Aether

London Borough of Merton

Greenhouse Gas Inventory Report 2023

January 2024

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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. Merton's Climate Strategy and Action Plan[1] was approved by Council on 18 November 2020.

Aether compiled a greenhouse gas (GHG) emissions inventory for the council and borough as part of the strategy development to understand the baseline carbon emissions[2] (referred to as the '2020 inventories' in this report). The inventories have been updated every two years since the 2020 baseline: in 2021[3] (referred to as the 2021 update in this report) and 2023. This report presents a brief analysis of the 2023 update to the GHG inventories (referred to as the 2023 update in this report).

2 Data and Methods

2.1 Greenhouse Gas (GHG) Inventories

A 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 or estimate of the activity which is taking place, such as number of cows or tonnes of fuel. This data typically comes from national statistical datasets or from the organisation in question, in this case Merton Council.

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.

When reporting emissions, it is important to consider which sources to include. The Greenhouse Gas Protocol provides a widely used set of standards which describe emission sources and "scopes" which should be considered as part of a local carbon accounting process; the definition of the three scopes is shown in **Table 1**, below, as applied to this update of the council and borough inventories. There is an overlap in scope between the inventories as the activities of Merton Council occur within the Borough of Merton. However, as the Merton Borough and Council inventories are used for different purposes, this does not present an issue.

[1] https://www.merton.gov.uk/system/files?file=draft20climate20strategy20and20action20plan20-20council20v2.pdf

[2] https://www.merton.gov.uk/assets/Documents/Merton_Support-Climate-Action_v3.1.pdf

[3] https://www.merton.gov.uk/system/files/Merton%202021%20GHG%20inventory%20report_FINAL.pdf

Table 1: Summary of emissions sources by scope in Merton's GHG inventories

Scope of emissions	Merton Council	Borough of Merton
1	Direct fuel consumption of (gas, petrol, diesel) in council operational buildings, community schools, council transport fleet	Direct fuel consumption of (gas, petrol, diesel, coal) in buildings and transport, net CO_2 emissions from land use and land use change
2	Electricity use purchased from the national grid in council operational buildings, community schools, streetlighting and council transport fleet	Electricity use purchased from the national grid
3	Fuel consumption (petrol and diesel) in council contracts for waste collection, highway works, green spaces maintenance, council grey fleet, street cleansing, transmission and distribution of electricity use, well-to-tank from fuel use	Waste processing at the Energy Recovery Facility (ERF) plant located outside the borough, transmission and distribution of electricity use, well-to-tank from fuel use

2.2 Input Data

The scope of the 2023 borough and council GHG inventories for Merton are the same as the 2020 baseline GHG inventories, as agreed through workshops with cross-department colleagues from Merton Council in November 2019.

For the borough GHG inventory the time series is 2017-2021. For the council inventory the time series is 2018-2022. The difference is due to the different time-lag of the input data required; the borough inventory uses national statistics which have a larger delay than the council-collected data.

Data was collected from both national data sets and directly from Merton Council. **Tables A1.1** and **A1.2** in **Appendix 1** summarise the data sources used for the council and borough GHG inventories.

GHG emissions for 2017-2020, previously published in the 2021 update have been recalculated in this 2023 update. This is standard practice for GHG inventory compilation to ensure that revisions to input data methodology and estimates are used in a consistent manner. See **Appendix 3** for more details on recalculations of previous estimates.

There have been some updates to the input data across the timeseries. Specifics of the changes are covered in the relevant sections when discussing the emissions from these sources.

3 Merton Borough GHG Inventory

3.1 Borough Emissions in 2021

The Merton Borough GHG inventory time series covers the years 2017-2021. Merton Borough's GHG emissions for 2021 have been estimated to be 692 ktCO_2e. Emissions by sector are presented in **Figure 1** and **Table 2.** The most significant emissions source is the residential sector, comprising 44% of total emissions from residential heating and electricity use. Emissions for Transport (other), Land use, and Borough waste processing (landfill) are too small to be seen on the graph, see **Table 2** for emissions breakdown.

Figure 1: Estimated ktCO_2e emissions for Merton Borough in 2021

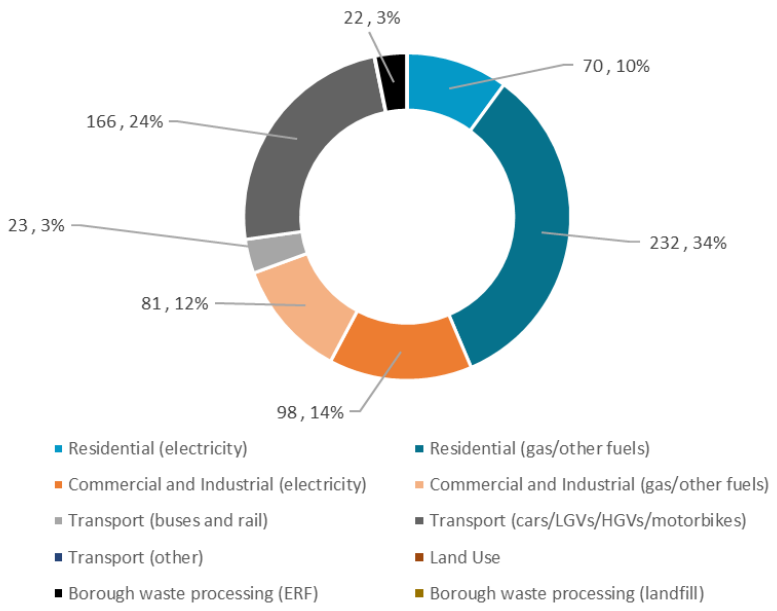


Table 2: Estimated ktCO_2e emissions for Merton Borough in 2021

Sector	2021 (kt CO_2e)	% of total emissions
Residential (electricity)	70	10%
Residential (gas/other fuels)	232	34%
Commercial and Industrial (electricity)	98	14%
Commercial and Industrial (gas/other fuels)	81	12%
Transport (buses and rail)	23	3%
Transport (cars/LGVs/HGVs/motorbikes)	166	24%
Transport (other)	0.3	0.05%
Land use	- 0.2	0.02%
Borough waste processing (ERF)	22	3%
Borough waste processing (landfill)	0.2	0.03%
Total	**692**	

Note: numbers may not match totals due to rounding. ERF = Energy Recovery Facility.

Energy use in buildings and transport

The sources of emissions in Merton are 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, the majority of which is emissions from private road transport.

Land use

Emissions from land use and land use change in Merton are currently a small net sink of CO_2 at 0.2 ktCO_2e. The net sink is now estimated to be smaller than in the 2021 update due to revised methodology in the Local Authority Greenhouse Gas Emissions National Statistics. This is driven by the inclusion of methane and nitrous oxide in the dataset for the first time since the 2021 Merton inventories. This methodology change means that the net sink from land use and land use change is smaller across the whole time series. In the 2023 inventory, the small net sink reduces the total 2021 emissions from 692.5 ktCO_2e to 692.4 ktCO_2e (0.02% reduction).

Waste processing

In 2020, the South London Waste Partnership (SLWP) set up a carbon working group with the four SLWP boroughs (Croydon, Kingston, Merton and Sutton) and Viridor to agree an approach for baselining, monitoring and reducing carbon emissions associated with the SLWP residual waste treatment contract. This includes carbon emissions from the Beddington Energy Recovery Facility (ERF). A baseline for 2019-2020 (the first full year of ERF operations) was calculated and subsequently published in the Viridor Carbon Management Plan (2021). The SLWP performed further calculations to attribute a proportion of those emissions to Merton based on the amount of residual waste sent for treatment by each SLWP borough through the contract. These emissions figures were included in Merton's 2021 borough GHG inventory. Merton Council also used the 2019-2020 baseline carbon factors to estimate emissions for 2017-2018, using tonnages of waste sent to the ERF in those years.

In this inventory update for 2023, we are including some subsequent revisions made to the original 2019-2020 baseline. These revisions follow a detailed internal and external review (externally by a specialist environmental consultancy) of the available data and reflect improvements in the quality of greenhouse gas emissions reporting since the Viridor Carbon Management Plan was published in 2021. Work continues to further review and refine the baseline emissions figures and they may be subject to further changes, although we do not expect these to be significant. If further changes do occur, these will be reflected in future iterations of the Merton GHG inventory.

In the 2023 update, emissions from processing this waste include:

- Combustion of fossil derived waste (Scope 1 of the ERF)
- Fuel/power imported into the site (Scope 2 of the ERF)
- Emissions from waste disposal to landfill or other ERF facilities when the ERF is not in operation (Scope 3 of the ERF).

Waste processed at the ERF generates electricity from the combustion of non-recyclable municipal waste. This electricity is exported to the National Grid. In 2021, the exported

electricity from waste generated in Merton is equivalent to a saving of around 5.4 $ktCO_2e$[4] assuming the electricity displaces other electricity generation supplied to the National Grid based on the average carbon intensity of this displaced generation. These avoided emissions are not included in the Merton Borough inventory.

3.2 Changes in emissions since 2017

Figure 2 and **Table 3** show emissions estimates for the borough for the years 2017 to 2021. Total emissions have decreased throughout the time series, reducing by 18% between 2017 and 2021.

[4] Value may be subject to revisions.

Figure 2: ktCO₂e emissions for Merton Borough, 2017 – 2021

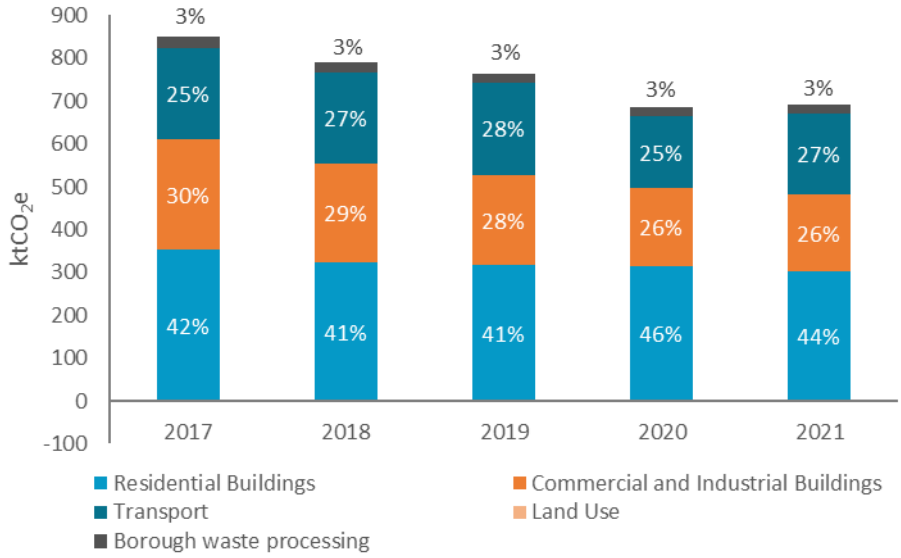


Table 3: Emissions (in ktCO₂e) and percentage change in emissions from each sector, 2017-2021

Sector	Scope	Emissions ($ktCO_2e$)					Change between 2017 baseline and 2021 (%)
		2017	2018	2019	2020	2021	
Residential (electricity)	2&3	120	94	85	82	70	-42%
Residential (gas/other fuels)	1&3	232	229	232	234	232	0%
Residential buildings total		353	323	316	315	302	-14%
Commercial and industrial (electricity)	2&3	178	152	138	109	98	-45%
Commercial and industrial (gas/other fuels)	1&3	80	79	72	71	81	1%
Commercial and industrial buildings total		257	231	211	180	179	-31%
Transport (buses and rail)	1&3	33	30	30	24	23	-30%
Transport (cars/LGVs/HGVs/motorbikes)	1&3	179	181	186	146	166	-7%
Transport (other)	1&3	0.3	0.3	0.3	0.3	0.3	-5%[5]
Transport total		213	211	216	170	190	-11%
Borough waste processing (ERF)	3	3	11	19	21	22	563%
Borough waste processing (landfill)	3	23	13	2	-	0.2	-99%
Borough waste processing total		27	24	20	21	22	-17%
Land use	1	- 0.13	0.005	- 0.06	- 0.12	- 0.16	24%
Borough Total		849	790	764	687	692	-18%

[5] There is a 5% decrease across the timeseries not evident in the emission values as the values and changes are very small.

