Leicester
City Council

Leicester's City-Wide Carbon Footprint Statement for 2021

March 2024

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1. Executive Summary

Leicester City Council has set an ambition to reach net zero carbon emissions in Leicester by 2030. From the baseline year of 2005 this equates to a reduction of 2,279 $ktCO_2e$ over 25 years.

Each year a carbon footprint is produced for the city, this presents the total greenhouse gas emissions attributed to the city in terms of kilo-tonnes of carbon dioxide equivalent ($ktCO_2e$). This carbon footprint is based on figures provided the UK Government's Department for Energy Security & Net Zero (DESNZ). In 2021 Leicester's city-wide carbon footprint was 1,327 $ktCO_2e$. It represents:

- a reduction of 952 $ktCO_2e$ from the 2005 baseline figure, a 41.8% reduction.
- an increase of 130 $ktCO_2e$ from 2020, a 10.9% increase.

Emissions per city resident (per capita) in 2021 were 3.6 tCO_2e This is an increase from 3.2 tCO_2e in 2020, but a reduction from 7.6 tCO_2e in 2005.

The emissions covered in the figures are split into sectors: Industrial; Commercial; Public Sector; Domestic; Transport; Land Use, Land Use Change & Forestry (LULUCF), Agriculture and Waste Management. These figures do not include emissions generated outside the city as a result of its consumption of goods and services.

Emissions rose significantly across all but one of the sectors in 2021. The main factor influencing this was the recovery from the Covid-19 pandemic, with changes to activity across all sectors, following a large fall in emissions the previous year. Further details of the reasons for these changes, including other factors, are provided within this report where available.

2. Introduction

Leicester City Council declared a climate emergency in February 2019. This means that we are committed to playing our part in reducing carbon emissions to help prevent the impacts of climate change getting much worse and to meet the goals of the Paris Agreement on climate change. As part of our response to the climate emergency we have developed Leicester's Climate Emergency Strategy and Leicester City Council's Climate Emergency Action Plan, setting out our approach to these challenges and a wide-ranging programme of actions being undertaken by the council to address them.

Leicester's city-wide carbon footprint includes the greenhouse emissions produced by individuals and organisations in the city each year, expressed in kilotonnes (1000 tonnes) of carbon dioxide equivalent ($ktCO_2e$). This includes emissions of carbon dioxide (CO_2) and other greenhouse gases including methane (CH_4) and nitrous oxide (N_2O). The figures include emissions from use of gas, electricity and other fuels

in buildings, use of fuels for transport, emissions and net reductions associated with land use and land use change and agricultural emissions in the city.

This report compares the city's greenhouse emissions for 2021 with previous years. It identifies how emissions have changed in each sector and presents progress in reducing them. It also highlights where more work will be needed to reduce emissions in the future. The figures in this report are taken from data produced by the UK Government's Department for Energy Strategy and Net Zero (DESNZ) which is produced and published annually for each UK local authority area.

3. Area Information

This carbon footprint covers the unitary authority area of Leicester, as administered by Leicester City Council.

4. Reporting Period

The carbon emissions within this report cover the 2021 calendar year, from 1st January to 31st December. This is the most recent year for which UK government-produced figures are available.

