Luton Borough Council

Climate Action Plan Support

December 2019 [DRAFT]

Anthesis

Contents

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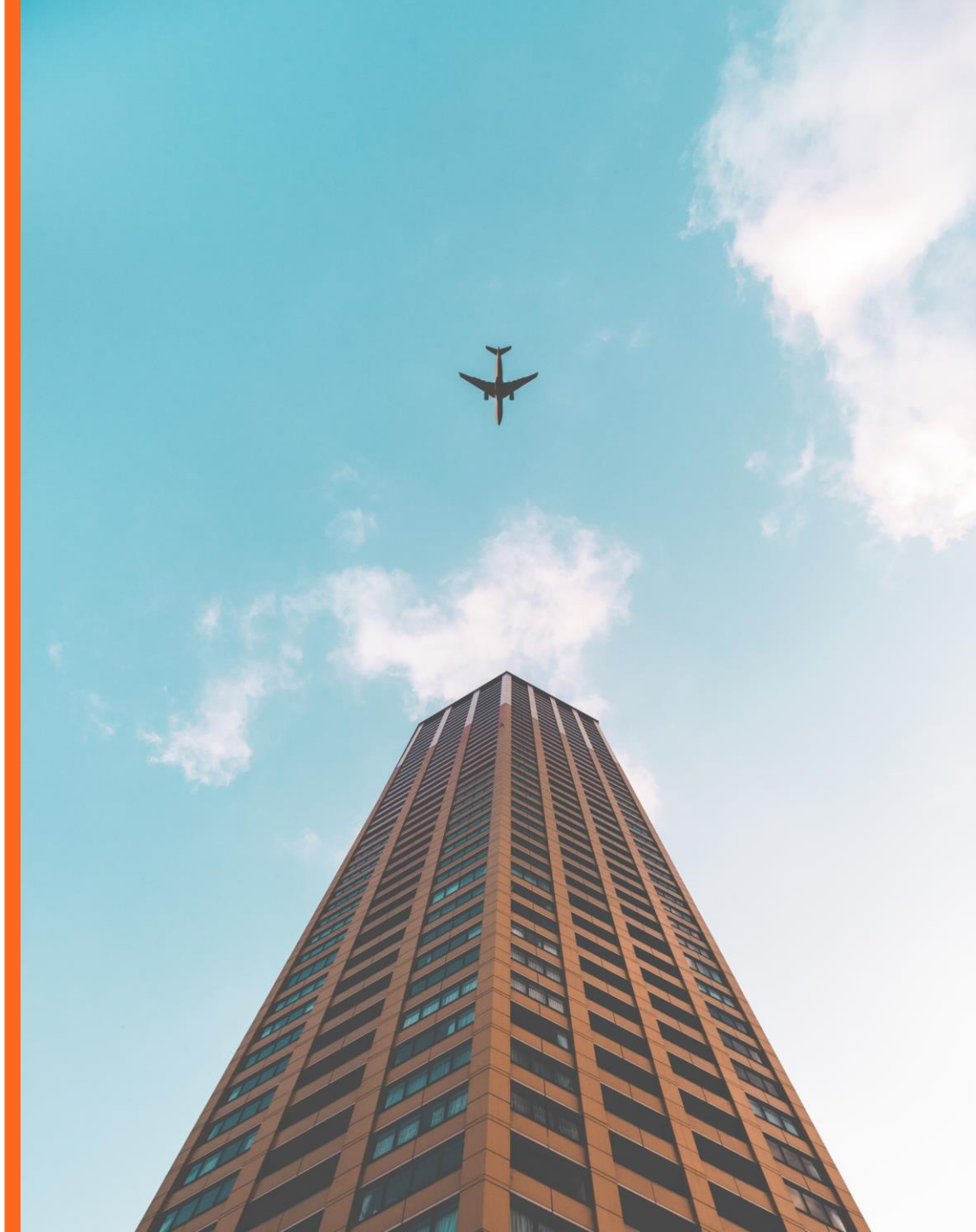


Introduction & Context

Introduction

This work is being commissioned by the Corporate Director, Place and Infrastructure at Luton Borough Council (LBC).

Aim

The aim of this work is to provide an evidence base which will inform the Council's Climate Action Plan to be published in 2020. This body of work focuses on the following areas in particular:

- analysis of the local authority's current emissions profile, including analysis of LBC's own emissions;
- analysis of the emissions associated with Luton Airport;
- determining future emissions pathways which benchmark the necessary action required for Luton to drastically reduce its in-boundary emissions;
- exploration of the relationship between citizen income and emissions within the borough;
- key results and findings from a series of stakeholder engagement sessions with the borough council's partners and elected members.

This report sits within a larger scope of work which includes a programme of stakeholder engagement sessions, as well as contribution to the planning of, and attendance at, a citizen's assembly to provide independent presentation of activities and field more technical questions.

Objectives

To better understand:

- the borough's carbon footprint using a location-based accounting approach;
- use this information to determine the proportion of emissions that can be influenced locally without the action of regional or national actors; and
- gaps in data where further work is needed.

To aid LBC in the following areas:

- providing a more informed evidence base for future action plan development which also serves to inform and direct existing local projects;
- encourage confidence in the mandate for climate action, thus facilitating the establishment of a robust local strategy which can deliver objectives over a long term cycle.

Introduction & Context

Context

Local and National Policy Drivers

Tackling the climate crisis is a long-standing issue in the UK, reflected in the legally binding target in the 2008 Climate Change Act. This was updated in 2019 to reflect the updated target of net zero emissions by 2050.

In July 2019, LBC made a public commitment to tackling climate change at a faster pace than national targets set by UK government. In doing so the Council committed to a target of decarbonising the operations of both the council and wider council partners before the Government's target of 2050 with the publication of a detailed action plan scheduled in January 2020.

Evidence of Need

The full council resolution came about as a response to the Intergovernmental Panel on Climate Change (IPCC) special report on the impacts of global warming of 1.5 °C above pre-industrial levels, issued in October 2018. The report stated that in order to remain within a 1.5 °C increase, governments would have to cut emissions of greenhouse gases by 45% by 2030.

The UN Environment Programme then published their 2018 Emissions Gap Report, which found that the Nationally Determined Contributions were insufficient to ensure that global temperature rises stays below 1.5 °C, and that nations must triple their efforts in order to meet even a 2 °C target. It also found that global emissions had increased in 2017 after 3 years of stagnation.

A key finding of the report is that: '…non-state and subnational action plays an important role in delivering national pledges. Emission reduction potential from non-state and subnational action could ultimately be significant, allowing countries to raise ambition.'

Research by the Global Carbon Project issued in December 2018 reported that global carbon emissions are on course to rise by a further 2.7% in 2018, an increase on the rise seen in 2017.

The above evidence makes clear that immediate and drastic action is required to avoid global warming to dangerous levels, whilst encouraging sub-national policy measures and action as a necessary means of reducing emissions.

References

- Council's commitment
- IPCC 1.5 Report
- Emissions Gap Report
- Global Carbon Project research

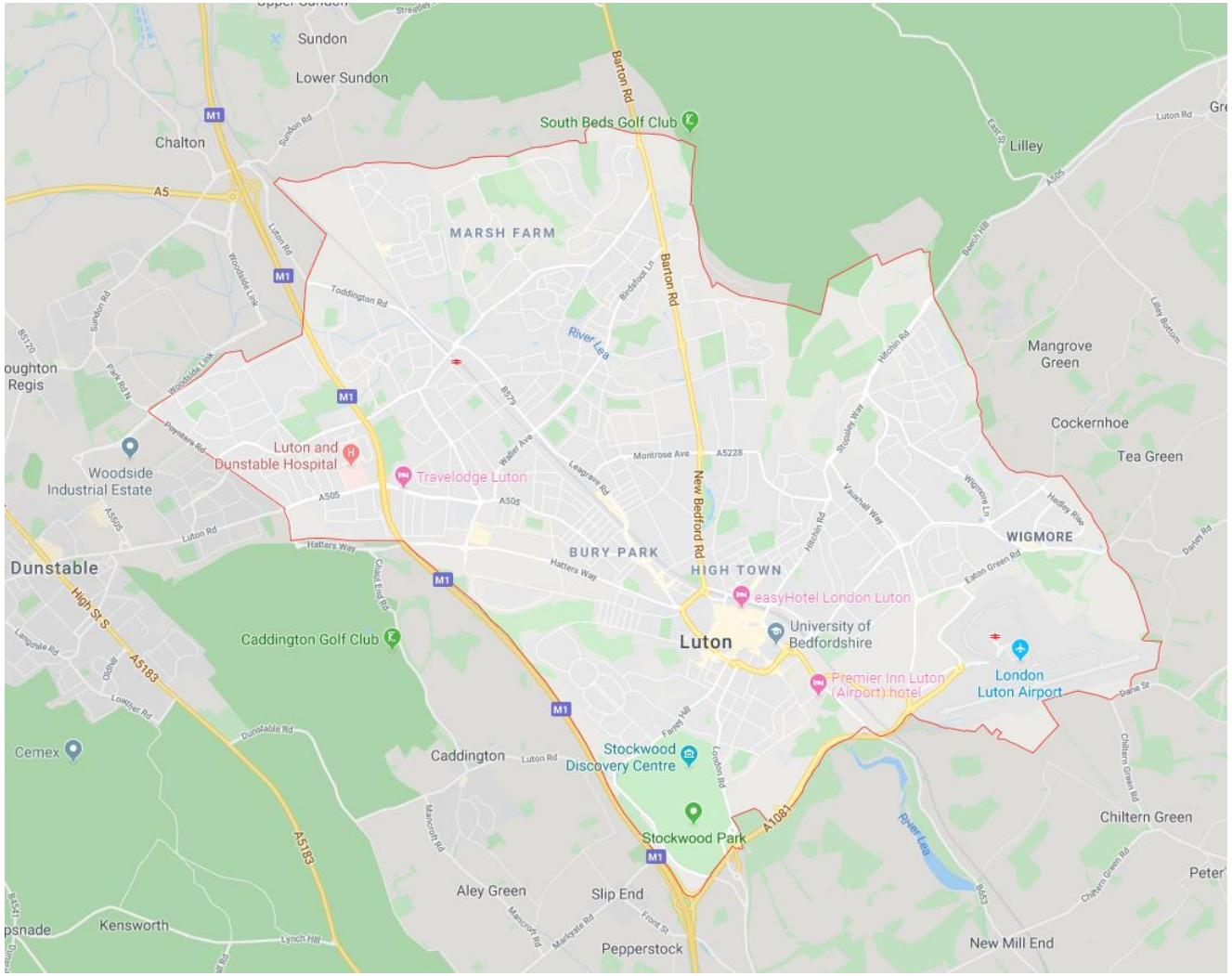
Introduction & Context

Context

Luton is a borough and unitary authority area in the Bedfordshire county of the South East of England, just 30 miles north of London and is one of the highest population towns without city status in the UK.

Metric	Description
Area	43.35 km^2
Population	214,109
Population density	4,939/km^2
Number of households	79,300
Number of registered businesses	7,170
Geography	Luton is bordered in the north east and south west by the Chiltern Hills and the source of the river Lea is in the Leagrave area
Transport	• Three railway stations: Luton, Luton Airport Parkway, Leagrave • M1 and A6 road connections to London • A505 from Dunstable and Hitchin • Luton airport • Bus service operators: Arriva Shires, Grant Palmer, Stagecoach and Centrebus • Rapid bus transit route from Luton to Dunstable

Table 1: Luton Borough statistics and geography



Introduction & Context

Luton Council's Influence

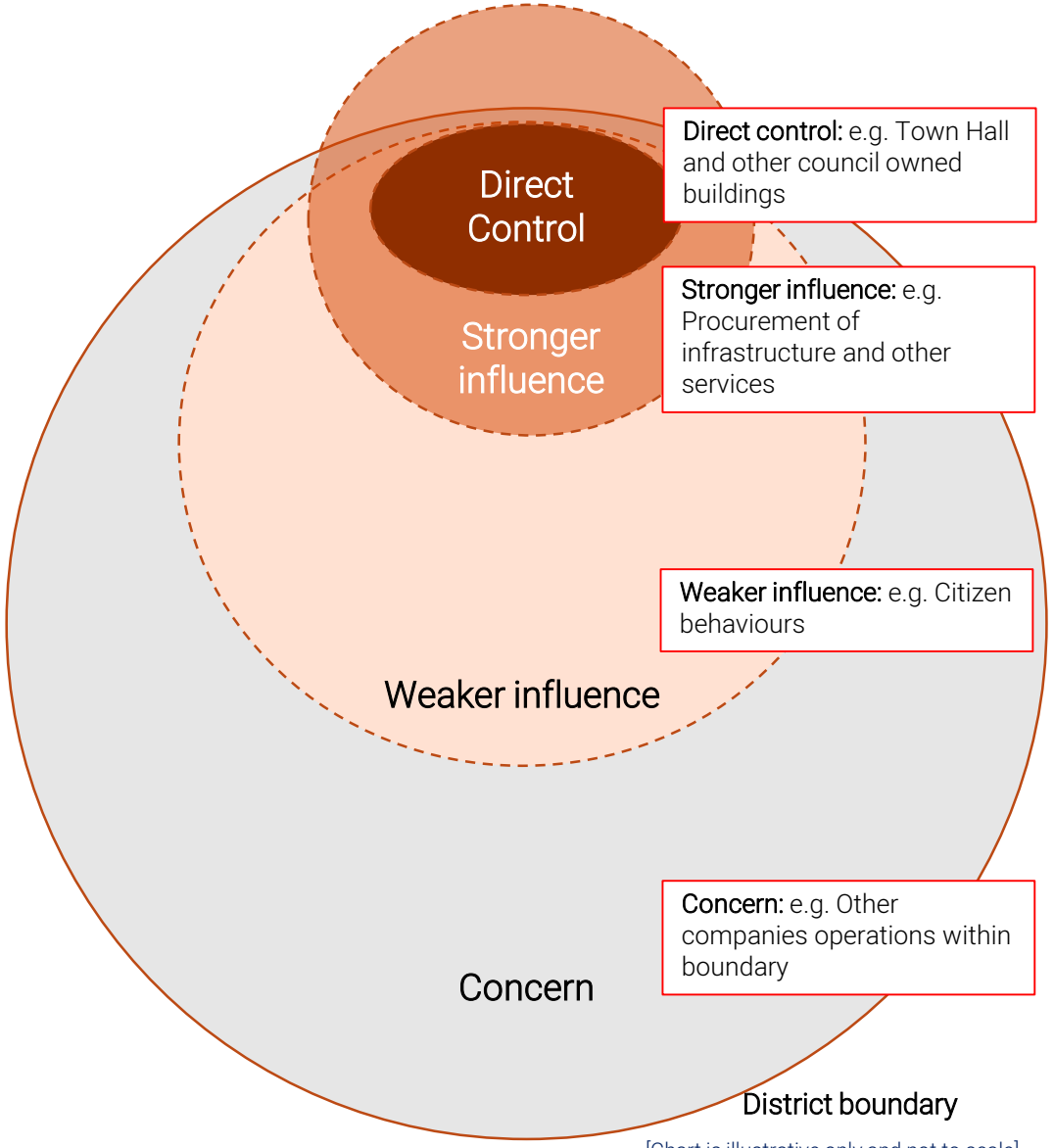
This chart illustrates that LBC's influence is varied and complex across the different activities that occur within their own operations and also across the borough.

Influence bandings are based on Anthesis' judgment following discussion with officers, and are by no means definitive. The examples that relate to each banding are intended to highlight opportunities for LBC to apply their influence in areas or ways previously not fully explored (e.g. by using 'convening power' and/or policy).

Influence extends beyond the district boundary, whereby LBC's demand (and supply) of goods and services drive emissions in supply chains around the world. Such emissions are referred to as consumption based emissions (relative to the UK produced emissions totals).[1]

Influence	Description
Direct Control	Emissions sources are directly owned or operationally controlled by the Council.
Stronger	Owners and operators of emissions sources are clearly defined but are not directly owned or operated by the Council. Emissions relate to council procurement or council led activities (some out of boundary).
Weaker	Emissions sources do not relate to council owned or operated assets, procurement or council led activities, however some convening power may exist with specific actors in the district.
Concern	Owners and operators of emissions sources are not clearly defined, influence limited to lobbying central government or trade associations.

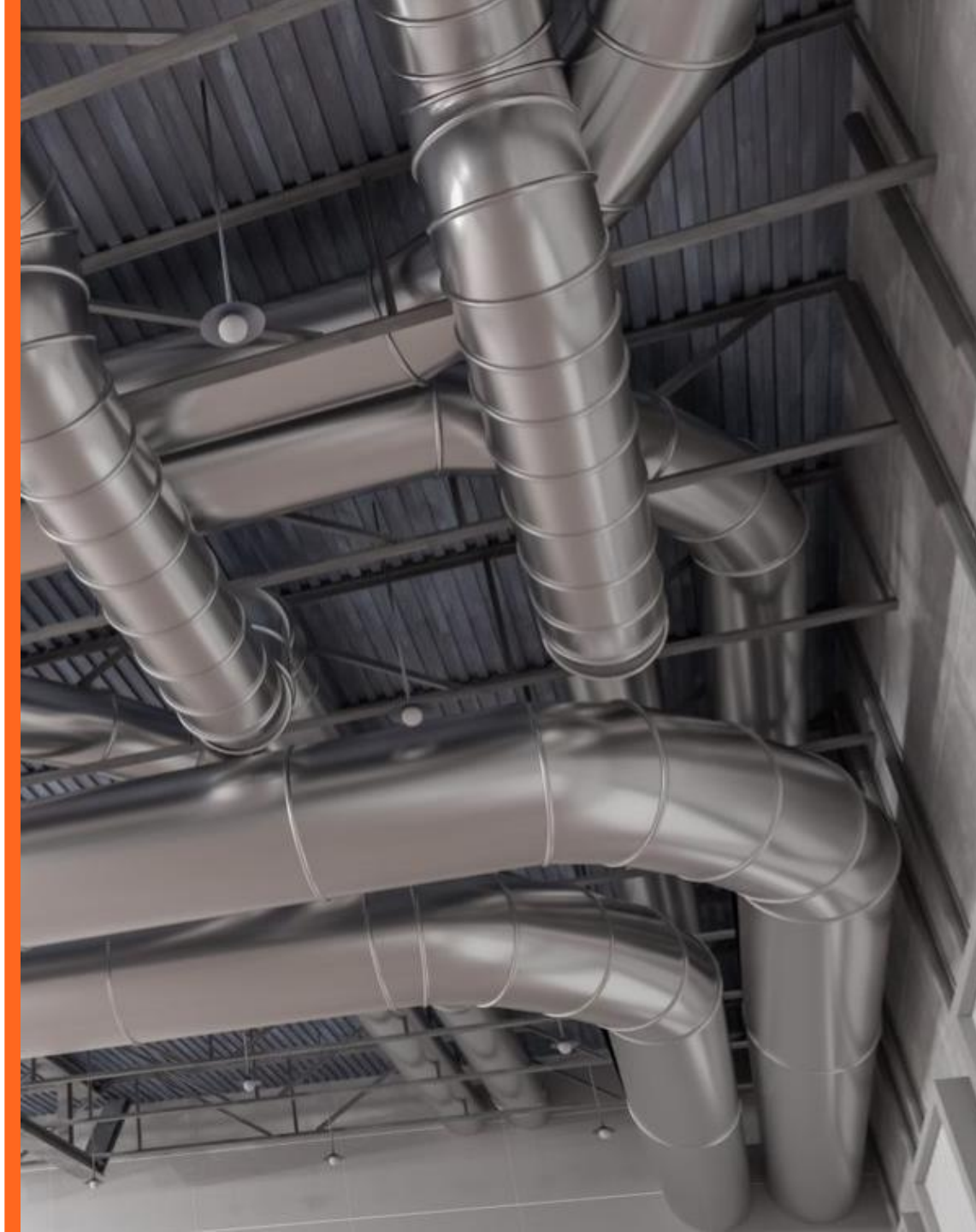
Table 2: Council influence bandings



[Chart is illustrative only and not to scale]

1 - https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/794557/Consumption_emissions_April19.pdf6

1. Luton Borough Current Emissions Profile



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1. Luton Borough Current Emissions Profile

Summary

The figures and charts presented below summarise the emissions relating to area administered by Luton Borough Council (LBC), with the **emissions resulting from London Luton Airport analysed separately in Section** 6. There are two methods used for this estimation; one uses the Anthesis' SCATTER tool, the other uses BEIS local Authority Emissions data. The differences between the two are explored overleaf (see Appendix 1 for full data tables).