Note: numbers may not match totals due to rounding. ERF = Energy Recovery Facility.

The scope 3 emissions included in the borough inventory are currently waste processing, transmission and distribution losses from electricity supply, and the well-to-tank emissions from fuels. The majority of scope 3 emissions for Merton borough are not included in this inventory. The out-of-scope consumption-based emissions discussed in **Section 3.3** include more of the borough scope 3 emissions, so provide an idea of the scale of these emissions.

One of the largest reductions in emissions across this period was a 45% reduction in emissions from electricity use in the commercial and industrial sector followed by a 42% reduction in emissions from electricity use in the residential sector. Although there is a large increase in the emissions from waste processing occurring at ERF across the timeseries, this reflects the transition from landfill waste processing to ERF waste processing. This means that the overall emissions from waste processing decrease from 27 ktCO_2e to 22 ktCO_2e between 2017 and 2021.

The reduction in emissions from electricity use was driven primarily by reductions in the carbon intensity of the UK electricity grid (see **Section 6**Error! Not a valid bookmark self-reference.), as is the case with most other local authority areas. As shown in Table 4 below, there was an increase in residential electricity usage in 2020; this may have been driven by higher electricity consumption in homes during the COVID-19 pandemic[6] due to national lockdowns. More details on the impact of electricity emission factors on emissions are discussed in **Section 6.**

Table 4: Activity data and emission factors for residential and commercial & industrial sectors, 2017 – 2021

Emission Source	Year				
	2017	2018	2019	2020	2021
Activity data (GWh)					
Residential (electricity)	313	306	305	323	302
Commercial and Industrial (electricity)	462	495	499	432	425
Emission factor (kgCO_2e/kWh)					
Residential (electricity)	0.352	0.283	0.256	0.233	0.212
Commercial and Industrial (electricity)					
Emissions (ktCO_2e)					
Residential (electricity)	120	94	85	82	70
Commercial and Industrial (electricity)	178	152	138	109	98

Note: Emissions include transmission and distribution of electricity (scope 3).

Emissions from transport did not change significantly across the time series, with a small 23 ktCO_2e total decrease between 2017 and 2021. This was mainly due to a 7% decrease (179 ktCO_2e in 2017 to 166 ktCO_2e in 2021) in emissions from cars, LGVs, HGVs and

[6] https://www.sciencedirect.com/science/article/pii/S0378778823006588?via%3Dihub

motorbikes. There was also a 30% decrease (33 ktCO_2e in 2017 to 23 ktCO_2e in 2021) in emissions from buses and rail. As most rail transport in Merton is electric, this reduction reflects the decarbonising of the UK electricity grid (see **Table A2.1** and **Table A2.2** in **Appendix 2)**.

Emissions from private transport using diesel decreased between 2017 and 2021 whilst private transport using petrol increased slightly across the same period, resulting in an overall 7% decrease in emissions from private transport. There is also a 23% decrease in emissions between 2019 and 2020 due to the reduced private transport during COVID-19 (see **Section 5**). This overall decrease may also reflect the impact of GLA ULEZ regulations as well as longer term impact of reduced promotion of diesel vehicles by the UK government. These trends map the change in fuel usage for each transport mode and type, as well as changes to associated emission factors **(Table 5).**

In the 2023 update, there has been a change in the method used to estimate transport emissions across the whole time series to include well-to-tank emissions which relate to the emissions produced during fuel production (see **Appendix 3** for more details). For transport in 2017, the inclusion of well-to-tank emissions has resulted in emissions estimates that are 17% higher compared to the estimates presented in the 2021 update.

Table 5: Borough private transport emissions and percentage change, 2017-2021

Emission source	Emissions (ktCO_2e)					Change from 2017 – 2021 (ktCO_2e)	% change 2017 – 2021
	2017	2018	2019	2020	2021		
Cars (petrol)	73.6	73.8	77.8	61.7	75.3	1.7	2%
Cars (diesel)	57.0	59.7	57.6	40.4	43.8	-13.2	-23%
Motorcycles (petrol)	2.9	3.0	3.3	3.0	4.3	1.4	47%
LGVs (petrol)	1.2	1.1	0.4	0.4	0.4	-0.8	-68%
LGVs (diesel)	30.7	31.9	34.6	28.8	29.6	-1.1	-4%
Total	165.5	169.5	173.8	134.2	153.4	-12.1	

Emissions from land use and land use change varied slightly across the time series, with a very small net emission reported in 2018 due to higher emissions from settlements in that year. Across the time series, there was an average sink of -0.1 ktCO_2e. This estimate has changed from the -1.1 ktCO2e reported in the 2021 update, due to updated methodology in the Local Authority Greenhouse Gas Emissions National Statistics. See **Appendix 3** for more details.

Emissions for waste processing were estimated for 2019-2021 by the SLWP and Viridor. Emissions for 2017-2018 were estimated in this inventory using waste tonnage figures for those years and the 2019 carbon intensity of treating waste at the Beddington ERF and the carbon intensity of processing waste at the Beddington Landfill Site. Total emissions from the processing of Merton's waste at the Beddington ERF in 2021 were estimated at 21.8 ktCO_2e. During periods of maintenance of the ERF, and whilst it was in

the commissioning phase, non-recyclable material was diverted for disposal at Beddington landfill. Waste processing emissions from Beddington Landfill were also estimated for 2021 at 0.2 $ktCO_2e$. As 2017-2018 estimates were derived from the 2019 carbon intensity metrics, the trend in waste processing emissions between 2017 and 2019 is only an approximation and does not reflect efforts to decarbonise the ERF operations.

The whole time series does reveal a reduction in overall emissions from the processing of waste from 26.6 to 22.1 $ktCO_2e$ as Merton has transitioned away from landfill and towards ERF since 2017. However, in 2021 there was an increase in ERF emissions compared to 2020 as the overall tonnages of waste increased.

Emissions from the waste processing of Merton's local authority collected waste sent to facilities other than ERFs, including waste sent directly to landfill, food waste to anaerobic digestion plants, and garden waste sent to composting plants, have not been estimated in this inventory. Emissions from the waste processing of commercial waste collected within the borough have also not been estimated. These scope 3 emissions sources could be included in future updates if data becomes available.

The proportion that each sector contributes to total emissions has subtly changed across the time series (**Table 3**). The residential sector is consistently the largest source of emissions at approximately 44%. The reduction in emissions from the commercial and industrial sector has resulted in a lower proportional contribution to total emissions, from 30% in 2017 to 26% in 2021. Whilst emissions from transport remained steady from 2017-2019, they have decreased in 2020 and increased slightly in 2021. However, the proportion of transport emissions has increased from 25% in 2017 to 27% in 2021 due to the reduction in proportion of emissions from the commercial and industrial sector.

3.3 Out of scope consumption-based emissions

Scope 3 consumption-based emissions relate to the embedded emissions in the consumption and/or use of goods and services by residents within Merton borough[7]. Estimates of these emissions are presented here to demonstrate the scale of a more complete scope 3 estimate including consumption-based emissions, compared to emissions which have been included in the inventory. Methodologies for estimating consumption-based emissions are not yet well established, have a high uncertainty, and will not reliably be updated at the same frequency as the GHG inventory, so are not included in the borough GHG inventory at this time.

The 2023 report by the University of Leeds, commissioned by London Councils, "Consumption-based Greenhouse Gas Household Emission Profiles for London and its Boroughs"[8] estimated consumption-based emissions for each London borough using an environmentally extended multiregional input-output model (EE-MRIO), apportioning

[7]These consumption-based emissions estimates do not include all scope 3 emissions associated with businesses or the Council. Emissions from local businesses are only reflected in the total if the goods sold are purchased by Merton residents. Transport emissions are only included if the driver is a Merton resident or the emissions are from the transportation of goods or services that are consumed by Merton residents.

[8] https://www.londoncouncils.gov.uk/our-key-themes/climate-change-0/londons-consumption-based-emissions-account

emissions to Merton residents using data on household spending on each consumption item.

The per-capita consumption-based estimates include emissions from the full supply chain of the following activities[9]:

- Food
- Housing (excluding direct emissions from the use of electricity, gas and other fuels, and refuse collection)
- Transport (excluding direct emissions from the use of fuels in private vehicles)
- Goods
- Services
- Government and Capital investment

However, a few emission sources in the consumption-based analysis are already included in the emissions that have been calculated in the borough inventory for 2021 in **Section 3.2.** Therefore, these have been excluded in the consumption-based emissions analysis for Merton to prevent double-counting. These excluded sources are the use of fuels in buildings for heating and power, refuse collection, and the use of fuels for private transport.

Rail and bus related emissions are included in the consumption-based analysis as these emissions cover residential travel outside of the borough as well as in the borough. However, inclusion of these figures means there is a small overlap with the existing rail and bus emissions calculated in the borough GHG inventory.

The consumption-based analysis does not include data from waste processing which is in the borough GHG inventory. Removing the overlapping activities from the University of Leeds factors results in the consumption-based emissions factors shown in **Table 6**.

Table 6: Per capita consumption based emissions factors for Merton after removing overlapping activities, based on the University of Leeds factors.

Emission Source	Year			
	2017	2018	2019	2020
Emission factor (tCO_2e/capita)	6.760	6.930	6.159	5.669

No data are available for 2021 therefore 2020 factors have been used for 2021. For Merton, with a 2021 population of 215,324, **the total consumption-based emissions are estimated at 1,221 $ktCO_2e$**. If these consumption-based emissions were included in Merton borough's GHG inventory for 2021, this would comprise 64% of GHG emissions. For Merton residents, aviation accounts for 9% of their per-capita consumption-based emissions in 2019, and 5% of their per-capita emissions in 2020. This likely reflects the decrease in aviation due to the COVID-19 lockdowns in 2020.