5. Summary of Change in Emissions

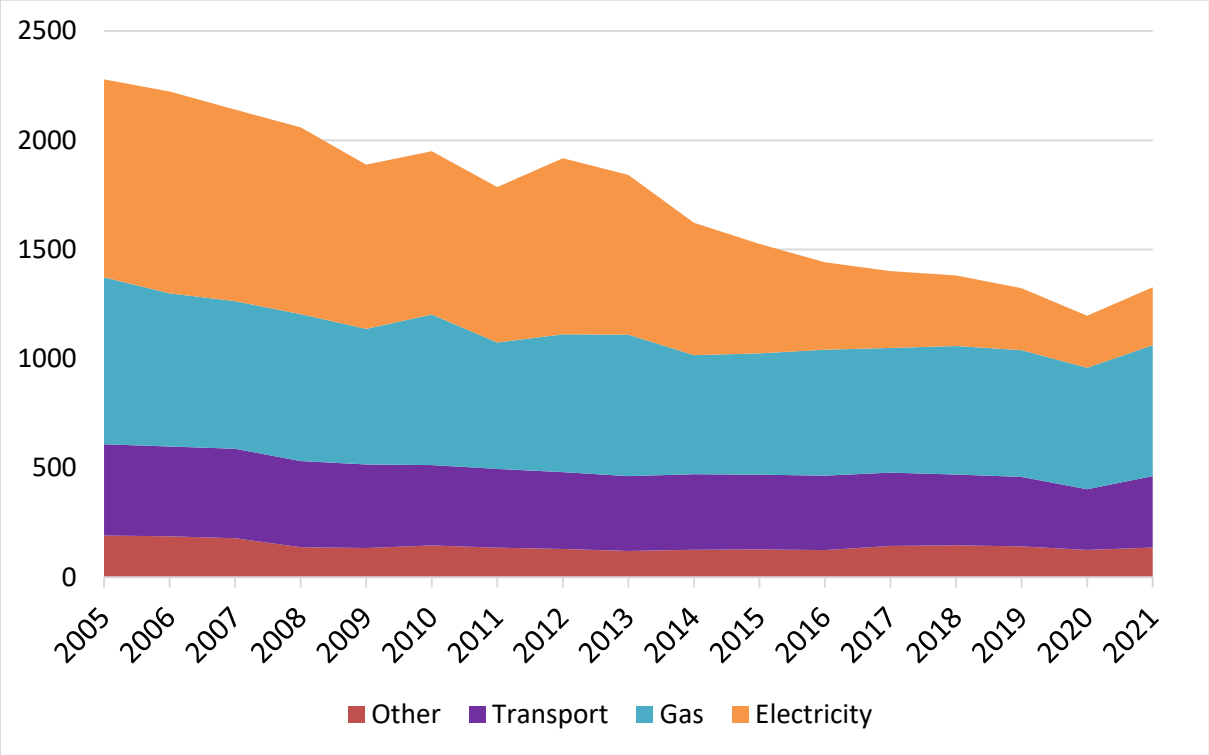
In 2021 Leicester's city-wide carbon emissions were 1,327 ktCO_2e, a 10.9% increase on 2020 CO_2e emissions. Emissions have, however fallen by 41.8% since the baseline year of 2005. This baseline year has been selected as 2005 as it is the first year for which emissions figures are available by sector and as such it is used for comparison elsewhere in the report.

Emissions for the last two years have been very significantly affected by the Covid-19 pandemic, which had major impacts on most of the sectors within this report. Whilst emissions have fallen substantially since 2005, achieving the rapid rate of further emissions reductions needed to reach net zero carbon emissions will require significant extra work and investment. This means that the ambition to make Leicester net zero carbon by 2030 will require far reaching and radical action in the city, with robust support from national government.

Emissions are also compared on a per capita (per resident) basis, to reflect changing population levels over time. Between 2005 and 2020 Leicester's population has increased by 21.4%, from 301,500 to 366,000. As such, whilst per capita emissions rose from 3.2 tCO_2e in 2020 to 3.6 tCO_2e in 2021, they have fallen significantly from 7.6 tCO_2e in 2005, a reduction of 57.5%.