Figure 1: SCATTER sector inventory for direct and indirect emissions within Luton, 2017 (LLA aviation emissions excluded)

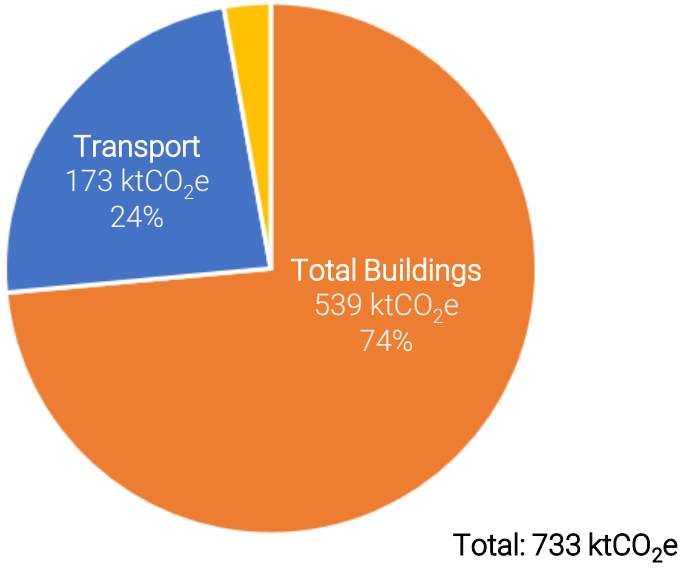


Figure 2: SCATTER sub-sector inventory for direct and indirect emissions within Luton, 2017 (LLA aviation emissions excluded)

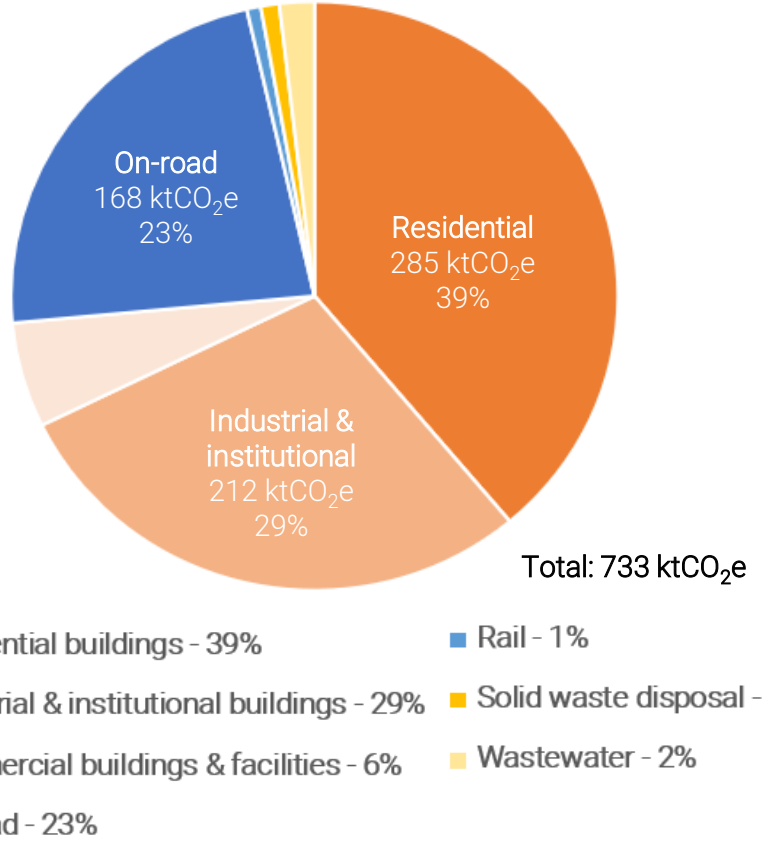
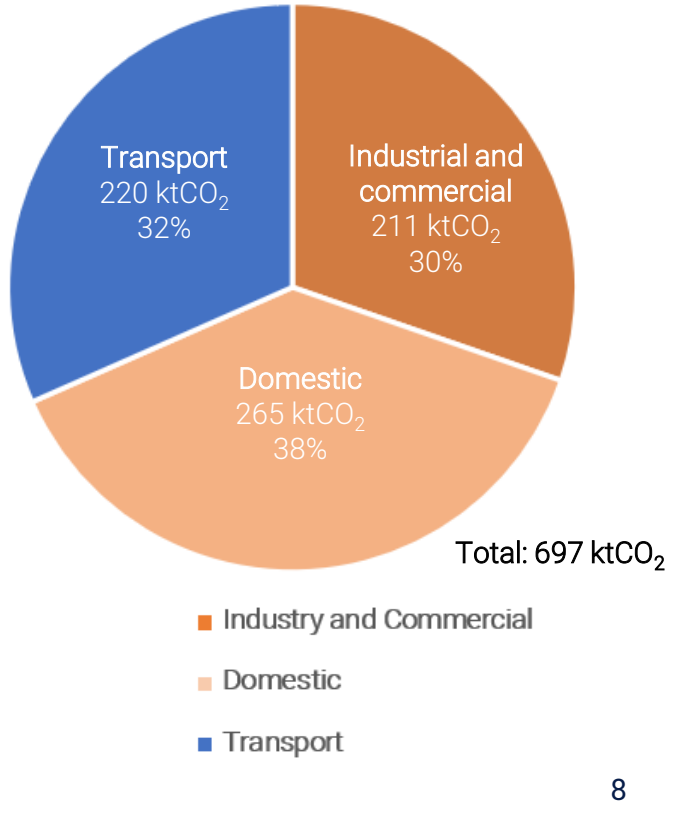


Figure 3: BEIS sector inventory for direct and indirect emissions within Luton, 2017



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1. Luton Borough Current Emissions Profile

SCATTER – Frequently Asked Questions

Aviation emissions are typically included in the SCATTER inventory, but have been removed from the initial emissions profile to allow comparability to BEIS data . Section 6 provides an in depth analysis of airport and aviation emissions.

What do the different emissions categories mean within the SCATTER Inventory?

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.

The BEIS Local Emissions Summary does not differentiate between direct/indirect/other (or the various 'scopes').

What do the different sectors and subsectors represent within the SCATTER Inventory?

- **The Direct Emissions Summary and Subsector categories** are aligned to the the World Resource Institute's Global Protocol for Community-Scale Greenhouse Gas Emission Inventories ("GPC"), as accepted by CDP and the Global Covenant of Mayors.
- **The BEIS Local Emissions Summary** represents Local Authority level data published annually by the Department for Business Energy & Industrial Strategy (BEIS).
- **Stationary energy** includes emissions associated with industrial buildings and facilities (e.g. gas & electricity).
- **IPPU** specifically relates to emissions that arise from production of products within the following industries: iron and steel, non-ferrous metals, mineral products, chemicals. These are derived from DUKES data (1.1-1.3 & 5.1).
- **Waterborne Navigation and Aviation** relate to trips that occur within the region. The figures are derived based on national data (Civil Aviation Authority & Department for Transport) and scaled to the Luton borough.
- The full methodology is available at http://SCATTERcities.com/pages/methodology

Why does the BEIS summary differ from the SCATTER summary?

- The BEIS summary **represents CO_2 only**; SCATTER also includes emissions factors for other greenhouse gases such as Nitrous Oxide (N_20) and Methane (CH_4). These are reported as a CO_2 'equivalents (e)'.
- The BEIS summary **does not provide scope split**; SCATTER reports emissions by scope 1, 2, and 3 (i.e. direct, indirect or other categories).
- **The BEIS summary categories are not directly consistent or mapped to the BEIS LA fuel data** which is available as a separate data set. SCATTER uses published fuel data and applies current-year emissions factors, whereas the BEIS data calculations scale down national emissions in each transport area. Specifically for road transport, BEIS data splits total emissions across road type; SCATTER uses fuel consumption for on-road transport per LA.
- **Different treatment of 'rural' emissions** i.e. Agriculture, Forestry and Other Land Use (AFOLU) and Land Use, Land Use Change & Forestry (LULUCF) categories are derived from different underlying data set.

1. Luton Borough Current Emissions Profile

High emitters and large businesses

Through analysis of publicly available data sources and consultation with council officers, a list of large organisations and high emissions businesses was collated. Many SMEs and businesses in certain sectors are not required to report publicly on their emissions, which was a barrier in assessing the exact emissions profile of these organisations. Some organisations were included in the list as a result of the size of their staff, relationship with the council and perceived influence over citizens or the wider borough area.

This list was then used to invite contacts within the businesses to attend a workshop to explore how businesses in the Luton borough could work together with LBC to collectively accelerate action toward a low carbon future, in line with LBC's targets around carbon neutrality and poverty. More detail on this workshop can be found in Section 7.

Company	Sector	Qualifier for inclusion	Supplier to LBC
FCC Recycling	Waste management	High emissions	Yes
CEMEX UK CEMENT LTD	Manufacturing	High emissions	
IBC Vehicles Limited (subsidiary of Vauxhall)	Manufacturing	High emissions	
LUTON AND DUNSTABLE HOSPITAL NHS TRUST	Healthcare	Large business	Yes
ENGIE Regeneration	Energy supply	High emissions	Yes
University of Bedfordshire	Education	Large business	
Luton Town Football Club	Sports & Leisure	Large business	
Luton Airport Operations	Transport – Aviation	Large business	
Bristol Laboratories	Manufacturing	Large business	
EasyJet	Transport – Aviation	Large business	
Tui	Transport – Aviation	Large business	
Monarch	Transport – Aviation	Large business	
Leonardo	Aerospace	Large business	
Arriva The Shires Ltd	Transport – Bus	Large business	

2. District Energy System Pathways

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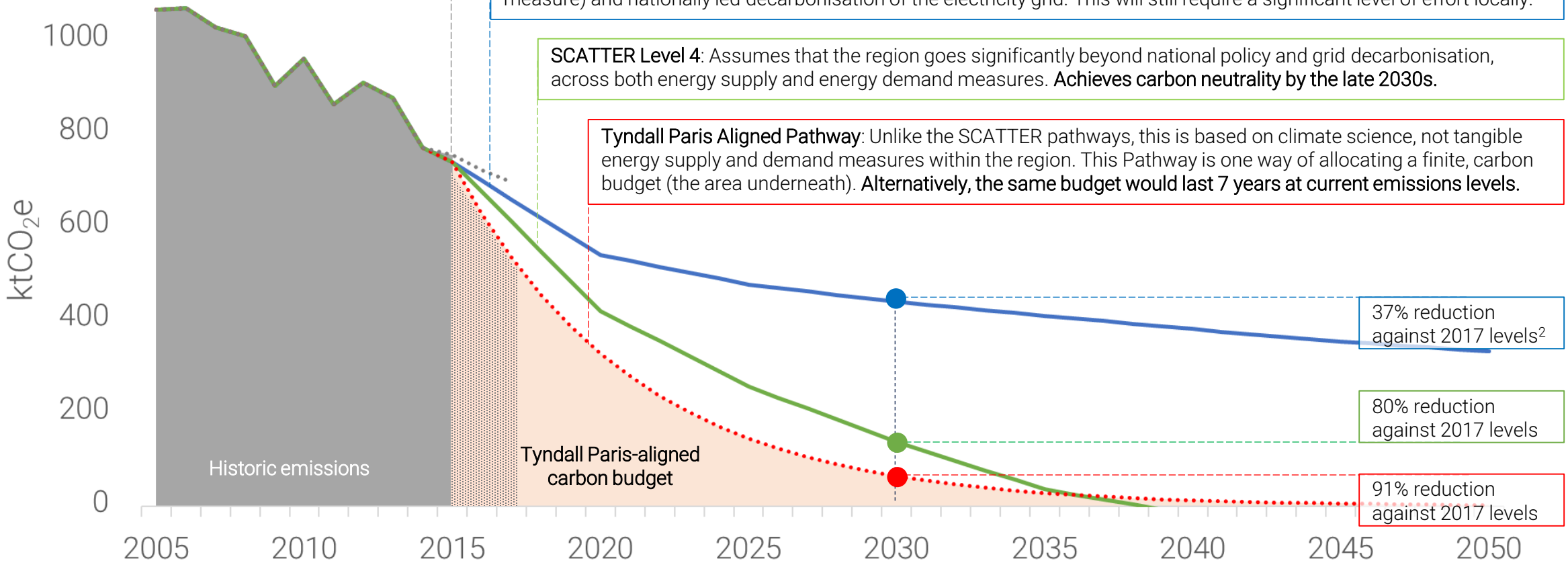
2. District Energy System Pathways

Summary

BEIS/SCATTER Overlap: The SCATTER model base year is 2015.[1] More recent data has since been published by BEIS (grey dotted line), enabling early comparison (shaded region).

Figure 4: Luton Carbon Budget and Pathways for the District-Wide Energy System, annotated.



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1 – Local Authority emissions & energy consumption data is published 2 years in arrears. SCATTER Tool operates from 2015 Base year, with adjustments made using 2016 & 2017 BEIS Local Authority Emissions data
2 – Whilst 2030 does not represent a significant milestone for Luton Borough Council specifically, it is a benchmark year in the 2019 manifestos of the major political parties.

2. District Energy System Pathways

Luton's Carbon Budget – Tyndall Centre Research

Introduction

The Tyndall Centre for Climate Research is a research organisation tied to the University of Manchester who have undertaken analysis to determine the contribution of each UK local authority to the national carbon budget. The defined carbon budgets are based on translating the targets set out in the Paris Agreement, informed by the latest research on climate change and defined in terms of science-based carbon accounting.

A temperature increase of 1.5°C is the result of a given concentration of atmospheric greenhouse gases. Using this principle as a starting point, it is possible to define a global emissions budget which relates to this temperature change. Subsequent allocation regimes can be applied to apportion a UK-wide energy budget before finally defining a budget for the Luton Borough region. A more complete description of these allocation regimes can be found in Appendix 2. A key omission from this budgeting analysis is emissions from aviation and shipping and the below results define an **energy-only** budget for the region's energy supply and demand.

Results

The Tyndall Centre research analysis[1] stipulates:

- The energy-only budget for the Luton area between 2020-2100 is **4.4 $MtCO_2$.**
- A **consistent emissions reduction rate of -13.1%** is needed to adhere to this budget.
- **By 2042, >95% of the recommended carbon budget will have been emitted** and low-level CO_2 emissions continue at a diminishing level to 2100.
- At current emissions levels, **only 6 years of carbon budget would remain,** from 2020.

Aviation and shipping

Aviation and shipping emissions are deducted from the budget at the UK level, **not** at the Luton Borough level. Therefore, the carbon budget allocated to Luton borough under the Tyndall Centre analysis does not include aviation emissions.

The Tyndall Centre analysis assumes the UK emissions from aviation as remaining constant up until 2030, followed by a linear reduction to full decarbonisation in the sector until 2075. The aviation assumptions are more optimistic than the Department for Transport emissions forecasts used in SCATTER.

With government predictions expecting significant growth in aviation and shipping emissions, the remaining UK budget available for local authorities will reduce significantly, requiring even greater reductions in emissions in order to keep within the 1.5 °C budget. It is therefore recommended that governments work collaboratively to consider strategies that limit emissions growth from aviation and shipping. A more thorough analysis of the emissions impacts of London Luton Airport (LLA) can be found in Section 6.

Year	Reduction in emissions against 2015 levels	Cumulative emissions total ($MtCO_2$)
2020	23.6%	0.58
2025	62.1%	2.52
2030	81.2%	3.48
2035	90.6%	3.95
2040	95.4%	4.19
2045	97.7%	4.31
2050	98.9%	4.37

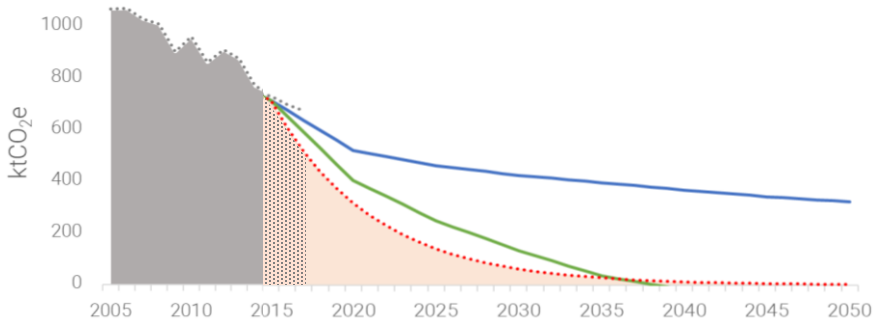
Table 3: Luton Borough Carbon Budget, Tyndall Centre analysis[1]

1 - https://carbonbudget.manchester.ac.uk/reports/E06000032/

2. District Energy System Pathways

SCATTER Model

Figure 5: Luton Carbon Budget and Pathways for the district-wide energy system



SCATTER "Level 1' Pathway – Assumes the selected region doesn't take much action beyond current, national policy and nationally led decarbonisation of the electricity grid.[1]

SCATTER "Level 4" Pathway – Assumes the selected region goes significantly beyond national policy and National Grid assumptions, across both energy supply and demand measures. Many assumptions aligned with the legacy DECC 2050 Pathways calculator 'Level 4'. See Appendix 4 for further details.

Tyndall Paris Aligned Budget – The finite, cumulative amount that the region should emit between now and 2050, based on research performed by the Tyndall Centre for Climate Change Research.[2]

Tyndall Paris Aligned Pathway – The yearly totals that must reduce 13% on average each year to keep within the budget. Note: Unlike the SCATTER Pathways, this does not specify what tangible measures could achieve this pathway, rather, it sets out what science (IPCC[3]) indicates we need to aim for.

Historic Pathway – Previous emissions totals as reported within the BEIS Local Authority Emissions data sets.[4]

This graph shows two possible future emissions pathways over time, as modelled by the SCATTER pathways tool. This tool focuses on energy system (fossil fuel consumption) emissions reductions within Luton. The pathways do not represent reductions outside of the LBC district boundary (i.e. consumption-based emissions) or emissions from the Airport (section 6).

Both Pathways can be compared against the Tyndall Centre for Climate Change Research's Paris Aligned Budget. This is derived from climate science[3] and applies a method for scaling down global carbon emissions budgets that are 'likely' to keep temperature change "well below 2°C and pursuing 1.5°C", to local authority regions. Unlike the SCATTER pathways, this is based on climate science, not tangible energy supply and demand measures in region. The cumulative nature of CO_2 reinforces the need for to take a 'budget' approach, where any annual shortfalls accumulate over time. This Pathway is just one way of allocating a finite, carbon budget (the area underneath the curve). Alternatively, the same budget would last only 7 years if emissions remain at current levels. This highlights the need for urgent action **now**.

Gaps exist between the SCATTER Level 4 Pathway and the Tyndall Paris Aligned Pathway / zero carbon axis because modelling assumptions are based on present day evidence and judgment. Such assumptions are not intended to constrain the future ambition to close the gap.

What do 'Carbon Neutral' and 'Net Zero' mean?

'Carbon neutral' or 'net zero' typically mean the same thing: that while emissions have been reduced overall, some carbon/GHG emissions remain but are then off-set through carbon dioxide removal from the atmosphere. Such removal may occur through Negative Emissions Technologies (NETs) such as biomass energy with carbon capture and storage, or, natural sequestration via means such as afforestation. It is important to define the scope of emissions covered within carbon neutral ambitions including defining which GHGs, scopes and sectors are covered by the target. Following this, defining the nature and extent of any 'offsetting' that may be required will need to be explored in future.

See also, a recent blog by the Tyndall Centre for Climate Change Research on the various related terms that may often get confused or used interchangeably with 'Carbon Neutrality'.

