Baseline Report

Climate Change Adaptation & Mitigation

Staffordshire County Council

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Revision 04

Quality information

Prepared by	Checked by	Verified by	Approved by
Harper Robertson Senior Sustainability Consultant Alice Purcell Graduate Sustainability Consultant Luke Mulvey Graduate Sustainability Consultant	Luke Aldred Associate Director	Luke Aldred Associate Director	Matthew Turner Regional Director

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Prepared for:

Staffordshire County Council

Prepared by:

Harper Robertson
Senior Sustainability Consultant
E: harper.robertson@aecom.com

AECOM Limited
Aldgate Tower
2 Leman Street
London E1 8FA
United Kingdom
aecom.com

Executive Summary

AECOM has been commissioned to provide technical support to develop an evidence base for new energy and sustainability policies being considered for Staffordshire County Council and its eight constituent Local Authorities. This Baseline Report is an interim deliverable which summarises the key findings to date with respect to quantifying the current energy and greenhouse gas emissions for each of the Local Authorities, and the expected future emissions trajectories should key interventions be facilitated.

Policy context

Most of the Local Authorities are undergoing updates to their Local Plans. Many of the Authorities have also declared a Climate Emergency, or are in the process of doing so, and have set target dates for achieving Net Zero emissions. Whilst the target dates for Net Zero vary from Authority to Authority, several are targeting 2030. The policy positions for each Authority are summarised in Table 1.1.

Table 1.1: Summary of policy positions by Local Authority

Authority	Local Plan update	Climate Emergency Declaration (and target year, if applicable)
Cannock Chase District Council	Yes	Yes (2030 target)
East Staffordshire Borough Council	No	No
Lichfield District Council	Yes	No
Newcastle-under-Lyme Borough Council	Yes	Yes (2030 target)
South Staffordshire District Council	Yes	Yes
Stafford Borough Council	Yes	Yes (2040 target)
Staffordshire Moorlands District Council	Yes	Yes (2030 target)
Tamworth Borough Council	Yes	Yes (2050 target; 2030 aspiration)
Staffordshire County Council	n/a	Yes

Baseline Fuel Consumption

Total fuel consumption in Staffordshire is estimated to be c. 22,481 GWh as of 2018. Overall, fuel use is dominated by natural gas, petroleum products and electricity (which together account for over 93.6% of the total for Staffordshire County as a whole), with the remaining c.6.4% being met by manufactured fuels, bioenergy& waste, and coal. This is shown in Figure 1-1.

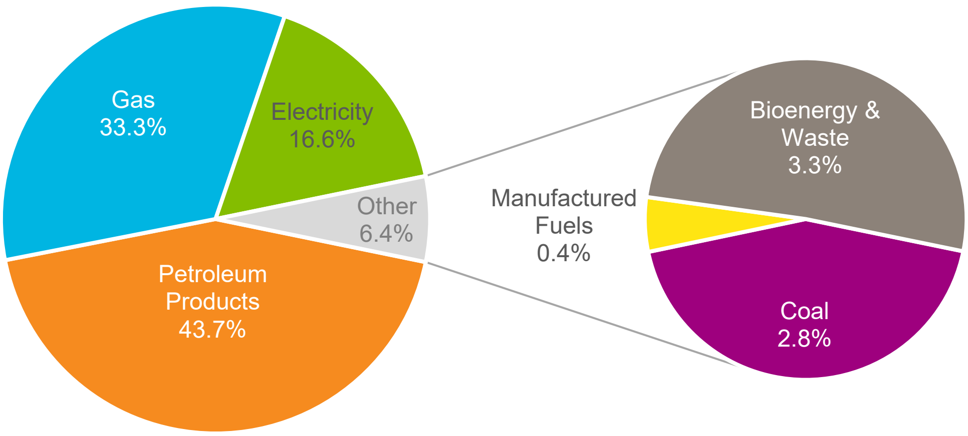

Figure 1-1: Fuel consumption by fuel type in 2018 - Staffordshire

As shown in Figure 1-2 below, the road transport sector has the highest annual fuel use; in 2018 this was 8,183 GWh (around 43.7% of the total). Fuel use in domestic buildings was 6,825 GWh (30% of the total) and fuel use in non-domestic buildings was 7,051 GWh (31% of the total).

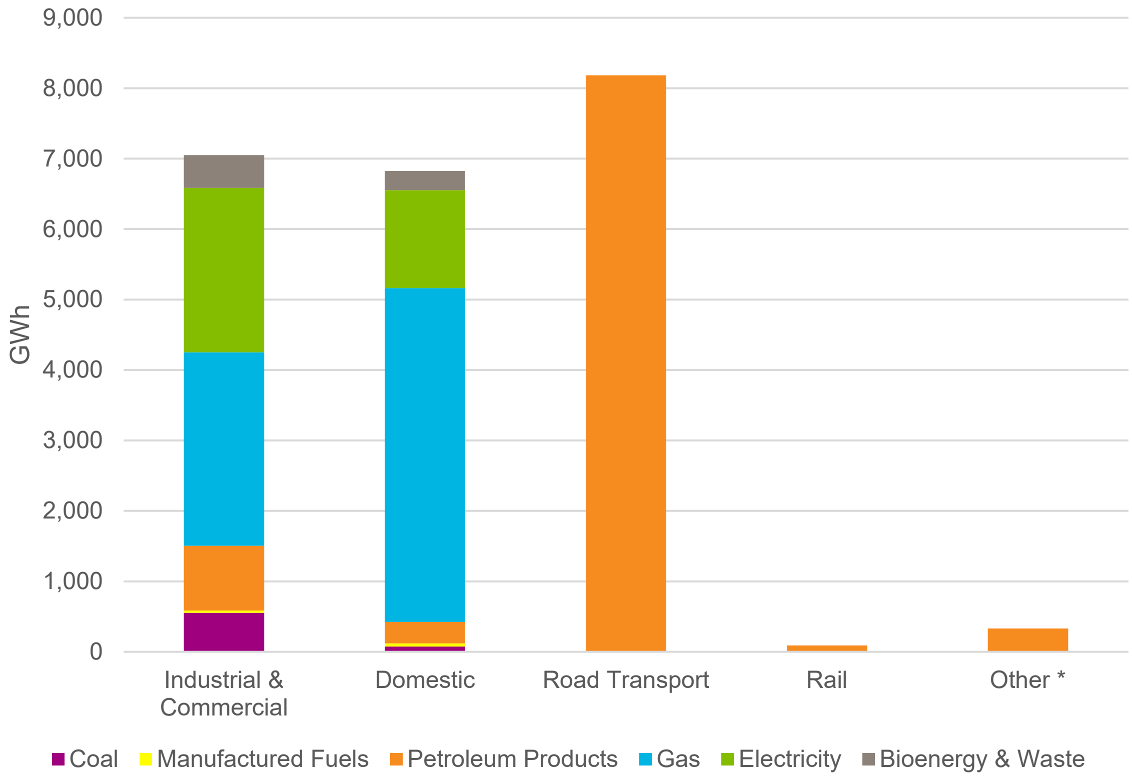

Figure 1-2 : Fuel consumption by sector and fuel type in 2018 - Staffordshire

The split of fuel consumption varies by Local Authority. In this report the fuel consumption is presented for each Local Authority, broken down by fuel type (e.g. natural gas, electricity, etc.) and by sectoral usage (e.g. dwellings, road transportation, etc.).

Broadly speaking, in most Staffordshire Local Authority areas, fuel use is dominated by road transport petroleum, followed by natural gas and then electricity. In Tamworth and Cannock Chase, use of petroleum is much lower, which probably reflects the fact that these areas are small and relatively built up. A notable exception is Staffordshire Moorlands, which has a much higher use of both coal and fuels derived from bioenergy and waste. This is associated with the industrial sector in Staffordshire Moorlands; however, the BEIS dataset does not contain further details of which particular industries or facilities use those fuels.

GHG Emissions

The baseline Scope 1, 2 and 3 GHG emissions in Staffordshire are estimated to be 6,421 ktCO_2e per year, as reported within the SCATTER database, an online tool that has been developed by BEIS for use in estimating emissions at a Local Authority level. Of this total, Scope 1 and 2 emissions (i.e. those associated with fuel consumption and electricity used within the area boundary) account for roughly 5,407 ktCO_2e.The figure below shows the breakdown of Scope 1, 2 and 3 GHG emissions by sector and fuel type at a County-wide level.

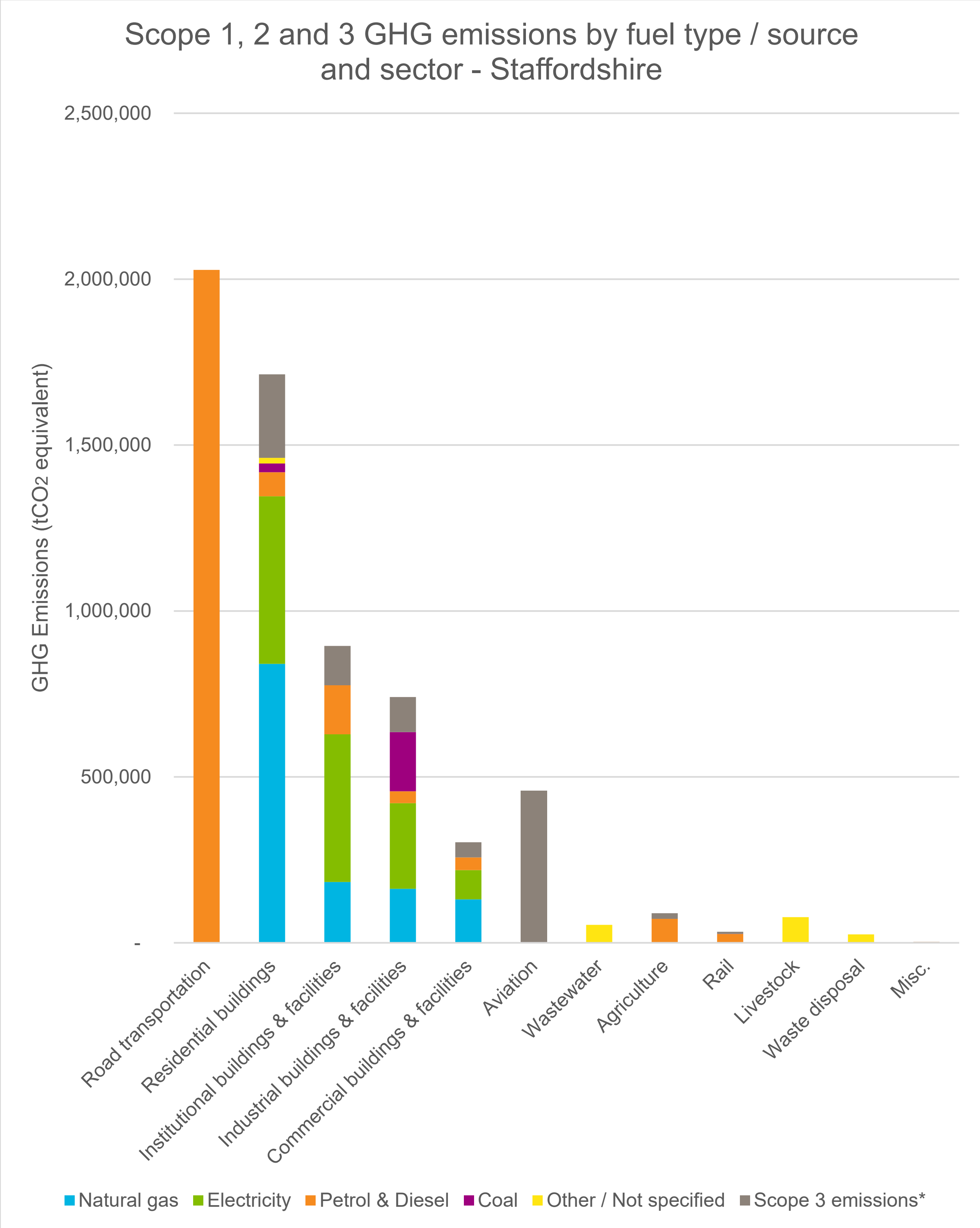

Figure 1-3. Scope 1, 2 and 3 GHG emissions by sector and fuel type – Staffordshire. Source: SCATTER

Although the SCATTER tool does not contain trends over time, this information is published by BEIS for Scope 1 and 2 CO_2 emissions only. Analysis of these BEIS statistics demonstrates that, since 2005, Scope 1 and 2 CO_2 emissions have decreased by around 25%. Roughly half of this change is attributed to the rapid decrease in the carbon intensity of grid electricity ('grid decarbonisation').

Looking forward to 2050, grid decarbonisation alone could theoretically result in a further 15% decrease in Scope 1 and 2 CO_2 emissions compared with 2017 levels. Furthermore, although future emissions are highly uncertain, it is estimated that:

- New development in Staffordshire (in line with Local Plan targets) could increase Scope 1 and 2 CO_2 emissions by roughly 5% - although the actual amount could be less depending on future changes in Building Regulations and sustainable construction practices;
- Switching to ultra low emission vehicles (ULEVs) could result in around a 28% decrease in annual Scope 1 and 2 CO_2 emissions, but the savings could improve even further in the event of future grid decarbonisation;
- Better standards for new buildings, combined with grid decarbonisation and switching to ULEVs, could decrease Scope 1 and 2 CO_2 emissions by over 50% compared with 2017 levels. Additional measures to decrease energy demand and promote the use of low and zero carbon (LZC) electricity instead of fossil fuels would provide further benefits.

These scenarios represent just a few of the steps that will need to be taken to reach the goal of achieving Net Zero emissions in future.

Ultra-Low Emission Vehicles

The analysis illustrates the low levels of ownership of ultra-low emission vehicles (ULEV) currently in Staffordshire. This varies between Local Authorities, although in all cases, ownership levels are under 1% of all licenced vehicles.

National policy and legislation are supporting the switchover from conventionally-fuelled vehicles to ULEVs, with the Government confirming that new cars running on conventional fuels (i.e. petrol and diesel) will be banned from 2035 at the latest (with the date potentially being brought forward to 2032 or earlier). In order to meet Net Zero transport emissions by 2050, the uptake of ULEVs will need to significantly increase (to c.45,000 vehicles across Staffordshire by 2025) beyond its current rate of adoption (which anticipates less than 5,000 vehicles by 2025).

Climate Risks

Staffordshire is exposed to a number of climate-related risks, in particular flooding. Climate change is expected to exacerbate these risks, and is expected to result in warmer, wetter winters and hotter, drier summers, with an increase in the frequency and intensity of extreme events.

Impacts are presented which are categorised as either risks (manifesting as negative impacts) or opportunities (positive impacts), and are seen to impact either the natural environment, infrastructure, or people and the built environment. Risks are shown to outnumber opportunities by over four-to-one.

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1. Introduction

1.1 Purpose of this Report

AECOM has been jointly commissioned by Staffordshire County Council and eight Local Authorities within Staffordshire to provide technical support to develop an evidence base for new energy and sustainability policies within the relevant forthcoming Local Plans.

This report summarises the findings of Stage 1 of the study, providing a baseline that will be used to inform subsequent analysis in Stage 2. It covers topics relating to climate change mitigation – that is, avoiding or minimising greenhouse gas (GHG) emissions that contribute to climate change – and adaptation, i.e. strategies for responding to the now-inevitable effects of climate change.

With regards to climate mitigation, this report presents the existing levels of fuel consumption, greenhouse gas emissions, low and zero carbon (LZC) energy generation, and ultra-low emission vehicle (ULEV) uptake in the County. Scenario modelling is also used to provide an estimate of some of the anticipated changes in GHG emissions that may arise as a result of new development along with broader national trends.

For climate adaptation, this report presents a summary of past climate-related weather events, which provides a baseline against which future trends in climate risks are identified. The potential impact of climate change that are expected to result from both opportunities (which are positive in nature) and risks (which are negative in nature) are also presented.

Stage 2 of the study will assess the potential for additional LZC uptake in the County and present a range of options for Local Authorities to respond to the global Climate Emergency through policy and other measures.

1.2 Scope of the Assessment

This report provides an area-wide assessment of conditions and potential changes relevant to Staffordshire. Results are presented for Staffordshire as a whole, and further details are supplied for each Local Authority, where relevant and subject to availability of information.

1.2.1 Greenhouse Gas Emissions

In accordance with the Greenhouse Gas (GHG) Protocol[1] and the Department of Business, Energy and Industrial Strategy (BEIS) '*Emissions Reduction Pledge 2020'* guidance,[2] for the purpose of GHG reporting, emissions are divided into three categories:

- **Scope 1** – Direct emissions that arise from burning fuels within the geographic area. This primarily includes fuel used in boilers to provide heating and hot water, fuel used in any vehicles while they are driving within the area boundaries, and gas used for cooking or catering.
- **Scope 2** – Indirect emissions associated with the use of electricity, where the point of use is located within the geographic area. This report has assumed that all emissions from grid electricity use fall under Scope 2, on the basis that the electricity may have been generated outside of the County boundary.
- **Scope 3** – Emissions that result from other activities outside the area boundary, but that take place as a result of the actions of people or organisations within it. This could in principle encompass a wide range of sources, such as emissions from commuting, shipping, or aviation. However, the Scope 3 emissions covered in this report primarily include the 'Well-to-Tank' emissions for fuels used in buildings and transport within the boundary of Staffordshire, and

[1] The GHG Protocol is the most widely used global standardised framework for measuring and reporting GHG emissions. It is managed through a partnership between the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD). For further details, see https://ghgprotocol.org/

[2] BEIS, *'Emissions Reduction Pledge 2020: Guidance for emissions reporting in the public and higher education sectors in England 2018-2020'* (April 2018). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/ file/745003/Guidance_note_for_voluntary_reporting-final.pdf

emissions from aviation which are allocated to each Local Authority based on percentage of population. See Appendix A for further details.

This report draws on two main sources of data in order to quantify Scope 1, 2 and 3 emissions based on readily available datasets. The SCATTER[3] tool provides an estimate of Scope 1, 2 and 3 GHG emissions using a snapshot of data from 2016. There are also annual statistics produced by BEIS which cover Scope 1 and 2 CO_2 emissions (excluding, for instance, aviation emissions which happen out of boundary, or methane emissions from livestock) for the time period 2005-2017. Appendix B contains a more detailed discussion of the differences between the SCATTER data and the BEIS data. Because of the difference in coverage, both provide useful information depending on the context; to avoid confusion, this report will clearly state which dataset is used wherever figures are cited. Results are presented by scope, fuel type and sector for each Local Authority.

1.2.2 Climate Risks

This report summarises past climate-related events and quantifies projected climate-related risks and opportunities with a view to determining their expected impact on each of the Local Authorities. The impacts identified are categorised as affecting either the natural environment, infrastructure, people and the built environment, or a combination of two or more.

1.3 Policy & Context

A selection of targets, policies and initiatives aimed at reducing carbon dioxide (CO_2) emissions have been reviewed and are described in detail in Appendix A, particularly those related to decarbonising heat, energy and transportation.

Most of the Local Authorities are undergoing updates to their Local Plans, for which this report is intended to help inform. It is also important to note that many of the Authorities have declared a Climate Emergency, or are in the process of doing so. Accompanying target dates for Net Zero emissions vary from Authority to Authority, though it is important to note that a number have adopted a target date of 2030.

The policy positions for each Authority are summarised in Table 1.1 and detailed in Appendix C.

Table 1.1: Summary of policy positions by Local Authority

Authority	Local Plan update	Climate Emergency Declaration (and target year, if applicable)
Cannock Chase District Council	Yes	Yes (2030 target)
East Staffordshire Borough Council	No	No
Lichfield District Council	Yes	No
Newcastle-under-Lyme Borough Council	Yes	Yes (2030 target)
South Staffordshire District Council	Yes	Yes
Stafford Borough Council	Yes	Yes (2040 target)
Staffordshire Moorlands District Council	Yes	Yes (2030 target)
Tamworth Borough Council	Yes	Yes (2050 target; 2030 aspiration)
Staffordshire County Council	n/a	Yes

1.4 Structure

The report is structured as follows:

- Section 2 – Provides an overview of the key drivers for achieving net zero emissions, including an overview of the current regulatory and policy context, with a focus on buildings and transport.
- Section 3 – Describes the current (baseline) fuel consumption and GHG emissions in Staffordshire, along with recent trends.

[3] https://scattercities.com/

- Section 4 – Discusses the potential changes in GHG emissions that could occur in the coming decade, with consideration given to trends such as new construction, energy efficiency standards for buildings, switching to electric heating systems, and uptake of ULEVs and LZCs.
- Section 5 – Estimates the existing amount of LZC energy technologies in Staffordshire and the potential level of electricity generation these provide.
- Section 6 – Describes the existing amount of ULEVs and chargepoints in Staffordshire.
- Section 7 – Presents an overview of key climate risks affecting the County.
- Appendices – These contain more detailed information regarding the data sources and methodology used to inform the analysis.

Each section presents an overview of information relevant to the County as a whole, in addition to more detailed information specific to each Local Authority (where applicable).

2. Baseline Fuel Consumption & GHG Emissions

This section summarises the current baseline energy and GHG emissions for Staffordshire as a whole.

Data specific to each District/Borough Council is presented in Appendix D for baseline fuel consumption and Appendix E for baseline GHG emissions.

2.1 Source of Data

Fuel consumption figures are taken from the BEIS publication *'Sub-national total final energy consumption statistics: 2005-2018'* (published in 2020).[4] The dataset[5] includes a breakdown of emissions by sector and fuel type. Further details of the methodology used to calculate these figures can be found in the *'Sub-national methodology and guidance booklet'* (BEIS, December 2018).[6]

GHG emissions data has been compiled from two different sources in order to provide the most comprehensive picture of emissions at a local level. This includes:

- Data retrieved from the SCATTER[7] tool, an online resource produced by BEIS in collaboration with Anthesis and the Tyndall Centre for Climate Change Research; and
- BEIS CO_2 emissions data[8] which is published annually for each Authority within the UK.

These datasets draw from some of the same underlying fuel consumption statistics (described above), but SCATTER provides a more detailed estimate of Scope 1, 2 and 3 emissions by sector based on UK-wide figures. SCATTER also covers a wider range of greenhouse gases, while the BEIS dataset only considers Scope 1 and 2 CO_2 emissions. However, SCATTER relies on 2016 statistics, whereas the BEIS dataset runs from 2005 through 2017 which allows for analysis of trends over time. For more information about the differences between these datasets, see Appendix B.

AECOM has endeavoured to ensure that all information is accurate, and has undertaken appropriate cross-checking of sources and sense-checking of results. However, we cannot take responsibility for raw data that has been compiled by third parties.

2.2 Fuel Consumption: Current Baseline & Recent Trends

In 2018 total fuel consumption in Staffordshire County[9] was approximately 22,481 GWh. As illustrated in Figure 2-1 overleaf, the largest proportion of fuel consumed was petroleum products (43.7%), with gas and electricity accounting for 33.3% and 16.6%, respectively. Other fuels, including bioenergy & waste, coal, and manufactured fuels make up the remaining 6.4%.

Corresponding data is presented in Table 2.1 on the following page.

[4] https://www.gov.uk/government/statistical-data-sets/total-final-energy-consumption-at-regional-and-local-authority-level
[5] The data presented in this report is from 2018. An earlier version of this Baseline Report provided 2017 data which has since been updated.
[6] Note that, for the purpose of this report, BEIS statistics for 'industrial & commercial' fuel consumption, 'public sector' fuel consumption and 'agriculture' fuel consumption are collectively referred to as 'non-domestic' uses. 'Bioenergy & waste' is not reported by sector. Electricity used for transport, (i.e. rail or ULEVs) is incorporated into the total figures for electricity.For further information see: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/771895/Sub-national_Methology_and_Guidance_Booklet_2018.pdf
[7] www.scattercities.com
[8] *'UK local authority and regional carbon dioxide emissions national statistics: 2005-2017'* (published in 2019). Available at: www.gov.uk/government/statistics/uk-local-authority-and-regional-carbon-dioxide-emissions-national-statistics-2005-to-2017
[9] This includes all fuel consumption from Cannock Chase, East Staffordshire, Lichfield, Newcastle-under-Lyme, South Staffordshire, Staffordshire Moorlands and Tamworth.

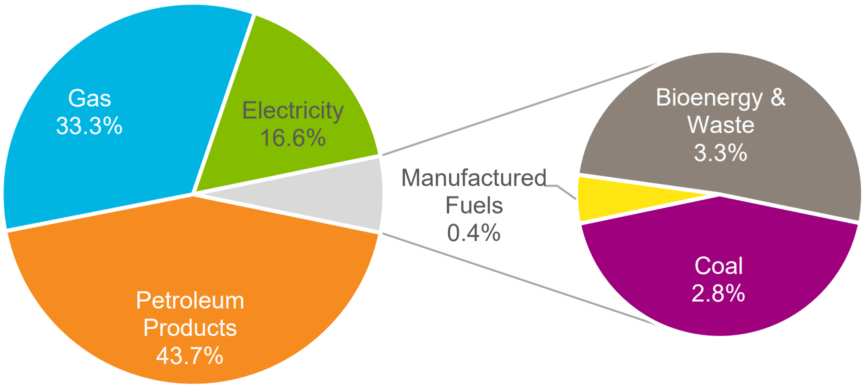

Figure 2-1: *Fuel consumption by fuel type in 2018 – Staffordshire*

	Industrial & Commercial (GWh)	Domestic (GWh)	Road transport (GWh)	Rail (GWh)	Other* (GWh)	Total (GWh)
Coal	553.0	74.0	0.0	0.8	1.8	629.6
Manufactured Fuels	32.3	47.0	0.0	0.0	0.0	79.3
Petroleum Products	919.4	303.1	8,183.1	88.9	330.3	9,824.7
Gas	2,747.3	4,739.5	0.0	0.0	0.0	7,486.8
Electricity	2,332.5	1,389.5	0.0	0.0	0.0	3,721.9
Bioenergy & Waste	466.8	2,71.7	0.0	0.0	0.0	738.5
Total by sector	**7,051.2**	**6,824.7**	**8,183.1**	**89.7**	**332**	**22,480.7**

Table 2.1: *Fuel consumption by sector and fuel type in 2018 – Staffordshire*

** Note: 'Other' includes petroleum products used in the public and agricultural sectors; however, this is the only fuel type for which those sectors are reported separately in the BEIS dataset. Any other fuels used in the public and agricultural sectors will be included within the 'Industrial & Commercial' figures. See the BEIS technical guidance for further details.*

Figure 2-2 overleaf illustrates that fuel use in the road transport sector accounts for the highest proportion of fuel consumption (36% of the total), followed by the industrial & commercial sector (31%) and domestic sector (30%). Within the domestic sector, approximately 69% of fuel consumed is gas and 20% is electricity. In the industrial & commercial sector, approximately 39% of fuel consumed is gas and 33% is electricity. Petroleum products are predominately associated with road transport and industrial uses.

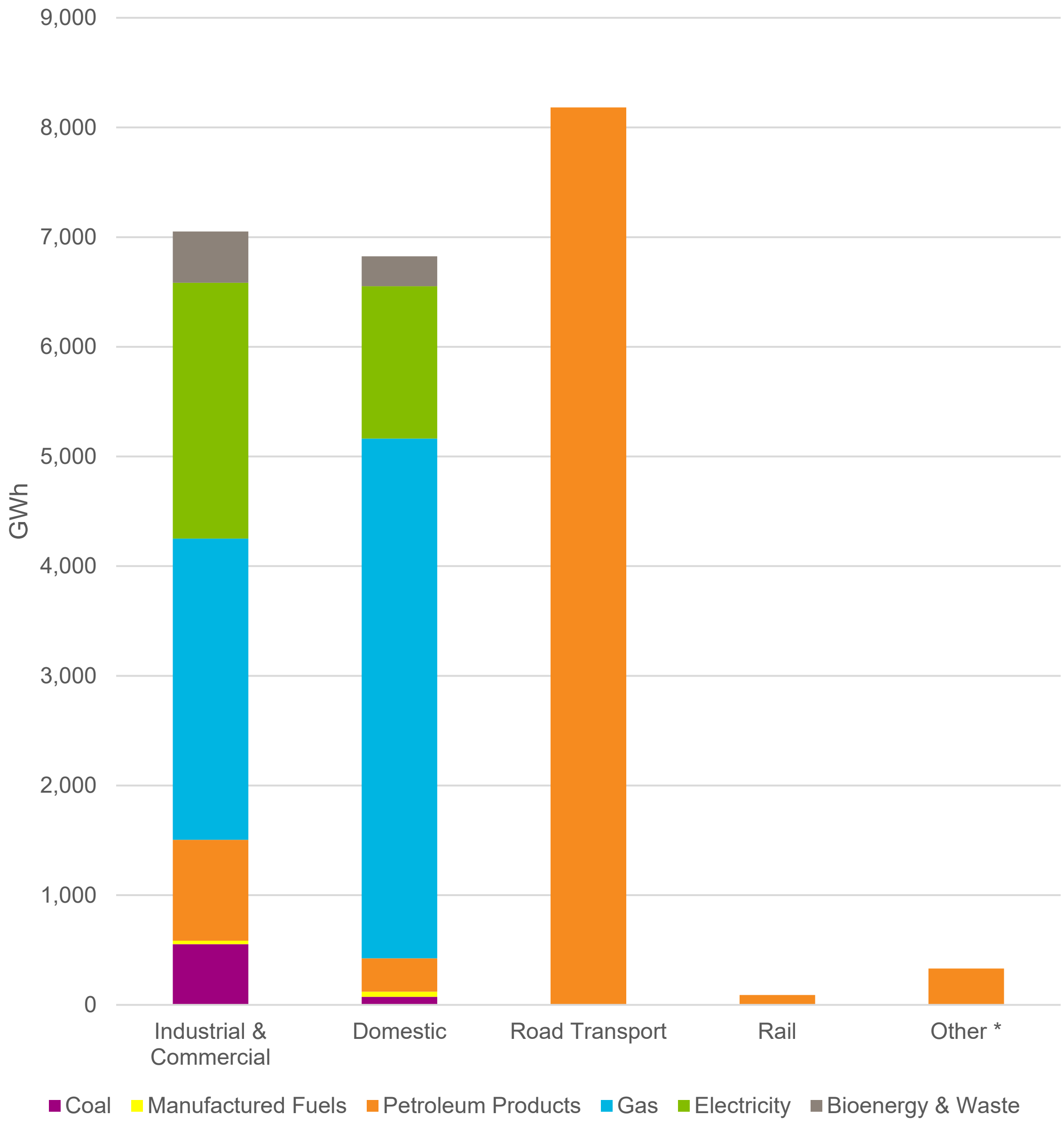

Figure 2-2 : Fuel consumption by sector and fuel type in 2018 - Staffordshire

The split of fuel use varies by Local Authority, as illustrated in Figure 2-3 below. In general, fuel use tends to be dominated by petroleum for road transport, followed by natural gas and electricity. In Tamworth and Cannock Chase, use of petroleum is much lower, which probably reflects the fact that these areas are small and relatively built up. A notable exception is Staffordshire Moorlands, which has a much higher use of both coal and fuels derived from bioenergy and waste. This is associated with the industrial sector in Staffordshire Moorlands; however, the BEIS dataset does not contain further details of which particular industries or facilities use those fuels.

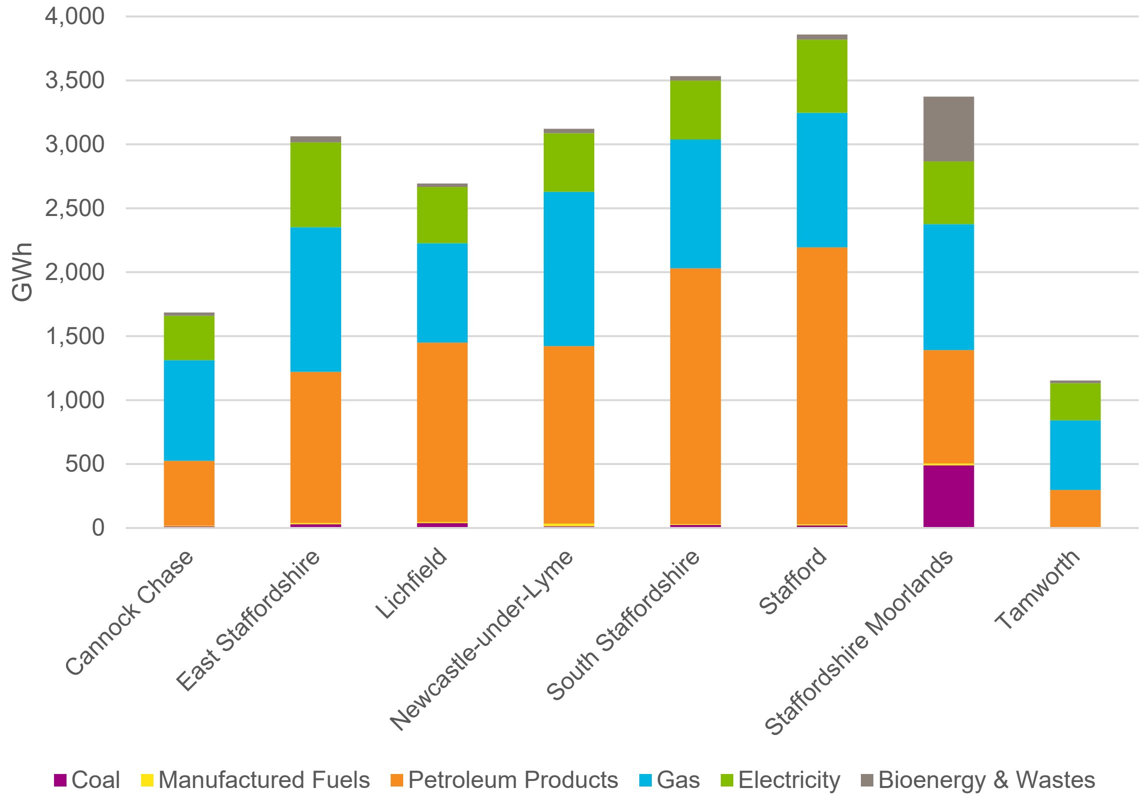

Figure 2-3. Fuel consumption by sector and fuel type in 2018 – Comparison of Local Authorities

Figure 2-4 shows the changes in fuel consumption in Staffordshire from 2005 to 2018. During this period, the use of gas, electricity and petroleum products decreased by 22%, 5% and 10% respectively. This is due to a combination of many factors, including consumer behaviour, uptake of energy efficiency measures, economic trends, population trends, fuel prices, and weather, to name only a few.

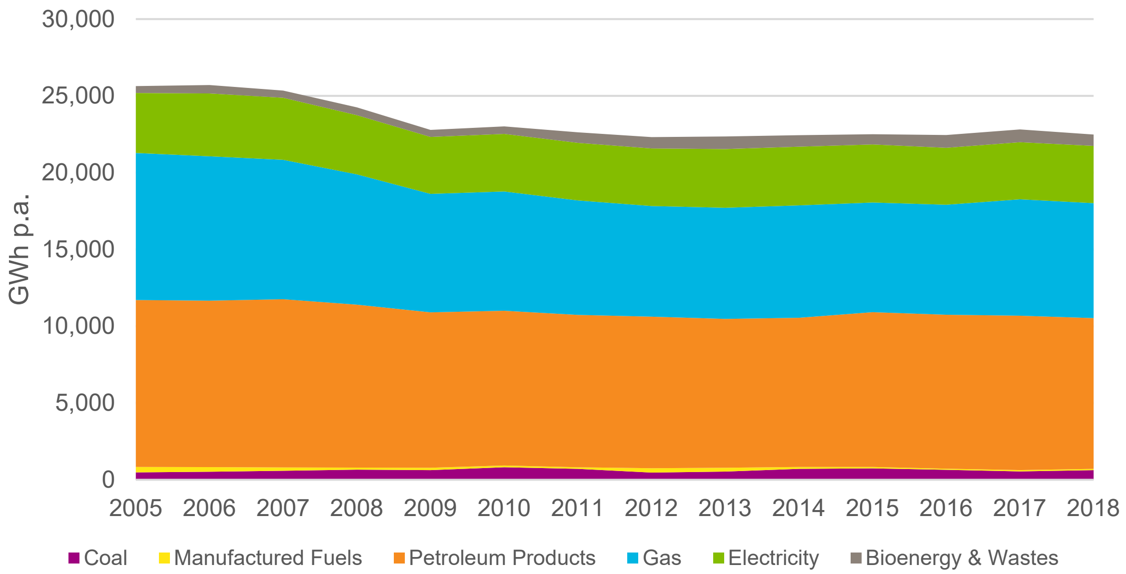

Figure 2-4: Changes in fuel consumption - Staffordshire (2005-2018)

2.3 GHG Emissions: Current Baseline & Recent Trends

The baseline Scope 1, 2 and 3 GHG emissions in Staffordshire are 6,421 ktCO_2e. Of this total, Scope 1 and 2 emissions (i.e. those associated with fuel consumption and electricity used within the area boundary) account for roughly 5,407.17 ktCO_2e.

Figure 2-5 shows the breakdown of Scope 1, 2 and 3 GHG emissions in Staffordshire as reported in the SCATTER tool. Data is provided in Table 2.2. on page 10.

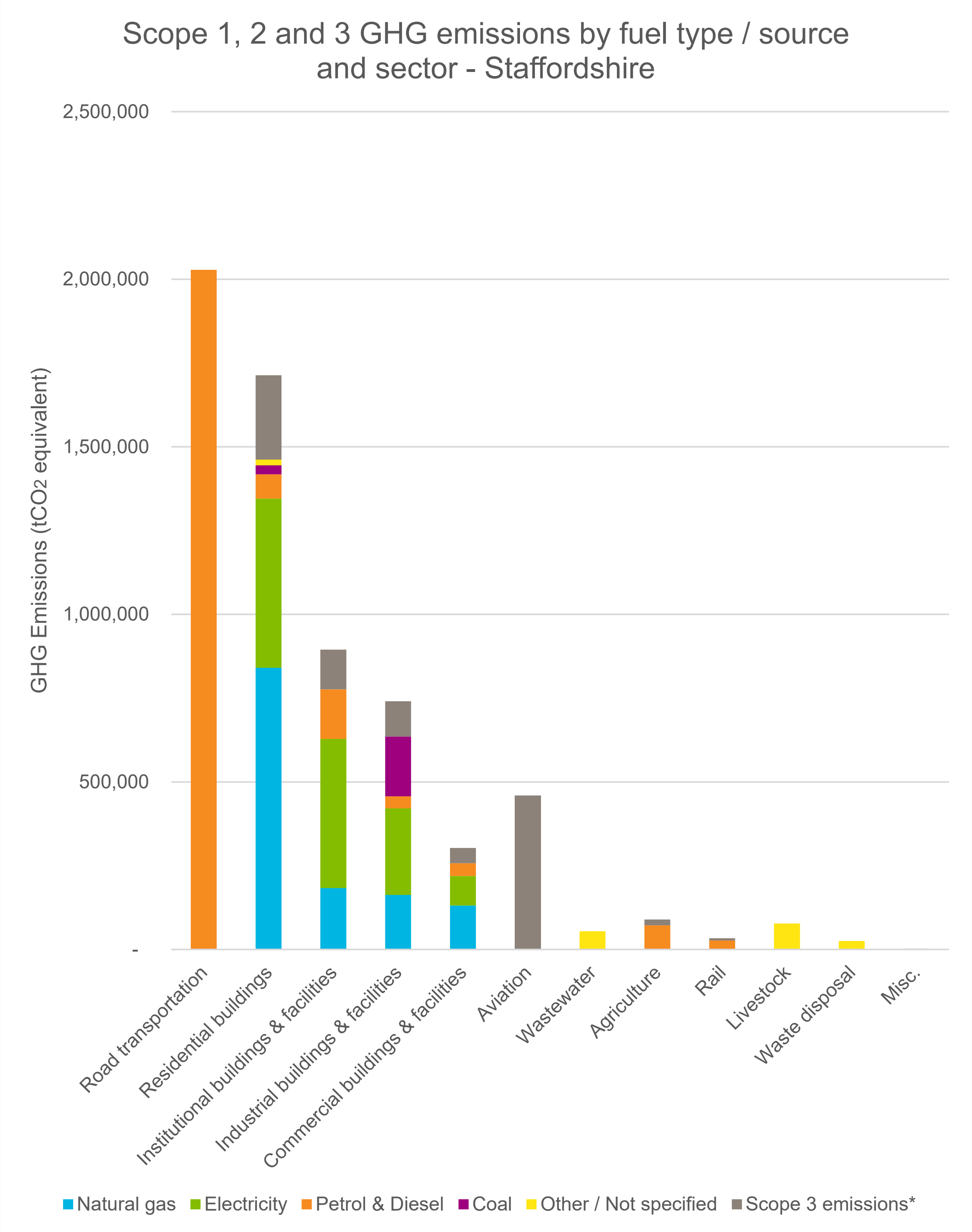

Figure 2-5. Scope 1, 2 and 3 GHG emissions by sector and fuel type – Staffordshire. Source: SCATTER (2016 data)

Description of GHG Emission Categories

In the chart above, emissions are grouped into categories based on the way they are presented within the SCATTER tool, as follows:

- **Road transportation**: This covers emissions from vehicles when they are being driven within the geographic boundary of Staffordshire. If a journey begins outside of Staffordshire, only the emissions from fuel used within the boundary are included. This category does not distinguish between journeys made by people or organisations who live or are based in Staffordshire and those who do not. It does *not* include electricity used to charge vehicles, which would be captured within the figures for electricity use in buildings and facilities.
- **Residential buildings**: This covers all fuel used in residential buildings, e.g. for heating, hot water, cooking, lighting, and appliances.
- **Institutional buildings & facilities**: This covers all fuel used in institutional buildings and facilities such as schools, hospitals, government buildings, street lighting and other public facilities.
- **Industrial buildings & facilities**: This covers all fuel used in industrial buildings and facilities. This includes construction activities, and energy used to generate heat or electricity for use within these industries.
- **Commercial buildings & facilities**: This covers all fuel used in commercial buildings and facilities.
- **Aviation**: This category represents emissions from aviation (combustion of turbine fuel). Figures are estimated based on nationwide totals and apportioned to Local Authorities based on population.
- **Wastewater**: This category represents emissions from municipal wastewater treatment. Figures are estimated based on nationwide totals and apportioned to Local Authorities based on population.
- **Agriculture**: In this instance, 'agriculture' refers primarily to the use of petrol and diesel for off-road transport and other agricultural machinery. Due to the way that fuel consumption is reported in the UK, other fuels used in agricultural buildings and facilities are assumed to be captured under the non-residential buildings and facilities categories.
- **Rail**: This includes diesel and coal used in railways within the geographic boundary of Staffordshire. As with road transport, electricity used in rail transport is not reported separately within publicly available datasets and is therefore assumed to be captured under categories representing non-residential buildings and facilities.
- **Livestock**: This includes methane emissions from the digestive processes of cattle, sheep, pigs, horses and poultry.
- **Waste disposal**: This covers emissions from the disposal and treatment of solid waste, including landfill, incineration, aerobic and anaerobic decomposition.
- **Miscellaneous ('Misc.')**: The SCATTER tool provides an estimate of emissions from a variety of other sources that make up a small portion of the overall total, such as waterborne navigation, carbon sequestration due to changes in land use, and certain industrial processes. For the sake of clarity, these are shown above as a 'Miscellaneous' category.

For more information about the categories reported, refer to the SCATTER tool methodology available at www.scattercities.com or the Greenhouse Gas Protocol *'Global Protocol for Community-Scale Greenhouse Gas Emission Inventories'* (2014).

Table 2.2. Scope 1, 2 and 3 GHG emissions by sector and fuel type – Staffordshire. Source: SCATTER (2016 data)

	Natural gas (tCO_2e)	Electricity (tCO_2e)	Petrol & Diesel (tCO_2e)	Coal (tCO_2e)	Other / Not specified (tCO_2e)	Scope 3 emissions* (tCO_2e)	% of total (%)
Road transportation	-	-	2,028,035	-	-	-	32%
Residential buildings	840,800	504,954	72,225	26,753	16,941	251,711	27%
Institutional buildings & facilities	183,359	444,926	147,882	-	-	118,621	14%
Industrial buildings & facilities	162,959	257,915	35,913	178,352	-	105,558	12%
Commercial buildings & facilities	131,123	88,048	38,229	-	-	45,548	5%
Aviation	-	-	-	-	458,973	-	7%
Wastewater	-	-	-	-	54,147	-	1%
Agriculture (off-road transport)	2	2	72,115	-	-	17,210	1%
Rail	-	-	26,749	241	-	6,415	1%
Livestock	-	-	-	-	77,566	-	1%
Waste disposal	-	-	-	-	25,421	-	<1%
Misc.**	-	-	2,404	-	-	15	<1%
Percent of total (%)	21%	20%	38%	3%	10%	8%	

** excluding aviation*

*** includes diesel from waterborne navigation and emissions from industrial processes (fuel type not specified)*

Results indicate that:

- The largest portion of GHG emissions result from petrol and diesel used in road transport (32%), followed by residential buildings (27%).
- Within the residential* sector, the use of natural gas (e.g. for heating, hot water and cooking) accounts for the majority of GHG emissions, although it is noted that there are a significant number of off-gas properties that utilise oil, electricity or other fuels for heating.
- Non-domestic[10] buildings and facilities collectively account for around 31% of total emissions. In the non-domestic sector, emissions are dominated by electricity use, followed by natural gas. There is also a significant contribution from coal, particularly in industrial buildings and facilities.
- Petroleum products (including petrol, diesel, oil, propane, etc.) account for the largest portion of emissions by fuel type, at 38% of the total. Natural gas and electricity each account for around one fifth of emissions, at 21% and 20% respectively.
- Emissions from aviation make up around 7% of the overall total. As stated above, this is based on UK-wide totals and allocated based on share of population.
- Emissions associated with wastewater processing, agricultural transport and machinery, rail, livestock, municipal waste disposal and other sources account for less than 5% of emissions in the County.

It should be noted that the figures for road transport are based on a DfT model that estimates the transport emissions along each road in the UK, then allocates emissions to each Local Authority based on the proportion of road that is contained within the relevant boundary. In other words, if a Staffordshire resident commutes outside of the County for work, only the part of their commute that takes place within Staffordshire is included within the GHG emissions baseline for Staffordshire. Using the same logic, if a lorry uses a motorway to pass *through* Staffordshire, the GHG baseline will include emissions from that lorry for the time that it was driving within the County. This is relevant because Staffordshire Local

[10] *Note that gas consumption is allocated to domestic and non-domestic properties based on the amount that is used over the course of a year, and therefore this data may include some smaller non-residential properties or exclude some larger residential ones.*

Authorities may have limited or no ability to impact these emissions, even though these emissions are allocated to them based on the current BEIS sub-national emissions reporting methodology.

Although it is not possible to disaggregate the transport emissions based on the origin / destination of the journey, or whether the driver is a Staffordshire resident, BEIS does report emissions by road type which can provide a starting point for understanding the potential impact of through-traffic on the overall GHG baselines. In 2017, roughly 39% of road transport CO_2 emissions for the County as a whole were due to the use of motorways (equivalent to approximately 12% of total Scope 1, 2 and 3 GHG emissions). This varies by Local Authority, as shown below.

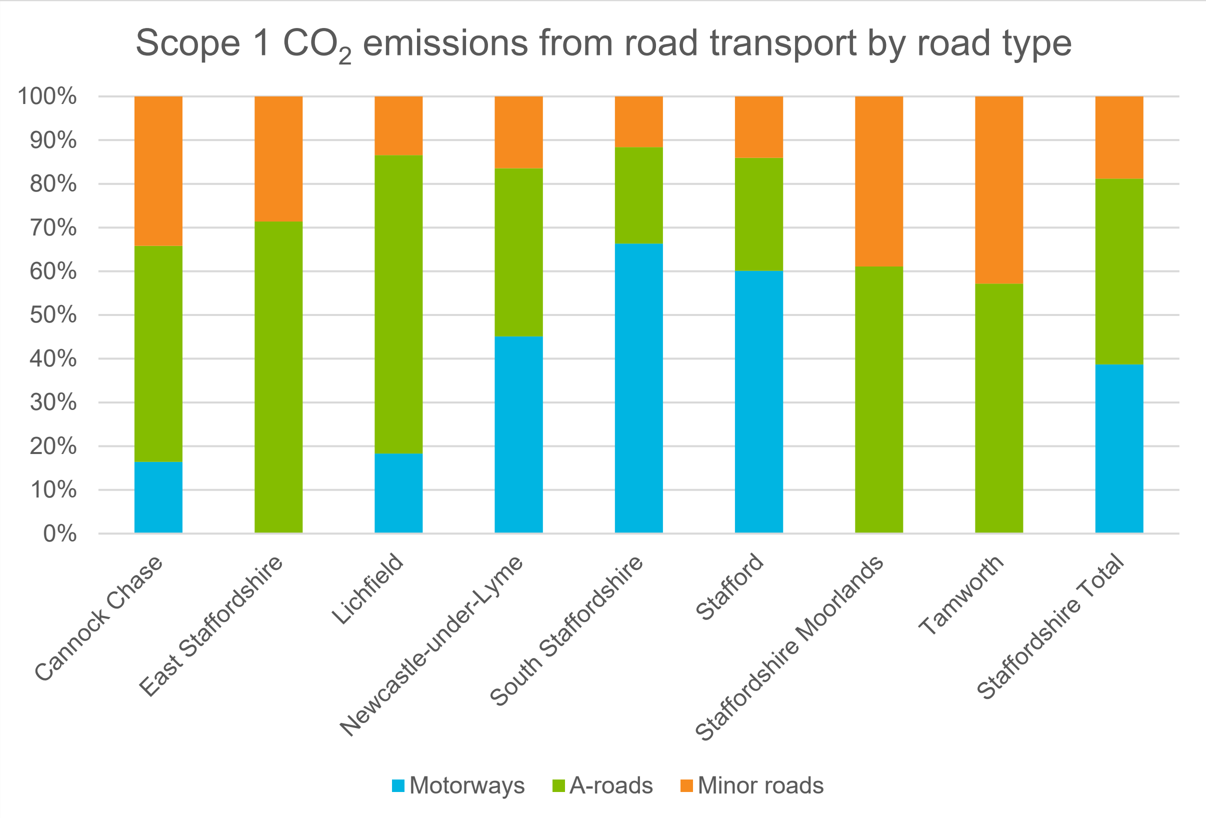

Figure 2-6. Scope 1 CO_2 emissions from transport by road type. Source: BEIS (2017 data)

The table below shows a breakdown of Scope 1, 2 and 3 GHG emissions by Local Authority for each of the Districts in Staffordshire. Further information for each District is provided in Appendix E. These results are broken down further in Figure 2-7 below, which compares the total Scope 1, 2 and 3 GHG emissions by Local Authority area for different fuel types (where specified).

Table 2.3. Scope 1, 2 and 3 GHG emissions per Local Authority. Source: SCATTER (2016 data)

Name	Scope 1 & 2 ($ktCO_2e$)	Scope 3 ($ktCO_2e$)	Scope 1, 2 & 3 ($ktCO_2e$)
Cannock Chase	400	100	501
East Staffordshire	754	150	904
Lichfield	627	123	750
Newcastle-under-Lyme	767	136	903
South Staffordshire	837	125	962
Stafford Borough	965	148	1,113
Staffordshire Moorlands	767	155	922
Tamworth	289	77	366
Staffordshire County	**5,407**	**1,014**	**6,421**

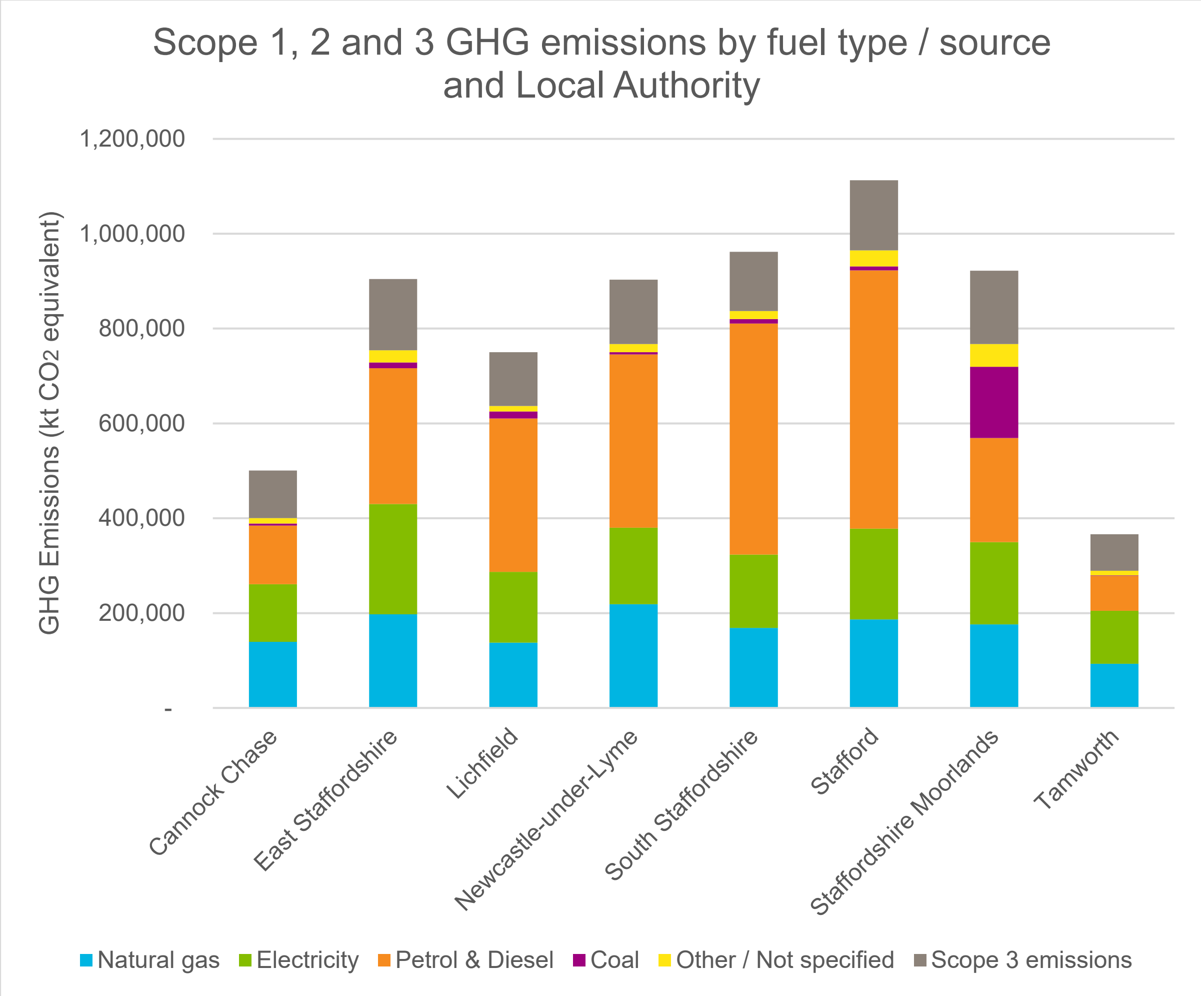

Figure 2-7. Scope 1, 2 and 3 GHG emissions by Local Authority. Source: SCATTER (2016 data)

It can be seen that Stafford Borough has the highest emissions overall, at 1,113 kilo tonnes CO_2 equivalent per year ($ktCO_2e$). This is due to the high level of emissions from petroleum products (primarily associated with road transport), which represents nearly 50% of all emissions in the Borough. At the other end of the spectrum, Tamworth has the lowest level of GHG emissions, at 366 $ktCO_2e$; this is dominated by fuel use in buildings, which accounts for around 68% of the total in the Borough. These differences are due to many different factors, ranging from population, to geography, to the types of businesses and industries operating in a given area. The table below shows an estimate of per capita emissions for each District based on both the SCATTER and BEIS datasets.

