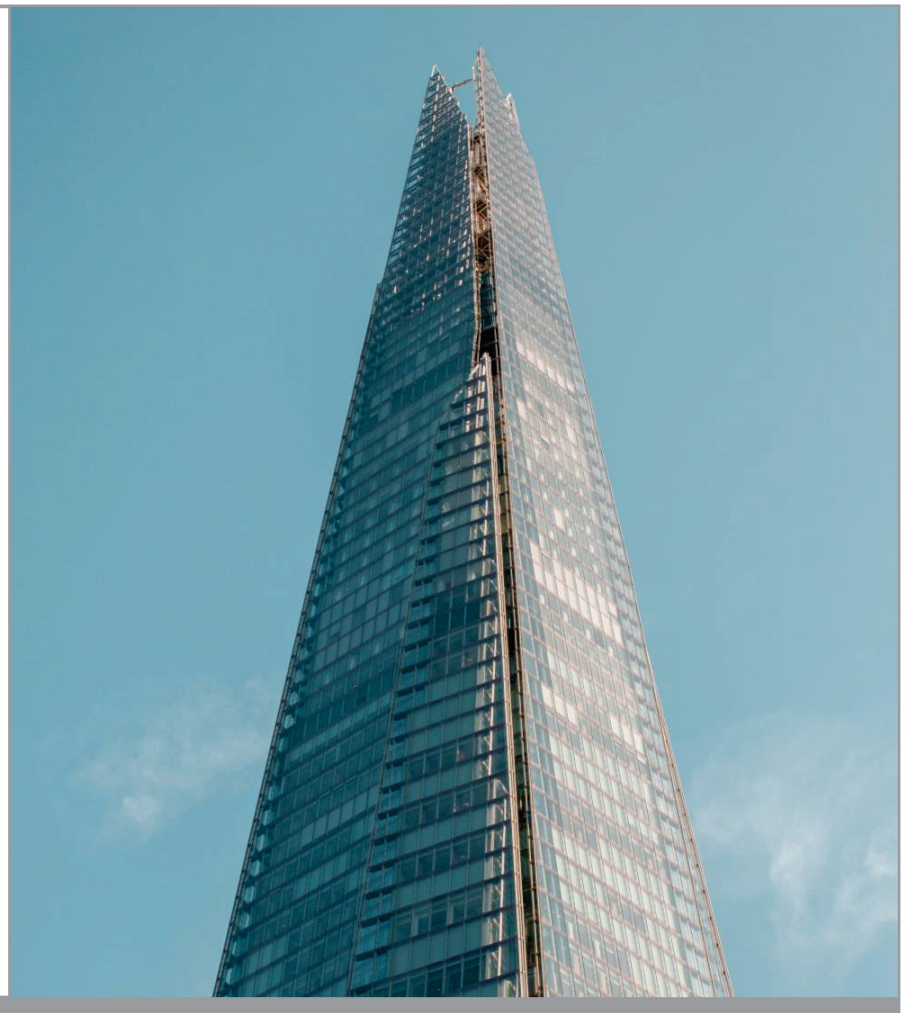
APPENDIX B

Southwark Climate Change Action Plan

Carbon Analytics

June 2021

DRAFT v2.0



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CONTENTS

02 – CARBON ANALYTICS
2.1 – COUNCIL'S OWN EMISSIONS ANALYSIS

Analysis of Southwark Council's operations and assets shows a council's own footprint of 432 $ktCO_2e$. The major contributors to this total are the council's buildings (recorded under Scope 1 & 2) and the council's procurement (recorded under Scope 3). Together these two emissions groups make up over 94% of the overall profile.

Understanding our own contribution as a council is a crucial first step in leading the borough's transition to net zero. The method used to calculate this footprint is aligned to the Greenhouse Gas Protocol and is based on the following sources of emissions:

- Vehicle fleet
- Buildings and other owned/ leased assets
- Employee commutes
- Procurement spend

Council's Own Footprint

The majority of the council's own footprint (>83%) is a result of Scope 3 contributions, most notably from the council's procurement. A much smaller contribution stems from the council's owned building stock, including council-owned social housing.
Emissions have been grouped according to the extent of the council's *operational control.* Assets that are directly under council ownership, such as buildings or fleet vehicles, have been designated as Scope 1 emissions. Other activities, such as employee commutes and business travel, have instead been recorded under Scope 3, since the council has more limited operational influence over these emissions.

A full list of the activities defined by this footprint, as well as a full scope split, can be found in Appendix 2.

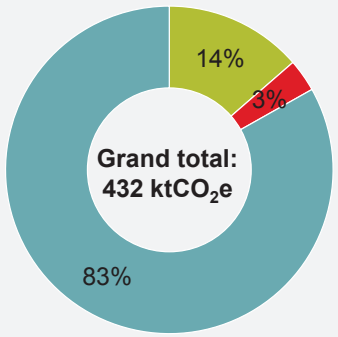


Figure 2.1.1: Emissions inventory for Southwark Council for the financial year 2019/20.

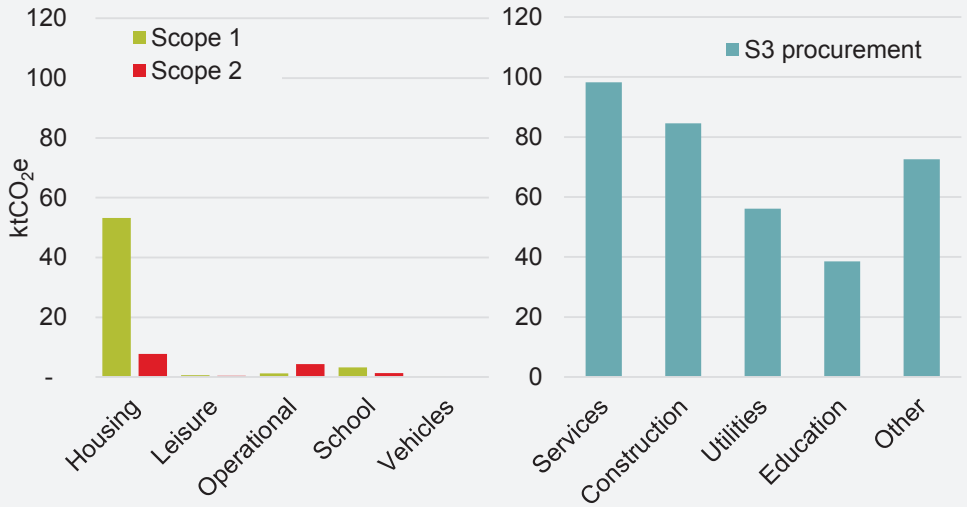


Figure 2.1.2: Scope breakdown (S1/2, left; S3 right) of the council's own footprint. The dominant sources of emissions are housing (14%) and procurement (>80%).

02 – CARBON ANALYTICS
2.1 – COUNCIL'S OWN EMISSIONS ANALYSIS

Scope 1 Emissions

Primarily, Scope 1 emissions arise from the consumption of gas in council buildings across the borough. The council owns and operates a number of homes, leisure centres and schools, as well as operational council buildings such as offices. Council-owned housing makes up in excess of 90% (53 $ktCO_2e$) of the contribution to Scope 1 emissions, compared to 6% (3 $ktCO_2e$) from schools and a small contribution from operational council buildings and leisure centres (2% and 1% respectively).

A much smaller contribution is made by council-leased vehicles, which are responsible for < 0.5 $ktCO_2e$ across various service vehicle types.

Overall, Scope 1 emissions from council buildings and vehicles makes up around 13% of the overall footprint shown in Figure 2.1.1.

Scope 2 Emissions

Scope 2 emissions stem primarily from the purchase of electricity in council-owned buildings. Once again, households form the majority of the overall total (56%), with streetlighting (15%) and operational buildings (15%) also making significant contributions. Smaller contributions come from schools (9%) and leisure centres (3%).

The contribution of Scope 2 emissions towards the council's total is small, however, making up just over 3% of the total footprint.

Figure 2.1.3 shows the individual buildings which make up the most significant contribution to these totals.