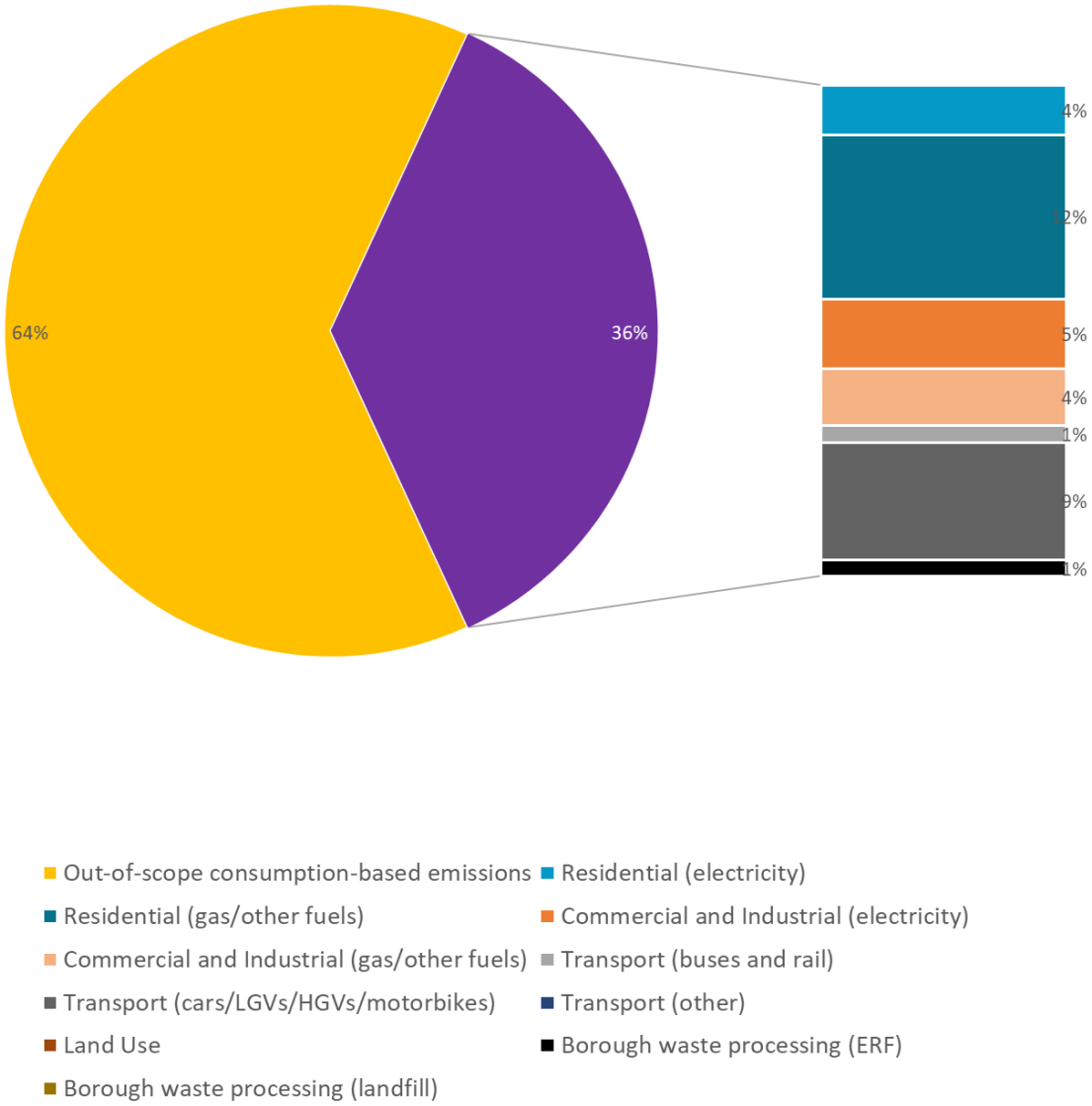
There were some recalculations to the University of Leeds per capita consumption-based emissions for Merton that result in a larger estimate of consumption-based emissions than in Merton's previous GHG inventory update. The consumption-based

[9] A full detailed breakdown of the sources included in each category can be found in the dataset available at https://www.londoncouncils.gov.uk/our-key-themes/environment/climate-change/consumption-based-greenhouse-gas-household-emissions

emissions for 2021 are 13% higher than the previously published estimate for 2019[10]. This is driven by the increase in population in Merton (4% increase in population between 2019 and 2021) and recalculations in the emissions factors (9% increase between the previous 2019 emission factor and the current 2021 emission factor).

Figure 3 shows the split of consumption-based emissions (yellow) which have been excluded from the borough inventory versus the direct GHG emissions (purple) which have been included in the borough inventory as detailed in **Section 3.1**. Emissions from the Transport (other), Land use, and Borough waste processing (landfill) categories are too small to be seen on the graph, see **Section 3.1** for details of these emissions.

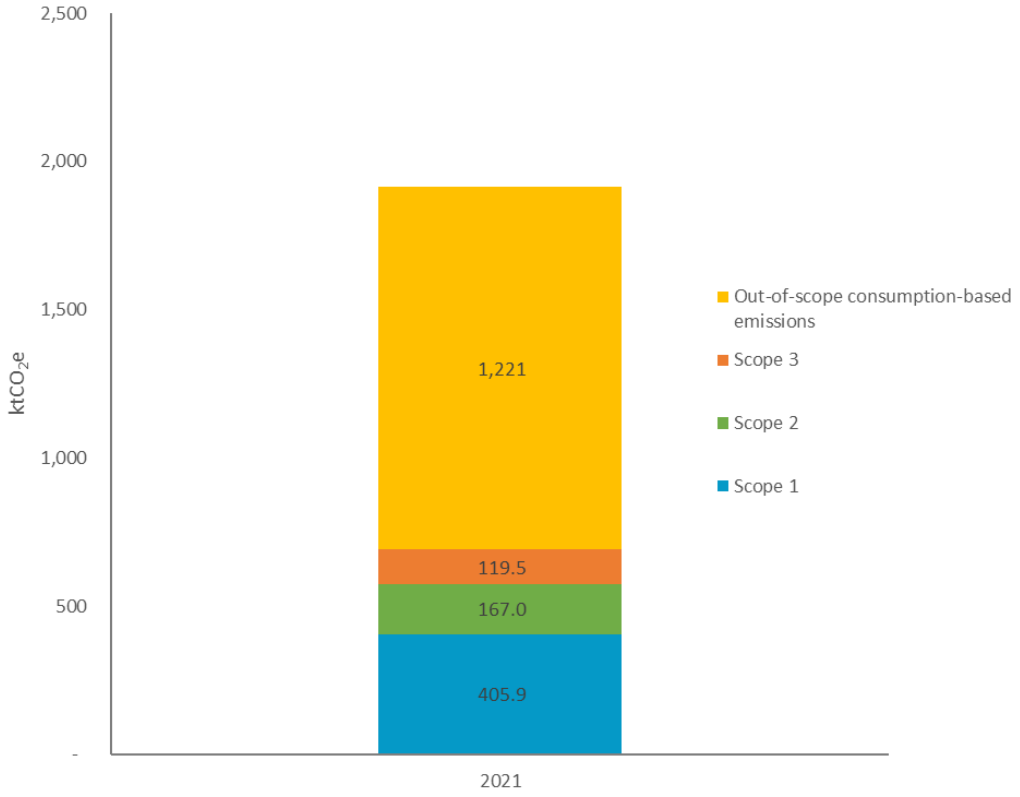
Figure 3: GHG inventory for Merton Borough, 2021, incl. consumption-based emissions (ktCO_2e)



[10] See factors in 2021 GHG inventory report: https://www.merton.gov.uk/system/files/Merton%202021%20GHG%20inventory%20report_FINAL.pdf

Only a fraction of the scope 3[11] emissions for Merton Borough are captured in the inventory. The out-of-scope consumption-based emissions represent a large portion of the scope 3 emissions for Merton borough. **Figure 4** shows the borough's 2021 GHG emissions split by scope, including the out-of-scope consumption-based emissions for scale. **Table 1** in the methods section summarises the sources of emissions within each scope.

Figure 4: $ktCO_2e$ emissions for Merton Borough, 2021, by scope



[11] Scope 3 refers to the GHG Protocol definition. Scope 3 emissions includes all indirect emissions not included in scope 2 (indirect emissions from the consumption of purchased electricity) occurring in the value chain of the reporting company.

4 Merton Council GHG Inventory

4.1 Council Emissions in 2022

The Merton Council GHG inventory time series covers the years 2018-2022. Estimated GHG emissions for Merton Council in 2022 were 9.7 $ktCO_2e$. This is a 18% decrease (2.1 $ktCO_2e$) from 2018 emissions. Emissions by sector are presented in **Figure 5** and **Table 7.** Among the sources of emissions that have been assessed (only a small portion of all possible scope 3 emissions have been assessed), the most significant portion is associated with gas consumption in the council's operational buildings and community schools, comprising 47% of the total emissions.

Figure 5: Estimated $ktCO_2e$ emissions for Merton Council in 2022

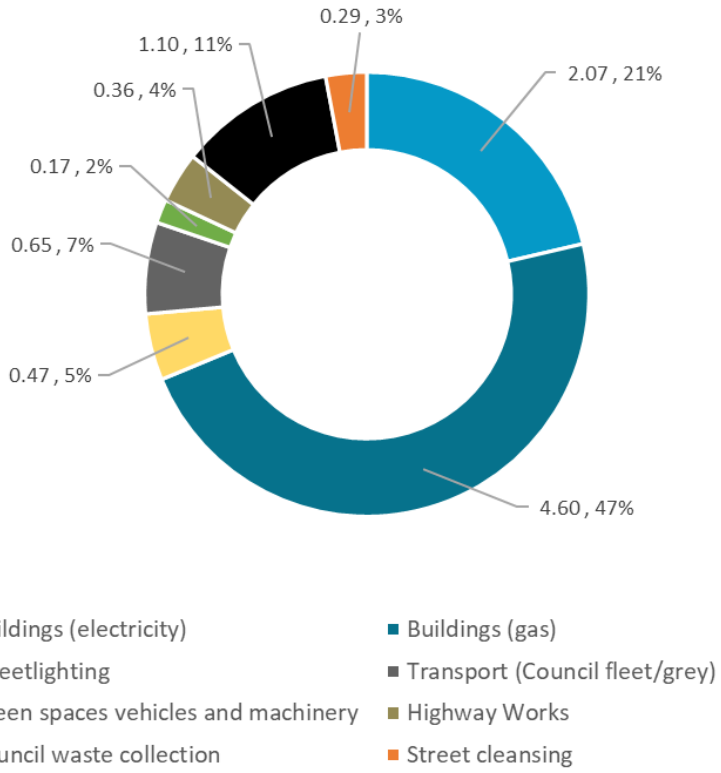


Table 7: Estimated $ktCO_2e$ emissions for Merton Council in 2022

Sector	Scope	2022 ($ktCO_2e$)	% of emissions assessed
Operational buildings (electricity)	2&3	1.06	11%
Operational buildings (gas)	1&3	1.85	19%
Community school buildings (electricity)	2&3	1.01	10%
Community school buildings (gas)	1&3	2.74	28%
Streetlighting (electricity)	2&3	0.47	5%
Council fleet/grey fleet	1,2&3	0.65	7%
Sub-total for direct council activities		7.9	80%
Green spaces vehicles and machinery	3	0.17	2%
Highway works	3	0.36	4%
Council waste collection	3	1.10	11%
Street cleansing	3	0.29	3%
Sub-total for procured services		1.9	20%
Total		**9.7**	

Previously, emissions from waste collection were estimated from tonnages of waste, and street cleansing was not included in the inventory due to a lack of data. In the 2023 council GHG inventory update, waste collection and street cleansing fuel use data from a Veolia refuelling station was sourced for 2018-2022. Fuel use data are considered more accurate than tonnage data for waste collection emissions estimates as these data represent the actual fuel used rather than an estimate of distance travelled based on tonnages. This fuel use data has been used to calculate emissions from waste collection and street cleansing.