	Population (thousands)	**SCATTER: Scope 1, 2 & 3 GHG emissions per capita (tCO_2e per year)**	**BEIS: Scope 1 & 2 CO_2 emissions per capita (tCO_2 per year)**
Cannock Chase	99.1	5.1	4.1
East Staffordshire	117.6	7.7	6.2
Lichfield	103.5	7.2	6.7
Newcastle-under-Lyme	129.0	7.0	6.0
South Staffordshire	111.9	8.6	8.4
Stafford	134.8	8.3	7.3
Staffordshire Moorlands	98.5	9.4	11.3
Tamworth	76.5	4.8	3.6
Staffordshire County	**870.8**	**7.4**	**6.8**

Table 2.4: Per capita emissions in Staffordshire, by Local Authority

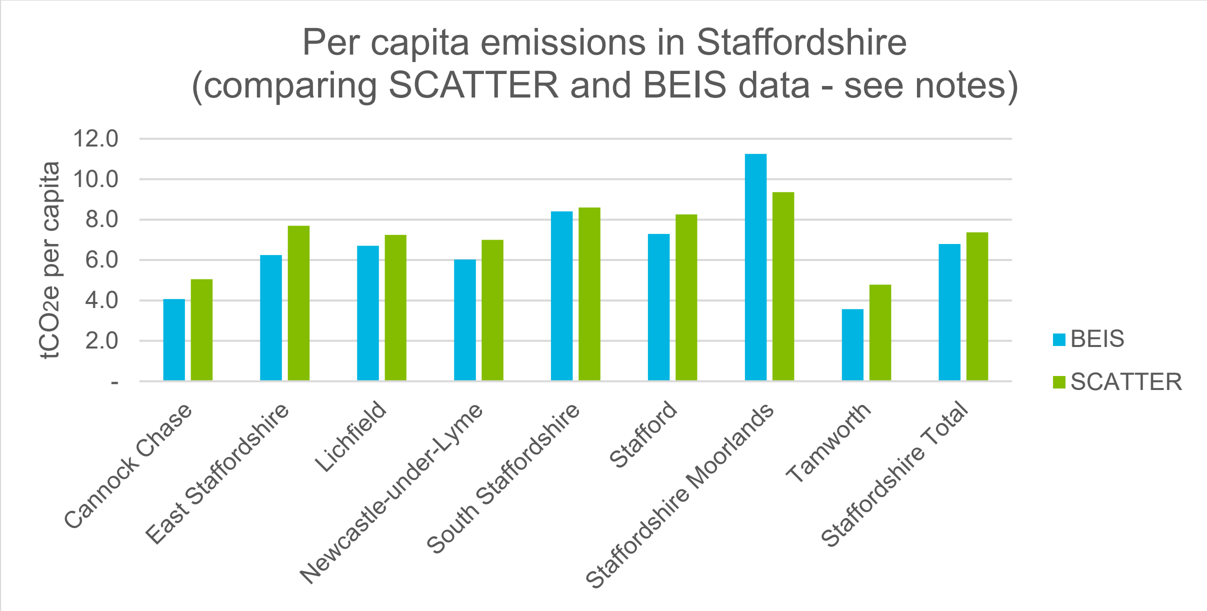

Figure 2-8. Per capita emissions in Staffordshire, by Local Authority

In order to consider trends over time, Scope 1 and 2 CO_2 emissions data published by BEIS has been used instead of SCATTER tool outputs (see Appendix B for more details). Based on this information, from 2005 to 2017, Scope 1 and 2 CO_2 emissions in Staffordshire decreased by roughly 25%, as shown in Figure 2-9 below.

Note: this estimate is based on BEIS CO_2-only emissions data and therefore does not directly align with the SCATTER data, but nonetheless indicates overall trends from major sources of emissions. Scope 3 emissions and non-CO_2 GHG emissions are not included within these trends because only one year of such data was available.

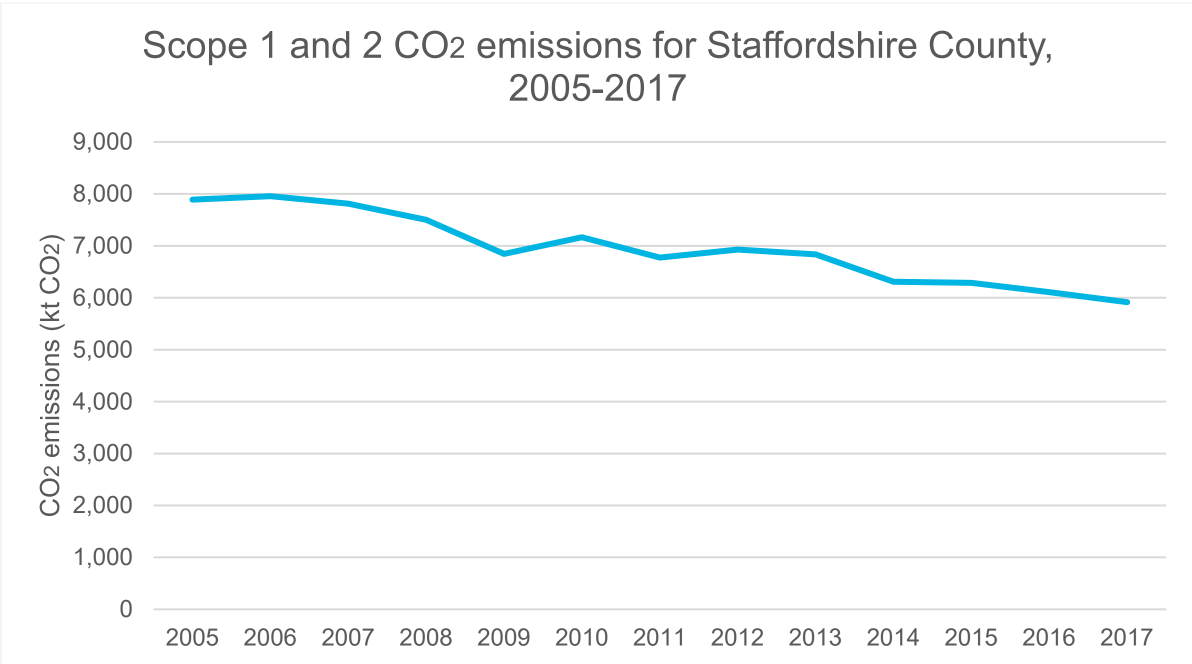

Figure 2-9. Scope 1 and 2 CO_2 emissions in Staffordshire County, 2005-2017. Source: BEIS

The figure below shows the change in Scope 1 and 2 CO_2 emissions over time for each Local Authority within Staffordshire. During that timeframe, emissions have fallen significantly across the board. However, when interpreting these results, it is important to note that:

- Changes in emissions do not necessarily reflect changes in fuel consumption or energy efficiency. For instance, an increase in electricity use could be offset by a decrease in electricity grid emissions.

- Similarly, year-to-year changes in fuel consumption relate to factors such as weather and should therefore be interpreted with caution.

The following section of this report provides a more in-depth discussion of some of the key factors affecting changes in emissions over time, drawing on recent and anticipated future trends.

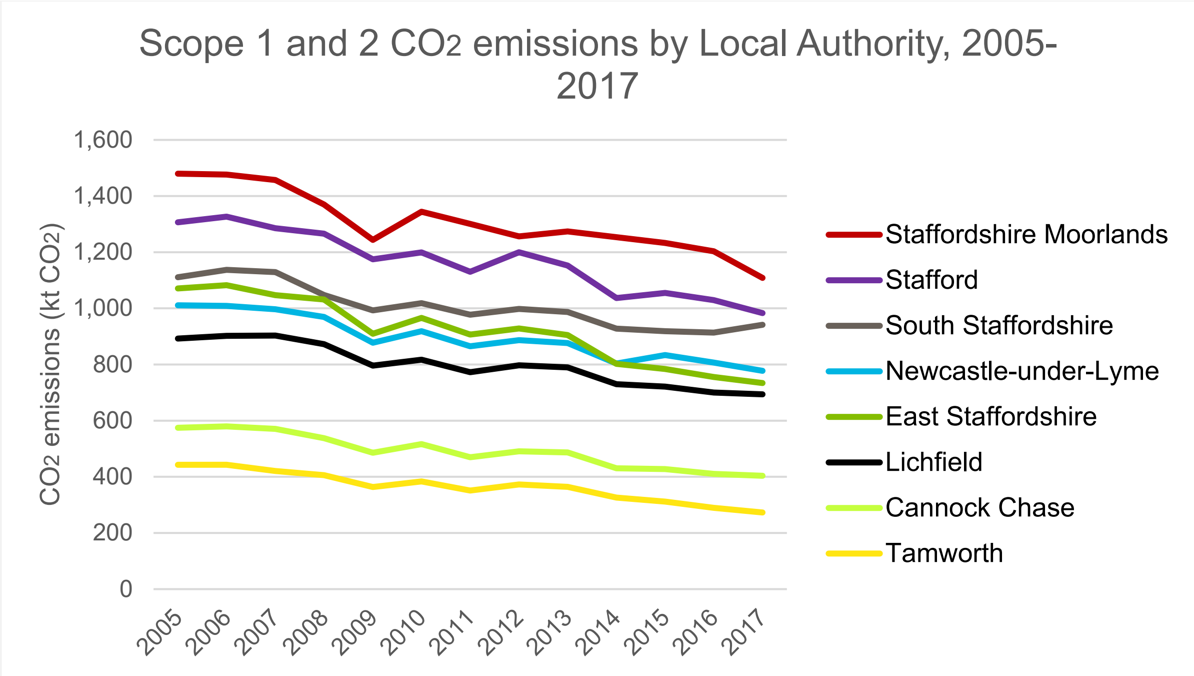

Figure 2-10. Scope 1 and 2 CO_2 emissions by Local Authority, 2005-2017. Source: BEIS

3. Potential CO_2 Emissions Trajectories

3.1 General Approach to Modelling

The analysis presented in this report considers interventions that could be influenced by Local Authorities (e.g. amount of new development and the associated energy demands and GHG emissions), but also accounts for broader trends expected to take place on a primarily national level (e.g. decarbonisation of the national electricity grid and ULEV uptake).

The model assumes that, in a hypothetical 'Business as Usual' ('BAU') scenario, no actions are taken to reduce emissions, fuel consumption remains steady, and total emissions do not change over time.[11] This is used as a baseline for assessing the relative impacts of different intervention measures.

It is important to note that these scenarios are *not* intended to predict actual fuel consumption or CO_2 emissions. In particular, they assume that all variables hold constant aside from those specifically mentioned, which is not realistic. However, the analysis is useful inasmuch as it highlights the potential scale and direction of different trends, which provides insight into key priorities and risks when considering pathways and component actions required to deliver the Net Zero target.

3.2 Source of Data

Key assumptions are outlined below. The methodology is described in detail in 0.

- **National electricity grid decarbonisation** – The emission factor for grid electricity is expected to fall progressively over time, as it will be generated using less fossil fuel and more renewable energy. This analysis considers the impact of a grid decarbonisation trajectory described in the National Grid Future Energy Scenarios, which would see emissions from electricity decrease by around 90% by 2050.[12] Note that this is a more ambitious rate of decarbonisation than that which is forecast in the *Updated Energy and Emissions Projections*, published annually by BEIS. There are also deviations between the data shown here for 2018 and 2019, and the official record figures released by BEIS for those years. It is recognised that projections for the future decarbonisation of the electricity grid are subject to significant uncertainty, and although the trajectory shown here is not a prediction of what will happen, it does reflect the scale of change that would be necessary to meet the UK's carbon emission reduction commitments.

  Figure 3-1 below presents a comparison between historic electricity grid emissions, and the future potential emissions based on the 'Consumer Renewables' scenario.

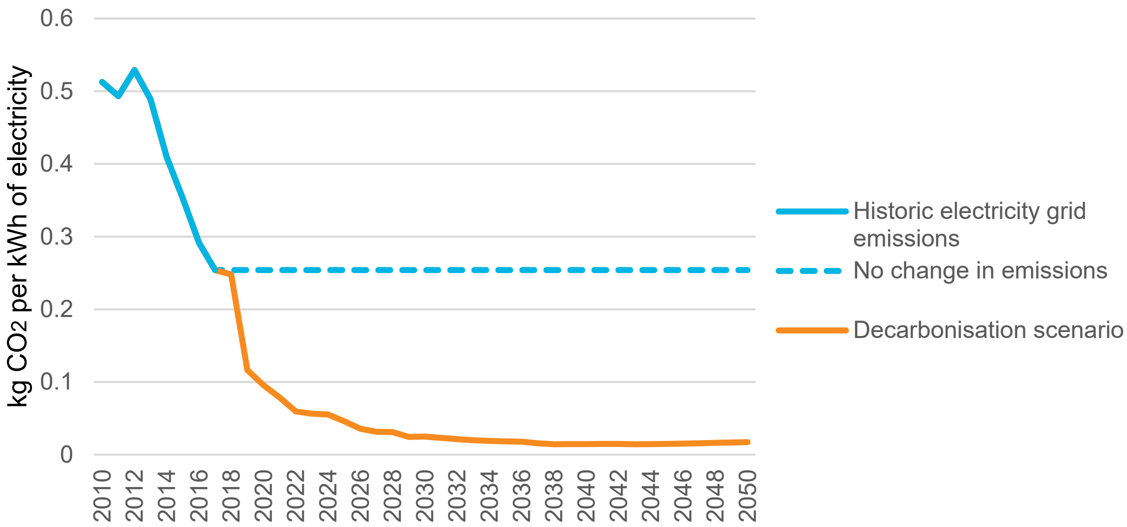

Figure 3-1. Comparison of historic electricity grid emissions vs. the FES decarbonisation scenario

[11] In reality CO_2e emissions depend on many variables, including economic trends, energy prices, and weather, to name only a few. For example, see National Grid *'Future Energy Scenarios'* (2019). Available at: http://fes.nationalgrid.com/fes-document/
[12] Based on the 'Consumer Renewables' trajectory outlined in the National Grid *'Future Energy Scenarios'* (2019). See Available at: http://fes.nationalgrid.com/media/1409/fes-2019.pdf

- **Changes in fuel consumption due to the anticipated amount of new development**: The potential change in fuel consumption is estimated based on a worst-case scenario where new buildings have the same energy demands as the existing building stock. The actual emissions from new buildings are expected to be less than this, subject to future changes in Building Regulations; in a best case scenario, emissions from new development would be net zero.
  - **Domestic:** Based on statistics provided in the UK National Energy Efficiency Database (NEED)[13] we have derived bespoke benchmarks for Staffordshire based on the median gas and electricity use in typical dwellings.
  - **Non-Domestic:** In order to estimate the increase in fuel consumption due to new non-domestic buildings, we have referred to Local Plan estimates for the amount of new development in hectares, and applied CIBSE Guide F benchmarks for electricity and heat demand. Estimates for the amount of new development are based on consultation with each District; in most cases these reflect Local Plan projections. It is understood that all figures are subject to change, for instance, due to changes in the national calculation methodology for housing provision, and uncertainties associated with the amount and timing of new development delivery. For more information and details of the new development figures used, see 0.
- **Uptake of Ultra Low Emission Vehicles (ULEVs)** – In line with assumptions made by the Department for Transport's *'Road to Zero'* report, we have assumed that ULEV uptake will increase rapidly in the coming decade and therefore aside from HGVs, all vehicles could be ultra-low emission (powered either by hydrogen or electricity) by 2030. The actual rate and timing of uptake is based on the Future Energy Scenarios *'Consumer Renewables'* trajectory, in line with our assumptions relating to grid decarbonisation.

  Figure 3-2 below shows an illustrative scenario to achieving zero emission transport, which is based on the National Grid Future Energy Scenarios. By 2029, electric and hydrogen fuelled vehicles should make up around a quarter of all vehicles, by 2033 they should make up over half of all vehicles and by 2036 they should make up over three quarters of all vehicles in Staffordshire.

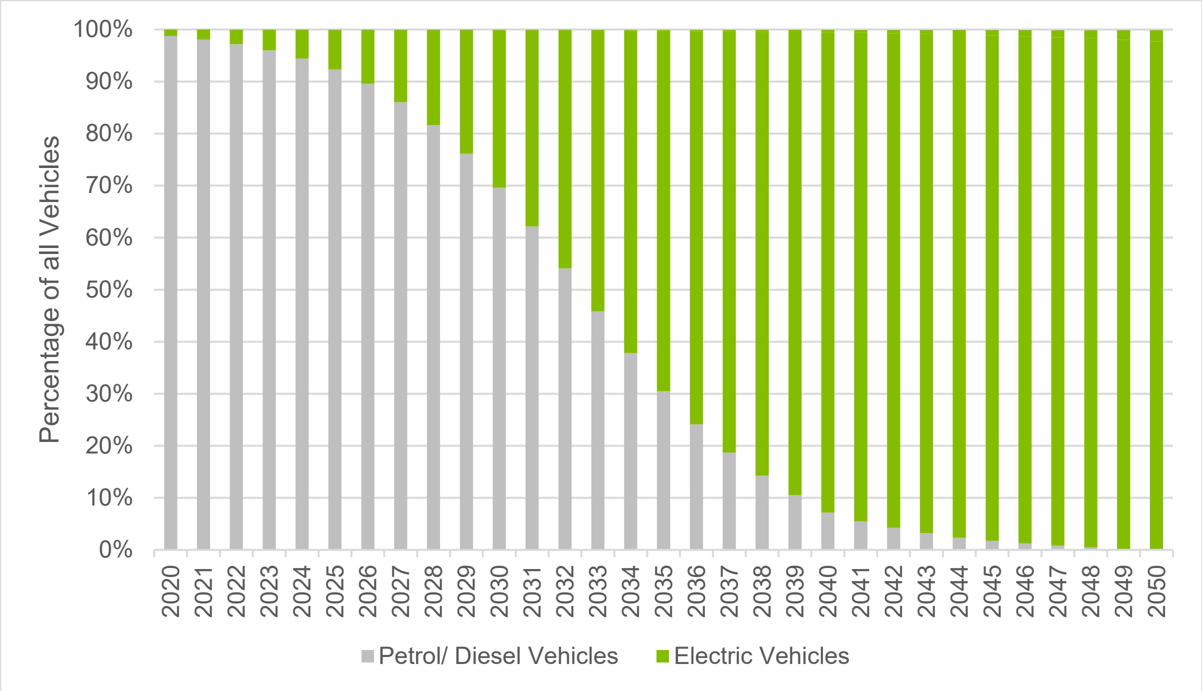

Figure 3-2: Vehicle Fuel Sources 2020-2050. Source: National Grid FES, 'Community Renewables' scenario

[13] NEED, *'Summary of Analysis, Great Britain'* (2019). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/812561/National_Energy_Efficiency_Data_Framework__NEED__report_summary_of_analysis_2019.pdf

For the purpose of this report, we have used the Department for Transport (DfT) definition of 'ultra low emission vehicle' which refers to *'vehicles that emit less than 75g of carbon dioxide (CO_2) from the tailpipe for every kilometre travelled. In practice, the term typically refers to battery electric, plug-in hybrid electric and fuel cell electric vehicles.'* As a result, this analysis has considered only CO_2 emissions, irrespective of the fuel used (e.g. electricity versus hydrogen) to avoid making assumptions about which technologies will be used.

3.3 Results

The following describes the potential scale and direction of change in Scope 1 and 2 CO_2 emissions that could arise due to the trends described above. The projections should therefore be understood as continuations of the Scope 1 and 2 CO_2 emission trends presented in Section 2.3. For the reasons outlined in Section 2.1 and Appendix B, they do not directly align with the GHG emission totals taken from the SCATTER dataset.

For the sake of brevity, the following data is presented only for Staffordshire County Council. Data specific to each Local Authority is presented in Appendix H.

The scenarios are presented separately and then cumulatively, as follows:

1. Impacts of electricity grid decarbonisation with no other changes
2. Impacts of new development, with and without electricity grid decarbonisation
3. Impacts of switching to ULEVs, with and without electricity grid decarbonisation.
4. Impacts of new development AND switching to ULEVs, with and without grid decarbonisation (that is, scenarios 1-3 considered simultaneously).

The wider implications of these changes, which broadly apply to all Local Authorities, are discussed in Section 3.4.

It is understood that several Local Authorities within Staffordshire may be required to accommodate additional development due to surplus from neighbouring localities. It is anticipated that Cannock Chase could deliver additional dwellings on behalf of Birmingham and the Black Country; Appendix H.1 contains an estimate of the impact this would have on Cannock Chase's emissions to 2050; however it can be seen that this has relatively little impact on the overall changes and therefore it has not been included in the County-wide estimate. Furthermore, it has been indicated that a shortfall of 73 dwellings from Tamworth will be delivered between Lichfield and North Warwickshire, the impact of this development has been discussed in Appendix H.4 Lichfield and H.14 Tamworth. It is estimated that this additional development would have a minimal impact on overall emissions changes and with potential for this development to be delivered outside of the Staffordshire boundary, this development has been excluded from the County-wide totals.

Figure 3-3 below shows the potential change in Scope 1 and 2 CO_2 emissions that could arise due to decarbonisation of the national electricity grid, as outlined in Section 3.2. Compared with 2017 levels, this would result in a 15% decrease in emissions by the year 2050.

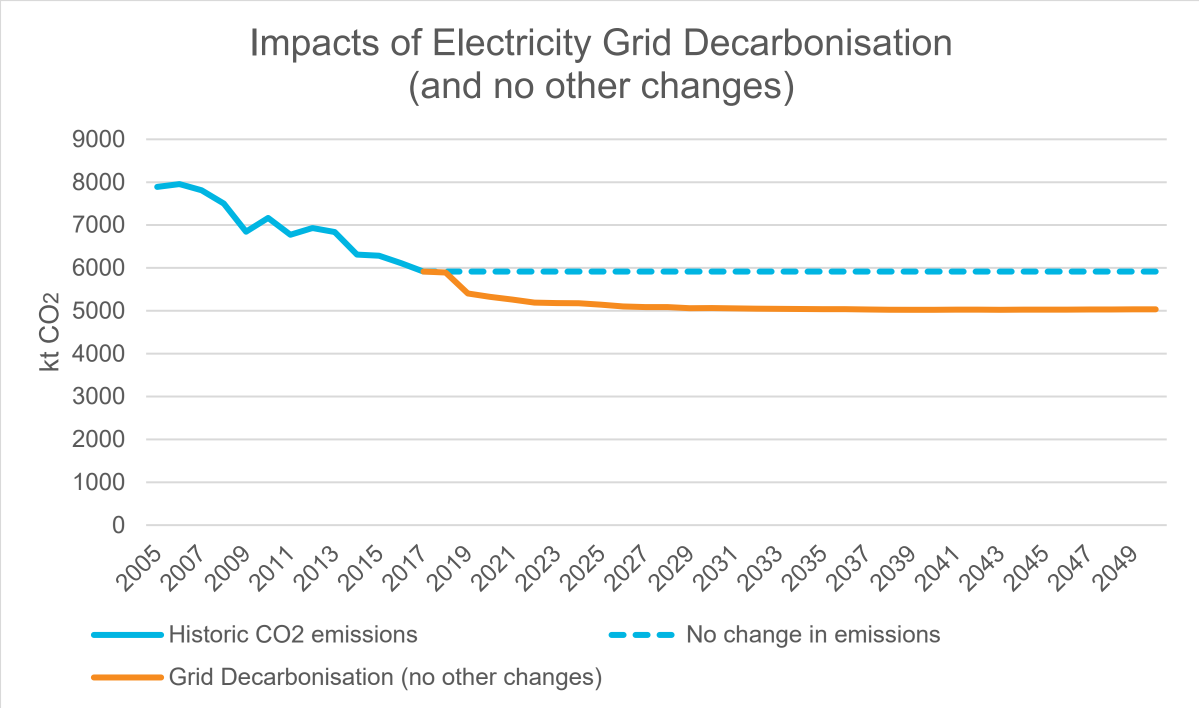

Figure 3-3: Change in Scope 1 & 2 CO_2 emissions due to grid decarbonisation – Staffordshire

Figure 3-4 below shows the potential change that could arise due to the projected amount of new development across the whole of Staffordshire. Compared with 2017 levels, this could result in up to a 7% increase in emissions, or up to a 12% decrease, depending on grid decarbonisation.

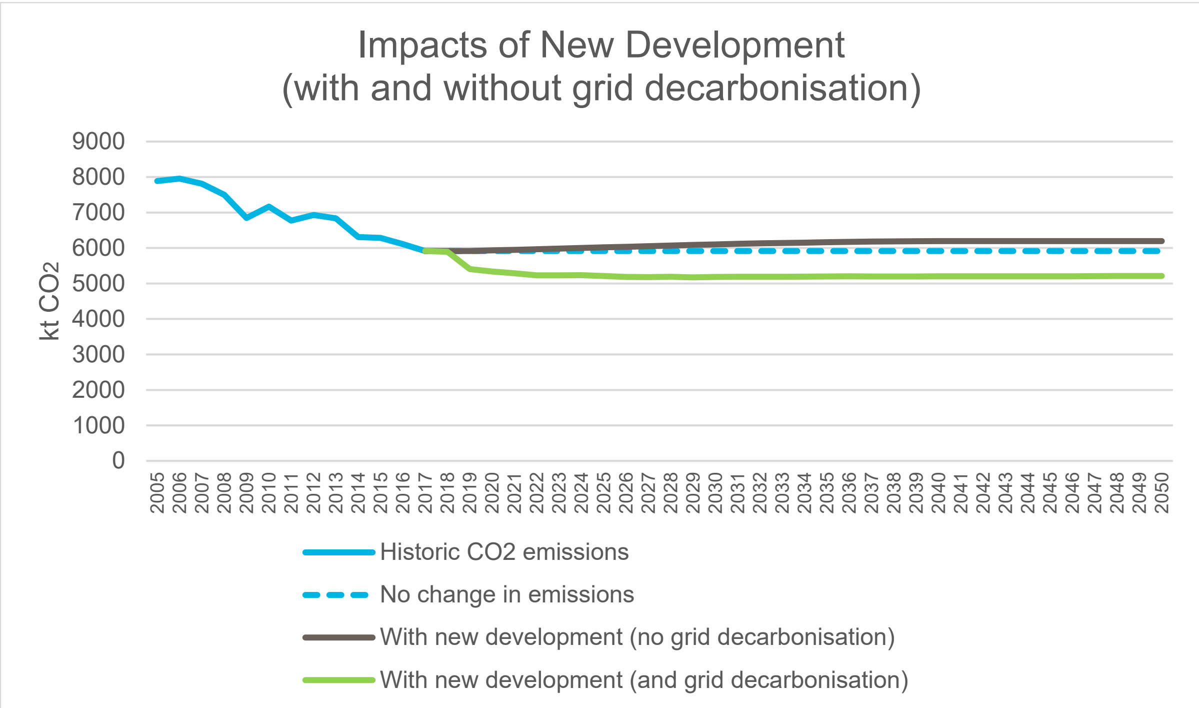

Figure 3-4: Change in Scope 1 & 2 CO_2 emissions due to new development – Staffordshire

Figure 3-5 below shows the potential impacts of switching from traditional fuel vehicles (i.e. those that use petrol and diesel products) to ULEVs. Due to the lower emissions from these vehicles, this shift could result in a decrease in emissions of around 28% - 56% depending on the extent of grid decarbonisation. This accounts for both the decrease in petroleum products and the increase in electricity use that result from the uptake of ULEVS (and the displacement of traditionally-fuelled vehicles). [Note that the greater savings in the decarbonisation scenario also accounts for decreasing emissions from electricity used in buildings. This reflects the fact that consistent assumptions have been applied to all variables in the model.]

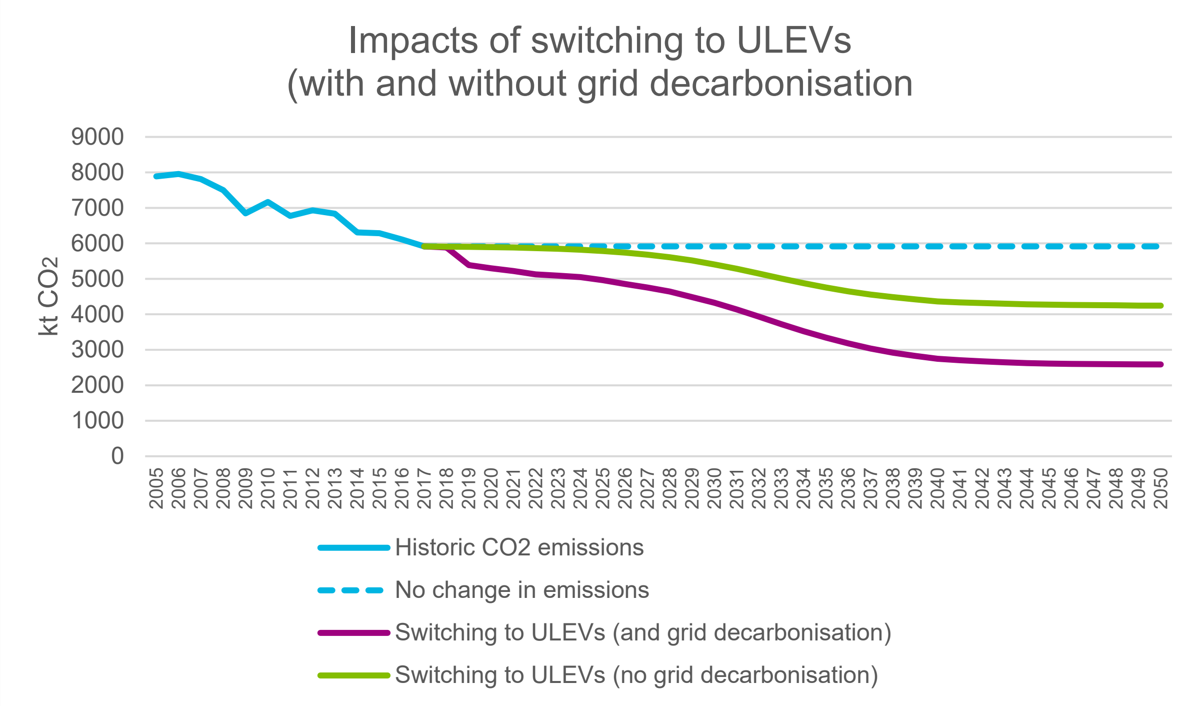

Figure 3-5: Change in Scope 1 & 2 CO_2 emissions due to switching to ULEVs – Staffordshire

The cumulative impact of these changes is shown in Figure 3-6 below. The shift away from traditional fuel vehicles serves to offset the slight increase in Scope 1 and 2 CO_2 emissions that arises from fuel consumption in new development. Overall, compared with 2017 levels, these scenarios indicate that emissions could decrease by up to 53% by 2050 when considering new development, ULEV uptake and grid decarbonisation, although it should be noted that in reality, there are a wide variety of factors influencing total Scope 1 and 2 CO_2 emissions.

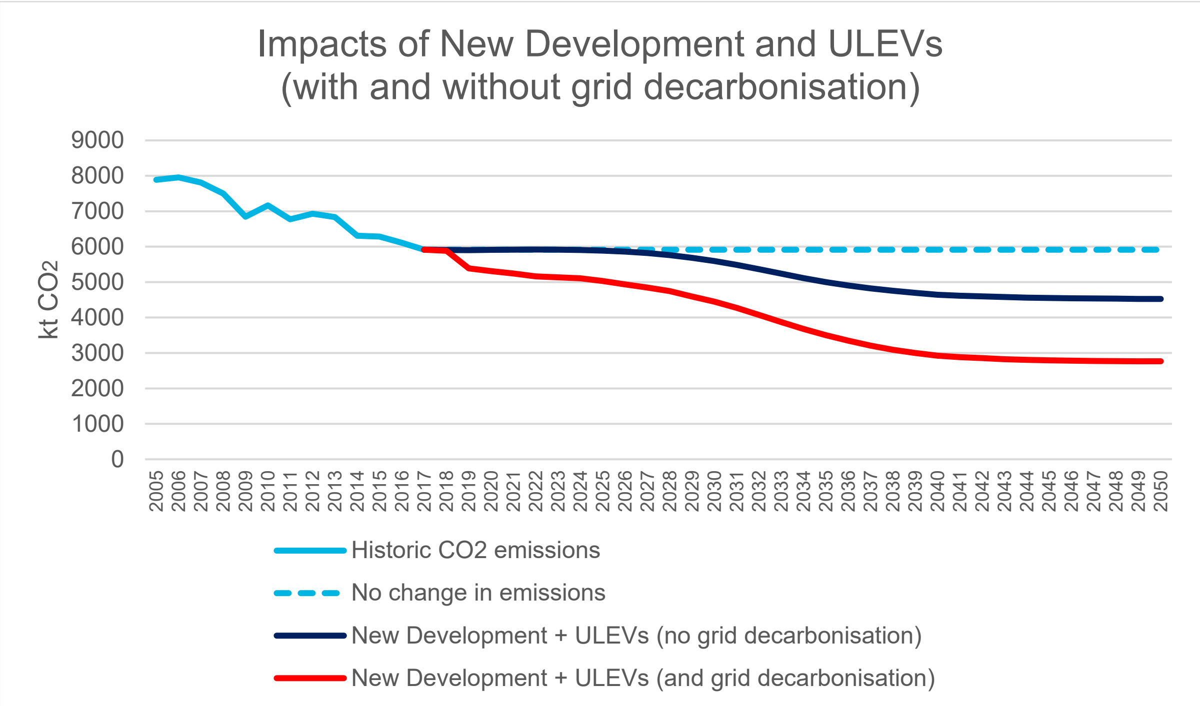

Figure 3-6: Change in Scope 1 & 2 CO_2 emissions due to all assessed interventions – Staffordshire

3.4 Implications for Staffordshire

3.4.1 National electricity grid decarbonisation

The change in emissions due to grid decarbonisation is linked with the proportion of total emissions that are due to electricity, in addition to the level of decarbonisation. In the event that the UK does not achieve the level of LZC energy deployment required to achieve this, then the difference would be lower than shown in the chart above.

Although the level of grid decarbonisation is uncertain, it is one of the most important variables that will determine whether the net zero target is achieved. Considering the historic trends in emissions since 2005 (see Section 2.3), it was shown that Scope 1 and 2 CO_2 emissions decreased by around 25%. Over this time period, if there had been no electricity grid decarbonisation, Scope 1 and 2 CO_2 emissions in Staffordshire would have decreased by only 13%.

This has both positive and negative implications. On one hand, if there is rapid and deep decarbonisation, county-wide emissions could decrease significantly even if no other actions were taken. On the other hand, this presents a key risk, because it means that much of the reliance on achieving the net zero target will rely on factors outside of the Local Authorities' ability to influence.

To address and mitigate this risk, consideration must be given to how Councils can best facilitate the government's objectives in decarbonising the grid as well as what measures they can take to best insulate themselves from the eventuality that grid decarbonisation does not happen as quickly and/or as deeply as the Government intends.[14] This would include actions such as those referenced in the Climate Emergency resolutions of Councils across Staffordshire, such as:

- Taking steps to reduce energy demands in the area, which helps to lower emissions regardless of grid decarbonisation;
- Promoting the uptake of LZC technologies through local planning policy and other areas of influence;
- Demonstrating best practice by using LZC energy and installing LZC technology in Council-owned buildings; and
- Lobbying the Government for changes in policies and incentive structures to facilitate the shift towards a decarbonised energy system.

3.4.2 New development

As shown above, assuming a worst-case scenario where new development in Staffordshire uses roughly the same amount of gas and electricity as existing buildings, if all other variables hold constant, this would result in a roughly 5% increase in County-wide Scope 1 and 2 CO_2 emissions by 2050. Even if new buildings are designed and constructed to meet the proposed Future Homes Standard, there would still be a small increase in emissions. Therefore, it will be vital to ensure that any new buildings are constructed or retrofitted to be capable of becoming net zero in operation[15] and incorporate LZC technologies wherever feasible.

[14] Although there has been significant progress in this area in recent years, future decarbonisation is anticipated to be much more difficult to achieve. To date, the decarbonisation of the national grid has been primarily achieved through the significant reduction in the use of coal fired power stations and the increase in the use of renewable technologies, particularly large-scale wind and biomass (where it is used for co-firing in power stations). However, the use of gas remains a significant component of the generation mix, and the timely replacement of the existing nuclear fleet is already proving to be challenging. Furthermore, significant additional pressures from the use of electricity to provide heating and power vehicles may incentivise power generation from fossil fuel sources to deal with greater peaks in demand.

[15] For more information, see https://www.gov.uk/government/consultations/the-future-homes-standard-changes-to-part-l-and-part-f-of-the-building-regulations-for-new-dwellings

The Future Homes Standard

Under the Future Homes Standard, new buildings would be required to meet significantly higher targets for energy efficiency and carbon savings. The Government states that, *'As part of the journey to 2050 we have committed to introducing the Future Homes Standard in 2025. This consultation sets out what we think a home built to the Future Homes Standard will be like. We expect that an average home built to it will have 75- 80% less carbon emissions than one built to current energy efficiency requirements (Approved Document L 2013). We expect this will be achieved through very high fabric standards and a low carbon heating system. This means a new home built to the Future Homes Standard might have a heat pump, triple glazing and standards for walls, floors and roofs that significantly limit any heat loss.'*

- BEIS, *'The Future Homes Standard Consultation'* (2019)

Note: This estimate is based on the amount of new development as set out in 0. It is understood that these figures are subject to revision. The actual change in emissions could be higher or lower depending on the amount that is delivered and the energy performance standards that are achieved.

The key takeaway from this analysis, however, is that new development has a small impact when compared to the scale of total emissions, which are currently dominated by fuel use in existing buildings and road transportation. This presents a challenge for Local Authorities seeking to reach a net zero target, because the energy performance of the existing building stock is largely outside their sphere of influence.

3.4.3 Switching to ultra-low emission vehicles

As discussed in further detail in Section 5.2, there has been an increase in electric vehicle registrations in Staffordshire, and growth is expected to continue; it is estimated that the price of electric, hybrid and traditional fuel cars could converge within the next decade,[16] which would help to facilitate the shift towards sustainable transport. Switching to ULEVs would reduce Scope 1 and 2 CO_2 emissions by around 28% if they were charged using national grid electricity in the present day. The savings would increase as the electricity grid decarbonises, or if the vehicles were charged using 100% renewable energy – for instance, generated by PV on the roof of a Council-owned car park.

Although switching to ULEVs will be an important part of reaching the decarbonisation target, even if this goal is achieved, it creates additional challenges. For instance, switching to the use of electricity means that achieving the net zero target is more dependent the rate of national electricity grid decarbonisation. It will also present a broad-ranging challenge across all areas of electricity infrastructure, which will be discussed further in the Stage 2 report for this study.[17] Increasing LZC energy generation, the use of smart EV charging and, potentially, vehicle-to-grid systems would mitigate some of the effects on peak demand and help to alleviate some of this pressure.

A large-scale shift to the use of electric vehicles must also be accompanied by a significant modal shift towards walking, cycling, ridesharing, and an increase in the use of public transport. This is necessary to reduce electricity demand – with added benefits in terms of air quality and, potentially, improving people's health. In practical terms, this means that spatial planning policies that reduce the need for journeys and promote walking and cycling will become more important.

Finally, it is worth emphasizing that the future CO_2 scenarios assume that almost all road vehicles can be ultra low emission by 2050. In reality, there are technological and cost-related barriers, particularly regarding heavy goods vehicles (HGVs). Achieving the level of decarbonisation shown above assumes that there will be a technology shift in the next few decades to enable all vehicles to make the transition.

3.5 Limitations

As stated above, the scenarios presented in this report are illustrative and intended to highlight key issues relevant to Local Plan development and inform the Councils' response to the Climate Emergency. They do not represent projections or predictions of future CO_2 emissions, which change for a wide

[16] Cambridge Econometrics and Element Energy, *'Fuelling Europe's Future: How the transition from oil strengthens the economy'* (2018). Available at: https://europeanclimate.org/wp-content/uploads/2018/02/FEF_transition.pdf
[17] National Grid, *'Future Energy Scenarios'* (2019). Available at: http://fes.nationalgrid.com/media/1409/fes-2019.pdf

variety of reasons, including but not limited to population growth, energy prices, weather, economic growth / decline, deforestation / afforestation, and so on.

The scenarios consider a limited range of variables and assume that all others hold constant over the time period to 2050. For instance, although the model accounts for fuel use in new buildings, it does not consider the associated change in emissions that would be expected to occur from the increase in population or construction of associated infrastructure needed to support such developments.

Another key caveat is that any changes modelled would need to be backed up by policies, funding, changes in technology, and user / consumer behaviour which are uncertain.

For more information about the methodology and the limitations of this approach, see 0.

3.6 Note: Potential impacts of Covid-19 pandemic

At the time of writing (August 2020), there is limited information available regarding the impacts that the COVID-19 pandemic may have on fuel consumption or GHG emissions, either in the short or long term.

Because statistics on fuel use in buildings (and associated Scope 1 and 2 CO_2 emissions) are published by BEIS two years in arrears, it is difficult to comment on whether there will be a change in energy use habits, although it would be reasonable to expect that fuel use would tend to decrease in offices and workplaces while increasing in domestic buildings due to home working.

There is evidence that lockdown restrictions on travel had a significant short-term impact on transport emissions. As shown in Figure 3-7 below, although the number of road journeys has returned to around 80-90% of pre-lockdown levels, there has been slower re-uptake of buses and trains, while rates of cycling have remained above average.[18] However, it is unclear how long these trends will be sustained over time.

Since road transport accounts for around 32% of total Scope 1, 2 and 3 GHG emissions in the County (see Section 2.3), a long-term change in travel behaviour could have a noticeable impact on overall emissions.

Note: Figure 3-7 reports the 7-day rolling average use of transport by mode, represented as percentages of an equivalent day or week.

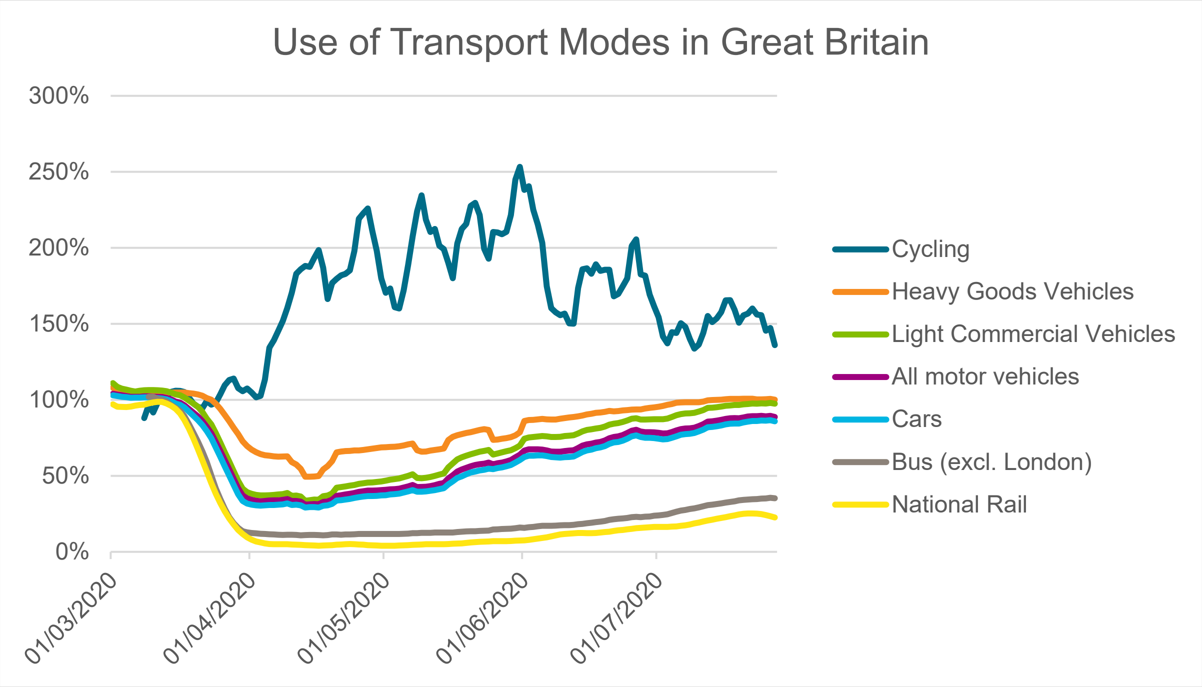

Figure 3-7. Use of transport modes in Great Britain (7-day rolling average). Source: DfT

[18] Department for Transport, 'Use of Transport Modes: Great Britain, since 1st March 2020' (updated 29th July 2020). Available at: https://www.gov.uk/government/statistics/transport-use-during-the-coronavirus-covid-19-pandemic

4. Low and Zero Carbon (LZC) Energy Technologies

4.1 Source of Data

The total number and type of electricity-generating LZC technologies within Staffordshire is recorded in *'Renewable energy by local authority'* (BEIS, published September 2019).[19] This was cross-checked against the Renewable Energy Planning Database[20] (REPD) which provides a quarterly record of all operational or planned LZC energy schemes that have been submitted for planning approval in the UK.

Regarding LZC technologies that generate only heat, there is less publicly available information. In order to provide an estimate of the number and type of these technologies, data was retrieved from the Renewable Heat Incentive (RHI) database.[21] It should be noted that these figures primarily focus on the total *number* of accredited installations; the figures are not disaggregated by technology type and figures for installed capacity are estimates based on nation-wide totals.

Due to the difference in the level of detail of these datasets, estimates for LZC electricity generation and estimates for LZC heat generation are presented separately. For further details, see 0.

4.2 Existing LZC Electricity Installations: Capacity and Generation

The following tables show the number and capacity of installed LZC energy technologies in Staffordshire, along with the estimated level of LZC electricity that could be generated each year.[22]

The total installed capacity is approximately 235 MWe, offering the potential to generate roughly 366,000 MWh of electricity per year. This is equivalent to just under 10% of the 2018 electricity demand for the County (which was around 3,722,000 MWh).

Table 4.1. LZC electricity: number of installations at Local Authority Level - as at end of 2018

Local Authority Name	PV	Onshore Wind	Hydro	Anaerobic Digestion	Sewage Gas	Landfill Gas	Municipal Solid Waste	Plant Biomass	Total
Cannock Chase	1,568	-	-	1	-	3	-	-	1,572
East Staffordshire	1,557	9	3	1	2	1	-	1	1,574
Lichfield	1,424	8	1	1	-	-	-	-	1,434
Newcastle-under-Lyme	2,076	6	-	1	-	1	-	-	2,084
South Staffordshire	1,298	3	-	-	2	1	1	1	1,306
Stafford	2,376	11	1	4	1	1	-	1	2,395
Staffordshire Moorlands	1,630	18	2	2	-	-	-	3	1,655
Tamworth	878	-	-	-	-	1	-	-	879
Total	12,807	55	7	10	5	8	1	6	12,899

[19] Available at: https://www.gov.uk/government/statistics/regional-renewable-statistics
[20] Available at: https://www.gov.uk/government/publications/renewable-energy-planning-database-monthly-extract
[21] For non-domestic installations, see *'Table 1.4 - Number of accredited applications and installed capacity by local authority'* and *'Table 1.1 - Number of applications and total capacity by technology type'*. For domestic installations, see *'Table 2.1 - Number of applications and accreditations by technology type'* and *'Table 2.4 - Number of accreditations by local authority'*. Available at: https://www.gov.uk/government/statistics/rhi-monthly-deployment-data-february-2020
[22] This includes Cannock Chase, East Staffordshire, Lichfield, Newcastle Under Lyme, South Staffordshire, Staffordshire Moorlands and Tamworth.

Table 4.2. LZC electricity: installed capacity (MW) at Local Authority Level - as at end of 2018

Local Authority Name	PV	Onshore Wind	Hydro	Anaerobic Digestion	Sewage Gas	Landfill Gas	Municipal Solid Waste	Plant Biomass	Total
Cannock Chase	6.2	-	-	6.5	-	8.2	-	-	20.9
East Staffordshire	64.2	0.9	0.1	0.1	2.3	0.6	-	0.1	68.1
Lichfield	9.5	1.9	0.0	0.5	-	-	-	-	11.9
Newcastle-under-Lyme	7.5	0.5	-	0.1	-	2.1	-	-	10.2
South Staffordshire	20.0	4.1	-	-	1.2	1.9	30.0	0.1	57.2
Stafford	11.9	2.0	0.0	1.8	0.2	1.7	-	2.9	20.4
Staffordshire Moorlands	29.6	1.2	0.0	0.1	-	-	-	8.4	39.4
Tamworth	4.6	-	-	-	-	2.0	-	-	6.6
Total	153	11	0	9	4	16	30	11	235

Table 4.3. LZC electricity: Electricity generation (MWh/yr) at Local Authority Level - as at end of 2018

Local Authority Name	PV	Onshore Wind	Hydro	Anaerobic Digestion	Sewage Gas	Landfill Gas	Municipal Solid Waste	Plant Biomass	Total
Cannock Chase	5,969	-	-	44,625	-	51,706	-	-	102,300
East Staffordshire	59,834	1,789	244	153	9,942	776	-	415	73,152
Lichfield	9,237	4,061	9	2,754	-	-	-	-	16,061
Newcastle-under-Lyme	7,350	1,122	-	190	-	15,428	-	-	24,090
South Staffordshire	18,283	8,659	-	-	7,110	1,808	*201,884**	368	36,227
Stafford	11,596	4,260	8	9,281	1,060	4,353	-	10,832	41,390
Staffordshire Moorlands	28,073	2,532	44	447	-	-	-	30,269	61,363
Tamworth	4,365	-	-	-	-	7,198	-	-	11,563
Total	144,706	22,423	305	57,450	18,112	81,269	-	41,884	366,147

** Estimate based on a 2018 annual report from Veolia – not included in the totals*

These results are illustrated on the following pages. It can be seen that PV is by far the most common technology in terms of the number of installations, but the majority of these are small-scale, domestic, roof-mounted systems of around 2-4 kWp capacity each. Around half of the PV capacity and renewable electricity generation in Staffordshire come from the 14 ground-mounted PV farms, which are concentrated in boroughs and districts that have greater access to land which is appropriate to large-scale PV installations. After PV, wind is the most common technology by number of installations.

Stafford Borough has the highest number of installations (2,395) of all of the Local Authorities, but Cannock Chase is likely to generate the most LZC electricity each year (102,300 MWh/yr) due to the large AD and landfill gas technologies that are installed. Comparing the number of technologies against the electricity generated by each technology highlights the difference in the typical size and output of different installations. For example, PV provides significantly less electricity per MW of installed capacity (955 MWh/MW) compared with onshore wind (over 2,000 MWh/MW) and both of these are lower than the outputs for AD, sewage and landfill gas plants.

Note that the BEIS RRS does not include electricity generation figures for the municipal solid waste incineration heat recovery facility in South Staffordshire (Four Ashes EfW) and therefore it is not represented in Figure 4-3 below. For context, however, the 2018 Annual Report for that facility made available by Veolia indicates that the exported electricity was 201,884 MWh in 2018.[23]

[23]Veolia, *'Staffordshire ERF: Annual Report'* (2018). Available at: https://ukwin.org.uk/library/205-AnnualPerformanceReport-2018.pdf

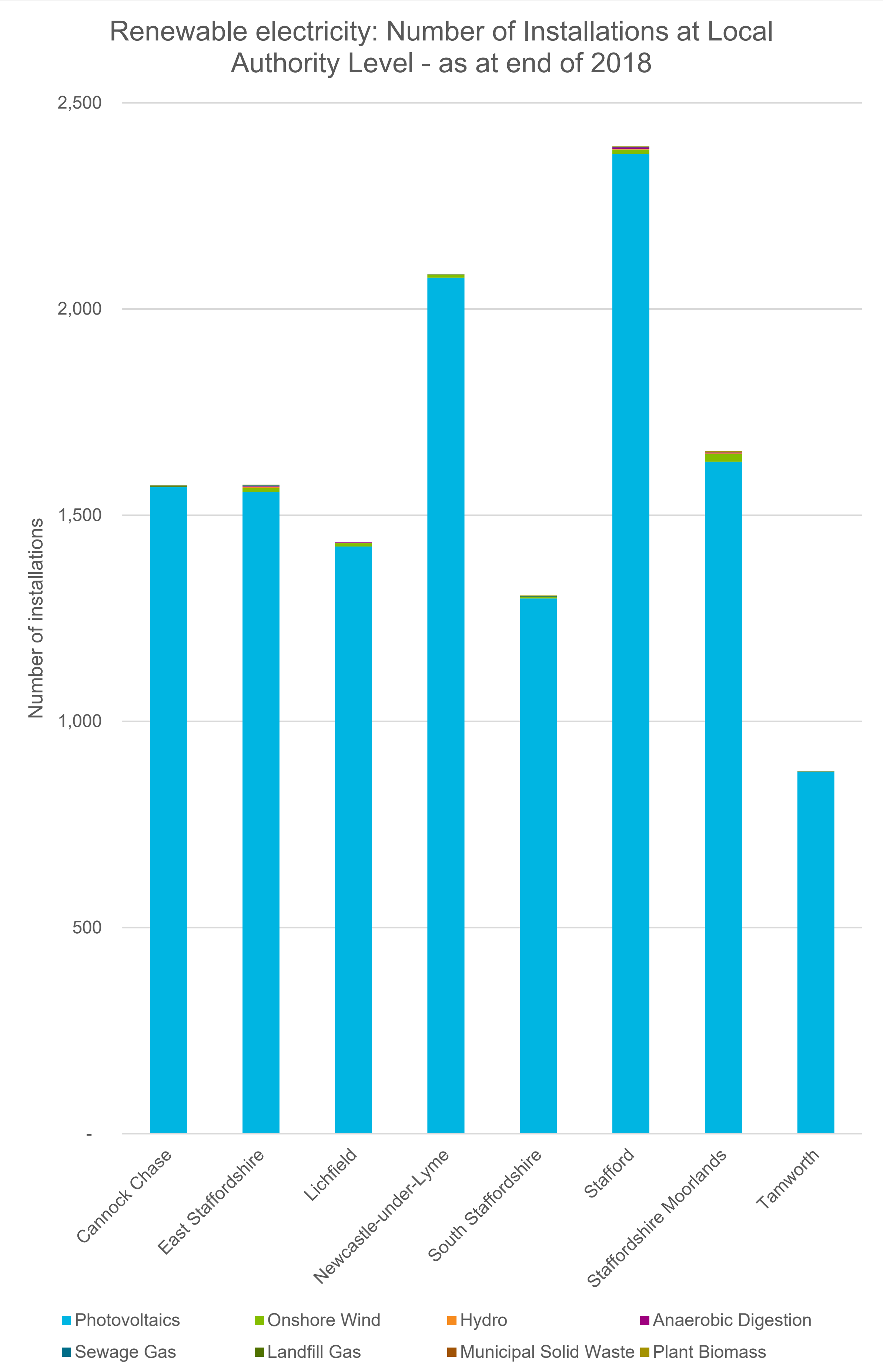

Figure 4-1. Number of renewable energy installations in each Local Authority

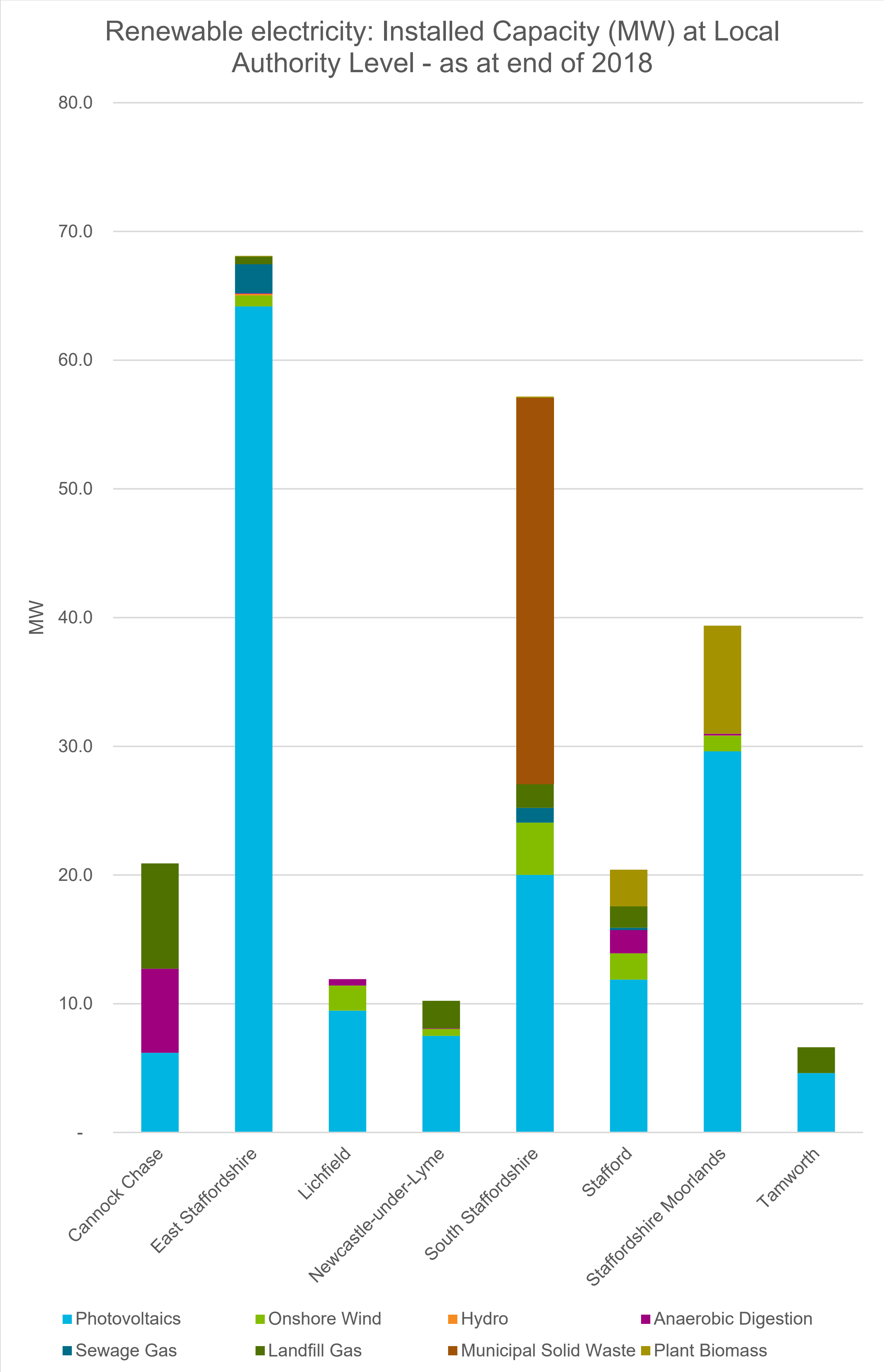

Figure 4-2. Renewable electricity capacity in each Local Authority

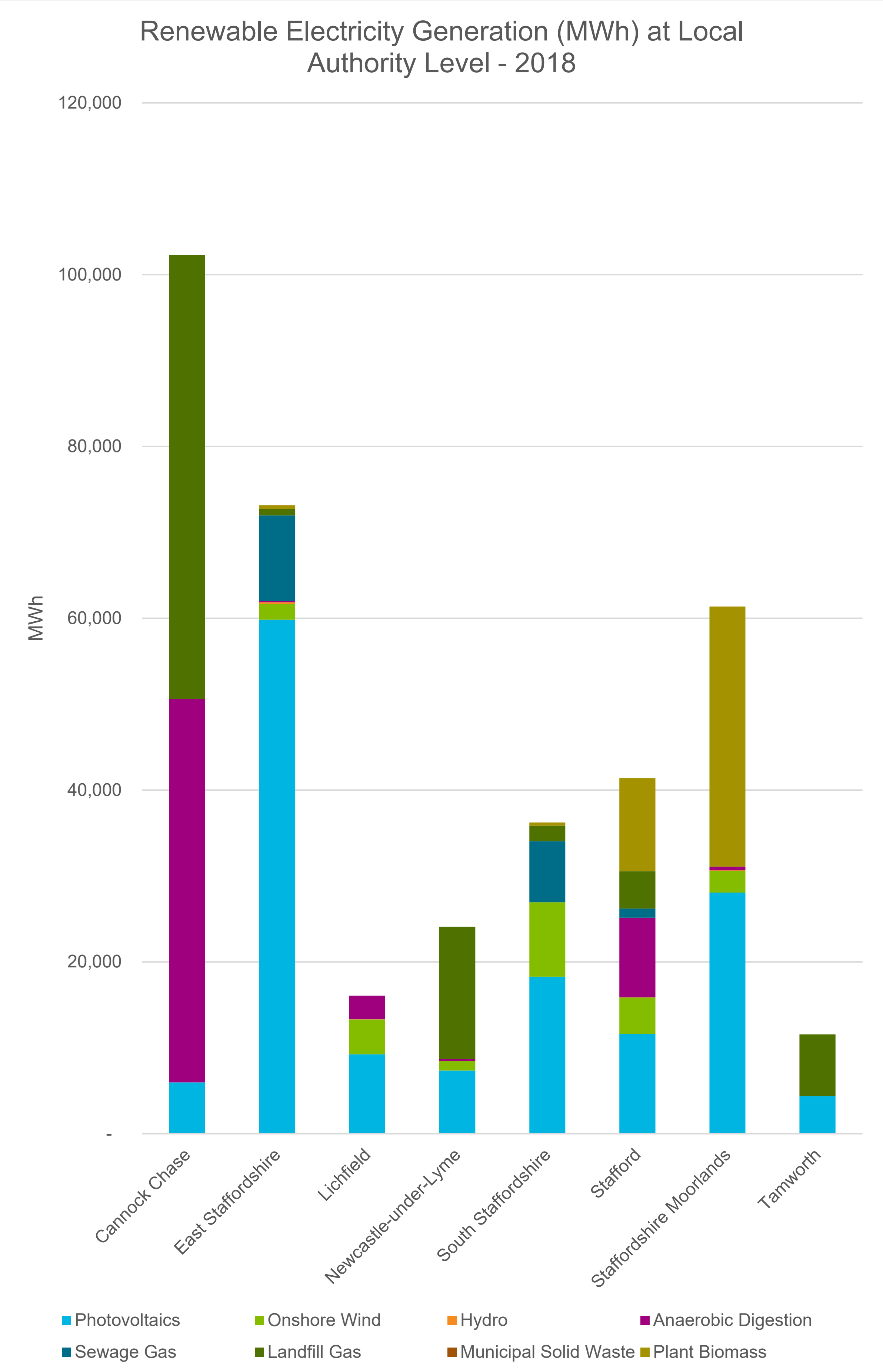

Figure 4-3. Annual renewable electricity generation in each Local Authority

A list of large-scale LZC installations is provided below, where information was provided in the REPD.