5.1 Changes by Fuel Source

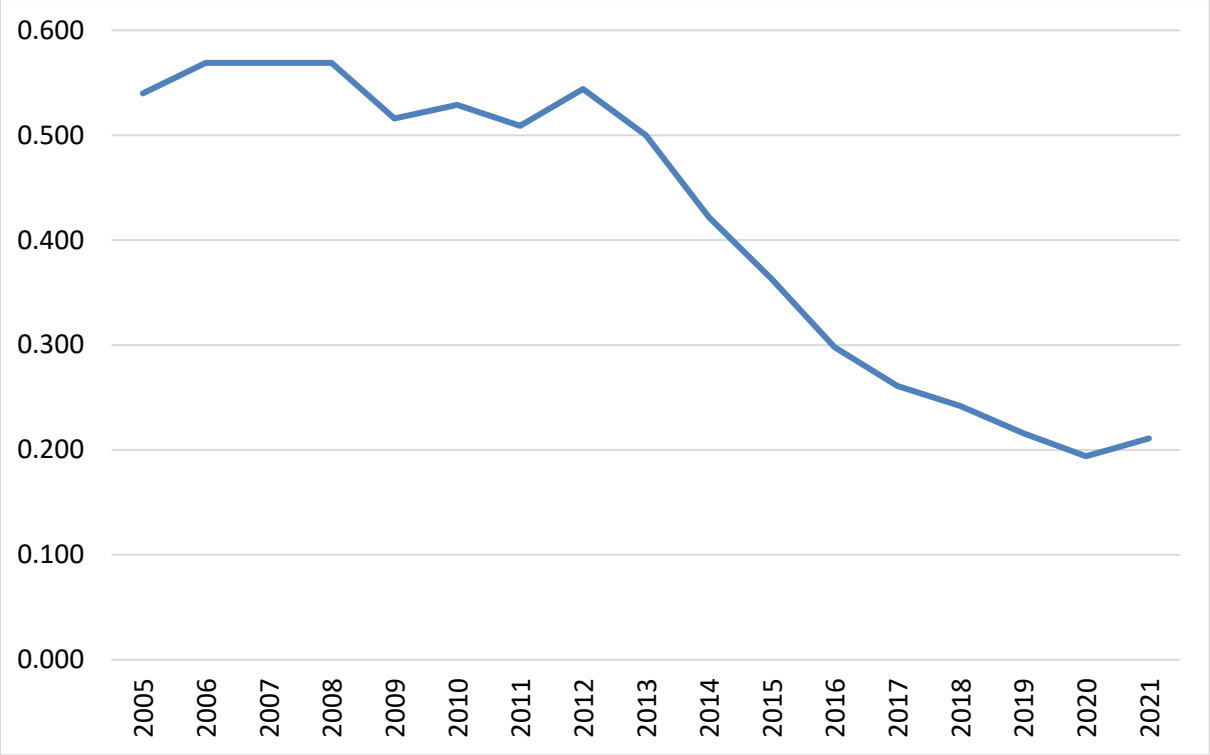
The level of emissions from each of the major fuel sources from 2005 to 2021 are shown in Graph 1 below. Over the last two years Leicester's emissions have been majorly impacted by the effects of the Covid-19 pandemic, including the lockdowns during this time and the ongoing return to a normal level of activity. This is one of the main drivers of an increased in emissions for all fuels in 2021, following falls in 2020. This is generally a result of increased consumption of fuels across the different sectors within the footprint.



Graph 1. Leicester's emissions by fuel source ($ktCO_2e$) from 2005 to 2021.

Compared to the 2005 baseline emissions are still significantly lower for all fuel types, however. The greatest reduction by far is in electricity emissions, which is largely a result of a reduction in the carbon emissions produced per unit of electricity generated in the UK (known electricity's 'carbon intensity'). This is largely due to the closure of many of the UK's coal-fired power plants and the development of renewables such as wind and solar power, although a significant proportion of electricity is also generated from the burning of natural gas.

The electricity emissions factors used since 2005 are shown in Graph 2 below. Notably, in 2021 the emissions factor increased year-on-year by 9%, the first time it has increased since 2012, which also accounts for some of the increase in emissions seen in 2021. This was due to a decrease in renewable generation in the year due to unfavourable weather conditions, and a decrease in nuclear power generation due to outages at power stations. These factors resulted in an increase in coal and natural gas use for electricity generation over the year.



Graph 2. Emission factor for UK electricity ($ktCO_2e/GWh$) used to produce annual data for 2005 to 2021.

Emissions from gas use and transport have fallen much more slowly since 2005 and represent a growing proportion of Leicester's remaining emissions. The emission factors for both of these areas have changed by much less than for electricity over time as there has not been a major change in how these fuels are sourced. As such, changes to the emissions factors in these areas have not been a major influence on overall changes since 2005. Achieving net zero carbon by 2030 in Leicester will therefore require particularly urgent action to decarbonise heating and transport.