There have been several improvements in data that have been introduced as part of this inventory update and applied across the whole timeseries (2018-2022). The largest recalculations in the 2023 update compared to the 2021 update are for procured services:

- Revisions and new data from 2018-2022 were included for highway works.
- In previous iterations of the inventory, council waste collection emissions were estimated using waste tonnage data and national conversion factors. In the 2023 update, fuel use data for the waste collection fleet were made available for the whole time series, allowing a more accurate estimate of emissions from this source. This is a separate source of emissions to those resulting from waste processing, which is included in the borough inventory (**Section 3.1**).
- Street cleansing emissions were included in the 2023 update for the first time.
- Well-to-tank emissions estimates were included for all procured services in the 2023 update for the first time.

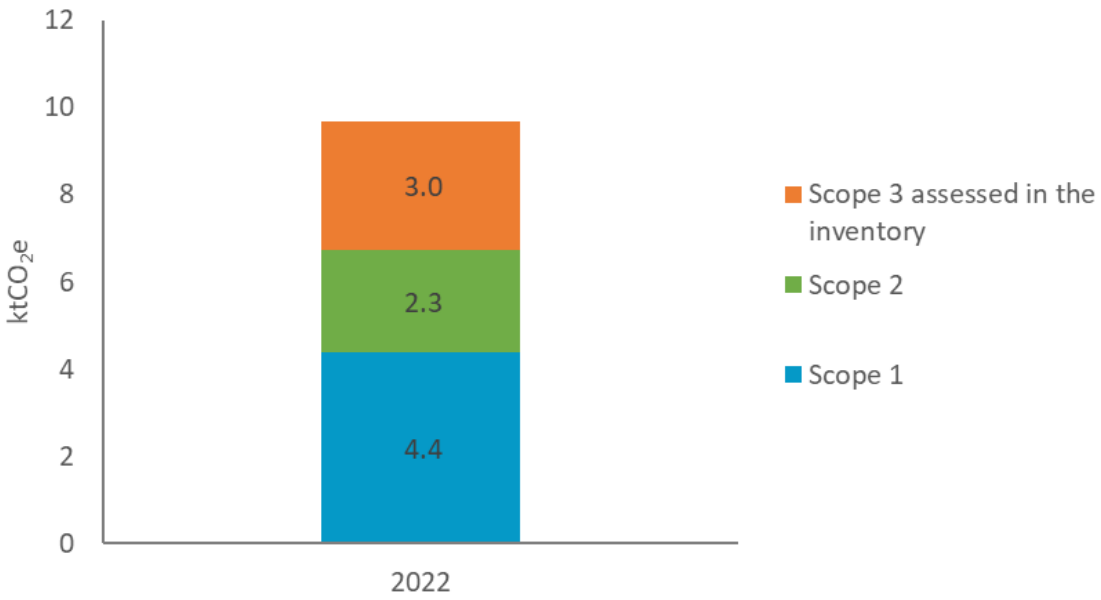
These improvements and additions for this year highlight how emissions from procured services are often limited by incompleteness and data availability. As more data and more accurate data become available, more emissions can be reported. Further details of recalculations from direct council activities and procured services can be found in **Appendix 3**.

Merton Council's GHG emissions for 2022 are shown in **Figure 6,** split by scope. The estimated scope 3 emissions from the council included in the inventory are currently estimated at 31% of the council's scope 1-3 emissions. This includes scope 3 emissions related to electricity (transmission and distribution losses), fuel use (well-to-tank emissions in transport and buildings), and from procured services for which data are available: Merton's green spaces management contract, highways maintenance contract, waste collection contract and street cleansing contract.

Most scope 3 emissions are not currently included in the inventory. For example, emissions from adult social care, staff commuting, other outsourced contracts (besides the waste collection, street cleansing, green spaces maintenance and highways maintenance currently included). These have not been included due to lack of data availability. If data were to be obtained for other sources, then the proportion of scope 3 emissions in the council's inventory would likely rise significantly.

Methodologies for estimating emissions from activities funded by pensions and investments are not yet well established, have high uncertainty, and the Council only has indirect control over them. As such, the Council may wish to monitor best estimates in the Climate Delivery Plan as part of the wider consideration of the Council's climate impact and aim to include further scope 3 emissions in the GHG inventory once better data are available.

Figure 6: $ktCO_2e$ emissions for Merton Council, 2022, by scope

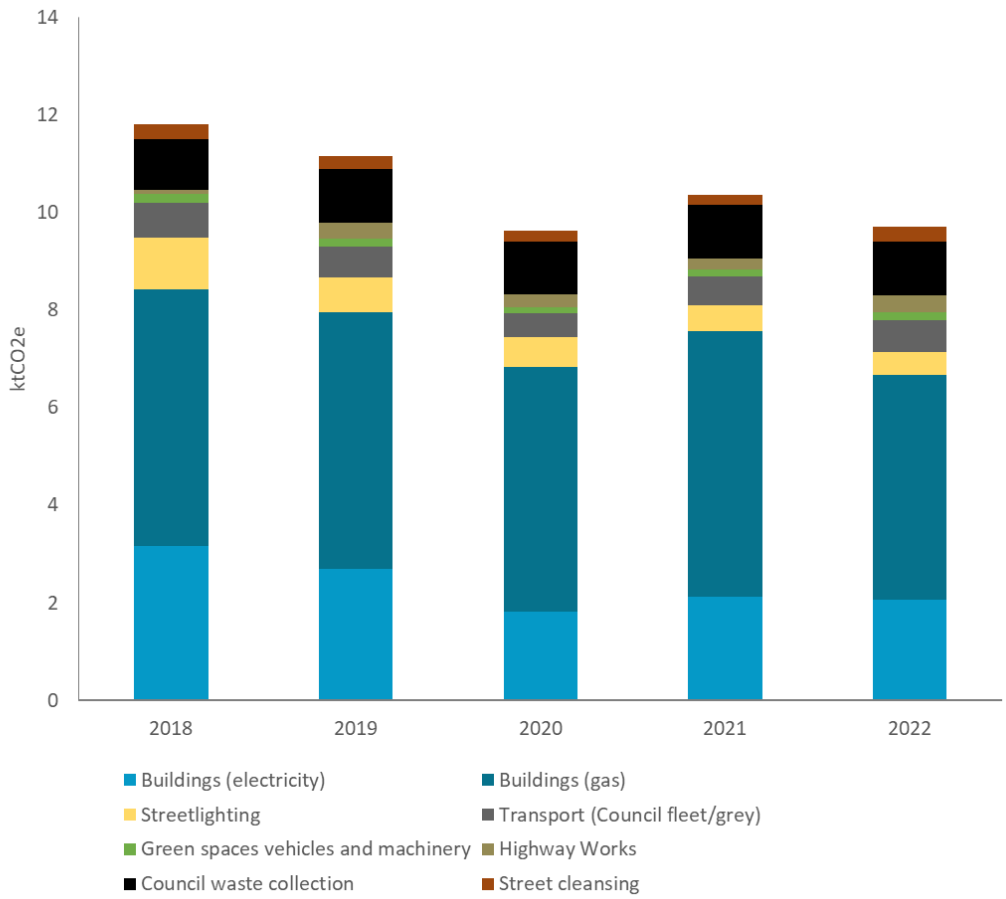


4.2 Changes in emissions since 2018

Estimated emissions for Merton Council for the years 2018 to 2022 are shown in **Figure** 7 and **Estimated emissions** from electricity consumption in council operational buildings and community schools decreased by 35% between 2018 and 2022 (from 3.2ktCO2e to 2.1kt CO2e), whilst emissions from natural gas consumption within the same buildings decreased by 12% between 2018 and 2022 (from 5.3kt CO2e to 4.6 ktCO2e). The reduction in estimated emissions from electricity consumption in buildings is due to a steady decrease in the carbon intensity of the electricity sourced from the National Grid. There was a large decrease in electricity use in 2020 which contributes to the drop in emissions in 2020 (26% decrease in kWh consumption between 2019 and 2020; see **Table A2.3** and **Table A2.4** in **Appendix 2**).

Table 8. Total emissions decreased by 18% between 2018 and 2022, from 11.8 ktCO_2e to 9.7 ktCO_2e. Gas consumption in council owned buildings remains the main source of emissions for the Council across the time series, although the largest reduction in emissions came from council building electricity usage.

Figure 7: ktCO_2e emissions for Merton Council, 2018 – 2022



Estimated emissions from electricity consumption in council operational buildings and community schools decreased by 35% between 2018 and 2022 (from 3.2ktCO_2e to 2.1kt CO_2e), whilst emissions from natural gas consumption within the same buildings decreased by 12% between 2018 and 2022 (from 5.3kt CO_2e to 4.6 ktCO_2e). The reduction in estimated emissions from electricity consumption in buildings is due to a steady decrease in the carbon intensity of the electricity sourced from the National Grid. There was a large decrease in electricity use in 2020 which contributes to the drop in emissions in 2020 (26% decrease in kWh consumption between 2019 and 2020; see **Table A2.3** and **Table A2.4** in **Appendix 2**).

Table 8: Emissions (in $ktCO_2e$) from each sector, 2018-2022

Sector	Scope	Emissions ($ktCO_2e$)					Change between 2018 baseline and 2022 (%)
		2018	2019	2020	2021	2022	
Operational Buildings (electricity)	2&3	1.61	1.39	0.79	1.03	1.06	-34%
Operational Buildings (gas)	1&3	2.37	2.40	2.00	2.05	1.85	-22%
Operational Buildings (total)		3.98	3.79	2.79	3.08	2.91	-27%
Community School Buildings (electricity)	2&3	1.55	1.30	1.03	1.10	1.01	-35%
Community School Buildings (gas)	1&3	2.88	2.86	3.00	3.39	2.74	-5%
Community Schools (total)		4.43	4.16	4.03	4.49	3.75	-15%
Streetlighting (electricity)	2&3	1.07	0.72	0.61	0.54	0.47	-56%
Council fleet/grey fleet	1,2 &3	0.72	0.62	0.50	0.59	0.65	-10%
Sub-total for direct council activities		10.2	9.3	7.9	8.7	7.8	-24%
Green spaces vehicles and machinery	3	0.18	0.17	0.12	0.14	0.17	-7%
Highway Works	3	0.08	0.33	0.26	0.21	0.36	337%
Council waste collection	3	1.03	1.10	1.08	1.11	1.10	7%
Street cleansing	3	0.32	0.25	0.24	0.21	0.29	-9%
Subtotal for procured services		1.6	1.9	1.7	1.7	1.9	19%
Total		**11.8**	**11.1**	**9.6**	**10.4**	**9.7**	**-18%**

Across the timeseries, there are increases in emissions for highway works, and council waste collection:

- There were revisions to the highway works data from 2019-2022 as more historical data became available for different fuel types. These increases were not reflected in 2018, so the increase in emissions from 2018 to 2019 may not reflect an actual increase in highway works.
- There is a variable but increasing trend of diesel use for waste collection from 2018-2022. This is reflected in an increase in emissions from waste collection.

5 Impacts of the COVID-19 pandemic

The COVID-19 pandemic resulted in a disruption to Council activities across 2020 and 2021, and this has been reflected in the estimated GHG emissions reported for these years.

Emissions from electricity usage in council operational buildings decreased by 43% in 2020, from 1.4 ktCO_2e in 2019 to 0.8 ktCO_2e in 2020. These figures include both emissions from direct consumption and scope 3 emissions from the electricity transmission and distribution. This is in part due to the continual decarbonisation of the National Grid, but also due to reduced electricity consumption which decreased from 5 GWh in 2019 to 3.1 GWh in 2020, reflecting a shift towards working from home. In 2021, emissions increased by 29% from the 2020 value, which reflects a slight shift away from homeworking, but electricity usage does not return to pre-COVID-19 levels until 2022 (**Table A2.4** in **Appendix 2**).