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1 – The BAU carbon intensity of electricity tracks the National Grid Future Energy Scenario (FES) "2 Degrees", 2017), on the basis that this was aligned with the legislated targets at the time the SCATTER tool was developed.
2 – This is based on information not yet publicly available, however the method is broadly comparable with work performed for the Greater Manchester Combined Authority and the City of Manchester. Contact c.w.jones@tyndall.ac.uk for further information.
3 – Intergovernmental Panel on Climate Change, 1.5°C Special Report, 2018
4 – Data is published 2 years in arrears, 2017 published data is represented on the graph as the SCATTER Pathways tool had not been updated at the time of writing. % Reduction figures presented do reflect the 2018 published BEIS data

2. District Energy System Pathways

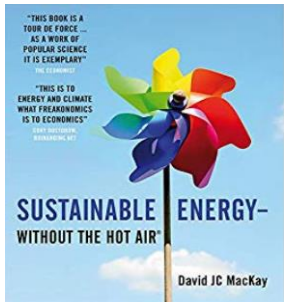
About the SCATTER model

SCATTER is intended to serve as one of many information sources to help local authority users inform their priorities for emissions reduction. Specifically with reference to the forward-looking pathways modelling element, it is intended to focus on the 'what' rather than the 'how'. It is important to note that SCATTER does not intend to prescribe certain technologies or policies, and similarly does not intend to discount other methods of arriving at the same outcome, just because they do not feature in the model. The SCATTER pathways serve as 'lines in the sand' and give users an indication of whether they are likely to be on-target or off-target for a carbon neutral trajectory through the adoption of interventions to drive the transition to a low carbon economy.

Note that the analysis undertaken for this report is based on the original SCATTER V1 (Excel-based tool) as it is the latest live version of the tool at the time of writing. Updates to the tool included in V2 (online tool) have not been included in this analysis. Naturally, technologies, assumptions and approaches to energy models are evolving all the time, and we would welcome the opportunity to receive feedback and/or collaborate on refinements of SCATTER in the future. Please share any feedback with scatter@anthesisgroup.com.

Basic principles

Sir David MacKay's 'Sustainable Energy - Without Hot Air (2009)" underpins the basis for the pathways modelling. As a scientific advisor to the Department for Energy & Climate Change (DECC), now BEIS, MacKay's work led to the development of the 2050 Pathways calculator. An open source, Microsoft Excel version of this tool was published by DECC which we used as the foundation for SCATTER.



Two key modifications were made by Anthesis:

1) We scaled it down for sub-national regions: Scaling assumptions and localised data sets were built into the tool so that results were representative of cities and local authority regions, rather than the UK as a whole.

2) We pushed ambition further: Technology specifications changes were reviewed and updated where judged to be out of date and constraining ambition. Given that almost a decade had passed since MacKay's publication and the release of the 2050 Pathways tool, we sought the counsel of a technical panel to make these updates. The technical panel comprised subject matter experts from Arup, BEIS, Electricity North West, GMCA, The Business Growth Hub, The Energy Systems Catapult, The Tyndall Centre and Siemens. We also referenced the 2050 Wiki page during the course of the update.

Many other sector specific aspects of modelling treatment and assumptions have required consideration and interpretation as we have applied the model to various cities and local authorities.

2. District Energy System Pathways

Supply & Demand

The energy system has two main components; energy supply, and energy demand. In this report, the term 'energy system' relates to energy in the form of solid, liquid and gaseous energy that is used to provide fuel, heat and electricity across buildings, transport and industrial sectors. Energy must be supplied to each of these sectors, in order to meet the demand for energy that the sectors require. Demand drives the amount of supply we need, and actors such as businesses, residents and public services all play a part in contributing to this demand.

Future demand is hard to predict. Recently published analysis within the National Grid's Future Energy Scenarios (FES) 2019 indicates that even under a scenario that meets the UK's net zero by 2050 (Two Degrees), electricity demand still increases. SCATTER's L4 Pathway on the other hand (consistent with the legacy 2050 Pathways tool), assumes that electricity demand still reduces overall. Factors such as increased electrification of heat and transport are naturally big drivers for the increase, but incentives and opportunities for demand reduction and energy efficiency measures are still significant and could slow or tip trends in the other direction.

Reducing demand should always come first.

Economically, this usually makes sense, whether at an individual, organizational or district level. For example, energy bills can reduce and at a district level, costs associated with installing new generation assets, new grid connections and grid reinforcement works and be minimised.

Socially, there are benefits if citizens can be better off if they shift to healthier forms of transport just as walking and cycling or increase efficiency of journeys by car sharing.

Table 4: FES & SCATTER Demand side assumptions at 2030 and 2050.

Source	Change in current[1] demand	
	2030	2050
FES Two Degrees (2019)	▲ 5%	▲ 48%
SCATTER Level 4 (L4) Pathway	▼ -25%	▼ -45%

Environmentally, emissions savings can often be achieved much quicker by implementing various demand side behaviour changes or 'quick win' efficiency measures. This can help safeguard carbon budgets and avoid placing too much reliance on slower, riskier, renewable supply infrastructure to deliver the emissions savings so critically required.

The potential for demand reduction is still huge. The International Energy Agency (IEA) estimated that efficiency measures (i.e. demand side reduction), could contribute 40% towards our emissions targets[2].

1 - FES: 2018, SCATTER: 2017 levels, electricity demand only.
2 – International Energy Agency, Energy Technology Perspectives, 2017

3. Energy System Interventions

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3. Energy System Interventions

Domestic Buildings

The following tables provide metrics to understand the nature and extent of Luton-specific measures. These are all assumed in order to track the green SCATTER level 4 (L4) pathway as shown on page 9. These assumptions are based on what is needed to achieve carbon reductions needed to achieve the L4 pathway and do not consider feasibility, financing or skills required to deliver the measures themselves. Note that all figures provided are against a baseline year of 2015.

Measure	Current LBC Context	SCATTER L4 Pathway[4]		
		2025	2030	2050
Improved insulation	8,716 ECO measures installed (c.10% of households) between 2013 and March 2019[1] 13.4% fuel poverty rate (c.10,000 households) in 2012[2] 71% of EPC-rated homes have a rating of D or below[3] 233 Watts/ºC average heat loss per house (Referred to in the legacy 2050 Pathways tool as thermal leakiness. See definition opposite)	Solid wall insulation retrofits at a rate of 719 households a year Loft insulation at a rate of 1,821 households per year Superglazing at a rate of 1,632 households per year New builds to PassivHaus or equivalent standard 183 Watts/ºC average heat loss per house (21% reduction in thermal leakiness)	Solid wall insulation retrofits at a rate of 773 households a year Loft insulation at a rate of 1,943 households per year Superglazing at a rate of 1,753 households per year New builds to PassivHaus or equivalent standard 158 Watts/ºC average heat loss per house (32% reduction)	The vast majority of households eligible for retrofit have been treated New builds to PassivHaus or equivalent standard 58 Watts/ºC average heat loss per house (75% reduction)
Reduction of average temperature[5]	Current average temperatures are approximately 17.3ºC[6]	16.8ºC	16.7ºC	16.0ºC

What is 'thermal leakiness'?

Thermal leakiness is a measure of how well a house **retains heat**. A house with high thermal leakiness will not retain heat very easily and will be more expensive to keep warm. Thermal leakiness varies across the ambition thresholds within SCATTER and depends on three variables, all of which will impact the Watts/ºC metric:

1) Thermal conductivity of the building fabric (i.e. 'U-values' of ceilings, floors, walls and windows).
2) Ventilation (i.e. effectiveness of draught-proofing).
3) Temperature difference with the outside (i.e. the average temperature of the home based on the occupant's preference or use of smart thermostats).

Examples of good practice:

Exeter's Zero Energy Building Catalyst is supporting 80 enterprises in Devon to engage with new models of retrofit.

South West England Ready for Retrofit report assessed local barriers and enablers in order to stimulate long term growth in the retrofit market.

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1 - See https://www.gov.uk/government/statistics/household-energy-efficiency-statistics-headline-release-september-2019
2 - https://www.luton.gov.uk/Community_and_living/Lists/LutonDocuments/PDF/JSNA/3.4%20Housing,%20overcrowding,%20fuel%20poverty,%20homelessness.pdf
3 - https://www.gov.uk/government/statistical-data-sets/live-tables-on-energy-performance-of-buildings-certificates#epcs-for-existing-domestic-properties – only approximately 75% of domestic properties in region are listed as having an EPC (c.57,000 households)
4 – For a full list of retrofit measures see Appendix 5, for a list of EPC ratings see Appendix 6
5 - Reductions may be achieved through better heating controls (i.e. 'Smart thermostats') that zone the heat, as opposed to reducing comfort
6 - ECUK (2017) Table 3.16: Internal and external temperatures 1970 to 2012

3. Energy System Interventions

Domestic Buildings

Measure	Current LBC Context	SCATTER L4 Pathway		
		2025	2030	2050
Decarbonisation of heat	c. 71,000 homes (85%) have gas systems installed.[1] Gas boilers will be banned in new homes from 2025. Renewable Heat Incentive (RHI) has accredited 6 domestic installations for renewable heat systems within Luton since 2014[2] See Appendix 7 for further detail on the type of heating technologies assumed within SCATTER	36% of household stock have a new heating system Majority of heating systems are gas boilers (both old and new), with some heat pumps[3] (27%) and district heating (<1%)	51% of household stock have a new heating system Majority of heating systems are gas boilers (both old and new), with an increased share of heat pumps (39%), and district heating (>1%)	94% of household stock have a new heating system Majority of heating systems are heat pumps (90%) and district heating (3%)
Appliance & lighting efficiency	Consumption by domestic lighting decreased 7% between 2015 and 2018[4] National average demand per household is 2.59 MWh	Average demand per household is 2.42 MWh	Average demand per household is 2.12 MWh	Average demand per household is 0.92 MWh
Electrification of cooking	47% electrified[5]	69% electrified	76% electrified	100% electrified

Examples of good practice:

Bedfordshire's sustainable warehouse was accredited in 2019 as the most sustainable building of its kind in the UK.

Sunderland City Council invested in the largest gas replacement project to switch to heating provided by ground source heat pumps to a block of 364 flats.

Bunhill Energy Centre in Islington supplies power and hot water to over 800 homes and some public buildings through district heating.

1 - Assuming 1 meter per household and 84,000 households in Luton (from SCATTER projections)
2 - https://www.gov.uk/government/statistics/rhi-monthly-deployment-data-may-2019
3 – Air-source and ground-source heat pump technology
4 - https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/820753/2019_Electrical_Products_Tables.xlsx
5 - based on legacy SCATTER assumptions

3. Energy System Interventions

Non-Domestic Buildings

Measure	Current LBC Context	SCATTER L4 Pathway		
		2025	2030	2050
Commercial space heating & cooling	62% of EPC-rated commercial 'lodgements' are rated D or lower[1]	15% reduction in commercial heating and cooling demand against 2015 levels	23% reduction in commercial heating and cooling demand against 2015 levels	49% demand in commercial heating and reduction demand against 2015 levels
Electrification of heat	89% gas and oil-fired boilers (2015)[2] See Appendix 7 for further detail on the type of heating technologies assumed	57% gas and oil-fired boiler	46% gas and oil-fired boiler	0% gas and oil-fired boiler
Appliances & lighting	Consumption by non-domestic lighting, computers and commercial motors fell 1.7% between 2015 and 2018[3] Total non-domestic consumption in 2017 was 1630 GWh	Non-domestic demand is 431 GWh	Non-domestic demand is 415 GWh	Non-domestic demand is 353 GWh
Energy used for cooking	24% electrified	46% electrified	57% electrified	100% electrified

Examples of good practice:

Cornwall Council will no longer provide gas in its new homes and piloted the use of ground source heat pumps at Tolvaddon Energy Park.

Yorkshire's Zero Carbon cross-sector working group promotes zero carbon domestic buildings which underpins strategic planning policy.

1 – See Appendix 6; a 'lodgement' is assumed to represent the same unit as 'household' (for domestic buildings) and allows comparison between the two different sector's properties.
2 - BEIS Total sub-national final energy consumption, 2015, Total Domestic Fuel - Allocated according to ECUK proportions
3 - https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/820753/2019_Electrical_Products_Tables.xlsx

3. Energy System Interventions

Transport

Measure	Current LBC Context	SCATTER L4 Pathway		
		2025	2030	2050
Distance reduction	27.4% of residents do not have access to private vehicles, with proportions rising as high as 53.2% in deprived wards[1]	Overall travel demand drops 17% relative to 2015 levels[2] 25% reduction in passenger miles travelled by car	Overall travel demand drops 25% relative to 2015 levels[2] 27% reduction in passenger miles travelled by car	Overall travel demand drops 25% relative to 2015 levels[2] 38% reduction in passenger miles travelled by car
Significant passenger transport modal shifts	63.4% of commuters use motor vehicles, 13.9% active transport modes 26% of school journeys are made by private car, but proportion of active transport modes is 52% for primary school and 69.2% for secondary schools	6% reduction in car transport share against 2015 levels Modal share of public transport (rail & bus) is 18% Modal share of active transport (walking & cycling) is 6%	10% reduction in car transport against 2015 levels Modal share of public transport (rail & bus) is 20% Modal share of active transport (walking & cycling) is 6%	22% reduction in car transport against 2015 levels Modal share of public transport (rail & bus) is 29% Modal share of active transport (walking & cycling) is 9%
Modal shift of freight and increase in efficiency	71% of freight emissions in the UK are from road[3]	Road freight is 99% diesel[3]	Road freight is 98% diesel	Road freight is 93% diesel

Examples of good practice:

Bath's BreATHe project will roll out levies for higher emission vehicles within Bath city centre.

Bristol Council plans to introduce a Clean Air Zone for charging non-compliant vehicles

Nottingham City Council introduced a Workplace Parking Levy (WPL) congestion charge to encourage employers to reduce the number of free workplace parking places they provide to staff and switch to alternative modes of transport.

Refer to Appendix 8 for further information on assumptions on other modes of transport.

1 –https://www.luton.gov.uk/Council_government_and_democracy/Lists/LutonDocuments/PDF/CPC/7-Joint-Strategic-Needs-Assessment-2015.pdf
2 - Based on 2015 Department for Transport Statistics - Table NTS0305 Average distance travelled by mode: England, 1995/97 to 2016 (4% walking, 1%, cycle, 80% car/van/motorcycle, 5% bus, 9%rail
3 - Department for Transport Statistics - Table TRA3105 Heavy goods vehicle traffic by axle configuration and road category in Great Britain, 2015

3. Energy System Interventions

Transport

Transport Glossary
EV – Electric Vehicle
PHEV – Plug-in Hybrid Electric Vehicle
HEV – Hybrid Electric Vehicle
ULEV – Ultra Low Emission Vehicle

Measure	Current LBC Context	SCATTER L4 Pathway		
		2025	2030	2050
Shift to zero carbon cars	Local company Cawleys have developed techniques which sustainably recover lithium used in EV batteries Number of EV charging points within city centre doubled in 2018 in comparison with 2017, now sitting at 24 charge points as well as 8 charge points for taxi ranks planned for next year	51% EV, 13% PHEV/HEV, 36% petrol/diesel	75% EV, 14% PHEV/HEV, 11% petrol/diesel	100% EV
Shift to zero carbon buses	Bus travel to and from LLA will be remodeled as part of a £160m investment increasing passenger capacity Council is working with operators to introduce hybrid and low emissions buses on certain routes[1]	48% EV, 40% PHEV/HEV, 12% petrol/diesel	76% EV, 14% PHEV/HEV	100% EV
Rail electrification	Midland Mainline electrification aims to complete upgrades to the line between Bedford and Kettering by Dec 2019	Rail is 100% electrified	Rail is 100% electrified	Rail is 100% electrified

Examples of good practice:

Edinburgh's EV Charging Plan is an ambitious plan for EV charging infrastructure.

Go Ultra Low is a national scheme aiming to inform consumers and promote the savings associated with switching to EV.

1 - https://www.luton.gov.uk/Environment/Lists/LutonDocuments/PDF/Environmental%20and%20Consumer%20Services/Pollution/2018-Air-Quality-Annual-Status-Report.pdf

3. Energy System Interventions

Waste

Measure	Current LBC Context	SCATTER L4 Pathway		
		2025	2030	2050
Waste reduction[1]	LBC collected 79,996 tonnes of household waste and 11,906 tonnes of non-household waste in 2017/2018[1]	8% decrease in quantity of household waste	12% decrease in quantity of household waste	25% decrease in quantity of household waste
Increased recycling[3]	In 2017/18 LBC recycled/composted 32.8% of household waste, 13.8% went to landfill and 53.4% was recovered in Energy from Waste LBC falls into the Low Performers category of local authorities saving carbon as a result of recycling based on analysis undertaken by Eunomia[2]	48% of commercial and household waste goes to recycling	55% of commercial and household waste goes to recycling	85% of commercial and household waste goes to recycling

Examples of good practice:

London's Library of Things projects promote a 'borrow not buy' movement for rarely-used items.

Loughborough Food Waste Processing projects aim to improve the reliability of anaerobic digesters.

1 - https://www.luton.gov.uk/Environment/Lists/LutonDocuments/PDF/Bins%20and%20recycling/Waste-Strategy.pdf
2 - www.eunomia.co.uk/carbonindex

3. Energy System Interventions

Industry

Measure	Current LBC Context	SCATTER L4 Pathway		
		2025	2030	2050
Industry efficiency	Per BEIS figures, total emissions from industry and commercial sources decreased 33% between 2011-17	49% reduction in emissions from industry	54% reduction in emissions from industry	78% reduction in emissions from industry[1]
Electrification of industry	35% of UK industrial energy consumption in 2018 was electric[2]	41% of industrial energy use is electrified	44% of industrial energy use is electrified	66% of industrial energy use is electrified
Carbon Capture and Storage (CCS) on industry	Currently no CCS facilities or research in region	2% of industrial emissions are captured by CCS	4% of industrial emissions are captured by CCS	42% of industrial emissions are captured by CCS
Oil production	No significant oil or petroleum product manufacturing within region	23% reduction in oil imports relative to 2015 levels	40% reduction in oil imports relative to 2015 levels	78% reduction in oil imports relative to 2015 levels

1 – Emissions are offset by CCS measures; these reductions describe the gross reductions of emissions through improvements in efficiency – https://www.irena.org/DigitalArticles/2019/Apr/-/media/652AE07BBAAC407ABD1D45F6BBA8494B.ashx

2 - https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/820647/DUKES_1.1.5.xls

3. Energy System Interventions

Renewable Energy Supply

Measure	Current LBC Context	SCATTER Level 4 Pathway		
		2025	2030	2050
Solar PV	4.8 MW installed capacity in 2018 with an annual output of 4.7 GWh[1]	0.5 km^2 of PV arrays across roof space (equivalent to arrays on 34% of households) 0.17 GW installed capacity[2] 127 GWh generated per year	0.7 km^2 of PV arrays across roof space (equivalent to arrays on 45.7% of households) 0.24 GW Installed Capacity 181 GWh generated per year	1.6 km^2 of PV arrays across roof space (60% of households as well as a further 0.6 km^2 of ground mounted and commercial property installations) 0.55 GW Installed Capacity 419 GWh generated per year
Storage	No notable energy storage projects within boundary	2.41 GW storage capacity in standby generators	2.52 GW storage capacity in standby generators	2.69 GW storage capacity in standby generators
Bioenergy supply (heat & electricity)	No installed capacity as of 2018	26 MW installed capacity	28 MW installed capacity	43 MW installed capacity
Solar thermal	No installed capacity through RHI scheme as of September 2019	0.2 km^3 solar panels for hot water 6.2 MW installed capacity	0.3 km^3 solar panels for hot water 7.9 MW installed capacity	0.6 km^3 solar panels for hot water 15.8 MW installed capacity

A note on supply technologies

SCATTER estimates values for the installed capacity of each supply technology, by taking a nationally assumed capacity figure (L1 was aligned to the 2017 National Grid's Future Energy Scenario, Two Degrees) and scaling down to region based on a local authority's size proxy (e.g. population, number of households, land area). This serves as an indicator for the nature and extent of renewable supply required to future demand.

SCATTER **does not** account for the geographies and local contexts unique to a given local authority, which we acknowledge play a very important role in the viability of a given technology.

Examples of good practice:

West Sussex Virtual Power Plant combines PV and storage across groups of property to act as a localised grid.

Kent's Cleve Hill Solar Farm produces enough power for 91,000 homes and generates over £1m a year for local authorities.