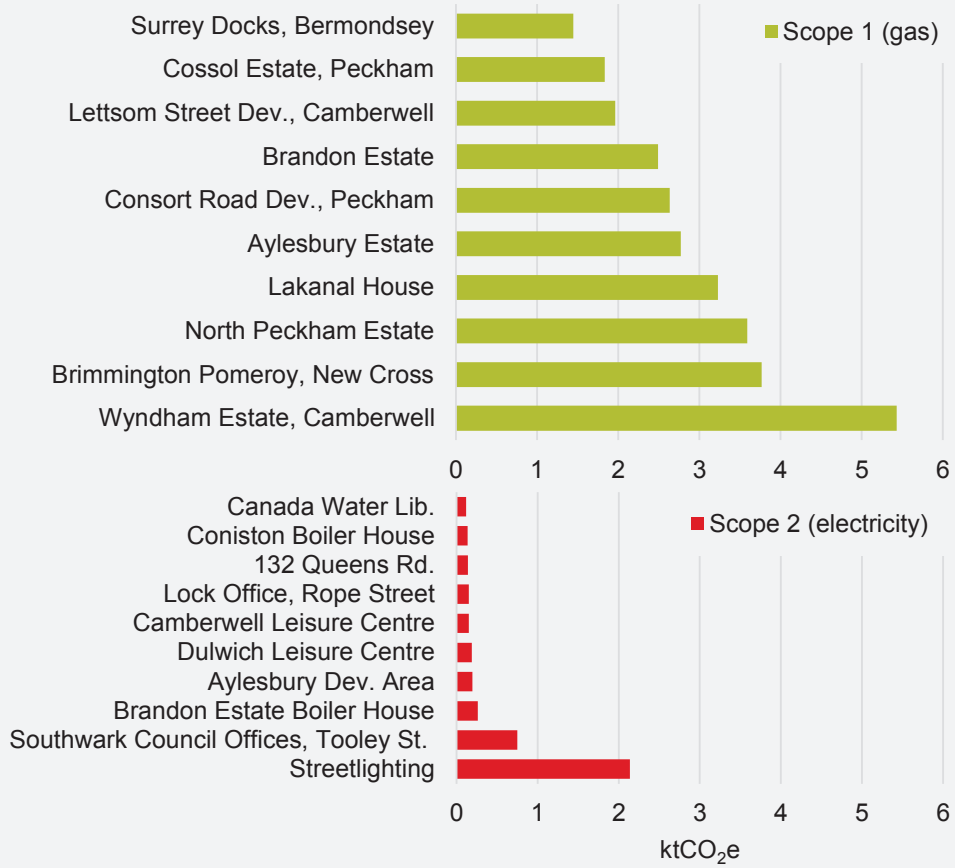


Figure 2.1.3: Largest single contributors to the Scope 1 & 2 buildings emissions totals.

02 – CARBON ANALYTICS
2.1 – COUNCIL'S OWN EMISSIONS ANALYSIS

Scope 3 emissions

By far the most significant contribution to the council's footprint, Scope 3 emissions sources come from three areas based on the assessed data:

- Council procurement
- Buildings
- Staff commutes

Emissions associated with council procurement have been calculated from spend data, with different activities associated with an emissions conversion factor, in a method similar to the one used to determine the borough-wide consumption-based emissions (see page 8).

Scope 3 emissions from buildings include the "well-to-tank" emissions associated with the supply of natural gas, as well as emissions associated with the transmission and distribution of grid electricity. These make a small contribution to the council's footprint, making up 2% of the overall total.

Employee commutes by private vehicle are the most significant scope 3 transport emissions category (in lieu of data on the council's business travel). The contribution from this category is small, however, and all employee commute emissions are not estimated to exceed 1 $ktCO_2e$

Figure 2.1.4 provides a breakdown of the council's procurement spend and the associated contribution to Scope 3 emissions. Appendix 3 also breaks down service procurement into more granular contributions.

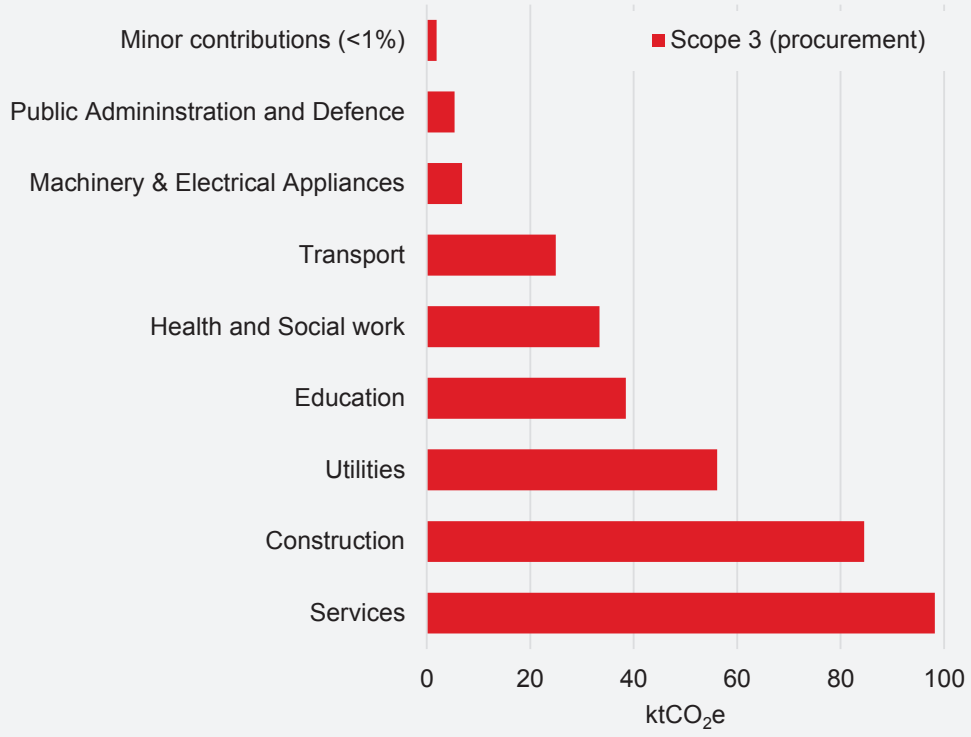


Figure 2.1.4: Contributions to the council's Scope 3 footprint. The dominant contributor to Scope 3 emissions, and the council's footprint as a whole, is procurement. "Minor contributions" denotes contributions to the procurement total which contribute <1 $ktCO_2e$. Please see Appendix 3 for a full breakdown.

02 – CARBON ANALYTICS
2.1 – COUNCIL'S OWN EMISSIONS ANALYSIS

Key suppliers to the council

Further analysis of the council's procurement spend data can provide a more granular breakdown of the most significant suppliers, both in terms of spend and emissions.

Figure 2.1.5 opposite shows the top ranking suppliers to the council based on these two measures. The top ten highest ranking suppliers in terms of Scope 3 emissions are shown in the upper graph, whilst the top ten highest ranking suppliers in terms of procurement spend is shown in the graph underneath.

There is a significant overlap between the suppliers which are used most frequently by the council and their related emissions. Eight suppliers appear in both of these top tens – these have been marked with an asterisk opposite.

Energy suppliers LASER Energy and Npower rank within the top ten suppliers by emissions, with LASER Energy the single largest contributor to the council's Scope 3 emissions from procurement. It should however be acknowledged that these emissions may overlap with Scope 1 & 2 given they relate to the provision of mains electricity and gas. A more detailed analysis of the council's spend data is necessary to confirm the extent to which this overlap results in double-counting.

Alternatively, the NHS CCG (Clinical Commissioning Group) and Walworth Homes Ltd. rank in the top ten suppliers by procurement spend, but do not rank among the top ten suppliers by emissions contributions.