Emissions reductions were less pronounced for natural gas consumption in council operational buildings, at 17%, decreasing from 2.4 ktCO_2e in 2019 to 2.0 ktCO_2e in 2020. This decrease is largely due to a reduction in gas consumption by these buildings, from 11.6 GWh in 2019 to 9.6 GWh in 2020. This reduction is likely because staff worked from home and spent less time in offices during the COVID-19 response. However, the emissions related to heating were potentially “outsourced” to staff homes, whether they live in the borough or not. Following the pandemic, Merton Council has implemented hybrid working (a mix of working in office and working from home) for their staff, which may influence gas consumption by council operational buildings.

Gas consumption in school buildings increased from 13.8 GWh in 2019 to 14.4 GWh in 2020. This is likely in response to the requirement of schools to increase ventilation rates to reduce the spread of COVID-19. Furthermore, the gas consumption in school buildings increased to 15.8 GWh in 2021 which may reflect the continuing need for ventilation during the winter period. In 2022, gas consumption in school buildings returned to below the pre-COVID-19 level at 12.8 GWh.

Depending on regional differences in the average size of home, heating or cooling needs and the efficiency of appliances, a day of working from home could increase household energy consumption by between 7% and 23% compared to a day working in the office (IEA, 2020). Emissions savings from the reduction in commutes by car that are greater than 3 km (an average figure for Europe) may offset this increase, resulting in a reduction in overall emissions. However, where commutes are less than this distance or are by public transport or active travel, working from home may lead to a net increase in emissions (IEA, 2020). To accurately capture the effect of working from home on Merton Council’s emissions, emissions could be calculated using the methodology in the EcoAct homeworking emissions white paper[12].

Emissions from private transport across the borough decreased in 2020, but increased again in 2021, although not to pre-COVID-19 levels. The decrease is likely due to reduced commuting and car travel emissions from national lockdowns and a large proportion of the work force being advised to work from home in 2020. Petrol car emissions returned to pre-COVID-19 levels in 2021, whereas diesel car emissions remained lower. This

[12] https://info.eco-act.com/en/homeworking-emissions-whitepaper-2020

sustained decrease in diesel car emissions may be related to the impact of GLA ULEZ regulations.

Emissions from council transport may have also been impacted by the pandemic. Estimated emissions from council fleet and grey fleet decreased by 13% between 2018 and 2019, and by 20% between 2019 and 2020 (**Table 9**). Council fleet vehicle miles were reduced in 2020 (**Table A2.3** in **Appendix 2**). The transition to some services being online because of the pandemic meant fewer vehicles were on the road. Estimated emissions from council fleet and grey fleet increased by 18% from 2020 to 2021 and increased 9% from 2021 to 2022, potentially reflecting the post-pandemic recovery with more vehicles back on the roads.

Table 9: Emissions from Council/grey fleet and percentage change, 2018- 2022

Council/grey fleet	2018	2019	2020	2021	2022
Emissions (tCO_2e)	716	620	498	590	645
Percentage change from previous year	-	-13%	-20%	18%	9%

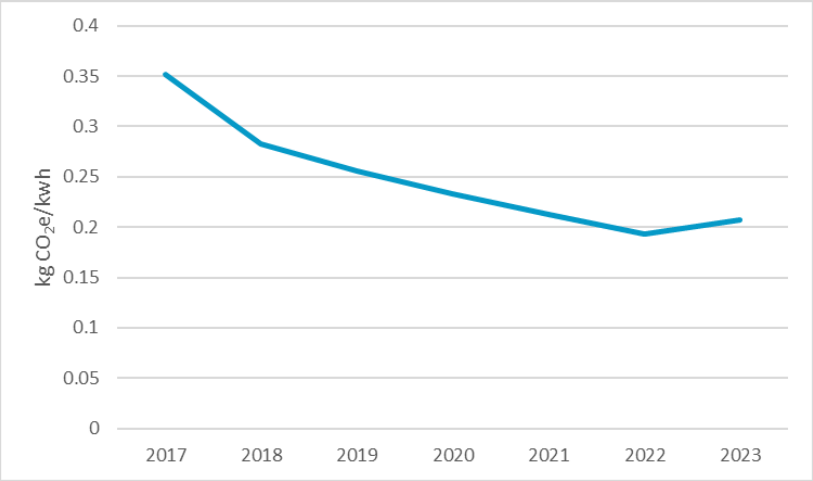
In the 2021 update, reported emissions from Highway Works vehicles doubled in 2020 compared to 2019. However, in the 2023 update the revision of data from 2019-2022 demonstrated much larger and variable emissions across the time series. It is hard to find any correlation of the highway works vehicle data and Merton's emergency transport response to COVID-19 to improve road safety, support social distancing and provide more space for walking and cycling.

6 UK gas demand and emission factor dynamics

Natural gas prices have been increasing in the UK and Europe over the last few years due to a combination of factors: lower wind availability creating a higher gas demand for power generation; increased natural gas demand in Asia; and increased oil prices.[13] In 2022, Russia's war on Ukraine and related political decisions had an impact on natural gas supply from Russia.[14]

Natural gas demand in the heating sector is particularly sensitive to changes in gas price. This sensitivity is reflected in the UK energy trends data where there was an 18% decrease in domestic gas demand between 2021 and 2022.[15] Similarly, when comparing April to June in 2023 to 2022, there is a 9.3% decrease in domestic gas demand, likely driven by increased energy costs as temperatures were similar between years. This decrease may be reflected in the subnational gas consumption statistics for Merton borough in the next GHG inventory update. Although external factors such as the energy crisis can result in lower emissions as gas demand decreases, these are not reflective of long-term behaviour change towards the net zero target for Merton Borough by 2050.

Figure 8: UK electricity emission factors (excl T&D) from 2017-2023[16]



Decreases in emissions from energy are often driven in part by decreases in UK emission factors. For example, **Figure 8** demonstrates the changes in the UK electricity emission factor from 2017 (not including transport and distribution emissions). The UK electricity emission factor varies between years as there are different proportions of renewable and non-renewable energy in the grid.

For the 2023 update, the decreasing trend in emission factors contributes to a general decrease in the borough (to 2021) and council (to 2022) scope 2 emissions. However, the 2023 emission factor (not used in this update), has increased due to reduced energy generation from renewables due to less favourable weather conditions in 2021 (note that the emission factor used in a year is calculated from national emissions inventory data 2 years earlier).[16] The electricity generated from natural gas increased to account for the lower renewable energy production. This highlights how the emissions from electricity can be dependent on uncontrollable external factors.

[13] https://www.bayes.city.ac.uk/news-and-events/news/2021/september/what-is-behind-the-rising-gas-prices
[14] https://www.sciencedirect.com/science/article/pii/S2589004223005680
[15] https://www.gov.uk/government/collections/energy-trends
[16] https://www.gov.uk/government/collections/government-conversion-factors-for-company-reporting

7 Conclusions and Recommendations

7.1 Summary of 2023 emissions estimates

The total reported emissions for the borough of Merton were 692 ktCO_2e in 2021, representing a 157 ktCO_2e decrease from the baseline in 2017. The residential sector was the most significant source of emissions, comprising 44% of total emissions in 2021. Emissions from the transport sector remained relatively constant between 2017 and 2019 but decreased in 2020 before increasing again in 2021. If the trend of decarbonisation of the National Grid continues thereby decreasing emissions from electricity usage, emissions from transport may represent a more significant proportion of borough emissions in future years. Waste processing emissions were revised from the previous inventory update, and account for 3% of the total borough emissions.

Reported emissions for Merton Council totalled 9.7 ktCO_2e in 2022, representing an 18% reduction compared to 2018. Gas consumption in council owned buildings was the main source of emissions, representing 47% of total emissions. The impacts of COVID-19 are reflected in council emissions, as shown by a 37% reduction in electricity consumption in council operational buildings in 2020.

Council action to replace the light bulbs used in street lighting with LED bulbs has directly resulted in reduced emissions and can be seen in the GHG emissions inventory in the decrease of emissions from streetlighting between 2018 and 2022 (36% reduction in kWh electricity use; see **Table A2.3** in **Appendix 2**). Significant emission reductions also occurred due to the decarbonisation of the National Grid, and potentially impacts of the pandemic.

7.2 Recommendations

To further improve the inventory, the quality of some of the current emission source estimates can be improved, and more indirect (scope 3) emission sources can be included. Potential actions could include:

- More careful management of data related to council fleet to improve confidence in data.
- A brief review of all possible scope 3 categories, according to the GHG Protocol, and screening to consider which sources could be included or covered more fully by the inventories. Some scope 3 sources that could be included are staff commuting and procurement of other goods and services. Merton Council is in the process of building capacity to lead on the decarbonisation of Merton's procured services. This will involve supporting contract managers with the process of engaging with suppliers to baseline, monitor and reduce emissions from Merton's existing contracts. This will enable further scope 3 emissions from procured services to be included in the inventory.
- If council staff continue to work significantly from home, the inclusion of electricity and heating emissions from home offices could be included in the inventory. This could be achieved using the methodology provided in the EcoAct homeworking emissions white paper[17].

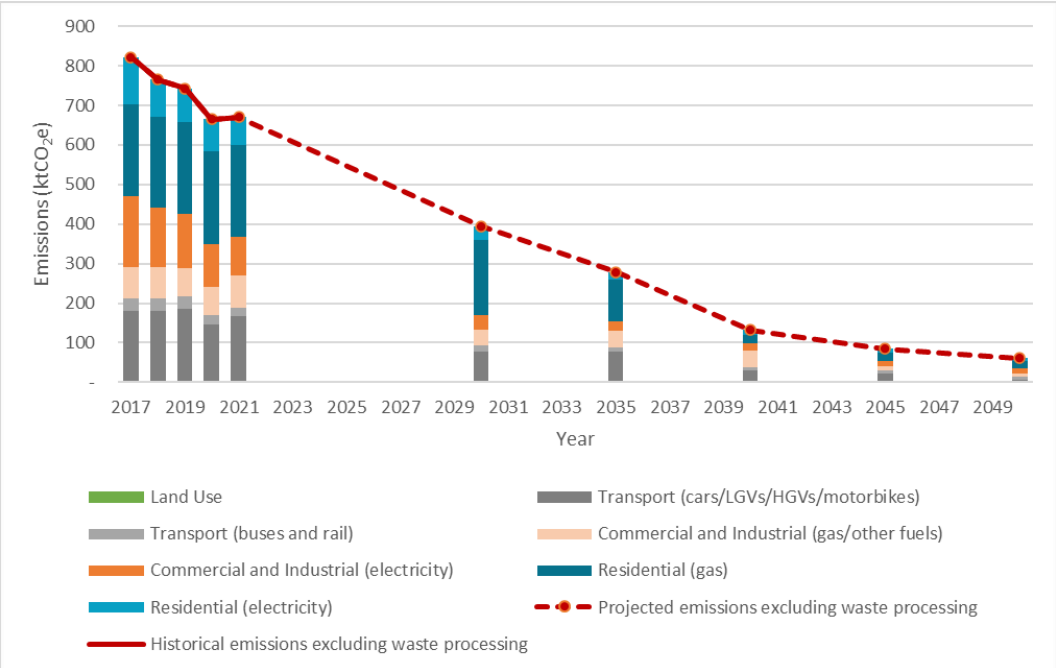
[17] https://info.eco-act.com/en/homeworking-emissions-whitepaper-2020

- Emissions from the processing of Merton's local authority collected waste sent to processing facilities other than Beddington ERF and landfill, have not been estimated in this inventory due to a lack of data. This covers emissions from commercial waste, various recycling streams, food waste to anaerobic digestion plants, and garden waste sent to composting plants. To improve the completeness of the borough inventory, these waste related emissions sources could be included in future inventories if data become available.