Anthesis

1 - RHI data used for this estimate can be found here. Domestic and non-domestic estimates were calculated by using national averages for the share of solar thermal applications and capacities, as well as the average capacity per solar thermal installation.
2 - https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/743822/Renewable_electricity_by_Local_Authority__2014-2017.xlsx
3 – The % of households quoted is taken from a 2.2 kW installation occupying 16m^2 of roof space and household number projections (as per the Energy Savings Trust Guidance)

3. Energy System Interventions

Renewable Energy Supply

The following energy technologies operate within the SCATTER tool but have very low feasibility given Luton's local geography. Acknowledging this, they are treated with the minimum ambition level within the tool (L1). For these or any of the supply technologies referenced in this section, if the technology is not feasible in the district boundary to the extent suggested, then the residual capacity is assumed to occur outside the boundary i.e. it is assumed that other regions would compensate for the lack of supply from this technology.

Measure	Current LBC Context	SCATTER Level 1 Pathway		
		2025	2030	2050
Hydro power	No installed capacity as of 2018	3.9 MW installed peak capacity	4.1 MW installed peak capacity	6.1 MW installed peak capacity
Wave, tidal and tidal stream	Total national generation from wave and tidal was 4.2 GWh in 2017	Energy generation from wave, tidal stream and tidal wave grows steadily to 60 GWh by 2050.		

Given Luton's size and urban profile, the installation of onshore wind turbines within boundary is unfeasible. However, out of boundary initiatives have proven a viable option for energy supply for a number of local authorities, particularly Warrington. For this reason the ambition level was kept high within the tool:

Measure	Current LBC Context	SCATTER Level 4 Pathway		
		2025	2030	2050
Onshore wind	No installed capacity as of 2018	18 turbines installed 45 MW installed capacity (2.5 MW per turbine)	26 turbines installed 65 MW installed capacity	66 turbines installed 165 MW installed capacity

3. Energy System Interventions

Renewable Energy Supply – Comparative Study

Luton has a limited amount of existent installed capacity for renewable energy supply. Here a comparison is made with local authorities of similar size by area, population (households) and GVA. Often, the feasibility of given technologies can be severely limited by local geographies and contexts (hydroelectric power in a flat region, large wind farms in a geographically small area etc.). The below table is intended to serve as a reference for the variety of technologies available across a number of urban areas which face similar constraints to Luton in terms of size, economic output and population. Solar PV, onshore wind, hydroelectric power and biomass have all been compared – note that 'biomass' incorporates a variety of specific technologies including anaerobic digesters, landfill gas and solid municipal waste. In addition, there are likely impacts on air quality as a result of burning biomass that should be considered.

Local Authority	Households[1,2]	Area (km²)[4]	Population ('000s)[5]	GVA (£m)[6]	Renewable Technology				Total installed renewable capacity (MW)[3]
					PV	Wind	Hydro	Biomass	
Luton	79,300	43.35	215	5,276	4.8	-	-	-	4.8
London Borough of Merton	+1%	+1%	-4%	+4%	4.3	0.004	-	1.7	+24%
Portsmouth	+15%	-7%	+0.03%	+8%	9.7	-	-	20.2	+519%
Dundee City	-12%	-13%	-31%	-32%	4.1	0.1	0.2	10.6	+210%
Southend-on-Sea	-1%	-4%	-15%	-39%	4.6	-	-	-	-5%

Per unit area of land, London Borough of Merton generates 21% more energy than Luton Borough – 110 kW/km² in Luton compared to 140 kW/km² in Merton – suggesting there is greater potential for capacity in Luton even after considering land constraints.

Table 5: Comparative metrics for Luton Borough and other UK local authorities.
All percentages listed are relative to the figures for Luton.

1 – https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/families/adhocs/008604estimatednumberofhouseholdsfortheunitaryauthoritiesofengland2004to2016
2 – https://www.nrscotland.gov.uk/files/statistics/council-area-data-sheets/dundee-city-council-profile.html#table_house_est
3 – https://www.gov.uk/government/statistics/regional-renewable-statistics
4 – https://www.ons.gov.uk/file?uri=/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/2011censuspopulationestimatesbyfiveyearagebandsandhouseholdestimatesforlocalauthoritiesintheunitedkingdom/r12ukrttablep04ukv2_tcm77-304141.xls
5 – https://www.gov.uk/government/collections/uk-local-authority-and-regional-carbon-dioxide-emissions-national-statistics
6 – https://www.ons.gov.uk/economy/grossvalueaddedgva/datasets/regionalgrossvalueaddedbalancedbylocalauthorityintheuk

3. Energy System Interventions

Estimated Emissions Savings Summary

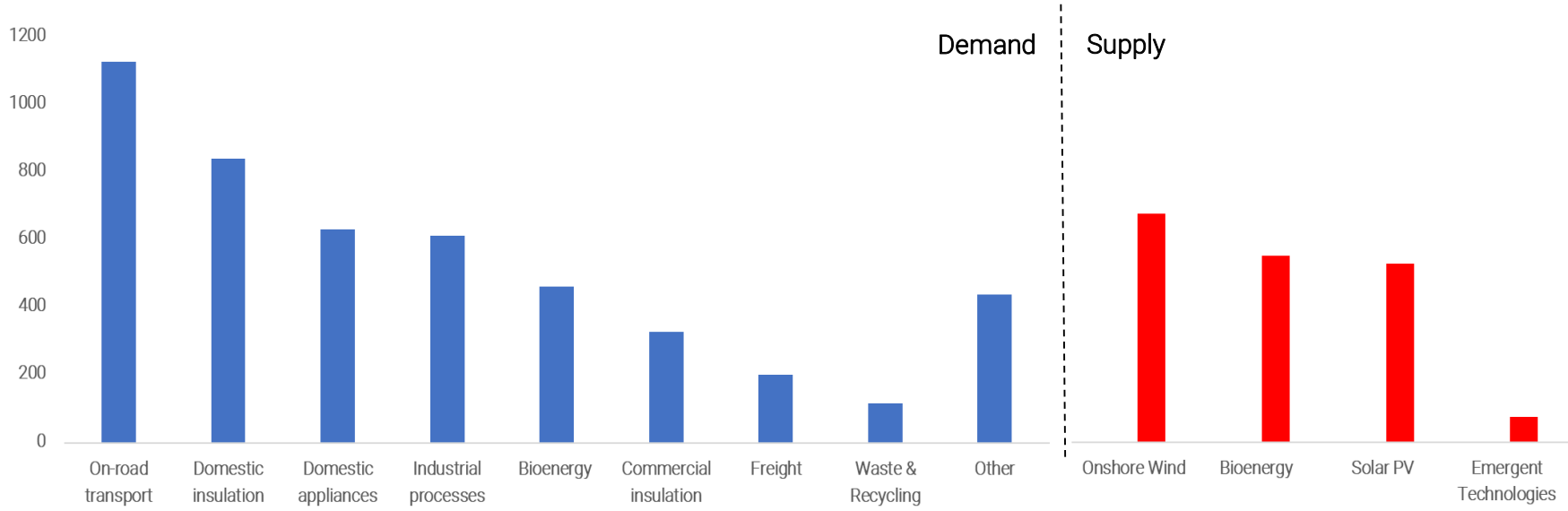
Table 6: Demand side measure cumulative savings to 2030

Demand-side measure	Cumulative saving to 2030 ($ktCO_2e$)
On-road Transport	1,129
Domestic Insulation	842
Domestic Appliances	632
Industrial Processes	614
Bioenergy	462
Commercial Insulation	330
Freight	203
Waste & Recycling	118
Other	441

Table 7: Supply side measure cumulative savings to 2030

Supply-side measure	Cumulative savings to 2030 ($ktCO_2e$)
Onshore Wind	662
Bioenergy	542
Solar PV	518
'Emergent' Technologies	74

The estimated cumulative savings to 2030 for demand-side measures are presented below (blue). Supply-side measures (red) have also been presented, though please note the limitations of such estimates and the importance of not summing the demand and supply.



Notes:

- It is not appropriate to sum any savings presented from renewable supply with savings achieved on the demand side of the energy system, as this is may result in double counting.
- Intervention is critical on the demand side to realise emissions savings from renewable supply. For example, if heating systems are not electrified, then a decarbonised electricity grid will have limited impact. Similarly if the grid is not decarbonised, savings from Electric Vehicles will not be as great.
- 'Emergent' technologies are hydro, tidal and wave power.
- 'Other' constitutes the following: rail transport, petroleum and fossil fuel production, carbon capture and storage

3. Energy System Interventions

Emissions Savings Summary

Comparisons against base year

This section provides an indication of relative savings by sector expressed as % reductions and intensity metrics.

The Global Protocol for Community-Scale Greenhouse Gas Emission Inventories describes how GHG inventories such as those in SCATTER can be used as a basis for performance tracking and goal setting. Progress can be assessed in a number of ways, but here a **base year emissions goals** approach and a **base year intensity goals** approach have been used.

The base year emissions goals approach compares emissions reductions relative to an emissions level in an historical baseline year (in this case, 2017 has been chosen as the most recent dataset). These emissions reductions are typically represented in percentage terms and are shown in the table below.

SCATTER sector	% reduction against 2017 by 2030
Domestic Buildings	72.3%
Non-domestic Buildings	67.5%
Transport	84.3%
Waste & Industry	123.6%
Total	**80.1%**

Table 8: Base year emissions goals approach to emissions tracking. Percentage reduction exceeding 100% within the waste & industry sector indicates that emissions are net-captured, either by means of CCS technologies or other means such as biomass.

The **base year intensity goals** approach compares changes in the emissions intensity relative to an historical baseline year. Emissions intensity can be defined as the amount of emissions per unit of a given parameter; most commonly population. In 2017 in the UK the emissions intensity per capita was 5.3 tCO_2/head. Two base year intensity goals are shown in the tables below; emissions intensity per capita and emissions intensity per unit of energy consumption.

Emissions intensity per unit of energy consumption is calculated from the ratio of projected values for net CO_2e emissions and energy demand (in TWh). The very sharp decrease in the emissions intensity per TWh accounts for changes to both the decarbonization of the energy supply as well as reduced demand.

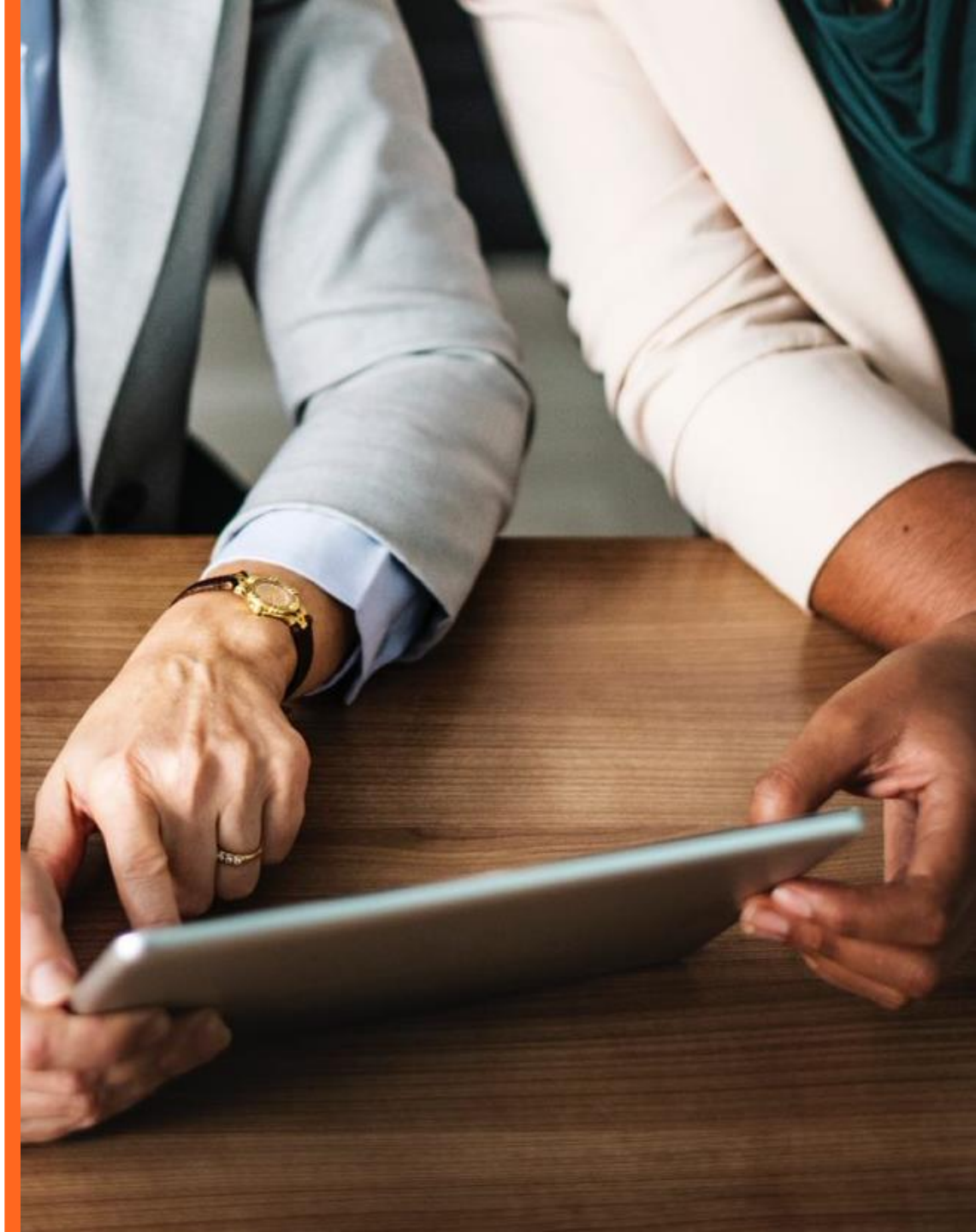
Emissions intensity per capita is similarly calculated from the ratio of projected emissions to projected population.

Year	Emissions intensity per capita	
	tCO_2e/head	% reduction against 2017 levels
2017	3.08	N/A
2025	1.07	65%
2030	0.55	82%

Year	Emissions intensity per TWh	
	$ktCO_2e$/TWh	% reduction against 2017 levels
2017	47.4	N/A
2025	27.1	43%
2030	21.6	54%
2050	8.7	82%

Table 9: Intensity emissions reduction approach to emissions tracking.

4. Luton Council’s Own Emissions



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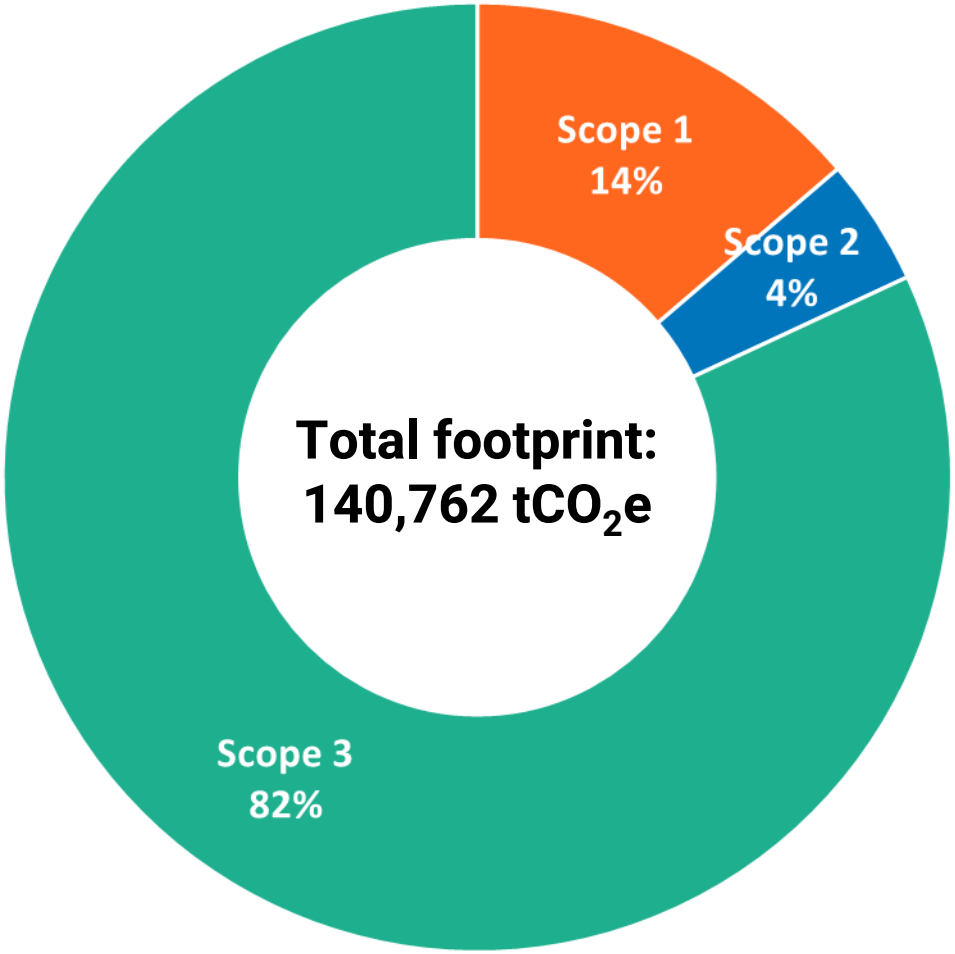
4. Luton Council's Own Emissions

Overview

- The analysis of Luton Borough Council's own emissions focused on six key emissions sources, including:
    - Buildings & Other Assets
    - Vehicle Fleet
    - Business Travel
    - Employee Commute
    - Procurement Spend

- Scope 3 emission sources are the largest contributor to the council's own emissions accounting for 82% of total emissions, with Scope 1 and 2 emissions sources contributing a marginal 14% & 4%, respectively.
- The largest single emissions source category from Indirect, Direct and Other emissions was Scope 3 input/output emissions from procurement spend, contributing to 78% of total emissions.
- In addition, a substantial proportion of emissions have been produced from Natural Gas, Electricity and Gas Oil Consumption in Buildings & Other Assets accounting for 19% of total emissions.
- The council's Scope 1 & 2 emissions represent <1% of the district's Scope 1 & 2 (Direct & Indirect emissions). It is not appropriate to directly compare the council's total footprint (i.e. Scopes 1, 2 & 3), as the proportion of Scope 3 emissions that occur inside and outside of the district boundary has not been defined.



4. Luton Council's Own Emissions

Table 10: Luton Borough Council emissions breakdown by scope and sector 2018-2019

Emission Source		Activity Data	Unit	tCO2e	% of total emissions
Scope 1					
Buildings & Other Assets	*Natural Gas*	79,507	*MWh*	14,623	10.39%
	Gas Oil	996,634	*Litres*	2,859	2.03%
Vehicle Fleet	*HGV (12t)*	3,292	*MWh*	816	0.58%
	Company Vans	2,082	*MWh*	516	0.37%
	LGV (2.5t - 12t)	1,622	*MWh*	402	0.29%
	SPV	326	*MWh*	81	0.06%
	Company Cars	168	*MWh*	41	0.03%
	PSV	32	*MWh*	8	0.01%
	Company Motorbikes	0.13	*MWh*	-	0.00%
Total Scope 1 Emissions				**19,344**	**13.74%**
Scope 2					
Buildings & Other Assets	*Purchased Electricity*	22,079	*MWh*	6,090	4.33%
Total Scope 2 Emissions				**6,090**	**4.33%**
Scope 3					
Buildings & Other Assets	*Natural Gas - WTT*	79,507	*MWh*	1,986	1.41%
	Gas Oil - WTT	996,634	*Litres*	630	0.45%
	UK Electricity - T&D	22,079	*MWh*	519	0.37%
Vehicle Fleet	*Essential Grey Fleet*	940	*MWh*	225	0.16%
	Casual Grey Fleet	272	*MWh*	65	0.05%
Business Travel	*Average Car: Petrol*	453,783	*Miles*	148	0.10%
	Average Car: Diesel	680,675	*Miles*	95	0.07%
Employee Commute	*Walk / Bicycle*	1,672,684	*Miles*	-	0.00%
	Private On-Road Transport	6,650,417	*Miles*	1,912	1.36%
	Public On-Road Transport	603,291	*Miles*	106	0.08%
	Public Off-Road Transport	862,629	*Miles*	61	0.04%
Procurement Spend	*Input/Output*	£319	*million GBP*	109,581	77.85%
Total Scope 3 Emissions				**115,328**	**81.93%**
Total Emissions				**140,762**	

Table 10 details a breakdown of the emissions for Luton Borough Council's emissions across council owned buildings, vehicle fleet, employee travel and procurement spend.