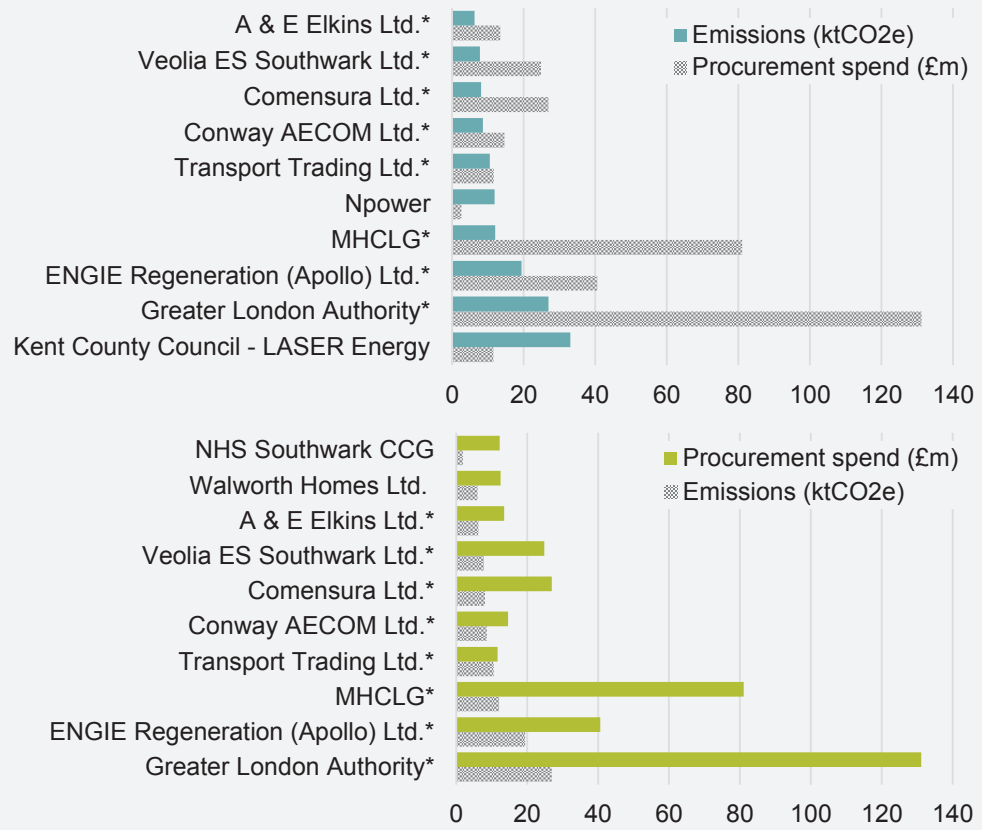


Figure 2.1.5: The top ten most significant suppliers used by the council in terms of GHG emissions (top) and outright spend (bottom). Eight suppliers appear in both lists (marked by an asterisk).

02 – CARBON ANALYTICS
2.2 – SCATTER EMISSIONS BASELINE

In 2017, Southwark's buildings, transport and waste disposal were responsible for emissions totalling 1,288 $ktCO_2e$. The majority resulted from buildings (79%) and transport (15%).

This emissions inventory has been calculated from the SCATTER Inventory Tool. The inventory shown opposite represents emissions from a specified set of activities within the borough's boundary, which is compliant with the BASIC reporting standards set out in the Greenhouse Gas Protocol for Cities.[1]

The emissions inventory detailed in previous work (London Borough of Southwark Carbon Scenarios to 2030, Carbon Descent, 2020) is based on annual emissions data published by BEIS. The SCATTER Inventory Tool provides emissions data for a broader range of activities and is aligned to international reporting frameworks. The differences between SCATTER and BEIS datasets are discussed in more detail in Appendix 6.

SCATTER considers emissions from multiple greenhouse gases, namely carbon dioxide, nitrous oxide and methane, and relates to the 2017 reporting year. The emissions inventory only includes emissions generated within Southwark (scopes 1 & 2). Consumption-based emissions analysis can be found on page 8.

[1] SCATTER defines emissions for a broader range of emissions than is required by the BASIC framework. For this full list of emissions please see Appendix 4.

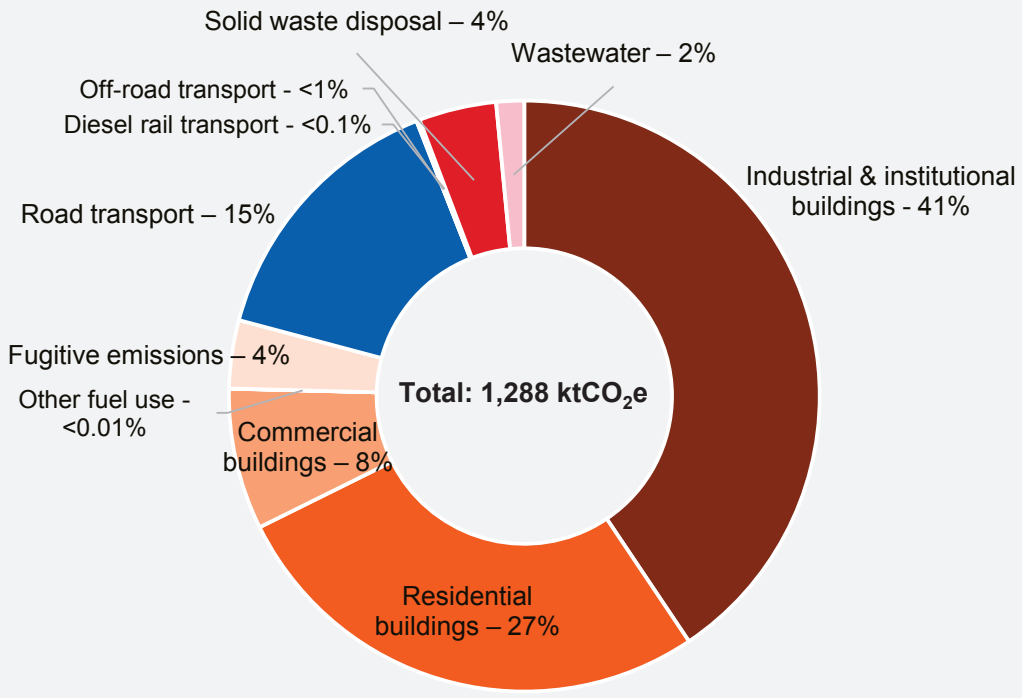


Figure 2.2.1: Emissions inventory for Southwark at the **borough** level. The basket of emissions profiled in this inventory is consistent with the BASIC reporting framework set out by Greenhouse Gas Protocol for Cities. A full SCATTER inventory is given in Appendix 4.

02 – CARBON ANALYTICS
2.2 – SCATTER EMISSIONS BASELINE

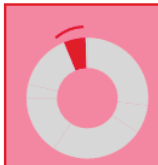
The following tables demonstrate the profile of each emissions sector and explain the sources of emissions included in each:

79% of emissions in Southwark come from buildings

- Residential buildings (27%): Domestic households of all tenure types.
- Institutional buildings & facilities (25%): Public sector buildings including schools, colleges and educational buildings, health centres, hospitals, leisure centres, council buildings etc.
- Industrial buildings & facilities (16%): Larger industrial facilities, including factories, warehouses and workshops associated with manufacturing and engineering.
- Commercial buildings & facilities (8%): Buildings from which commercial businesses operate e.g. shops, shopping centres, offices, restaurants etc.
- Other fuel use (<0.01%): Fuel consumption from other sources (off-road transportation in the industrial & agricultural sectors).
- Fugitive emissions (4%): Emissions from leaks and other fuel released through transportation and storage of fuels. Scaled to Southwark by population from national figures.

15% of emissions in Southwark come from transport

- On-road transport (15%): Emissions from all forms of on-road passenger vehicle, including cars, vans, motorcycles, buses and taxis.
- Diesel rail (<0.1%): Emissions from diesel-fuelled rail transport. Emissions from electricity consumption within the rail sector are included in the commercial and industrial sectors as it is not possible to separate these emissions.
- Off-road (<1%): A base assumption of 1% of total on-road emissions.



6% of emissions in Southwark come from waste disposal

- Solid waste disposal (4%): Incorporates various waste streams across commercial, industrial and municipal sources.
- Wastewater (2%): Scaled directly from national wastewater data by population.

02 – CARBON ANALYTICS
2.3 – BOROUGH-WIDE CONSUMPTION-BASED EMISSIONS

In 2018, Southwark's consumption-based emissions are estimated to have been 2,194 $ktCO_2e$. This figure describes the emissions impact of all imported goods and services to the borough and is based upon economic activity data for the borough.

Defining Consumption-Based Emissions

The term *consumption-based emissions* describes greenhouse gas emissions that occur as a result of imported goods and services to the borough. This group of emissions differs from those described on page 7, in that they allocate lifecycle emissions of goods and services to the end user, in this case Southwark as a borough.