Table 4.4. Large-scale LZC installations in Staffordshire. Source: REPD

Planning Authority	Technology Type	Capacity (MW)	Site Name	Status
Cannock Chase Council	Battery	49.9	Former Rugeley Power Station	Awaiting Construction
East Staffordshire Borough Council	Anaerobic Digestion	6.0	Poplars Anaerobic Digestion Facility (Waste AD)	Operational
	PV	4.3	Marchington Solar Farm	Operational
	PV	18.7	Rolleston Park Farm	Operational
	PV	1.8	Blakenhall Park Solar Farm	Operational
	PV	6.4	Solar farm at land at The Willows, Uttoxeter	Operational
	PV	6.2	Morton House (Marchington)	Operational
	PV	5.8	Land of Green Lane	Operational
	PV	5.0	Woodhouse Fields Farm	Operational
Lichfield District Council	PV	1.0	Huddlesford Farm	Operational
	PV	1.0	Park Lane	Operational
Newcastle Under Lyme Borough Council	Battery	20.0	Noriker Power Staunch	Operational
	Battery	40.0	Rubber and Allied Products	Awaiting Construction
	Wind Onshore	1.0	Keele University	Awaiting Construction
	PV	7.6	Keele University	Awaiting Construction
South Staffordshire Council	Landfill Gas	4.4	Himley Wood Landfill Site	Operational
	PV	5.8	Jaguar Land Rover	Operational
	PV	1.8	Barr Farm	Operational
	Wind Onshore	4.0	Rodbaston	Operational
	PV	5.0	Land East of Lawn Lane	Operational
	Battery	50.0	Wolverhampton West Sub Station	Awaiting Construction
Stafford Borough Council	Biomass (dedicated)	2.6	Eccleshall Biomass	Operational
	Landfill Gas	1.3	Meece Landfill	Operational
Staffordshire County Council	Anaerobic Digestion	1.3	Brookfield Farm AD Plant (Farm AD)	Operational
	EfW Incineration	23.0	Four Ashes EfW	Operational
	Biomass (dedicated)	1.0	Bloomfield Recycling Site	Awaiting Construction
	Anaerobic Digestion	1.5	Bloomfield Recycling Site	Awaiting Construction
Staffordshire Moorlands District Council	PV	11.5	Lower Newton Farm	Operational
	PV	8.4	Land at Heywood Grange	Operational
	PV	5.0	Moneystone Quarry Solar Farm	Operational
Tamworth Borough Council	Landfill Gas	1.0	Wilnecote Landfill Site	Operational

These installations have been mapped in Figure 4-4 on the following page. Note that the map includes both operational installations and those that have been granted planning permission but are awaiting construction. Although we have endeavoured to check the REPD records against satellite imagery, all locations are approximate. Our review did not find detailed location data for the rest of the installations described in the RRS, which are assumed to be smaller-scale and more dispersed.

Figure 4-4. Approximate locations of existing and planned large-scale LZC technologies in Staffordshire. Source: Renewable Energy Planning Database

The following pages provide a more detailed breakdown of LZC installations for each Local Authority.

4.2.1 Cannock Chase

As shown in Table 4.5., Cannock Chase had an estimated total of 20.9 MW LZC electricity capacity installed as at the end of 2018 with a total electricity generation of 102,300 MWh per year. Although PV installations represent the highest number of installations in the area, the majority of electricity generation capacity is due to three landfill gas plants which account for over 50% of the potential LZC electricity generation in Cannock Chase, with the remaining 44% generated at a single anaerobic digestion (AD) plant.

Table 4.5. Renewable electricity generation (as at end of 2018) - Cannock Chase

	Total Installations (#)	Installed Capacity (MW)	Total Generation (MWh)
Photovoltaics	1,568	6.2	5,969
Anaerobic Digestion	1	6.5	44,625
Landfill Gas	3	8.2	51,706
Total	**1,572**	**20.9**	**102,300**

4.2.2 East Staffordshire

As shown in Table 4.6., East Staffordshire had an estimated total of 68.1 MW LZC electricity capacity installed as at the end of 2018 with a total generation of 73,152 MWh. Of these, there are a total of 1,557 PV installations, which are estimated to provide nearly 60,000 MWh per year of LZC electricity (around 82% of LZC electricity generation in the Borough). East Staffordshire also contains the highest number (3no.) of hydroelectric installations in the County.

Table 4.6. Renewable electricity generation (as at end of 2018) - East Staffordshire

	Total Installations	Installed Capacity (MW)	Total Generation (MWh)
Photovoltaics	1,557	64.2	59,834
Onshore Wind	9	0.9	1,789
Hydro	3	0.1	244
Anaerobic Digestion	1	0.1	153
Sewage Gas	2	2.3	9,942
Landfill Gas	1	0.6	776
Plant Biomass	1	0.1	415
Total	**1,574**	**68.1**	**73,152**

4.2.3 Lichfield

As shown in Table 4.7., Lichfield had an estimated total of 11.9 MW LZC electricity capacity installed as at the end of 2018 with a total generation of 16,061 MWh. Of these installations there are a total of 1,424 photovoltaics, which are estimated to account for around 57.5% of LZC electricity generation in Lichfield.

Table 4.7. Renewable electricity generation (as at end of 2018) - Lichfield

	Total Installations	Installed Capacity (MW)	Total Generation (MWh)
Photovoltaics	1,424	9.5	9,237
Onshore Wind	8	1.9	4,061
Hydro	1	<0.1	9
Anaerobic Digestion	1	0.5	2,754
Total	**1,434**	**11.9**	**16,061**

4.2.4 Newcastle-under-Lyme

As shown in Table 4.8., Newcastle-under-Lyme had an estimated total of 10.2 MW LZC electricity capacity installed as at the end of 2018 with a total generation of 24,090 MWh. This is dominated by PV in terms of the number of installations which are estimated to account for over 30% of renewable energy generation within the area. However, based on these statistics, around 64% of renewable energy generation in Newcastle-under-Lyme is produced by the single landfill gas installation.

Table 4.8. Renewable electricity generation (as at end of 2018) - Newcastle-under-Lyme

	Total Installations	Installed Capacity (MW)	Total Generation (MWh)
Photovoltaics	2,076	7.5	7,350
Onshore Wind	6	0.5	1,122
Anaerobic Digestion	1	0.1	190
Landfill Gas	1	2.1	15,428
Total	**2,084**	**10.2**	**24,090**

4.2.5 South Staffordshire

As shown in Table 4.9., South Staffordshire had an estimated total of 57.2 MW LZC electricity capacity installed as at the end of 2018 with a total generation of 36,227 MWh. This is dominated by PV in terms of the number of installations, and is estimated to account for over 50% of renewable electricity generation within the area. There is significant capacity provided by the municipal solid waste installation of 30MW (52% of total installed capacity); however, the amount of LZC electricity generated by this installation is unknown due to limitations in the dataset and it is not included within the total in Table 4.9. below.

Table 4.9. Renewable electricity generation (as at end of 2018) – South Staffordshire

	Total Installations	Installed Capacity (MW)	Total Generation (MWh)
Photovoltaics	1,298	20.0	18,283
Onshore Wind	3	4.1	8,659
Sewage Gas	2	1.2	7,110
Landfill Gas	1	1.9	1,808
Municipal Solid Waste	1	30.0	-
Plant Biomass	1	0.1	368
Total	**1,306**	**57.2**	**36,227**

4.2.6 Stafford

As shown in Table 4.10., Stafford had an estimated total of 20.4 MW LZC electricity capacity installed as at the end of 2018 with a total generation of 41,390 MWh. In terms of the number of installations, this is dominated by PV; the 2,376 installations are estimated to generate around 11,596 MWh per year of LZC electricity (28% of the total). The plant biomass installation provides the greatest single contribution to LZC electricity generation in the area, generating over 10,800 MWh per year of renewable electricity. Generation from anaerobic digestion plants is also significant and estimated at over 9,200 MWh/year.

Table 4.10. Renewable electricity generation (as at end of 2018) – Stafford

	Total Installations	Installed Capacity (MW)	Total Generation (MWh)
Photovoltaics	2,376	11.9	11,596
Onshore Wind	11	2.0	4,260

	Total Installations	Installed Capacity (MW)	Total Generation (MWh)
Hydro	1	<0.1	8
Anaerobic Digestion	4	1.8	9,281
Sewage Gas	1	0.2	1,060
Landfill Gas	1	1.7	4,353
Plant Biomass	1	2.9	10,832
Total	**2,395**	**20.4**	**41,390**

4.2.7 Staffordshire Moorlands

As shown in Table 4.11., Staffordshire Moorlands had an estimated total of 39.4 MW LZC electricity capacity installed as at the end of 2018 with a total generation of 61,363 MWh. Of these installations there are 1,630 PV installations, generating over 28,000 MWh per year. However, the majority of LZC electricity generation potential at present comes from plant biomass; the three installations in the area are estimated to provide over 30,000 MWh per year.

Table 4.11. Renewable electricity generation (as at end of 2018) - Staffordshire Moorlands

	Total Installations	Installed Capacity (MW)	Total Generation (MWh)
Photovoltaics	1,630	29.6	28,073
Onshore Wind	18	1.2	2,532
Hydro	2	<0.1	44
Anaerobic Digestion	2	0.1	447
Plant Biomass	3	8.4	30,269
Total	**1,655**	**39.4**	**61,363**

4.2.8 Tamworth

As shown in Table 4.12., Tamworth had an estimated total of 6.6 MW LZC electricity capacity installed as at the end of 2018 with a total generation of 11,563 MWh. Of these installations there are 878 PV installations and one landfill gas plant; the latter is estimated to provide the majority of LZC electricity generation in the Borough due to its size.

Table 4.12. Renewable electricity generation (as at end of 2018) - Tamworth

	Total Installations	Installed Capacity (MW)	Total Generation (MWh)
Photovoltaics	878	4.6	4,365
Landfill Gas	1	2.0	7,198
Total	**879**	**6.6**	**11,563**

4.3 Existing LZC Heat Installations

The table below shows the number of accredited LZC heat installations that are listed in the RHI database. This indicates that there are at least 1,192 LZC heat technologies in Staffordshire.

Table 4.13. Renewable heat technologies. Source: RHI Database

	Total installations	Installed Capacity (MW)
Cannock Chase	*Not reported**	-
East Staffordshire	251	11
Lichfield	141	20

Newcastle-under-Lyme	156	17
South Staffordshire	124	24
Stafford Borough	237	20
Staffordshire Moorlands	259	17
Tamworth	*Not reported**	-
Staffordshire County	**1,192**	**112**

** Not reported within the publicly available RHI database for data protection reasons.*

The RHI database does not provide a breakdown of installations for each Local Authority by technology type and installed capacity. However, for the UK as a whole, RHI statistics show that:

- The majority of non-domestic accredited installations are biomass boilers; around a quarter use biomethane, and the remainder comprises a mixture of technologies, most notably combined heat and power (CHP) or ground source heat pumps.
- The majority of domestic accredited installations are air source heat pumps, with the remainder primarily split between ground source heat pumps, biomass boilers and solar thermal technologies.

In general, areas with higher proportions of off-grid properties tend to have higher numbers of LZC heat technologies, as indicated in Figure 4-5 below. The graph compares the number of domestic RHI installations against the estimated proportion of domestic properties that are off the gas grid.[24]

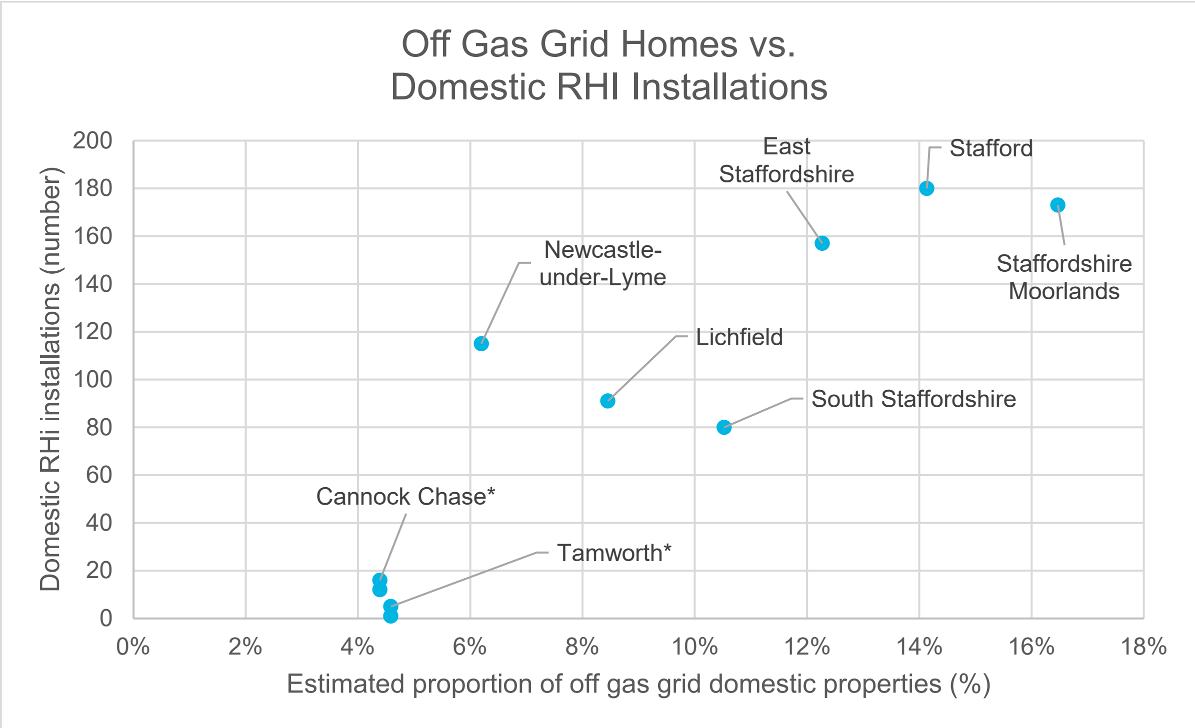

Figure 4-5. Number of domestic RHI installations compared with the estimated proportion of off gas grid properties.

** For Cannock Chase and Tamworth, the precise number of RHI installations is not publicly available. Therefore, the sum of installations for other Local Authorities in Staffordshire was subtracted from the County-wide total to provide an upper and lower estimate.*

[24] Based on comparing the number of domestic gas meters to the number of domestic electricity meters as of 2018, per BEIS, *'Sub-national_electricity_consumption_statistics_2005-2018'* and *'Sub-national_gas_consumption_statistics_2005-2018'*.

5. Ultra-Low Emission Vehicles (ULEVs) and Charging Infrastructure

5.1 Source of Data

Reaching net zero carbon emissions by 2050 will require transport-related emissions to be eliminated through the uptake of electric and hydrogen fuelled vehicles and the phasing out of petrol and diesel vehicles, as well as increasing usage of public transport.

Estimates for the current number of vehicles (including ULEVs) in Staffordshire are taken from *'VEH0105: Licensed vehicles by body type and local authority'* and *'VEH0132: Licensed ultra low emission vehicles by local authority'* (2019) which are published by the Department for Transport (DfT). [25,26] These datasets record the number of vehicle registrations in each Local Authority from 2011 through 2019.

Note: For the purpose of this report, we have used the DfT definition of 'ultra low emission vehicle' which refers to *'vehicles that emit less than 75g of carbon dioxide (CO_2) from the tailpipe for every kilometre travelled. In practice, the term typically refers to battery electric, plug-in hybrid electric and fuel cell electric vehicles.'*

The DfT also publishes an online map of public electric vehicle charging points in each Local Authority which has been used to estimate the current number in Staffordshire. [27]

The National Grid's 'Community Renewables' FES was used to project the potential future numbers of vehicles by type and fuel, showing an indicative road map of the changes in numbers of vehicles that will need to be seen in Staffordshire in order to reach net zero emissions by 2050.[28]

5.2 Current Uptake of ULEVs and Charging Infrastructure

The table below shows the estimated number of ULEVs that are currently registered in Staffordshire, along with the number of public EV chargepoints in the County.

Table 5.1. Uptake of ULEVs and estimated number of public charging points in Staffordshire

	Number of licensed ULEVs	ULEVs as % of total vehicles	Total public charging devices	Total public rapid* charging devices	Charging devices per 100,000 population
Cannock Chase	354	0.53%	13	7	13
East Staffordshire	275	0.37%	15	5	13
Lichfield	323	0.45%	15	2	14
Newcastle-under-Lyme	248	0.34%	25	19	19
South Staffordshire	238	0.32%	16	9	14
Stafford	361	0.41%	27	7	20
Staffordshire Moorlands	222	0.32%	8	1	8
Tamworth	167	0.35%	5	2	7
Staffordshire County	**2,188**	**0.39%**	**124**	**52**	**14**

** DfT statistics classify chargepoints of 43kW and above as 'rapid'.*

[25] Department for Transport, *'VEH0105: Licensed vehicles by body type and local authority'* (December 2019). Available at: https://www.gov.uk/government/statistical-data-sets/all-vehicles-veh01#licensed-vehicles
[26] Department for Transport, *'VEH0132: Licensed ultra low emission vehicles by local authority'* (December 2019). Available at: https://www.gov.uk/government/statistical-data-sets/all-vehicles-veh01#licensed-vehicles
[27] Department for Transport, *'Table 1: Publicly available electric vehicle charging devices by local authority'* (July 2020). Available at: http://maps.dft.gov.uk/ev-charging-map/
[28] As the Net Zero FES does not contain Natural Gas-powered vehicles, these were not shown in projections, although they do feature in the Community Renewables FES. The Community Renewables scenario was used as the Net Zero FES does not have transport projections data available.

As shown in Figure 5-1, there was a more than ten-fold increase in the number of ULEVs registered in Staffordshire between 2011 and 2019, with 2,188 as of December 2019. Nonetheless, these represent a small portion (<0.4%) of the more than 568,000 vehicles licensed in Staffordshire.

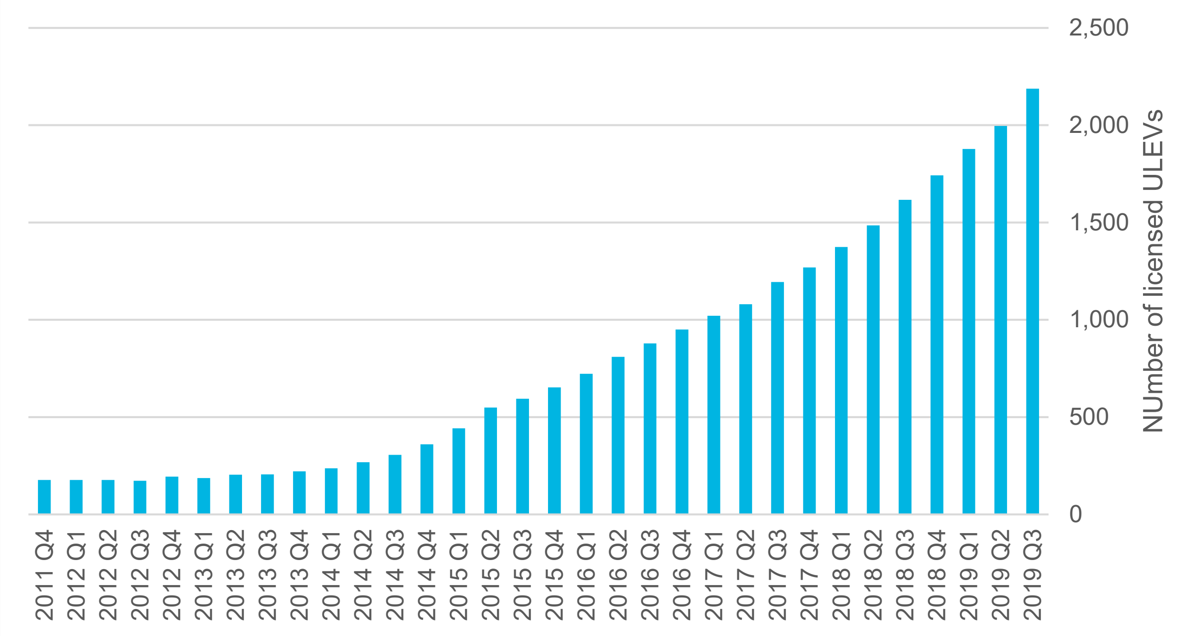

Figure 5-1. Ultra low emission vehicle (ULEV) registrations in Staffordshire, 2011-2019

5.3 Future Trends in Transportation

To reach net zero emissions in transport, petrol and diesel vehicles will have to be phased out entirely by 2050 at the latest, being replaced mostly by ULEVs. Figure 5-2 shows an illustrative scenario to achieving zero emission transport, which is based on the National Grid Future Energy Scenarios. By 2029, electric and hydrogen fuelled vehicles should make up around a quarter of all vehicles, by 2033 they should make up over half of all vehicles and by 2036 they should make up over three quarters of all vehicles in Staffordshire.

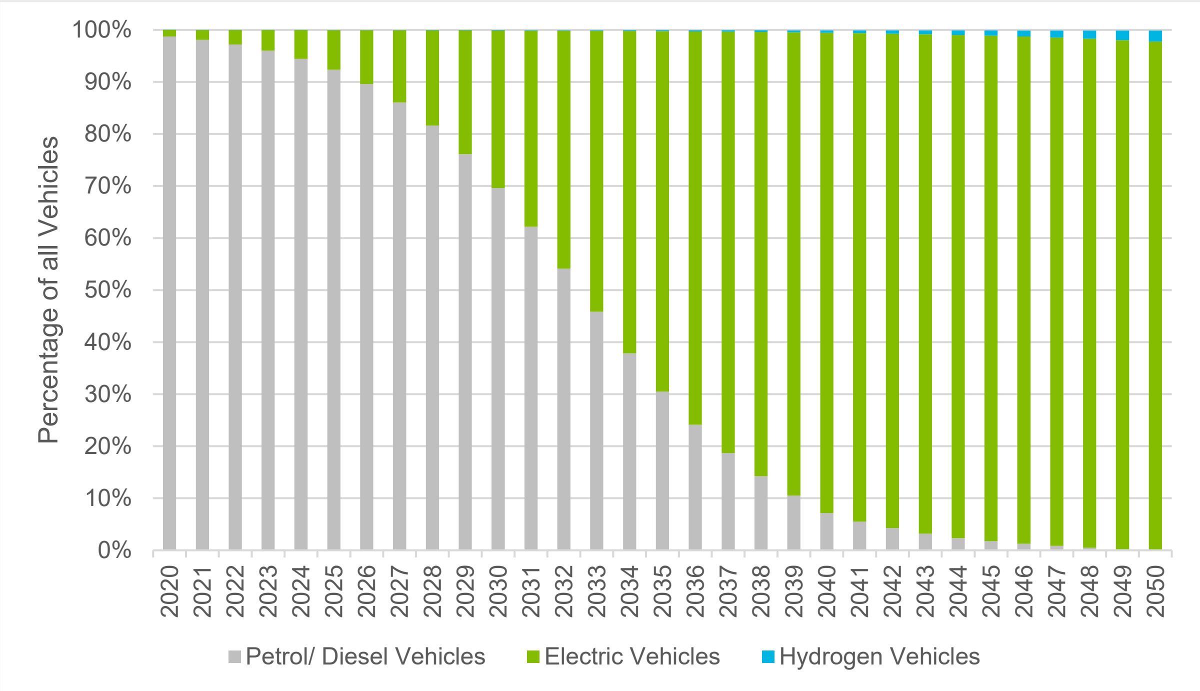

Figure 5-2: Vehicle Fuel Sources 2020-2050 (National Grid FES: ‘Community Renewables’)

Table 5.2. shows the implications of this change for Staffordshire in terms of the number of vehicles that use traditional fuels (petrol or diesel) compared with electric or hydrogen fuelled vehicles. To be on track to match these figures, the number of ULEVs in Staffordshire would have to be over 20 times higher than current levels within 5 years.

Table 5.2. Illustrative trajectory showing changes in vehicle fuel sources from 2019 to 2050 based on National Grid Future Energy Scenarios

Year	Petrol/ Diesel Vehicles	Electric Vehicles	Hydrogen Vehicles
2019	570,000	2,200	0
2020	567,000	7,000	30
2025	540,000	45,000	170
2030	410,000	180,000	550
2035	180,000	410,000	1,500
2040	45,000	530,000	3,000
2045	12,000	538,000	6,000
2050	0	537,000	13,000

By way of illustrating the challenge, Figure 5-3 compares the historical growth in ULEVs in Staffordshire from 2011 to Q3 2019 against two potential scenarios for growth through the year 2025:

a) Uptake increases linearly in line with the trends in the past three years (blue); and

b) Uptake increases in line with the Future Energy Scenarios as described in Table 5.2. (green).

This highlights that, in order for Staffordshire to be on track to reaching net-zero transport emissions by 2050, the uptake rates will need to increase dramatically.

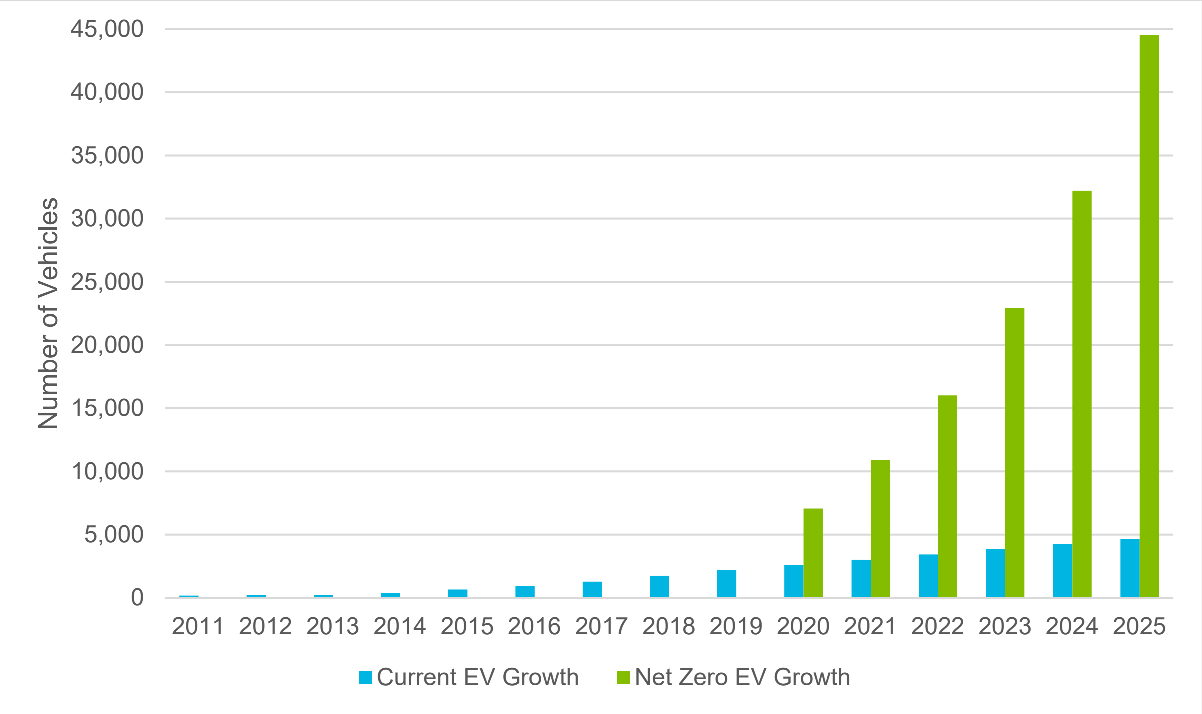

Figure 5-3: Current EV Growth vs. Net Zero EV Growth, 2011-2025 – Staffordshire County

Although it is expected to be a significant challenge to reach these growth rates, the Government has confirmed that new cars running on conventional fuels (i.e. petrol and diesel) will be banned from 2035 at the latest (with the date potentially being brought forward to 2032 or earlier). This is expected to support the ULEV market and accelerate the switch away from conventionally-fuelled vehicles.

Furthermore, and potentially as an indirect effect of the legislation described above, it is estimated that the price of electric, hybrid and traditional fuel cars could converge within the next decade[29]. This would be expected to further facilitate the shift, but this will need to be supported by robust policy and infrastructure reinforcements provided at a local level.

A large-scale shift to the use of electric vehicles must also be accompanied by a significant modal shift towards walking, cycling, ridesharing, and an increase in the use of public transport. This is necessary to reduce electricity demand – with added benefits in terms of air quality and, potentially, improving public health.

[29] Cambridge Econometrics and Element Energy, *'Fuelling Europe's Future: How the transition from oil strengthens the economy'* (2018). Available at: https://europeanclimate.org/wp-content/uploads/2018/02/FEF_transition.pdf

6. Climate Risks

The primary aim of the climate risk analysis is to provide a high-level understanding of the risks and impacts associated with climate change that future development areas are expected to experience in Staffordshire.

The consideration of climate change adaptation and environmental risks in the development of Local Plans is an important step to help future development, regardless of use, cope with the future challenges and demands that it may be exposed too.

Staffordshire is no stranger to climate hazards, experiencing the frequent impact of flooding throughout the County. As a result, it is important to acknowledge the extensive work and strategic planning currently in place at a regional and district level in order to plan for and act on flood events. This report will therefore build upon and develop existing knowledge held by the Councils, whilst broadening the understanding around wider climate risks.

The spatial aspect of this assessment is limited to the "key development" allocation areas for either residential or employment land that is in the process of being provided by the individual district level councils within Staffordshire. For detail around the sources and types of information used within this analysis, please refer to Appendix J.

6.1 Weather and Climate Data

6.1.1 Past Severe Weather Events

The Staffordshire County Council Local Climate Impact Profile contains information on past severe weather events experienced within the county between 1999 and 2009. A key aim of this analysis has been to update this information to the present day (2020) from 2010.

The LCLPI derived heavy rain, snow and strong winds being the three weather types that have impacted Staffordshire most frequently in the analysis time period. This is summarised in Figure 6-1 below.

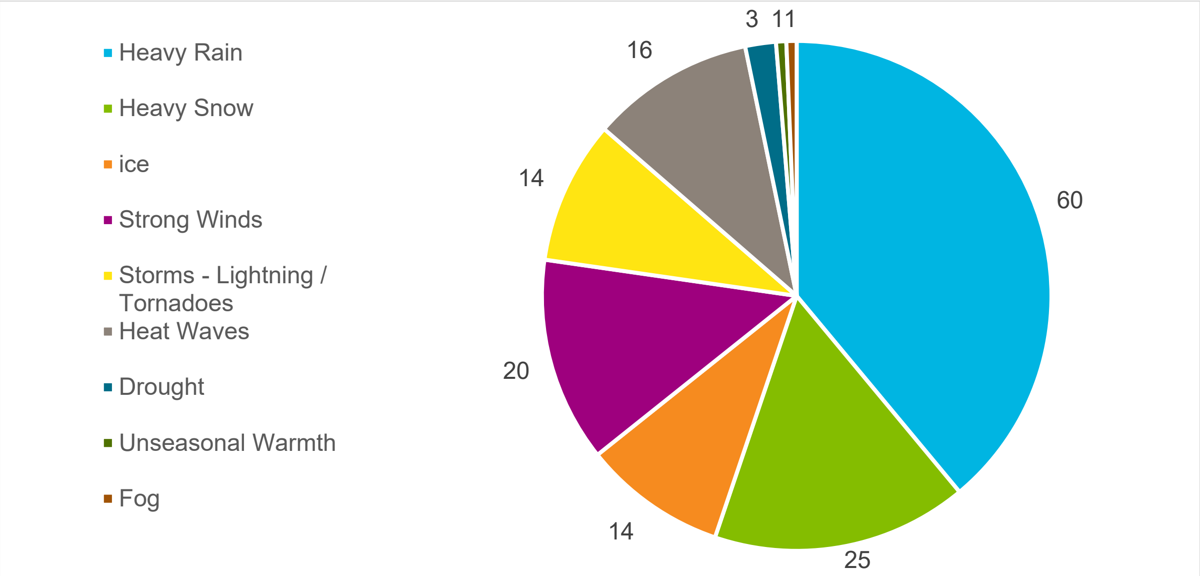

Figure 6-1: Type and number of weather types, 1999 – 2009 from Staffordshire LCLIP

Appendix K contains a review of past severe weather events that have occurred in and around Staffordshire since 2010, as documented in media reports and any relevant district and county-council level documents received. Each event was categorised against a primary hazard, in order to understand their prevalence over the last decade.

Overall a total of **33** climate-related events were recorded across Staffordshire between 2010 and 2020. Of these, surface water or river-related flood events recorded the highest number of events at **16,** with the second most prevalent hazard being heatwaves with **8** events, and the third being severe storms & gales with **5.**

- The most frequent hazard, flooding (caused by either fluvial or surface water) is experienced throughout Staffordshire. The extent of the impact experienced due to this flooding naturally varies, depending on the duration and scale of the event. For example, in June 2016, intense rainfall over a week and a half, caused flooding in multiple locations across the County, such as at Bishops Wood, Cannock, Stafford and Shenstone, inundating open land and also numerous residential and commercial properties. In May 2019, heavy rainfall caused minor surface flooding in Great Wyrley in South Staffordshire, damaging up to 5 residential properties.

- Temperatures in Staffordshire were observed to have increased to within the region of 30ºC or above on 8 occasions between 2010 and 2020. These events were often caused by stubborn high-pressure weather systems. With high temperatures come overheating and an increased risk to the most vulnerable population groups within society, such as the elderly and infirm.

- Storms & severe gales is a hazard that is made up of multiple aspects, presenting both high winds and heavy rain, resulting in it being a catalyst for other hazards such as flooding. Storms such as ex-hurricane Ophelia (Oct 2017), Storm Freya (Winter 2018 / 19) and more recently Storm Dennis (February 2020) have impacted Staffordshire through tree falls, entrained debris and flooding which disrupted infrastructure networks such as transport and power, while also causing damage to properties and presenting a risk to life.

6.1.2 Climate Projections and Trends

UK Climate Projections 2018 (UKCP18)[30] have been developed by the UK Climate Impacts Programme (UKCIP)[31] to provide projections for future climate scenarios and trends. UKCP18 data is the most robust source of information on the UK's future climate, it is based on the latest developments in climate science and has been subject to an independent peer review.

The projections displayed within Table 6.1 – Table 6.6 represent average weather conditions and do not capture the full range of possible more frequent severe weather events (i.e. dry spells, heatwaves and prolonged heavy rainfall) in the future. They contain only the high emission scenario projections (RCP8.0) with a 50% probability level: 10% and 90% probability levels are shown in brackets to indicate the range of potential outcomes. The projections have been placed against the baseline climate data for Staffordshire, which represent an average derived from met office weather stations between 1981 – 2010.

Each table represents a 25km grid of projection data applied across Staffordshire. Where these grids fall across multiple districts they have been grouped accordingly. If a district lies within two or more grids, the grid that covers that largest assumed area of the district has been selected.

For more detail on the data, please refer to 0.

[30] https://www.metoffice.gov.uk/research/approach/collaboration/ukcp/about
[31] Through collaboration between Defra, the Environment Agency, the University of East Anglia and the Hadley Centre of the Met Office

Table 6.1: Climate Projections for Staffordshire Moorlands.

Climate Variable	Baseline (1981 - 2010)	Projected Change for 2030	Projected Change for 2050	Projected Change for 2080
Mean annual air temperature anomaly at 1.5m (°C)	9.5	+0.73 (+0.14/ +1.30)	+1.61 (+0.70/+2.60)	+3.19 (+1.48/+5.03)
Maximum annual air temperature anomaly at 1.5m (°C)	13.2	+0.79 (+0.18/ +1.37)	+1.75 (+0.64/+2.88)	+3.40 (+1.36/ +5.46)
Minimum annual air temperature anomaly at 1.5m (°C)	5.8	+0.67 (-0.001/ +1.37)	+1.54 (+0.59/+2.63)	+3.06 (+1.34/ +5.03)
Annual precipitation rate anomaly (%) with Baseline rainfall (mm).	777.3	-0.50 (-4.24/ +3.73)	-0.79 (-5.46 / +4.08)	+1.11 (-2.66/ +4.90)

Table 6.2: Climate Projections for Newcastle Under-Lyme

Climate Variable	Baseline (1981 - 2010)	Projected Change for 2030	Projected Change for 2050	Projected Change for 2080
Mean annual air temperature anomaly at 1.5m (°C)	9.5	+0.74 (+0.14 / +1.31)	+1.63 (+0.71 / +2.63)	+3.22 (+1.49 / +5.09)
Maximum annual air temperature anomaly at 1.5m (°C)	13.2	+0.80 (+0.18/ +1.39)	+1.78 (+0.65/ +2.93)	3.45 (+1.38/ +5.54)
Minimum annual air temperature anomaly at 1.5m (°C)	5.8	+0.74 (+0.14 / +1.31)	+1.78 (+0.65/ +2.93)	+3.09 (+1.34 / +5.07)
Annual precipitation rate anomaly (%) with Baseline rainfall (mm).	777.3	-0.27 (-4.45 / +5.68)	-0.51 (-5.72 / +4.69)	+1.50 (-2.81/ +5.89)

Table 6.3: Climate Projections for East Staffordshire

Climate Variable	Baseline (1981 - 2010)	Projected Change for 2030	Projected Change for 2050	Projected Change for 2080
Mean annual air temperature anomaly at 1.5m (°C)	9.5	+0.80 (+0.23 / +1.36)	+1.77 (+0.84 /+2.77)	+3.38 (+1.68 / +5.20)
Maximum annual air temperature anomaly at 1.5m (°C)	13.2	+0.80 (+0.23 / +1.36)	+1.93 (+0.80 / +3.07)	+3.62 (+1.60/ +5.67)
Minimum annual air temperature anomaly at 1.5m (°C)	5.8	+0.80 (+0.23 / +1.36)	+1.66 (+0.66/ +2.79)	+3.22 (+1.46 / +5.23)
Annual precipitation rate anomaly (%) with Baseline rainfall (mm).	777.3	-0.50 (-5.30 / +4.67)	-1.13 (-6.44 / +4.37)	+0.54 (-3.57/ +4.74)

Table 6.4: Climate Projections for Stafford

Climate Variable	Baseline (1981 - 2010)	Projected Change for 2030	Projected Change for 2050	Projected Change for 2080
Mean annual air temperature anomaly at 1.5m (°C)	9.5	+0.75 (+0.14 / +1.33)	+1.66 (+0.73 / +2.68)	+3.27 (+1.52 / +5.17)
Maximum annual air temperature anomaly at 1.5m (°C)	13.2	+0.81 (+0.18 /+1.42)	+1.82 (+0.67 /+2.98)	+3.50 (+1.40 /+5.64)
Minimum annual air temperature anomaly at 1.5m (°C)	5.8	+0.75 (+0.14 / +1.33)	+1.58 (+0.61 / +2.69)	+3.13 (+1.36 / +5.14)
Annual precipitation rate anomaly (%) with Baseline rainfall (mm).	777.3	-0.19 (-5.24 /+5.22)	-0.92 (-6.86 / +4.96)	+0.91 (-4.35 / +6.20)

Table 6.5: Climate Projections for Cannock Chase, Lichfield and Tamworth

Climate Variable	Baseline (1981 - 2010)	Projected Change for 2030	Projected Change for 2050	Projected Change for 2080
Mean annual air temperature anomaly at 1.5m (°C)	9.5	+0.80 (+0.23 / +1.37)	+1.79 (+0.85 / +2.80)	+3.42 (+1.70 / +5.26)
Maximum annual air temperature anomaly at 1.5m (°C)	13.2	+0.88 (+0.27/ +1.49)	+1.95 (+0.81/ +3.10)	+3.66 (+1.61/ +5.73)
Minimum annual air temperature anomaly at 1.5m (°C)	5.8	+0.80 (+0.23 / +1.37)	+1.68 (+0.67/+2.83)	+3.27 (+1.48 / +5.30)
Annual precipitation rate anomaly (%) with Baseline rainfall (mm).	777.3	-0.13 (-5.59 / +5.68)	-1.11 (-6.95 / +4.83)	+0.85 (-4.57 / +6.22)

Table 6.6: Climate Projections for South Staffordshire

Climate Variable	Baseline (1981 - 2010)	Projected Change for 2030	Projected Change for 2050	Projected Change for 2080
Mean annual air temperature anomaly at 1.5m (°C)	9.5	+0.75 (+0.14 / +1.34)	+1.69 (+0.74 / +2.71)	+3.31 (+1.54 / +5.23)
Maximum annual air temperature anomaly at 1.5m (°C)	13.2	+0.82 (+0.17 /+1.43)	+1.84 (+0.68 /+3.02)	+3.55 (+1.42 /+5.71)
Minimum annual air temperature anomaly at 1.5m (°C)	5.8	+0.75 (+0.14 / +1.34)	+1.59 (+0.62 / +2.72)	+3.16 (+1.37 /+5.19)
Annual precipitation rate anomaly (%) with Baseline rainfall (mm).	777.3	-0.15 (-5.55 /+6.18)	-1.00 (-7.40 / +5.33)	0.52 (-4.98 / 5.980

The trends we expect to observe in future temperature and precipitation change are broken down by temperature and projections.

For temperature under a high emission scenario and a 90% probabilistic level, we expect:

- The trend of rising annual temperatures is forecast to continue, with seasonal average warming by 2080 expected to rise by 5.4º in summer and 4.2ºC in winter.
- Extreme temperatures are set to rise, with the temperature of hot summer days to increase by up to 6.8ºC by 2080.
- Hot spells (temperatures above 30ºC for two or more consecutive days) are also set to continue to increase in frequency and duration, rising from an average of 0.25 per year in 2018 to 4.3 per year by 2080.

For precipitation under a high emission scenario and a 90% probabilistic level, we expect:

- There will be a greater seasonality of rainfall with more in winter and less in summer (when compared to baseline conditions). This is portrayed by a season average precipitation change by 2070 of between -47% and +2% in summer and -1% and +35% in winter which may lead to changes in water availability such as increased water shortages in summer.
- Rainfall events that currently occur typically once every 2 years will increase in frequency by 25%.

More generally, we continue to anticipate a move towards warmer, wetter winters and hotter, drier summers, with an increase in the frequency and intensity of extreme events.

6.1.3 Sea Level Rise

Although Staffordshire County is land-locked and contains no coastal areas, it is still important to understand and acknowledge the projections in sea level rise, given the impact this will have on neighbouring areas and national-level infrastructure networks. The following table portrays the comparison between the low (RCP2.0) and high emission (RCP 8.0) scenarios by 2100 relative to the 1981 – 2000 baseline average.

Table 6.7: Sea Level Change (m) at 2100 relative to 1981 - 2000 baseline average. UKCP18.

Confidence Level	Low Emission Scenario	High Emission Scenario
10%	<0.29m	<0.53
90%	<0.7m	<1.15m

UK costal flood risk is expected to increase over the 21st century beyond the considerations of the emission scenarios considered and be dominated by the effects of average sea level rise over time as opposed to atmospheric storminess and extreme coastal sea level events.

The emissions already produced to date on a global scale mean that we are locked-in to experience a minimum sea level rise to the extent of the “low emission scenario” data. Unless emission levels and the associated temperature increase is curbed, sea level will continue to rise.

6.2 Climate Hazards and Key Risks

6.2.1 Climate Hazards

From analysing past events, alongside other key documents such as the Staffordshire Community Risk Register[32], we can determine which hazards Staffordshire is exposed too. These are:

- Severe Storm & Gales
- Cold and Snow
- River Flooding
- Surface Water Flooding
- Heat Wave
- Drought
- Wildfires

[32] https://www.staffordshireprepared.gov.uk/test/Old-Template-Pages/Risk-Register/documents/Staffordshire-Community-Risk-Register-June-2017.pdf

6.2.2 Key Risks / Opportunities

In order to determine the key risks / opportunities for Staffordshire and the key development areas, relevant technical chapters within the UK Climate Change Risk Assessment[33] were reviewed, including:

- Chapter 3: Natural Environment & Assets
- Chapter 4: Infrastructure
- Chapter 5: People and the Built Environment.

The following scale of relevance was developed and applied to these risks, in order to determine which risks would directly impact future development areas within Staffordshire.

Table 6.8: Scale of Relevance

High	Would directly impact future development in Local Plans.
Medium	Would indirectly influence future development in Local Plans
Low	Very little to no direct or indirect influence on future development in Local Plans.

The set of key climate risks below has been allocated a relevance scale of 'High', meaning they would directly impact or provide opportunity for new development areas across Staffordshire. Please refer to the full table in Appendix L for the comment / rationale for the relevance rating applied per risk.

Table 6.9: UKCCRA Risks deemed 'High' relevance. Green = Natural Environment, Blue = Infrastructure, Orange = People and the Built Environment

Risk Ref	Risk as per UKCCRA with a "High" Relevance to Staffordshire	Primary Climate Hazard
8	**Ne8**: Risks of land management practices exacerbating flood risk	River Flooding
14	**Ne14:** Risks and opportunities from changes in landscape character	Cross-Cutting
15	**In1:** Risks of cascading failures from interdependent infrastructure networks	Cross-Cutting
16	**In2:** Risks to infrastructure services from river, surface water and groundwater flooding	River Flooding
18	**In4:** Risks of sewer flooding due to heavy rainfall	Surface Water Flooding
19	**In5:** Risks to bridges and pipelines from high river flows and bank erosion	River Flooding
20	**In6:** Risks to transport networks from slope and embankment failure	Severe Storm & Gales
23	**In9:** Risks to public water supplies from drought and low river flows	Drought
25	**In11:** Risks to energy, transport and digital infrastructure from high winds and lightning	Storm & Severe Gales
27	**In13**: Risks to transport, digital and energy infrastructure from extreme heat	Heat Wave

[33] https://www.theccc.org.uk/tackling-climate-change/preparing-for-climate-change/uk-climate-change-risk-assessment-2017/ccra-chapters/

28	**In14:** Potential benefits to water, transport, digital and energy infrastructure from reduced extreme cold events	Cold and Snow
29	**PB1:** Risks to health and wellbeing from high temperatures	Heat Wave
31	**PB3:** Opportunities for increased outdoor activities from higher temperatures	Heat Wave
32	**PB4:** Potential benefits to health and well-being from reduced cold	Heat Wave
33	**PB5:** Risks to people, communities and buildings from flooding	Surface Water Flooding
35	**PB7:** Risks to building fabric from moisture, wind and driving rain.	Severe Storm & Gales
37	**PB9:** Risks to health and social care delivery from extreme weather	Cross-Cutting
38	**PB10**: Risks to health from changes in air quality	Heat Wave
41	**PB13**: Risks to health from poor water quality	Drought
42	**PB14:** Risk of household water supply interruptions	Cross-Cutting

Of the 20 risks deemed to be of "High' relevance to key development areas in Staffordshire, 5 of the risks are associated with a primary hazard of either River Flooding or Surface Water Flooding. 5 more are associated with heat waves, and 4 can be deemed as 'cross-cutting' risks, associated with multiple hazards.

The largest number of risks are posed to Infrastructure and People and the Built Environment at 9 risks each, with Natural Environment & Assets only having 2 associated highly relevant risks. Within this, 2 of the risks also demonstrate opportunities and potential beneficial impacts, which are further outlined in Table 6.10 below.

6.3 Impacts from Climate Change on Expected Future Development Areas

Based on the key UKCCRA risks that are relevant to key development areas across Staffordshire, the following impact statements have been developed. These provide a high-level broad-brush approach to the County as a whole. Cascading impacts have not been considered in this assessment (i.e. the chain of events associated with each impact).

All opportunities (which are expected to have positive impacts), as opposed to risks (which are expected to have negative impacts), can be identified by the word "**Opp"** written prior to the impact statement. The impact statements below have been developed in response to the risks that are outlined in Table 6.10. They are linked to the individual risks by the "risk ref" column.

Table 6.10: Impact statements associated with future development areas.

Risk Ref	Impact Statement
8	Riverine and Surface water flooding could be exacerbated for other landowners and occupiers by future development areas.
14a	**Opp:** A changing climate causes natural communities that characterise the current landscape to change, making new areas of land available for development.
14b	A changing climate causes natural communities that characterise the current landscape to change, making current areas of land allocated for development unsuitable.
15a	Climate related events cause a loss of infrastructure services (e.g. power, energy, water, waste-water), disrupting activity within the development area.

15b	The connection of new development areas to existing, interdependent infrastructure networks will heighten the risk of cascading failures due to a climatic event.
15c	Climate-related events causing impact/damage to pre-existing interdependent infrastructure resulting in future development sites becoming economically unviable.
15d	**Opp:** Deployment of independent, micro-grid infrastructure within development areas for energy and heat generation to reduce interdependencies and cascading risk of failure due to a climate event.
16a	Storm and / or flooding event results in power or communication outage, disrupting all activity within the new development areas.
16b	Road/rail blockage may cause material supply disruption to a development site, which causes negative impact on the schedule, has financial implications to a developer and may increase in final product cost
18	Severe flooding damages sewage infrastructure, causing a negative impact on biodiversity through pollution in the area with potential for EA penalties.
19	High river flows and increased bank erosion cause long-term disruption of important transport corridors in, around and between new development areas, impacting access by workers / residents / occupants and the transfer of goods and materials.
20	Landslides cause long-term disruption of important transport corridors in, around and between new development areas impacting access by workers residents / occupants and the transfer of goods and materials.
23	Water shortage temporarily affects the habitability and operational capacity of future development areas.
25	Lightning storm conditions cause short to medium term disruption of infrastructure and transport services to the development area.
27	Heatwave conditions cause disruption to major infrastructure within and connecting to the development area.
28a	**Opp:** A reduction in extreme cold events cause design considerations of cold sensitive infrastructure to change.
28b	**Opp:** Potential saving from less frequent snow clearing and/or cold related maintenance (e.g. potholes repair from reduced freeze-thaw effect)
29	Overheating in development buildings cause or exacerbate occupant illnesses, impacting material selection and design standards.
31	**Opp:** Rising temperatures cause the demand on and use of open space to change, creating a positive impact on local business and commercial opportunities.
32	**Opp:** Rising temperatures cause a reduction in cold temperature related illness for residents.
33	A major flooding event causing property damage, injury or loss of life, with insurance becoming unviable for new developments.
35	More severe storms and gales cause a rise in moisture within building fabrics, increasing the maintenance and repair works required.
37	Extreme weather events increase the pressure on local and regional health and social care delivery, impacting the wellbeing of occupants in new development areas.
38	Poor air quality causes illness amongst the occupants.
41	Poor water quality causes illness amongst the occupants.
42a	A climatic event interrupting water supplies reduces the liveability of buildings within the development area.
42b	Climate event interrupting water supplies increases building operation costs in new development areas due to higher water prices.

All spatially relevant risks associated with the “key development areas” has been developed as part of the final ‘Stage 2’ deliverable.

Appendix A – Scope 3 GHG Emissions

Scope 3 emissions can arise from a wide range of sources and activities. This report has described Scope 3 emissions based on SCATTER tool outputs for each Local Authority in Staffordshire. The coverage of the SCATTER tool is in line with the Global Covenant of Mayors Common Reporting Framework (CRF) which provides an international standardised template for emissions reporting.

On this basis, the Scope 3 emissions reported in this study primarily comprise emissions from aviation (including out-of-boundary flights) and 'fuel lifecycle emissions' from energy use in buildings and transport. Note that they do not include upstream emissions from the purchase of consumer goods, IT equipment, services, etc. Because most of these sources contribute a small proportion of the overall total when taken individually, these have been consolidated for the sake of clarity in the report. Further details are provided in the table below.

Sector	**Sub-sector**	**Scope 3 emissions from…**	**Notes**
Stationary energy	All building types	Coal, petroleum products, natural gas, electricity, and biomass	These are 'fuel lifecycle emissions' also known as 'Well-to-Tank' emissions. BEIS describes these as resulting from *'the extraction, transport, refining, purification or conversion of primary fuels to fuels for direct use by end-users and the distribution of these fuels.'* - BEIS, *'Methodology Paper for Emission Factors'* (2018).
Transportation	On- and off-road, rail and waterborne navigation		
	Aviation	Aviation turbine fuel	Emissions from aviation are allocated to each Local Authority based on percentage of population
Waste	Solid waste disposal Biological treatment Incineration and open burning Wastewater	N/a – see notes	From the SCATTER methodology: *'This covers non-energy related emissions from disposal and treatment of waste (incl. wastewater) generated within the city boundary, as a result of aerobic or anaerobic decomposition of waste, or incineration.'* In other words, it is assumed that any fuel used in waste treatment facilities within Staffordshire will be captured within the 'stationary energy' category, and any fuel used to transport waste will be captured in the 'transportation' category.

Appendix B – Comparison of BEIS and SCATTER data

The table below outlines key differences between the emissions data provided in the CO_2-only BEIS dataset, compared with the SCATTER tool outputs, as presented in Section 3.