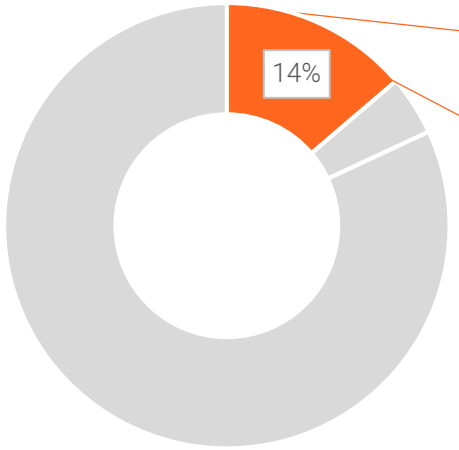
An **operational control approach** to GHG accounting has been used for the analysis of emissions from owned/leased buildings and assets. In reference, the GHG Protocol define operational control as an organisations 'authority to introduce and implement its operating policies at the operation' (GHG Protocol, 2019). This is demonstrative for commercial properties, such as parks and playing fields, community support centres, municipal waste recycling centres etc., which have been encompassed under the council's Scope 1, 2 and 3 emissions.

- **Procurement spend is the largest emissions source, accounting for nearly 78% of the council's Scope 1, 2 and 3 emissions.** Procurement spend relates to services that the council procures to support services across the borough, such as road or building maintenance.
- The Council's buildings emissions account for **20% of the Scope 1, 2 and 3 emissions, however still represent a significant proportion of emissions, 26,707 tCO_2e.** As much of these buildings are both owned and operated by the council, there is significant opportunity to implement emissions reduction measures on these assets.

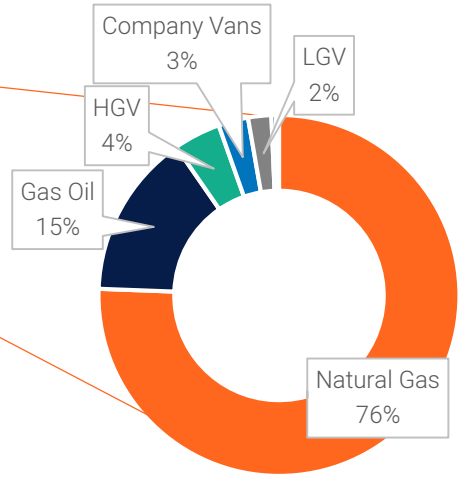
Glossary
HGV: Heavy Goods Vehicles
LGV: Light Goods Vehicles
SPV: Special Purpose Vehicles
PSV: Public Service Vehicles
WTT: Well-To-Tank
T&D: Transmission & Distribution

4. Luton Council's Own Emissions

Direct Emissions (Scope 1)



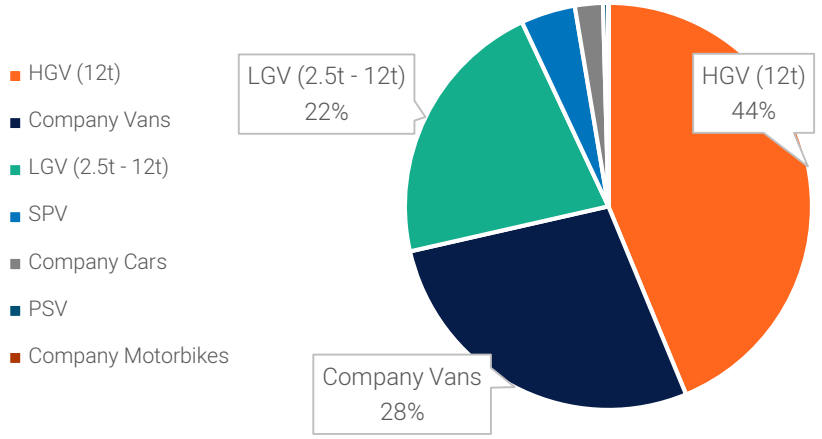
Scope 1 (direct) emissions



Scope 1 – Further analysis

- The analysis of Luton Borough Council's own direct (scope 1) emissions focused on two key emissions sources:
  - Buildings & Other Assets
  - Vehicle Fleet
- Scope 1 emissions accounted for **19,344 tCO_2e**, which is **14%** of the council's own emissions for FY1819.
- The biggest source of direct emissions were buildings and other assets owned by the council, accounting for **90%** of direct emissions.
- The majority of direct emissions were sourced from natural gas consumption in buildings and other assets accounting for 14,623 tCO_2e (**76%**), and gas oil consumption producing 2,859 CO_2e (**15%**).
- The remainder of direct emissions are produced from the council's own vehicle fleet (**10%**), including **815.5 tCO_2e** from HGV's (12t), **515.5 tCO_2e** from Company Vans & **402 tCO_2e** from LGV's (2.5t – 12t). The aforementioned vehicle types accounted for **94%** of total emissions from the council's own vehicle fleet, with the remaining **6%** encompassing SPV's, company vans, company cars & company motorbikes.

Council's Own Vehicle Fleet, by vehicle type
Scope 1 (tCO_2e)



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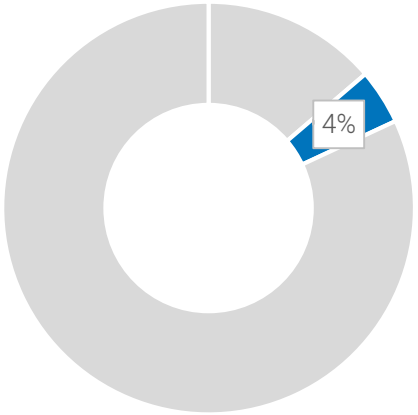
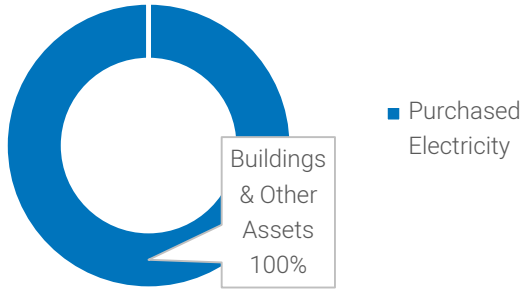
4. Luton Council's Influence
Indirect Emissions (Scope 2)

Scope 2 – Further analysis

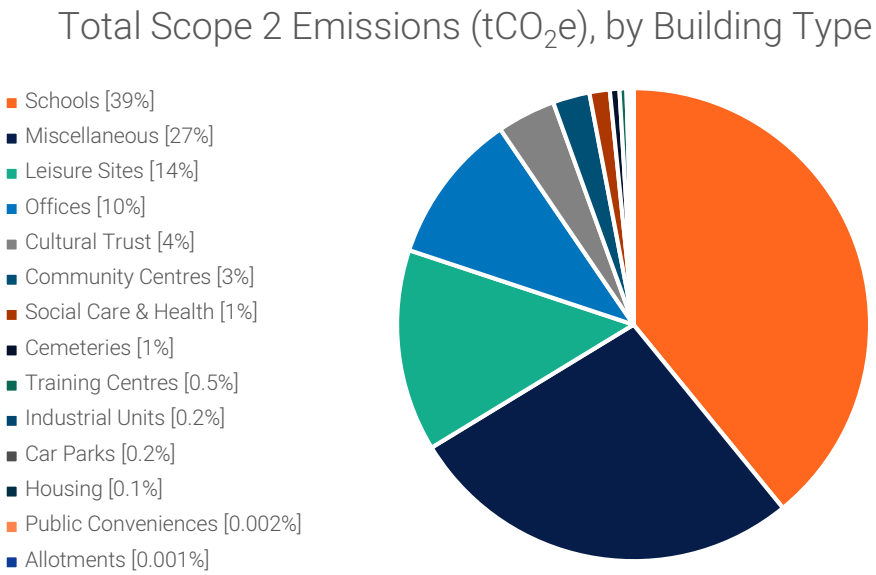
- The analysis of Luton Borough Council's own direct emissions focused on Buildings & Other Assets

- Scope 2 emissions accounted for **6,090 tCO_2e**, and **4.3%** of the council's own emissions for FY1819.





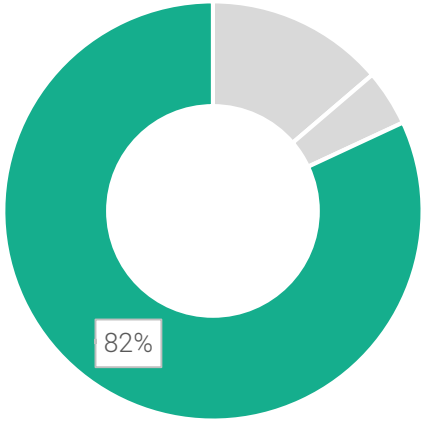
- The council's own indirect emissions are all associated with Purchased electricity from buildings and other assets, contributing **100%.**
- The largest contributor to the council's own indirect emissions was from building's and other assets categorised as schools, accounting for **2,123 tCO_2e. (18%)** of total emissions from purchased electricity consumption within this sector.

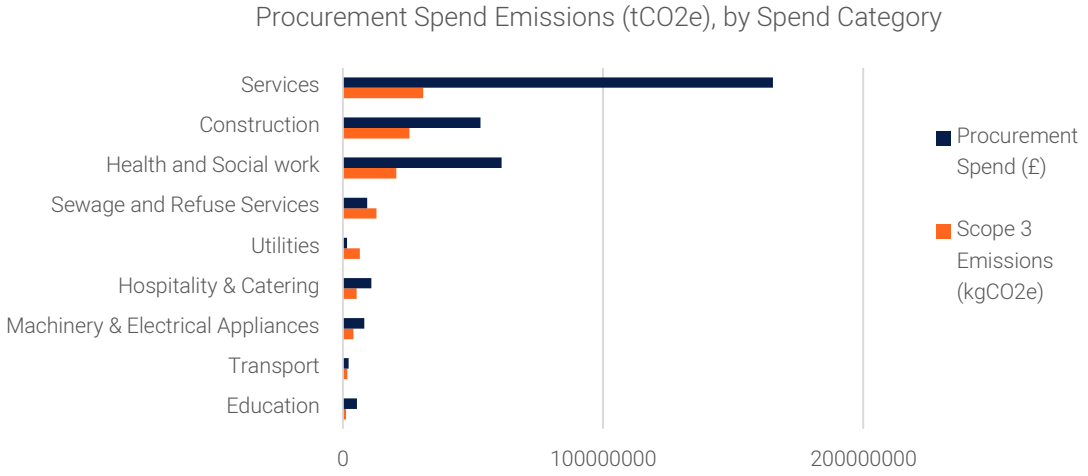


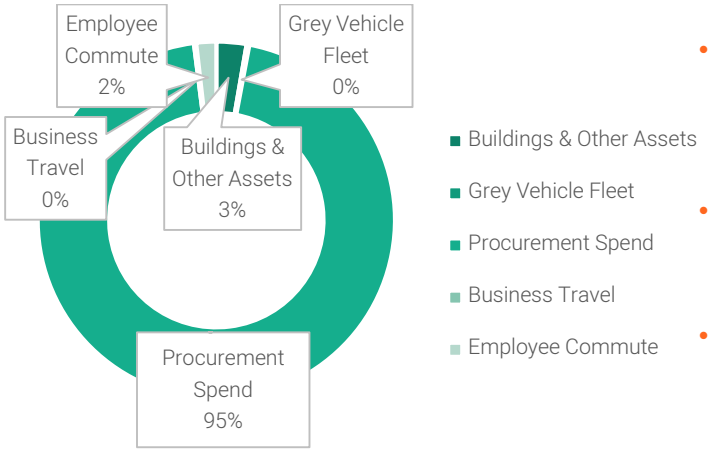
4. Luton Council's Influence
Other Emissions (Scope 3)

Scope 3 – Further analysis

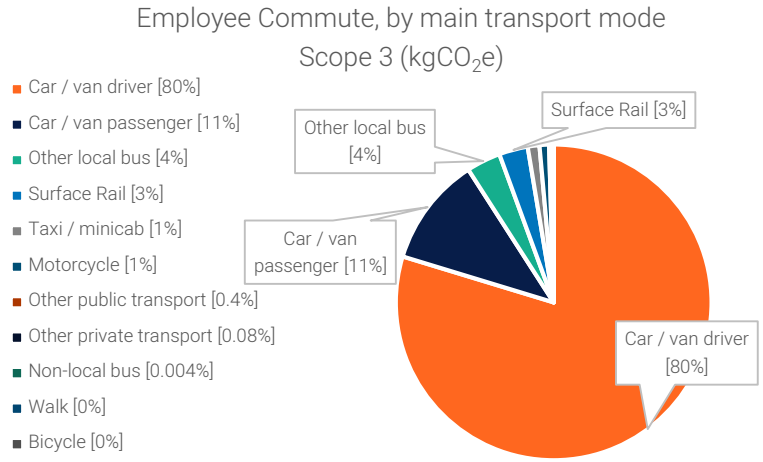
- The analysis of Luton Borough Council's own other emissions focused on six key emissions sources, including:
    - Buildings & Other Assets
    - Grey Vehicle Fleet
    - Business Travel
    - Employee Commute
    - Procurement Spend







- The council's other emissions are largely comprised of input/output emissions associated with procurement spend, accounting for **82%** of total GHG emissions, and **95%** of Scope 3 GHG emissions.
- The top emission sources under procurement spend were categorised as main contract capital works, accounting for 15,328 tCO_2e.
- The Scope 3 emissions from employee commute were estimated using public datasets from the Department for Transport (DfT) National Travel Survey (NTS) including, average commuter trips by employment status and main mode. This was calculated based on organisational employee size/person(s), with car/van drivers on average making up the largest proportion (**80%**) of Scope 3 emissions from employee commute.



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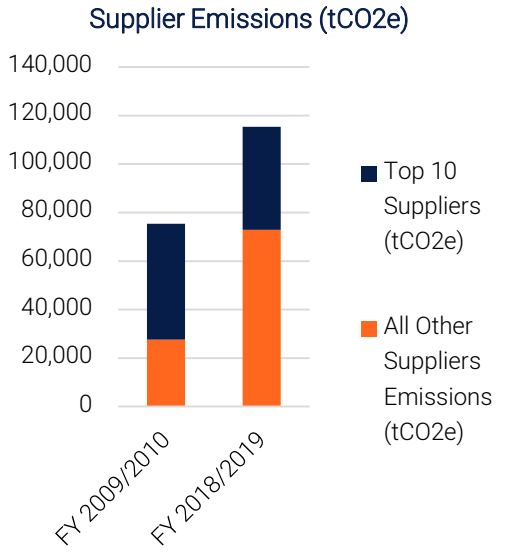
4. Luton Council's Influence

Large emitters: Procurement Spend Analysis FY1819

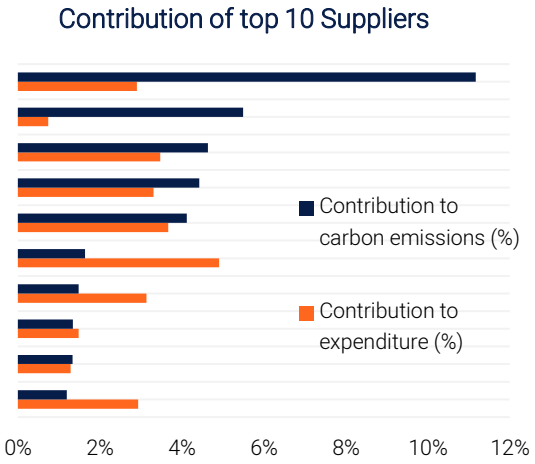
- The council's own procurement spend emissions amounted to **115,368 tCO_2e** in FY1819, compared to **75,349 tCO_2e** in FY09/10.
- In FY1819, the highest consumption-based emissions were associated with expenditure from FCC Recycling (UK) Ltd contributing **12,889 tCO_2e** and **11.17%** of total procurement spend emissions. The total expenditure associated with **FCC Recycling (UK)** amounted to **2.9%** of total procurement spend. In FY0910, the most significant contributor to total carbon emissions (tCO2e) was E.ON Energy LTD associated with **11,202 tCO_2e (14.87%)** compared to **527 tCO_2e** in FY1819.
- The top 10 most significant contributors to the council's own carbon footprint attributed **27.84%** of procurement spend and **36.84%** of total emissions associated with supplier expenditure compared to **19.38%** and **63.41%**, respectively, in FY0910.
- The emissions associated with expenditure to **NPower Ltd** were significant in both FY1819 (**6,338 tCO_2e**) and FY0910 (**9,890 tCO_2e**), whereby the supplier was ranked 2nd in both periods. However, the supplier was apportioned to **64%** less carbon in FY1819.

Please note this method assigns the top 10 highest emitters based on the council's scope 3 consumption-based emissions rather than district-wide territorial-based emissions. As a result, we have prioritised engagement with organisations falling inside the city boundary as these will fall into greater influence of the council.

In addition, emissions have been calculated using DEFRA input/output emissions factors matched to broad procurement spend categories. For a more concise analysis of consumption-based emissions from supplier activities more granular data would be required to establish precise emission sources (e.g. emissions from FCC Recycling do not account for variations in emissions due to different waste disposal methods or energy capture from waste plants (EFW).[1]



Supplier Name	Expenditure (£)		Expenditure (%)	Carbon Apportioned (tCO2e)	Carbon Apportioned (%)	Carbon Footprint (tCO2e per £mn)	Luton Coucil (in-boundary)
FCC Recycling (UK) Ltd	£	9.27	2.90%	12,889.19	11.17%	1,390.82	Yes
NPower Ltd	£	2.37	0.74%	6,338.15	5.49%	2,676.54	No
Engie Regeneration Ltd	£	11.07	3.47%	5,351.77	4.64%	483.38	Yes
Volker Highways Crowley Ltd	£	10.56	3.31%	5,099.74	4.42%	482.86	Yes
Guidant/Redacted Personal Payment	£	11.70	3.66%	4,757.41	4.12%	406.79	n/a
Foreign / CHAPS Payments	£	15.68	4.91%	1,888.95	1.64%	120.50	n/a
Central Bedfordshire Council	£	10.02	3.14%	1,711.15	1.48%	170.82	Yes
NHS Luton CCG	£	4.73	1.48%	1,545.72	1.34%	327.08	Yes
Cambridgeshire Community Services	£	4.10	1.28%	1,540.49	1.34%	375.88	Yes
Police & Crime Commissioner for Bedfordshire	£	9.37	2.94%	1,379.49	1.20%	147.23	Yes
Total	**£**	**88.85**	**27.84%**	**42,502.1**	**36.84%**		



1- Source: Trucost, 2010. Luton: Carbon Hot Spot Footprint

4. Luton Council's Influence
Recommendations

This table sets out the recommendations for potential carbon reduction measures for some of the major direct emissions sources, with some example case studies for how other councils in the UK have worked with organisations in the sector. This illustrates the range of influence the council has.

Source	Total emissions (tCO_2e)	Carbon reduction measures	Council's influence	Council engagement examples
Libraries 	37,093 tCO_2e	• Reduce energy demand through retrofitting measures including insulation • Invest in on-site renewable energy generation and storage • Improve the energy efficiency of lighting and appliances • Develop a sustainable community engagement strategy • Connect buildings to air source or ground source heating systems or join district heat networks where feasible • Introduce smart energy management systems to optimise energy use	Stronger influence	• Lambeth Council committed to increase participation in the Re:Fit programme[1] to asses public buildings such as libraries for retrofitting potential to improve energy performance.
Town Hall 	33,708 tCO_2e		Direct control	• Waltham Forest Council has invested in 30 energy reduction projects across its building stock, including a boiler upgrade and improved insulation in the Town Hall resulting in 43% reduction in energy consumption.
Sports & Leisure facilities 	22,159 tCO_2e		Stronger influence	• Epping Forest Council replaced the heating system in Loughton Leisure Centre with a new on-site CHP unit, improving energy efficiency of the building.
Schools 	8,294 tCO_2e		Weaker influence	• LESS CO2[2] is a programme that helps schools to reduce their energy usage and bring down bills focusing on ways to integrate energy and carbon savings, making schools more sustainable through behavioural changes and retrofits. • Funded by Camden Council and local businesses, Camden Climate Change Alliance provides support and advisory services to schools to conduct waste audits, provide energy certificates and prepare sustainable travel plans.

