide range of stakeholders, from the national Government through to private companies and homeowners. Even then, it is likely that some emissions remain in sectors where full decarbonisation is not yet technically possible, or where the cost of full decarbonisation is prohibitive or disproportionate. For these cases there may be a need to invest in offset credits to support decarbonisation elsewhere, to meet the net zero targets

Figure 12 Levels of control available to Merton Council



4.6 Offsetting

Achieving carbon neutrality is likely to involve both a combination of deep carbon emissions reductions and the offsetting of any remaining carbon emissions. To satisfy the net zero target, emissions that remain for the council by 2030, and for the borough by 2050, would need to be offset for every year that emissions remain.

Carbon offsetting enables individuals and organisations to compensate for any emissions they cannot avoid or reduce, by paying for a carbon credit i.e. to pay for an equivalent amount of emissions to be reduced or removed elsewhere. Because climate change is a global issue and greenhouse gases mix in the atmosphere, in practical terms it does not matter precisely where the GHGs are reduced.

These emissions savings are generated through the implementation of a wide variety of projects across a wide range of locations and might range from planting trees, to installing solar panels, to cancelling industrial carbon credit allowances. The Committee on Climate Change warns that offsetting is not a panacea and that to reach net zero, "most sectors will need to reduce emissions close to zero without offsetting; the target cannot be met by simply adding mass removal of CO_2 onto existing plans for the 80% target."[14]

The Committee on Climate Change suggests the UK will need to develop a substantial 'negative sector' by 2050, i.e. that technology will need to be further developed that is

[14] Committee on Climate Change (2019), Net Zero – The UK's contribution to stopping global warming, 2 May 2019

capable of directly removing greenhouse gases from the air. In its advice, the remaining emissions are removed largely using bio-energy with carbon capture and storage (BECCS), where additional amounts of energy crops (e.g. short rotation coppice willow or *miscanthus*) are grown, burned to produce power and the resulting CO_2 is stored underground[15]. There may be limited potential for such solutions within Merton itself, but other more viable opportunities for the Borough might include building with biomass[16].

Key considerations in weighing up offsetting options include:

- **Carbon Price**: Current offsetting costs are relatively low, sometimes under £10 per tonne. However, it is expected that offsetting costs will increase, partly due to rising demand but also because of increasing costs of abatement through time. In the UK the shadow price of carbon is set by the Government. It provides policy guidance and is applied in the appraisal of all government projects with carbon implications. In the current BEIS central price trajectory the shadow price of carbon for modelling purposes grows from £14 (central estimate) per tonne of CO_2 in 2020 to £43 per tonne in 2030. However a recent report has suggested a shadow price consistent with a net-zero target would start at £50 per tonne of CO_2 (with a range of £40–100) in 2020 and complete decarbonisation will require the use of negative emissions technology, which, at the scale required, could cost in the order of £160 (£125–300) per tonne of CO_2 in 2050.[17]
- **Location**. The geographic origin of carbon offsets is important to consider. Most carbon offsets available for purchase are generated by activities taking place in countries other than the UK. Carbon offsets from international activities can offer particular benefits: they tend to be lower cost than abatement options in the UK, maximising the value of each pound spent on climate change mitigation, and can also support wider sustainable development goals. However, domestic schemes can provide homegrown environmental and economic benefits (literally, in the case of tree planting) and may be a preferable option.
- **Timing:** Merton Council will need to consider when any push to begin offsetting the council's or borough's emissions should begin. One approach could be to wait until 2030 before offsetting residual emissions for the council, and 2050 for the borough. This may focus minds on emissions reductions until that point. But other options could include setting up offsetting schemes and policies sooner, to help normalise the process and costs of offsetting, to increase the 'price' of carbon-intensive activities (and therefore de-incentivise them) and to help fund emissions reductions within the borough.
- **Budget and ownership**: Merton Council will need to think carefully about the potential costs of offsetting borough-wide emissions, particularly if the aim is to offset all scopes (i.e. including scope 3 emissions). The costs of doing this could be prohibitive. And who should be responsible for offsetting? One option could be for Merton Council to choose to commit to offsetting all emissions

[15] Although note this may result in other environmental impacts, for example in relation to air quality or sustainable land use.
[16] Whereby plant-based materials are used in construction, storing carbon and preserving it for as long as the building remains standing.
[17] http://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/2019/05/GRI_POLICY-REPORT_How-to-price-carbon-to-reach-net-zero-emissions-in-the-UK.pdf

from its own operations, and then encourage individuals and organisations to offset their own emissions (direct and indirect).