The Scope 1 & 2 emissions described by the BASIC framework can be thought of as *territorial emissions* since they occur as a result of in-borough fuel consumption, whereas consumption-based emissions may arise outside of the borough but are driven by demand within it. For example, emissions from out-of-borough food production are not measured under Scope 1 & 2 totals but are recorded under Southwark's consumption-based emissions total if those food products are later consumed within the borough.

For a full dataset of the borough's consumption-based emissions, please see Appendix 5.

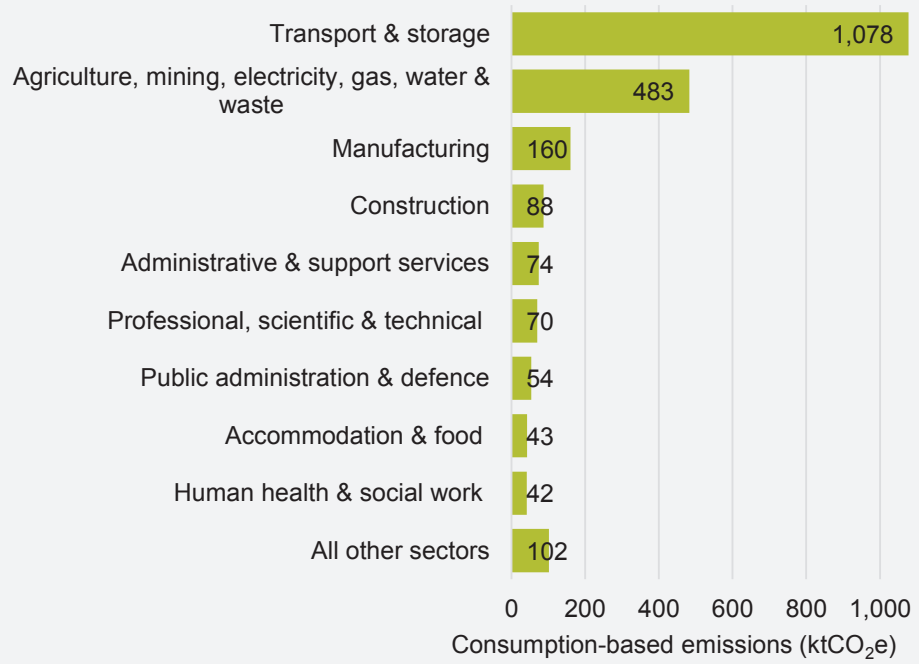


Figure 2.3.1: Consumption-based emissions estimates for Southwark, broken down by industry sector and activities. Based on DEFRA and BEIS statistics on local economic activity and national figures for consumption-based emissions. "All other sectors" includes: education, information and communication, arts entertainment and recreation, wholesale and retail trade, real estate activities, financial and insurance activities, and all other service-based activities.

02 – CARBON ANALYTICS
2.3 – BOROUGH-WIDE CONSUMPTION-BASED EMISSIONS

Defining emissions in terms of industry sectors

Local figures for consumption-based emissions are not measured by national government in the same way as Scope 1 & 2 emissions. Instead, consumption-based emissions for the borough have been estimated from economic activity (gross value added, or GVA) within Southwark. Consumption-based emissions at the national level are grouped according to standard industrial classification (SIC) codes for this reason.

Transport & Storage

Transport and storage is the most significant industry sector contributor to Southwark's consumption-based emissions. Given its context as an inner London borough, Southwark is heavily reliant on imported goods and services. This is reflected in the large proportion of consumption-based emissions driven by freight transport, air travel and distribution. Consumption-based emissions from transport & storage are distinct from the Scope 1 & 2 emissions from transport, which record the emissions from fuel consumption within the borough only.

Agriculture, Mining, Electricity, Gas, Water and Waste

The second most significant industry sector which contributes to the borough's consumption-based emissions total relates to the growth of crops and rearing of animals, as well as energy production and waste disposal.
These emissions are distinct from Scope 2 emissions from a carbonised electricity grid, since they also include emissions from the transmission and distribution of energy e.g., power losses in transmission cables.

Manufacturing & Construction

The third and fourth highest contributing sectors to consumption-based emissions are manufacturing and construction. Manufacturing emissions relate to the production of goods that are later consumed within Southwark, including food, textiles and electrical products. Construction activities covered by this estimate include the design and delivery of infrastructure projects.

Service Based Sectors

Smaller contributions to consumption-based emissions are made from a variety of other service-based sectors. This covers emissions associated with all other service-based sectors, including high street retail, office-based professional services and arts & entertainment.

03 – FUTURE EMISSIONS PATHWAY
3.1 – COUNCIL'S OWN EMISSIONS PATHWAY

The potential impact of various carbon-reducing measures have been estimated using high-level modelling, in order to provide an indication for the scale and nature of change required for the council to minimise its own carbon footprint.

Eight measures have been assessed for their impact on Scope 1 & 2 emissions arising from buildings and vehicle fleet, compared to a far less ambitious scenario where local activity is much more limited. The results of this analysis can be seen opposite, in Figure 3.1.1 & 3.1.2.

Results

Successful implementation of the modelling interventions (described below) is projected to yield roughly a 9% reduction along the baseline case pathway and a 57% reduction (without any additional offsetting) along the ambitious pathway case.

Modelling Interventions

The baseline case assumes that:

- Energy demand for heating remains fixed
- The council continues its electrification of its small van fleet
- The nationally-led decarbonisation of the electricity grid continues according to Treasury projections.

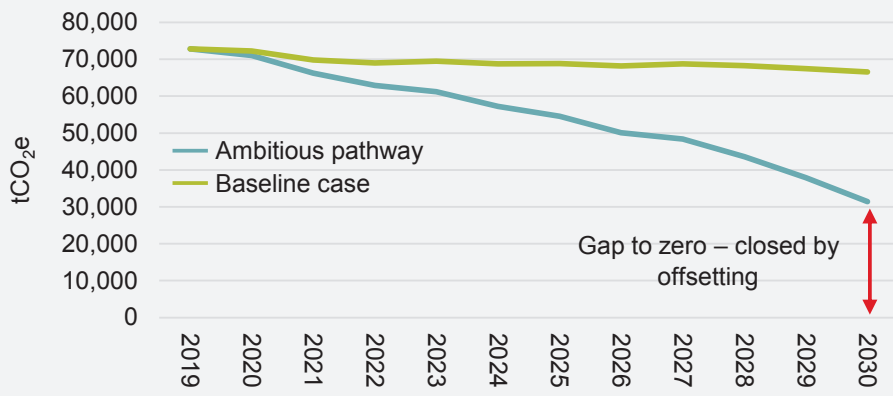


Figure 3.1.1: Pathways analysis for the council to 2030, based on indicative measures.

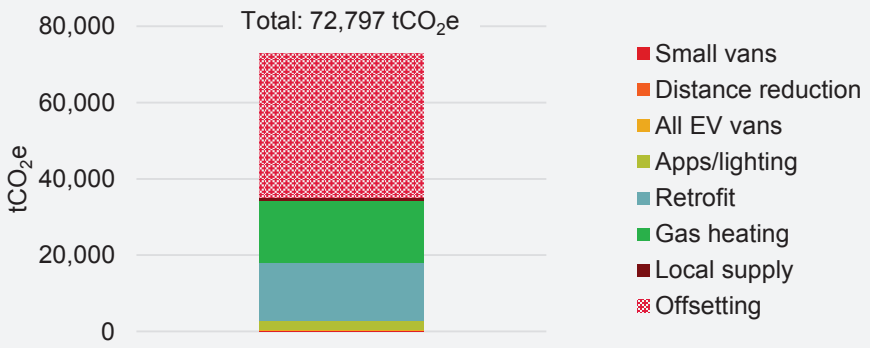


Figure 3.1.2: Stacked bar chart indicating the relative savings impact of each intervention at 2030.