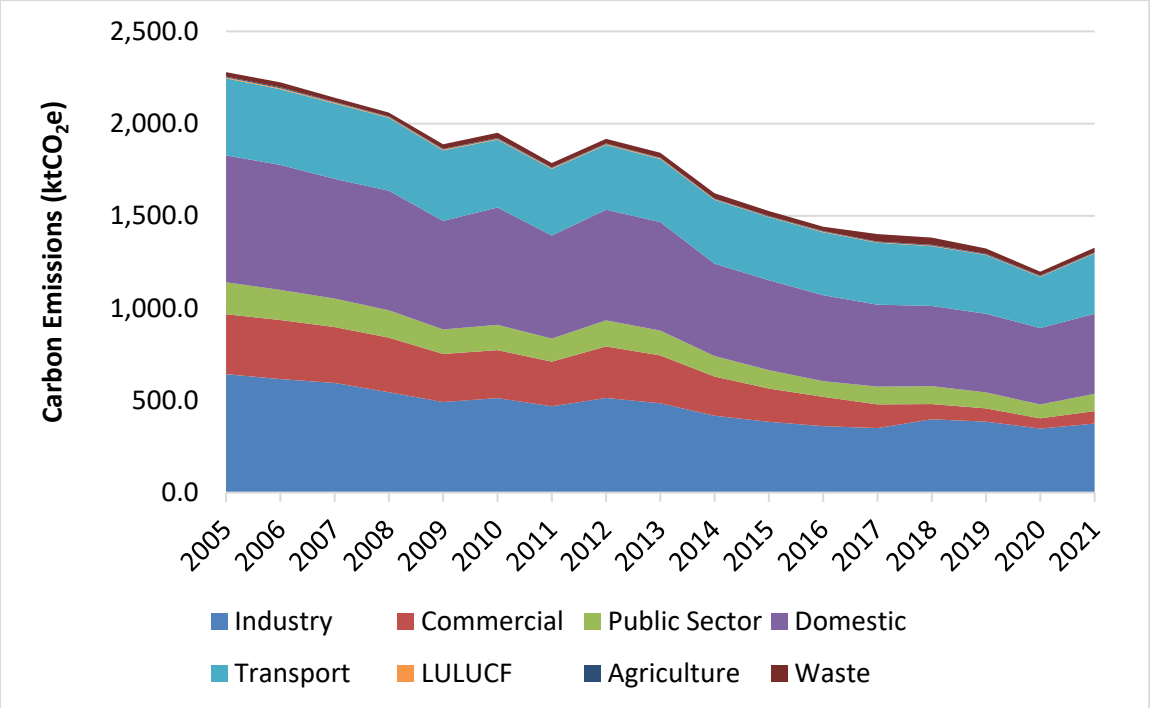
One of the major factors behind the increase in emissions from gas consumption across many of the sectors is the cold winter experienced at the start of 2021. Data from the UK government's Digest of UK Energy Statistics (DUKES) shows a 7.7% increase in the number of Heating Degree Days (HDD) in 2021 compared to 2020. This is a measure of how much and for how long temperature fall below a certain level. In increase in HDDs means that occupied buildings are likely to have required more heating over this time. As some buildings use electric heating this is also likely to have had some effect on electricity consumption.