- **Scopes:** Should emissions from all scopes be offset? As highlighted above, costs of offsetting all indirect emissions could be prohibitive. And given they are difficult to quantify; it may not be possible to robustly measure how much carbon needs to be offset. Limiting the scope of what should be offset (e.g. Scopes 1 and 2) may be a pragmatic option and might also help avoid double-counting.
- **Quality and verification**: Whichever option or scheme(s) Merton opt for, it will be important to select an offset strategy that involves the purchase of robust, verifiable carbon offsets to ensure that any carbon offset:
  - Is additional
  - Avoids carbon "leakage"
  - Is not double-counted
  - Is permanent
  - Does not overestimate the GHG reduction
  - Does not cause the buyer to postpone its own mitigation actions
  - Does not cause other environmental or social damage
  - Is not claimed by other entities[18].

In practice, it is very difficult to find carbon offset purchases that truly meet all of the quality criteria listed above[19]. For example, the majority of renewable energy projects are unlikely to be additional; they would have gone ahead regardless of the offset revenue. Tree planting may not be permanent or sustainable. Projects for the purchase of cook stoves in developing countries have a tendency to overestimate GHG savings and should be thought of as development projects instead of credible offsetting projects. With these concepts in mind, it is imperative that GHG emissions are reduced as close to zero as possible to limit the level of offsetting required by Merton.

Green spaces

Trees have the potential to sequester carbon from the atmosphere and act as a carbon sink. In the UK in 2018, 13% of land area is woodland and the forestry sector is net carbon sink. However, ageing forests sequester less carbon than new forests, and tree planting rates in the UK have declined dramatically over the last 20 years.

Merton has approximately 1,464 hectares of council maintained green spaces, street trees and private gardens. Using an estimated sequestration rate of 270 tonnes of CO_2 per hectare[20] (over 40 years), to offset the borough's 2050 emissions in the decarbonisation scenario (62.0 ktCO_2) would require the forestation of an additional 230 hectares. The trees would need to be maintained (i.e. not cut down) for at least 40 years. If the borough's emissions stayed constant for the next year, then a further 230 hectares of trees would need to be planted. This equates to approximately 0.15 million

[18] Broekhoff, D., Gillenwater, M., Colbert-Sangree, T., and Cage, P. (2019) Securing Climate Benefit: A Guide to Using Carbon Offsets. Stockholm Environment Institute & Greenhouse Gas Management Institute. http://www.offsetguide.org/wp-content/uploads/2019/11/11.15.19.pdf

[19] http://www.anjakollmuss.com/posts/unterstanding-carbon-offsets/

[20] Taken from the Woodland Carbon Code and "Carbon Canopy – Tree planting for investors, landowners and the planet" by Trust for Oxfordshire's Environment, the International Tree Foundation and Nicholsons. By nature, this is a simplified average as trees sequester carbon at different rates depending on age of tree, growth rate, climate, species etc.

additional trees needing to be planted per year[21]. The decarbonisation scenario includes an action of planting 800 trees per year.

Clearly, Merton's green space is not large enough for this, Merton already has trees in its green space, cannot forest all of its green space, and it would not be beneficial to do so because the space has other important social benefits. Merton might instead focus on the additional benefits that a realistic level of tree planting can bring, such as recreation, biodiversity, flood alleviation, urban cooling and air pollution "barriers", rather than as a key method of GHG emissions reductions.

Summary

There are essentially two options for Merton to consider for how to close the gap between the remaining emissions and the net zero targets. The most scientifically credible would be a method of carbon capture and storage. Direct air capture is not yet feasible, and trees have a limited potential. Using biomass in building construction may be suitable for Merton as a way of ensuring the "lock-in" of the carbon stored in trees, although it has not yet been fully investigated and double counting of emissions savings needs to be avoided. Carbon capture and storage technologies attached to industrial point sources are the most efficient means, opportunities for which are currently limited in Merton, but if the industrial sector develops this may be worth exploring. The other, logistically easier, option is to find offsetting projects that meet all of the criteria discussed above. It is worth noting that negative emissions technologies are expected to develop substantially in the next decade.