For further information about the BEIS data, see the *'Technical Report: Local and Regional Carbon Dioxide Emissions Estimates for 2005-2017 for the UK'* (BEIS, June 2019).[34, 35]

For further information about the SCATTER data, see the 'Inventory Methodology' at: https://scattercities.com/pages/methodology/

	BEIS dataset	**SCATTER dataset**
Time series	2005-2017 (More up to date; ability to analyse trends over time)	2016 only (Less up to date; cannot analyse trends over time)
Reported in units of…	CO_2 only	CO_2 equivalent (including CO_2, CH4, N_2O and F-gases)
Scope of emissions	Scope 1 & 2 emissions	Scope 1, 2 & 3 emissions
Geographic coverage	Dataset only considers emissions arising from fuels used within the boundary of the relevant Authority. For instance, if waste is generated in Staffordshire, emissions associated with disposing of that waste are only captured in the dataset if the transportation, management and landfill disposal of that waste all takes place within Staffordshire.	Dataset considers emissions resulting from all activities located within the boundary of the relevant Authority. For instance, if waste is generated in Staffordshire, all emissions associated with disposing of that waste are captured within the dataset.
Sectors included	-	-
Residential buildings	Yes	Yes
Commercial buildings & facilities *Institutional buildings & facilities* *Industrial buildings & facilities* *Agriculture*	These are included within the BEIS CO_2 statistics for 'Industrial & Commercial' uses. In this report they are referred to as 'Non-domestic' uses.	Yes, derived from the total BEIS fuel consumption figures for each Local Authority and disaggregated based on nation-wide estimates
Fugitive emissions	No	Yes, based on the UK-wide total, allocated to each Local Authority by population
On-road transport	Yes	Yes
Off-road transport	No	Yes - agricultural vehicles only
Rail	Yes	Yes
Waterborne navigation	No	Yes

[34] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/812146/Local_authority_CO2_technical_report_2017.pdf

[35] BEIS, *'Local and Regional Carbon Dioxide Emissions Estimates 2005-2017: Technical Report'* (2019). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/812146/Local_authority_CO2_technical_report_2017.pdf

Aviation	No	Yes, based on the UK-wide total, allocated to each Local Authority by population
Solid waste disposal *Wastewater treatment* *Industrial processes* *Industrial product use*	CO_2 emissions associated with these activities would be captured within the 'non-domestic' CO_2 emissions figures (see above), if fuels are used within the geographic boundary of the relevant Authority.	Yes
Livestock (digestion)	No	Yes
Land use	Yes (referred to as 'Land Use, Land Use Chance and Forestry' or LULUCF)	Yes (Referred to as 'Agriculture, Forestry, and Other Land Use' or AFOLU)

Appendix C – Policy and Context

C.1 National and International

UK Climate Change Act: 2050 Target Amendment Order (2019)

This policy legally commits the UK Government to reducing emissions by 100% by the year 2050, compared with a 1990 baseline.[36] As described by the UK Committee on Climate Change (CCC), *'The Act provides the UK with a legal framework including a 2050 target for emissions reductions, five-yearly 'carbon budgets' (limits on emissions over a set time period which act as stepping stones towards the 2050 target), and the development of a climate change adaptation plan.'*[37]

As noted in the CCC report *'Net Zero: The UK's contribution to stopping global warming'* (2019), this level of carbon reduction is achievable using known technologies and techniques,[38] such as:

- Reducing demand through resource and energy efficiency;
- Societal choices e.g. reducing meat consumption;
- Electrification of transport and heating;
- Development of hydrogen gas and carbon capture and storage (CCS) technologies; and
- Land use changes that promote carbon sequestration and biomass production.

The Paris Climate Agreement

The UK ratified the Paris Climate Agreement in November 2016. The Agreement's central aim 'is to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below 2º Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5º Celsius.'[39]

For context, a study produced by the Tyndall Centre for Climate Change Research[40] considered scenarios compatible with the Paris Agreement, and calculated the total carbon budget for the West Midlands through the year 2100. It found that, *'At 2017 CO_2 emission levels, the West Midlands would use this entire budget within 7 years from 2020.'*

National Planning Policy Framework

The National Planning Policy Framework (NPPF) sets out Government planning policy for England. It states that, *'the purpose of the planning system is to contribute to the achievement of sustainable development.'* It provides guidance for local planning authorities drawing up local plans and is a material consideration for those determining applications.

The NPPF further states, *'at the heart of the [National Planning Policy] Framework is a presumption in favour of sustainable development.'* It addresses topics that are relevant to the economic, environmental and social sustainability of development proposals, including but not limited to:

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[36] The original (2008) target of 80% was amended through subsequent legislation in 2019. *See 'The Climate Change Act 2008 (2050 Target Amendment) Order 2019'*: http://www.legislation.gov.uk/uksi/2019/1056/contents/made
[37] https://www.theccc.org.uk/tackling-climate-change/the-legal-landscape/
[38] Available at: https://www.theccc.org.uk/publication/net-zero-the-uks-contribution-to-stopping-global-warming/
[39] https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement
[40] Tyndall Centre, *'Setting Climate Commitments for the West Midlands: Quantifying the implications of the United Nations Paris Agreement'* (December 2019). Available at: https://carbonbudget.manchester.ac.uk/reports/WM/

- Promoting sustainable transport;
- Making effective use of land;
- Achieving well-designed places;
- Protecting Green Belt land;
- Meeting the challenge of climate change, flooding and coastal change; and
- Conserving and enhancing the natural environment.

Building Regulations (Part L)

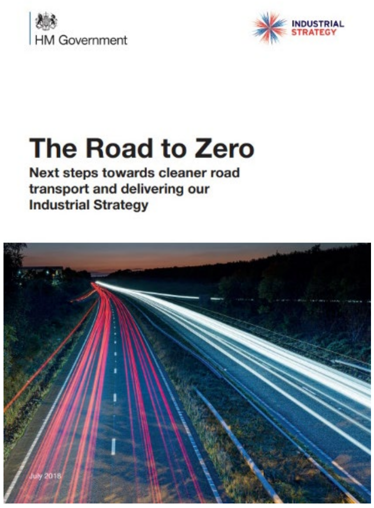
Part L of Building Regulations is the key mechanism that prescribes standards for the conservation of fuel and power in buildings in the UK, based on metrics such as the estimated level of energy demands and CO_2 emissions.

At the time of writing, the Ministry of Housing, Communities and Local Government (MHCLG) has recently released a consultation on proposed future standards (see box below) that would significantly reduce emissions from new domestic buildings in the UK. The consultation also states that the Government will make further improvements to Building Regulations requirements for existing domestic buildings as well as new and existing non-domestic buildings. [41]

The Road to Zero (2018)

The Road to Zero report[42], published in July 2018 sets out the Government's core mission; 'to put the UK at the forefront of the design and manufacturing of zero emissions vehicles and for all new cars and vans to effectively be zero emission by 2040.' The strategy furthers the ambitions of the Air Quality Plan for NO_2[43] and Clean Growth Strategy (see following section) in defining key policies with a primary focus on the introduction of low and zero emission vehicles, with the aim that *'at least 50%, and as many as 70%, of new car sales and up to 40% new van sales being ultra-low emission by 2030. By 2050 we want almost every car and van to be zero emission.'*

In supporting these longer-term ambitions, the strategy outlines supporting policy action toward the fulfilment of these broader goals, including:



- Reducing emissions from existing vehicles on the road;
- Extension of the Clean Vehicle Retrofit Accreditation Scheme (CVRAS) beyond its current scope to include both vans and black cabs; and
- Developing a strategy to tackle HGV and freight-related emissions through Highways England research.

The Government has stated that local action will be supported through new policies, including the provision of funding to extend ultra-low emission bus schemes and taxi charging infrastructure. Ongoing goals to encourage the uptake of clean new vehicles will be backed by developing electric vehicle infrastructure, offering funds and grants for provision of electric charge points.

[41] BEIS, *'The Future Homes Standard Consultation'* (2019). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/843757/Future_Homes_Standard_Consultation_Oct_2019.pdf
[42] HM Government, *'The Road to Zero: Next steps towards cleaner road transport and delivering our Industrial Strategy'* (2018) Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/739460/road-to-zero.pdf
[43]Air quality plan for nitrogen dioxide (NO2) in UK (2017) https://www.gov.uk/government/publications/air-quality-plan-for-nitrogen-dioxide-no2-in-uk-2017

UK Clean Growth Strategy and Industrial Strategy (2017)

The UK Clean Growth Strategy[44] (CGS) was published in October 2017 and sets out the Government's vision for decoupling economic growth from carbon emissions.

It includes objectives for increasing the generation of energy from renewable sources, increasing the delivery of clean, smart and flexible power, and accelerating the shift to low carbon transport, smart grids and energy storage. The delivery of low carbon heating is identified as a priority, indicating that heat pumps, district heating networks and a hydrogen gas grid could all support the scale of change required, while acknowledging the significant technical and financial obstacles.

The Clean Growth Strategy also discusses the need to improve energy efficiency in buildings, particularly the existing stock. This includes a strategy of progressively increasing the minimum Energy Performance Certificate (EPC) ratings that will be considered permissible in order to allow the sale or rental of buildings, as required by the Minimum Energy Efficiency Standards (MEES) regulations. [45]

The UK Industrial Strategy,[46] published in November 2017, emphasises the themes of the CGS and describes a 'Grand Challenge' for maximising the advantages that the UK can gain from the global shift to a low carbon economy. Both documents note the potential for low carbon industries to deliver a high level of GDP growth compared with the current forecast.

C.2 Regional

This section provides an overview of local development policies for Staffordshire, highlighting those that are relevant to climate change mitigation and adaptation such as sustainable design standards, measures intended to promote sustainable transport, and criteria for renewable energy proposals. Where relevant, it also summarises key drivers such as Climate Emergency declarations and other commitments by Local Authorities.

Staffordshire County Council

Staffordshire County Council is the upper tier Authority for Staffordshire. The Council declared a Climate Emergency on 25th July 2019. An extract from the motion is provided below.[47]

This County Council therefore:

- *Calls upon Her Majesty's Government to explore supporting domestic implementation of the Sustainable Development Goals through funded partnership roles within each local authority area;*
- *Encourages councils to continue their work on linking their local priorities with the overall ambitions of the SDGs;*
- *Declares a 'Climate Emergency', and commits to supporting Staffordshire councils in their work to tackle climate change by providing a strong unified voice for councils in lobbying for support to address this emergency, and sharing best practice; and*
- *The county council refreshes the good work of Hard Rain, Hard Rain 2 and Green Shoots to meet these new targets and share best practice across all councils.*

[44] HM Government *'Clean Growth Strategy'* (2017). Available at: https://www.gov.uk/government/publications/clean-growth-strategy

[45] The *'Energy Efficiency (Private Rented Property) (England and Wales)'* Regulations 2015 introduced the Minimum Energy Efficiency Standard (MEES) for buildings across the UK. For further information, see https://www.gov.uk/government/publications/the-private-rented-property-minimum-standard-landlord-guidance-documents

[46] HM Government, *'Industrial Strategy: Building a Britain Fit for the Future'* (2017). Available at: https://www.gov.uk/government/publications/industrial-strategy-building-a-britain-fit-for-the-future

[47] http://moderngov.staffordshire.gov.uk/ieListDocuments.aspx?CId=124&MId=10640&Ver=4

Key policies and drivers relevant to climate change mitigation and adaptation in each District are outlined in the following sections. In line with the Localism Act (2011), each District within Staffordshire produces Local Plans that set out a vision and spatial strategy for sustainable development, providing *'a framework for addressing housing needs and other economic, social and environmental priorities.'*[48] Staffordshire County Council is responsible for broader strategic planning on issues such as transport, waste disposal, and flood risk. Therefore, note that the following Staffordshire County Council policies also comprise part of the Development Plan for each District:

- The Waste Local Plan for Staffordshire and Stoke-on-Trent (2010-2026), adopted by Staffordshire County Council and Stoke-on-Trent City Council on 22nd March 2013
- The Minerals Local Plan for Staffordshire (2015-2030), adopted by Staffordshire County Council on the 16th February 2017

Cannock Chase District Council

The *'Local Plan Part 1 (Core Strategy and Rugeley Town Centre Area Action Plan)'* was adopted by Cannock Chase Council in June 2014. At the time of writing, Cannock Chase is also progressing a Local Plan review; this will replace both the adopted Local Plan Part 1 and supplant the previously intended Local Plan Part 2.

The adopted Local Plan includes the following key policies relevant to climate change mitigation and adaptation:

- Policy CP1 – Strategy
- Policy CP3 – Chase Shaping Design
- Policy CP10 – Sustainable Transport
- Policy CP16 – Climate Change and Sustainable Resource Use
- Policy RTC3 – Urban Design Principles

In addition to these policy drivers, Cannock Chase District Council declared a Climate Emergency on 17th July 2019, agreeing to *'commit to the vision of carbon neutrality by 2030 at the latest'* and take actions to reduce GHG emissions, such as lobbying the Government to facilitate local action, promoting community energy schemes, and engaging with local partners.[49]

East Staffordshire Borough Council

East Staffordshire Borough Council adopted a Local Plan in October 2015 covering the time period 2012-2031. The adopted Local Plan includes the following key policies relevant to climate change mitigation and adaptation:

- Policy SP1 – East Staffordshire Approach to Sustainable Development
- Policy SP7 – Sustainable Urban Extensions
- Policy SP27 – Climate Change, Water Body Management and Flooding
- Policy SP28 – Renewable and Low Carbon Energy Generation
- Policy SP35 – Accessibility and Sustainable Transport
- Policy DP2 – Designing in Sustainable Construction

[48] https://www.gov.uk/guidance/local-plans
[49] https://www.cannockchasedc.gov.uk/sites/default/files/01-agenda_council_170719.pdf

Lichfield District Council

The Lichfield District Council Local Plan Strategy 2008-2029 was adopted in February 2015, followed by the Lichfield District Local Plan Allocations Document which was adopted in July 2019. Together, these form the current Development Plan Document (DPD) for Lichfield District Council.

- Strategic Priority 3 – Climate Change
- Core Policy 3 – Delivering Sustainable Development
- Core Policy 5 – Sustainable Transport
- Policy SC1 – Sustainability Standards for Development
- Policy SC2 – Renewable Energy
- Policy ST1 – Sustainable Travel
- Policy BE1 – High Quality Development

At the time of writing, the Local Plan is under review; the Preferred Options consultation concluded in January 2020. The new Local Plan, which will cover the period 2018 to 2040, includes:

- Strategic Policy OSC1 – Securing Sustainable Development
- Strategic Policy OSC2 – Renewables and Low Carbon Energy
- Strategic Policy OSC3 – Sustainable Building Standards for Non-Domestic Buildings
- Strategic Policy OSC4 – High Quality Design
- Strategic Policy OSC5 – Flood Risk, Sustainable Drainage & Water Quality
- Strategic Objective and Priority 5 – Sustainable Transport
- Strategic Policy OSS1 – Presumption in favour of sustainable development
- Strategic Policy OST1 – Our Sustainable Transport
- Strategic Policy OST2 – Sustainable Travel
- Strategic Objective and Priority 3 – Climate Change

Newcastle-under-Lyme Borough Council

The current development plan is the 'Newcastle-under-Lyme Local Plan 2011 (saved policies)'; however, a new Local Plan is being produced jointly with Stoke-on-Trent, with a draft due to be published in spring 2020. The new Local Plan will cover the time period up to 2037.

Key policies from the adopted Local Plan relevant to climate change mitigation and adaptation are listed below.

- Policy S1 – Sustainable Development
- Policy S2 – Renewable Energy
- Policy S15 – The Design of Development
- Policy T1 – Sustainable Development
- Policy T2 – Green Travel Plans

On 3rd April 2019 the Council declared a Climate Emergency.[50] The motion included a commitment to *'aim to make Newcastle under Lyme a carbon-neutral borough by 2030.'* In addition to this commitment on carbon neutrality for the Borough as a whole, the Council has produced a Carbon Management Plan

[50] https://moderngov.newcastle-staffs.gov.uk/documents/s28984/Climate%20emergency%20motion.pdf

addressing its own emissions and is developing an action plan for climate change mitigation with input from experts at Keele University.

South Staffordshire District Council

The South Staffordshire Local Plan is composed of the Core Strategy (2012) and the Site Allocations Document (2018). It is supported by several Supplementary Planning Documents (SPDs), including the Sustainable Design SPD adopted in 2018. Strategic Objective 7 of the Local Plan is, *'To reduce the effect of society on the environment, and adapt to the impacts of climate change.'* It also contains the following policies relevant to climate change mitigation and adaptation:

- Core Policy 3 – Sustainable Development and Climate Change. This is supported by:
    - Policy EQ5 – Sustainable Resources and Energy Efficiency
    - Policy EQ6 – Renewable Energy
- Core Policy 4 – Promoting High Quality Design
- Core Policy 11 – Sustainable Transport
- Policy EV11 – Sustainable Travel

At the time of writing, the South Staffordshire Local Plan is under review; the Issues and Options Consultation period was conducted in 2018, a consultation on broad locations for growth was conducted in 2019, and a Preferred Options consultation is expected to take place in autumn 2020.

The Sustainable Design SPD covers the following topics:

- Sustainable locations and modes of transport
- Promoting energy efficiency through appropriate design
- Increasing biodiversity in scheme design
- Delivering Sustainable Drainage Systems (SuDS); and
- Ensuring sustainable waste management in new development.

The SPD also includes a 'Householder's Guide to Sustainable Construction and Renewable Energy' which provides further information and guidance.

South Staffordshire declared a Climate Emergency on 10th September 2019.

Stafford Borough Council

The Local Development Scheme for Stafford Borough comprises the 'Plan for Stafford Borough' (2014) and the 'Plan for Stafford Borough Part 2' (2017). At the time of writing, the Stafford Borough Local Plan is under review and an Issues and Options consultation is ongoing, due to conclude in March 2020. A Preferred Options consultation is expected to take place in early 2021. The new Local Plan will cover the period 2020 to 2040.

Climate change informs the spatial vision for Stafford Borough and is listed among the key issues and challenges in the adopted Local Plan, which also includes the following policies relevant to climate change mitigation and adaptation:

- Policy N1 – Design
- Policy N2 – Climate Change
- Policy N3 – Low Carbon Sources & Renewable Energy
- Policy E2 – Sustainable Rural Development
- Policy T1 - Transport

On 23rd July 2019, Stafford Borough Council declared a Climate Change Emergency[51] which included agreements to:

1. *Join other Councils in declaring a Climate Emergency and work towards achieving our vision of carbon neutrality by 2040; [and]*
2. *Continue to concentrate on activities that reduce emissions from its own activities and will work towards carbon neutrality by 2040.*

Following the Climate Emergency Declaration, in January 2020 a draft Climate Change Strategy and Action Plan was published which outlines steps the Council will take in order to meet these goals. The draft Climate Change Strategy updates and builds upon earlier commitments outlined in *'A Climate Change Adaptation Plan for Stafford Borough Council'* (2012).[52]

Staffordshire Moorlands District Council

The Staffordshire Moorlands Core Strategy, 'A Local Plan for the Future of Staffordshire Moorlands' was adopted in 2014. A new Local Plan was submitted to the Secretary of State for examination in June 2018; subject to the outcome of examination hearings, it is expected to be adopted in 2020.

The submission version of the new Local Plan includes a key Spatial Objective to *'create a District where development minimises its impact on the environment, helps to mitigate and adapt to the adverse effects of climate change and makes efficient use of resources.'* It also contains the following policies related to climate change mitigation and adaptation which broadly carry forward those that are contained within the Core Strategy:

- Policy SS1 – Development Principles
- Policy SD1 – Sustainable Use of Resources
- Policy SD2 – Renewable / Low Carbon Energy
- Policy SD3 – Sustainability Measures in Development
- Policy DC1 – Design Considerations

The following policies from the Core Strategy are also updated within the submission version of the Local Plan, e.g. replacing out of date references to an earlier transport strategy:

- Policy T1 – Development and Sustainable Transport
- Policy T2 – Other Sustainable Transport Measures

Staffordshire Moorlands District Council declared a Climate Emergency on 10th July 2019, resolving to, *'Start working with partners across the district and region towards making The Staffordshire Moorlands carbon neutral by 2030, taking into account emissions from both production and consumption.'* [53]

Tamworth Borough Council

The Tamworth Borough Council Local Plan 2006-2031 was adopted in 2016. At the time of writing, the Council is reviewing the effectiveness of the policies and it is anticipated that a formal update process will commence in 2020. Strategic Spatial Priorities in the Local Plan include SP11: '*To minimise the causes and adapt to the effects of climate change by encouraging high standards of energy efficiency, sustainable use of resources and use of low carbon/renewable technologies as well as on site green infrastructure'* and SP12: *'To promote sustainable transport modes for all journeys by improving walking, cycling and public transport facilities throughout the Borough and to neighbouring areas and beyond.'*

The Local Plan also contains the following key policies relevant to climate change mitigation and adaptation:

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[51] https://www.staffordbc.gov.uk/sites/default/files/cme/DocMan1/Committee%20Minutes%2019-20/Council/MCouncil%20-%2023%20July%202019.pdf
[52] https://www.staffordbc.gov.uk/sites/default/files/cme/DocMan1/Sustainability/Climate%20Change%20Adaptation%20Plan.pdf
[53] https://democracy.highpeak.gov.uk/ieListDocuments.aspx?CId=133&MId=1363&Ver=4

- SU1: Sustainable Transport Network
- SU2: Delivering Sustainable Transport
- SU3: Climate Change Mitigation
- SU4: Flood Risk and Water Management

The Tamworth Climate Change Strategy (2011) included an action plan outlining key projects that could be initiated within the first year post-publication, ranging from media campaigns, advice and awareness campaigns, initiating a renewable energy programme and organising a Climate Change week in collaboration with local businesses and other organisations such as schools and charities.[54]

The Council declared a Climate Emergency on November 2019, when it resolved to *'Make the Council's activities net-zero carbon by 2050 with aspiration to achieve 2030 should the Council be financially able to do so.'*[55]

[54] https://www.tamworth.gov.uk/sites/default/files/planning_docs/G-Natural_Environment_Climate_Change_A/G6_Climate_Change_Strategy_2011.pdf
[55] http://democracy.tamworth.gov.uk/mgDecisionDetails.aspx?IId=16340&Opt=1

Appendix D – Baseline Fuel Consumption by Council

D.1 Cannock Chase

In 2018, total fuel consumption in Cannock Chase was approximately 1,684.6 GWh (13.6% of all fuel consumption in Staffordshire). As illustrated in Figure 6-2 , the largest proportion of fuel consumed was gas (46.7%), with petroleum products and electricity accounting for 30.2% and 20.6%, respectively. Other fuels, including bioenergy & waste, coal, and manufactured fuels make up the remaining 2.6%.

	Industrial & Commercial (GWh)	Domestic (GWh)	Road transport (GWh)	Rail (GWh)	Other* (GWh)	Total (GWh)
Coal	6.0	6.0	-	-	-	12.1
Manufactured Fuels	1.1	4.0	-	-	-	5.1
Petroleum Products	107.9	4.0	384.4	8.8	3.3	508.4
Gas	230.5	555.6	-	-	-	786.1
Electricity	193.4	153.6	-	-	-	346.9
Bioenergy & Waste	0.0	26.0	-	-	-	26.0
Total by sector	**538.9**	**749.2**	**384.4**	**8.8**	**3.4**	**1684.6**

Table 6.11: *Fuel consumption by sector and fuel type in 2018 – Cannock Chase*

'Other' includes petroleum products used in the public and agricultural sectors; however, this is the only fuel type for which those sectors are reported separately in the BEIS dataset. Any other fuels used in the public and agricultural sectors will be included within the 'Industrial & Commercial' figures.

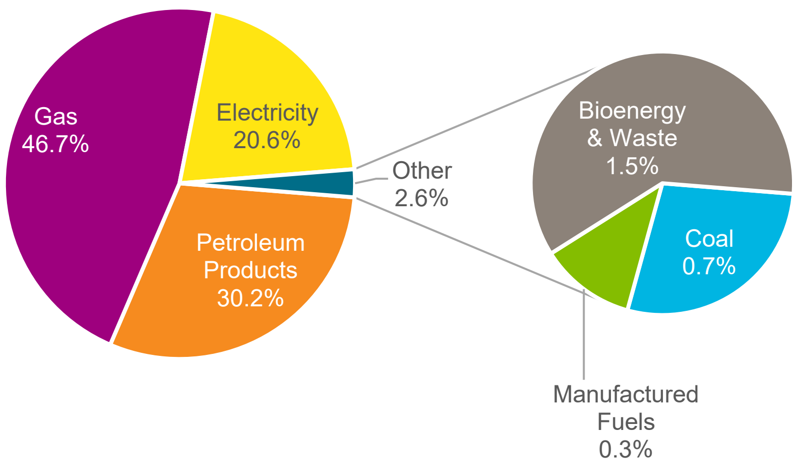

Figure 6-2: Fuel consumption by fuel type in 2018 – Cannock Chase

Figure 6-3 shows that the domestic sector accounts for the highest proportion of energy consumption (44.5%), followed by the industrial & commercial and road transport sectors (32% and 22.8% respectively). Within the domestic sector, approximately 74.2% of fuel consumed is gas and 20.5% is electricity. In the industrial and commercial sectors, approximately 42.8% of fuel consumed is gas and 35.9% is electricity.

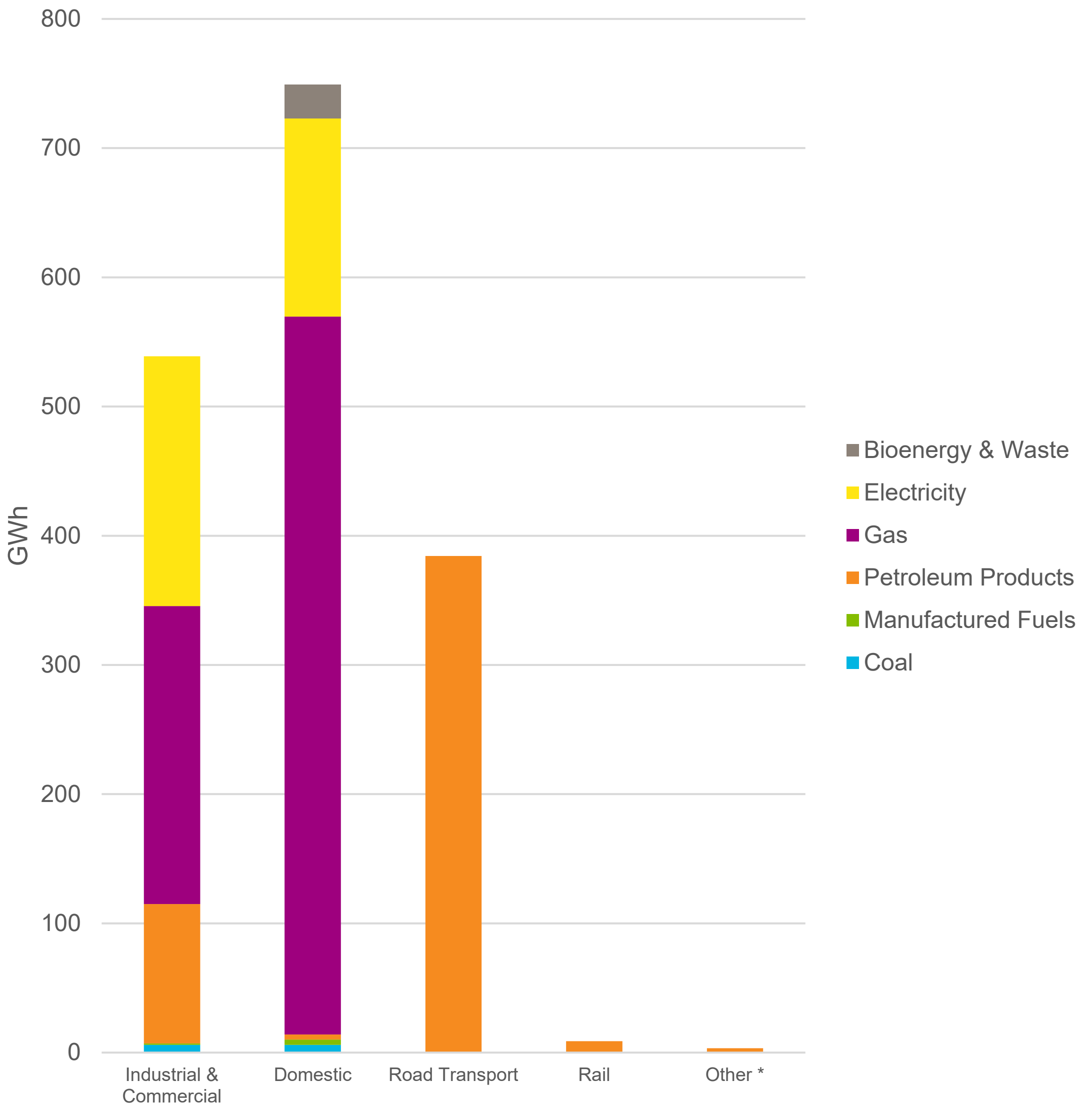

Figure 6-3: Fuel consumption by sector and fuel type in 2018- Cannock Chase

D.2 East Staffordshire

In 2018, total fuel consumption in East Staffordshire was approximately 3,026.3 GWh (13.6% of all fuel consumption in Staffordshire). As illustrated in Figure 6-4, the largest proportion of fuel consumed was gas (36.9%), with petroleum products and electricity accounting for 38.6% and 21.6%, respectively. Other fuels, including bioenergy & waste, coal, and manufactured fuels make up the remaining 2.8%.

	Industrial & Commercial (GWh)	Domestic (GWh)	Road transport (GWh)	Rail (GWh)	Other* (GWh)	Total (GWh)
Coal	18.3	11.2	-	-	0.4	29.9
Manufactured Fuels	1.9	7.4	-	-	-	9.3
Petroleum Products	197.2	51.3	839.1	18.3	76.2	1,182.1
Gas	533.2	598.1	-	-	-	1,131.3
Electricity	471.7	190.6	-	-	-	662.3
Bioenergy & Waste	-	47.4	-	-	-	47.4
Total by sector	**1,222.4**	**905.9**	**839.1**	**18.3**	**76.6**	**3,062.3**

Table 6.12: Fuel consumption by sector and fuel type in 2018 – East Staffordshire

'Other' includes petroleum products used in the public and agricultural sectors; however, this is the only fuel type for which those sectors are reported separately in the BEIS dataset. Any other fuels used in the public and agricultural sectors will be included within the 'Industrial & Commercial' figures.

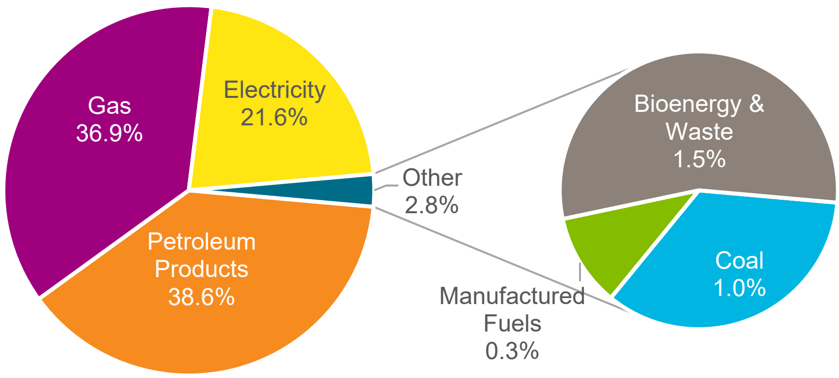

Figure 6-4: Fuel consumption by fuel type in 2018 – East Staffordshire

Figure 6-5 shows that the industrial & commercial sector accounts for the highest proportion of energy consumption (39.9%), followed by the domestic and road transport sectors (29.6% and 27.4% respectively). Within the domestic sector, approximately 66% of fuel consumed is gas and 21% is electricity. In the industrial & commercial sector, approximately 43.6% of fuel consumed is gas and 38.6% is electricity.

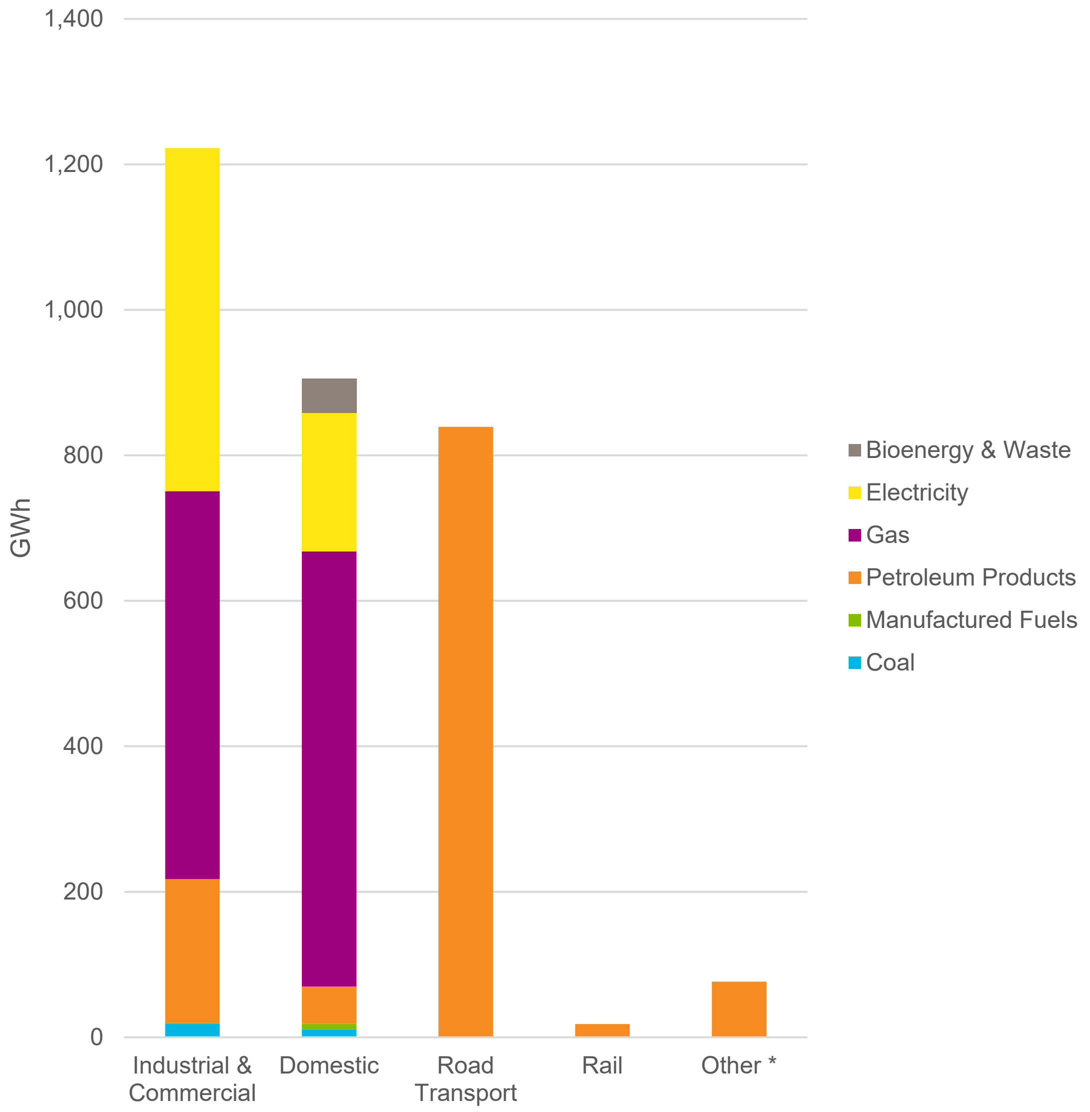

Figure 6-5: Fuel consumption by sector and fuel type in 2018- East Staffordshire

D.3 Lichfield

In 2018, total fuel consumption in Lichfield was approximately 2,694 GWh (12% of all fuel consumption in Staffordshire). As illustrated in Figure 6-6, the largest proportion of fuel consumed was petroleum products (52%), with gas and electricity accounting for 28.9% and 16.3%, respectively. Other fuels, including bioenergy & waste, coal, and manufactured fuels make up the remaining 2.8%.

	Industrial & Commercial (GWh)	Domestic (GWh)	Road transport (GWh)	Rail (GWh)	Other* (GWh)	Total (GWh)
Coal	31.1	6.7	-	-	0.2	38
Manufactured Fuels	5.4	4.4	-	-	-	9.9
Petroleum Products	106.3	31.9	1,210.6	25.9	26.7	1,401.5
Gas	167.3	610.1	-	-	-	777.4
Electricity	263.9	175.3	-	-	-	439.2
Bioenergy & Waste	-	28.1	-	-	-	28.1
Total by sector	**574**	**856.6**	**1,210.6**	**26**	**26.9**	**2,694**

Table 6.13: Fuel consumption by sector and fuel type in 2018 – Lichfield

'Other' includes petroleum products used in the public and agricultural sectors; however, this is the only fuel type for which those sectors are reported separately in the BEIS dataset. Any other fuels used in the public and agricultural sectors will be included within the 'Industrial & Commercial' figures.

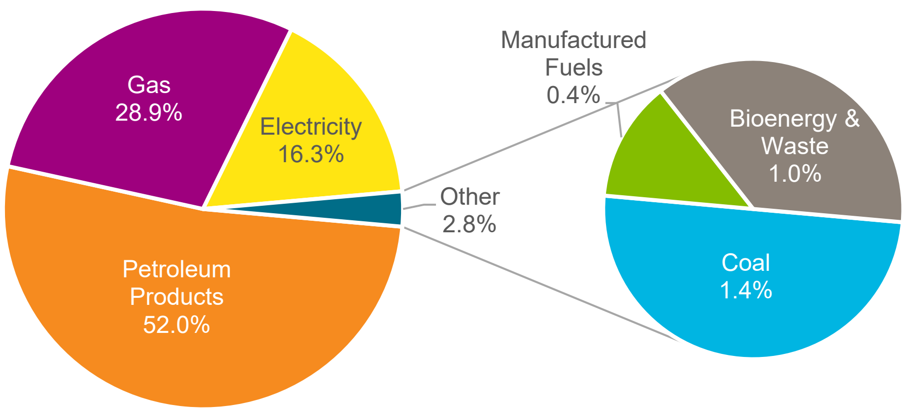

Figure 6-6: Fuel consumption by fuel type in 2018 – Lichfield

Figure 6-7 shows that the road transport sector accounts for the highest proportion of fuel consumption in Lichfield (44.9%), followed by the domestic and industrial & commercial sectors (31.8% and 21.3% respectively). Within the domestic sector in Lichfield, approximately 71.2% of fuel consumed is gas and 20.5% is electricity. In the industrial & commercial sector, approximately 46% of fuel consumed is electricity and 29.1% is gas.

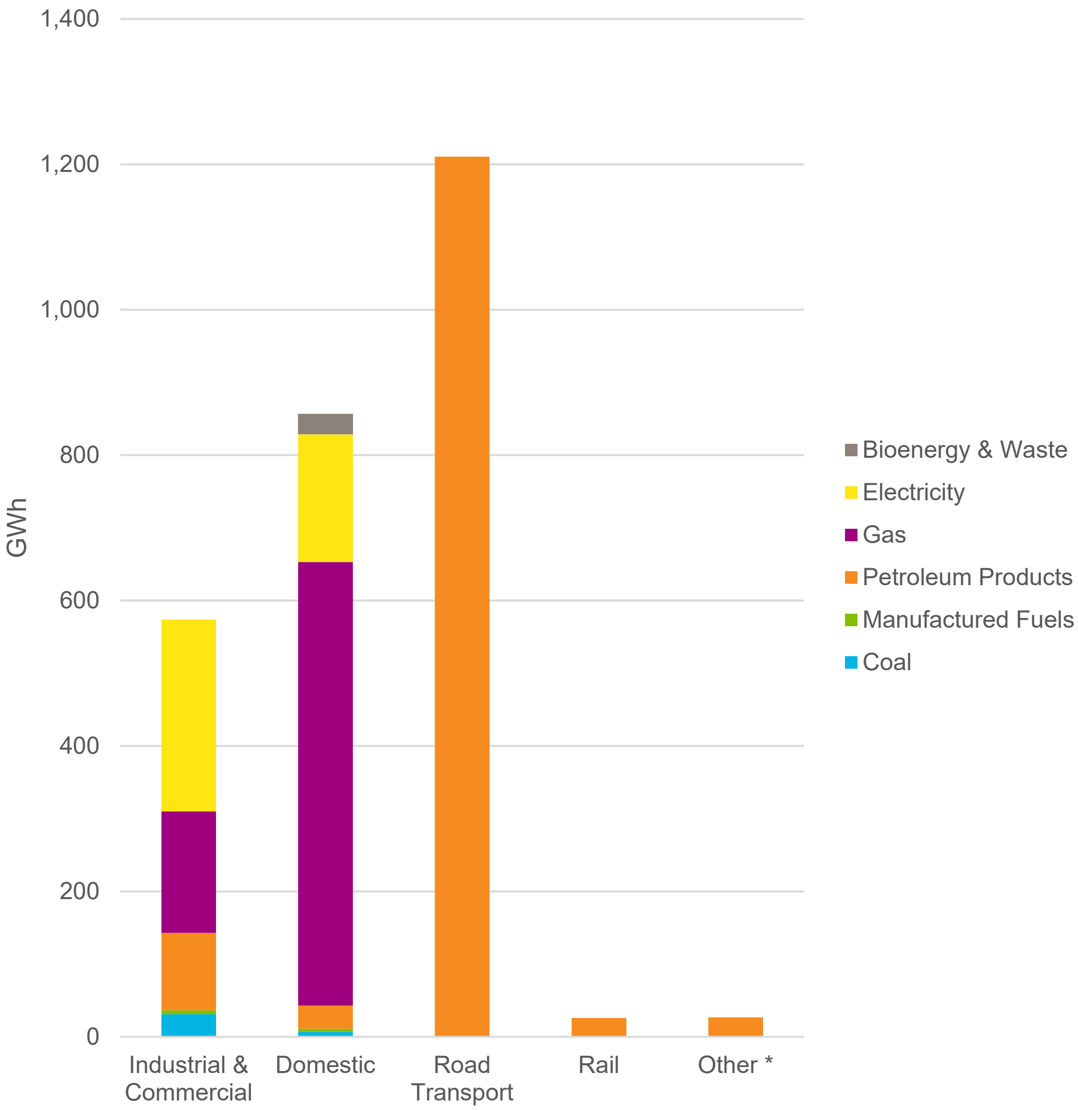

Figure 6-7: Fuel consumption by sector and fuel type in 2018- Lichfield

D.4 Newcastle-under-Lyme

In 2018, total fuel consumption in Newcastle-under-Lyme was approximately 3,121.7 GWh (13.9% of all fuel consumption in Staffordshire). As illustrated in Figure 6-8, the largest proportion of fuel consumed was petroleum products (44.5%), with gas and electricity accounting for 38.6% and 14.7%, respectively. Other fuels, including bioenergy & waste, coal, and manufactured fuels make up the remaining 2.2%.

	Industrial & Commercial (GWh)	Domestic (GWh)	Road transport (GWh)	Rail (GWh)	Other* (GWh)	Total (GWh)
Coal	4.7	8.3	-	-	0.1	13.2
Manufactured Fuels	15.7	5.5	-	-	-	21.2
Petroleum Products	53.2	22.7	1,279.3	4.2	28.6	1,388.0
Gas	480.7	725.0	-	-	-	1,205.8
Electricity	271.7	186.7	-	-	-	458.5
Bioenergy & Waste	-	35.0	-	-	-	35.0
Total by sector	**826.1**	**983.4**	**1,279.3**	**4.2**	**28.8**	**3,121.7**

Table 6.14: Fuel consumption by sector and fuel type in 2018 – Newcastle-under-Lyme

'Other' includes petroleum products used in the public and agricultural sectors; however, this is the only fuel type for which those sectors are reported separately in the BEIS dataset. Any other fuels used in the public and agricultural sectors will be included within the 'Industrial & Commercial' figures.

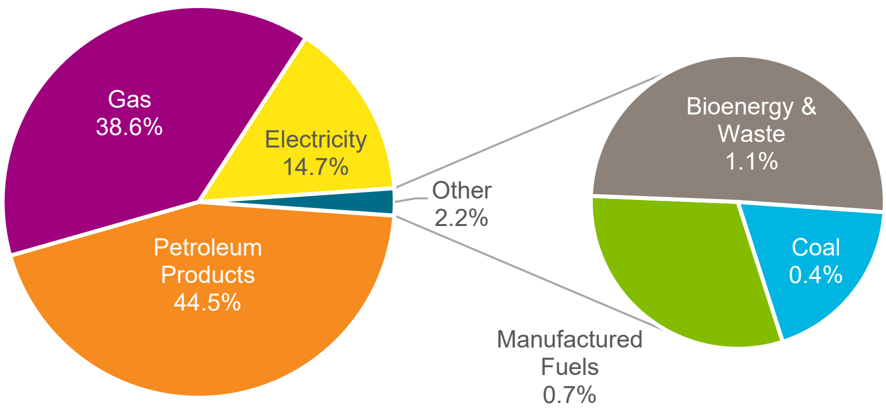

Figure 6-8: Fuel consumption by fuel type in 2018 – Newcastle-under-Lyme

Figure 6-9 shows that the road transport sector accounts for the highest proportion of fuel consumption in Newcastle-under-Lyme (41%), followed by the domestic and industrial & commercial sectors (31.5% and 26.5% respectively). Within the domestic sector, approximately 73.7% of fuel consumed is gas and 19% is electricity. In the industrial & commercial sector, approximately 58.2% of fuel consumed is gas and 32.9% is electricity.

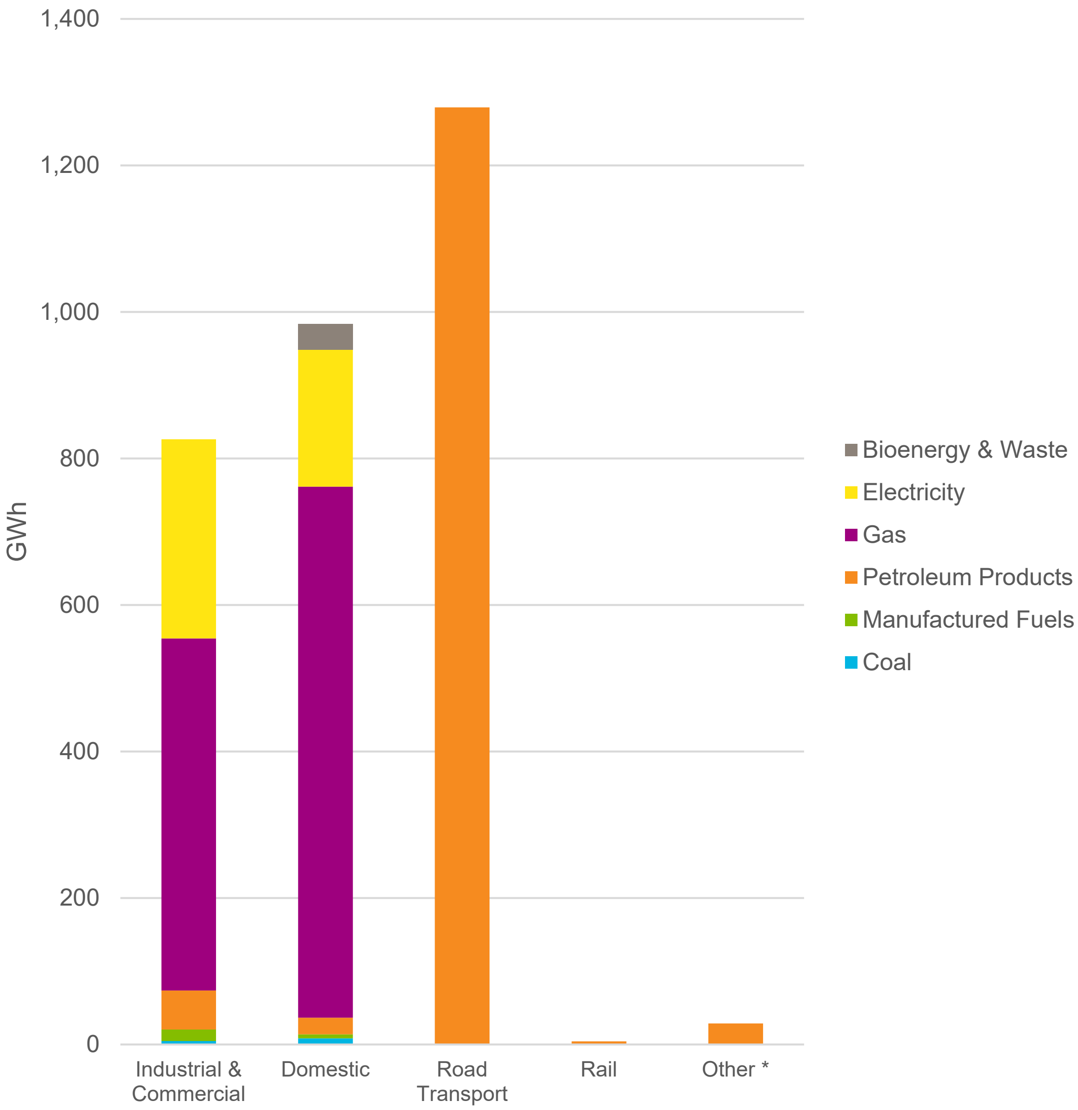

Figure 6-9: Fuel consumption by sector and fuel type in 2018- Newcastle-under-Lyme

D.5 South Staffordshire

In 2018, total fuel consumption in South Staffordshire was approximately 3,534 GWh (15.7% of all fuel consumption in Staffordshire). As illustrated in Figure 6-10, the largest proportion of fuel consumed was petroleum products (56.6%), with gas and electricity accounting for 28.5% and 13.1%, respectively. Other fuels, including bioenergy & waste, coal, and manufactured fuels make up the remaining 1.8%.

	Industrial & Commercial (GWh)	Domestic (GWh)	Road transport (GWh)	Rail (GWh)	Other* (GWh)	Total (GWh)
Coal	15.6	7.3	-	-	0.2	23.1
Manufactured Fuels	1.6	4.9	-	-	-	6.6
Petroleum Products	180.8	34.7	1,740.8	9.7	34.8	2,000.8
Gas	395.9	610.9	-	-	-	1,006.8
Electricity	282.2	179.1	-	-	-	461.3
Bioenergy & Waste	2.1	33.1	-	-	-	35.2
Total by sector	**878.3**	**870**	**1,740.8**	**9.7**	**34.9**	**3,533.7**

Table 6.15: Fuel consumption by sector and fuel type in 2018 – South Staffordshire

'Other' includes petroleum products used in the public and agricultural sectors; however, this is the only fuel type for which those sectors are reported separately in the BEIS dataset. Any other fuels used in the public and agricultural sectors will be included within the 'Industrial & Commercial' figures.

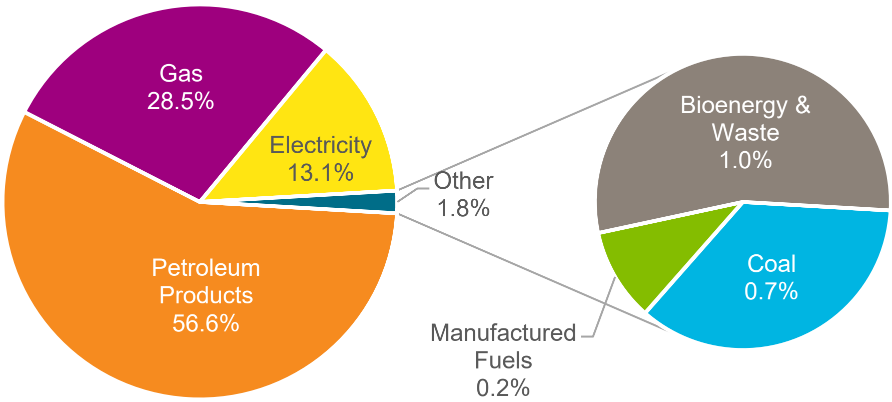

Figure 6-10: Fuel consumption by fuel type in 2018 – South Staffordshire

Figure 6-11 shows that the road transport sector accounts for roughly half of fuel consumption in the District (49.3%), with the remainder almost evenly split between the domestic and industrial & commercial sectors (24.6% and 24.9% respectively). Within the domestic sector, approximately 70.2% of fuel consumed is gas and 20.6% is electricity. In the industrial & commercial sector, approximately 45.1% of fuel consumed is gas, 32.1% is electricity and 20.6% is petroleum products.

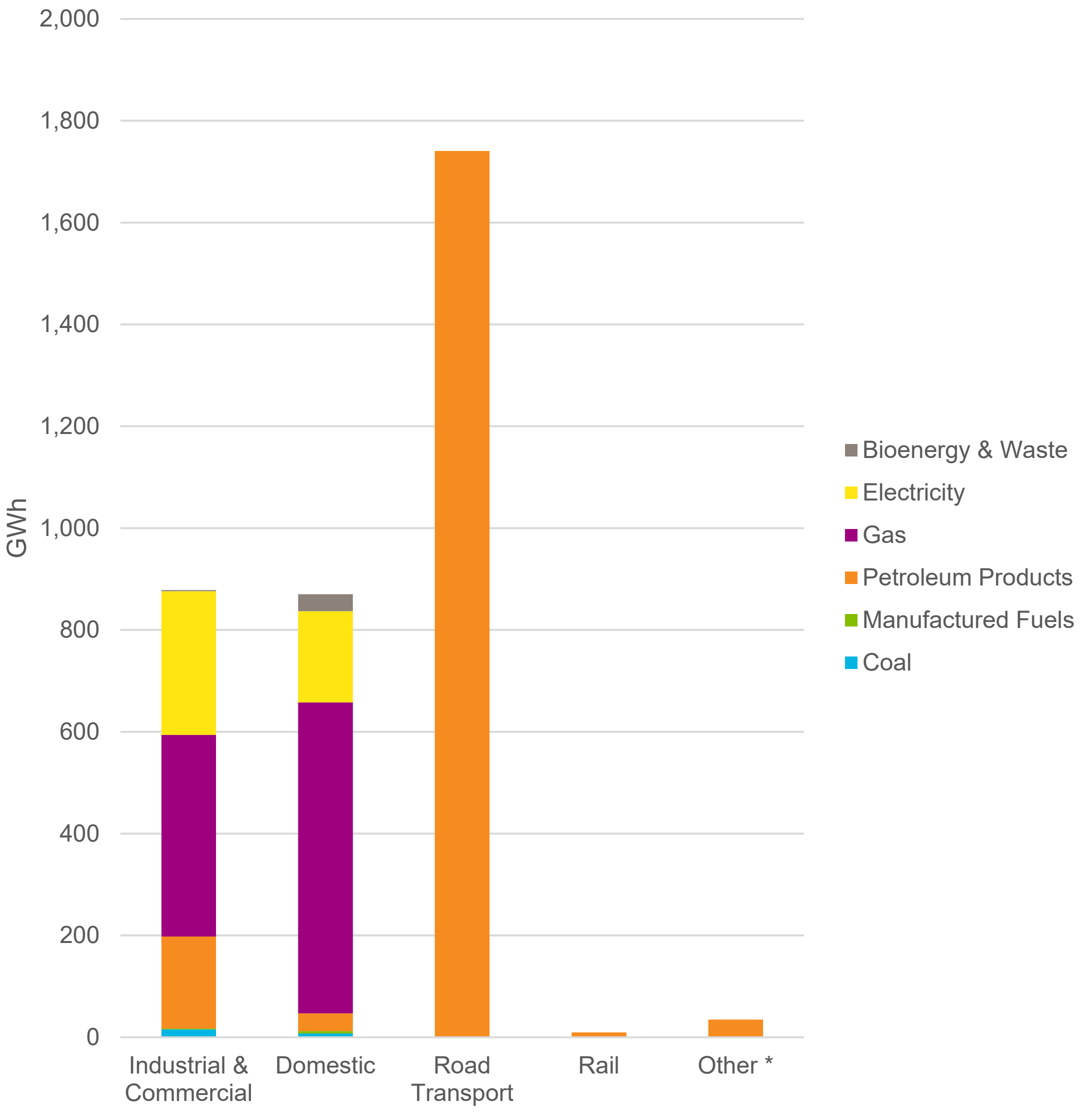

Figure 6-11: Fuel consumption by sector and fuel type in 2018 - South Staffordshire

D.6 Stafford

In 2018, total fuel consumption in Stafford Borough was approximately 3,851 GWh (17.2% of all fuel consumption in Staffordshire). As illustrated in Figure 6-12, the largest proportion of fuel consumed was petroleum products (56.2%), with gas and electricity accounting for 27.2% and 14.8%, respectively. Other fuels, including bioenergy & waste, coal, and manufactured fuels make up the remaining 1.8%.