7.3 Progress towards targets

Based on figures from the 2023 update for emissions in the years 2017-2021, emissions from Merton Borough are not decreasing as quickly as modelled in the decarbonisation pathway outlined in the 2020 "London Borough of Merton Climate Action Support" report[18]**.** As waste processing emissions from the ERF were not included in the pathways modelling due to lack of data, they have been excluded from the 2023 estimates here for comparison in **Figure 9**. However, the comparison should be seen as indicative only, as the model has not been recalculated with the changes described in **Appendix 3.**

Figure 9: Comparing 2023 estimates (excluding waste processing) against the decarbonisation pathway for Merton Borough, 2017 – 2050, as published in 2020



Estimated emissions for Merton Council are variable but seem to be decreasing in line with the pathway trajectory outlined in the 2020 report (**Figure 10**).

Street cleansing emissions were included in the inventory for the first time in this update, so are not included in the comparison with the decarbonisation pathway for Merton council below.

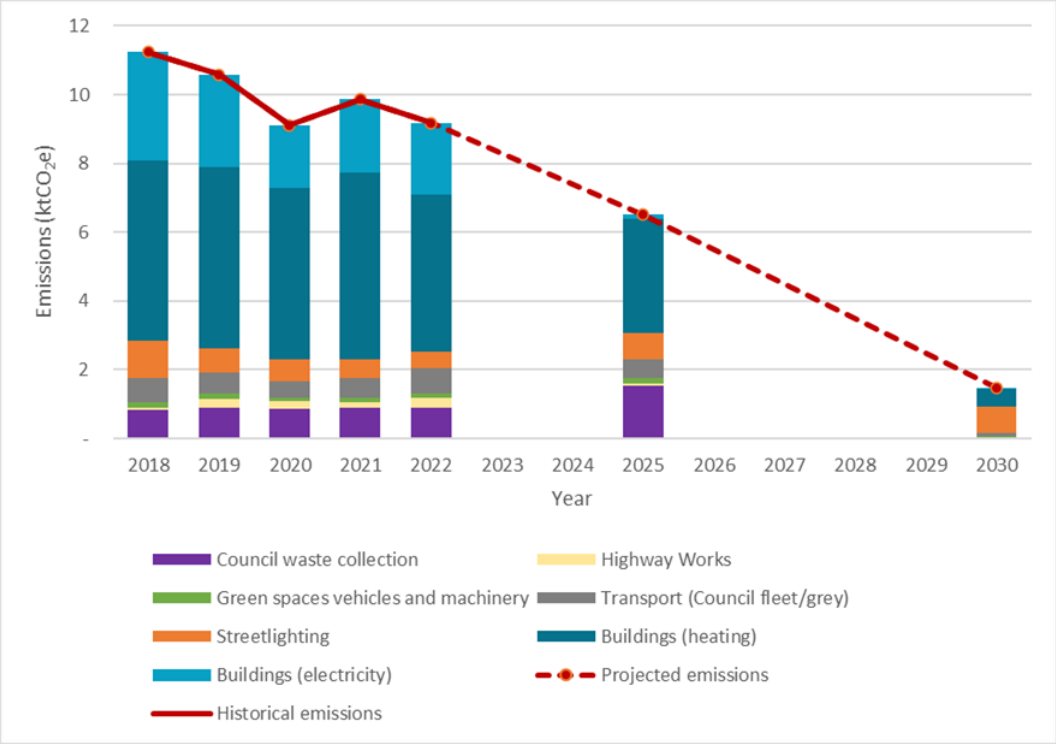
Although some emissions in 2020 decreased due to the pandemic this trend does not continue in 2021 and 2022. The pathway model included a project to replace old

[18] https://www.merton.gov.uk/system/files?file=merton_support-climate-action_v3.1.pdf

streetlights with LEDs, with the first full year of carbon savings beginning in the 2017/18 financial year. This was actioned by the council in 2017.

It should be noted that the carbon intensity of the UK electricity supply in 2022 was higher than that modelled for 2022 in the initial analysis (Aether, 2020), which would contribute to higher emissions in the inventory. Comparison results are indicative only, as the model has not been recalculated with the changes described in **Appendix 3.**

Figure 10: Comparing 2023 estimates against the decarbonisation pathway for Merton Council, 2017 – 2030, as published in 2020



8 References

Aether (2020), London Borough of Merton Climate Action Support, https://www.merton.gov.uk/system/files?file=merton_support-climate-action_v3.1.pdf

IEA (2020), "Working from home can save energy and reduce emissions. But how much?", IEA, Paris, https://www.iea.org/commentaries/working-from-home-can-save-energy-and-reduce-emissions-but-how-much

Merton Council (2020), Merton Climate Strategy and Action Plan, https://www.merton.gov.uk/system/files?file=draft20climate20strategy20and20action20plan20-20council20v2.pdf

University of Leeds (2021), "Consumption-based Greenhouse Gas Household Emission Profiles for London Boroughs", London Councils, https://www.londoncouncils.gov.uk/our-key-themes/environment/climate-change/consumption-based-greenhouse-gas-household-emissions

Viridor (2021) Carbon Management Plan for the SLWP Residual Waste Treatment Contract and the Beddington Energy Recovery Facility, report to the South London Waste Partnership Joint Committee, 8th June 2021, https://moderngov.kingston.gov.uk/documents/s92419/2a.%20JWC%20Paper%20-%20Carbon%20Management%20Plan%20-%20June%202021%20Final.pdf

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Appendix 1 - Input data

Table A1.1: Data sources for the borough GHG inventory

Source number	Data Source	Sector	Description
1	Department for Business, Energy and Industrial Strategy (BEIS): 'Sub-national electricity sales and numbers of customers'	Grid electricity; domestic economy, domestic standard and non-domestic	This dataset provides energy consumption data for domestic and commercial electricity use in the borough of Merton.
2	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.
3	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.
4	Department for Business, Energy and Industrial Strategy (BEIS): 'Residual fuel consumption at regional and local authority level"	Petroleum, coal and manufactured solid fuels consumption	This dataset 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.
5	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.
6	Department for Business, Energy and Industrial Strategy (BEIS): 'Greenhouse gas reporting: conversion factors' 2017 - 2022	All sectors	This dataset provides emission factors for all sources covered in this inventory.
7	Greater London Authority: 'London Energy and Greenhouse Gas Inventory (LEGGI)'	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. Data for 2021 was not available at the time of this inventory compilation so 2020 values were used.
12	Office for National Statistics (ONS): Subnational population estimates	Population of Merton borough	This dataset provides population estimates for the borough of Merton, used to calculate the consumption-

Source number	Data Source	Sector	Description
			based emissions that are outside the scope of the inventory.
15	Beddington Energy Recovery Facility	Waste	CO2 and N2O emissions from the combustion of waste, emissions associated with imported fuel/power and waste diverted to landfill or other ERF facilities.

Table A1.2: Data sources for the Council GHG inventory

Source number	Data Source	Sector	Description
9	DECC GHG Report (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.
9	DECC GHG Report (received from Merton Council)	Transport	Distance travelled by the council vehicle fleet, by fuel type and vehicle type.
10	Council staff survey (received from Merton Council)	Transport	Distance travelled by council staff for work trips (grey fleet).
13	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.
14	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.

Appendix 2 - Activity data and emission factors

Table A2.1: Activity data for the borough GHG inventory

Sector	Category	Fuel	Unit	Data Source	Activity data by year				
					2017	2018	2019	2020	2021
Commercial	Non-domestic	Gas	GWh	3	302	301	277	277	307
Commercial	Non-domestic	Electricity	GWh	1	462	495	499	432	425
Commercial	Public Administration	Petroleum	ktoe	4	0.01	0.01	0.01	0.00	0.00
Commercial	Commercial	Petroleum	ktoe	4	0.16	0.16	0.15	0.08	0.09
Industrial	Industry	Petroleum	ktoe	4	3.70	3.90	3.82	3.60	3.90
Industrial	Industry	Manufactured solid fuels	ktoe	4	0.11	0.06	0.04	0.03	0.00
Land Use	LULUCF	Net GHG emissions	kt CO_2e	5	-0.13	0.00	-0.06	-0.12	-0.16
Residential	Domestic	Gas	GWh	3	1,086	1,084	1,105	1,115	1,074
Residential	Domestic	Electricity	GWh	1	313	306	305	323	302
Residential	Domestic	Petroleum	ktoe	4	0.37	0.38	0.38	0.37	0.38
Residential	Domestic	Coal	ktoe	4	0.07	0.07	0.07	0.06	0.06
Residential	Domestic	Manufactured solid fuels	ktoe	4	0.07	0.07	0.07	0.06	0.05
Transport	Buses	Petrol	ktoe	2	3.14	3.26	2.69	2.17	2.38
Transport	Cars	Petrol	ktoe	2	19	19	20	16	20
Transport	Cars	Diesel	ktoe	2	15	16	15	11	12
Transport	Motorcycles	Petrol	ktoe	2	1	1	1	1	1
Transport	HGV	Diesel	ktoe	2	3	3	3	3	3
Transport	LGV	Petrol	ktoe	2	0	0	0	0	0
Transport	LGV	Diesel	ktoe	2	8	8	9	8	8
Transport	Rail - london underground	Electricity	kWh	7	19,031,769	18,906,899	16,419,563	14,324,500	14,324,500
Transport	Rail - trams	Electricity	kWh	7	3,351,411	3,204,820	3,085,541	2,468,433	2,468,433
Transport	Rail - national rail	Electricity	kWh	7	31,000,333	31,000,333	49,106,538	43,017,106	43,017,106

Sector	Category	Fuel	Unit	Data Source	Activity data by year				
					2017	2018	2019	2020	2021
Transport	Rail - Passenger	Diesel	kWh	7	2,430,826	2,430,826	2,476,713	1,842,456	1,842,456
Transport	Rail - Freight	Diesel	kWh	7	261,120	261,120	600,592	534,041	534,041
Transport	Off-road/agriculture	Petroleum	ktoe	4	0.09	0.09	0.08	0.07	0.09
Population	Population	Merton total	people	12	206,052	206,186	206,548	206,453	215,324
Waste processing	ERF	Tonnes of waste treated	Tonnes	19	6,613	22,051	37,731	44,199	42,465
Waste processing	Landfill	Tonnes of waste treated	Tonnes	19	39,729	21,702	2,698	-	564