03 – FUTURE EMISSIONS PATHWAY
3.1 – COUNCIL'S OWN EMISSIONS PATHWAY

The ambitious pathway assumes the above measures from the baseline case, as well as the following:

- **Reduction in vehicle mileage:** Outright reduction in van mileage across all vehicle types.
- **Switch to EV for all other vehicles:** Transition to EV for all other van types, including cage tippers & large vans.
- **Energy efficient lights and appliances:** Improvements to appliance and lighting efficiency, including streetlights, which brings a reduction of 35% to current electricity demand. It is assumed that 90% of lighting and appliances by demand are in receipt of this measure.
- **Retrofit of council buildings:** Improvements to building fabric which reduce the demand for energy for heating and hot water. This is modelled as a 35% reduction in fuel consumption for buildings. It is assumed that 75% of council buildings by overall demand receive this level of retrofit.
- **Switching away from gas heating:** Gas heating systems are replaced with less carbon intensive alternatives. This measure is far and away the most meaningful in terms of potential for carbon abatement given the dominance of gas consumption emissions in the Scope 1 & 2 emissions categories. This is modelled as a replacement in demand from gas to other heating technologies, split here 50:50 between electric heating systems (e.g. heat pumps) or district heating networks (which carry a less carbon-intensive emissions factor than individual gas boilers).
- The evolution of the emissions factor for electricity was taken from the Treasury Green Book projections, whilst the emissions factor for district heating evolved according to a fixed reduction factor.
- **Local renewables:** Whilst the grid factor for electricity falls around 43% according to Treasury projections, the increased demand for electricity from vehicles and heating systems means that emissions from electricity do offset the carbon abated from leaving behind gas systems. The installation of local renewables is here projected to mitigate the impacts of this increase in electricity demand by providing 10% of the additional demand through locally installed solar PV.
- **Offsetting:** All remaining emissions are assumed to be offset.

03 – FUTURE EMISSIONS PATHWAY
3.2 – BOROUGH-WIDE PATHWAYS

Updated EnergyPRO Modelling

This action plan is informed by an updated version of work previously commissioned by Southwark Council. EnergyPRO modelling for borough-wide emissions was carried out by Carbon Descent in late 2020, and the same model was used here following an alignment to data from the SCATTER Inventory Tool. The scope of the EnergyPRO modelling includes emissions from Southwark's buildings, on-road transport and energy supply. In sub-sections of Chapter 5 that were not modelled as part of EnergyPRO, supplementary analysis has been carried out using the SCATTER Pathways Tool.

A note describing the methodology behind this alignment can be found in Appendix 6.

The graphs in Figures 3.2.1 & 3.2.2 show the results of this updated modelling. Figure 3.2.1 shows a *business-as-usual* (BAU) case for Southwark, according to Scenario 1 as outlined in the Carbon Descent report. Figure 3.2.2 shows the projections for Southwark's emissions according to Scenario 3, which assumes a transition to electrified heating and transport as well as a successful programme of energy demand reduction measures. Residual emissions at 2030 are the result of a non-zero grid factor. The detailed implications and assumed levels of activity underpinning these scenarios are given in Chapter 5.

EnergyPRO calculations were also used to provide estimates for the capital expenditure figures and carbon savings given in Chapter 5.

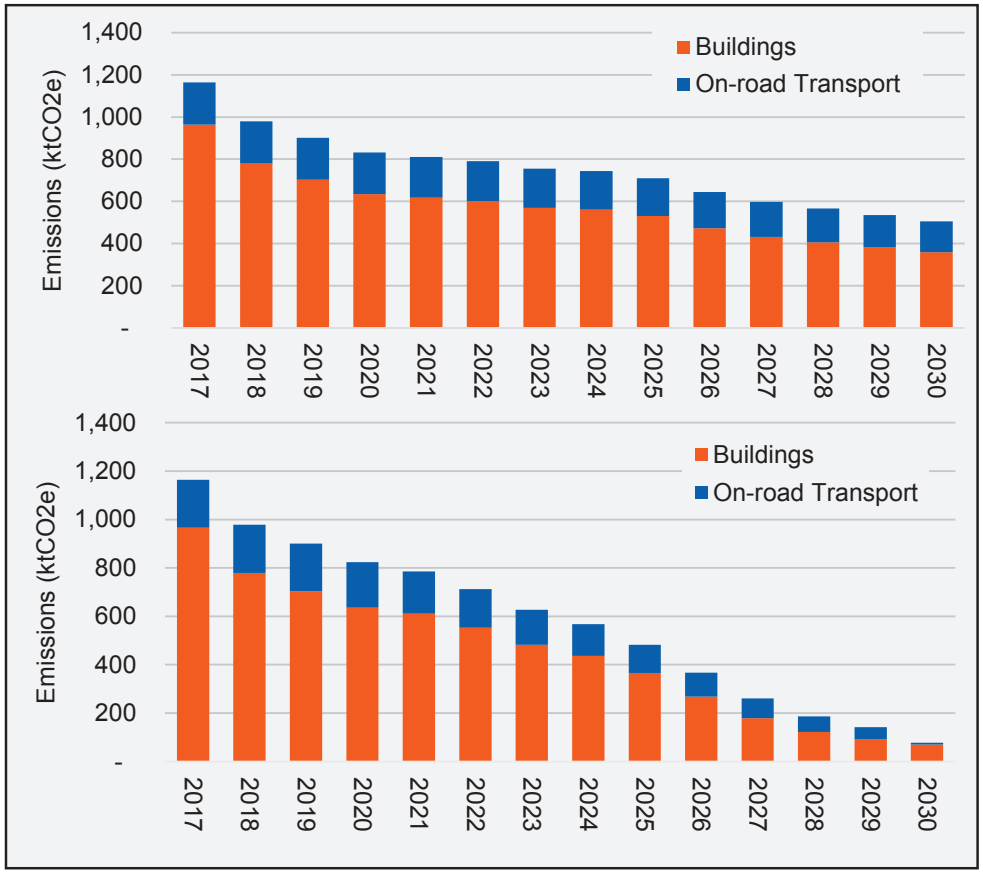


Figure 3.2.1 (right, top): BAU case taken from EnergyPRO.

Figure 3.2.2 (right, bottom): Scenario 3 ("All measures") case taken from EnergyPRO.

Both scenarios had 2017 data aligned to the SCATTER inventory in Figure 2.2.1.

03 – FUTURE EMISSIONS PATHWAY
3.2 – BOROUGH-WIDE PATHWAYS

Alignment with National Targets

In December 2020, the Committee on Climate Change (CCC) published their Sixth Carbon Budget report, setting out the UK's path to Net Zero. This research included an assessment of feasible, costed policy measures at the national level to deliver significant carbon reductions.

It is in this report that the CCC recommend that the UK reduces all emissions by 78% by 2035 against 1990 levels. This recommendation was eventually added to national government commitments to reach Net Zero by 2050, strengthening the UK's commitment on climate action.

Southwark's 2030 target for net zero as a borough is even more ambitious still. The graph opposite in Figure 3.2.3 shows how Southwark's future emissions pathways compare to the updated national commitment in terms of speed and rate of reduction in carbon emissions.

The Importance of Early Reductions

The CCC recommendations and the updated emissions reductions targets in the Climate Change Act highlight the importance of making deep-cutting emissions reductions as soon as possible. Reducing emissions early matters, since the negative outcomes of climate change are driven by *cumulative* carbon emissions.

This also highlights the importance of prioritising actions that deliver the deepest carbon reductions. More details on the prioritisation of actions can be found in Chapter 4.