1 - https://localpartnerships.org.uk/our-expertise/refit/
2 -http://www.lessco2.org.uk/schools

4. Luton Council's Influence

Recommendations

Source	Total emissions (tCO_2e)	Carbon reduction measures	Council's influence	Council engagement examples
Procurement spend 	109,581 tCO_2e	• Mandate carbon emissions reporting from suppliers • Update responsible procurement requirements to include metrics on carbon savings	Direct control	• Lambeth Council have introduced mandatory carbon reporting[1] as part of their procurement process and have written to engage all current suppliers with the net zero challenge.
Employee Commuting 	2,565 tCO_2e	• Implement a cycle to work scheme • Consider a sustainable travel plan	Weaker influence	• Leicester City Council launched a cycle scheme[2] for 8,000 staff members to encourage uptake of electric bikes by reducing the upfront cost.
Council owned fleet 	2,397 tCO_2e	• Switch council fleet to electric or plug-in hybrid electric vehicles • Regulate a zero emissions zone or workplace parking levy in key locations to provide funding for transitioning council fleet to low emissions vehicles	Direct control	• Nottingham City Council was part of a pilot EU funded scheme, CleanMobilEnergy[3] to roll out electric vehicle waste collection trucks powered by renewable energy through a smart energy management scheme.

1 - https://moderngov.lambeth.gov.uk/documents/s107089/Appendix%20A%20LBL%20carbon%20reduction%20plan.pdf#page=9
2 - https://employeebenefits.co.uk/leicester-city-council-cycle-8000/
3 - https://www.nweurope.eu/projects/project-search/cleanmobilenergy-clean-mobility-and-energy-for-cities/

5. Citizen Emissions

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5. Citizen Emissions

Energy Consumption Emissions, by Household Income

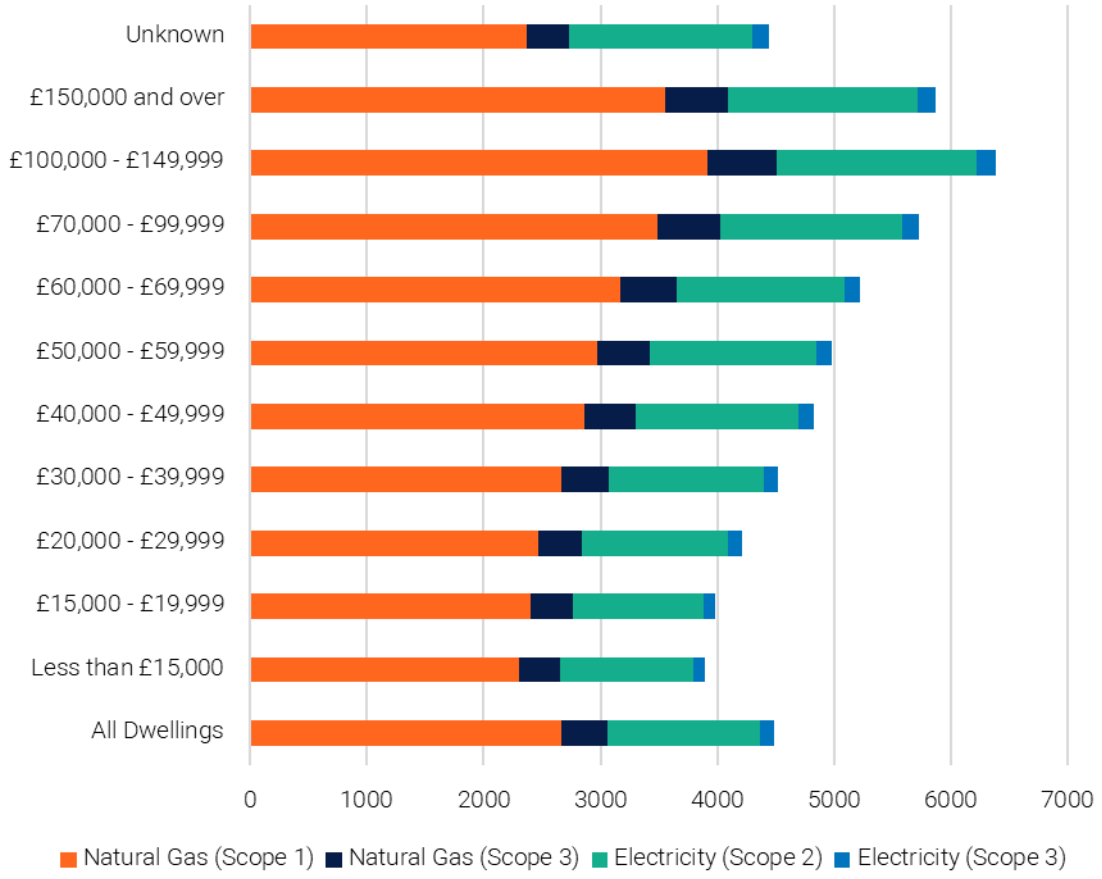
The Department for Business, Energy & Industrial Strategy (BEIS) publish data tables for household consumption, including the National Energy Efficiency Data (NEED): consumption data tables 2019. The NEED summary local authority consumption statistics include gas and electricity consumption by household income.

- The total emissions associated with mean gas consumption in all dwellings within the Luton Unitary Authority amounted to **3,065 $kgCO_2e$**, and electricity consumption attributed a total of **1,423 $kgCO_2e$**.
- The NEED statistics for Luton Borough demonstrate that the **£100,000 - £149,999** household income band was responsible for the highest level of emissions from mean gas and electricity consumption, with **6,383 $kgCO_2e$**.
- The majority of emissions within the £100,000 - £149,999 household income band are from scope 1 emissions associated with mean household gas consumption (**61%**), and scope 2 emissions from purchased electricity consumption (**27%**).
- As **Luton Borough has the highest percentage of fuel poor households in the East of England region**[1], there is a significant need to reduce fuel poverty through improvements in insulation and energy efficiency measures for low income households.

Recommendations

- Considering the highest emissions income bracket is the £100,00 - £149,999 bracket, **further analysis could look into the types of houses in this bracket to provide targeted advice to homeowners to reduce energy consumption**.
- It will be important to **improve energy efficiency in households in the lower income brackets**, as while these households consume the least energy they are likely to be fuel poor households that would benefit from savings on energy bills.

Luton Borough: Energy consumption emissions by household income (2017)



1 -https://www.gov.uk/government/statistics/sub-regional-fuel-poverty-data-2019

5. Citizen Emissions

Energy Consumption Emissions, by Postcode area

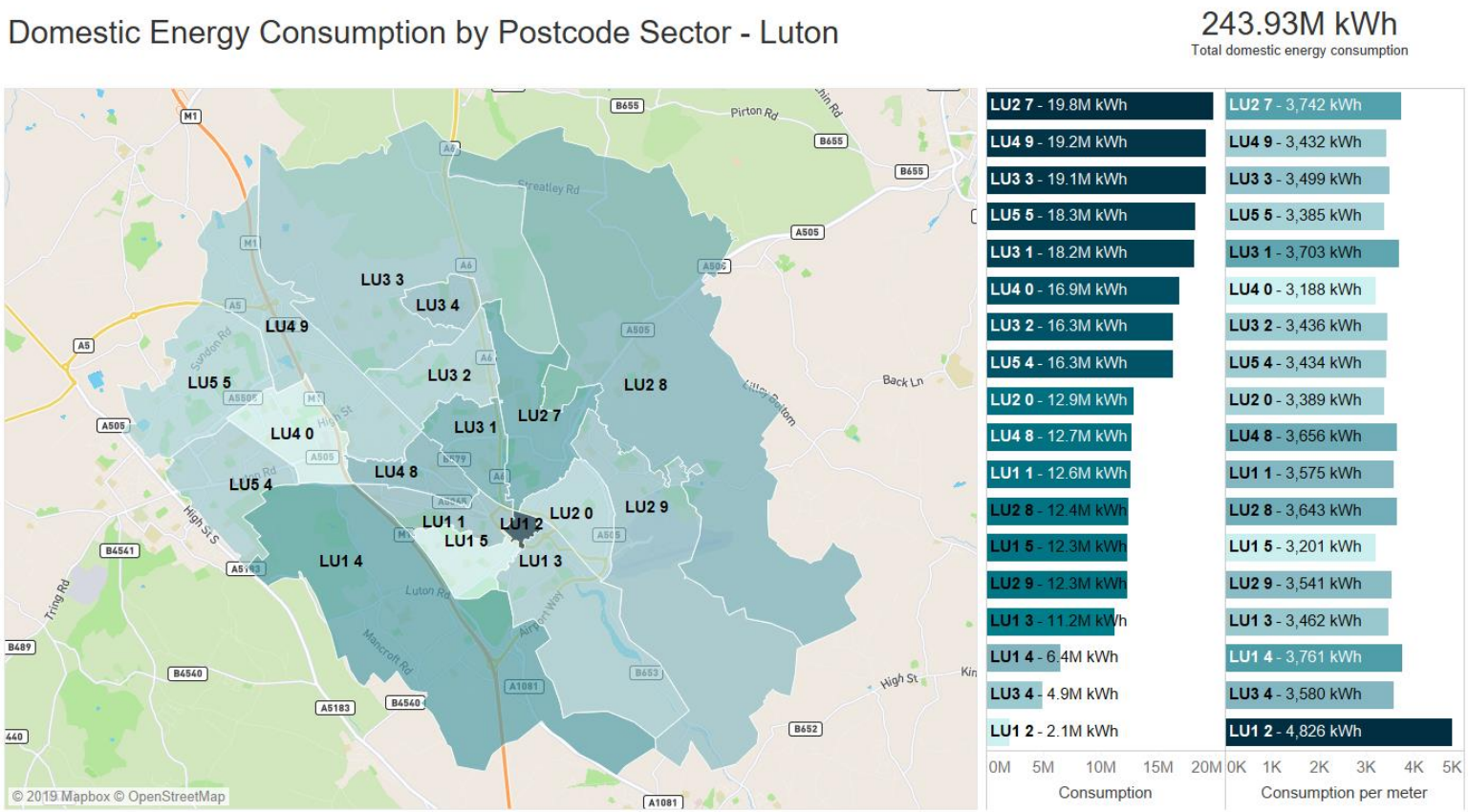
This analysis looks at domestic energy consumption by postcode sector in Luton in order to better understand the energy use in households across the borough.

- Total energy consumed by households in Luton in 2017 was 243,000,000 kWh[1]
- The postcode with the domestic energy **highest consumption per meter was LU1 2 with 4,826 kWh consumed** in 2017
- The postcode with the domestic energy **highest total consumption was LU2 7 with 19,800,000 kWh consumed** in 2017
- The LU1 2 postcode consumption is **33% higher** than the average consumption per meter for the East of England (3,248 kWh) [2]

Recommendations

- Further analysis could look at identifying which meters and households were responsible for the greatest share of consumption in LU 2 postcode area to understand why domestic energy consumption there is so high
- Areas of low energy consumption could also correlate with areas of fuel poverty

Luton Borough: Energy consumption emissions by Postcode area (2017)



1 - https://www.gov.uk/government/statistics/postcode-level-electricity-statistics-2017-experimental
2 - https://www.gov.uk/government/statistics/sub-national-electricity-and-gas-consumption-summary-report-2017

5. Citizen Emissions

Transport Emissions, by Household Income

This analysis aims to map travel emissions across different modes of transport to income quintiles, as a method for understanding the emissions associated with travel at each household income level.

As an approximate comparison the average Gross Disposable Household Income (GDHI) per head for Luton Borough in 2018[1], was approximately £14,889 in 2016. The GDHI for Luton Borough falls into the second level household income quartile

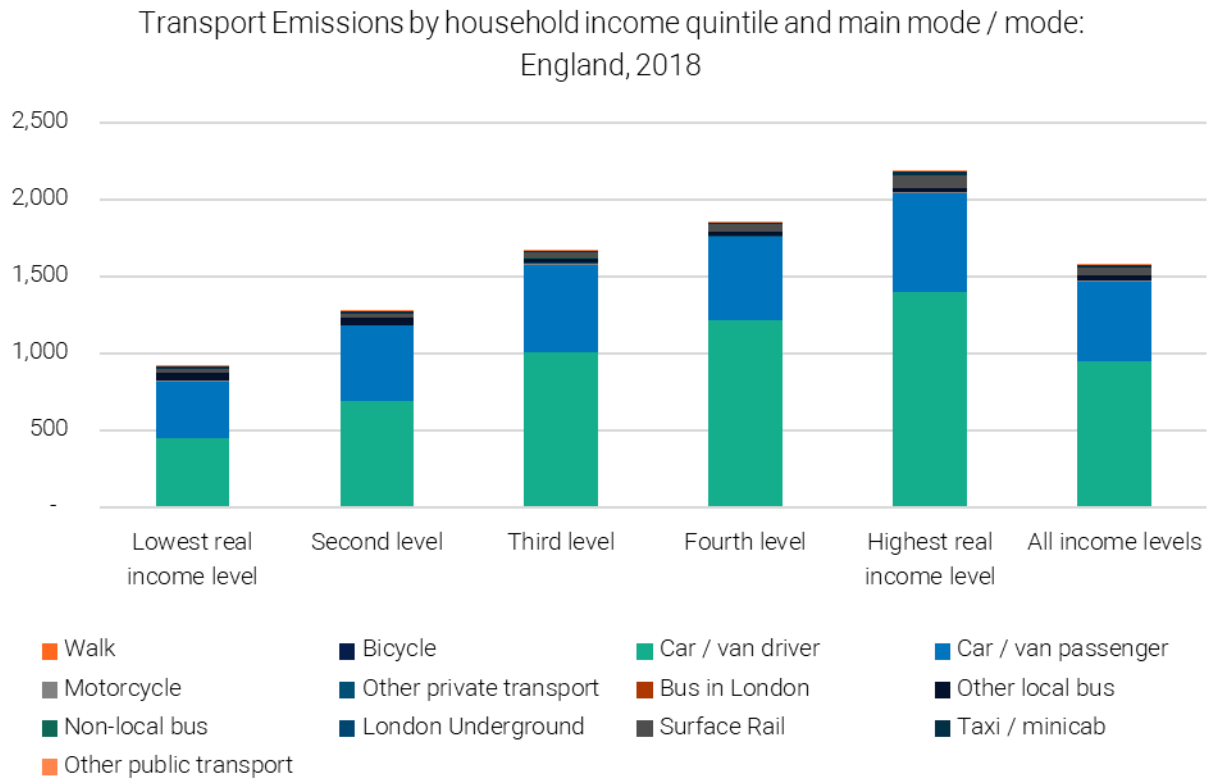
Using the second level income quintile as the average household income, the total travel emissions per person in 2018 equated to **1,272 $kgCO_2e$.** The total travel emissions per person in 2018 for the highest income level quintile was **2,200 $kgCO_2e$ or 1.8 times greater** than the total travel emissions for the second level quintile. This highlights the disparity between income and travel associated emissions.

93% of transport emissions in the second income quartile are from car/van passengers (**38%**) and drivers (**55%**).

** Please note emissions from aviation are not included in the Department for Transport (DfT) National Travel Survey (NTS)[2], assume all transport modes are public transport and/or on-road transportation.*

Recommendations

- Introducing policies and implementing actions that **encourage the shift away from private vehicle use** to other modes of transport will be essential for all income brackets, especially those that target high income citizens
- **Increasing affordable public transport** options will help to tackle environmental impacts as well as address poverty issues in the borough
- **Considering a low emissions zone** in the central areas could discourage heavy emissions vehicle use



Income Quintile	Lowest real income level	Second level	Third level	Fourth level	Highest real income level
Percentile	0-20 pctl.	20-40 pctl.	40-60 pctl.	60-80 pctl.	80-100 pctl.
Pre-tax	£0 - £15,500	£15,500 - £20,500	£20,500 - £27,500	£27,500 - £40,000	£40,000 - £166,000
Post-tax	£0 - £14,700	£14,700 - £18,700	£18,700 - £24,500	£24,500 - £34,800	£34,800 - £111,000

1 - Office of National Statistics (2018) Regional gross disposable household income, UK: 1997 to 2016
2 - Department for Transport National Travel Survey, Table NTS0705: Travel by household income quintile and main mode or mode: England

6. London Luton Airport Emissions

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6. London Luton Airport Emissions

Overview

Luton Airport serves a **growing number of domestic and international passengers** each year, and contributes a significant amount of the borough's overall emissions. The airport is also a key economic hub for the Luton borough, providing jobs though a number of key businesses in the airport vicinity. It will be vital for the council to work closely with the airport and associated businesses to manage the environmental impacts of the airport's operations, passenger activity and flights.

Recommendations

- Much of the airport's emissions relate to flight emissions, though there is a significant contribution from the transport to and from the airport, **48% of emissions**. This will be a key opportunity for Luton Borough Council to influence activities of Luton Airport passengers. It is anticipated that the opening of the **Luton Direct Air Rail Transit (DART)** help to reduce passengers arriving and leaving the airport by private vehicle.
- **67% of Luton Airport passengers arrive at the airport in private vehicles.** In order to reduce emissions from surface transport, it will be imperative that passengers have access to affordable, regular public transport options to incentivise the shift away from current high levels of private vehicle use.
- **Luton Airport and several of the key airline companies situated in Luton are engaged through the Sustainable Aviation membership network** to apply a framework for managing air quality, emissions, noise and clean technologies in the aviation industry. This collaboration platform will be critical in ensuring the operations and activities of the associated businesses are considered in alignment and all stakeholders are involved in the commitment to reduce their impacts.
- Luton Borough Council has the ability to use its powers to convene key aviation businesses in the Luton area to encourage shared learning.
- The majority of flights taken from Luton Airport are for leisure rather than business, suggesting that the council could look at engaging with leisure travel passengers to consider alternative options. The Citizen's Assembly could provide a good forum for engagement with the public on this topic to help highlight the impact of aviation.
- **Over 70% of travellers from Luton Airport are residents of Greater London**, which could help to the council to identify and promote the best travel routes by public transport.

6. London Luton Airport Emissions

Methodology

This section provides an analysis of the emissions associated with London Luton Airport categorised into Scope 1 (direct), Scope 2 (indirect) and Scope 3 (other), as outlined in the Greenhouse Gas Protocol accounting methodology, the Global Protocol for Community-Scale Greenhouse Gas Emissions (GPC). The sources covered for aviation emissions within each scope are listed below:

Scope	Emissions source
Scope 1 - Direct emissions	• Emissions from energy use in airport buildings • Fuel combustion of all flights that take off and land within the city boundary • Fuel consumption of all vehicles owned/leased by the airport
Scope 2 - Indirect emissions	• Energy consumed by aircraft charging at the airport • Energy consumed by all airport owned/leased buildings
Scope 3 - Other	• Fuel consumed by departing aviation trips • Waste disposal • Water supply and treatment • Passenger vehicles arriving or departing from the airport • Staff commuting to the airport • Purchased goods and services

SCATTER aviation assessment

As per the GPC methodology and based on publicly available data, the SCATTER tool calculates aviation emissions using the following process:

- Data for aviation emissions is extracted from the Greenhouse Gas Inventories for England, Scotland, Wales & Northern Ireland: 1990-2017, Categories 1A3a and Aviation Bunkers for England, Wales, Scotland and Northern Ireland for Aviation Spirit and Aviation Turbine Fuel. This provides the total emissions for landing and take-off (LTO) and Cruise phases of UK flights. A percentage of total aircraft movements for each UK airport was calculated from the Civil Aviation Authority (CAA) 2017 dataset Table_05_Air_Transport_Movements, Airport data 2017, Civil Aviation Authority.

- Scope 1 emissions: LTO emissions are used as a proxy for flights that take off and land within the boundary of the local authority area. The disadvantage of this methodology is that LTO actually relates to flights that do not start and end in boundary (i.e. are not considered scope 1 according to the GPC methodology). Here it is used as a proxy to represent emissions relating to in-boundary flights e.g. police helicopters/'grass strip' flights that fall under this category, which do take off and land in-boundary.

- LTO emissions have been allocated to UK airports based on the percentage of total aircraft movements. Airport names have been manually matched to individual local authority codes in the Civil Aviation Authority air transport movements dataset. LTO tonnes of fuel were calculated from the total impacts using BEIS fuel emission factors. LTO impacts are reported as Scope 1 aviation. Using LTO as a proxy is consistent with the methodology applied within Greater Manchester and the Greater London Combined Authority[1] PAS 2070 assessments.