	Industrial & Commercial (GWh)	Domestic (GWh)	Road transport (GWh)	Rail (GWh)	Other* (GWh)	Total (GWh)
Coal	7.1	11.9	-	-	0.8	19.7
Manufactured Fuels	1.1	7.4	-	-	-	8.5
Petroleum Products	103.0	83.9	1893.6	7.4	79.0	2,166.8
Gas	336.3	714.9	-	-	-	1,051.2
Electricity	350.1	221.6	-	-	-	571.7
Bioenergy & Waste	-	40.2	-	-	-	40.2
Total by sector	**797.6**	**1,079.8**	**1,893.6**	**7.4**	**79.8**	**3,858.1**

Table 6.16: Fuel consumption by sector and fuel type in 2018 – Stafford

'Other' includes petroleum products used in the public and agricultural sectors; however, this is the only fuel type for which those sectors are reported separately in the BEIS dataset. Any other fuels used in the public and agricultural sectors will be included within the 'Industrial & Commercial' figures.

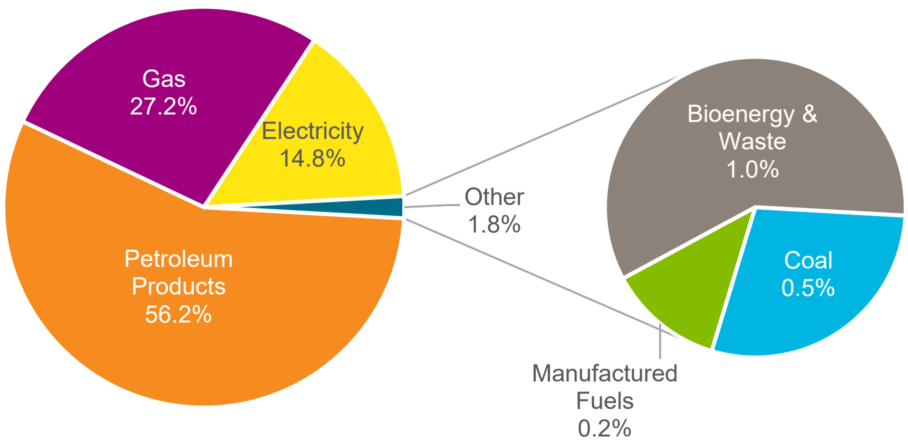

Figure 6-12: Fuel consumption by fuel type in 2018 – Stafford

Figure 6-13 shows that the road transport sector accounts for the highest proportion of fuel consumption (49.1%), followed by the domestic and industrial & commercial sectors (28% and 20.7% respectively). Within the domestic sector, approximately 66.2% of fuel consumed is gas and 20.5% is electricity. In the industrial & commercial sector, approximately 42.2% of fuel consumed is gas and 43.9% is electricity. Most of the remainder is petroleum products (e.g. petrol, diesel, oil, LPG).

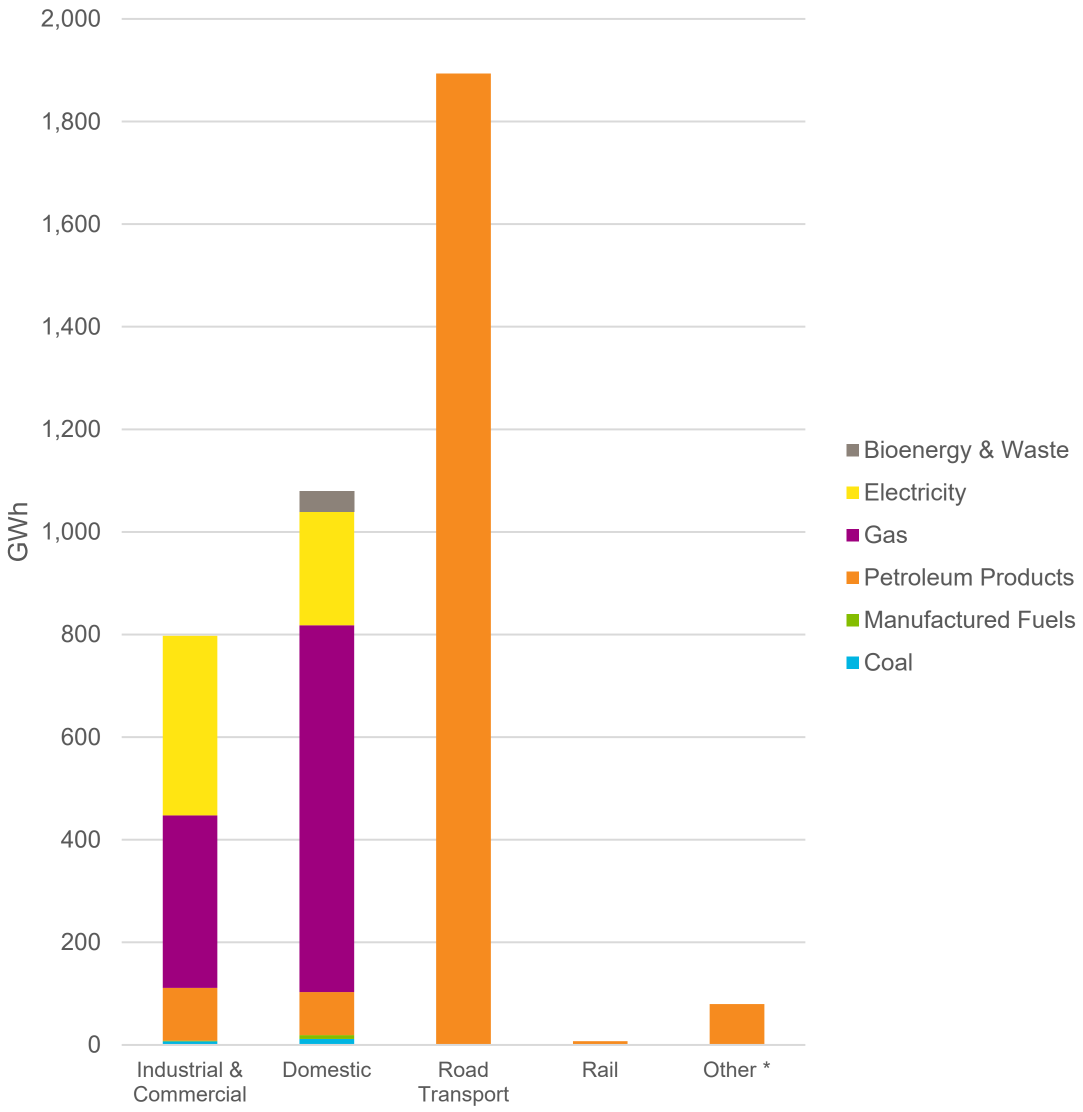

Figure 6-13: Fuel consumption by sector and fuel type in 2018- Stafford

D.7 Staffordshire Moorlands

In 2018, total fuel consumption in Staffordshire Moorlands was approximately 3,372.2 GWh (15% of all fuel consumption in Staffordshire). The split of fuel types and uses in Staffordshire Moorlands is somewhat different to that of the other Local Authorities in the County, and this appears to be primarily due to the higher-than-average use of both coal and bioenergy & waste, both of which are predominantly used in the industrial sector. As shown in Figure 6-14, the largest proportion of fuel consumed was gas (29.2%), closely followed by petroleum products (26.3%) bioenergy & waste (15%), electricity (14.6%) and coal (14.6%). Manufactured fuels make up the remaining 1.8%.

	Industrial & Commercial (GWh)	Domestic (GWh)	Road transport (GWh)	Rail (GWh)	Other* (GWh)	Total (GWh)
Coal	470.3	19.5	-	0.8	0.1	490.7
Manufactured Fuels	3.8	11.0	-	-	-	14.8
Petroleum Products	136.7	72.5	593.8	2.3	80.7	886.0
Gas	446.3	538.1	-	-	-	984.4
Electricity	327.9	163.1	-	-	-	491.1
Bioenergy & Waste	464.6	41.1	-	-	-	505.8
Total by sector	**1,849.7**	**845.3**	**593.8**	**3.1**	**80.8**	**3,372.7**

Table 6.17: Fuel consumption by sector and fuel type in 2018 – Staffordshire Moorlands

'Other' includes petroleum products used in the public and agricultural sectors; however, this is the only fuel type for which those sectors are reported separately in the BEIS dataset. Any other fuels used in the public and agricultural sectors will be included within the 'Industrial & Commercial' figures.

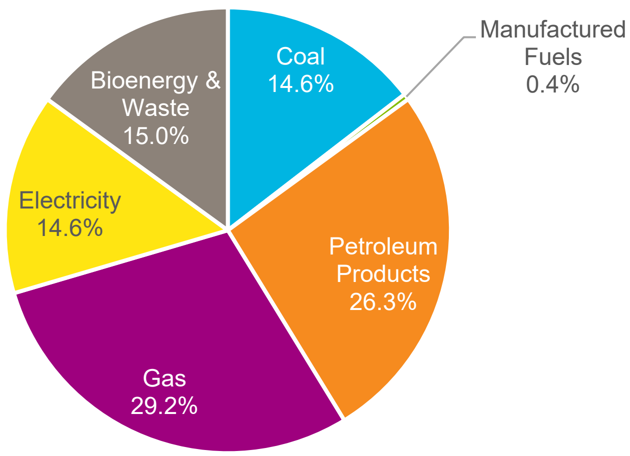

Figure 6-14: Fuel consumption by fuel type in 2018 – Staffordshire Moorlands

Figure 6-15 illustrates that the industrial & commercial sector accounts for the highest proportion of fuel consumption in Staffordshire Moorlands (54.8%), followed by the domestic and road transport sectors (25.1% and 17.6% respectively). Within the domestic sector, approximately 63.7% of fuel consumed is gas and 19.3% is electricity, which is broadly in line with the other Local Authorities in Staffordshire. In the industrial & commercial sector, meanwhile, approximately 25.4% of fuel consumed is coal, 25.1% is bioenergy & waste, 24.1% is gas and 17.7% is petroleum products. Although this is a significantly larger amount of both coal and bioenergy & waste than seen elsewhere, further details are not provided in the BEIS dataset as to which specific industries or facilities may be using these fuels.

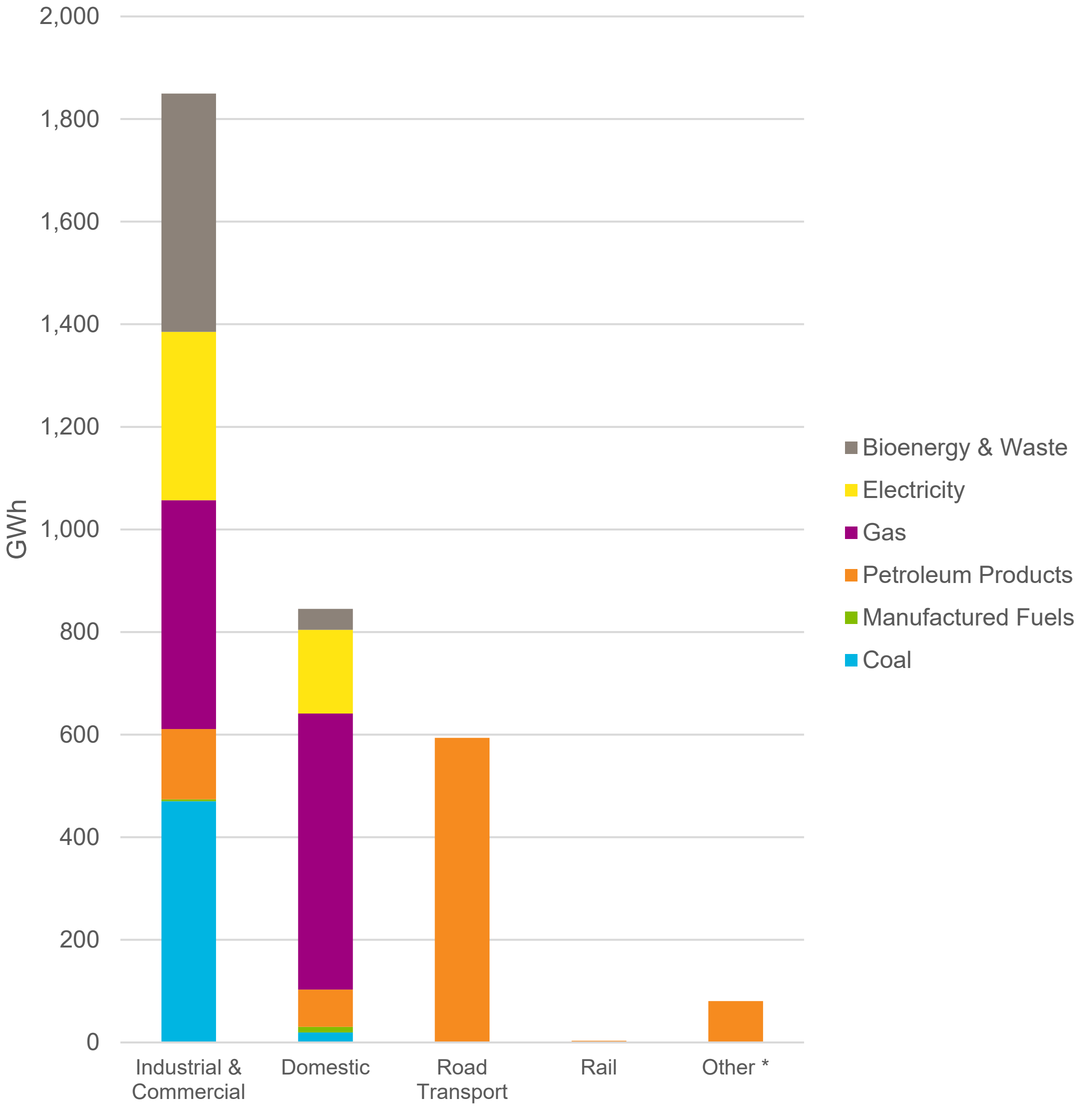

Figure 6-15: Fuel consumption by sector and fuel type in 2018 - Staffordshire Moorlands

D.8 Tamworth

In 2018, total fuel consumption in Tamworth was approximately 1,153.5 GWh (5.1% of all fuel consumption in Staffordshire). As illustrated in Figure 6-16, the largest proportion of fuel consumed was gas (47.1%), with electricity and petroleum products each accounting for roughly 25.2%. Other fuels, including bioenergy & waste, coal and manufactured fuels make up the remaining 2.4%.

	Industrial & Commercial (GWh)	Domestic (GWh)	Road transport (GWh)	Rail (GWh)	Other* (GWh)	Total (GWh)
Coal	-	3.0	-	-	-	3.0
Manufactured Fuels	1.5	2.4	-	-	-	3.9
Petroleum Products	34.1	2.2	241.5	12.3	1.0	291.1
Gas	157.1	386.7	-	-	-	543.8
Electricity	171.5	119.3	-	-	-	290.9
Bioenergy & Waste	-	20.8	-	-	-	20.8
Total by sector	**364.3**	**534.4**	**241.5**	**12.3**	**1.0**	**1,153.5**

Table 6.18: Fuel consumption by sector and fuel type in 2018 – Tamworth

'Other' includes petroleum products used in the public and agricultural sectors; however, this is the only fuel type for which those sectors are reported separately in the BEIS dataset. Any other fuels used in the public and agricultural sectors will be included within the 'Industrial & Commercial' figures.

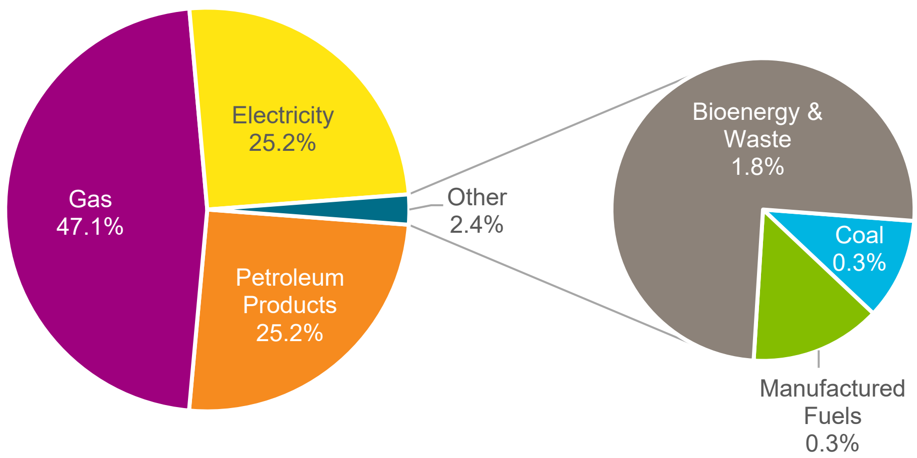

Figure 6-16: Fuel consumption by fuel type in 2018 – Tamworth

Figure 6-17 shows that the domestic sector accounts for the highest proportion of fuel consumption in Tamworth (46.3%), followed by the industrial & commercial and road transport sectors (31.6% and 20.9% respectively). Within the domestic sector, approximately 72.4% of fuel consumed is gas and 22.3% is electricity. In the industrial & commercial sector, approximately 47.1% of fuel consumed is electricity, and 43.1% is gas.

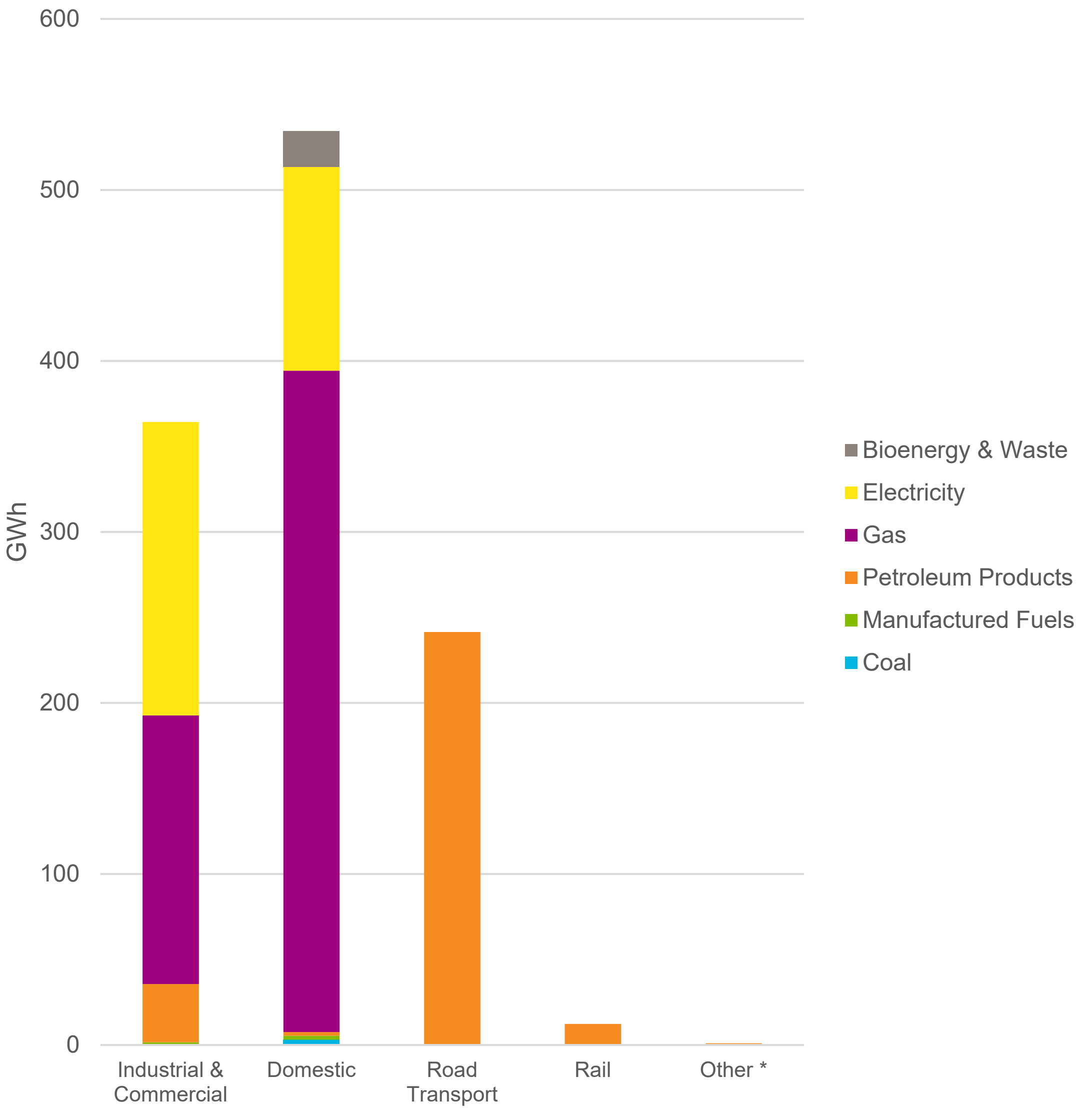

Figure 6-17: Fuel consumption by sector and fuel type in 2018 – Tamworth

Appendix E – Baseline GHG Emissions by Council

E.1 Cannock Chase

The baseline Scope 1, 2 and 3 GHG emissions in Cannock Chase are estimated to be 500.74 ktCO_2e. Of this total, Scope 1 and 2 emissions (i.e. those associated with fuel consumption and electricity used within the area boundary) account for roughly 400.31 ktCO_2e.

Figure 6-18 shows the breakdown of Scope 1, 2 and 3 GHG emissions in Cannock Chase. Data is provided in Table 6.19..

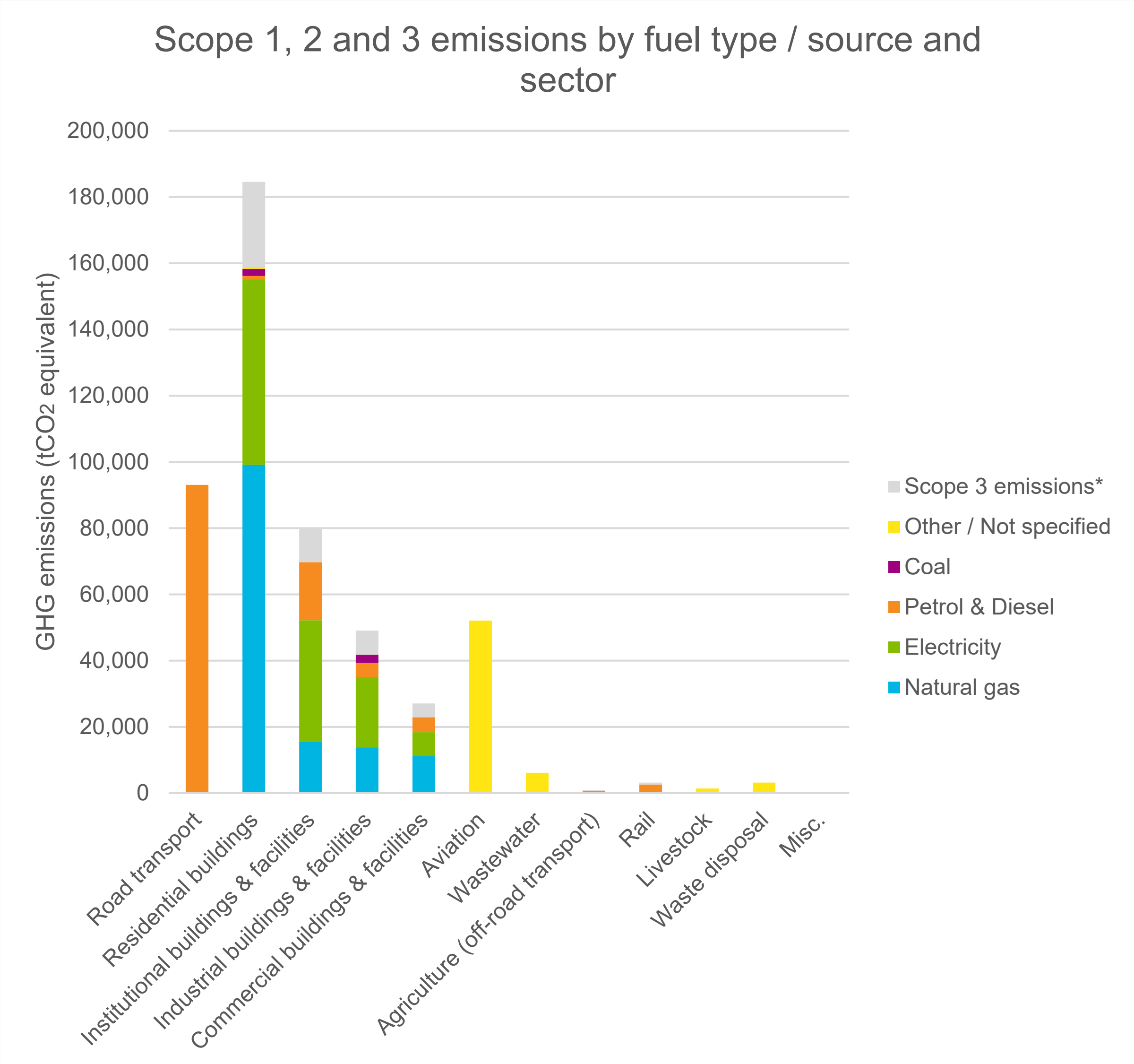

Figure 6-18. Scope 1, 2 and 3 GHG emissions by sector and fuel type - Cannock Chase. Source: SCATTER

Results indicate that the largest portion of emissions result from fuel consumption in domestic buildings (37%). Within this sector, the use of natural gas (e.g. for heating, hot water and cooking) accounts for the majority of GHG emissions. Non-domestic buildings collectively account for around 31% of total emissions while petrol and diesel used for road transport accounts for around 19%. Emissions from aviation make up around 10% of the overall total; these are based on UK-wide aviation emissions, allocated to Cannock Chase based on its population. Other sectors and sources of emissions collectively make up approximately 3% of the overall total. Note that motorways represent around 16% of road transport emissions for Cannock Chase, or around 3% of the total emissions.

Table 6.19. Scope 1, 2 and 3 GHG emissions by sector and fuel type - Cannock Chase. Source: SCATTER

	Natural gas (tCO_2e)	Electricity (tCO_2e)	Petrol & Diesel (tCO_2e)	Coal (tCO_2e)	Other / Not specified (tCO_2e)	Scope 3 emissions* (tCO_2e)	% of total (%)
Road transportation	0	0	93,074	0	0	0	*19%*
Residential buildings	99,162	56,057	934	2,184	507	25,732	*37%*
Institutional buildings & facilities	15,525	36,684	17,511	0	0	10,321	*16%*
Industrial buildings & facilities	13,797	21,265	4,253	2,445	0	7,306	*10%*
Commercial buildings & facilities	11,102	7,259	4,527	0	0	4,172	*5%*
Aviation	0	0	0	0	52,113	0	*10%*
Wastewater	0	0	0	0	6,148	0	*1%*
Agriculture (off-road transport)	0	0	731	0	0	177	*<1%*
Rail	0	0	2,559	0	0	610	*1%*
Livestock	0	0	0	0	1,408	0	*<1%*
Waste disposal	0	0	0	0	3,178	0	*1%*
Misc.	0	0	2	0	0	1	*<1%*
Percent of total (%)	*28%*	*24%*	*25%*	*1%*	*13%*	*10%*	

** excluding aviation*

From 2005 to 2017, Scope 1 and 2 CO_2 emissions in Cannock Chase decreased by roughly 30%, as shown in Figure 6-19 below. This estimate is based on BEIS CO_2-only emissions data and therefore does not directly align with the SCATTER data, but nonetheless indicates overall trends from major sources of emissions.

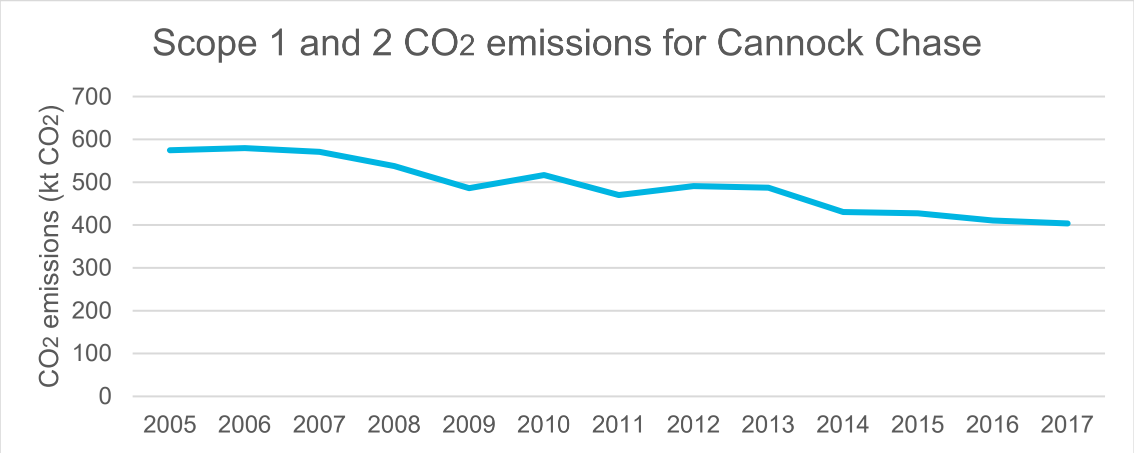

Figure 6-19. Scope 1 and 2 CO_2 emissions in Cannock Chase, 2005-2017. Source: BEIS

When interpreting these results, it is important to note that:

- Changes in CO_2 emissions do not necessarily reflect changes in fuel consumption or energy efficiency. For instance, an increase in electricity use could be offset by a decrease in electricity grid emissions.
- Similarly, year-to-year changes in fuel consumption relate to factors such as weather and should therefore be interpreted with caution.

E.2 East Staffordshire

The baseline Scope 1, 2 and 3 GHG emissions in East Staffordshire are estimated to be 904.31 ktCO_2e. Of this total, Scope 1 and 2 emissions (i.e. those associated with fuel consumption and electricity used within the area boundary) account for roughly 754.30 ktCO_2e.

Figure 6-20 shows the breakdown of Scope 1, 2 and 3 GHG emissions in East Staffordshire. Data is provided in Table 6.20..

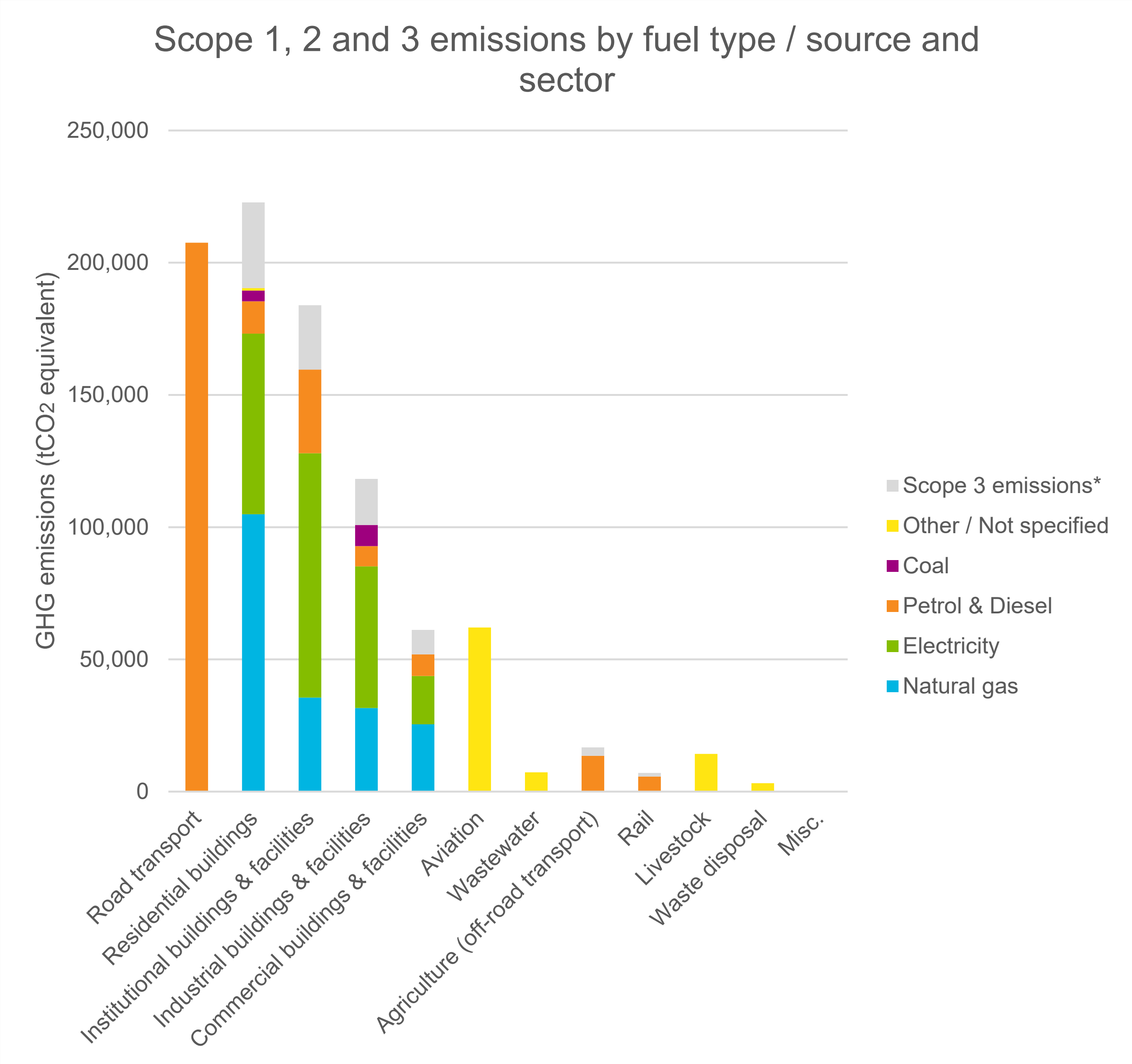

Figure 6-20. Scope 1, 2 and 3 GHG emissions by sector and fuel type – East Staffordshire. Source: SCATTER

Results indicate that the largest portion of emissions result from fuel consumption in non-domestic buildings, which collectively account for around 40% of all emissions. Within this sector, the use of electricity accounts for nearly half of all emissions, followed by natural gas which represents around one quarter. Domestic buildings account for around 25% of total emissions while petrol and diesel used for road transport accounts for around 23% (there are no motorways passing through East Staffordshire). Emissions from aviation make up around 7% of the overall total; these are based on UK-wide aviation emissions, allocated to East Staffordshire based on its population. Other sectors and sources of emissions collectively make up around 5% of the overall total.

Table 6.20. Scope 1, 2 and 3 GHG emissions by sector and fuel type – East Staffordshire. Source: SCATTER

	Natural gas (tCO_2e)	Electricity (tCO_2e)	Petrol & Diesel (tCO_2e)	Coal (tCO_2e)	Other / Not specified (tCO_2e)	Scope 3 emissions* (tCO_2e)	% of total (%)
Road transportation	0	0	207,560	0	0	0	*23%*
Residential buildings	104,887	68,301	12,220	4,048	960	32,416	*25%*
Institutional buildings & facilities	35,564	92,396	31,616	0	0	24,335	*20%*
Industrial buildings & facilities	31,607	53,560	7,678	8,009	0	17,377	*13%*
Commercial buildings & facilities	25,432	18,285	8,173	0	0	9,251	*7%*
Aviation	0	0	0	0	62,049	0	*7%*
Wastewater	0	0	0	0	7,320	0	*1%*
Agriculture (off-road transport)	0	0	13,514	0	0	3,225	*2%*
Rail	0	0	5,696	0	0	1,358	*1%*
Livestock	0	0	0	0	14,285	0	*2%*
Waste disposal	0	0	0	0	3,178	0	*<1%*
Misc.	0	0	7	0	0	2	*<1%*
Percent of total (%)	*22%*	*26%*	*32%*	*1%*	*10%*	*10%*	

** excluding aviation*

From 2005 to 2017, Scope 1 and 2 CO_2 emissions in East Staffordshire decreased by roughly 31%, as shown in Figure 6-21 below. This estimate is based on BEIS CO_2-only emissions data and therefore does not directly align with the SCATTER data, but nonetheless indicates overall trends from major sources of emissions.

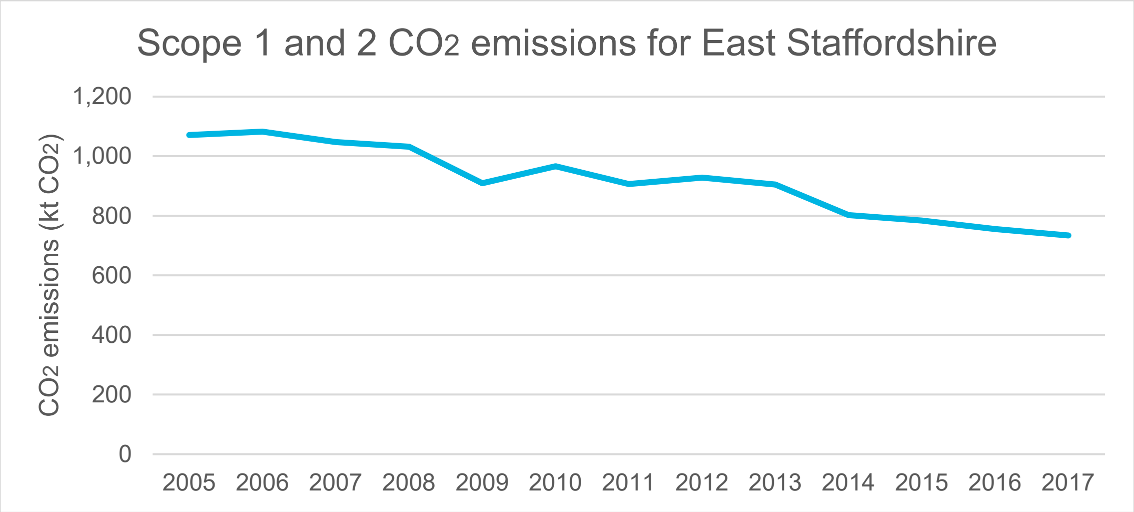

Figure 6-21. Scope 1 and 2 CO_2 emissions in East Staffordshire, 2005-2017. Source: BEIS

When interpreting these results, it is important to note that:

- Changes in CO_2 emissions do not necessarily reflect changes in fuel consumption or energy efficiency. For instance, an increase in electricity use could be offset by a decrease in electricity grid emissions.
- Similarly, year-to-year changes in fuel consumption relate to factors such as weather and should therefore be interpreted with caution.

E.3 Lichfield

The baseline Scope 1, 2 and 3 GHG emissions in Lichfield are estimated to be 750.25 ktCO_2e. Of this total, Scope 1 and 2 emissions (i.e. those associated with fuel consumption and electricity used within the area boundary) account for roughly 626.99 ktCO_2e.

Figure 6-22 shows the breakdown of GHG emissions in Lichfield. Data is provided in Table 6.21..

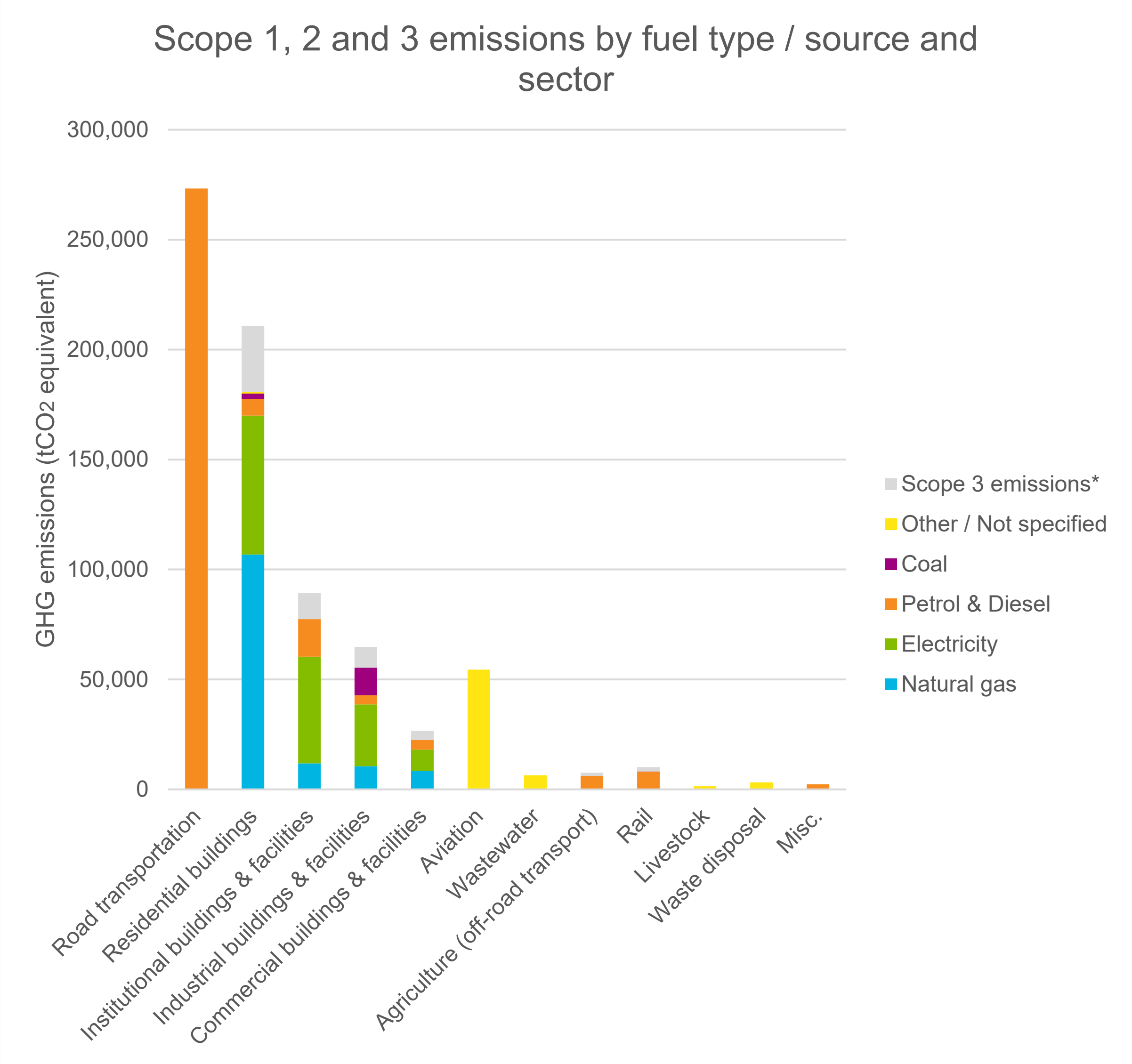

Figure 6-22. Scope 1, 2 and 3 GHG emissions by sector and fuel type – Lichfield. Source: SCATTER

Results indicate that the largest portion of emissions result from petrol and diesel used in road transport (36%), followed by residential buildings (28%). Within the residential sector, the use of natural gas (e.g. for heating, hot water and cooking) accounts for the majority of GHG emissions. Non-domestic buildings collectively account for around 25% of total emissions. Emissions from aviation make up around 8% of the overall total; these are based on UK-wide aviation emissions, allocated to Lichfield based on its population. Note that motorways represent around 18% of road transport emissions for Lichfield, or around 7% of the total emissions.

Note: Our analysis found that the Lichfield SCATTER dataset included various additional reporting categories that were not provided for other Local Authorities, along with several calculation errors. These have been manually corrected where possible. Where this was not possible, figures have been omitted to ensure a like-for-like comparison with the data presented for other Local Authorities. This is estimated to have a small (1-2%) impact on the overall figures.

Table 6.21. Scope 1, 2 and 3 GHG emissions by sector and fuel type – Lichfield. Source: SCATTER

	Natural gas (tCO_2e)	Electricity (tCO_2e)	Petrol & Diesel (tCO_2e)	Coal (tCO_2e)	Other / Not specified (tCO_2e)	Scope 3 emissions* (tCO_2e)	% of total (%)
Road transportation	0	0	273,271	0	0	0	*36%*
Residential buildings	106,830	63,174	7,602	2,420	680	30,108	*28%*
Institutional buildings & facilities	11,840	48,542	17,065	0	0	11,791	*12%*
Industrial buildings & facilities	10,523	28,139	4,144	12,535	0	9,463	*9%*
Commercial buildings & facilities	8,467	9,606	4,412	0	0	4,152	*4%*
Aviation	0	0	0	0	54,438	0	*7%*
Wastewater	0	0	0	0	6,422	0	*1%*
Agriculture (off-road transport)	0	0	6,121	0	0	1,460	*1%*
Rail	0	0	8,160	12	0	1,947	*1%*
Livestock	0	0	0	0	1,408	0	*<1%*
Waste disposal	0	0	0	0	3,178	0	*<1%*
Misc.	0	0	2,341	0	0	0	*<1%*
Percent of total (%)	*18%*	*20%*	*43%*	*2%*	*9%*	*8%*	

** excluding aviation*

From 2005 to 2017, Scope 1 and 2 CO_2 emissions in Lichfield decreased by roughly 22%, as shown in Figure 6-23 below. This estimate is based on BEIS CO_2-only emissions data and therefore does not directly align with the SCATTER data, but nonetheless indicates overall trends from major sources of emissions.

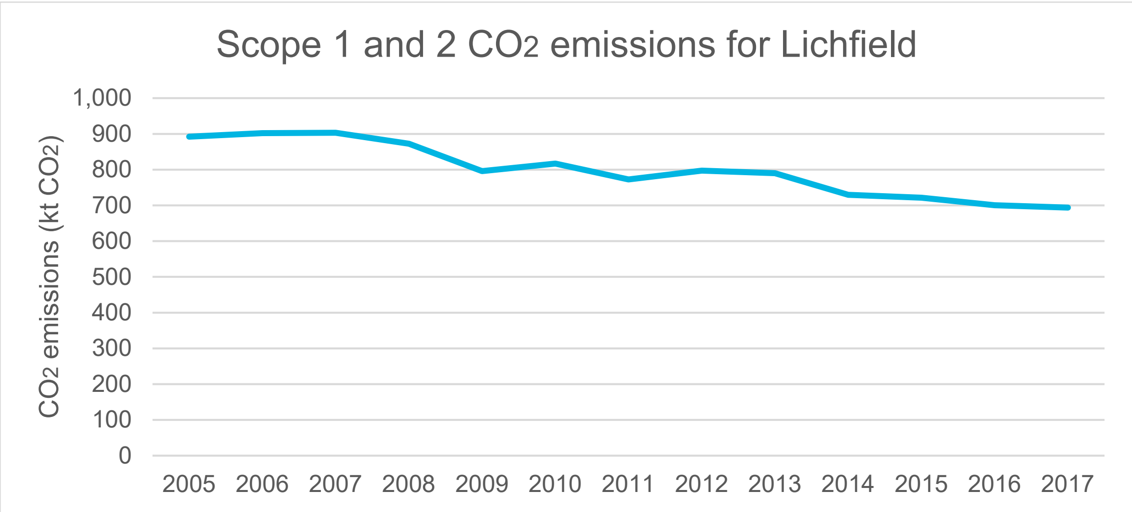

Figure 6-23. Scope 1 and 2 CO_2 emissions in Lichfield, 2005-2017. Source: BEIS

When interpreting these results, it is important to note that:

- Changes in CO_2 emissions do not necessarily reflect changes in fuel consumption or energy efficiency. For instance, an increase in electricity use could be offset by a decrease in electricity grid emissions.
- Similarly, year-to-year changes in fuel consumption relate to factors such as weather and should therefore be interpreted with caution.

E.4 Newcastle-under-Lyme

The baseline Scope 1, 2 and 3 GHG emissions in Newcastle-under-Lyme are estimated to be 903.02 ktCO_2e. Of this total, Scope 1 and 2 emissions (i.e. those associated with fuel consumption and electricity used within the area boundary) account for roughly 767.38 ktCO_2e.

Figure 6-24 shows the breakdown of Scope 1, 2 and 3 GHG emissions in Newcastle-under-Lyme. Data is provided in Table 6.22.

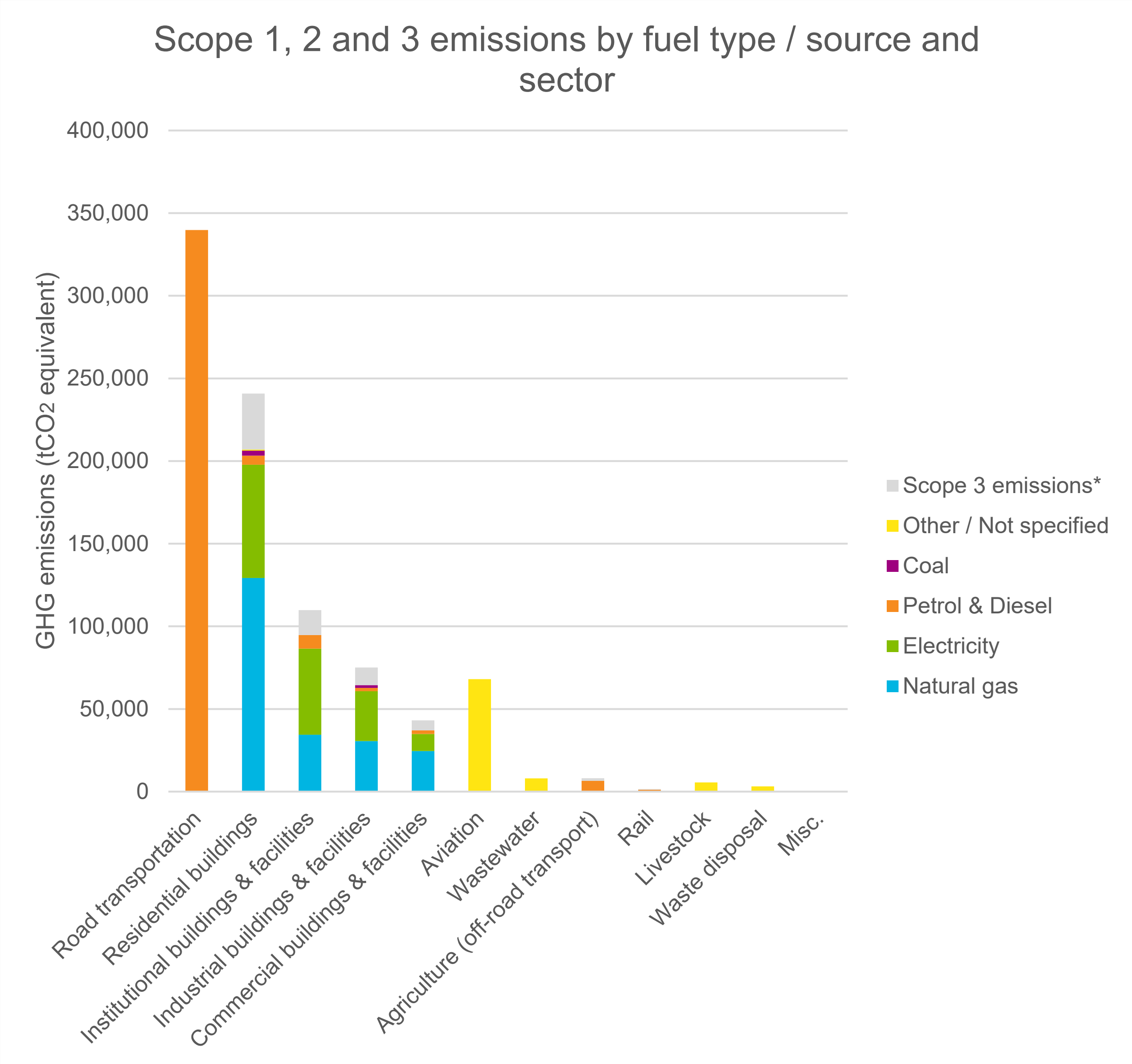

Figure 6-24. Scope 1, 2 and 3 GHG emissions by sector and fuel type – Newcastle-under-Lyme. Source: SCATTER

Results indicate that the largest portion of emissions result from petrol and diesel used in road transport (38%), followed by residential buildings (27%). Within the residential sector, the use of natural gas (e.g. for heating, hot water and cooking) accounts for the majority of GHG emissions. Non-domestic buildings collectively account for around 25% of total emissions. Emissions from aviation make up around 8% of the overall total; these are based on UK-wide aviation emissions, allocated to Newcastle-under-Lyme based on its population. Other sectors, such as wastewater treatment, waste disposal, and livestock collectively account for less than 3% of total emissions. Note that motorways represent around 45% of road transport emissions for Newcastle-under-Lyme, or around 17% of the total emissions.

Table 6.22. Scope 1, 2 and 3 GHG emissions by sector and fuel type – Newcastle-under-Lyme. Source: SCATTER

	Natural gas (tCO_2e)	Electricity (tCO_2e)	Petrol & Diesel (tCO_2e)	Coal (tCO_2e)	Other / Not specified (tCO_2e)	Scope 3 emissions* (tCO_2e)	% of total (%)
Road transportation	0	0	339,768	0	0	0	*38%*
Residential buildings	129,278	68,558	5,411	3,015	651	33,913	*27%*
Institutional buildings & facilities	34,395	52,118	8,229	0	0	15,029	*12%*
Industrial buildings & facilities	30,568	30,212	1,998	1,655	0	10,675	*8%*
Commercial buildings & facilities	24,597	10,314	2,127	0	0	6,095	*5%*
Aviation	0	0	0	0	68,074	0	*8%*
Wastewater	0	0	0	0	8,031	0	*1%*
Agriculture (off-road transport)	0	0	6,557	0	0	1,565	*1%*
Rail	0	0	1,200	0	0	286	*<1%*
Livestock	0	0	0	0	5,509	0	*1%*
Waste disposal	0	0	0	0	3,178	0	*<1%*
Misc.	0	0	12	0	0	3	*<1%*
Percent of total (%)	*24%*	*18%*	*40%*	*1%*	*9%*	*7%*	

** excluding aviation*

From 2005 to 2017, Scope 1 and 2 CO_2 emissions in Newcastle-under-Lyme decreased by roughly 22%, as shown in Figure 6-25 below. This estimate is based on BEIS CO_2-only emissions data and therefore does not directly align with the SCATTER data, but nonetheless indicates overall trends from major sources of emissions.

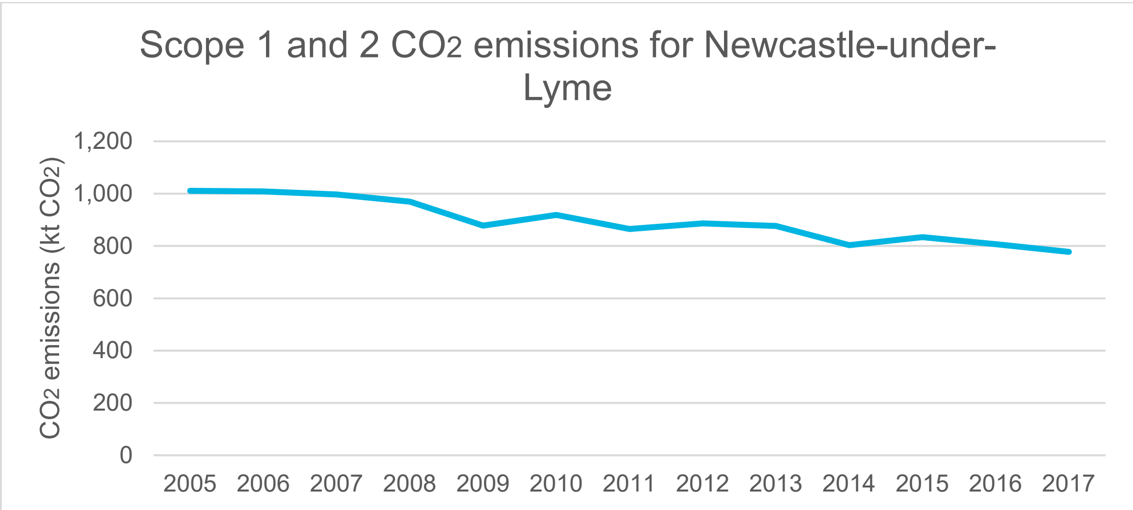

Figure 6-25. Scope 1 and 2 CO_2 emissions in Newcastle-under-Lyme, 2005-2017. Source: BEIS

When interpreting these results, it is important to note that:

- Changes in CO_2 emissions do not necessarily reflect changes in fuel consumption or energy efficiency. For instance, an increase in electricity use could be offset by a decrease in electricity grid emissions.
- Similarly, year-to-year changes in fuel consumption relate to factors such as weather and should therefore be interpreted with caution.

E.5 South Staffordshire

The baseline Scope 1, 2 and 3 GHG emissions in South Staffordshire are estimated to be 961.75 $ktCO_2e$. Of this total, Scope 1 and 2 emissions (i.e. those associated with fuel consumption and electricity used within the area boundary) account for roughly 836.82 $ktCO_2e$.

Figure 6-26 shows the breakdown of Scope 1, 2 and 3 GHG emissions in South Staffordshire. Data is provided in Table 6.23..