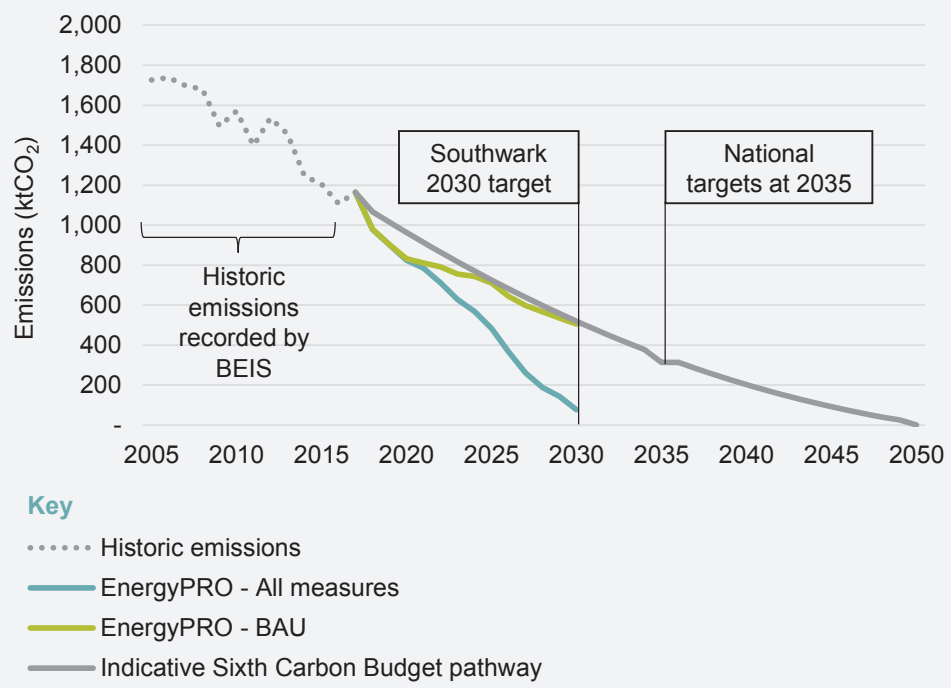


Figure 3.2.3: EnergyPRO pathways for borough-wide emissions compared against historic emissions from BEIS data (dashed grey line) and a representative pathway consistent with targets set out in the Sixth Carbon Budget published by the Committee on Climate Change (CCC, solid grey line). This was modelled as an 80% reduction against 2010 levels by 2035 (from Table 10.1 of the CCC's report).

Appendices

APPENDIX 1: GLOSSARY OF TERMS

AFOLU – Agriculture, forestry and land use

BEIS – UK Government Department for Business, Energy and Industrial Strategy, the successor to the Department for Energy and Climate Change (DECC)

Carbon dioxide equivalent (CO_2e) – the standard unit of measurement for greenhouse gases. One tonne of CO_2 is roughly equivalent to six months of commuting daily by car or burning 1-2 bathtubs' worth of crude oil. "Equivalent" means that other greenhouse gases have been included in the calculations

Carbon sink – a process or natural feature that removes carbon from the local atmosphere (e.g. trees or wetlands). The carbon is said to be *sequestered* from the atmosphere

Climate Emergency – a situation in which urgent action is required to reduce or halt climate change and avoid potentially irreversible environmental damage resulting from it

Decarbonisation – the process of changing our activities and industry practices to create an economy that sustainably reduces emissions of carbon dioxide

DEFRA – UK Government Department for Food & Rural Affairs

Energy system - the consumption of fuel, heat and electricity across buildings, transport and industrial sectors, from solid, liquid and gaseous sources

GHG – Greenhouse gas

IPCC – Intergovernmental Panel for Climate Change

LULUCF – Land use, land use change and forestry

MHCLG – Ministry for Housing, Communities & Local Government

SCATTER – Anthesis-developed tool which is used to set emissions baselines and reductions targets. See the SCATTER website for more information

T&D – '*Transmission & Distribution (T&D) factors should be used to report the Scope 3 emissions associated with grid losses (the energy loss that occurs in getting the electricity from the power plant to the organisations that purchase it).'* (DEFRA, 2019)

WTT: '*Well-to-tank (WTT) fuels conversion factors should be used to account for the upstream Scope 3 emissions associated with extraction, refining and transportation of the raw fuel sources to an organisation's site (or asset), prior to combustion.*' (DEFRA, 2019)

APPENDIX 2: COUNCIL'S OWN EMISSIONS

Table: Emissions breakdown by source and activity (2019-2020).

Emission source					
Scope 1		**Activity Data**	**Unit**	**tCO_2e**	**% of total emissions**
Buildings & Other Assets	Natural Gas	317,614	MWh	58,400	13.5%
	Gas Oil	0	MWh	0	0.00%
Vehicle Fleet	Small Van (petrol)	467,451	Miles	179	0.04%
	Medium Van (SWB)	709,430	Miles	222	0.00%
	Large Van (Transit)	36,786	Miles	16	0.01%
	Large Van (3.5t cage tipper)	114,824	Miles	51	0.11%
Total Scope 1 emissions				**58,868**	**13.61%**
Scope 2		**Activity Data**	**Unit**	**tCO_2e**	**% of total emissions**
Buildings & Other Assets	Purchased Electricity	59,738	MWh	13,927	3.22%
Vehicle Fleet	Small Van (Electric)	15,995	Miles	1	0.00%
Total Scope 2 emissions				**13,928**	**3.22%**

Emission source					
Scope 3		**Activity Data**	**Unit**	**tCO_2e**	**% of total emissions**
Buildings & Other Assets	Natural Gas – WTT	317,614	MWh	7,594	1.76%
	Gas Oil – WTT	0	MWh	0	0.00%
	UK Electricity – T&D	59,738	MWh	1,198	0.28%
Employee Commute	Walk/Bicycle	665,973	Miles	0	0.00%
	Private On-Road Transport	2,884,083	Miles	814	0.19%
	Public On-Road Transport	209,733	Miles	35	0.01%
	Public Off-Road Transport	677,106	Miles	40	0.01%
Procurement Spend	Input/Output	£10,467	Million GBP	350,007	80.93%
Total Scope 3 emissions				**359,688**	**83.17%**
Total emissions (Scope 1, 2 & 3)				**432,485**	

Assumptions note

Data from the borough's schools was taken from the period October '19-October '20 as opposed to the financial year 19/20. The deviation between this data and the actual energy consumption from within FY19/20 is assumed small, to the point of being ignored for the purposes of this analysis.

APPENDIX 3: COUNCIL'S PROCUREMENT SPEND

Table 1: Procurement spend emissions summary

Category	Emissions (tCO2e)	Procurement Spend (k£)	Proportion of emissions
Services (see opposite)	98,196	508,211	28%
Construction	84,578	177,069	24%
Utilities	56,143	18,296	16%
Education	38,514	175,591	11%
Health and Social Work	33,415	95,952	10%
Transport	24,968	27,681	7%
Machinery & Electrical Appliances	6,844	25,929	2%
Public Administration & Defence	5,410	14,614	2%
Minor Contributions (see below)	1,938	3,402	0.6%
Grand total	**350,007**	**170,980**	**100%**

Table 2: Minor contributions breakdown

Category	Emissions (tCO2e)	Procurement Spend (k£)	Proportion of emissions
Post And Telecommunications	711	1,824	0.2%
Sewage and Refuse Services	506	370	0.1%
Material/Chemical Use	361	475	0.1%
Manufactured Goods & Recycling	197	459	0.1%
Hospitality & Catering	151	261	0.0%
Fuels	12	12	0.0%
AFOLU	0.4	1	0.0%
Minor Contributions sub-total	**1,938**	**3,402**	**0.6%**

Table 2: Services breakdown

Category	Emissions (tCO2e)	Procurement Spend (k£)	Proportion of emissions
Printing matter & related services	1,314	459	0.1%
Banking & finance	69,487	9,815	3%
Insurance & pension funds	52,958	14,241	4%
Real estate activities	9,591	1,057	0.3%
Legal, consultancy, other business activities	14,839	2,371	1%
Services from membership organisations	250,032	37,218	11%
Other service activities	109,991	33,035	9%

APPENDIX 4: BEIS AND SCATTER DATA TABLES

Sector	Scope 1 & 2 Emissions, $ktCO_2$
Industry and Commercial Electricity	307.7
Industry and Commercial Gas	190.1
Large Industrial Installations	0.5
Industrial and Commercial Other Fuels	9.0
Agriculture	0.1
Domestic Electricity	113.4
Domestic Gas	195.1
Domestic 'Other Fuels'	4.1
Road Transport (A roads)	114.0
Road Transport (Motorways)	-
Road Transport (Minor roads)	94.7
Diesel Railways	0.5
Transport Other	0.9
LULUCF Net Emissions	-0.5
Grand Total	**1,029.6**

IE	= Included Elsewhere
NE	= Not Estimated
NO	= Not Occurring
	Included within BASIC
	Not included within BASIC

Sub Sector	Direct ($ktCO_2e$)	Indirect ($ktCO_2e$)	Other ($ktCO_2e$)
Residential buildings	191.94	157.06	56.97
Commercial buildings & facilities	51.32	48.18	16.31
Institutional buildings & facilities	74.92	243.46	53.47
Industrial buildings & facilities	63.40	141.13	34.34
Agriculture	0.10	0.00	0.02
Fugitive emissions	48.07	0.00	0.00
On-road	192.12	IE	IE
Rail	0.42	IE	0.10
Waterborne navigation	NO	IE	IE
Aviation	NO	IE	166.91
Off-road	1.92	0.00	NE
Solid waste disposal	54.59	0.00	IE
Biological treatment	NO	0.00	IE
Incineration and open burning	NO	0.00	IE
Wastewater	19.69	0.00	NO
Industrial process	5.88	-	0.00
Industrial product use	0.00	-	NE
Livestock	0.07	0.00	0.00
Land use	-0.41	0.00	0.00
Other AFOLU	NE	0.00	0.00
Electricity-only generation	NO	-	NO
CHP generation	0.47	-	0.09
Heat/cold generation	NO	-	0.00
Local renewable generation	0.04	NO	0.00
Sub-total	**704.54**	**589.82**	**656.33**
	Grand total: 1,621.98		

Notes:

- BEIS 2018 data (far left) and SCATTER 2017 data (near left) are compiled using different methodologies.
- Within the SCATTER model, national figures for emissions within certain sectors are scaled down to a local authority level based upon a series of assumptions and factors.