Table A2.2: Emission factors for the borough GHG inventory

Sector	Category	Fuel	Unit	Data Source	Emission Factors by year				
					2017	2018	2019	2020	2021
Multiple	UK	Grid Electricity	kgCO2e/kWh	UK Government GHG Conversion Factors for Company Reporting - UK Electricity - Electricity generated	0.352	0.283	0.256	0.233	0.212
Multiple	UK	Grid Electricity T&D	kgCO2e/kWh	UK Government GHG Conversion Factors for Company Reporting - Transmission and distribution - T&D- UK electricity	0.033	0.024	0.022	0.020	0.019
Multiple	UK	Natural Gas	kgCO2e/kWh	UK Government GHG Conversion Factors for Company Reporting - Fuels - Gaseous Fuels - Natural Gas - kWh (Gross CV)	0.184	0.184	0.184	0.184	0.183
Multiple	UK	Natural Gas WTT	kgCO2e/kWh	UK Government GHG Conversion Factors for Company Reporting - WTT - Fuels - Gaseous Fuels - Natural Gas - kWh (Gross CV)	0.028	0.026	0.024	0.024	0.031
Multiple	Industrial & Commercial	Coal	kgCO2e/kWh	UK Government GHG Conversion Factors for Company Reporting - Fuels - Solid fuels - Coal (industrial) - kWh (Gross CV)	0.324	0.325	0.332	0.320	0.324
Multiple	Industrial & Commercial	Coal WTT	kgCO2e/kWh	UK Government GHG Conversion Factors for Company Reporting - WTT - Fuels - Solid fuels - Coal (industrial) - kWh (Gross CV)	0.050	0.051	0.050	0.052	0.053
Multiple	Industrial & Commercial	Gas oil	kgCO2e/kWh	UK Government GHG Conversion Factors for Company Reporting - Fuels - Liquid fuels - Gas Oil - kWh (Gross CV)	0.276	0.277	0.257	0.254	0.257
Multiple	Industrial & Commercial	Gas oil WTT	kgCO2e/kWh	UK Government GHG Conversion Factors for Company Reporting - WTT - Fuels - Liquid fuels - Gas Oil - kWh (Gross CV)	0.059	0.059	0.059	0.059	0.059
Residential	Domestic	Solid smokeless fuel	ktCO2e/TJ	NAEI https://naei.beis.gov.uk/data/ef-all-results?q=149740	0.103	0.103	0.103	0.103	0.103
Residential	Domestic	Coal	kgCO2e/kWh	UK Government GHG Conversion Factors for Company Reporting - Fuels - Solid fuels - Coal (Domestic) - kWh (Gross CV)	0.342	0.345	0.345	0.345	0.345
Residential	Domestic	Coal WTT	kgCO2e/kWh	UK Government GHG Conversion Factors for Company Reporting - WTT - Fuels - Solid fuels - Coal (Domestic) - kWh (Gross CV)	0.050	0.051	0.050	0.052	0.053

Sector	Category	Fuel	Unit	Data Source	Emission Factors by year				
					2017	2018	2019	2020	2021
Residential	Domestic	Kerosene (burning oil)	kgCO2e/kWh	UK Government GHG Conversion Factors for Company Reporting - Fuels - Liquid fuels - Burning Oil - kWh (Gross CV)	0.247	0.247	0.247	0.247	0.247
Residential	Domestic	Kerosene (burning oil) WTT	kgCO2e/kWh	UK Government GHG Conversion Factors for Company Reporting - WTT - Fuels - Liquid fuels - Burning Oil - kWh (Gross CV)	0.051	0.051	0.051	0.051	0.051
Transport	Car (average size)	Diesel	kg CO2e/km	UK Government GHG Conversion Factors for Company Reporting - Passenger vehicles - Cars (by size) - Average car - Diesel	0.179	0.178	0.173	0.168	0.168
Transport	Car (average size)	Diesel WTT	kg CO2e/km	UK Government GHG Conversion Factors for Company Reporting - WTT- pass vehs & travel- land - Cars (by size) - Average car - Diesel	0.043	0.042	0.041	0.040	0.041
Transport	Car (average size)	Petrol	kg CO2e/km	UK Government GHG Conversion Factors for Company Reporting - Passenger vehicles - Cars (by size) - Average car - Petrol	0.186	0.184	0.181	0.174	0.174
Transport	Car (average size)	Petrol WTT	kg CO2e/km	UK Government GHG Conversion Factors for Company Reporting - WTT- pass vehs & travel- land - Cars (by size) - Average car - Petrol	0.051	0.050	0.049	0.048	0.049
Transport	London buses	Petrol	kg CO2e/passenger km	UK Government GHG Conversion Factors for Company Reporting - Business travel-land - Bus - Local London Bus	0.073	0.072	0.082	0.079	0.077
Transport	London buses	Petrol WTT	kg CO2e/passenger km	UK Government GHG Conversion Factors for Company Reporting - WTT- pass vehs & travel- land - Bus - Local London Bus	0.017	0.017	0.020	0.019	0.019
Transport	HGV (all, average% laden)	Diesel	kg CO2e/km	UK Government GHG Conversion Factors for Company Reporting - Freighting goods - HGV(all diesel) - All HGVs - average % laden	0.870	0.845	0.880	0.865	0.864
Transport	HGV (all, average% laden)	Diesel WTT	kg CO2e/km	UK Government GHG Conversion Factors for Company Reporting - WTT- delivery vehs & freight - HGV(all diesel) - All HGVs - average % laden	0.209	0.208	0.208	0.206	0.209
Transport	Motorcycle (average)	Petrol	kg CO2e/km	UK Government GHG Conversion Factors for Company Reporting - Passenger vehicles - Motorbike - Average	0.117	0.115	0.116	0.113	0.114

Sector	Category	Fuel	Unit	Data Source	Emission Factors by year				
					2017	2018	2019	2020	2021
Transport	Motorcycle (average)	Petrol WTT	kg CO2e/km	UK Government GHG Conversion Factors for Company Reporting - WTT- pass vehs & travel- land - Motorbike - Average	0.031	0.031	0.031	0.031	0.031
Transport	Van (average)	Petrol	kg CO2e/km	UK Government GHG Conversion Factors for Company Reporting - Freighting goods - Vans - Average (up to 3.5 tonnes) - Petrol	0.262	0.249	0.236	0.220	0.210
Transport	Van (average)	Petrol WTT	kg CO2e/km	UK Government GHG Conversion Factors for Company Reporting - WTT- delivery vehs & freight - Vans - Average (up to 3.5 tonnes) - Petrol	0.072	0.068	0.064	0.060	0.059
Transport	Van (average)	Diesel	kg CO2e/km	UK Government GHG Conversion Factors for Company Reporting - Freighting goods - Vans - Average (up to 3.5 tonnes) - Diesel	0.257	0.257	0.252	0.247	0.241
Transport	Van (average)	Diesel WTT	kg CO2e/km	UK Government GHG Conversion Factors for Company Reporting - WTT- delivery vehs & freight - Vans - Average (up to 3.5 tonnes) - Diesel	0.062	0.061	0.060	0.060	0.059
Transport	Rail	Diesel	kgCO2e/kWh	UK Government GHG Conversion Factors for Company Reporting - Fuels - Liquid fuels - Diesel - kWh (Gross CV)	0.245	0.248	0.245	0.058	0.237
Transport	Rail	Diesel WTT	kgCO2e/kWh	UK Government GHG Conversion Factors for Company Reporting - WTT - Fuels - Liquid fuels - Diesel - kWh (Gross CV)	0.058	0.058	0.058	0.058	0.058
Consumption	London		tCO2e/capita	London Councils consumption-based household emissions profiles for London boroughs - Merton - direct emissions excluded	6.760	6.930	6.159	5.669	5.669
Waste processing	ERF	Average carbon intensity	tCO2e/tonne	Viridor Carbon Management Plan June 2021	0.394	0.394	0.394	0.485	0.473
Waste processing	Landfill	Average carbon intensity	tCO2e/tonne	Viridor Carbon Management Plan June 2021	0.587	0.587	0.587	-	0.417

Table A2.3: Activity data for the Council GHG inventory

Sector	Category	Fuel	Unit	Data Source	Activity data by year				
					2018	2019	2020	2021	2022
Energy	Operational Buildings	Electricity	kWh	8	5,237,919	5,000,090	3,129,290	4,437,729	5,040,080
Energy	School Buildings	Electricity	kWh	8	5,055,543	4,688,521	4,062,906	4,749,398	4,768,153
Energy	Operational Buildings	Gas	kWh	8	11,316,821	11,559,894	9,632,131	9,579,435	8,662,060
Energy	School Buildings	Gas	kWh	8	13,740,019	13,775,952	14,447,773	15,791,111	12,846,343
Energy	Streetlighting	Electricity	kWh	8	3,486,753	2,583,625	2,423,534	2,327,006	2,226,063
Transport	Cars	Petrol	km	9	41,090	35,747	47,562	23,999	43,888
Transport	Cars	Diesel	km	9	125,893	69,351	75,978	43,076	43,605
Transport	Cars	Petrol Hybrid	km	9	8,896	13,369	6,960	6,779	13,753
Transport	Van	Diesel	km	9	245,459	182,729	234,901	190,184	146,096
Transport	Van	Petrol	km	9		20,851	30,510	26,995	21,890
Transport	HGV (over 3.5t)	Diesel	km	9	457,126	396,166	311,704	413,543	462,003
Transport	Cars	Electric	km	9	5,427	2,277	6,375	6,244	3,201
Transport	Ebike	Electric	km	9				5,423	1,582
Transport	Cars	unknown (grey fleet)	km	10	461,984	450,385	258,819	306,066	315,033
Street cleansing	Streets	Diesel	litres	16	97,554	78,737	75,187	66,330	91,221
Waste	Collections	Diesel	litres	16	317,506	343,212	340,650	355,679	347,736
Highway Works	FM Conway	Petrol	litres	13	1,567	2,114	2,817	2,987	2,842
Highway Works	FM Conway	Diesel	litres	13	23,844	83,501	51,469	47,754	97,888
Highway Works	FM Conway	Red diesel	litres	13		16,231	25,010	14,283	11,025
Highway Works	FM Conway	Electricity	kWh	13		-	-	248	233
Highway Works	FM Conway	Biofuel	litres	13					2
Highway Works	FM Conway	Propane	kg	13		611	611	611	611
Transport (ID Verde)	ID Verde	Petrol	litres	14	9033.24	9378.44	6977.27	9042.38	10106.63
Transport (ID Verde)	ID Verde	Diesel	litres	14	39,617	36,733	28,695	37,068	43,994
Transport (ID Verde)	ID Verde	Red diesel	litres	14	7,000	7,993	4,363	-	-