5 Tracking Progress

By updating the GHG inventory on a regular basis, Merton will be able to track the level of GHG emissions for the council and the borough included in the scope of the inventories, albeit with some delay in data availability. The ability of the GHG inventory to show progress in decarbonisation and the effectiveness of mitigation actions depends on the GHG estimation methods possible for the inventory. Where data availability is a limiting factor, the inventory might not show a true reflection of decarbonisation efforts. Developing indicators to track mitigation progress will allow secondary monitoring of Merton's decarbonisation actions. Potential indicators and data sources are presented for each sector of Merton's climate action plan in the following tables. These are in addition to the data sets used in the inventory, set out in **tables 3 and 4**. As Merton develops the delivery plan for the climate action plan, specific metrics may be identified as key indicators, which may be based on some of the following data sets.

Buildings and energy

The key units of change in this section of Merton's action plan relate to the electricity and gas consumption of buildings. Energy efficiency improvements and behaviour change actions aim to reduce energy consumption. Fuel switching, such as gas to electricity for heating purposes, moves to a lower-carbon intensive fuel. This relies on the national electricity grid heavily decarbonising across the next few decades.

Table 10: Indicators to track progress in the buildings and energy sector for the borough

Indicator	Potential data source
Capacity and generation of domestic solar PV installations	https://www.gov.uk/government/statistical-data-sets/sub-regional-feed-in-tariffs-confirmed-on-the-cfr-statistics - a full data set at borough-level post-closure of the feed in tariff remains to be developed
Energy efficiency in non-council buildings	Improvements in DEC classifications for public buildings. https://epc.opendatacommunities.org/
Gas consumption in non-domestic buildings	MSOA data on gas consumption in Merton https://www.gov.uk/government/statistics/lower-and-middle-super-output-areas-gas-consumption
Electricity consumption in non-domestic buildings	MSOA data on electricity consumption in Merton https://www.gov.uk/government/statistics/lower-and-middle-super-output-areas-electricity-consumption
Number of houses retrofitted with measures to reduce energy consumption	Through monitoring plans of incentive schemes implemented to encourage uptake/installation of measures, or through Parity Projects' CROHM software (Carbon Reduction Options for Housing Managers).
Electricity consumption in residential buildings	LSOA domestic electricity consumption. https://www.gov.uk/government/statistics/lower-and-middle-super-output-areas-electricity-consumption
Gas consumption in residential buildings	LSOA domestic gas consumption. https://www.gov.uk/government/statistics/lower-and-middle-super-output-areas-gas-consumption

Table 11: Indicators to track progress in the buildings and energy sector for the council

Indicator	Potential data source
Electricity consumption in council operational buildings	Consumption rates from meters
Gas consumption in council operational buildings	Consumption rates from meters
Number of streetlamps replaced with LEDs	Project monitoring plan
Number of council operational buildings audited and retrofit works planned/completed	Building energy audits and project progress status
Capacity and generation output of new council solar PV installations	Generation rates from meters. Data are already being tracked by the council: https://www.merton.gov.uk/planning-and-buildings/sustainability-and-climate-change/what-merton-has-already-done-to-address-climate-change

Transport

The actions in the transport section of Merton's plan primarily relate to reducing fossil fuel consumption in vehicles (particularly private vehicles), through switching to electric vehicles and increasing modal share of active travel and public transport.

Table 12: Indicators to track progress in the transport sector for the borough

Indicator	Potential data source
Investments in active travel infrastructure	Merton Council/GLA finance reports
Investments in public transport infrastructure	Merton Council/GLA/TfL finance reports
Number of electric taxis registered in Merton	TfL data on registered taxis in the borough https://tfl.gov.uk/info-for/taxis-and-private-hire/licensing/licensing-information
Number of schools that have monitored travel plans	School surveys
Proportion of people living within 400m of the London-wide strategic cycle network	https://www.merton.gov.uk/streets-parking-transport/lip3
Number of active travel trips	https://www.merton.gov.uk/streets-parking-transport/lip3
Number of cycle trips	Counts from automatic monitoring devices/ https://www.merton.gov.uk/streets-parking-transport/lip3
Number of electric vehicles travelling in Merton	Use of ANPR to monitor through traffic, or through the use of electric vehicle charging points.
Number of vehicles travelling, and vehicle km, in Merton	https://roadtraffic.dft.gov.uk/local-authorities/204
Number of electric vehicles registered in Merton	Table VEH0132 https://www.gov.uk/government/statistical-data-sets/all-vehicles-veh01#ultra-low-emissions-vehicles
Number of charging points installed (private & public)	Survey, investment reports, other sources e.g. https://www.zap-map.com/live/
Number of electric buses in Merton	Lobby TfL to include this information in bus performance reports

Table 13: Indicators to track progress in the transport sector for the council

Indicator	Potential data source
Number of deliveries made to council buildings by van	Procurement records
Number of deliveries made to council buildings by zero emission vehicles	Procurement records
Number of electric vehicles in the council fleet	Council fleet data

Green economy

The green economy vision focuses on businesses and individuals in Merton operating sustainably and locally, moving towards a circular economy approach of re-use & repair. The key units of change for decarbonisation tracking in this sector is the volume of waste generated and the share of each waste processing stream.