5.2 Sector Analysis

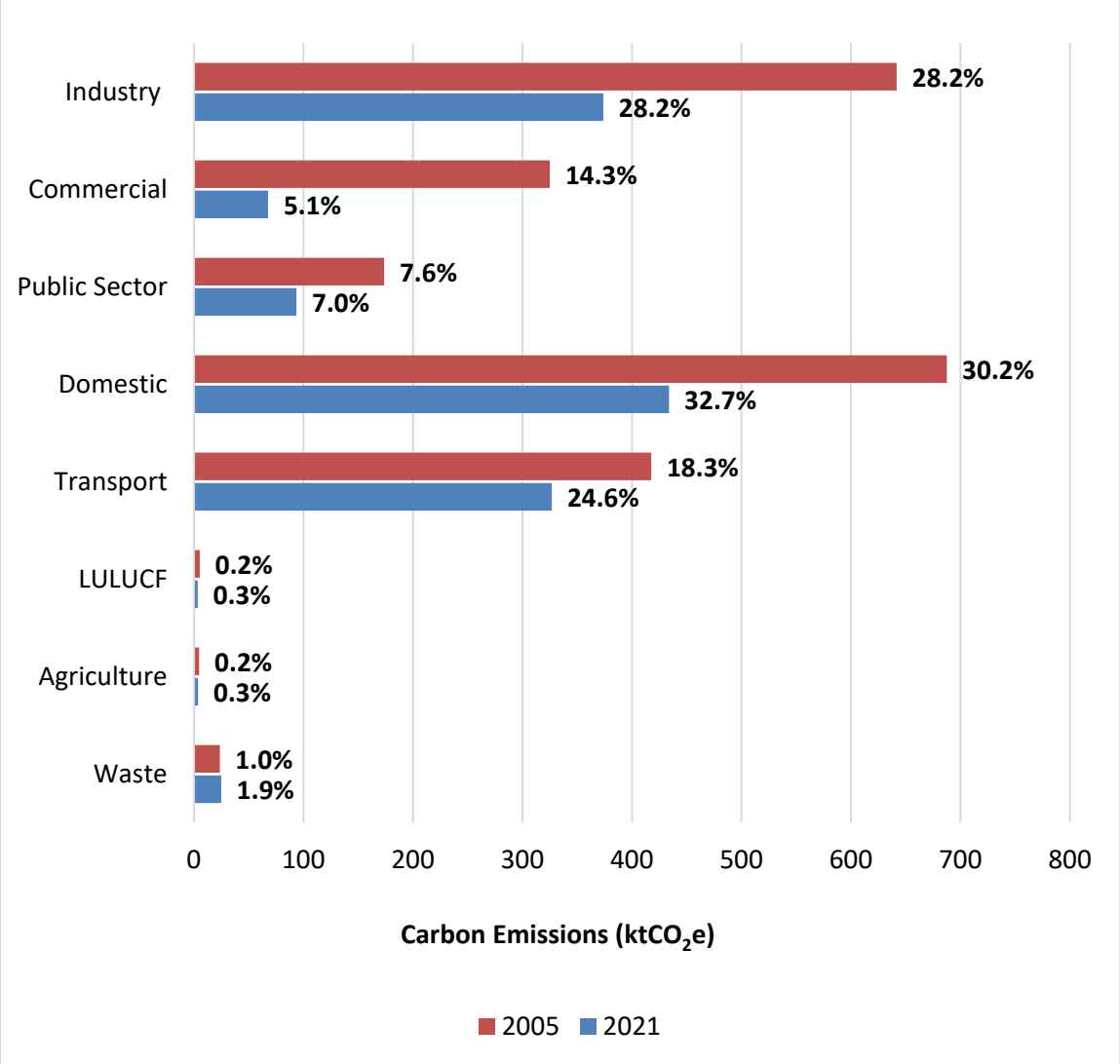
Leicester's city-wide emissions are divided into eight sub-sectors – Industrial, Commercial, Public Sector, Domestic, Transport, Land Use, Land Use Change and Forestry (LULUCF), Agriculture and Waste. This allows trends to be monitored and the most CO_2e intensive sectors to be identified. DESNZ provide a

Technical Report alongside the figures which notes that a combination of direct data and proxy estimates are used to apportion emissions between the sectors. As such it is important to note that the figures for Leicester therefore will account for local factors to some degree but will not fully represent locally specific changes.

Since 2005 emissions have fallen fastest overall for commercial properties (79% reduction), followed by the public sector (46%), industry (42%), homes (37%) and transport (22%). Emissions have also fallen for the agriculture sector, by 22%, and for LULUCF (37%), but it should be noted that each of these sectors account for less than 0.3% of the city's total. Emissions from waste management, included in the footprint for the first time this year have risen by 5% since 2005. The differences between sectors are due to a number of factors, including the mix of fuels used within each, as detailed in the previous section. The changes for each sector and the total amount and proportion of the footprint attributable to each of them are shown in Graph 3 and Graph 4 below.



Graph 3. Leicester's emissions by sector from 2005 to 2021.



Graph 4. Leicester's emissions by sector and the proportion of the footprint attributable to them in 2021 in comparison to 2005.

Within each sector many of the changes seen in 2021 are directly connected to the impacts of the Covid-19 pandemic and the ongoing recovery. This is likely to have been particularly impactful in Leicester, which spent longer in local lockdowns than any other UK city in 2020. Further details of CO_2e emissions changes in each sector, both in the last year and from 2005 can be found below.

5.3 Industrial emissions

	2005	2020	2021	Change on 2020	Change on 2005
Industry Electricity	288.5	88.0	101.9	+15.7%	-64.7%
Industry Gas	210.4	168.2	173.2	+3.0%	-17.7%
Large Industrial Installations	5.2	1.3	1.3	-3.1%	-75.6%
Industry 'Other'	137.6	89.5	97.5	+8.9%	-29.1%
Industry Total	641.7	347.0	373.9	+7.7%	-41.7%

Table 1. Leicester's industrial carbon emissions for 2005, 2020 and 2021.