- Scope 3 emissions: Cruise impacts were allocated to LAs based on percentage of population, assuming that flying is uniformly distributed across the whole population. Cruise tonnes of fuel were calculated from the total impacts using BEIS fuel emission factors. Cruise impacts are reported as Scope 3 aviation.

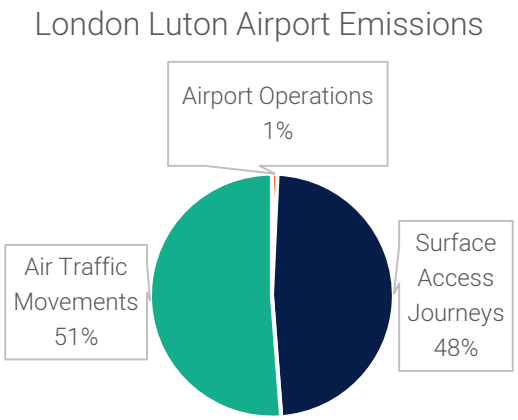
1 - https://shop.bsigroup.com/upload/PAS2070_case_study_bookmarked.pdf

6. London Luton Airport Emissions

GHG Emissions Profile

At the time of writing this report, no data was provided by London Luton Airport for analysis of GHG emissions for the airport. Therefore data from the London Luton Airport Limited (LLAL) Preliminary Environmental Information Report (PEIR 2019) is included here to provide an overview of the airport emissions profile. **99%** of London Luton Airport's emissions relate to air traffic movement and surface access journeys (Scope 3 emissions);

- Air traffic movement is responsible for the largest share, **51%** of all airport GHG emissions;
- There is a **huge opportunity to reduce emissions from surface access journeys** as these contribute nearly as much to Luton Airport's overall GHG profile as flight emissions;
- The PEIR report only assess CO_2 emissions and therefore excludes other gases such as **nitrous oxide and water vapour** due to scientific uncertainty of the scale of their impact, however these could add significant additional impact of CO_2 emissions from aviation;
- The airport's operations including **all buildings, assets and land side vehicles (Scope 1 and 2) emit just one percent of the overall GHGs.**



Emissions source	Description	Emissions ($MtCO_2$)	Data source
Airport Operations	GHG emissions from the operation of airport, buildings, assets, infrastructure and airside/land side vehicles.	0.014	LLAOL
Surface access journeys	GHG emissions from the transportation by land of passengers, staff and freight to/from the airport	0.91	ARUP/AECOM Transport Specialists
Domestic and international air traffic movements including Landing take-off cycle and cruise	Emissions from fuel used by aircraft during the landing take-off cycle (including decent/ascent up to 3000ft) and during the cruise phase of flight (departures from Luton only to avoid double counting)	0.97	DfT, Aviation Forecast 2017 (Ref 8.38)

Source: London Luton Airport Limited (LLAL) Preliminary Environmental Information Report (data from 2017)

Anthesis and Luton Borough Council are in discussions with London Luton Airport Ltd. (LLAL) and London Luton Airport Operations Ltd. (LLAOL) and hope to update this section with more detailed information on the airport emissions following additional data collation.

Further analysis on the passengers using Luton Airport is provided on the next page.

6. London Luton Airport Emissions

Passenger analysis

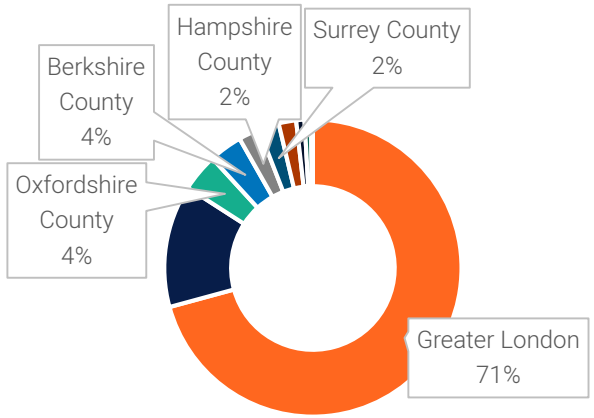
In order to understand the profile of passengers at Luton Airport, survey data provided by the Civil Aviation Authority (CAA) has been included.

- The majority of passengers (**54%**) terminating their journeys at Luton Airport are from the South East region;
- However Luton Airport is the **least frequently used airport for South East passengers** compared to the other surveyed South East airports (Gatwick, Heathrow, London City and Stansted);

Region	Gatwick		Heathrow		London City		Luton		Stansted	
	000's	%	000's	%	000's	%	000's	%	000's	%
East Midlands	609	1.5	1,266	2.5	16	0.4	1,293	8.3	815	3.4
East of England	3,076	7.5	4,253	8.3	352	8.0	4,890	31.4	7,427	30.7
North East	104	0.3	86	0.2	0	0.0	24	0.2	75	0.3
North West	185	0.4	375	0.7	0	0.0	75	0.5	118	0.5
Scotland	105	0.3	101	0.2	0	0.0	7	0.0	37	0.2
South East	33,487	81.3	38,995	76.1	3,965	90.3	8,278	53.2	14,560	60.2
South West	2,207	5.4	3,513	6.9	36	0.8	327	2.1	469	1.9
Wales	460	1.1	901	1.8	5	0.1	95	0.6	105	0.4
West Midlands	618	1.5	1,274	2.5	11	0.3	433	2.8	323	1.3
Yorkshire and the Humber	327	0.8	497	1.0	5	0.1	129	0.8	274	1.1
Northern Ireland & Eire	3	0.0	13	0.0	0	0.0	0	0.0	0	0.0

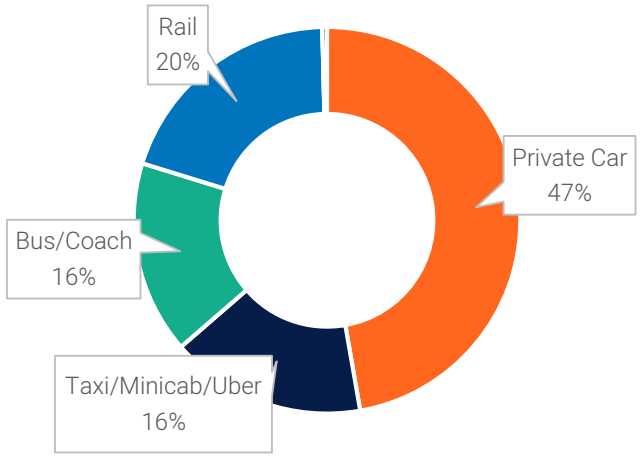
Source: Civil Aviation Authority 2017 Passenger Survey Report Table 4.3a. Only South East airport figures are included in the table above.

Origin/desitnation of passengers terminating at Luton Airpot



- **71%** of passengers terminating at Luton Airport list Greater London as their origin/destination;
- **Private transport is more frequently used to arrive at Luton Airport**, with **66.6%** of passengers listing private transport as their mode of arriving at the airport, 33.2% public transport and 0.2% other;
- According to the CAA 2017 passenger survey, **Luton Airport has the highest proportion of passengers using private transport out of all South East Airports**
- **Luton Airport passengers have the highest proportion of private car use** of any of the South East airports, suggesting an untapped opportunity to reduce surface transport emissions by encouraging the shift to public transport options.

Main mode of surface transport to Luton Airport



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6. London Luton Airport Emissions

Luton Airport, Income of UK & Foreign Passengers

In total, Luton Airport served over 16 million UK and international passengers in 2018[1]. Most flights out of Luton airport are international, while 8% are domestic.

This analysis aims to explore the correlation between income, air travel and emissions to help inform an understanding of income profile and residence of passengers at Luton Airport.

- Analysis of the 2018 Civil Aviation Authority (CAA) annual passenger survey reports[2] demonstrate that the **largest number of terminal passengers at Luton Airport fall within the £57,500 - £80,499** salary band (approximately 191,804 terminal passengers).
- **First class long-haul flights outside of Europe are responsible for the highest level of CO_2 emissions, accounting for 0.6 tCO_2e per passenger-km**. This includes the influence of radioactive forcing, in order to capture the maximum climate impact[3].
- **89% of passengers in the CAA survey were flying for leisure**, while only 11% were business related flights.
- **60% of passengers within the £57,500 - £80,499 salary band were UK passengers travelling between international/non-UK destinations.** The emissions per passenger-km associated with this type of air travel account for an average of approximately **0.2 tCO_2e**.

			Mean income
UK passengers	Business	International	£73,561
		Domestic	£72,276
	Leisure	International	£44,651
		Domestic	£52,162
Foreign Passengers	Business	International	£62,610
		Domestic	£79,601
	Leisure	International	£53,576
		Domestic	£61,252
ALL	Business	Total	£69,992
	Leisure	Total	£46,898

UK Domestic & Foreign Terminal passengers at Luton Airport (CAA, 2018)

Please note the surveys includes personal income for business passengers and household income for leisure passengers travelling through the airport.

1 – https://www.caa.co.uk/Data-and-analysis/UK-aviation-market/Airports/Datasets/UK-Airport-data/Airport-data-2018/
2 - https://www.caa.co.uk/Data-and-analysis/UK-aviation-market/Consumer-research/Departing-passenger-survey/2018-Passenger-survey-report/
3 - https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2019

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7. Stakeholder Engagement Sessions

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7. Stakeholder Engagement Sessions - Internal

Council Officers and Elected Members

Overview

This section reviews the results and discussion of internal and external stakeholder engagement sessions. In order to understand the barriers and enablers as observed by Luton Borough Council's members and officers, two engagement sessions were held, during which participants discussed the feasibility of various emissions reduction measures which feature within SCATTER. These measures related to various energy system sectors, including buildings (both domestic and non-domestic), transport, industry and waste. A more detailed description of the SCATTER model can be found in Section 2.

Following discussion of each measure and the different ambition levels, participants cast votes on the level of ambition they deemed feasible for the borough, with Level 1 being the lowest level of ambition and Level 4 being the highest. These ambition levels were then input into the model to define a tailored emissions reduction pathway for both the members and the officers.[1] An average of these two voting records was subsequently derived to produce a tailored emissions reduction pathway.

Key voting outcomes

1. The pathway for both officers and members is roughly consistent with a Level 3 ambition scenario. At Level 3 ambition, Luton would overspend on its carbon budget by approximately 60%.
2. Members and officers were similarly ambitious within transport and domestic building interventions. The largest contrasts were in the waste sector where members were more ambitious on the feasibility of levels of waste reduction and recycling
3. The radical step changes required by the renewable energy measures limited the ambition of the voting to Level 1 from most participants.

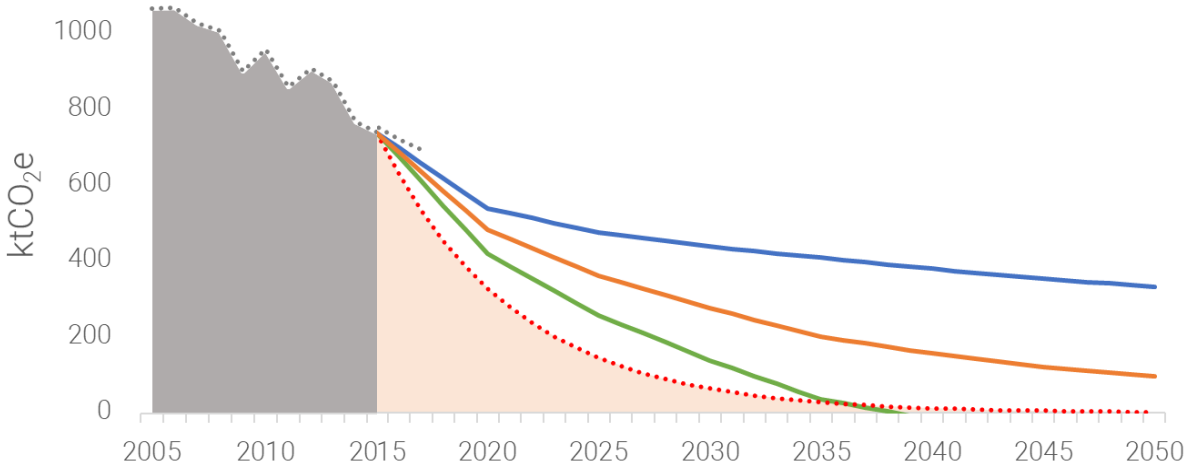
Learnings at a glance

- **Engagement and education of local people, in particular younger people, is a priority.** The ambitions of citizens' and Youth Climate Board representatives should be used to inform further development of priorities. Ahead of the Citizens' Assembly, a representative demographic for each ward of the borough must be encouraged to attend.
- **Overlap with existing Council aims is significant.** Measures and schemes across domestic retrofit, transport and waste all serve to meet the Council's aim to eradicate poverty within Luton by 2040. Within each sector a number of co-benefits exist; eliminating fuel poverty, encouraging active transport and improving air quality are intrinsically linked to improving the standard and quality of life of local residents whilst delivering emissions reductions.
- **Collaboration across Council departments is essential to progress these ambitions.** Actions and projects sit across various departments within the Council and meeting as a group encourages knowledge sharing and coherent strategy planning. Ensuring that efforts are 'joined-up' will result in faster-moving action and quicker wins.
- **Significantly increasing renewable energy supply represents a challenge, for various reasons.** Due to the borough's small area, implementing land-intensive technologies such as onshore wind will be extremely difficult. This places greater responsibility on technologies such as solar PV, which need to become more commercially viable before widespread implementation can happen.

1 – Given that the model is based upon more measures than time allowed discussion for, some measures within the model were estimated based upon voting patterns and comments in similar intervention areas that took place during the workshop.

7. Stakeholder Engagement Sessions – Internal

Voting Results



The above graph demonstrates a number of different emissions pathways for Luton (for an annotated version, see page 10). **The orange line is reflective of the votes cast by officers and members during their respective workshops.**

In cumulative terms, to 2050, the pathway that was voted for represents an emissions budget overspend of just over 60%.

The above table is an assessment of the Luton emissions budget overspend as compared to the Tyndall budget. The cumulative budget describes the total amount of emitted carbon, and the 'equivalent number' column gives an indication of how far over-budget emissions may go.

For reference, the other SCATTER pathways are also included. The 'business-as-usual' or 'BAU' row describes a future pathway where emissions remain at 2017 levels all the way to 2050.

The average ambition level varied across different sectors for both groups, but was roughly consistent with a 'Level 3' pathway. The most ambitious voting was around transport – distance reduction and modal shift measures averaged 3 across both groups. Electrification of domestic heating and improvements to lighting and appliances were two other interventions which garnered the most ambitious voting (i.e. a majority of 3's and 4's). Less ambitious voting was centred on the improvement of renewable energy supply sources, given the sharp increase in uptake required to meet Levels 1 & 2.

Voting on waste treatment was the main difference between the two groups. For officers, the average vote was at Level 2, whereas for members the ambition level was between Level 3 and Level 4 (across waste reduction and recycling rate measures). This discrepancy in the two groups is not very strongly represented in the different pathways given the relatively small proportion of in-boundary emissions resulting from waste disposal and treatment.

Pathway	Cumulative Budget to 2050 ($MtCO_2e$)	Equivalent number of Paris-aligned budgets required
Tyndall Paris-aligned budget 2015-50[1]	6.58	-
Level 1	16.24	2.5
Level 2	14.93	2.3
Level 3	9.62	1.5
Level 4	6.16	0.94
Officers' Pathway	**10.88**	**1.6**
Members' Pathway	**10.74**	**1.6**
BAU	25.83	3.9

1 – Note that this budget is calculated from a combination of the Tyndall budget 2018-2100 and historical BEIS datasets from 2015-17 to reflect the fact that the SCATTER pathways begin in 2015.

7. Stakeholder Engagement Sessions – Internal

Discussion

Domestic Property

- **Luton needs an attractive platform for private homeowners to invest in retrofit measures.** Too many residents 'fall through the cracks' in terms of eligibility for grant funding and being able to finance retrofit projects themselves. Any scheme that the Council endorses must therefore appeal to as broad a range of incomes and housing stock types as possible, including those residents with middle incomes.

- **All residents will have to replace their boiler system within the next 15-20 years**, so opportunity exists to encourage a switch to electrified heating systems such as heat pump technology. Challenges around public perception of air-source heat pumps persist and this may slow down their uptake. The added demand on space that heat pumps incur may also be a barrier in smaller homes.

- **Domestic retrofit programmes offer huge opportunity for upskilling and improving the regulations for new build properties is necessary.** Stimulating a skills market to support retrofit demand can create potentially large numbers of jobs in a transition to a green economy. *According to the UK Green Building Council, 23 person years of employment could be created for every £1m invested in retrofit.*[1]

- **Domestic retrofit offers massive co-benefit potential.** Reducing energy bills for Luton's residents and eliminating fuel poverty links directly to the Council's target of eradicating poverty by 2040. Heat-saving insulation can also provide acoustic insulation from noise pollution close to the airport. *Emissions from gas heating systems contribute a fifth of NO_x emissions in urban areas, and for every pound spent on reducing fuel poverty an estimated 42 pence is expected in annual NHS savings.*

- **Luton has a potential coverage exceeding 80% for PV installation on domestic property.**

Transport

- **Luton is heavily congested and over-reliant on car travel. Modal shift of transport away from cars should be a high priority.** The associated health benefits of active transport and improvements in air quality offer the capacity for joined-up planning between different departments within the Council.

- **EV charging infrastructure and cycling infrastructure requires significant investment.** Vehicle-to-grid charging capacity could also be considered and grid reinforcement may be needed to meet the increased demand on electricity as EV uptake increases. *Current national trends indicate that sales of EV are increasing 69% per annum whilst charging infrastructure growth is much lower, at 31% per annum.*

- **Plans for clean air zones in some areas (e.g. outside schools) could be more ambitious.** It is also important to avoid becoming a 'sink hole' for high-emitting vehicles pushed out of Greater London, as has happened in other satellite regions. *Bristol City Council recently announced plans for a diesel vehicle ban across some areas of the city and plan to introduce a levy for diesel vehicles travelling at certain times of the day.*

- **The maximum number of passengers using Luton airport will grow significantly over the next decade, from 19 million to over 32 million.** *For an in-depth analysis of the airport's emissions and what that means for Luton's emissions, see Section 6. Luton Airport's current passenger figures for 2018 were 16.6 million.*

1 – https://www.ukgbc.org/wp-content/uploads/2017/09/08498-Regen-Retrofit-Report-WEB-Spreads.pdf

7. Stakeholder Engagement Sessions – Internal

Discussion

Industry

- **Collaboration and buy-in from the region's key private sector partners will be essential for meaningful changes to Luton's emissions.** The Council has good relationships with a number of commercial organisations within the borough. *Council-Business Alliances have proven an effective means of engaging private sector partners with emissions reductions targets. See the CDP Guidebook.*
- **Developing technologies like carbon capture and storage (CCS) may not be directly useful to the region.** This is down to the industrial profile of the borough and the types of businesses that trade within boundary. A greater focus on electrification of industrial processes, as well as improvements in efficiency, are more achievable goals for the borough.
- **Improving the means of space heating in industrial facilities is a potential quick win.** More efficient methods of heating large buildings such as warehouses and factories can drastically reduce energy demand. Infrared heating is a potential solution over convection heating.

Waste

- **Luton's residents throw away over £30m worth of food every year.** Emphasis must be placed on reducing usage and the quantity of waste per household as well as improving recycling rates. *Luton's waste strategy sets out the target of reducing average annual food waste from 19,600 tonnes to 15,000 tonnes by 2028.*
- **More stringent 'comply or pay' regulations may be preferable over incentives.** This is seen as a means of encouraging behaviour changes. Nudges such as reforming the frequency of waste collections for certain categories of waste could also create change in this area.
- **Analysis of higher waste areas may inform future projects around waste management.** An understanding of the correlation between median household income and quantity of waste produced may guide the modality of any incentives (or indeed compliances).

Conclusions and next steps

The workshop highlighted the importance of cross department collaboration to consider which levers needed to shift to enable current policies to support the low carbon transition. There is potential for future sector specific workshops to explore in greater detail how to overcome the challenges and maximise the co-benefits and opportunities of each emissions reduction measure.