Table 14: Indicators to track progress in the green economy sector

Indicator	Potential data source
Household waste tonnages by processing stream	South London Waste Partnership
Proportion of household waste being recycled	South London Waste Partnership
Percentage of households that have food and recycling waste collected separately	Household surveys
Waste tonnages collected from street bins	Procurement data

Green spaces

Green spaces are a high-profile area of many climate action plans, evoking a strong public reaction. Green spaces should be maintained and enhanced for their many other beneficial properties, besides carbon sequestration.

Table 15: Indicators to track progress in the green spaces sector

Indicator	Potential data source
Tree cover in Merton	Survey of tree cover in Merton

6 Recommendations

As a result of this project, the following recommendations are offered.

Merton Borough Council's direct actions

In terms of its own actions, Merton Council will need to be both ambitious and demonstrative, fully taking up its leadership role within the borough. This will include significant budget allocation to, and the identification of other funding sources for, decarbonisation schemes. The projections in the decarbonisation scenarios are not a binding commitment for the council; they indicate a potential pathway towards the net zero targets. Even with some ambitious decarbonisation actions included, emissions are expected to remain in the council's scope in 2030 and the borough's scope in 2050. To get as close to net zero as possible, Merton will need to ramp up delivery of decarbonisation actions at pace and scale.

Some of the actions with the larger emissions savings will require Merton Council to enable and encourage delivery of new services, likely by third parties, in areas where the Council has not previously taken a leading role, such as retrofitting buildings, supporting a replacement of gas with heat pumps and encouraging the public to switch to electric vehicles.

Action by the Council should prioritise its own estate and procured services, with a particular focus on reducing gas use.

Further work should be undertaken to explore and, where possible, quantify the co-benefits arising from the measures undertaken and planned. This will provide more evidence to support business cases for action and engagement by other stakeholders such as those in public health.

The Council should use the full range of powers at its disposal to both help drive change and demonstrate leadership in GHG emission reduction. These will include land use planning powers (for new build and renovation standards), building control, the promotion of low carbon development, the facilitation of opportunities for renewable energy and further new technologies, and enforcement in the private rented sector[21].

Data improvements and quantification of scope 3 emissions

There are a few key areas of data that need improvements to provide a better estimate of GHG emissions in Merton:

- Fuel used by waste collection vehicles for the Council (to improve on the current methodology using BEIS emission factors)
- Emissions related to major procurement contracts by the Council (to cover more scope 3 emission sources)
- Non-road mobile machinery (NRMM) emission in the borough
- Development of reliable emission factors for waste processing streams, such as energy from waste processing through working with the Beddington ERF and SLWP

[21] A more extensive discussion of these powers can be found here : https://www.theade.co.uk/resources/publications/the-warm-arm-of-the-law-tackling-fuel-poverty-in-the-private-rented-sector

The estimates for scope 3 GHG emissions sources in the inventories and decarbonisation scenarios have a high uncertainty, and for some sources the data does not yet exist to include them. However, such scope 3 sources which cannot be measured should still be included in Merton's climate action plan. After all, to reduce the impacts of climate change and limit atmospheric warming to within 2°C, all sources of emissions globally need to be reduced to net zero.

In subsequent GHG inventories, improvements to estimates of scope 3 emissions may be a focus. There is not yet a consistent approach taken across local authority GHG inventories, so Merton may wish to align themselves with any guidance that arises in the future.

Lobbying and engagement actions

There are important supporting actions whose effects in the modelling cannot be measured, but nevertheless impact on the success of Merton's climate action plan. These include the extent to which the Council is able to reach all of Merton's different types of communities, at all levels and in all locations. Public engagement is crucial to the delivery of decarbonisation actions. It depends on Council officers at all levels taking on board climate objectives as well as delivering the service they have been tasked to do.