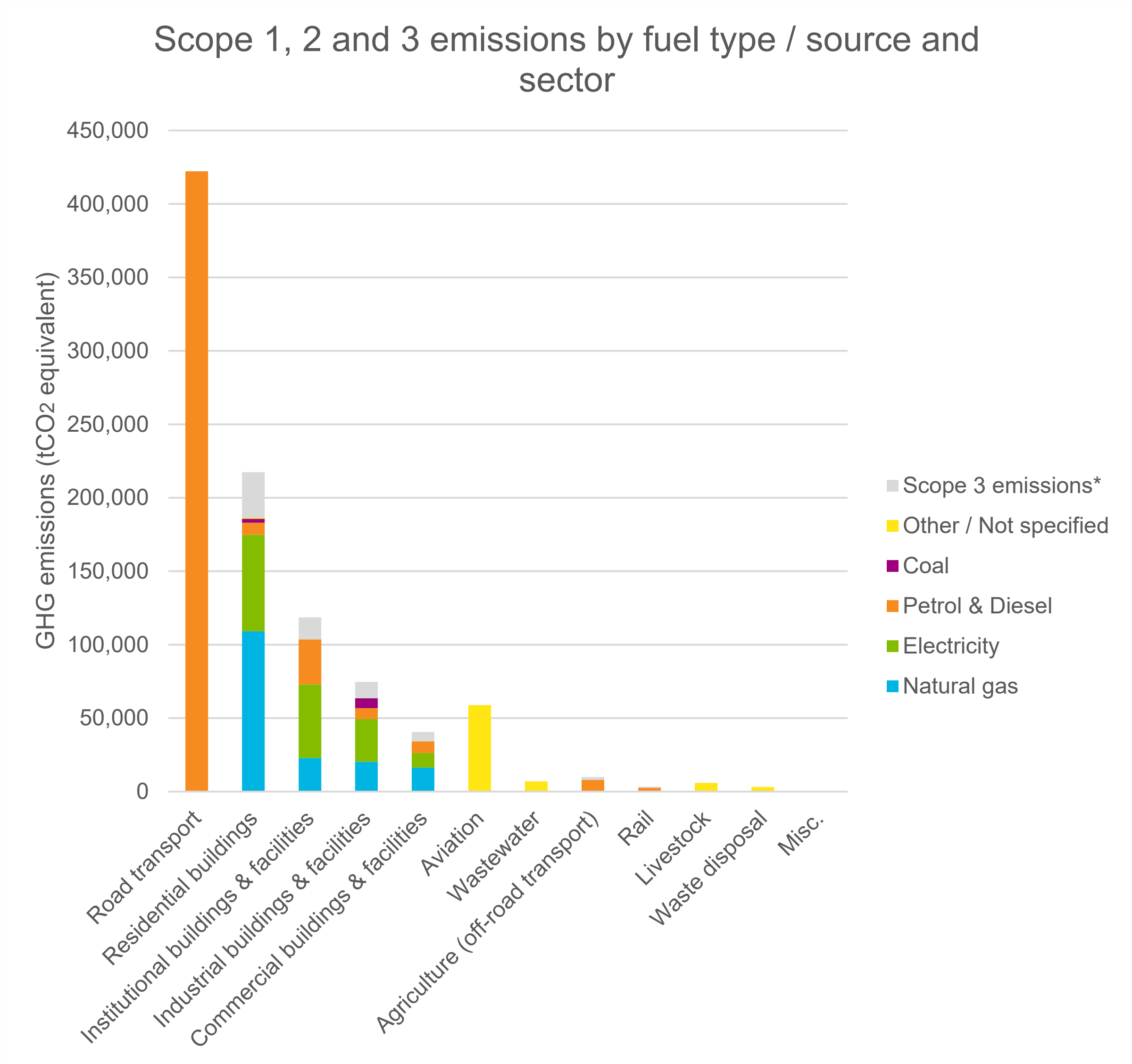

Figure 6-26. Scope 1, 2 and 3 GHG emissions by sector and fuel type – South Staffordshire. Source: SCATTER

Results indicate that the largest portion of emissions (44%) result from petrol and diesel used for road transportation. Emissions from domestic and non-domestic buildings each account for just under a quarter of total emissions (23% and 24% respectively). Emissions from aviation turbine fuel make up around 6% of the overall total; these are based on UK-wide aviation emissions, allocated to South Staffordshire based on its population. Other sectors and sources of emissions collectively make up only 3% of the overall total. Note that motorways represent around 66% of road transport emissions for South Staffordshire, or around 29% of the total emissions.

Table 6.23. Scope 1, 2 and 3 GHG emissions by sector and fuel type – South Staffordshire. Source: SCATTER

	Natural gas (tCO_2e)	Electricity (tCO_2e)	Petrol & Diesel (tCO_2e)	Coal (tCO_2e)	Other / Not specified (tCO_2e)	Scope 3 emissions* (tCO_2e)	% of total (%)
Road transportation	0	0	422,289	0	0	0	*44%*
Residential buildings	109,143	65,678	8,255	2,646	687	31,110	*23%*
Institutional buildings & facilities	22,885	50,073	30,652	0	0	14,952	*12%*
Industrial buildings & facilities	20,339	29,026	7,444	6,736	0	11,145	*8%*
Commercial buildings & facilities	16,366	9,909	7,924	0	0	6,352	*4%*
Aviation	0	0	0	0	58,825	0	*6%*
Wastewater	0	0	0	0	6,940	0	*1%*
Agriculture (off-road transport)	0	0	8,000	0	0	1,910	*1%*
Rail	0	0	2,648	0	0	631	*<1%*
Livestock	0	0	0	0	5,980	0	*1%*
Waste disposal	0	0	0	0	3,178	0	*<1%*
Misc.	0	0	16	0	0	4	*<1%*
Percent of total (%)	*18%*	*16%*	*51%*	*1%*	*8%*	*7%*	

** excluding aviation*

From 2005 to 2017, Scope 1 and 2 CO_2 emissions in South Staffordshire decreased by roughly 15%, as shown in Figure 6-27 below. This estimate is based on BEIS CO_2-only emissions data and therefore does not directly align with the SCATTER data, but nonetheless indicates overall trends from major sources of emissions.

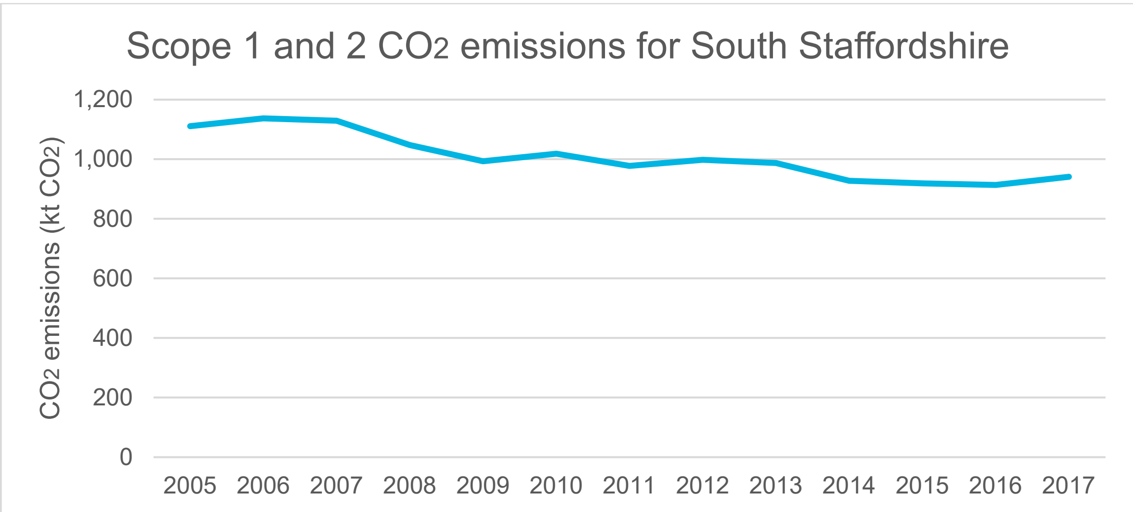

Figure 6-27. Scope 1 and 2 CO_2 emissions in South Staffordshire, 2005-2017. Source: BEIS

When interpreting these results, it is important to note that:

- Changes in CO_2 emissions do not necessarily reflect changes in fuel consumption or energy efficiency. For instance, an increase in electricity use could be offset by a decrease in electricity grid emissions.
- Similarly, year-to-year changes in fuel consumption relate to factors such as weather and should therefore be interpreted with caution.

E.6 Stafford

The baseline Scope 1, 2 and 3 GHG emissions in Stafford are estimated to be 1,112.86 ktCO_2e. Of this total, Scope 1 and 2 emissions (i.e. those associated with fuel consumption and electricity used within the area boundary) account for roughly 964.76 ktCO_2e.

Figure 6-28 shows the breakdown of Scope 1, 2 and 3 GHG emissions in Stafford. Data is provided in Table 6.24..

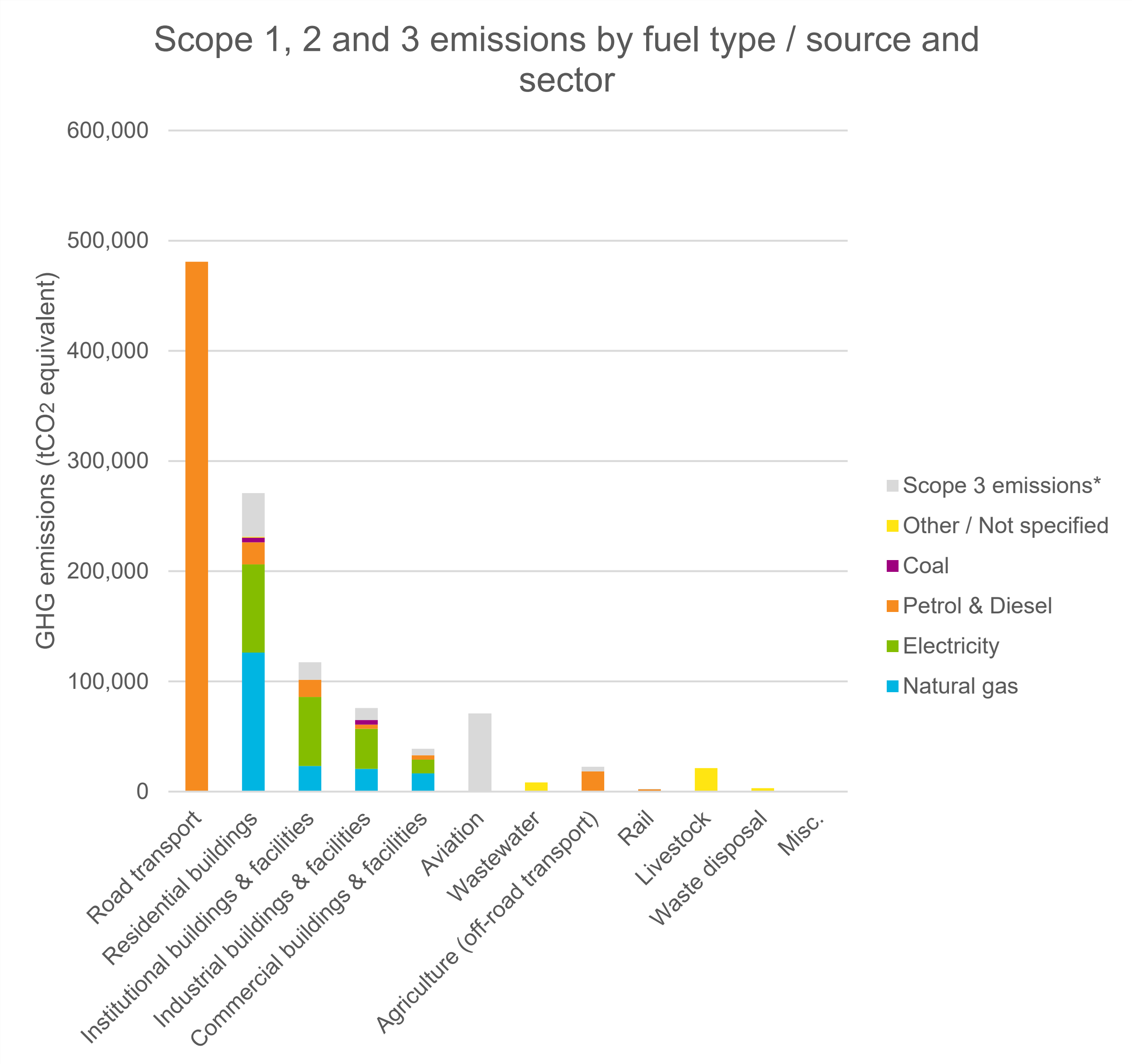

Figure 6-28. Scope 1, 2 and 3 GHG emissions by sector and fuel type – Stafford. Source: SCATTER

Results indicate that the largest portion of emissions (43%) result from petrol and diesel used for road transportation. After road transport, fuel consumption in domestic buildings is the next most significant source of emissions representing 24% of the total. Within this sector, the use of natural gas (e.g. for heating, hot water and cooking) accounts for just under half of GHG emissions. Non-domestic buildings collectively account for around 21% of total emissions; within this sector, roughly half of emissions are associated with the use of electricity and around one quarter from natural gas. Emissions from aviation make up around 6% of the overall total; these are based on UK-wide aviation emissions, allocated to Stafford based on its population. Other sectors and sources of emissions collectively make up around 5% of the overall total. Note that motorways represent around 60% of road transport emissions for Stafford, or around 26% of the total emissions.

Table 6.24. Scope 1, 2 and 3 GHG emissions by sector and fuel type – Stafford. Source: SCATTER

	Natural gas (tCO_2e)	Electricity (tCO_2e)	Petrol & Diesel (tCO_2e)	Coal (tCO_2e)	Other / Not specified (tCO_2e)	Scope 3 emissions* (tCO_2e)	% of total (%)
Road transportation	0	0	480,827	0	0	0	*43%*
Residential buildings	126,153	80,084	20,003	4,288	769	39,685	*24%*
Institutional buildings & facilities	23,210	62,661	15,690	0	0	15,848	*11%*
Industrial buildings & facilities	20,628	36,323	3,810	4,110	0	11,089	*7%*
Commercial buildings & facilities	16,598	12,400	4,056	0	0	5,772	*3%*
Aviation	0	0	0	0	70,875	0	6%
Wastewater	0	0	0	0	8,361	0	1%
Agriculture**	1	1	18,261	0	0	4,359	2%
Rail	0	0	1,987	0	0	474	<1%
Livestock	0	0	0	0	21,333	0	2%
Waste disposal	0	0	0	0	3,178	0	<1%
Misc.	0	0	19	0	0	5	<1%
Percent of total (%)	17%	17%	49%	1%	9%	7%	

** Excluding aviation*

*** Note: for most Districts, this category comprises agricultural off-road transport / machinery; the SCATTER methodology does not explain the use for natural gas or electricity reported here for Stafford.*

From 2005 to 2017, Scope 1 and 2 CO_2 emissions in Stafford decreased by roughly 25%, as shown in Figure 6-29 below. This estimate is based on BEIS CO_2-only emissions data and therefore does not directly align with the SCATTER data, but nonetheless indicates overall trends from major sources of emissions.

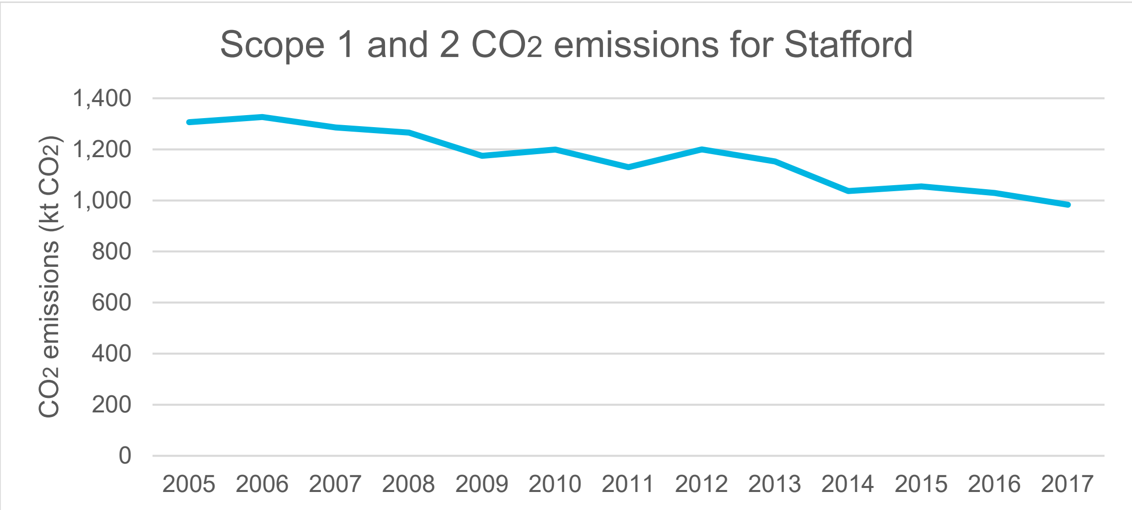

Figure 6-29. Scope 1 and 2 CO_2 emissions in Stafford, 2005-2017. Source: BEIS

When interpreting these results, it is important to note that:

- Changes in CO_2 emissions do not necessarily reflect changes in fuel consumption or energy efficiency. For instance, an increase in electricity use could be offset by a decrease in electricity grid emissions.
- Similarly, year-to-year changes in fuel consumption relate to factors such as weather and should therefore be interpreted with caution.

E.7 Staffordshire Moorlands

The baseline Scope 1, 2 and 3 GHG emissions in Staffordshire Moorlands are estimated to be 921.92 $ktCO_2e$. Of this total, Scope 1 and 2 emissions (i.e. those associated with fuel consumption and electricity used within the area boundary) account for roughly 767.27 $ktCO_2e$.

Figure 6-30 shows the breakdown of Scope 1, 2 and 3 GHG emissions in Staffordshire Moorlands. Data is provided in Table 6.25..

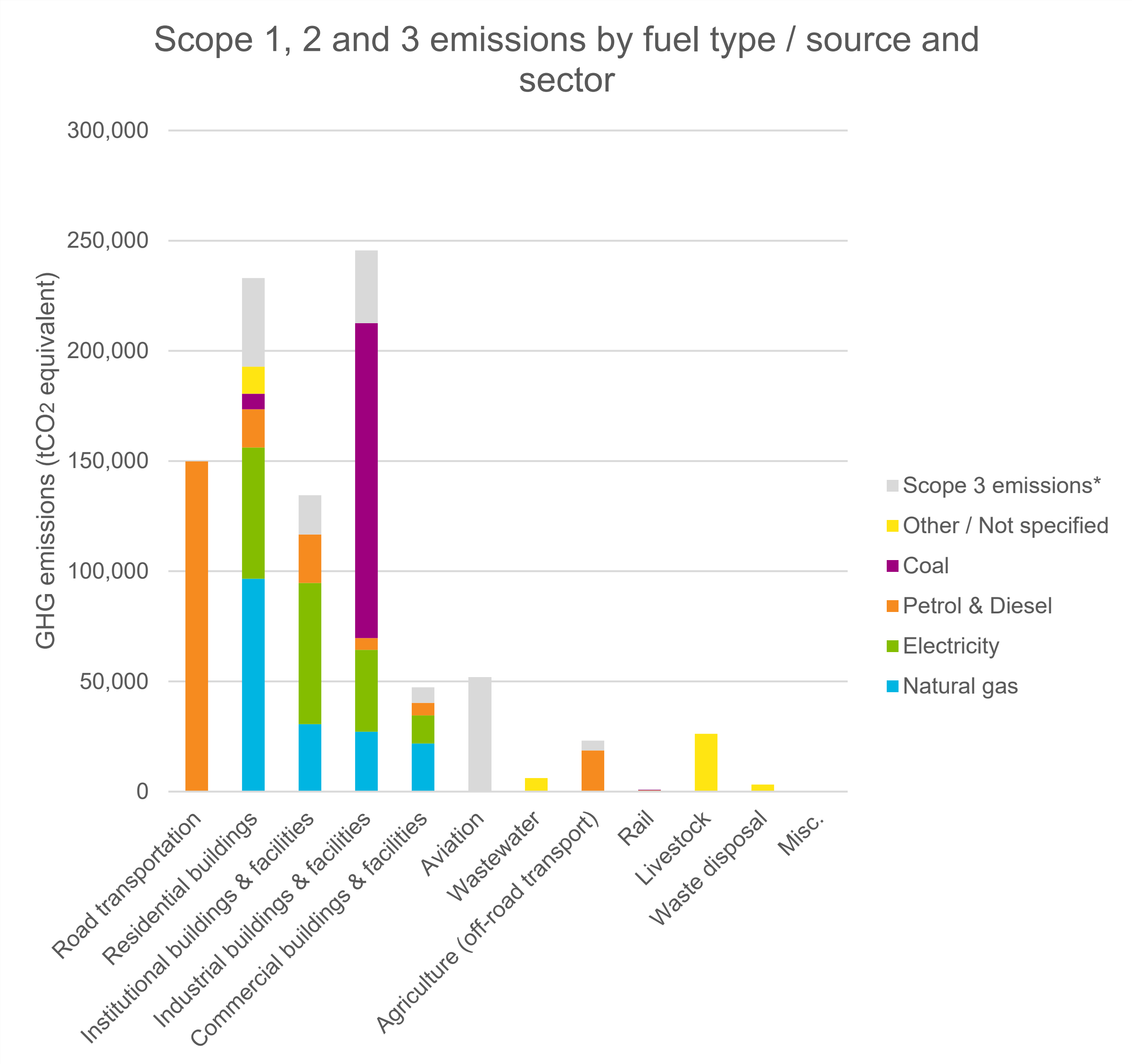

Figure 6-30. Scope 1, 2 and 3 GHG emissions by sector and fuel type – Staffordshire Moorlands. Source: SCATTER

Results indicate that the largest portion of emissions result from fuel consumption in non-domestic buildings which collectively account for 46%. This is dominated by the industrial sector; notably, unlike other Local Authorities in Staffordshire, a considerable proportion of emissions result from the use of coal. Residential buildings account for around 25% while petrol and diesel used for road transport accounts for around 16% (there are no motorways passing through Staffordshire Moorlands). Emissions from aviation make up around 6% of the overall total; these are based on UK-wide aviation emissions, allocated to Staffordshire Moorlands based on its population. Other sectors and sources of emissions collectively make up around 6% of the overall total.

Table 6.25. Scope 1, 2 and 3 GHG emissions by sector and fuel type – Staffordshire Moorlands. Source: SCATTER

	Natural gas (tCO_2e)	Electricity (tCO_2e)	Petrol & Diesel (tCO_2e)	Coal (tCO_2e)	Other / Not specified (tCO_2e)	Scope 3 emissions* (tCO_2e)	% of total (%)
Road transportation	0	0	149,826	0	0	0	*16%*
Residential buildings	96,628	59,553	17,286	7,065	12,307	40,171	*25%*
Institutional buildings & facilities	30,586	64,125	21,990	0	0	17,786	*15%*
Industrial buildings & facilities	27,183	37,172	5,340	142,862	0	33,034	*27%*
Commercial buildings & facilities	21,873	12,690	5,685	0	0	7,062	*5%*
Aviation	0	0	0	0	51,954	0	*6%*
Wastewater	0	0	0	0	6,129	0	*1%*
Agriculture (off-road transport)	0	0	18,714	0	0	4,462	*3%*
Rail	0	0	611	230	0	181	*<1%*
Livestock	0	0	0	0	26,233	0	*3%*
Waste disposal	0	0	0	0	3,178	0	*<1%*
Misc.	0	0	4	0	0	1	*<1%*
Percent of total (%)	*19%*	*19%*	*24%*	*16%*	*11%*	*11%*	

** excluding aviation*

From 2005 to 2017, Scope 1 and 2 CO_2 emissions in Staffordshire Moorlands decreased by roughly 25%, as shown in Figure 6-31 below. This estimate is based on BEIS CO_2-only emissions data and therefore does not directly align with the SCATTER data, but nonetheless indicates overall trends from major sources of emissions.[56]

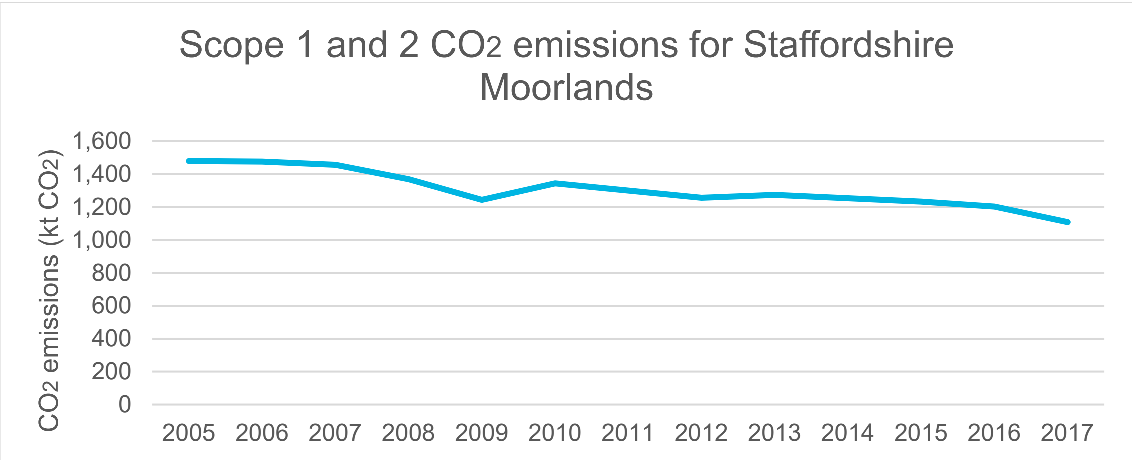

Figure 6-31. Scope 1 and 2 CO_2 emissions in Staffordshire Moorlands, 2005-2017. Source: BEIS

When interpreting these results, it is important to note that:

- Changes in CO_2 emissions do not necessarily reflect changes in fuel consumption or energy efficiency. For instance, an increase in electricity use could be offset by a decrease in electricity grid emissions.
- Similarly, year-to-year changes in fuel consumption relate to factors such as weather and should therefore be interpreted with caution.

[56] *Note: The discrepancy between BEIS and SCATTER data for Staffordshire Moorlands is significantly higher than for other Districts. This is likely due to the presence of one or more large industrial or commercial consumers whose fuel use is not captured in SCATTER due to data disclosure issues. For further information, refer to the BEIS methodology discussion of 'Large industrial installations.' See* https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/812146/Local_authority_C02_technical_report_2017.pdf

E.8 Tamworth

The baseline Scope 1, 2 and 3 GHG emissions in Tamworth are estimated to be 366.25 ktCO_2e. Of this total, Scope 1 and 2 emissions (i.e. those associated with fuel consumption and electricity used within the area boundary) account for roughly 289.34 ktCO_2e.

Figure 6-32 shows the breakdown of Scope 1, 2 and 3 GHG emissions in Tamworth. Data is provided in Table 6.26..

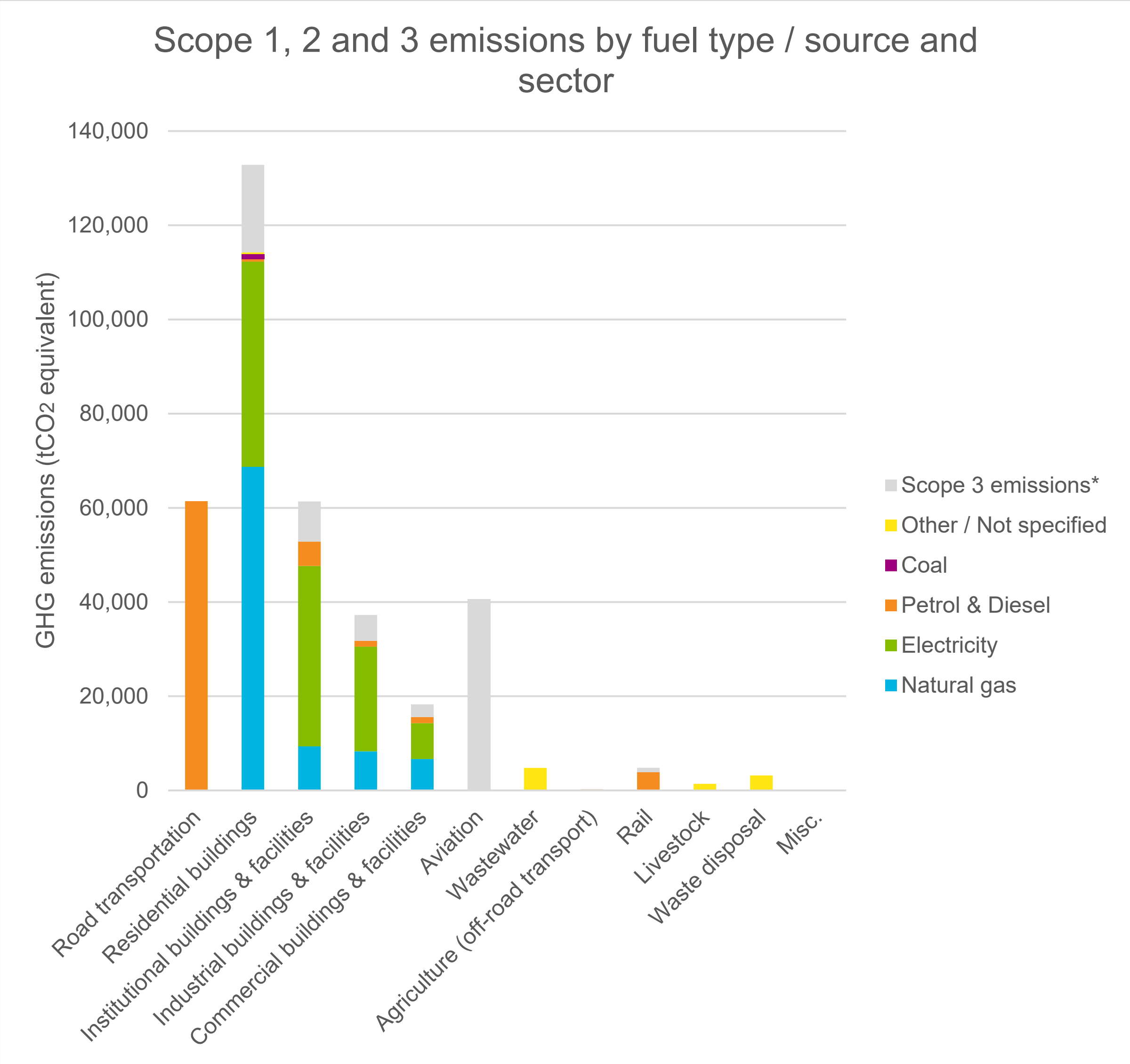

Figure 6-32. Scope 1, 2 and 3 GHG emissions by sector and fuel type – Tamworth. Source: SCATTER

Results indicate that the largest portion of emissions result from fuel consumption in domestic buildings (36%). Within this sector, the use of natural gas (e.g. for heating, hot water and cooking) accounts for the majority of GHG emissions. Non-domestic buildings collectively account for around 32% of total emissions while petrol and diesel used for road transport accounts for around 17% (there are no motorways passing through Tamworth). Emissions from aviation make up around 11% of the overall total; these are based on UK-wide aviation emissions, allocated to Tamworth based on its population. Other sectors and sources of emissions collectively make up around 5% of the overall total.

Table 6.26. Scope 1, 2 and 3 GHG emissions by sector and fuel type – Tamworth. Source: SCATTER

	Natural gas (tCO_2e)	Electricity (tCO_2e)	Petrol & Diesel (tCO_2e)	Coal (tCO_2e)	Other / Not specified (tCO_2e)	Scope 3 emissions* (tCO_2e)	% of total (%)
Road transportation	0	0	61,419	0	0	0	*17%*
Residential buildings	68,719	43,550	513	1,087	380	18,575	*36%*
Institutional buildings & facilities	9,353	38,328	5,129	0	0	8,559	*17%*
Industrial buildings & facilities	8,312	22,218	1,246	0	0	5,468	*10%*
Commercial buildings & facilities	6,689	7,585	1,326	0	0	2,693	*5%*
Aviation	0	0	0	0	40,644	0	*11%*
Wastewater	0	0	0	0	4,795	0	*1%*
Agriculture (off-road transport)	0	0	216	0	0	52	*<1%*
Rail	0	0	3,887	0	0	927	*1%*
Livestock	0	0	0	0	1,408	0	*<1%*
Waste disposal	0	0	0	0	3,178	0	*1%*
Misc.	0	0	1	0	0	0	*<1%*
Percent of total (%)	*25%*	*30%*	*20%*	*<1%*	*14%*	*10%*	

** excluding aviation*

From 2005 to 2017, Scope 1 and 2 CO_2 emissions in Tamworth decreased by roughly 38%, as shown in Figure 6-33 below. This estimate is based on BEIS CO_2-only emissions data and therefore does not directly align with the SCATTER data, but nonetheless indicates overall trends from major sources of emissions.

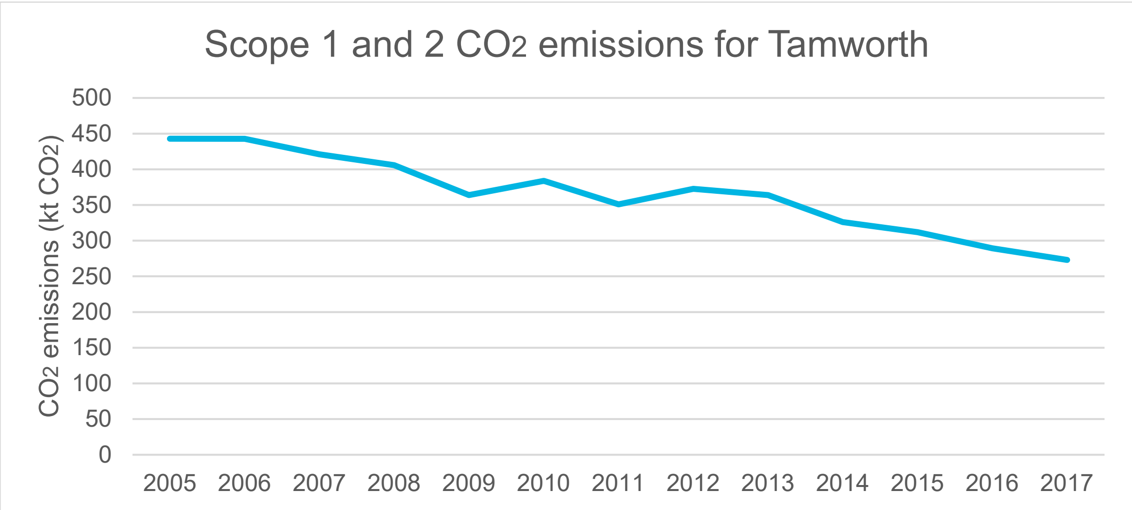

Figure 6-33. Scope 1 and 2 CO_2 emissions in Tamworth, 2005-2017. Source: BEIS

When interpreting these results, it is important to note that:

- Changes in CO_2 emissions do not necessarily reflect changes in fuel consumption or energy efficiency. For instance, an increase in electricity use could be offset by a decrease in electricity grid emissions.
- Similarly, year-to-year changes in fuel consumption relate to factors such as weather and should therefore be interpreted with caution.

Appendix F – Approach to Modelling CO_2 Emissions Trajectories

F.1 Overview

The GHG emissions baselines presented in Section 2 and Appendix C use data from the SCATTER tool which covers Scope 1, 2 and 3 emissions for each Local Authority. By contrast, the CO_2 scenarios presented in Section 3 are based on the 2017 dataset published by BEIS, which considers Scope 1 and 2 emissions from sources located within the boundary of the local authority area. This includes the emissions associated with electricity if the point of end use is within the boundary. It also includes the modelled emissions from transportation occurring within that geographic area, i.e. if a car drives through the Local Authority area, only the emissions within the Local Authority boundary are counted.

The trajectories developed by AECOM account for new development (dwellings and employment floorspace) based on figures provided by each District (see Appendix G for details). These illustrative trajectories are contrasted against a hypothetical 'Business as Usual' or 'No change' scenario, which assumes that all CO_2 emissions remain constant (i.e. there is no change from the BEIS 2017 figures).

F.2 Calculation method

Emissions from gas and electricity use in buildings

In order to estimate the change in CO_2 emissions resulting from grid decarbonisation, BEIS figures for CO_2 emissions from electricity and gas were divided by the relevant 2017 Carbon Emission Factors (CEFs) for each fuel. This effectively provides an estimate of the gas and electricity consumption in that year. Then:

- In the 'Grid decarbonisation – no other changes' scenario, this figure is multiplied by the CEF for each year through 2050, to show a decrease over time.
- In the 'Impacts of new development' scenario, the additional gas and electricity demands from new development are added to the total figures, and then the new total is multiplied by the relevant CEF to calculate the change in emissions.
- The impacts of grid decarbonisation can be shown by using an alternative CEF for electricity (see explanation of 'Grid decarbonisation pathway' below).

Emissions from road transportation

CEFs for traditional fuel vehicles and ULEVs are provided in the HM Treasury/BEIS *'Green Book Supplementary Guidance: Toolkit for valuing changes in greenhouse gas emissions'* (2019) which is intended for use by organisations reporting on their greenhouse gas emissions. A comparison of these figures suggests that, at present, ULEVs emit roughly 33% as much CO_2e as traditional fuel vehicles. In the scenarios that account for grid decarbonisation, this figure is reduced proportional to the change in the CEF for grid electricity.

The current proportion of vehicles that are ultra low emission as of 2020 is taken from the analysis presented in Section 5. It is assumed that the rate of uptake will increase over time in line with the FES 'Consumer Renewables' trajectory (see Section 5 for more information).

BEIS figures for CO_2 emissions from road transport as of 2017 are taken as a starting point for transport emissions. These are then multiplied by an adjustment factor which is derived from (a) the relative emissions from ULEVs compared with traditional fuel vehicles, and (b) the proportion of ULEVs in a given year.

Grid decarbonisation pathway

CEFs for electricity were taken from the National Grid Future Energy Scenarios (FES) 'Consumer Renewables' trajectory (2019 publication). In this scenario there is a high level of local renewable energy generation, including quadrupling decentralised wind energy capacity; policy support for onshore wind and energy storage is presumed to be strong, and energy demand is 2/3rds of 2018 levels by 2050 with a drop in residential heat demand of a quarter due to energy efficiency measures.

Note that this trajectory reflects the level of decarbonisation that would be necessary for the UK to meet a decarbonisation target of 80%, as the FES 2019 was published prior to the Climate Change Act 2050 Target Amendment increased the UK's target to net zero emissions. It is **not** a projection of the likely emissions from grid electricity, but an illustrative scenario of changes that could occur.

New buildings

The amount of proposed new development (number of dwellings and m^2 of employment floorspace) is multiplied by benchmarks to provide an estimate of the additional annual amount of gas and electricity that would be used within Staffordshire. This is then multiplied by carbon emission factors (see 'Grid decarbonisation pathway' above) for each fuel type to estimate the resulting increase in CO_2 emissions.

For domestic buildings, benchmarks were derived from median consumption figures for Staffordshire County as reported in the National Energy Efficiency Database (NEED). For non-domestic buildings, CIBSE Guide F benchmarks were used to estimate gas and electricity demand. The table below shows the annual demand for electricity and heat for each building type; heating is assumed to be supplied by natural gas.

Category	Electricity	Heat	Source
Non-domestic buildings	128 kWh/m^2	97 kWh/m^2	CIBSE Guide F (2012) *Energy Efficiency in Buildings*. Figures are for 'office' spaces.
Domestic buildings	13,073 kWh/dwelling	13,073 kWh/dwelling	NEED (2019 version). Figures are for median gas and electricity demand for all dwellings in Staffordshire. See '*Table LA5: Gas consumption by property type and Local Authority*' and '*Table LA6: Electricity consumption by property type and Local Authority*'

Because these benchmarks are based on the typical energy performance of the existing building stock, they should be understood as relatively high / upper estimates for the likely energy demands in new buildings which are typically more efficient.

Emissions from other sources

This assessment has only considered changes in CO_2 emissions from the changes listed above. The estimates assume that all other sources of emissions as listed in the BEIS dataset are held constant over the time period to 2050, which includes:

- Emissions from any fuels used in buildings, industry or agriculture, other than gas and electricity;
- Emissions from railways; and
- Emissions or removals (absorbing CO_2) due to changes in land use, forestry, etc.

It is understood that, in reality, all of these are subject to change for a wide variety of reasons, including but not limited to population growth, energy prices, weather, economic growth / decline, deforestation / afforestation, and so on.

F.3 Limitations

As stated previously, this study has only considered sources of emissions that are listed within published datasets (SCATTER and BEIS CO_2 statistics). For instance, it does not cover all supply chain (Scope 3) emissions from the purchase of food and other products that are brought to Staffordshire from other locations. Due to lack of information about other GHG emissions at a Local Authority level, therefore, the baseline presented in this report is likely to be an underestimate of the total. This is an inherent limitation of undertaking any GHG emissions boundary analysis. On the other hand –

- **SCATTER data:** The sources of emissions covered in the GHG baseline section are in line with the Global Covenant of Mayors Common Reporting Framework[57] (CRF) which provides an international standardised template for reporting.
- **BEIS CO_2 data:** Because this information is published annually by BEIS and includes all UK Local Authorities, use of this data facilitates a straightforward comparison between the Local Authorities in Staffordshire and elsewhere.

Another key overarching limitation of this approach is that any changes modelled would need to be backed up by policies, funding, changes in technology, and user / consumer behaviour which are uncertain.

[57] https://www.globalcovenantofmayors.org/our-initiatives/data4cities/common-global-reporting-framework/

Appendix G – Development Trajectory

The quantum and type of development used in the analysis presented in this report is summarised here for each Local Authority.

G.1 New Housing Development

Table 6.27: Anticipated new domestic development (highlighted cells indicate information taken from the source document and used to calculate either annual dwellings, or total new dwellings.)

	Start	Finish	Additional dwellings per year	Total new dwellings	Source & Assumptions
Cannock Chase	2020	2024	277	1,108	Local Plan Review 2016 to 2036 - Issues and Options Consultation - May 2019.
	2025	2037	284	3,408	
East Staffordshire	2012	2031	754	14,326	5 Year Housing Supply Methodology - 30th September 2019. *Note: This is an estimation based on sustaining the rate of 754 dwellings per year throughout the Local Plan period to the year 2031.*
Lichfield	2018	2040	536	11,800	Local Plan Review 2018 to 2040 - Preferred Options - November 2019; Housing and Economic Development Needs Assessment (Lichfield & Tamworth) 2019. *Note: The document indicates a total of 11,800 dwellings are needed which has been distributed linearly (on a per year basis) throughout the Local Plan period to the year 2040.*
Newcastle-under-Lyme	2013	2037	586	14,064	Draft Joint Local Plan - Part 1 - Strategies and Policies 2020. *Note: The document indicates a total of 14,064 dwellings are needed which has been distributed linearly throughout the Local Plan period to the year 2037.*
South Staffordshire	2018	2037	466	8,845	Local Plan Spatial Housing Strategy and Infrastructure Delivery - October 2019. *Note: The document indicates a total of 8,845 dwellings are needed which has been distributed linearly throughout the Local Plan period to the year 2037.*
Stafford Borough	2020	2040	494	9,876	Assumes delivery of remaining commitments (including adopted Local Plan 2011- 2031 allocations) and Local Housing Need post-2031. *Note: This does not account for a garden community in Stafford Borough, see footnote number 58.*

Staffordshire Moorlands	2012	2031	320	6,080	Local Plan Review - Submission Version - February 2018.
Tamworth	2016 2037	2036 2050	177 40	2,655 520	Local Plan 2006 to 2031 - adopted February 2016. *Note: It is assumed that the development rate of 177 dwellings per annum of the Local Plan is sustained to 2036, with the specified windfall rate of 40 dwellings per annum assumed from 2037 to 2050.*
Total	**-**	**-**	**3,609**	**72,682**	**Calculated based on the above**

G.2 New Non-Domestic Development

Table 6.28: Anticipated new non-domestic development (highlighted cells indicate information taken from the source document and used to calculate annual additional floorspace)

	Start	Finish	Additional floorspace per year (m2)	New employment land (hectares)	Source
Cannock Chase	2020	2036	7,813	25	Local Plan Review 2016 to 2036 - Issues and Options Consultation - May 2019.
East Staffordshire	2020	2031	18,182	40	Local Plan Document 2012 to 2031 - adopted October 2015. *Note: This includes 30 hectares identified in the Employment Land Review (2013) plus 10 hectares allocated for development in the 2006 Local Plan.*
Lichfield	2020	2040	13,477	70.3	Local Plan Review 2018 to 2040 - Preferred Options - November 2019. *Note: It is assumed that this figure includes an uptake of 6.5 hectares from Tamworth.*
Newcastle-under-Lyme	2020	2037	24,118	82	Draft Joint Local Plan - Part 1 - Strategies and Policies 2020.
South Staffordshire	2020	2037	110,588	376 (106 ha baseline; 270 ha Strategic Rail Freight Interchange)	Economic Development Needs Assessment (EDNA) - Part 1 - August 2018. *Note: This includes a designation of 270ha for the Strategic Rail Freight Interchange employment site.*
Stafford Borough	2020	2040	28,250	113	Assumes delivery of remaining commitments (including adopted Local Plan 2011- 2031 allocations) and employment land required to deliver Local Housing Need post-2031. *Note: This does not account for a garden community in Stafford Borough, see footnote number 58.*

	Start	Finish	Additional floorspace per year (m2)	New employment land (hectares)	Source
Staffordshire Moorlands	2020	2031	12,273	27	Local Plan Review - Submission Version - February 2018.
Tamworth	2020	2031	8,182	18	Local Plan 2006 to 2031 - adopted February 2016. *Note: It is understood that a minimum of 18 ha is to be met within the District boundary with the remaining need to be delivered by Lichfield and North Warwickshire.*
Total	**-**	**-**	**222,882**	**751**	**Calculated based on the above**

Appendix H – CO_2 Emissions Trajectories by Council

H.1 Cannock Chase

Figure 6-34 below shows the potential change in Scope 1 and 2 CO_2 emissions that could arise due to decarbonisation of the national electricity grid, as outlined in Section 3.1. Compared with 2017 levels, this would result in a 21% decrease in emissions through the year 2050.

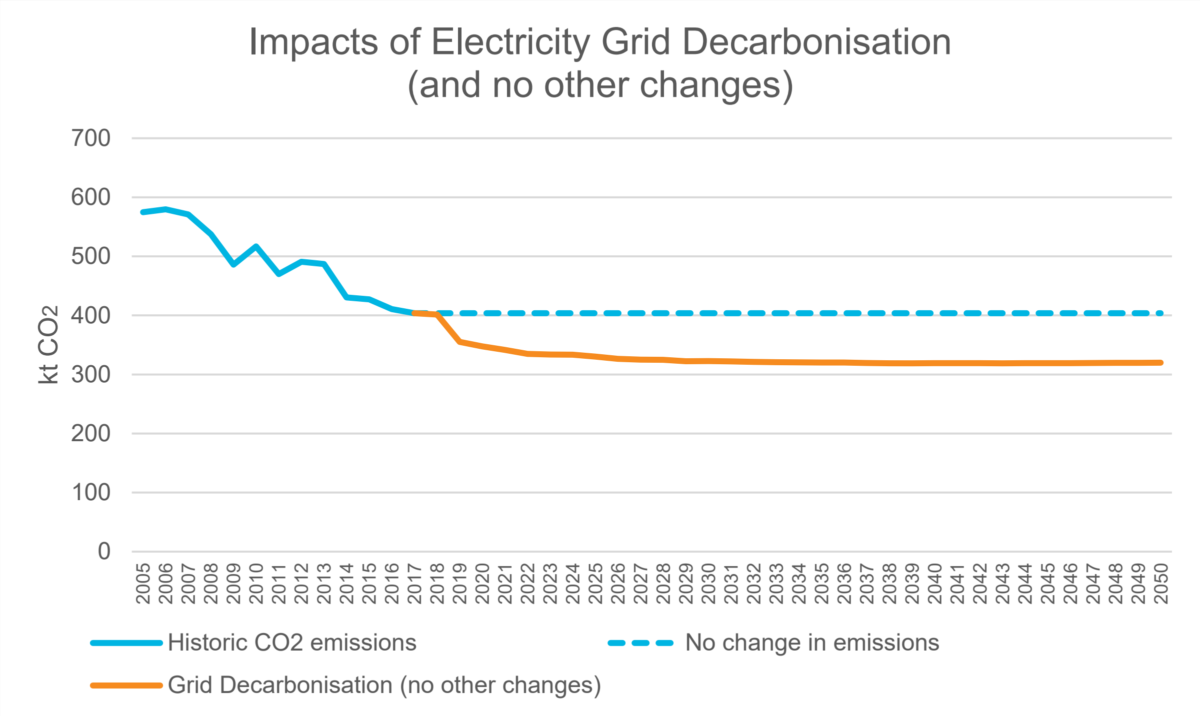

Figure 6-34: Change in Scope 1 & 2 CO_2 emissions due to Grid Decarbonisation – Cannock Chase

Figure 6-35 below shows the potential change that could arise due to the projected amount of new development in Cannock Chase. Compared with 2017 levels, this could result in up to a 6% increase in emissions, or up to a 17% decrease over the course of the Local Plan period, depending on grid decarbonisation.

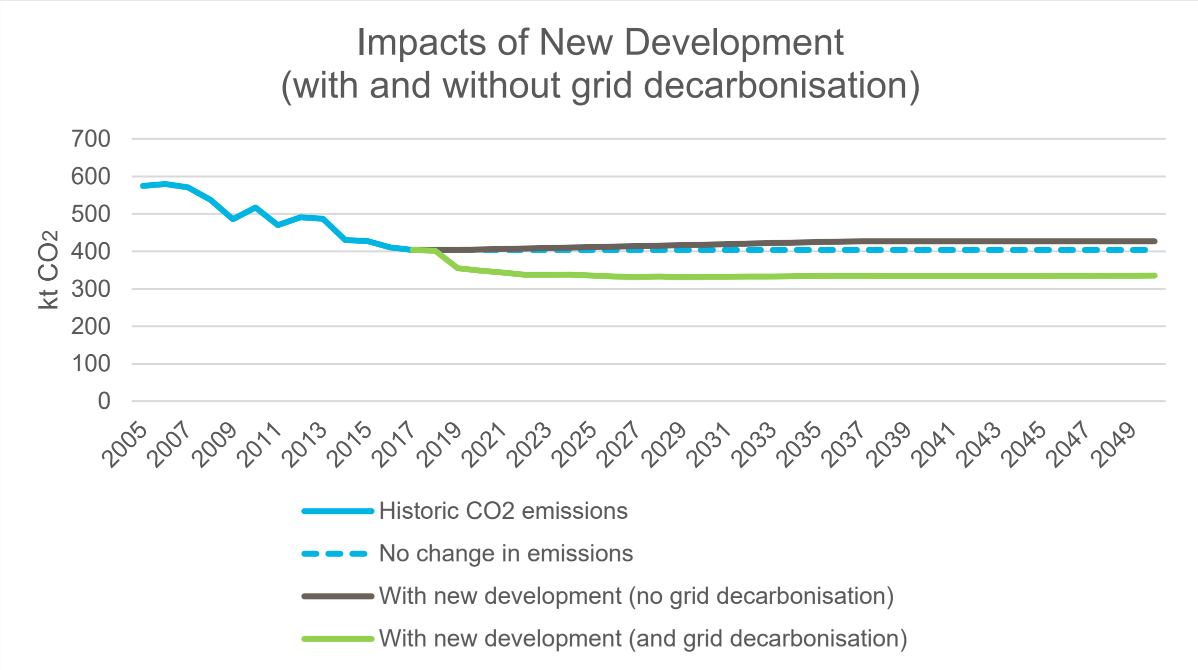

Figure 6-35: Change in Scope 1 & 2 CO_2 emissions due to New Development – Cannock Chase

Figure 6-36 below shows the potential impacts of switching from traditional fuel vehicles (i.e. those that use petrol and diesel products) to ULEVs. Due to the lower emissions from these vehicles, this shift could result in a decrease in emissions of around 19% to 49% depending on grid decarbonisation. [Note that the greater savings account for the impacts on electricity emissions in existing buildings.]

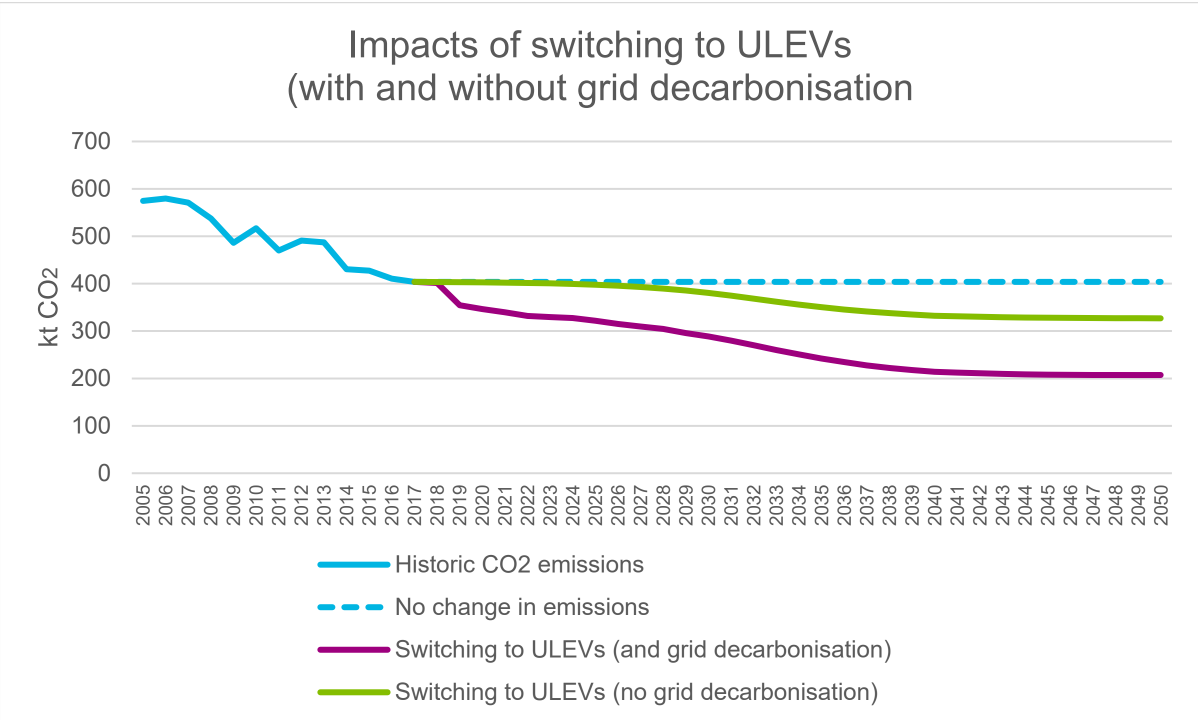

Figure 6-36: Change in Scope 1 & 2 CO_2 emissions due to Switching to ULEVs – Cannock Chase

The cumulative impact of these changes is shown in Figure 6-37 below. The shift away from traditional fuel vehicles serves to offset the slight increase in CO_2 emissions that results from fuel consumption in new development. Overall, compared with 2017 levels, these scenarios indicate that emissions could decrease by up to 45% by 2050 when considering new development, ULEV uptake and grid decarbonisation, although it should be noted that in reality, there are a wide variety of factors influencing total CO_2 emissions.

It is understood that Cannock Chase may be required to accommodate additional development from Birmingham and the Black Country. This development may amount to between 500 and 2,500 additional dwellings on top of local need. It is anticipated that these dwellings would be delivered following fulfilment of Cannock Chase's 5-year supply position housing requirements into the new Local Plan period from 2025 to 2037. An uptake of 2,500 additional dwellings per annum from Birmingham and the Black Country from 2025 to 2037 would be expected to have a minimal impact up upon emissions levels to 2050 retaining a decrease of around 45% compared to 2017 levels.