7. Stakeholder Engagement Sessions – External

Carbon Neutral Commercial Workshop Feedback

Overview

Following identification of large businesses and high emissions organisations in the borough, an invitation was sent to a number of high emitting and large businesses to invite them to attend a workshop to identify opportunities and barriers in implementing low carbon activities in their businesses as part of supporting Luton Borough Council to accelerate carbon reductions across the borough.

Outcomes

- There is **appetite from businesses in Luton to work collaboratively** to support the council's climate ambitions;
- Many large businesses in Luton have **demonstrated emissions reduction through improving efficiency** of operations and processes;
- These more environmentally mature businesses are **now seeing emissions plateau would benefit from support on how to make deeper emissions cuts** beyond what has already been achieved;
- There is an **opportunity to share knowledge and best practice in local clusters or geographic locations**, especially between larger businesses and SMEs. This was seen as a more viable option for progress than sector specific engagement, since many sector specific working groups already exist;
- **Financing is one of the key barriers** to businesses enacting more significant change in their energy supply;
- There are **many alignments between Luton's zero poverty ambition and the net zero carbon ambition**, which businesses could help tackle;
- The council could facilitate business engagement to ensure there is a continued forum for knowledge sharing, especially through existing business forums.

Feedback

Attendees were invited to discuss the barriers and enablers to emissions reduction activities and any key areas they had succeeded with. The feedback was collated via a written questionnaire (see Appendix 8), though most attendees preferred to take the questionnaire back to their colleagues to compile feedback. Feedback from those who did complete the questionnaire on the day has been summarised in the following pages.

Businesses invited:

- FCC Recycling
- CEMEX UK CEMENT LTD
- Vauxhall
- LUTON AND DUNSTABLE HOSPITAL NHS TRUST
- ENGIE Regeneration
- University of Bedfordshire
- Luton Town Football Club
- Luton Airport Operations
- Bristol Laboratories
- EasyJet
- Tui
- Monarch
- Harrods Aviation
- Signature Flight
- Leonardo
- Arriva The Shires Ltd
- DHL

7. Stakeholder Engagement Sessions – External

Carbon Neutral Commercial Workshop Feedback

Opportunity to do more

Feedback collated during the commercial stakeholder workshop indicated that each of the businesses were at various stages of maturity in terms of environmental performance, and that each of the sectors they represent have their own specific challenges and associated requirements which have encouraged the businesses to take more action. Many of the businesses who attended were leading organisations that have already demonstrated reductions and are keen to know how they can support the borough to achieve its ambitions beyond what they are doing already. Some of the feedback provided in response to the questionnaire section on opportunities to take further action (Appendix 8) is summarized below with respondents asked to rank the listed opportunities from 1-5.

Action category	Organisation A	Organisation B	Organisation C	Organisation D
Reduce stationary energy demand	5	2	1	1
Increased low-carbon energy supply	2	5	3	4
Shift to low-carbon transport	3	5	1	5
Reduce waste and improve 'circularity'	4	1	1	2
Improve natural assets	1	3	3	3

Key:

1 – Best opportunity for further action
2 – Some opportunity for further action
3 – Limited scope for further action
4 – Minimal scope for further action
5 – No opportunity for further action

7. Stakeholder Engagement Sessions – External

Carbon Neutral Commercial Workshop Feedback

Barriers to action

Over 60% of the barriers reported during the session related to finance, indicating there is a strong need for new and innovative financial models in order for these activities to be implemented further. The need for strong leadership buy-in and commitment was noted as a key enabler, which helped to catalyse action in some businesses. Attendees responses to the questionnaire (Appendix 8) section on barriers to implementing actions are summarised below. The full list of barriers provided to respondents is provided on the next page.

Action category	Organisation A	Organisation B	Organisation C
Reduce stationary energy demand	F4 – Measurement of impact	F1 – Access to capital	F2 – Payback/ROI
Increased low-carbon energy supply	P1 – Local government	Already 100% renewable	K1 – solution identification/design specification
Shift to low-carbon transport	F1 – Access to capital	Not in our control – third party	F4 – Measurement of impact
Reduce waste and improve 'circularity'	F4 – Measurement of impact	F2 – Payback/ROI F4 – Measurement of impact	K1 – solution identification/design specification F2 – Payback/ROI
Improve natural assets	F2 – Payback/ROI	F1 – Access to capital G1 – Leadership engagement	F1 – Access to capital

Some key barriers include:

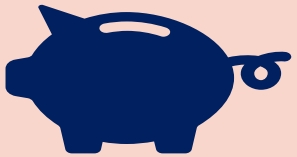
- Capital cost of investment
- The need for demonstrating payback on emissions reduction activities
- Some activities are outside of the businesses control and require third party decisions
- Buy-in from senior leadership

7. Stakeholder Engagement Sessions – External

Carbon Neutral Commercial Workshop Feedback

Attendees of the workshop were provided with a list of common barriers faced by organisations (below) categorised into key themes of Financial, Governance, Knowledge, Policy and Physical barriers. Respondents were also encouraged to share any additional barriers that were not listed where relevant.

Financial



F1 Access to capital or finance
F2 Payback period / ROI
F3 Team capacity
F4 Measurement of impact

Governance

G1 Leadership engagement
G2 Team structure
G3 Internal policy & process
G4 Culture & behaviour
G5 Key Performance Indicators & incentives

Knowledge

K1 Solution identification or design specification
K2 Carbon & climate literacy
K3 Access to knowledge and communication

Policy

P1 Local Government
P2 National Government
P3 Industry/Trade body

Physical

M1 Disruption to operations or individuals
M2 Physical constraints (i.e. space or location)

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7. Stakeholder Engagement Sessions – External

Carbon Neutral Commercial Workshop Feedback

Achievements to date

Businesses who attended the workshop had already undertaken some steps toward reducing emissions from their activities and many have targets in place to maintain reductions. Many businesses also raised a concern that once the core of reduction measures had been implemented, that their emissions were plateauing, suggesting a need for understanding how continued reductions could be maintained.

Action category	Organisation A	Organisation B
Reduce stationary energy demand	2	1
Increased low-carbon energy supply	1	5
Shift to low-carbon transport	5	1
Reduce waste and improve 'circularity'	3	1
Improve natural assets	4	5

Some activities that have been undertaken to date:

- Switching to LED lighting and power bars
- Switching to a 100% renewable energy supplier
- Implementing smart meters
- Coffee cup scheme to reduce waste
- Investing in electric vehicle charge points
- Channelling waste to anaerobic digestion facilities for reclaiming energy
- Considering green roofs
- Considering solar panels for on-site renewable energy generation

Key:

1 – Best achievement to date in this action area
2 – Some achievements to date in this action area
3 – Limited achievements to date in this action area
4 – Very little achievements to date in this action area
5 – No achievements to date in this action area

Appendices

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Appendix 1
Data Tables for SCATTER and BEIS Emissions Summaries

Sector	Scope 1 & 2 Emissions, $ktCO_2$
Industry and Commercial Electricity	106.2
Industry and Commercial Gas	71.4
Large Industrial Installations	0
Industrial and Commercial Other Fuels	33.1
Agriculture	0.5
Domestic Electricity	71.5
Domestic Gas	187.6
Domestic 'Other Fuels'	6.2
Road Transport (A roads)	48.5
Road Transport (Motorways)	37.5
Road Transport (Minor roads)	106.4
Diesel Railways	6.2
Transport Other	21.6
LULUCF Net Emissions	-1.6
Grand Total	**694.9**

Notes:
- BEIS data (above) and SCATTER data (right) are compiled using different methodologies. The SCATTER model operates on 2016 data. BEIS data is from 2017.
- 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.

IE	= Included Elsewhere
NE	= Not Estimated
NO	= Not Occurring

Sub Sector	Direct, $ktCO_2e$	Indirect, $ktCO_2e$
Residential buildings	184.1	100.7
Commercial buildings & facilities	26.1	16.1
Institutional buildings & facilities	52.9	81.3
Industrial buildings & facilities	30.5	47.1
Agriculture	0.3	IE
Fugitive emissions	0	0
On-road	167.7	IE
Rail	5.5	IE
Waterborne navigation	0	NO
Aviation	160	IE
Off-road	0	0
Solid waste disposal	7.2	0
Biological treatment	0	0
Incineration and open burning	0	0
Wastewater	13.6	0
Industrial process	0	0
Product use	0	0
Livestock	2.3	0
Land use	0	0
Other AFOLU	NE	0
Electricity-only generation	0	0
CHP generation	0	0
Heat/cold generation	0	0
Local renewable generation	0	0
Sub-total	**650.3**	**245.2**
Grand total	**895.5**	

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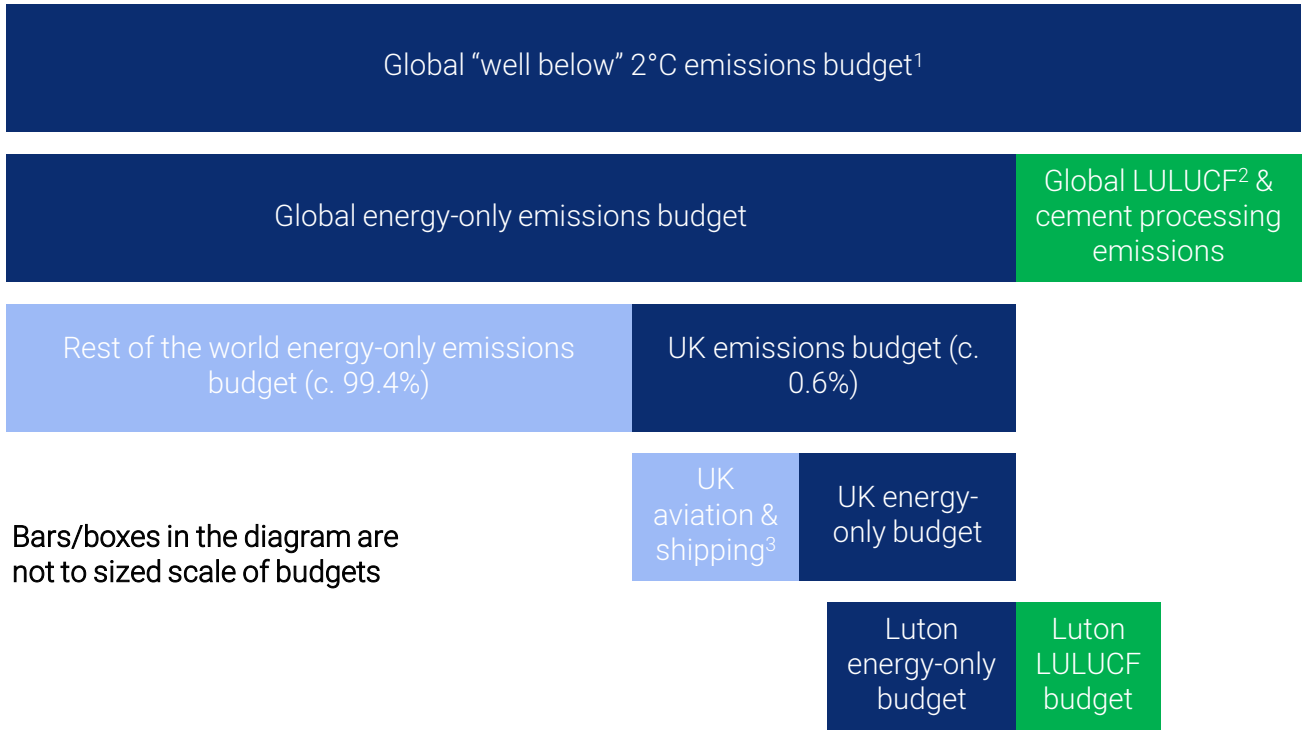
Appendix 2
Deriving the Luton carbon budget



The borough's carbon budget defines a finite emissions limit that should not be exceeded in order that Luton plays its full part in adhering to the Paris Agreement.

The global budget is taken from the IPCC Special Report on 1.5 °C and represents the latest IPCC estimate of the quantity of CO_2 that can be emitted whilst remaining consistent with keeping global temperatures below 2 °C.

The carbon budget report is available here.

1 - Budget derived from IPCC AR5 synthesis report and represents a 66-100% probability of global warming not exceeding 2°C ("well below"). Due to the inertia in our energy systems and the amount of carbon we have already emitted, the Paris 1.5°C commitment is now only likely to be viable if negative emissions technologies (NETs) prove to be successful at a global scale. If the 15% emissions reduction rates for Trafford are achieved and NETs are deployed at the scales assumed in the global models, then the targets adopted may be considered as a 1.5°C compatible. This also expressly assumes that other carbon cycle feedbacks, such as methane released due to melting permafrost etc., do not occur, and that an overshoot of 1.5°C does not result in increased feedbacks that further accelerate warming at lower budgets than the IPCC budgets currently estimate.
2 - Land Use, Land Use Change & Forestry
3 - UK Aviation & Shipping is accounted for at the national level. If emissions due to aviation and shipping increases, then a smaller proportion of the UK-wide budget is available for the energy-only budget and vice versa.

Appendix 3
Summary list of interventions and modification summary

Measure	Updated from original Pathways Calculator?
Energy generation & storage	
Onshore wind	N
Biomass power stations	Y
Solar panels for electricity	N
Solar panels for hot water	N
Storage, demand shifting & interconnection	N
Geothermal	N
Hydro	N
CCS	N
Bioenergy sourcing	
Increase in land used to grow crops for bioenergy	Y
Reduction in quantity of waste	N
Increase the proportion of waste recycled	Y
Bioenergy imports	N
Transport	
Reducing distance travelled by individuals	N
Shift to zero emission transport	Y
Choice of fuel cell or battery powered zero emission vehicles	N
Freight: Shift to rail and water and low emission HGVs	N

Measure	Updated from original Pathways Calculator?
Domestic buildings	
Average temperature of homes	N
Home insulation	Y
Home heating electrification	Y
Home heating that isn't electric	N
Home lighting & appliances	N
Electrification of home cooking	N
Commercial buildings	
Commercial demand for heating and cooling	Y
Commercial heating electrification	Y
Commercial heating that isn't electric	N
Commercial lighting & appliances	N
Electrification of commercial cooking	N
Industrial processes	
Energy intensity of industry	Y

Notes:

- Updates flagged do not include scaling to local region – it is assumed that this happened for all measures. They relate to instances where the upper threshold of the ambition has been pushed further(i.e. at Level 4)
- Updates exclude alignment of Level 1 ambition to the National Grid FES (2017)
- Note that bioenergy source did not have material bearing on the model due to assumptions linked to bioenergy shortfalls (i.e. it is assumed that bioenergy would be sourced from outside of region, or another renewable source would be used). Waste assumptions may however drive more sustainable consumption behaviours.

Appendix 4
Domestic retrofit measures assumed within SCATTER

Retrofit Measure	Number of households retrofitted per annum						
Year	2020	2025	2030	2035	2040	2045	2050
Solid wall insulation	719	747	773	804	1,039	8	8
Cavity wall insulation	1,523	122	111	114	348	-	-
Floor insulation	821	852	882	917	1,185	891	891
Superglazing	1,632	1,694	1,753	1,824	2,357	1,771	1,771
Lofts	1,821	1,883	1,943	2,022	2,669	-	-
Draughtproofing	5,735	342	313	321	965	9	9

Notes:

- This data is included within SCATTER but is not directly linked to the emissions calculation in the model (it was used to inform cost assumptions in the original legacy DECC 2050 Pathways calculator).
- The numbers shown are the minimum assumed measures for the L4 Pathway, as ambition was pushed further than the legacy DECC tool to which this table relates.
- 2050 household levels are predicted to be 106,236, derived from non-region specific growth assumptions in legacy DECC Pathways tool.
- Household is defined as per https://www.gov.uk/guidance/definitions-of-general-housing-terms#household
- The average heat loss per home includes new builds (at PassivHaus standard), which will contribute to lowering the average over time.
- For further detail, please refer to Section D of the DECC 2050 Pathways guidance:

Appendix 5
Energy Performance Certificates (EPCs)

Non-domestic EPC ratings for Luton, 2008-19	
EPC rating	Number of lodgements
A	19
A+	1
B	176
C	668
D	756
E	371
F	139
G	117
Not Recorded	0
Total number of lodgements	2,247

Domestic EPC ratings for Luton, 2008-19	
EPC Rating	Number of lodgements
A	9
B	1,117
C	15,365
D	24,936
E	12,826
F	2,504
G	504
Not Recorded	0
Total number of lodgements	57,261

Notes:

- Defining in terms of 'lodgements' allows direct comparison between domestic and non-domestic property.
- Only 75% of domestic properties carry a publicly available EPC rating.
- Live reporting on the EPC ratings of all properties (both domestic and non-domestic) can be found at: https://www.gov.uk/government/statistical-data-sets/live-tables-on-energy-performance-of-buildings-certificates#epcs-for-all-properties-non-domestic-and-domestic

Appendix 6
Domestic & commercial heating and hot water systems assumed within SCATTER

Heating and hot water systems share, as a % of households (domestic)				
Technology package	2020	2025	2030	2050
Gas boiler (old)	37%	31%	25%	-
Gas boiler (new)	34%	28%	23%	-
Resistive heating	7%	7%	7%	7%
Oil-fired boiler	6%	5%	4%	-
Solid-fuel boiler	2%	2%	1%	-
Stirling engine μCHP	-	-	-	-
Fuel-cell μCHP	-	-	-	-
Air-source heat pump	9%	18%	26%	60%
Ground-source heat pump	4%	9%	13%	30%
Geothermal	-	-	-	-
Community scale gas CHP	-	-	-	-
Community scale solid-fuel CHP	-	-	-	-
District heating from power stations	-	1%	1%	3%

Heating and hot water systems share, as a % of households (commercial)				
Technology package	2020	2025	2030	2050
Gas boiler (old)	45%	37%	30%	-
Gas boiler (new)	16%	13%	11%	-
Resistive heating	18%	16%	14%	7%
Oil-fired boiler	8%	7%	5%	-
Solid-fuel boiler	-	-	-	-
Stirling engine μCHP	-	-	-	-
Fuel-cell μCHP	-	-	-	-
Air-source heat pump	9%	17%	26%	60%
Ground-source heat pump	4%	9%	13%	30%
Geothermal	-	-	-	-
Community scale gas CHP	-	-	-	-
Community scale solid-fuel CHP	-	-	-	-
District heating from power stations	-	1%	1%	3%

Notes:

- Domestic (left) and commercial (right) share of heating technologies assumed within SCATTER
- Matrix is unchanged from original DECC Pathways Calculator. It is acknowledged newer technologies or fuel sources such as hydrogen are not reflected in this tool.

Appendix 7
Transport assumptions

Projection of modal share of all passenger transport (units: % of passenger-km)			
Mode	2015	2050 BAU	2050 L4
Walking	4%	4%	4%
Bicycles	1%	1%	5%
Cars, Vans and Motorcycles	80%	80%	62%
Buses	5%	5%	19%
Railways	9%	9%	10%
Travel demand relative to 2015	100%	100%	75%

Ambition level (units: Pax* / vehicle-km) @ 2050			
Mode	2015	2050 BAU	2050 L4
Cars, Vans and Motorcycles	1.56	1.56	1.65
Buses	11.32	11.32	18.00
Railways	0.32	0.37	0.42

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*Pax ~ people/persons/occupants

Appendix 8

Carbon Neutral Commercial Workshop Questionnaire

Organisation:	

For each action category…

Action Category	Rank by opportunity to 'do more'	Describe the most significant barrier (see table below)	Rank by most effective emission reduction achievements to date	Highlight key experiences that others may be able to learn from
Reduce stationary energy demand				
Increased low-carbon energy supply				
Shift to low-carbon transport				
Reduce waste and improve 'circularity'				
Improve natural assets				

Notes:

- Rank 1-5 with 1 being the 'best' opportunity/most effective achievement and 5 being the 'worst'/least effective
- The defined barriers serve as indicative groupings only; feel free to note down a barrier that is not within the table
- Highlight as many experiences/learnings as are relevant; we acknowledge that there may only be one or two examples to draw on

Financial	Governance	Knowledge	Policy
F1 – Access to capital	G1 – Leadership engagement	K1 – solution identification/design specification	P1 – Local government
F2 – Payback/ROI	G2 – Team structure	K2 – Carbon & climate literacy	P2 – National Government
F3 – Team capacity	G3 – Internal policy & process		P3 – Industry/trade body
F4 – Measurement of impact	G4 – Culture & behaviour		
	G5 – KPIs & Incentives		

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