Industrial emissions in 2021 were 374 ktCO_2e, making up 28% of the city's carbon footprint. These emissions have increased by 7.7% on 2020, although they are 41.8% lower than in the baseline year of 2005. The most significant increase in this sector in 2021 comes from electricity use, where emissions rose by 15.7%. This partly reflects a 9% increase in the emissions factor for the year, as well as an increase in consumption. This is likely due to an increase in manufacturing activity following a reduction in 2020 due to the impacts of Covid-19.

Emissions from gas use also increased in 2021, by 3%, due to an increase in consumption over the year. This is likely due to a combination of a colder winter in 2021 and an increase in the use of gas for industrial processes as activity increased. The relatively small increase may reflect the timing of the lockdowns in 2020, as they began after the end of winter, meaning that heating use for the overall year was less impacted by the pandemic. The increase in consumption of other fuels is likely to be a result of the factors affecting gas emissions.

Emissions from large industrial installations have fallen by 3.1% this year. The reason for this change is not immediately apparent but may reflect specific changes at the small number of sites contributing to this category.

5.4 Commercial emissions

	2005	2020	2021	Change on 2020	Change on 2005
Commercial Electricity	262.4	34.7	41.8	+20.3%	-84.1%
Commercial Gas	61.6	19.9	25.2	+26.4%	-59.1%
Commercial 'Other'	1.0	0.6	0.7	+13.6%	-31.7%
Commercial Total	325.0	55.2	67.6	+22.4%	-79.2%

Table 2. Leicester's commercial carbon emissions for 2005, 2020 and 2021.

Commercial carbon emissions in 2021 were 67.6 $ktCO_2e$, representing 5% of Leicester's total emissions. They have increased by 22.4% since 2020, but have fallen by 79.2% since 2005, the largest decrease among all sectors in that time. There has been a significant rise in electricity-related emissions of 20.3% against 2020. This is mostly a result of increased consumption following a significant fall in 2020, alongside the increase in the emissions factor. The changes in this sector are particularly large as the commercial sector experienced greater impacts from Covid-19 and lockdowns than other sectors, with many businesses closed entirely for periods throughout 2020.

Emissions from gas consumption also increased in 2021 by 22.4%. This is due to increased consumption of gas and is likely to be due to a combination of the increase in Heating Degree Days in 2021 and in overall economic activity in the sector. Another potential driver of the increase is that many businesses were required to keep doors and windows open for air circulation following the end of lockdown restrictions, increasing their heating use. This may help to explain why these emissions are significantly above their 2019 levels, unlike other commercial and industrial emissions. Emissions from other fuel use have also risen significantly, which is likely to reflect similar factors.

5.5 Public Sector emissions

	2005	2020	2021	Change on 2020	Change on 2005
Public Sector Electricity	92.8	25.3	28.2	+11.3%	-69.7%
Public Sector Gas	73.4	50.0	65.3	+30.6%	-11.0%
Public Sector 'Other'	7.4	0.005	0.006	+28.2%	-99.9%
Public Sector Total	173.6	75.3	93.5	+24.1%	-46.1%

Table 3. Leicester's public sector carbon emissions for 2005, 2020 and 2021.

Public sector emissions were 93.5 $ktCO_2e$ in 2021, making up 7% of the total city-wide footprint. This sector includes organisations such as the local NHS trust, the city council, universities and schools, the emergency services and central government offices. These emissions rose significantly in 2021, by 24.1% but, as with other sectors, remain well below their 2005 levels, having fallen by 46.1% in this time. The 11.3% increase in emissions in 2021 from electricity use in this area is largely due to an increase in the emissions factor. The relatively small increase in consumption despite the end of lockdown restriction may reflect the fact that many public sector organisations continued to operate throughout 2020 compared to other sectors.

Emissions from gas use have increased very significantly compared to 2020 however, by 30.6%. As with other areas this is likely to be explained to some extent by the increase in heating degree days, alongside a general increase in activity in the sector. However, unlike most other sectors, these emissions are significantly higher than in pre-pandemic years. One potential explanation for this could be a particular increase in school gas consumption. Many schools were required to keep windows open throughout the particularly cold winter months at the start of 2021 to increase air circulation, which may have had a particularly large impact on gas consumption for heating. Emissions from other fuels also increased over the year, but remain an extremely small part of the footprint, representing just 0.01% of the sectors emissions.