Merton should engage in lobbying the GLA and central Government, both as a Council in its own right and in conjunction with partner organisations (within and outside the borough). Adopting ambitious targets and plans will strengthen the Council's position. Lobbying could relate to policies to provide:

- an increase in electric vehicle charging infrastructure (public and private);
- incentives for zero emission vehicles;
- support for domestic property retrofits;
- higher energy standards for new build homes;
- acceleration of the grid decarbonisation;
- a national heat strategy with incentives to reduce gas use;
- incentives for companies to achieve net zero carbon emissions;
- funding to facilitate ambitious decarbonisation programmes by local authorities.

It is important to ensure that governance and financing is geared towards delivering climate targets as a contingent part of every Council service. It will require national government policies and funding streams to enable actions to take place, so providing a unified and strong lobbying message to Government will be important.

Annex 1: Model assumptions

Baseline projection

The changes in the baseline emissions profile are a response to pressures and actions from outside the borough, excluding any further specific action from Merton. The largest driver of emissions reduction in the baseline scenario is the UK's projections for the national grid electricity carbon intensity. The forecast after 2019 is from the Treasury Green Book supplementary appraisal guidance on valuing energy use and greenhouse gas (GHG) emissions (BEIS, updated in March 2019[22]). This forecasts a significant reduction in grid electricity emission factor by 2050 (but above zero). All other emission factors are assumed constant.

The BEIS 2018 energy projections[23] have been used as the basis of the baseline projection for the modelling, applicable for both the Council projection to 2030 and the borough projection to 2050. This baseline includes the predicted impacts of energy efficiency and other policies on national emissions including the assumption that all new build development will comply with Building Regulations 2013. The BEIS projections do not account for local or regional policies such as those for London so a modification to the BEIS data has been made to constrain gas demand from 2025 based on current policy in London. Fuel consumption changes in the commercial, public services, residential and industrial sectors are taken from the future forecast from Annex F Final energy demand of the BEIS projections dataset, converted to year-on-year percentage changes to 2035 beyond which there is no data provided and therefore no further changes are assumed. The percentage rates calculated from the BEIS dataset are presented within the modelling and can be summarised as:

- Small increases (<2%) in electricity across all sectors, domestic natural gas (until 2025) and industrial gas oil
- Small decreases (<-2%) in non-domestic natural gas and council natural gas
- Large decreases (>-5%) in commercial and public administration gas oil consumption.

The change in ratio of diesel to petrol cars is based on TfL projections. Taken as the change in percentage share of diesel cars for Outer London from 2017 onwards from "Basic London Fleet Projections - Proportion of VKM by Vehicle Type"[24]. It has been assumed that km travelled is in proportion to the percentage share of that vehicle type in the fleet. This translates as a decrease in diesel cars from 2022. No baseline change has been assumed for electric vehicle penetration because this is modelled in the decarbonisation scenario. Other borough travel demand is assumed constant.

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[22] https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal using the long-run marginal commercial/public sector (2019 - 2030) from Table 1: Electricity emissions factors to 2100, kgCO2e/kWh.
[23] https://www.gov.uk/government/publications/updated-energy-and-emissions-projections-2018 using data for the Existing Policies Scenario
[24] https://naei.beis.gov.uk/data/ef-transport

It is assumed that all residual household waste will be diverted from landfill by 2022, being processed through energy from waste plants instead. Other levels of waste processing are assumed constant.

Decarbonisation scenario

The actions included in the decarbonisation scenario are high-level and the resulting emissions savings should not be read as predictions, but indications for the magnitude of emissions reductions possible per action. The assumptions for each action are included within the model. The same emission factors are used as in the baseline scenario.

For the modelling of residential actions, the approach taken was to represent combinations of measures to make homes more efficient and to decarbonise their heating systems and generate renewable electricity using solar PV. These are needed to be applied across the large majority of existing homes. Efficiency measures include draught proofing, insulation and replacement windows and doors and lighting improvements. Heating measures relate to improvements to existing electric heating systems and replacement of gas boilers with heat pumps.

Parity Projects[25] generated scenarios for this project using their CROHM software (Carbon Reduction Options for Housing Managers) which calculated the measures that could theoretically be applied to each household within Merton. The datasets produced detailed the energy savings, carbon savings and costs of measures. This was calculated based on Parity Projects' comprehensive database of properties built using algorithmic interpretation of data from the most recent Energy Performance Certificates (EPC) open data set, Post Office Postal Address File, and data received under the Public Sector Mapping Agreement licence from the Greater London Authority (GLA).