Table A2.4: Emission factors for the Council GHG inventory

Sector	Category	Fuel	Unit	Data Source	Emission Factors by year				
					2018	2019	2020	2021	2022
Energy	UK	Grid Electricity	kgCO2e/kWh	UK Government GHG Conversion Factors for Company Reporting - UK Electricity - Electricity generated	0.283	0.256	0.233	0.212	0.193
Energy	UK	Grid Electricity T&D	kgCO2e/kWh	UK Government GHG Conversion Factors for Company Reporting - Transmission and distribution - T&D- UK electricity	0.024	0.022	0.020	0.019	0.018
Energy	UK	Natural Gas	kgCO2e/kWh	UK Government GHG Conversion Factors for Company Reporting - Fuels - Gaseous Fuels - Natural Gas - kWh (Gross CV)	0.184	0.184	0.184	0.183	0.183
Energy	UK	Natural Gas - WTT	kgCO2e/kWh	UK Government GHG Conversion Factors for Company Reporting - WTT - Fuels - Gaseous Fuels - Natural Gas - kWh (Gross CV)	0.026	0.024	0.024	0.031	0.031
Energy	UK	Gas oil - red diesel	kgCO2e/l	UK Government GHG Conversion Factors for Company Reporting - Fuels - Liquid Fuels - Gas Oil - litres	2.970	2.758	2.758	2.759	2.759
Transport	UK	Car - Petrol - Average	kg CO2e/km	UK Government GHG Conversion Factors for Company Reporting - Passenger vehicles - Cars (by size) - Average car - Petrol	0.184	0.181	0.174	0.174	0.170
Transport	UK	Car - Petrol - Average WTT	kg CO2e/km	UK Government GHG Conversion Factors for Company Reporting - Passenger vehicles - Cars (by size) - Average car - Petrol	0.050	0.049	0.048	0.049	0.049
Transport	UK	Car - Diesel - Average	kg CO2e/km	UK Government GHG Conversion Factors for Company Reporting - Passenger vehicles - Cars (by size) - Average car - Diesel	0.178	0.173	0.168	0.168	0.171
Transport	UK	Car - Diesel - Average WTT	kg CO2e/km	UK Government GHG Conversion Factors for Company Reporting - Passenger vehicles - Cars (by size) - Average car - Diesel	0.042	0.041	0.040	0.041	0.041
Transport	UK	Car - hybrid - average mileage (km)	kg CO2e/km	UK Government GHG Conversion Factors for Company Reporting - Passenger vehicles - Cars (by size) - Average car - Hybrid	0.126	0.115	0.116	0.120	0.120
Transport	UK	Car - hybrid - average mileage (km) WTT	kg CO2e/km	UK Government GHG Conversion Factors for Company Reporting - Passenger vehicles - Cars (by size) - Average car - Hybrid	0.032	0.029	0.030	0.031	0.031
Transport	UK	Van - Diesel - Average - up to 3.5t (km)	kg CO2e/km	UK Government GHG Conversion Factors for Company Reporting - Delivery vehicles - Vans - Average (up to 3.5t) - Diesel	0.257	0.252	0.247	0.241	0.232
Transport	UK	Van - Diesel - Average - up to 3.5t (km) WTT	kg CO2e/km	UK Government GHG Conversion Factors for Company Reporting - Delivery vehicles - Vans - Average (up to 3.5t) - Diesel	0.061	0.060	0.060	0.059	0.059

Sector	Category	Fuel	Unit	Data Source	Emission Factors by year				
					2018	2019	2020	2021	2022
Transport	UK	Van - Petrol - Average - up to 3.5t (km)	kg CO2e/km	UK Government GHG Conversion Factors for Company Reporting - Delivery vehicles - Vans - Average (up to 3.5t) - Petrol	0.249	0.236	0.220	0.210	0.213
Transport	UK	Van - Petrol - Average - up to 3.5t (km) WTT	kg CO2e/km	UK Government GHG Conversion Factors for Company Reporting - Delivery vehicles - Vans - Average (up to 3.5t) - Petrol	0.068	0.064	0.060	0.059	0.059
Transport	UK	HGV - Diesel - Average all types and sizes - average laden	kg CO2e/km	UK Government GHG Conversion Factors for Company Reporting - Freighting Goods - HGV - Diesel - Average all types and sizes - average laden	0.873	0.880	0.865	0.864	0.891
Transport	UK	HGV - Diesel - Average all types and sizes - average laden WTT	kg CO2e/km	UK Government GHG Conversion Factors for Company Reporting - Freighting Goods - HGV - Diesel - Average all types and sizes - average laden	0.208	0.208	0.206	0.209	0.209
Transport	UK	Car - battery electric vehicle - Average (km)	kg CO2e/km	UK Government GHG Conversion Factors for Company Reporting - UK electricity for Evs - Cars (by size) - Average car - Battery electric vehicle	0.060	0.055	0.053	0.050	0.047
Transport	UK	Car - battery electric vehicle T&D - Average (km)	kg CO2e/km	UK Government GHG Conversion Factors for Company Reporting - UK electricity T&D for Evs - Cars (by size) - Average car - Battery electric vehicle	0.005	0.005	0.005	0.004	0.004
Transport	UK	Car - Unknown fuel - Average (km)	kg CO2e/km	UK Government GHG Conversion Factors for Company Reporting - Passenger vehicles - Cars (by size) - Average car - Unknown	0.181	0.177	0.171	0.171	0.171
Transport	UK	Car - Unknown fuel - Average (km) WTT	kg CO2e/km	UK Government GHG Conversion Factors for Company Reporting - Passenger vehicles - Cars (by size) - Average car - Unknown	0.046	0.045	0.044	0.045	0.045
Transport	UK	Petrol - average biofuel (litres) - Transport	kg CO2e/l	UK Government GHG Conversion Factors for Company Reporting - Fuels - Liquid Fuels - Petrol (average biofuel blend) - litres	2.203	2.209	2.168	2.194	2.162
Transport	UK	Diesel - average biofuel (litres) - Transport	kg CO2e/l	UK Government GHG Conversion Factors for Company Reporting - Fuels - Liquid Fuels - Diesel (average biofuel blend) - litres	2.627	2.594	2.546	2.512	2.558
Transport	UK	Biodiesel	kg CO2e/l	UK Government GHG Conversion Factors for Company Reporting - Biofuel - Biodiesel - litres	0.035	0.032	0.166	0.168	0.168
Transport	UK	Propane	kg CO2/kg	UK Government GHG Conversion Factors for Company Reporting - Fuels - Gaseous Fuels - LPG - tonnes	2.937	2.937	2.939	2.939	2.939
Transport	UK	Petrol - average biofuel (litres) - Transport - WTT	kg CO2e/l	UK Government GHG Conversion Factors for Company Reporting - WTT - Fuels - Liquid Fuels - Petrol (average biofuel blend) - litres	0.597	0.599	0.593	0.613	0.613

Sector	Category	Fuel	Unit	Data Source	Emission Factors by year				
					2018	2019	2020	2021	2022
Transport	UK	Diesel - average biofuel (litres) - Transport - WTT	kg CO2e/l	UK Government GHG Conversion Factors for Company Reporting - WTT - Fuels - Liquid Fuels - Diesel (average biofuel blend) - litres	0.618	0.617	0.610	0.610	0.610
Transport	UK	Biodiesel - WTT	kg CO2e/l	UK Government GHG Conversion Factors for Company Reporting - WTT- bioenergy - Biodiesel - litres	0.313	0.367	0.374	0.419	0.363
Transport	UK	Propane - WTT	kg CO2/kg	UK Government GHG Conversion Factors for Company Reporting - WTT - Fuels - Gaseous Fuels - LPG - tonnes	0.369	0.369	0.359	0.347	0.347
Transport	UK	Gas oil - red diesel WTT	kgCO2e/l	UK Government GHG Conversion Factors for Company Reporting - WTT - Fuels - Liquid Fuels - Gas Oil - litres	0.633	0.633	0.633	0.633	0.633

Appendix 3 - Recalculations

The previous GHG inventory update for Merton (carried out in 2021) provided emissions estimates for the borough between 2017-2019. The activity data and emission factors used in the inventory have since been revised, altering estimated emissions as outlined below and in **Table 10**.

Total GHG estimates for the borough in the 2021 update for the baseline year 2017 were 767 ktCO_2e, which has been revised to 849 ktCO_2e for 2017 in this 2023 update. Changes are as a result of the following changes:

- Well-to-tank emissions in fuels used in combustion and transport were included in the borough inventory for the first time to address a previous omission. This results in an increase in emissions in the residential (8% increase in 2017 baseline), and commercial and industrial (6% increase in 2017 baseline) sector.
- The road transport figures were published by DESNZ[19], and improvements in methodology resulted in an increase of 508 tonnes of oil equivalent (toe) for petrol cars and 2377 toe for diesel cars for 2017. This is equivalent to an increase of emissions of 6.9 ktCO_2e and 8.8 ktCO_2e, respectively.
- Including well-to-tank emissions for the fuels used in vehicles resulted in an increase in vehicle transport emissions by 17% in 2017. The total increase in transport emissions compared to the previous update was 28% in 2017.
- Waste processing emissions from Beddington ERF were also updated in the inventory, reflecting a 58% decrease to the 2019 estimate from the 2021 update due to a refinement of the methodology used by Viridor to calculate their emissions. As in the 2021 update, emissions for 2017-2018 were estimated from tonnages of waste sent to ERF and diverted to landfill in those years and the carbon factors from 2019.
- CO_2 sequestered by land use, land use change and forestry has also been recalculated. In the 2021 update, land use within the borough was reported as sequestering 1.1 ktCO_2e in 2017. Changes in the methodology used in the UK local authority and regional greenhouse gas emissions national statistics has resulted in this being recalculated as a smaller net sink of 0.13 ktCO_2e. This is mainly due to the inclusion of the greenhouse gases methane and nitrous oxide which have a stronger warming effect than carbon dioxide[20]. This only impacts the land use and land use change estimate as other categories are calculated from different sources.

Recalculations were made to the Council emissions for the years 2018-2020 between the 2021 and 2023 update, due to the following revisions to methodology and activity data:

- Gas use in buildings, transport and procured services emissions were affected by well-to-tank emissions being included in the inventory for the first time.

[19] https://www.gov.uk/government/publications/regional-energy-data-guidance-note
[20] https://assets.publishing.service.gov.uk/media/64a68241c531eb000c64ff3f/uk-local-and-regional-ghg-emissions-2005-to-2021-technical-report.pdf

This was to address a previous omission of the scope 3 well-to-tank emissions for gas use in buildings, transport and procured services.

- The methodology for council waste collection was updated to use fuel data rather than estimating emissions based on waste tonnages and national conversion factors. This resulted in a decrease in emissions from 1.5 kt CO2e in 2017 in the 2021 update to 1.0 kt CO2e in 2017 in the 2023 update. These estimates are considered more accurate as they do not rely on assumptions about distance travelled based on the tonnages of waste collected.
- There were revisions to the activity data provided for green spaces vehicles and machinery from ID Verde and highway works from FM Conway as updated historical data became available.
- Emissions from street cleansing vehicles were included for the first time in the 2023 update.

Table 10: Details of recalculations in the borough and council inventory

Inventory	Category	Recalculation type	Detail
Borough	Land use	Activity data update	Methane and nitrous oxide now included in the inventory. Reduced the overall CO2e removals from previous update.
Borough	Residential	Activity data update	Revisions to sub-national gas and electricity consumption datasets.
Borough	Commercial and industrial	Activity data update	Revisions to sub-national gas and electricity consumption datasets.
Borough	Transport	Activity data update	Revisions to national road transport fuel consumption tables. Unit correction within the dataset does not affect emissions in the inventory.
Borough	Transport	Methodology update	Double counting of rail emissions from two datasets removed from the inventory.
Borough	Waste processing	Activity data update and methodology update.	Waste processing emissions were recalculated for the baseline 2019 for Beddington ERF and waste diverted to landfill. These recalculations were changes to the tonnage data and improvements to the emissions calculation method including the removal of double counting.
Borough and Council	Residential, Commercial and Industrial, and Transport	Methodology update	Scope 3 well-to-tank emissions were included in the inventory for fuel use. Previously, only the scope 3 emissions from transport and distribution of electricity were included in the inventory. In the 2023 update, well-to-tank emissions were included to address this omission.
Council	Green spaces vehicles and machinery	Activity data update	Revisions to the activity data across the time series in the fuel data resulting in

Inventory	Category	Recalculation type	Detail
			decreases in emissions in 2018 and 2020, and an increase in 2019.
Council	Highway works	Activity data update	Updated activity data providing a more detailed breakdown of fuels. Revisions affect years 2019 and 2020.
Council	Highway works	Methodology update	Correction to the classification of gas oil. Now classified as red diesel. Slight change in the emission factor applied. Revisions affect 2018-2020.
Council	Council waste collection	Methodology update	Improvement in methodology for council waste collection. Fuel data for waste collection vehicles is used to estimate emissions rather than tonnage data.

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