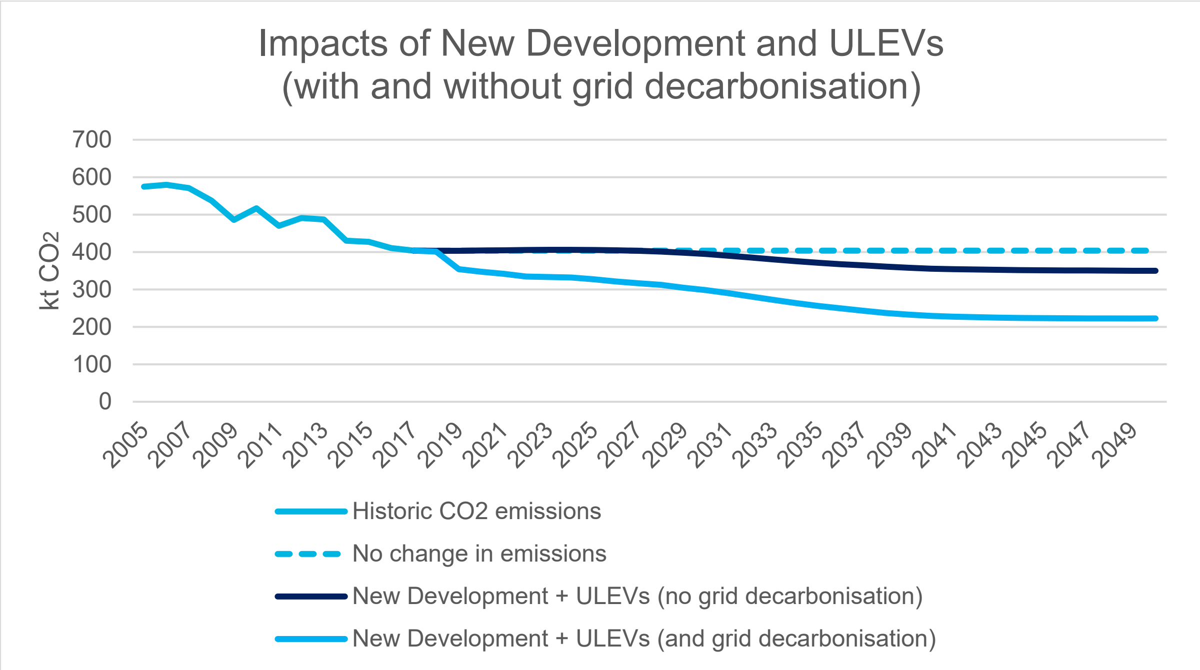

Figure 6-37: Change in Scope 1 & 2 CO_2 emissions due to All Assessed Interventions – Cannock Chase

H.3 East Staffordshire

Figure 6-38 below shows the potential change in Scope 1 and 2 CO_2 emissions that could arise due to decarbonisation of the national electricity grid, as outlined in Section 3.1. Compared with 2017 levels, this would result in a 22% decrease in emissions through the year 2050.

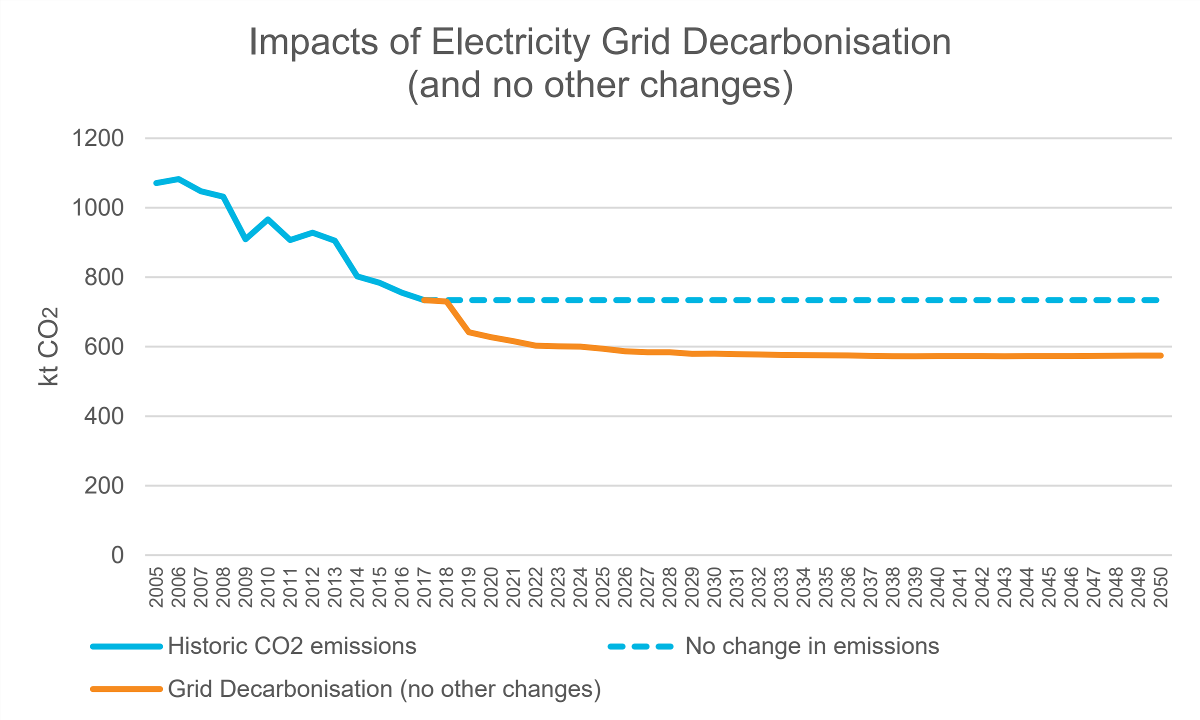

Figure 6-38: Change in Scope 1 & 2 CO_2 emissions due to Grid Decarbonisation – East Staffordshire

Figure 6-39 below shows the potential change that could arise due to the projected amount of new development in East Staffordshire. Compared with 2017 levels, this could result in up to a 5% increase in emissions, or up to a 18% decrease, depending on grid decarbonisation.

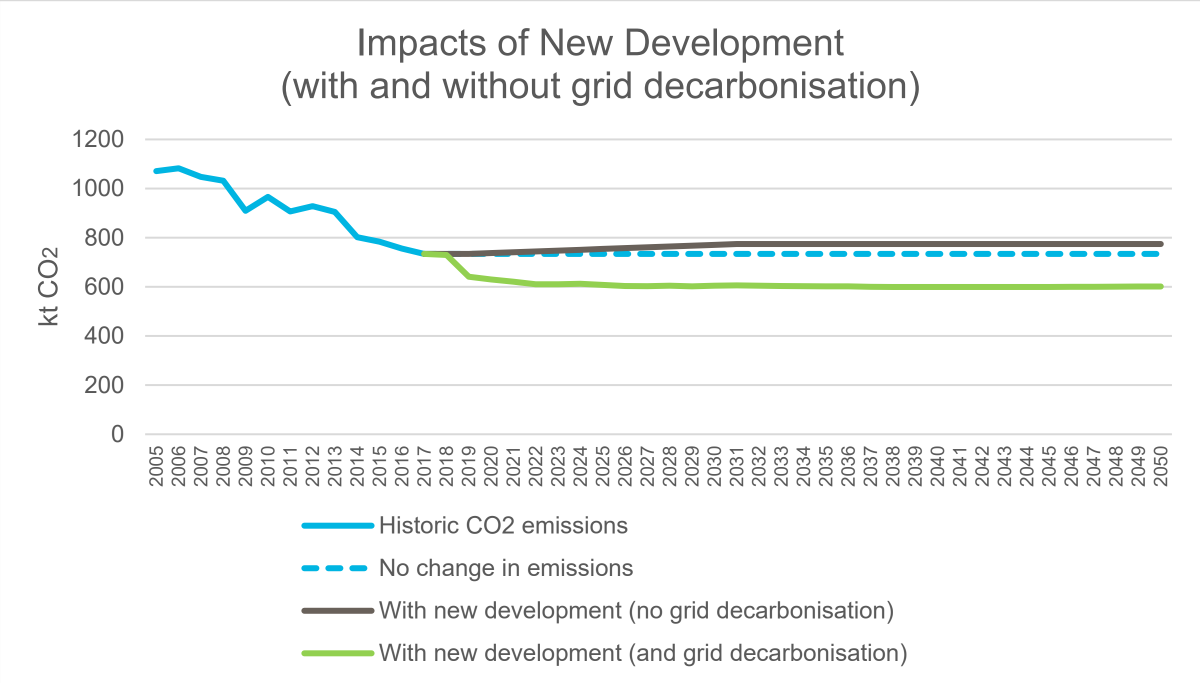

Figure 6-39: Change in Scope 1 & 2 CO_2 emissions due to New Development – East Staffordshire

Figure 6-40 below shows the potential impacts of switching from traditional fuel vehicles (i.e. those that use petrol and diesel products) to ULEVs. Due to the lower emissions from these vehicles, this shift could result in a decrease in emissions of around 23% to 56% depending on grid decarbonisation. [Note that the greater savings account for the impacts on electricity emissions in existing buildings.]

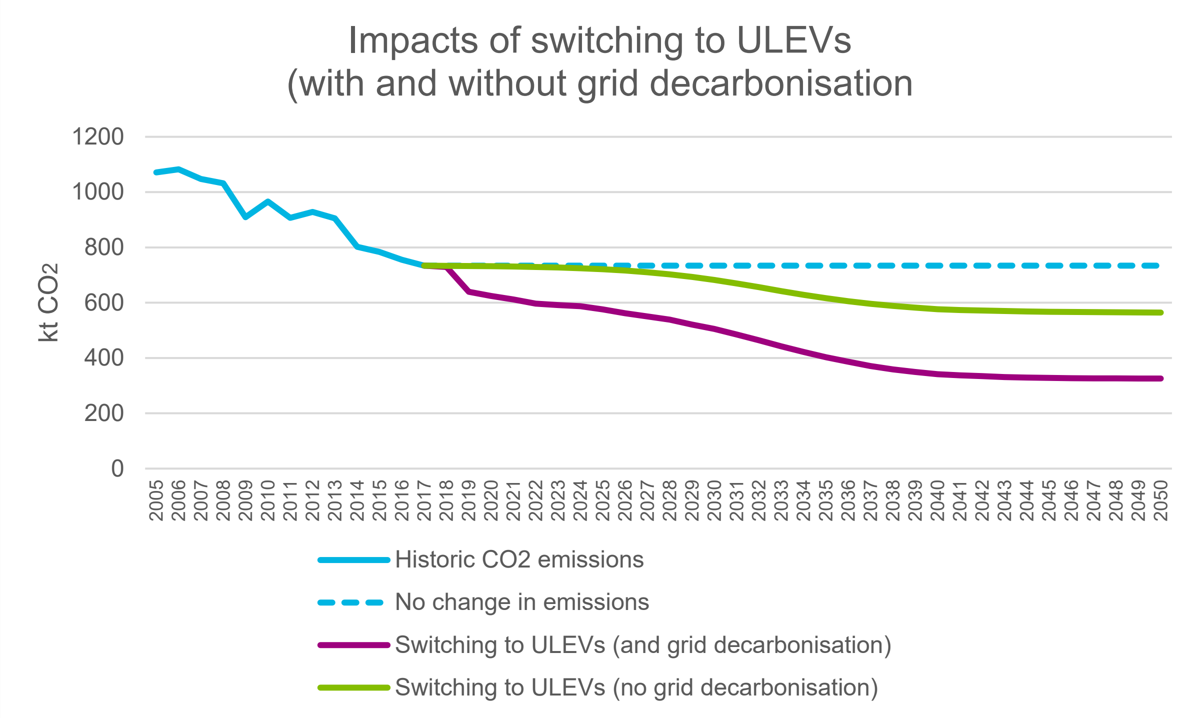

Figure 6-40: Change in Scope 1 & 2 CO_2 emissions due to Switching to ULEVs – East Staffordshire

The cumulative impact of these changes is shown in Figure 6-41 below. The shift away from traditional fuel vehicles serves to offset the slight increase in CO_2 emissions that results from fuel consumption in new development. Overall, compared with 2017 levels, these scenarios indicate that emissions could decrease by up to 52% by 2050 when considering new development, ULEV uptake and grid decarbonisation, although it should be noted that in reality, there are a wide variety of factors influencing total CO_2 emissions.

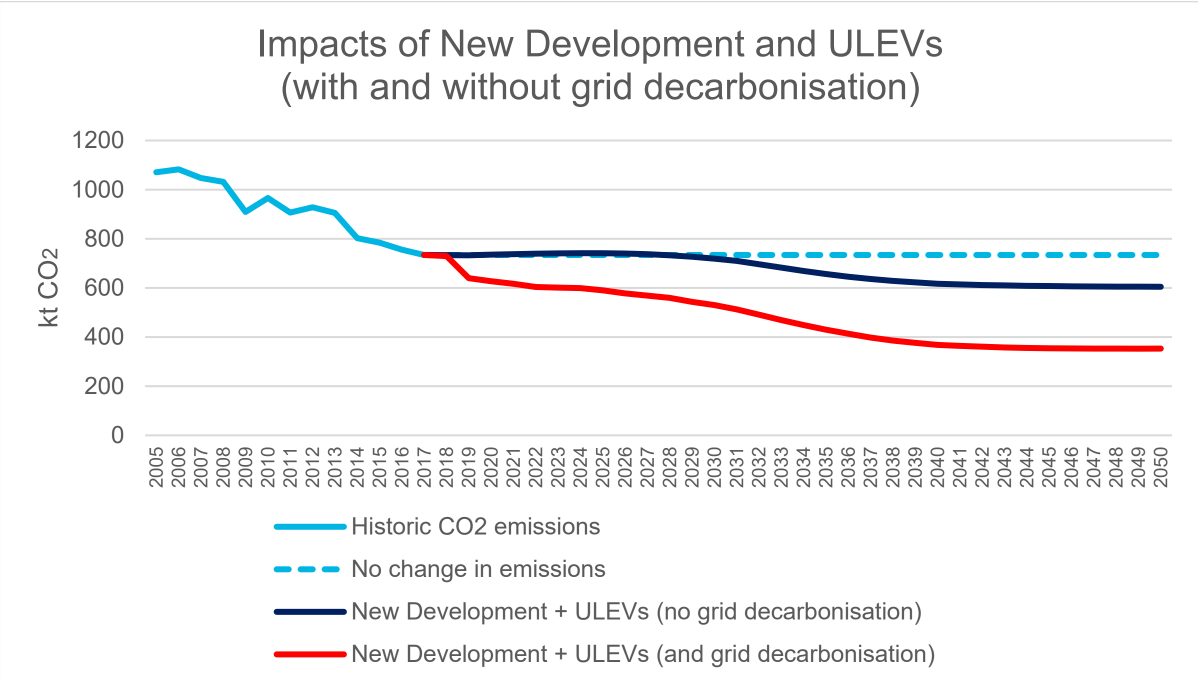

Figure 6-41: Change in Scope 1 & 2 CO_2 emissions due to All Assessed Interventions – East Staffordshire

H.5 Lichfield

Figure 6-42 below shows the potential change in Scope 1 and 2 CO_2 emissions that could arise due to decarbonisation of the national electricity grid, as outlined in Section 3.1. Compared with 2017 levels, this would result in a 15% decrease in emissions through the year 2050.

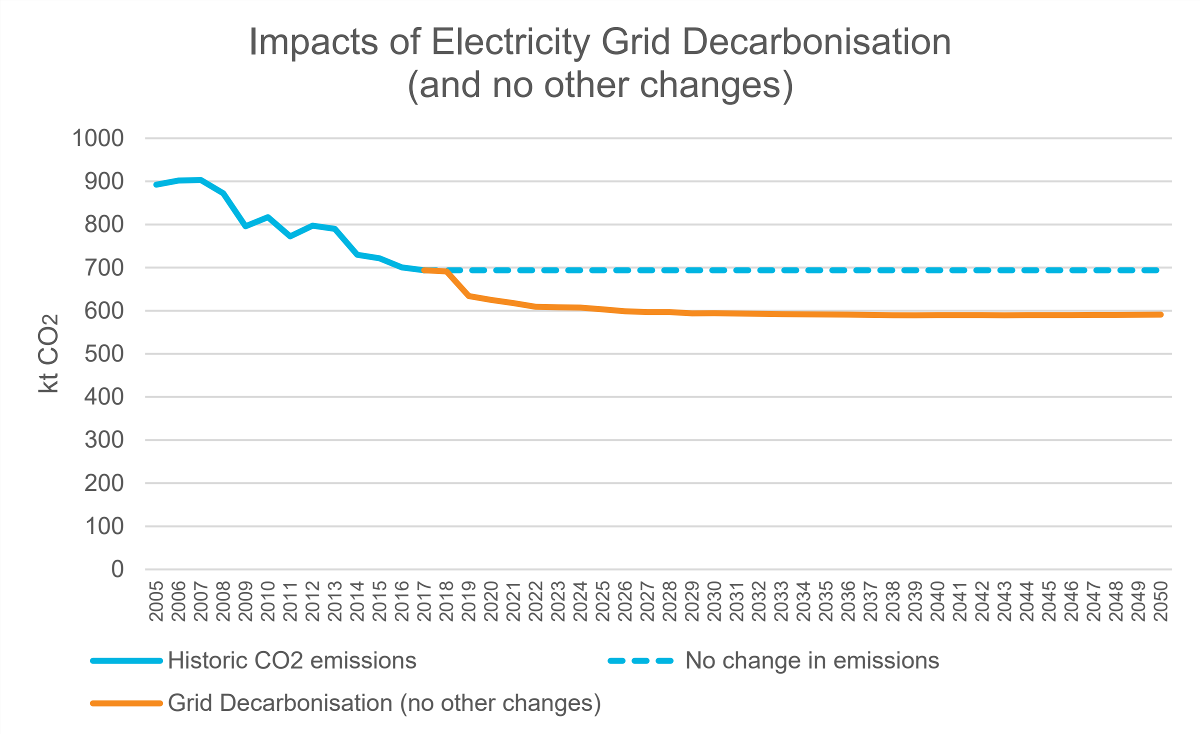

Figure 6-42: Change in Scope 1 & 2 CO_2 emissions due to grid decarbonisation – Lichfield

Figure 6-43 below shows the potential change that could arise due to the projected amount of new development in Lichfield. Compared with 2017 levels, this could result in up to a 7% increase in emissions, or up to a 10% decrease, depending on grid decarbonisation.

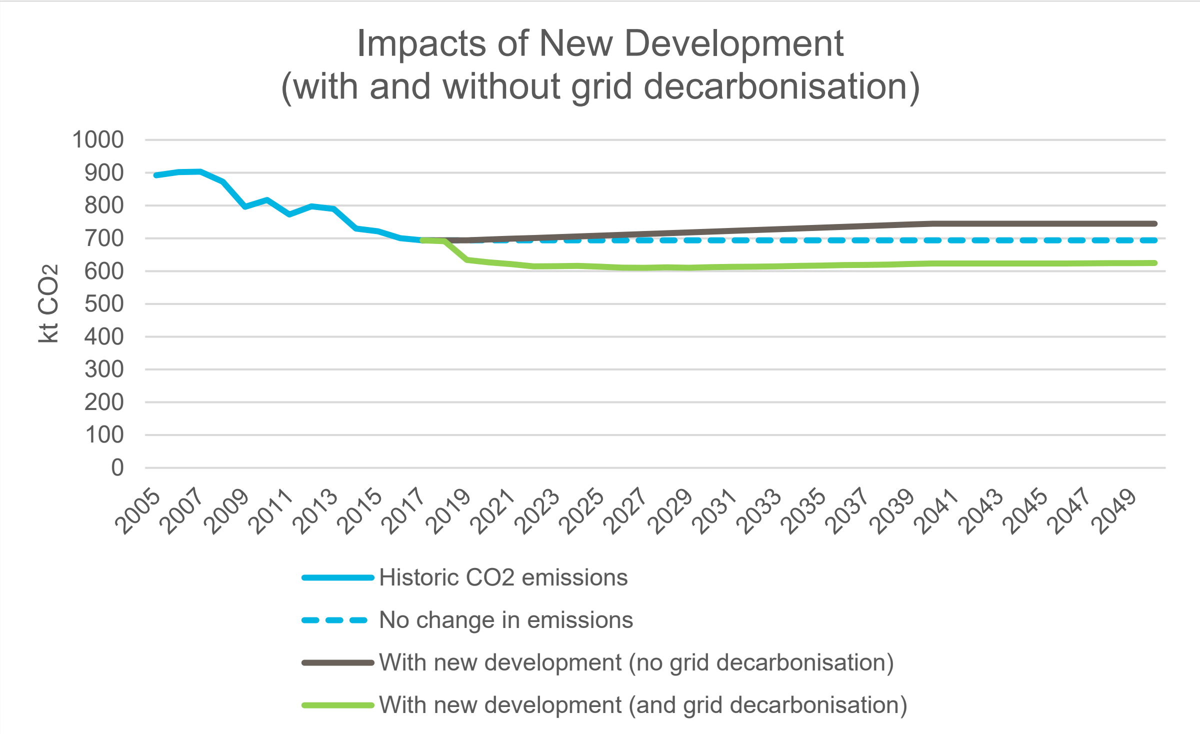

Figure 6-43: Change in Scope 1 & 2 CO_2 emissions due to new development – Lichfield

Figure 6-44 below shows the potential impacts of switching from traditional fuel vehicles (i.e. those that use petrol and diesel products) to ULEVs. Due to the lower emissions from these vehicles, this shift could result in a decrease in emissions of around 37% to 69% depending on grid decarbonisation. [Note that the greater savings account for the impacts on electricity emissions in existing buildings.]

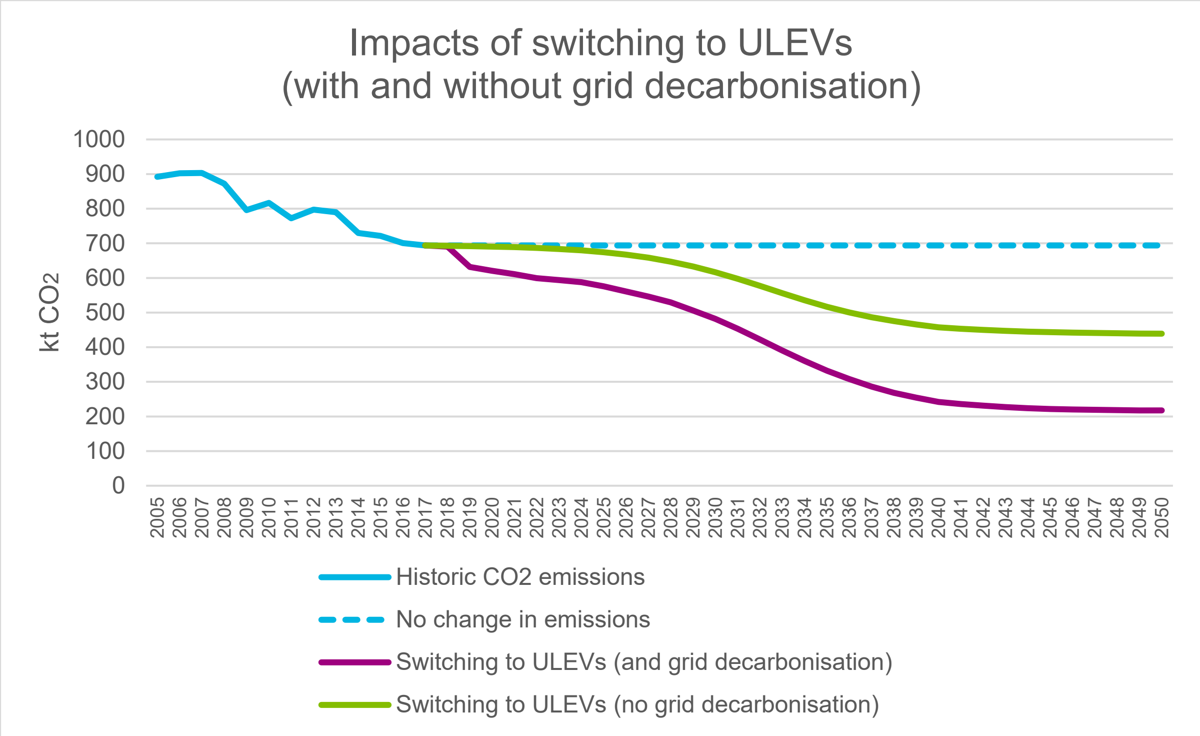

Figure 6-44: Change in Scope 1 & 2 CO_2 emissions due to switching to ULEVs – Lichfield

The cumulative impact of these changes is shown in Figure 6-45 below. The shift away from traditional fuel vehicles serves to offset the slight increase in CO_2 emissions that results from fuel consumption in new development. Overall, compared with 2017 levels, these scenarios indicate that emissions could decrease by up to 64% by 2050 when considering new development, ULEV uptake and grid decarbonisation, although it should be noted that in reality, there are a wide variety of factors influencing total CO_2 emissions.

It is understood that Lichfield will assist in delivering shortfall of new development need for Tamworth. It is assumed that stated non-domestic development figures (see Section G.2) are inclusive of agreement for an uptake of 6.5 ha new employment land. It is anticipated that the delivery of 73 dwellings per annum surplus from Tamworth, will be met between Lichfield and North Warwickshire. It is acknowledged that in the period of delivery to 2036 the split in this development between the two Local Authorities is likely to vary. However, uptake of the additional 73 dwellings per annum from Tamworth would be expected to limit the reduction in emissions levels in 2050 to around 63% compared to 2017 levels.

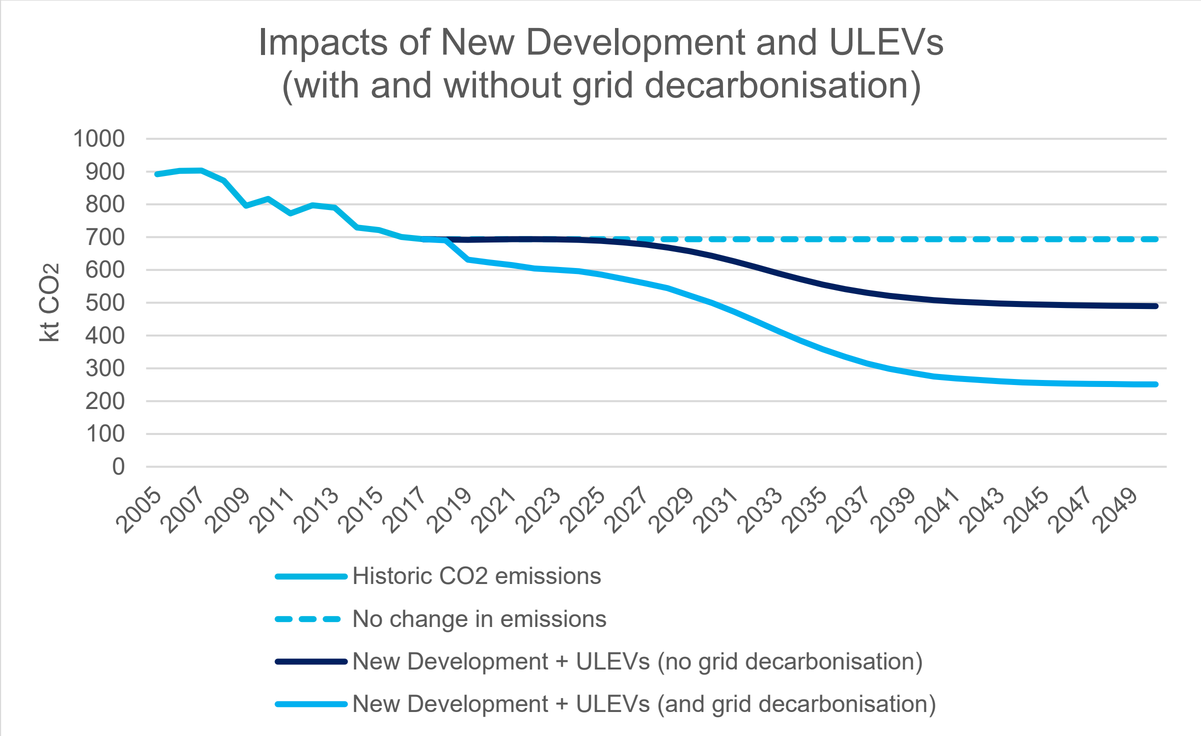

Figure 6-45: Change in Scope 1 & 2 CO_2 emissions due to all assessed interventions – Lichfield

H.7 Newcastle-under-Lyme

Figure 6-46 below shows the potential change in Scope 1 and 2 CO_2 emissions that could arise due to decarbonisation of the national electricity grid, as outlined in Section 3.1. Compared with 2017 levels, this would result in a 14% decrease in emissions through the year 2050.

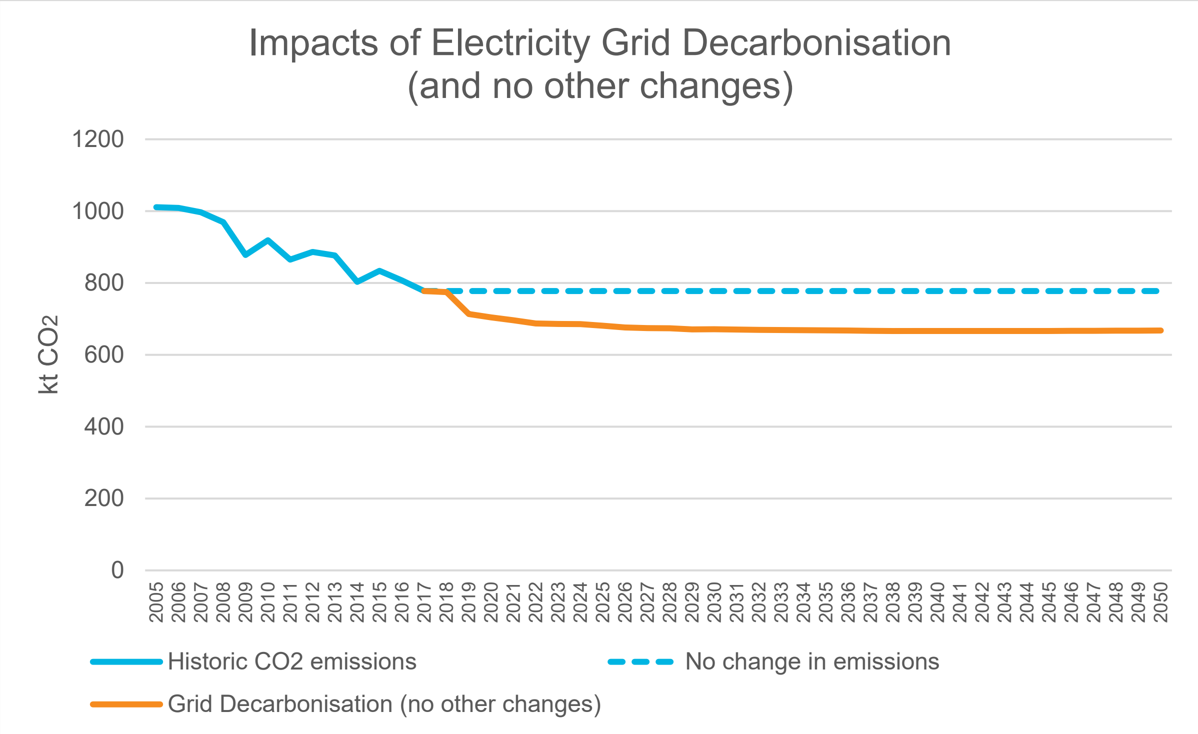

Figure 6-46: Change in Scope 1 & 2 CO_2 emissions due to grid decarbonisation – Newcastle-Under-Lyme

Figure 6-47 below shows the potential change that could arise due to the projected amount of new development in Newcastle-under-Lyme. Compared with 2017 levels, this could result in up to an 7% increase in emissions, or up to a 10% decrease, depending on grid decarbonisation

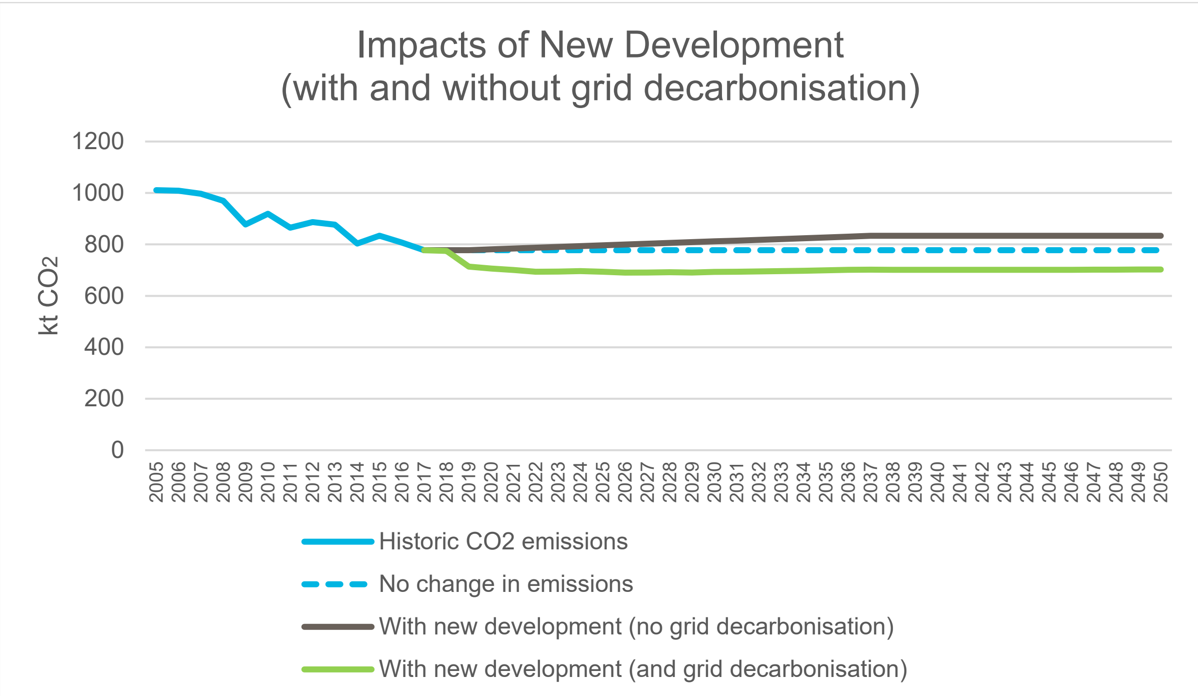

Figure 6-47: Change in Scope 1 & 2 CO_2 emissions due to new development – Newcastle-Under-Lyme

Figure 6-48 below shows the potential impacts of switching from traditional fuel vehicles (i.e. those that use petrol and diesel products) to ULEVs. Due to the lower emissions from these vehicles, this shift could result in a decrease in emissions of around 32% - 61% depending on grid decarbonisation. [Note that the greater savings account for the impacts on electricity emissions in existing buildings.]

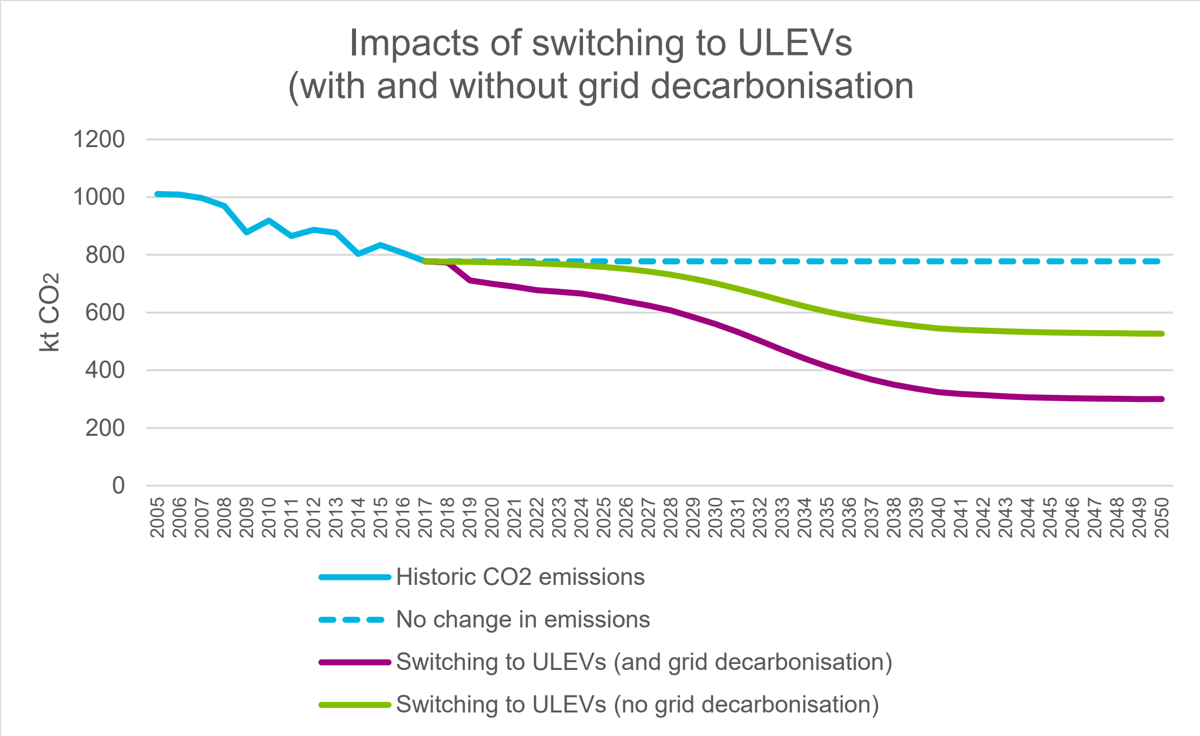

Figure 6-48: Change in Scope 1 & 2 CO_2 emissions due to switching to ULEVs – Newcastle-Under-Lyme

The cumulative impact of these changes is shown in Figure 6-49 below. The shift away from traditional fuel vehicles serves to offset the slight increase in CO_2 emissions that results from fuel consumption in new development. Overall, compared with 2017 levels, these scenarios indicate that emissions could decrease by up to 57% by 2050 when considering new development, ULEV uptake and grid decarbonisation, although it should be noted that in reality, there are a wide variety of factors influencing total CO_2 emissions.

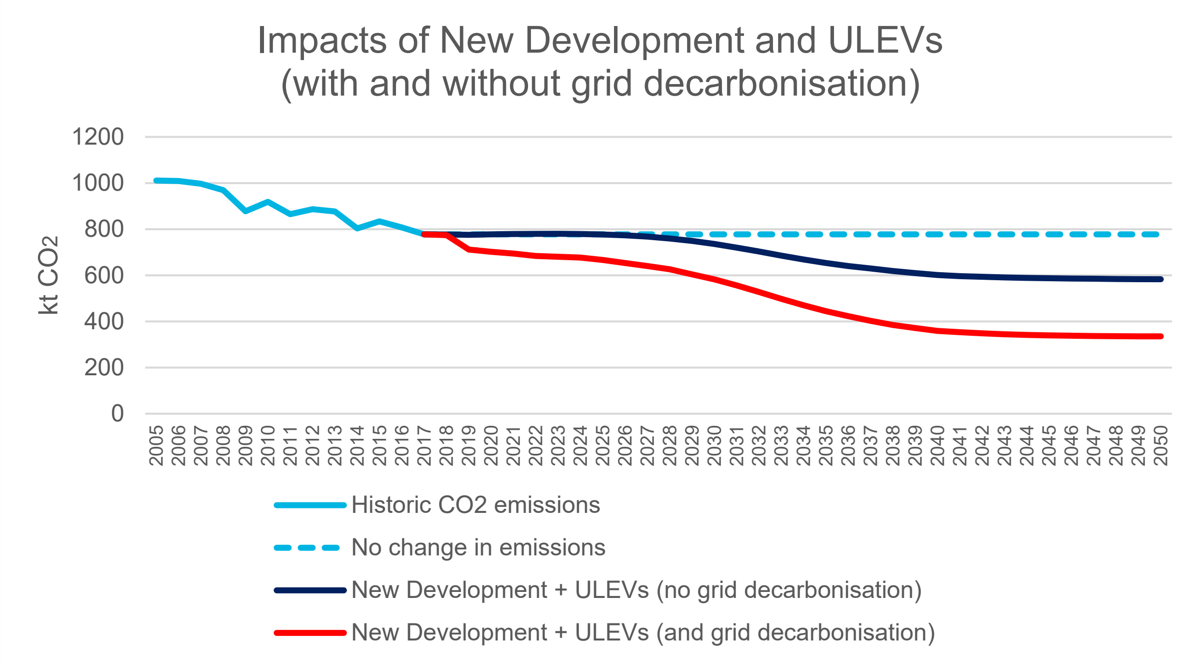

Figure 6-49: Change in Scope 1 & 2 CO_2 emissions due to all assessed interventions – Newcastle-Under-Lyme

H.9 South Staffordshire

Figure 6-50 below shows the potential change in Scope 1 and 2 CO_2 emissions that could arise due to decarbonisation of the national electricity grid, as outlined in Section 3.1. Compared with 2017 levels, this would result in a 12% decrease in emissions through the year 2050.

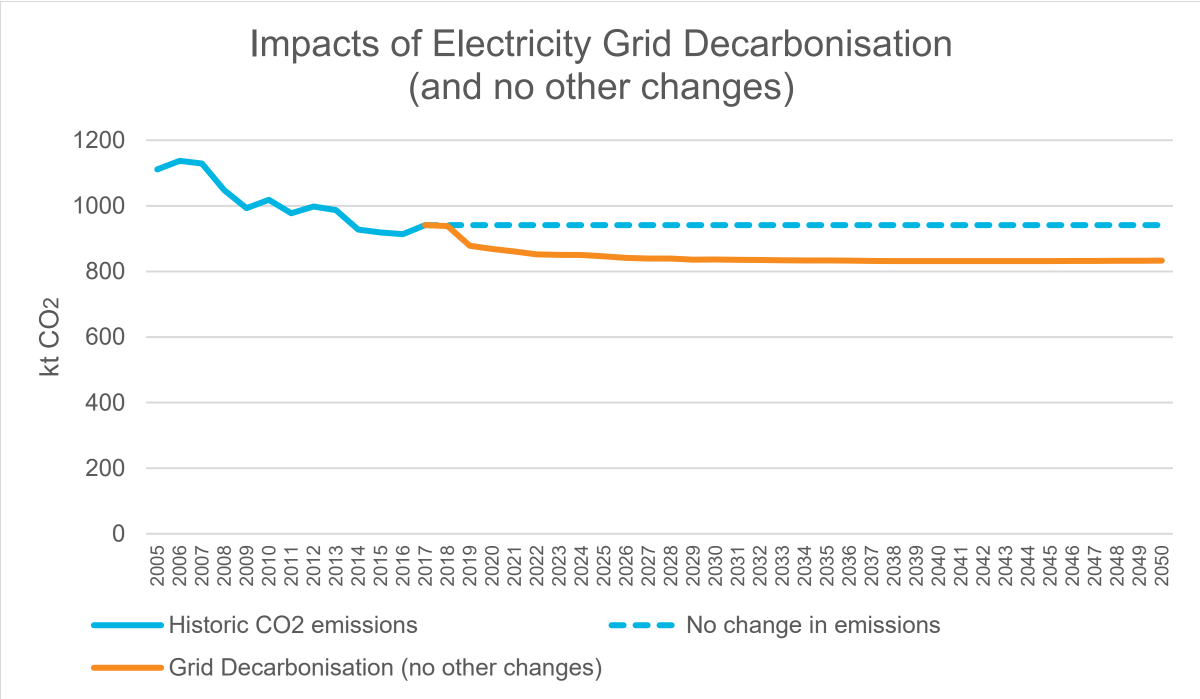

Figure 6-50: Change in Scope 1 & 2 CO_2 emissions due to grid decarbonisation – South Staffordshire

Figure 6-51 below shows the potential change that could arise due to the projected amount of new development in South Staffordshire. Compared with 2017 levels, this could result in up to a 14% increase in CO_2 emissions, or up to a 5% decrease, depending on grid decarbonisation. Should the Strategic Rail Freight Interchange employment site not be delivered, a lesser impact upon carbon emissions would be expected of up to 6%, whilst a decrease of up to 8% in CO_2 emissions may result, depending upon grid decarbonisation, when observing baseline growth only.

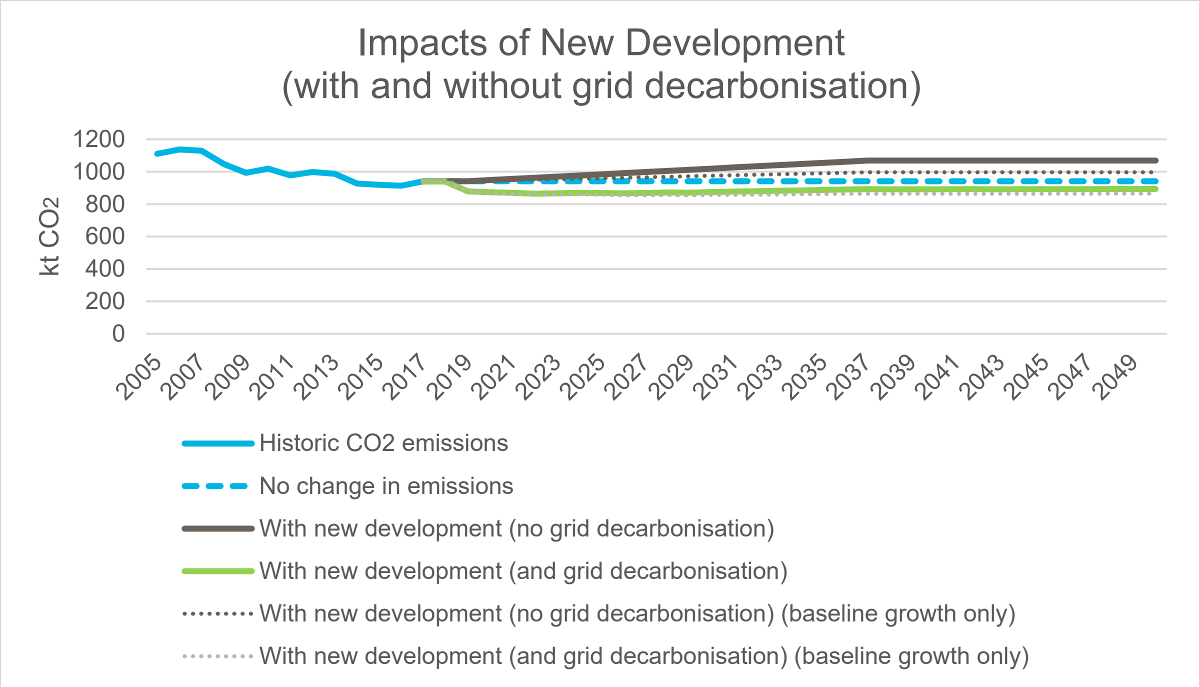

Figure 6-51: Change in Scope 1 & 2 CO_2 emissions due to new development – South Staffordshire

Figure 6-52 below shows the potential impacts of switching from traditional fuel vehicles (i.e. those that use petrol and diesel products) to ULEVs. Due to the lower emissions from these vehicles, this shift could result in a decrease in emissions of around 38% to 68% depending on grid decarbonisation. [Note that the greater savings account for the impacts on electricity emissions in existing buildings.]

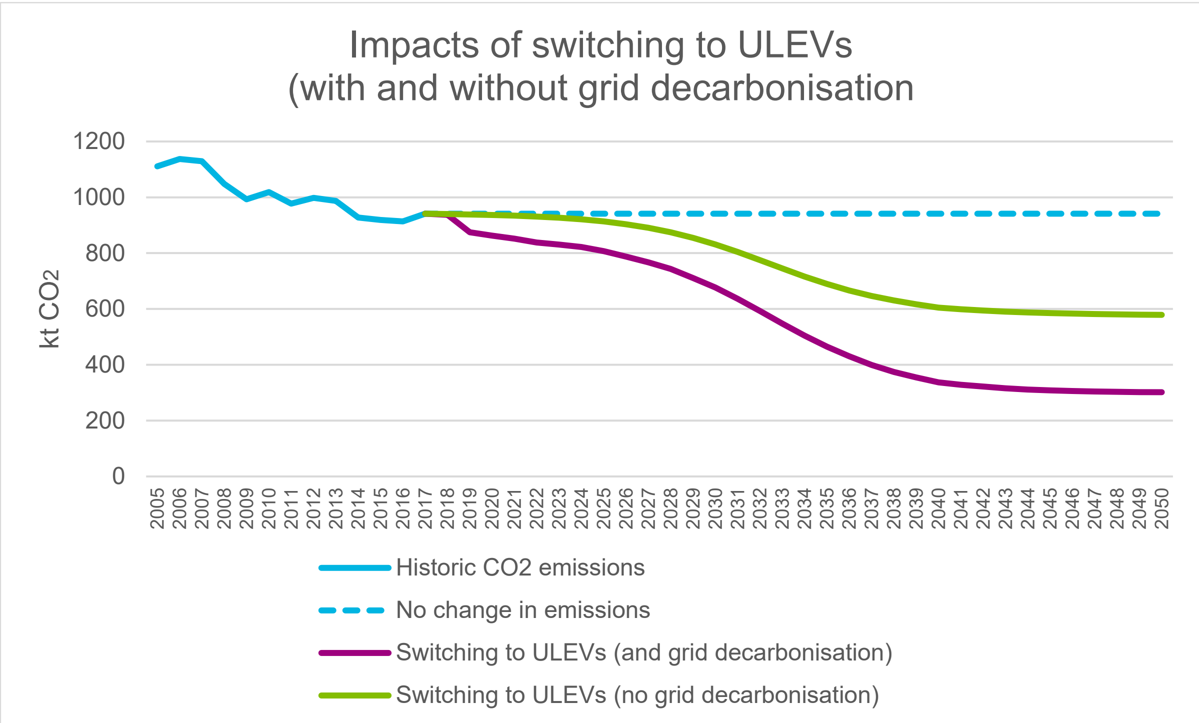

Figure 6-52: Change in Scope 1 & 2 CO_2 emissions due to switching to ULEVs – South Staffordshire

The cumulative impact of these changes is shown in Figure 6-53 below. The shift away from traditional fuel vehicles serves to offset the slight increase in CO_2 emissions that results from fuel consumption in new development. Overall, compared with 2017 levels, these scenarios indicate that emissions could decrease by up to 61% by 2050 when considering new development, ULEV uptake and grid decarbonisation, although it should be noted that in reality, there are a wide variety of factors influencing total CO_2 emissions.

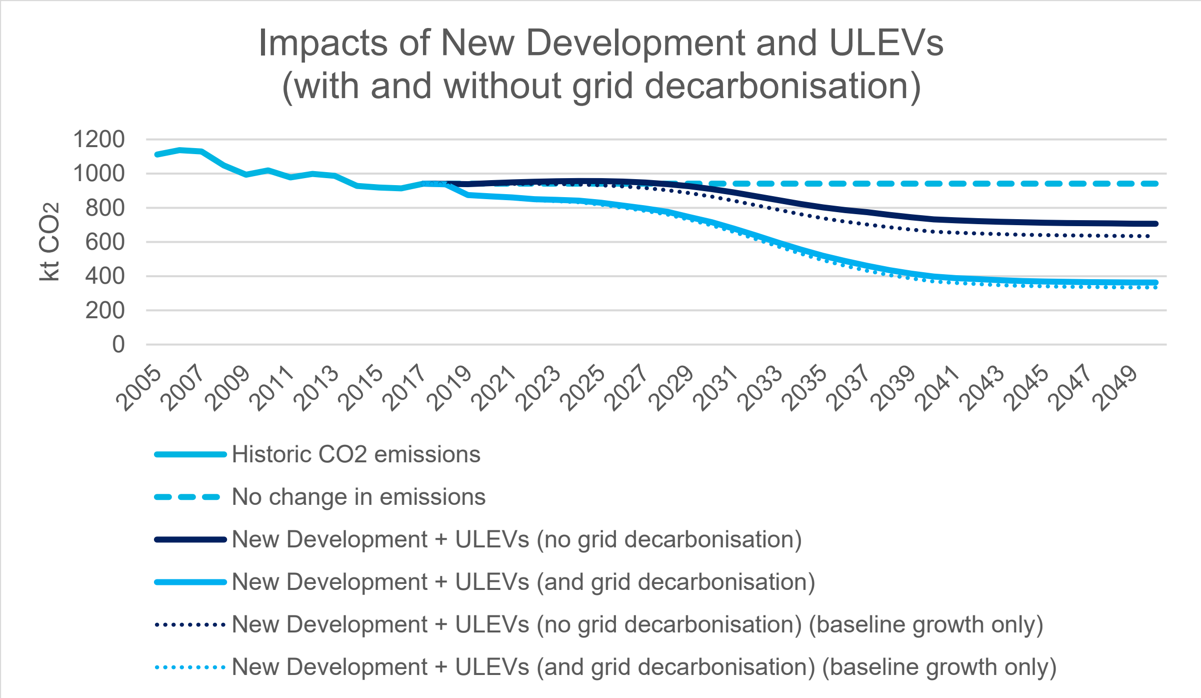

Figure 6-53: Change in Scope 1 & 2 CO_2 emissions due to all assessed interventions – South Staffordshire

H.11 Stafford

Figure 6-54 below shows the potential change in Scope 1 and 2 CO_2 emissions that could arise due to decarbonisation of the national electricity grid, as outlined in Section 3.1. Compared with 2017 levels, this would result in a 13% decrease in emissions through the year 2050.

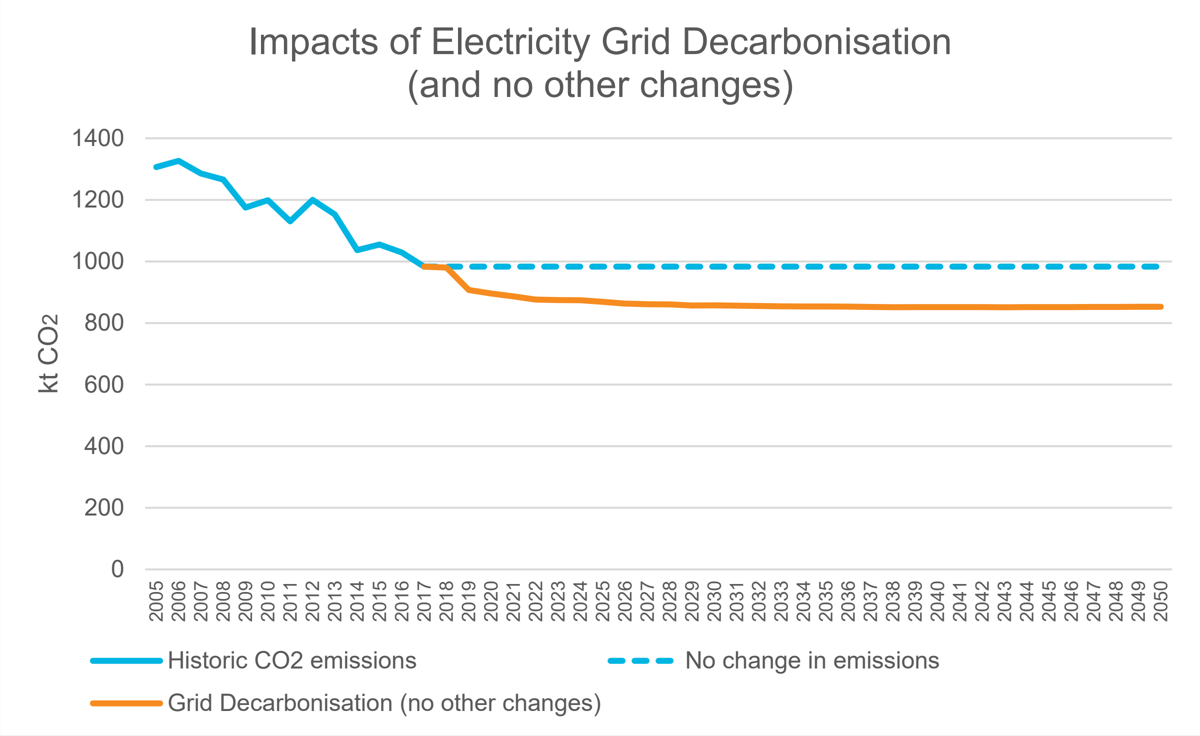

Figure 6-54: Change in Scope 1 & 2 CO_2 emissions due to grid decarbonisation – Stafford

Figure 6-55 below shows the potential change that could arise due to the projected amount of new development in Stafford[58]. Compared with 2017 levels, this could result in up to a 6% increase, or up to an 9% decrease, depending on grid decarbonisation

[58] This study does not account for a garden community in Stafford Borough. The figures detailed are based on a baseline level of development post 2031, calculated using the standard government methodology to calculate Local Housing Need. The implications of climate change from a garden community, should one be brought forward, will be subject to a separate study.