The CROHM software delivers cost-optimised rules-based whole house retrofit plans for each individual property within the borough. The software algorithms test up to 2,400 energy efficiency interventions, varied in terms of technology, product performance and scale. The model incorporates future carbon factors, to show the impact of the decarbonisation of the grid on their carbon footprint. It also incorporates real-life costs, which are continuously updated as the market evolves; and in-use factors, which adapt laboratory-tested performance to better reflect real-world performance once products are installed in homes.

The scenarios that were developed for this project considered first what early wins measures could be applied (with costs of less than £750 per action), and what would be necessary to reach as close to net zero carbon as possible.

The detailed outputs from CROHM were then aggregated to the whole of Merton and calibrated to actual baseline gas and electricity consumption data from BEIS (as SAP calculations often over-estimate actual energy use). Total fuel savings compared to the baseline for the two scenarios were calculated for electricity and gas. The fuel savings and costs of measures were then entered into the carbon scenario model.

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[25] https://parityprojects.com/

The tables below show the assumed measures to be applied in Merton as calculated by the CROHM database in order to achieve the savings assumed in the "low cost" and "high cost" housing actions in **Table 7** in the main report.

Early Wins Scenario - Numbers of measures and costs											
			Breakdown of specific measures and detailed sub-types								
Measure type	Total number	Total cost	Measure	No.	Cost	Measure	No.	Cost	Measure	No.	Cost
Fabric	29221	£104,438,302	Walls	7755	£88,143,133	Cavity	7755	£88,143,133	Cavity Insulation	771	£2,541,696
									External to Cavity	6984	£85,601,437
			Roofs	18231	£15,385,225	Loft Insulation	18057	£15,015,537	Virgin	14965	£12,937,682
									Top Up	3021	£2,016,973
									Unknown, No Access to Loft	52	£44,312
									Unknown, Access to Loft	19	£16,570
						Rafter or Ceiling Insulation	174	£369,688			
			Draughts	3235	£909,944	Chimneys	1507	£548,940			
						Doors and Windows	1728	£361,004			
Heating and Hot Water	20334	£6,191,196	Individual Heating and Hot Water	20334	£6,191,196	Secondary Heating	20334	£6,191,196	Remove Secondary Heating	20334	£6,191,196
Lighting	57558	£3,370,398									
Total	**107113**	**£113,999,896**									

High investment, no gas, target zero CO2 scenario - number of measures and costs											
			Breakdown of specific measures and detailed sub-types								
Measure type	Total number	Total cost	Measure	No.	Cost	Measure	No.	Cost	Measure	No.	Cost
Fabric	273441	£1,307,865,715	Walls	71506	£661,628,565	Cavity	23487	£196,992,415	Cavity Insulation	1054	£3,232,287
									Internal to Cavity	1	£904
									External to Cavity	22432	£193,759,224
						Solid	45215	£444,026,091	External lo Solid	45215	£444,026,091
						System	2505	£19,689,961	External to System	2505	£19,689,961
						Other	299	£920,098	Stone or Cob	17	£150,238
									Alternate Wall	282	£769,860
			Roofs	20320	£17,689,664	Loft Insulation	19965	£16,366,741	Virgin	14963	£12,936,214
									Top Up	4879	£3,326,517
									Unknown, No Access to Loft	104	£87,440
									Unknown, Access to Loft	19	£16,570
						Flat Roof insulation	180	£952,397			
						Rafter or Ceiling Insulation	175	£370,526			
			Floors	29177	£55,004,450	Solid Floors	3107	£6,239,006			
						Suspended Timber Floor	23758	£43,074,309			
						Suspended Not Timber Flc	2018	£3,930,836			
						Exposed Floor	294	£1,710,299			
			Glazing	149324	£572,642,219	Double	605&5	£342,082,140			
						Triple	16060	£133,555,099			
						Doors	72679	£97,005,000			
			Draughts	3114	£900,797	Chimneys	1549	£562,080			
						Doors and Windows	1565	£338,717			
Heating and Hot Water	166883	£1,083,172,302	Individual Heating and Hot Water	166883	£1,083,172,302	Heating System	82908	£1,018,377,600	Heat Pump System	112908	£1,018,377,600
						Secondary Heating	18731	£5,624,502	Remove Secondary Heating	18731	£5,624,502
						WWHRS	65244	£59,170,200			
Lighting	70154	£4,023,613									
Photovoltaics	7352	31, 543,255									
Total	**517830**	**£2,395,061,630**									
						WWHRS = Waste water heat recovery system					

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