What do the different emissions categories mean within SCATTER?

Direct = GHG emissions from sources located within the local authority boundary (also referred to as Scope 1). For example petrol, diesel or natural gas.

Indirect = GHG emissions occurring as a consequence of the use of grid-supplied electricity, heat, steam and/or cooling within the local authority boundary (also referred to as Scope 2).

Other = All other GHG emissions that occur outside the local authority boundary as a result of activities taking place within the boundary (also referred to as Scope 3). This category is not complete and only shows sub-categories required for CDP / Global Covenant of Mayors reporting.

APPENDIX 5: CONSUMPTION-BASED EMISSIONS

Table: Historic and present consumption-based emissions for the borough.

Breakdown of Southwark consumption emissions by SIC category

SIC Sectors	Emissions (ktCO2e)									
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Agriculture, mining, electricity, gas, water and waste	1,837	1,953	1,468	2,730	3,334	540	265	486	281	483
Manufacturing	105	104	97	94	98	88	75	83	148	160
Construction	79	84	79	64	52	62	75	84	96	88
Wholesale and retail trade; repair of motor vehicles and motorcycles	14	15	15	10	9	10	10	9	9	10
Transport and storage	799	704	759	809	724	937	1,006	1,019	1,081	1,078
Accommodation and food services	30	32	31	36	36	34	34	37	39	43
Information and communication	25	23	24	23	20	21	25	25	24	25
Financial and insurance activities	10	8	10	12	11	4	5	4	2	2
Real estate activities	8	8	8	10	10	10	11	12	10	11
Professional, scientific and technical activities	63	61	60	66	65	70	67	65	67	70
Administrative and support service activities	45	59	83	79	77	73	72	72	73	74
Public administration and defence; compulsory social security	38	43	62	68	60	54	53	60	61	54
Education	25	21	26	30	26	24	25	24	25	27
Human health and social work activities	38	41	36	40	48	43	42	45	42	42
Arts, entertainment and recreation	11	10	11	12	13	12	14	15	15	12
Other service activities	10	12	11	15	16	13	13	11	12	16
Activities of households as employers; undifferentiated goods and services-producing activities of households for own use	0	0	0	0	0	0	0	0	0	0
Total	3,137	3,179	2,780	4,096	4,601	1,995	1,793	2,051	1,985	2,194

Highest emissions year for this sector

Lowest emissions year for this sector

APPENDIX 6: ENERGYPRO MODELLING NOTE AND OVERLAP WITH SCATTER

Differences between SCATTER and BEIS figures

Baseline figures from different sources may not directly match as a result of differences in the types of activity that are measured as part of the baseline. For example, one baseline may include activity from the agricultural sector, but use a dataset that does not include contributions from non-CO_2 sources. BEIS emissions statistics fall within this category for agricultural emissions. Another reason baselines may differ is that different reporting standards require different activities to be included within emissions figures.

The differences in the emissions figures is due to the different underlying datasets used to compile BEIS & SCATTER profiles, as well as a slight difference in the different activities included as part of the baseline. SCATTER's inventory is compiled from a broader range of sources than BEIS reported statistics and is aligned to global reporting standards set out by the Global Protocol for City-wide (GPC) Greenhouse Gas Emissions.

EnergyPRO alignment with SCATTER

EnergyPRO scenarios use Committee on Climate Change Balanced path (2020) grid factor projections to 2030. This sees the grid factor drop to 46 gCO_2/kWh by 2030. This grid factor is different to the one used to calculate the emissions inventory from SCATTER, which is taken from DEFRA methodologies for emissions reporting. This explains the downturn in emissions between 2017 & 2018.

EnergyPRO scenarios consider all direct and indirect emissions from buildings & facilities and on-road transport.

The BAU case assumes low levels of uptake of insulation, solar PV, heat pumps, and electric vehicles. The 'All measures' (Scenario 3) case assumes high uptake of insulation, high levels of PV, all transport switched to EVs, all gas cooking switched to electric, all space heating and hot water requirements provided by heat pumps or SELCHP – all by 2030. In essence, all heating and transport systems are electric in 2030 and the only emissions are from grid electricity.

Cost estimates for waste measures within SCATTER

As waste emissions have not been costed from EnergyPRO, a high-level estimate has instead been made using carbon abatement costs published by the Committee on Climate Change in their Sixth Carbon Budget. National figures for the estimated pound of annualised marginal investment required per tonne of emissions abated have been applied to carbon savings from the SCATTER Pathways.

APPENDIX 7: ENERGYPRO MODELLING

The following tables briefly describes the assumptions used for each measure under the EnergyPRO modelling for borough-wide emissions:

Measure	Sector	New build?	Units	Source
Solar PV	Res		kW	GLA projections for Southwark were used for the BAU scenario. These GWh generated were back calculated in installed kW peak and these were then modelled in energyPRO using 2017 hourly solar radiation data. For the All measures scenario maximum possible amounts were estimated based on 4kW per house and a total of 23,759 houses. Note that many of these would not be South facing systems but East/West facing. Germany has noted that a higher installation of East/West systems might have been preferable in terms of spreading hourly generation more evenly over a day.
Solar PV	C&I		kW	As above. The split between Res and C&I was based on the ratio of installed capacity in 2018. For the All measures scenario the maximum was estimated based on 20% of C&I floorspace (20% is 756,000 m^2). 4 m^2/kW peak was assumed as a mean value for the area of panels required over the period (5m^2/kW peak is the current value but it is improving). This gives 189 MW as a maximum value for the C&I sector.
Heat Pumps	Res	Retrofit	Homes	The BAU scenario assumes a low level of uptake of heat pumps based on GLA projections for Southwark. For the All measures scenario it was assumed that all existing residential gas boilers were replaced with either heat pumps or a connection to SELCHP by 2030. This means that by 2030 around half of all existing homes have heat pumps. COP for the heat pumps were based on the Daikin HT air source heat pump and varied with external air temperature. Each home retrofitted was assumed to have the space heating and DHW consumption of an average Southwark 2017 home.
Heat Pumps	Res	Newbuild	Homes	In the BAU scenario it is assumed that all newbuild from 2022 will be fitted with heat pumps. In the All measures scenario it is assumed that no new build will be fitted with HPs (instead they will all connect to SELCHP, see below). COP for the heat pumps were based on the Daikin LT air source heat pump. The space heating and hot water projections for newbuild were used to estimate the heat output of each heat pump.
Heat Pumps	C&I	Retrofit	MWh heat	For BAU scenario no retrofit heat pumps were assumed. For the All measures scenario it was assumed that 1/8th of all existing gas boilers were replaced with heat pumps each year from 2022 in order to replace all gas boilers.
Heat Pumps	C&I	Newbuild	MWh heat	Assumed all newbuild from 2022 will be fitted with heat pumps in both BAU and All measures scenarios. The space heating and hot water projections for newbuild were used to estimate the heat output of each heat pump.
SELCHP	Res	Existing DH	Homes	There are currently around 17,000 homes in Southwark that are served by a district heating network, of which around 2650 are connected to SELCHP. In both scenarios it is assumed that the SELCHP network will be expanded to cover all of these 17,000 homes by 2030 (i.e. replacing communal gas boilers/CHP).