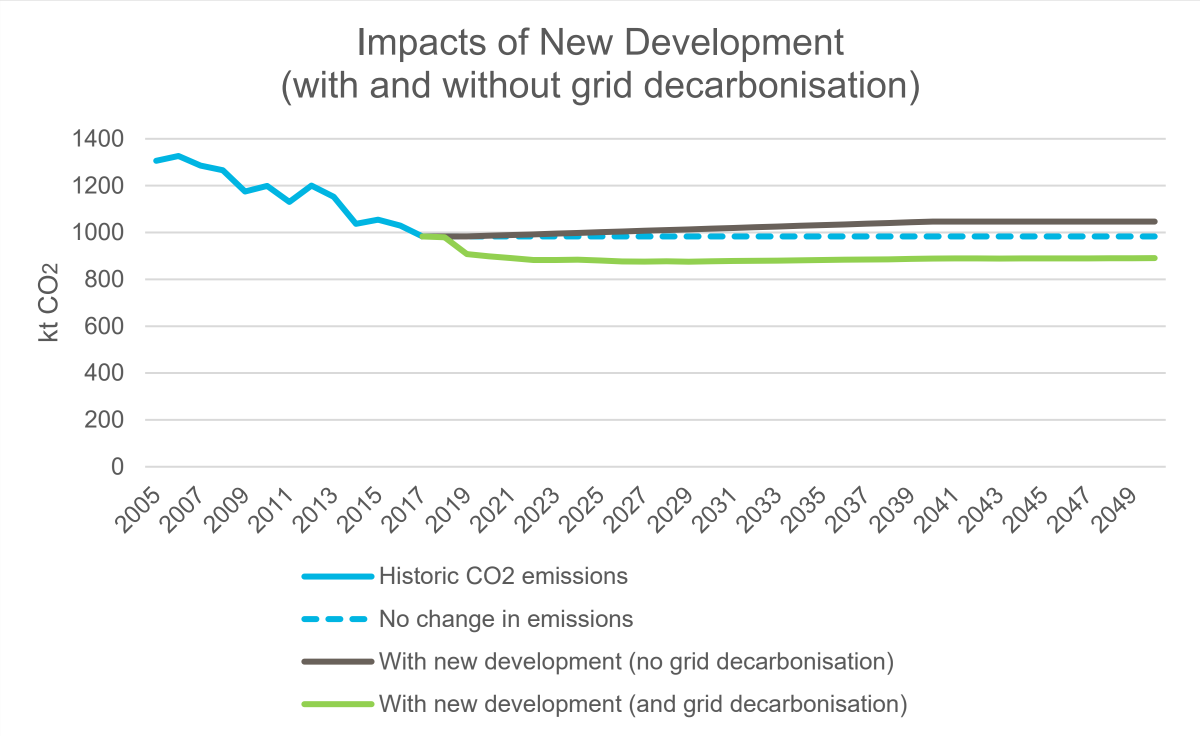

Figure 6-55: Change in Scope 1 & 2 CO_2 emissions due to new development – Stafford

Figure 6-56 below shows the potential impacts of switching from traditional fuel vehicles (i.e. those that use petrol and diesel products) to ULEVs. Due to the lower emissions from these vehicles, this shift could result in a decrease in emissions of around 39% to 71% depending on grid decarbonisation. [Note that the greater savings account for the impacts on electricity emissions in existing buildings.]

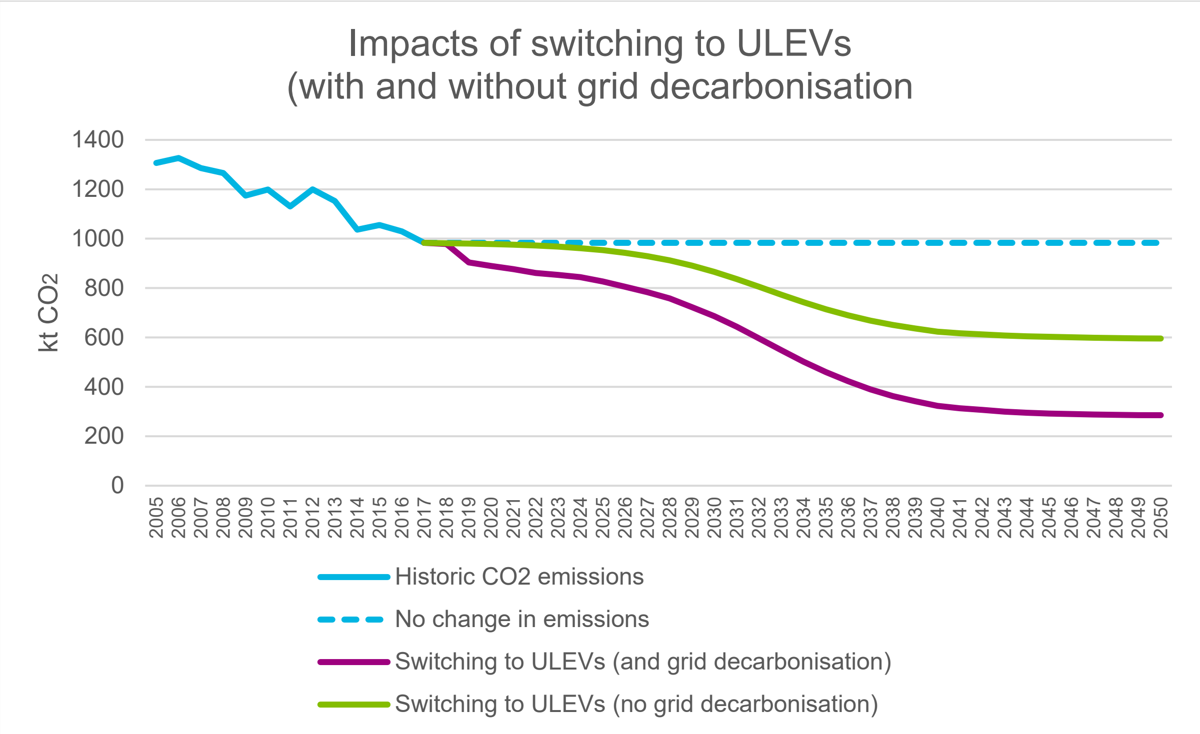

Figure 6-56: Change in Scope 1 & 2 CO_2 emissions due to switching to ULEVs – Stafford

The cumulative impact of these changes is shown in Figure 6-57 below. The shift away from traditional fuel vehicles serves to offset the slight increase in CO_2 emissions that results from fuel consumption in new development. Overall, compared with 2017 levels, these scenarios indicate that emissions could decrease by up to 67% by 2050 when considering new development, ULEV uptake and grid decarbonisation, although it should be noted that in reality, there are a wide variety of factors influencing total CO_2 emissions.

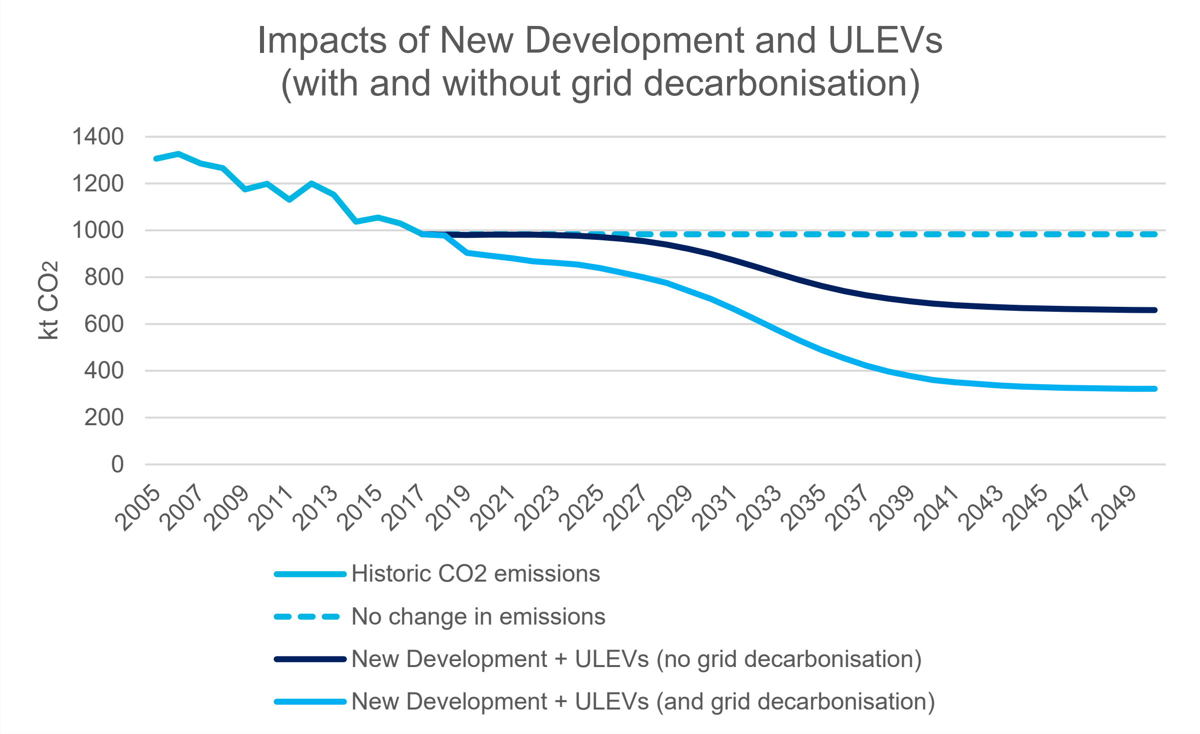

Figure 6-57: Change in Scope 1 & 2 CO_2 emissions due to all assessed interventions – Stafford

H.13 Staffordshire Moorlands

Figure 6-58 below shows the potential change in Scope 1 and 2 CO_2 emissions that could arise due to decarbonisation of the national electricity grid, as outlined in Section 3.1. Compared with 2017 levels, this would result in a 10% decrease in emissions through the year 2050.

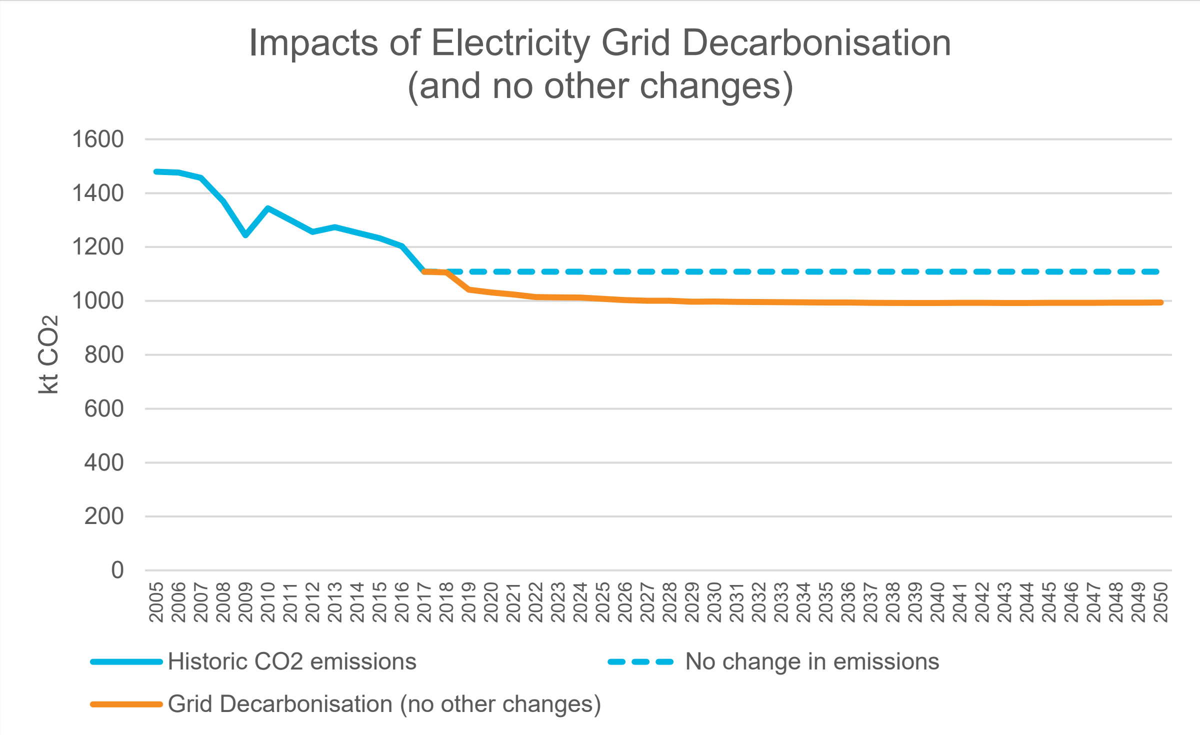

Figure 6-58: Change in Scope 1 & 2 CO_2 emissions due to grid decarbonisation – Staffordshire Moorlands

Figure 6-59 below shows the potential change that could arise due to the projected amount of new development in Staffordshire Moorlands. Compared with 2017 levels, this could result in up to a 2% increase, or up to a 9% decrease, depending on grid decarbonisation.

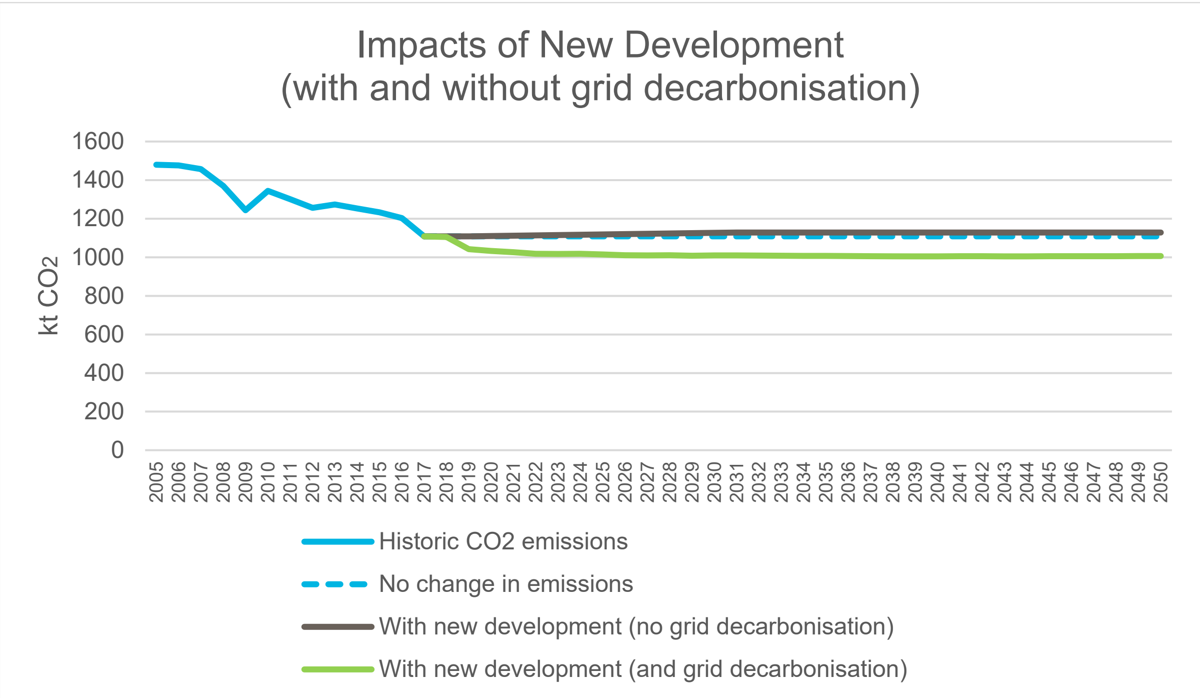

Figure 6-59: Change in Scope 1 & 2 CO_2 emissions due to new development – Staffordshire Moorlands

Figure 6-60 below shows the potential impacts of switching from traditional fuel vehicles (i.e. those that use petrol and diesel products) to ULEVs. Due to the lower emissions from these vehicles, this shift could result in a decrease in emissions of around 10%-26% depending on grid decarbonisation. [Note that the greater savings account for the impacts on electricity emissions in existing buildings.]

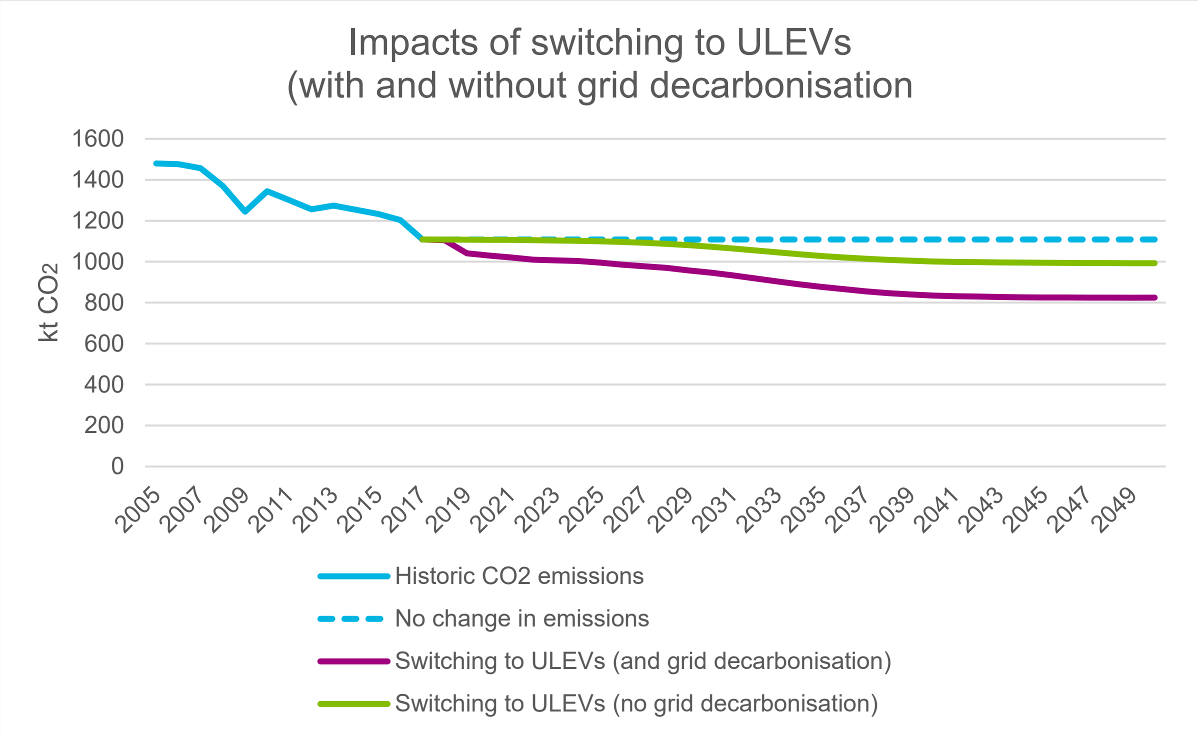

Figure 6-60: Change in Scope 1 & 2 CO_2 emissions due to switching to ULEVs – Staffordshire Moorlands

The cumulative impact of these changes is shown in Figure 6-61 below. The shift away from traditional fuel vehicles serves to offset the slight increase in CO_2 emissions that results from fuel consumption in new development. Overall, compared with 2017 levels, these scenarios indicate that emissions could decrease by up to 25% by 2050 when considering new development, ULEV uptake and grid decarbonisation, although it should be noted that in reality, there are a wide variety of factors influencing total CO_2 emissions.

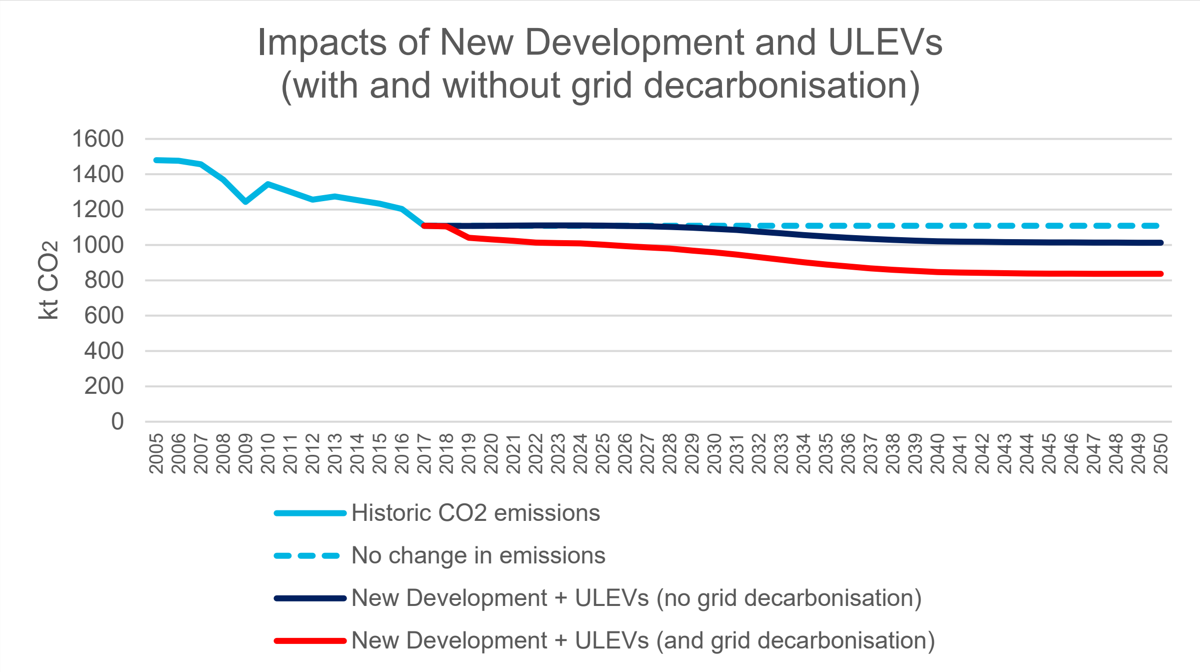

Figure 6-61: Change in Scope 1 & 2 CO_2 emissions due to all assessed interventions – Staffordshire Moorlands

H.15 Tamworth

Figure 6-62 below shows the potential change in Scope 1 and 2 CO_2 emissions that could arise due to decarbonisation of the national electricity grid, as outlined in Section 3.1. Compared with 2017 levels, this would result in a 26% decrease in emissions through the year 2050.

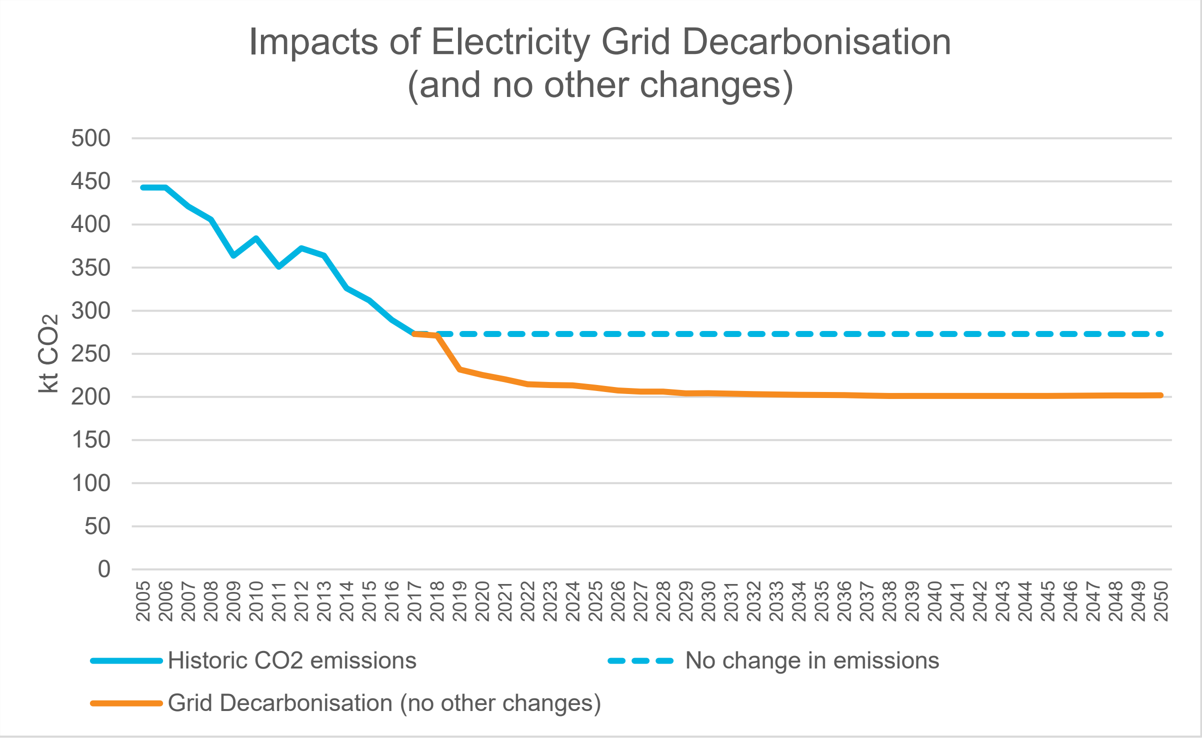

Figure 6-62: Change in Scope 1 & 2 CO_2 emissions due to grid decarbonisation – Tamworth

Figure 6-63 below shows the potential change that could arise due to the projected amount of new development in Tamworth. Compared with 2017 levels, this would result in up to a 6% increase, or up to a 22% decrease, depending on grid decarbonisation. [Note that the greater savings account for the impacts on electricity emissions in existing buildings.]

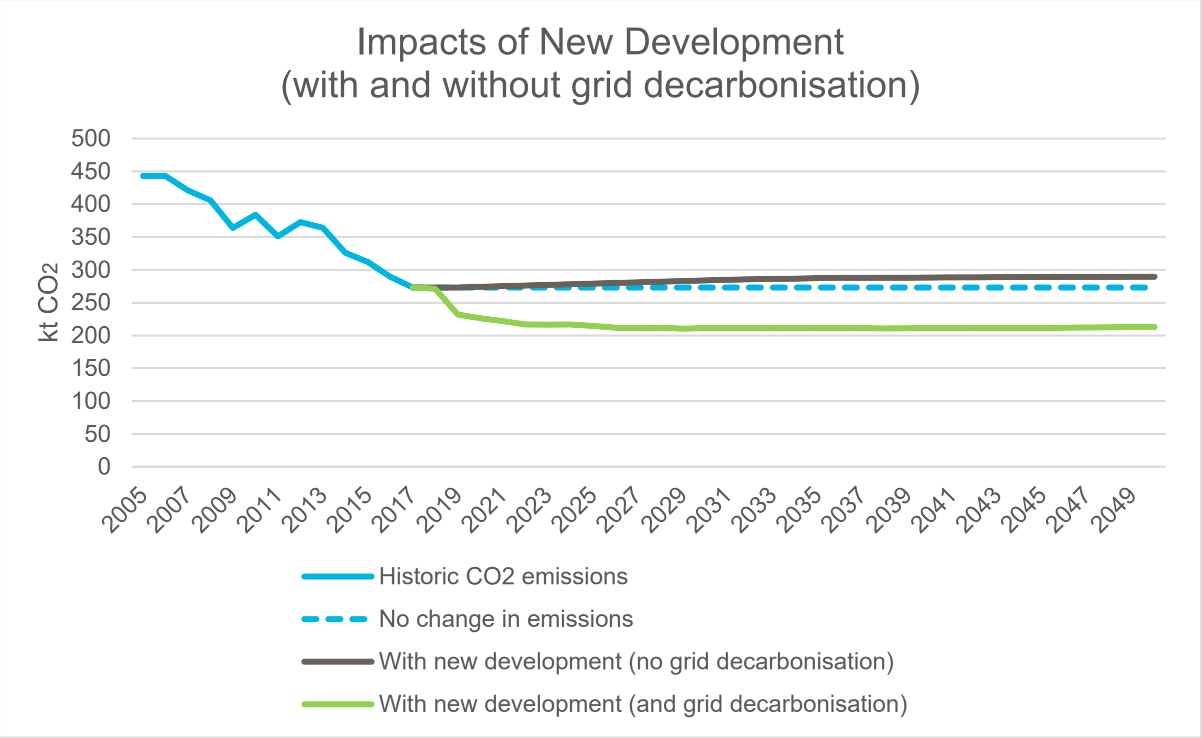

Figure 6-63: Change in Scope 1 & 2 CO_2 emissions due to new development – Tamworth

Figure 6-64 below shows the potential impacts of switching from traditional fuel vehicles (i.e. those that use petrol and diesel products) to ULEVs. Due to the lower emissions from these vehicles, this shift could result in a decrease in emissions of around 19% - 54% depending on grid decarbonisation. [Note that the greater savings account for the impacts on electricity emissions in existing buildings.]

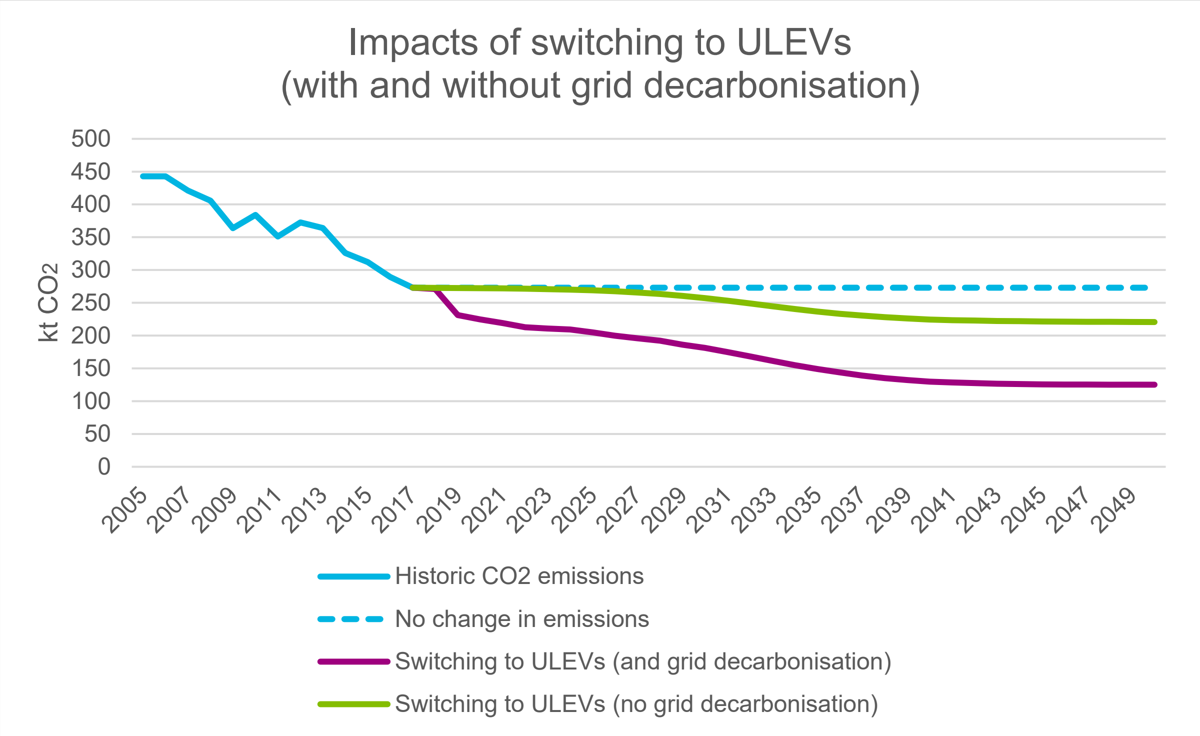

Figure 6-64: Change in Scope 1 & 2 CO_2 emissions due to switching to ULEVs – Tamworth

The cumulative impact of these changes is shown in Figure 6-65 below. The shift away from traditional fuel vehicles serves to offset the slight increase in CO_2 emissions that results from fuel consumption in new development. Overall, compared with 2017 levels, these scenarios indicate that emissions could decrease by up to 50% by 2050 when considering new development, ULEV uptake and grid decarbonisation, although it should be noted that in reality, there are a wide variety of factors influencing total CO_2 emissions.

It is understood that neighbouring Local Authorities will deliver new development shortfall from Tamworth, with a minimum of 177 dwellings per annum and 18 ha new employment land to be met within the Borough's boundary and represented in this study. Should the full development requirement for Tamworth be delivered within the Borough, an additional 73 dwellings per annum to 2036 and up to 32 ha new employment land across the Local Plan period to 2031, additional emissions would limit observable reduction to around 48% in 2050 compared with 2017 emissions levels.

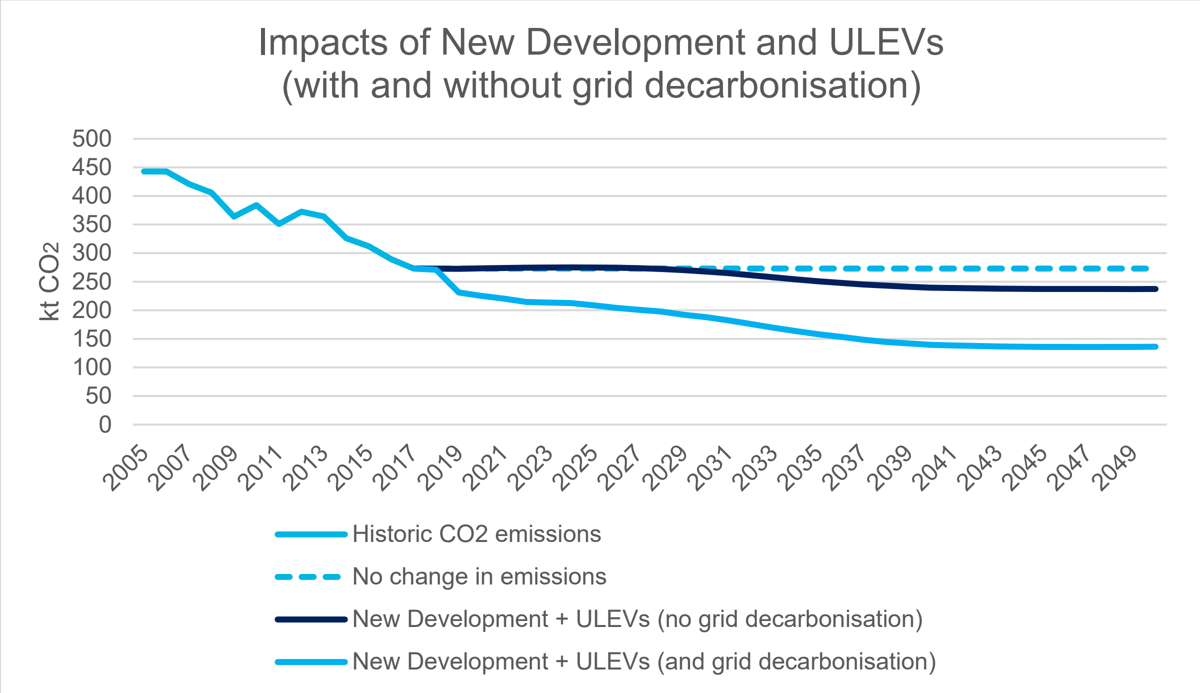

Figure 6-65: Change in Scope 1 & 2 CO_2 emissions due to all assessed interventions – Tamworth

Appendix I – Sources of Information About LZC Technologies

A desk review has been carried out to investigate the number and the capacity of the existing LZC installations in Staffordshire. In addition to the BEIS dataset, *'Renewable energy technologies by local authority'* (2019), this review examined the following sources of information:

Renewable Heat Incentive (RHI) data: The Renewable Heat Incentive scheme is a government environmental programme that provides financial incentives to increase the uptake of renewable heat. The scheme is available for domestic and non-domestic use and eligible installations receive quarterly payments over 20 years based on the amount of heat generated. The Department for Business, Energy & Industrial Strategy (BEIS) publishes monthly reports on RHI deployment data and these are available in regional format. Data was taken from 'RHI deployment data: January 2020' (accessed 20/02/20) and was processed down to Local Authority level for the purposes of this report.

The use of the RHI datasets means that only registered or accredited schemes have been captured by this study. This incentive scheme is regarded as a key driver for micro generation installations due to the more favourable financial conditions it creates. However, for some technologies, in particular SHW, a number of installations may have been present before the introduction of the RHI or simply may not have been registered.

The Renewable Energy Planning Database ('REPD'): REPD is managed by Eunomia Research and Consulting Ltd ('Eunomia') on behalf of BEIS. The database tracks the progress of renewable electricity projects including those that could also be used for CHP. The REPD is updated on a quarterly basis and provides detailed information on electricity storage projects and renewable energy projects that are 150KW and over. Data was taken from 'Renewable Energy Planning Database (REPD): December 2019' (accessed 20/02/20) and was processed down to Local Authority level for the purposes of this report.

OFGEM Feed in Tariff (FiT) data: The Feed-in Tariff scheme was a government programme designed to promote the uptake of renewable and low carbon electricity generation technologies. The scheme was introduced in 2010 and was available for anyone who has installed, or was looking to install, one of the following technology types up to a capacity of 5MW, or 2kW for CHP:

- Solar photovoltaic (solar PV)
- Wind
- Micro combined heat and power (CHP)
- Hydro
- Anaerobic digestion (AD)

Ofgem publishes UK Quarterly reports showing a breakdown of accredited installations (anonymised) under the Feed-in Tariff scheme from 01 April 2010. Data was taken from *'Feed-in Tariff Installation Report 30 June 2019'* (accessed 20/02/20) and was processed down to Local Authority level for the purposes of this report. Note that the FiT has been closed to new applications since 1st April 2019 and therefore any technologies installed since then will not be included. [59]

The FiT database contains some records of hydropower installations in Staffordshire as listed below. Note that these records show a total of five installations whereas the RRS shows a total of seven; the reason for this discrepancy is not clear from public documents but may be related to the difference in publication dates and sources for the FiT versus the RRS databases.

East Staffordshire	E01029423	ST14	45.00
East Staffordshire	E01029467	Unknown	6.00
Stafford	E01029743	ST18	2.76
Staffordshire Moorlands	E01029797	Unknown	14.00
Staffordshire Moorlands	E01029797	Unknown	0.75

[59] https://www.ofgem.gov.uk/publications-and-updates/feed-tariff-installation-report-30-june-2019

The British Hydropower Association's 'Map of Hydropower Installations' (2014): The British Hydropower Association published a map of large (10 MW and above) small (1 MW - 9.99 MW) and mini (0.1 MW - 0.99 MW) hydropower schemes across the UK in 2014.[60] It does not show micro scale (<100kW) hydropower installations in Staffordshire; as noted above, our review suggests that at least five of the seven installations in Staffordshire fall into this category so these would be excluded from the map. The map is also now somewhat out of date so it is difficult to comment on where the remaining hydro installations might be.

Data validation and accuracy

Although care has been taken to ensure that the information presented in this report is complete and accurate, because databases were not compiled by AECOM, we cannot take responsibility for the accuracy of the data they contain. Wherever possible, databases were cross-checked, and Google satellite images were used to confirm the locations of larger installations.

60 http://www.british-hydro.org/wp-content/uploads/2018/03/BHA14_LR.pdf

Appendix J – Climate Risks – Source of Data / Information

The approach adopted in this analysis aims to identify key climate risks and understand the exposure of key development sites to future climate risks. The assessment has been informed by research-based analysis, as per the following.

J.1 Past Severe Weather Events

Understanding past severe weather events and their impacts is an important tool in the climate risk screening process, as it establishes a baseline against which climate trends and projections can be applied. Information on past events in Staffordshire was gathered through the following channels; online search for publicly available reports or press-articles relating to past severe weather events since 2010 and a review of the Staffordshire Local Climate Impacts Profile Report[61] produced by Staffordshire County Council

Based on this information, a summary of past severe weather events was produced, covering any reporting impacts and financial costs of the events (if known). Please refer to Section 6.1.1 for this summary.

J.2 Observed Weather Data, Trends and Headline Projections

To inform the understanding of the future shift in hazards, climate risk and potential impacts across Staffordshire, the following sources of weather and climate data were reviewed:

- Observed Met Office weather data from Denstone and Penkridge weather stations (1981 – 2010) serving as a climate baseline for Staffordshire.
- Trends observed over the baseline period, based on the UKCP18 "Science Overview Report"[62]
- UKCP18 projections for climate average over land at a 25km scale for the Staffordshire region utilising high emission scenario (RCP8.5 data).

Released in November 2018, UKCP18 data is an update on the UKCP09 projections over UK land areas and projections for sea level rise. For the purpose of this analysis, the UKCP18 Probabilistic projections at a scale of 25km have been utilised. These typically provide the broadest range of probability levels within the project data, ranging from 10% probability to 90% probability:

- **10% probability level** – this demonstrates what the future change is **unlikely to be less than**. There is a 90% chance the projected change will be more than this.
- **50% probability level** - this is known as the **central estimate**. i.e. what the future change is as likely not to be.
- **90% probability level** – this demonstrates what the future change is **unlikely to be more than**. There is a 10% chance the projected change will be more than this.

A precautionary principle has also been applied while analysing the projection data, utilising the higher emission scenarios of RCP6.0 and RCP8.5 where possible. This is in line with the latest analysis on global emissions as per the UN 2019 Emissions Gap Report.

The climate projections provide an indication of what future average climate conditions and trends will look like up until 2100. Some of the main climate variables that UKCP18 provide projections for are summarised in Table 6.29 below:

[61] Staffordshire County Council Local Climate Impact Profile 2010
[62] https://www.metoffice.gov.uk/pub/data/weather/uk/ukcp18/science-reports/UKCP18-Overview-report.pdf

Table 6.29: Definition of climate variables used in UKCP18 projection data.

Variable	Definition
Mean annual air temperature (ºC)	30-year average of daily / monthly / annual daily air temperature
Maximum annual air temperature (ºC)	30-year average of daily / monthly / annual average of daily maximum air temperature
Minimum annual air temperature (ºC)	30-year average of daily / monthly / annual average of daily minimum air temperature.
Annual precipitation rate (%)	Annual average of daily precipitation rate
Relative sea level rise (m)	Change in the elevation of the water surface with respect to the level of adjacent land. This takes into account both changes in absolute sea level as well as changes in land-level.

J.3 Hazards and Potential Impacts

The hazards and potential impacts that Staffordshire has been exposed to, and may be exposed to in the future, were analysed through the use of the following sources:

- Staffordshire Local Climate Impacts Profile Report produced by Staffordshire County Council
- Shropshire & Staffordshire Local Flood Risk Strategy[63]
- June 2016 Flood Investigation Report[64]
- South Staffordshire Flood Risk Assessment[65]

J.4 Climate Risks

Key risks and opportunities have been identified by the relevant technical chapters within the UK Climate Change Risk Assessment. The appropriate chapters are:

- Chapter 3: Natural Environment & Assets
- Chapter 4: Infrastructure
- Chapter 5: People and the Built Environment.

Other, local documentation has been utilised to inform the relevance of national risks, such as the Staffordshire Community Risk Register 2017.

i) Spatial Allocations

The spatial aspect of the assessment has, where possible, been informed by the provision of key development allocations for both residential and employment land across the different councils within Staffordshire. Since the Councils have developed their Local Plans at different rates, the received level of detail for spatial allocation data is different from one Council to another.

More information around the data provided for this aspect of the study will be available in the final deliverable.

[63] https://shropshire.gov.uk/media/1229/lfrmspluspartplus1-shropshireplusandplusstaffordshireplusgroupplusstrategy.pdf
[64] https://www.staffordshire.gov.uk/environment/Flood-Risk-Management/Documents/June-2016-Flood-Investigation-Report.pdf
[65] https://www.staffordbc.gov.uk/sites/default/files/cme/DocMan1/Planning%20Delivery/SFRA-Volume-1-Report-2014.pdf

Appendix K – Past Severe Weather Events

A summary of the number of events associated with hazards.

Flooding	12
Flooding (Fluvial)	4
Severe Storm & Gales	5
Heavy Rain	0
Heatwave	8
Drought	1
Snow	2

Year	Month	Weather Event Type	Location	Impacts	Source
2012	June-November	Flooding	All SSCs	Prolonged period of wet weather resulting in numerous local flooding issues across Staffordshire	https://www.staffordshire.gov.uk/environment/Flood-Risk-Management/Documents/lfrms-summary.pdf https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/weather/learn-about/uk-past-events/interesting/2012/exceptionally-wet-weather---november-2012---met-office.pdf
2012	Summer	Flooding (Fluvial)	All SSCs		https://www.sstaffs.gov.uk/doc/181158/name/2018s1642%20-

					%20Southern%20Staffordshire%20SFRA%20Final%20Report%20v20.pdf/
2013-14	Winter	Flooding (Fluvial)	All SSCs	Intense rainfall events causing flooding across the study area	As above.
2016	June	Flooding (Fluvial)	All SSCs	Intense rainfall between the 8th and 17th of June caused pluvial and fluvial flooding across the County. The worst affected areas included Bishops Wood, Kinver and Wheaton Aston in South Staffordshire; Cannock; Stafford; and Shenstone, Harlaston and Clifton Campville in Lichfield	As above.
2013	January	Flooding (Fluvial)		Trent and Mersey Canal in Weston (Stafford Borough)	As above.
Multiple	Multiple	Flooding	Rugeley (Cannock Chase District)	Rugeley has a history of flooding from the Rising Brook which flows culverted through the town. Flooding occurs when the culvert is full, and from overtopping upstream of Hagley playing fields causing water to back up and flow overland through the town	As above.
2013	July	Flooding	Lichfield District	Sandford Street, Wheel Lane and Birmingham Road flooded from intense rainfall	As above.
2012	June	Flooding	Multiple, South Staffordshire	Intense rainfall causing pluvial flooding in Huntington, Essington and Great Wyrley from overland flow. Groundwater flooding in Essington	As above.
2012	Summer	Flooding	Multiple, South Staffordshire	Fluvial, pluvial and highways flooding in Bilbrook, Brewood, Codsall, Essington, Great Wyrley, Huntington, Lower Penn and Perton	As above.
2018	May	Flooding	Coven, South Staffordshire	Intense rainfall causing external flooding of the culvert under St Pauls school	As above.
2018	May	Flooding	Great Wyrley, South Staffordshire	Pluvial flooding from intense summer storms causing flooding to >5 properties	As above.
2019	May	Flooding	Perton, South Staffordshire	Surface water flooding to 4 properties	As above.

2019	May	Flooding	Cheslyn Hay, South Staffordshire	Pluvial flooding to >5 properties, pending S19 report	As above.
2012	Summer	Flooding	Stafford Borough	Intense rainfall in July 2012 caused Borough-wide flooding	As above.
2020	February	Flooding	Northern Staffordshire	High winds and heavy rain brought chaos as **Storm Ciara** hit the region. Hundreds of homes were left without electricity and roads were closed due to flooding and fallen trees. Rail services to Stoke-on-Trent and the surrounding area were reduced and buses diverted and delayed, as the Met Office and police advised people not to travel unless necessary.	https://www.stokesentinel.co.uk/news/stoke-on-trent-news/day-chaos-storm-ciara-battered-3828290
2020	February	High Winds	As above.	As above.	As above.
2020	February	Flooding	Newcastle-under-Lyme, Stafford, Staffordshire Moorlands and Tamworth	**Storm Dennis.** Yellow warning issued covering Stoke-on-Trent, Newcastle-under-Lyme, Stafford and the Staffordshire Moorlands. Heavy and prolonged rain is expected to hit the region, with further flooding and travel disruption expected. Many trees fell across roads in the area and hundreds of homes suffered power cuts throughout Sunday	https://www.stokesentinel.co.uk/news/stoke-on-trent-news/storm-dennis-weather-stoke-staffordshire-3838996 https://www.birminghammail.co.uk/news/midlands-news/dramatic-footage-shows-flooded-tamworth-17764416 https://www.stokesentinel.co.uk/news/stoke-on-trent-news/storm-dennis-hits-north-staffordshire-3851330
2020	February	Severe Storm & Gales	As above.	As above.	As above.
2014	August	Severe Storm & Gales	Staffordshire	Staffordshire area seem to have been impacted by strong winds and very wet weather from the remnants of ex-hurricane Bertha.	https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/weather/learn-about/uk-past-events/interesting/2014/ex-hurricane-bertha---met-office.pdf

2017	October	Severe Storm & Gales	Staffordshire	On 16 October 2017 ex-hurricane Ophelia brought very strong winds to western parts of the UK and Ireland. This date fell on the exact 30th anniversary of the Great Storm of 16 October 1987	https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/weather/learn-about/uk-past-events/interesting/2017/ex-hurricane-ophelia-16-october-2017---met-office.pdf
2018-19	Winter	Severe Storm & Gales	Midlands	Storm Freya brought strong winds and heavy rain to England, Wales and southern Scotland. Strong winds caused disruption on the rail network across Wales and the Midlands, and a number of fallen trees blocked some routes for motorists	https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/weather/learn-about/uk-past-events/interesting/2019/2019_003_storm_freya.pdf
2020	January	Severe Storm & Gales	Staffordshire	The UK and Ireland will turn increasingly windy as **Storm Brendan** approaches, and there'll also be some heavy rain.	https://www.expressandstar.com/news/2020/01/12/strong-wind-and-heavy-rain-to-hit-midlands-as-storm-brendan-rolls-in/
2013	July	Heatwave	South Staffordshire	From 3 to 23 July 2013 the UK experienced a spell of hot, sunny weather with an area of high pressure established across the UK. South Staffordshire seems to have had between 4 to 6 days of T>28C	https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/weather/learn-about/uk-past-events/interesting/2013/hot-dry-spell-july-2013---met-office.pdf
2015	July 1st	Heatwave	Midlands	Temperatures across the Midlands, East Anglia and parts of north-west and north-east England were also into the low 30s including 33.4 °C at Coningsby, Lincolnshire and 31.9 °C at Brampton, Cumbria	https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/weather/learn-about/uk-past-events/interesting/2015/heatwave-1-july-2015---met-office.pdf
2017	June	Heatwave	Midlands	The UK experienced a spell of hot, sunny weather in June 2017 associated with high pressure drawing warm air from the near-continent. Staffordshire area weather stations seem to have achieved 29.3 and 29.9C.	https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/weather/learn-about/uk-past-events/interesting/2017/hot-spell-june-2017---met-office.pdf

2018	April	Heatwave	Midlands	The UK experienced some unusually high temperatures for the time of year from 18 to 22 April, with high pressure over the near continent drawing very warm air from the south. Temperatures in Staffordshire area ranged from 22 to 26C.	https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/weather/learn-about/uk-past-events/interesting/2018/exceptional-warmth-april-2018---met-office.pdf
2018	August	Heatwave	Stafford Borough	Heatwave leads to discovery of historic sites in Staffordshire	https://www.stokesentinel.co.uk/news/local-news/cropmark-history-stafford-keele-templar-1902296
2018	July	Heatwave	Stoke-on-Trent and north Staffordshire	Temperatures around 30 degrees	https://www.stokesentinel.co.uk/news/stoke-on-trent-news/north-staffordshire-continuing-bake-sunshine-1757423
2019	July/August	Heatwave	Stafford Borough	Temperatures between 30 and 32 degrees. Britain normally see an average rainfall of about 80mm in June. During that month in 1976, just 18.5mm of rain fell. This June has been even worse, with just 6.8mm of rain	https://www.stokesentinel.co.uk/news/local-news/temperatures-staffordshire-rival-barcelona-heatwave-3123243 https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/weather/learn-about/uk-past-events/interesting/2019/2019_007_july_heatwave.pdf
2019	August	Heatwave	Stoke-on-Trent and north Staffordshire	High temperatures around 30 degrees, thunderstorms and non-stop rain	https://www.stokesentinel.co.uk/news/stoke-on-trent-news/august-bank-holiday-heatwave-weather-3242926

2010-2012		Drought	Midlands	The drought was due to a sequence of dry months from winter 2009/10 to March 2012, particularly in the spring, autumn and winter seasons. For England and Wales, this was one of the ten most significant droughts of one to two years duration in the last 100 years. Across southern England, the two-year period April 2010 to March 2012 was the equal-driest such two-year period in records from 1910, shared with April 1995 to March 1997.	https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/weather/learn-about/uk-past-events/interesting/2012/england-and-wales-drought-2010-to-2012---met-office.pdf
2013	March	Snow	Midlands	One of the most significant examples of snowfall in late March was from 17 to 24 March 1979. 10 to 20 cm of snow fell across the Midlands and North West England, with 10 to 30 cm across the Pennines and North Wales, with the snow lying un-melted for at least a week.	https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/weather/learn-about/uk-past-events/interesting/2013/snow-and-low-temperatures-late-march-2013---met-office.pdf
2018	February and March	Snow	West Midlands	The UK experienced a spell of severe winter weather with very low temperatures and significant snowfalls from late February to early March 2018. On 1 March parts of the west Midlands and south Wales recorded daily maximum temperatures more than 12 °C below the March average (around -2 °C compared to a March average of around 10 °C)	https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/weather/learn-about/uk-past-events/interesting/2018/snow-and-low-temperatures-february-to-march-2018---met-office.pdf

Appendix L – UKCCRA Risks – Scale of Relevance

Ref#	Risk as per UKCCRA	UKCCRA National Urgency Score	Scale of Relevance (High - Medium - Low)	Comment / Rationale
8	**Ne8**: Risks of land management practices exacerbating flood risk	More action needed	High	Future development falls under the bracket of "land management practices"
14	**Ne14:** Risks and opportunities from changes in landscape character	Watching brief	High	Landscape character is a core consideration for local planning authorities.
15	**In1:** Risks of cascading failures from interdependent infrastructure networks	More action needed	High	Infrastructure is directly linked with future development.
16	**In2:** Risks to infrastructure services from river, surface water and groundwater flooding	More action needed	High	Infrastructure is directly linked with future development.
18	**In4:** Risks of sewer flooding due to heavy rainfall	More action needed	High	Future development would require new or expanding sewage infrastructure.
19	**In5:** Risks to bridges and pipelines from high river flows and bank erosion	Research priority	High	This could impact development infrastructure and access to the development.
20	**In6:** Risks to transport networks from slope and embankment failure	More action needed	High	This could impact development infrastructure
23	**In9:** Risks to public water supplies from drought and low river flows	More action needed	High	Could directly influence development water supplies.
25	**In11:** Risks to energy, transport and digital infrastructure from high winds and lightning	Research priority	High	This could impact development infrastructure
27	**In13**: Risks to transport, digital and energy infrastructure from extreme heat	Sustain current action	High	This could impact development infrastructure
28	**In14:** Potential benefits to water, transport, digital and energy infrastructure from reduced extreme cold events	Sustain current action	High	This could impact development infrastructure

29	**PB1:** Risks to health and wellbeing from high temperatures	More action needed	High	The development could influence the risk to health and wellbeing of its residents.
31	**PB3:** Opportunities for increased outdoor activities from higher temperatures	Watching brief	High	Future development could consider indoor recreational facilities.
32	**PB4:** Potential benefits to health and well-being from reduced cold	More action needed	High	The development could influence the risk to health and wellbeing of its residents.
33	**PB5:** Risks to people, communities and buildings from flooding	More action needed	High	The development could influence the risk to health and wellbeing of its residents.
35	**PB7:** Risks to building fabric from moisture, wind and driving rain.	Research priority	High	Directly impact materials in infrastructure
37	**PB9:** Risks to health and social care delivery from extreme weather	More action needed	High	LA should ensure local NHS services, GPs etc have plans in place to act in extreme conditions. I think this risk covers wider vulnerable groups (e.g. elderly residents) not just care homes, hospitals etc
38	**PB10**: Risks to health from changes in air quality	Research priority	High	The development could influence the risk to health and wellbeing of its residents.
41	**PB13**: Risks to health from poor water quality	Sustain current action	High	The development could influence the risk to health and wellbeing of its residents.
42	**PB14:** Risk of household water supply interruptions	Sustain current action	High	The development could influence the risk to health and wellbeing of its residents.
11	**Ne11:** Risks to aquifers, agricultural land and habitats from saltwater intrusion	Sustain current action (watching brief in NI & Scotland)	Medium	Dependent on where Staffordshire sources its drinking water from. Given its land-locked nature this is a medium relevance.
21	**In7:** Risks to hydroelectric generation from low or high river flows	Watching brief	Medium	Little to no reliance on hydroelectric generation.
1	**Ne1:** Risk to species and habitats due to inability to respond to changing climate conditions.	More action needed	Low	No link to future development.
2	**Ne2:** Opportunities from new species colonisations	More action needed	Low	No link to future development.

3	**Ne3:** Risks and opportunities from changes in agricultural and forestry productivity and land suitability	Research priority	Low	No link to future development.
4	**Ne4:** Risks to soils from increased seasonal aridity and wetness	More action needed	Low	No link to future development.
5	**Ne5**: Risks to natural carbon stores and carbon sequestration	More action needed	Low	No link to future development.
6	**Ne6**: Risks to agriculture and wildlife from water scarcity and flooding	More action needed	Low	No link to future development.
7	**Ne7**: Risks to freshwater species from higher water temperatures	Research priority	Low	No link to future development.
9	**Ne9:** Risks to agriculture, forestry, landscapes and wildlife from pests, pathogens and invasive species	Sustain current action	Low	No link to future development.
10	**Ne10**: Risks to agriculture, forestry, wildlife and heritage from changes in frequency and/or magnitude of extreme weather and wildfire events	Sustain current action	Low	No link to future development.
12	**Ne12**: Risks to habitats and heritage in the coastal zone from sea-level rise; and loss of natural flood protection	More action needed	Low	Staffordshire is not coastal
13	**Ne13:** Risks to, and opportunities for, marine species, fisheries and marine heritage from ocean acidification and higher water temperatures	Research priority	Low	Staffordshire is not coastal
17	**In3**: Risks to infrastructure services from coastal flooding and erosion	More action needed	Low	Staffordshire is not coastal
22	**In8:** Risks to subterranean and surface infrastructure from subsidence	Watching brief	Low	Staffordshire is not coastal
24	**In10:** Risks to electricity generation from drought and low river flows	Watching brief	Low	No dependence on hydroelectric generation.
26	**In12:** Risks to offshore infrastructure from storms and high waves	Research priority	Low	Staffordshire is not coastal

30	**PB2:** Risks to passengers from high temperatures on public transport	Research priority	Low	No link to future development.
34	**PB6:** Risks to the viability of coastal communities from sea level rise	Research priority	Low	Staffordshire is not coastal
36	**PB8**: Risks to culturally valued structures and the wider historic environment	Research priority	Low	No link to future development.
39	**PB11**: Risks to health from vector borne pathogens	Research priority	Low	No link to future development.
40	**PB12**: Risk of food borne disease cases and outbreaks	Watching brief	Low	No link to future development.