APPENDIX 7: ENERGYPRO MODELLING

Measure	Sector	New build?	Units	Source
SELCHP	Res	New DH	Homes	In the BAU scenario no further new or existing homes are connected to district heating networks. The max thermal output available to Southwark from SELCHP is 33MWth. In the 'All measures' scenario around half of all homes in Southwark are connected to the network by 2030. This comprises of all 17,000 homes that are already on DH networks, all newbuild homes from 2022, plus and half of all the other existing homes (the other half get HPs). To cope with winter peak demand, 120 MW of back up heat pumps and a large thermal store will also be required.
Induction Hobs/ Electric Ovens	Res	Retrofit	Homes	For the BAU scenario no changes were assumed in cooking fuel, except that no gas hobs/ovens were installed in newbuild. For the All measures scenario all gas hobs and electric ovens were replaced by 2030 by induction hobs and electric ovens. It was assumed that 51% of homes in Southwark had gas hobs in 2017 and 31% had gas ovens – from BEIS national statistics. Both measures (by coincidence) were assigned an efficiency gain of 54%. This was based on analysis of energy labels for gas and electric ovens and for induction hobs from a German study.
Induction Hobs/ Electric Ovens	C&I	Retrofit	MWh heat	The same efficiency gains were assumed for C&I replacement of gas ovens and hobs as for the residential sector. National figures from ECUK End Use Data Tables were used to determine the proportion of C&I gas use assigned to gas catering in 2017.
LED Lighting	Res	Retrofit	Homes	BEIS dataset energy consumption UK tables were used. These provide a breakdown of lamp types in homes nationally. It was assumed that Southwark homes were typical of the national figures. The dataset provides numbers of lamps by type i.e. GLS, halogen, CFL and LED. Savings were calculated by assuming a linear replacement of all non-LED lamp types with LEDs by 2030. In 2016 19% of lamps were still non-LED according to the BEIS dataset.
Grid Decarbonisation	All		$kgCO_2/kWh$	Based on the Committee on Climate Change Sixth Carbon Budget, Balanced Net Zero Pathway projections for grid carbon emissions (published December 2020). This starts at 219 gCO_2/kWh in 2019 and drops to 46 $gCO_2//kWh$ by 2030. For 2017 the grid emissions factor used is 351 gCO_2/kWh to match the latest figure used in SCATTER. https://www.theccc.org.uk/wp-content/uploads/2020/12/The-Sixth-Carbon-Budget-The-UKs-path-to-Net-Zero.pdf
Heat Pumps	C&I	Newbuild	MWh heat	Assumed all newbuild from 2022 will be fitted with heat pumps in both BAU and All measures scenarios. The space heating and hot water projections for newbuild were used to estimate the heat output of each heat pump.

APPENDIX 7: ENERGYPRO MODELLING

Measure	Sector	New build?	Units	Source
Appliances	Res	Retrofit	Homes	The same BEIS dataset used for LEDs was used for appliances. In this case we estimated the trend rate of improvement in energy consumption relating to appliances. This national trend rate was then apportioned to the Southwark housing stock and it was assumed that the trend would continue to 2030 at a linear rate. The calculated saving annually was 39 kWh per home. This means that the average annual consumption from appliances would fall from 2,320 kWh in 201 to 1,813 kWh per home by 2030.
LED Lighting & motor efficiency	C&I		MWh	Commercial and industrial efficiency improvements were restricted to lighting and motors. While this might appear narrow, motors are one of the largest single sources of electricity use in the sector and are used to drive pumps, fans and compressors which are the main source of energy consumption in ventilation and air-conditioning systems. The BEIS dataset showed that, for computing, reductions in energy consumption had stalled in the last few years so it is assumed that this sector remains static. Again trend rates in efficiency were derived from the BEIS dataset.
Insulation package	Res	Retrofit	Homes	The approach to insulation was to include four measures: solid wall insulation, cavity wall insulation, loft insulation and double glazing. Energy Saving Trust (EST) figures were used to derive savings per home. EST give figures for different dwelling types i.e. detached or semi-detached et cetera. The saving figures were then weighted according to the dwelling type mix across Southwark. However, the remaining number of uninsulated lofts, walls and windows varies greatly in Southwark between each element. To combine the measures into a single retrofit measure further weighting was applied based on the maximum potential for each measure. In the BAU scenario the GLA retrofit figures (i.e. number of homes) were used for Southwark. For the All measures scenario it was assumed that all single glazed windows, all lofts without insulation and all unfilled cavities and all solid walls or system built walls were insulated.
Newbuild	Res	Newbuild	Homes	The number of newbuild homes was taken from the gross and net completions reported by Southwark. Energy consumption by end use for new builds was calculated from EPC certificate data for Southwark. An incremental reduction in heating demand from tightening of national Building Regulations was assumed (40% improvement every 4 years).
Demolition	Res	Retrofit	Homes	The number of homes demolished was taken from the gross and net completions reported by Southwark. Energy consumption by end use was calculated assuming the demolished home had the consumption of an average home in 2017, which was estimated from EPC certificate data.

APPENDIX 7: ENERGYPRO MODELLING

Measure	Sector	New build?	Units	Source
Newbuild	C&I	Newbuild	000's m^2	The number and floor area of newbuild commercial and industrial was provided by Southwark planning department and as described earlier energy consumption by end use was calculated from EPC certificate data for Southwark.
Demolition	C&I	Retrofit	000's m^2	The number and floor area of newbuild commercial and industrial was provided by Southwark planning department and as described earlier energy consumption by end use was calculated from EPC certificate data for Southwark.
Electric Cars	Transport		vehicle Mkm	For the BAU scenario GLA projections from the Mayor's transport strategy for Southwark were utilised. For the All measures scenario it was assumed that all vehicles would be electric by 2030.
Electric Buses & HGVs	Transport		vehicle Mkm	For the BAU scenario GLA projections from the Mayor's transport strategy for Southwark were utilised. For the All measures scenario it was assumed that all vehicles would be electric by 2030.
Vehicle km reduction	Transport		vehicle Mkm travelled	For all scenarios GLA projections from the Mayor's transport strategy for Southwark were utilised – delivering a 9% reduction in overall vehicle km by 2030.

APPENDIX 5: ENERGYPRO COST ASSUMPTIONS

			Marginal Cost (£k)		Carbon savings (tCO_2)		Cost per tonne k£/tCO_2	
Sector	Measure	Retrofit or Newbuild?	BAU (£k)	All measures (£k)	BAU (tCO_2)	All measures (tCO_2)	BAU k£/tCO_2	All measures k£/tCO_2
Domestic	New Solar PV		9,284	144,006	255	4,401	36.5	32.7
	Retrofit LED Lighting	Retrofit	3,812	3,812	2,222	2,222	1.7	1.7
	Efficient Appliances		-	-	3,412	3,412	-	-
	Retrofit Elec cookers	Retrofit	-	48,602	140	4,240	-	11.5
	Retrofit Insulation	Retrofit	353,102	603,095	23,400	174,572	28.0	10.6
	Retrofit heat pumps	Retrofit	86,280	617,211				
	Newbuild heat pumps	Newbuild	189,004	-				
	Existing district heating onto SELCHP	Existing DH	26,248	33,970				
	New district heating onto SELCHP	New DH	-	597,614				
Non-domestic	New Solar PV		1,196	179,521	56	8,756	21.2	20.5
	LED Lighting & motor eff'y		13,764	13,764	6,345	6,345	2.2	2.2
	Retrofit Elec cookers	Retrofit	-	3,576	5,735	21,634	-	0.2
	Retrofit heat pumps	Retrofit	-	676,408	55,238	144,531	0.6	4.9
	Newbuild heat pumps	Newbuild	33,547	33,547				
Transport	Electric Cars		185,921	885,906	53,230	190,816	4.0	5.1
	Electric Buses		-	18,943				
	Electric HGVs		-	37,886				
	Vehicle km reduction		25,008	25,008				
Other	Remove oil & coal		-	-	- 208	15,889	-	-
	Grid decarbonisation		-	-	508,406	509,247	-	-
	Total		**927,166**	**3,922,869**	658,231	1,086,064		

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