5.6 Domestic emissions

	2005	2020	2021	Change on 2020	Change on 2005
Domestic Electricity	262.3	90.2	92.7	+2.8%	-64.7%
Domestic Gas	418.1	317.4	334.8	+5.5%	-19.9%
Domestic 'Other'	7.2	6.5	6.3	-2.4%	-11.4%
Domestic Total	687.6	414.0	433.8	+4.8%	-36.9%

Table 4. Leicester's domestic carbon emissions for 2005, 2020 and 2021.

Domestic carbon emissions were 433.8 $ktCO_2e$ in 2021 and remain the largest single sector within the footprint, making up 33% of Leicester's emissions. Emissions in this sector rose overall in 2021, by 4.8%, although they remain significantly lower than in 2005, having fallen by 36.9% since then. The increase in electricity emissions is a result of the 9% increase emissions factor in 2021, balanced out by a reduction in actual electricity consumption during the year. This is likely to reflect a reduction in the amount of time people were spending at home, following the loosening of lockdown restrictions after 2020.

Gas emissions have also risen for 2021 and, unlike electricity emissions, this is not a result of a significant change in the emissions factor. As in other areas, this is likely to be a result of the increase in Heating Degree Days in 2021 compared to the previous year, increasing overall heating demand. It is unclear why emissions for other fuels have fallen in 2021, although they remain a very small part of the footprint for the domestic sector, representing just 1.5% of emissions.

5.7 Transport emissions

	2005	2020	2021	Change on 2020	Change on 2005
Road Transport (A roads)	197.8	121.8	135.1	+10.9%	-31.7%
Road Transport (Minor roads)	207.0	145.6	180.3	+23.9%	-12.9%
Diesel Railways	8.9	6.2	6.7	+7.9%	-24.2%
Transport 'Other'	3.9	4.2	4.6	+10.1%	+18.4%
Transport Total	417.6	277.8	326.7	+17.6%	-21.8%

Table 5. Leicester's transport carbon emissions for 2005, 2020 and 2021.

Transport emissions were 326.7 $ktCO_2e$ in 2021, representing 25% of the city's footprint. Emissions have increased by 17.6% compared to 2020, although they remain 21.8% lower than in 2005. Emissions from transport on A roads have increased by 10.9%, and emissions from transport on minor roads have increased by 23.9%. The main overall reason for this increase is assumed to be the expected increase in travel throughout 2021 following the large reductions in 2020 due to the Covid-19 pandemic and associated lockdowns. The Transport 'Other' emissions category covers emissions from lubricants and LPG fuels and has also increased for the year and is also likely to be a result of increased activity.

Based upon the data available it is unclear why emissions have risen by much more significantly for minor roads than for A roads, with 2021 emissions from travel on minor roads significantly greater than in the previous few years before 2020. However, one reason for the increase in road emissions may be a switch from public transport to private transport due to ongoing public health measures and concerns due to Covid-19 throughout 2021. Reflecting this, while railway emissions have increased by 7.9% in the year they remain below their pre-pandemic levels, as train usage has been slower to return to previous levels.

5.8 Land Use, Land Use Change and Forestry

	2005	2020	2021	Change on 2020	Change on 2005
Net Emissions: Forest land	-1.5	-1.6	-1.6	-0.2%	7.9%
Net Emissions: Cropland	0.2	0.2	0.2	+0.9%	-13.5%
Net Emissions: Grassland	-0.6	-0.7	-0.7	+0.6%	21.5%
Net Emissions: Settlements	7.0	5.4	5.4	-0.6%	-22.8%
Net Emissions: Indirect N_2O	0.1	0.1	0.1	-0.6%	-24.1%
LULUCF Net Emissions	5.2	3.3	3.3	+1.0%	-36.5%

Table 6. Leicester's land use, land use change and forestry carbon emissions for 2005, 2020 and 2021.

Land Use, Land Use Change and Forestry (LULUCF) within city boundaries remains a small part of the overall footprint of the city, at just 0.2% of the total. The main source of emissions comes from settlements, reflecting long-term changes to soil carbon content from building on previously open land. Cropland and Indirect N_20 emissions are also net sources of emissions. Conversely, two categories provide a net reduction in emissions from carbon sequestration: forest land and grassland. There are no local emissions for two other categories, wetlands and wood products, and they have not been included in the table above.

The changes in these figures over time, especially over the longer term since 2005 are likely to reflect changing use of land in the city, and the way this land is managed. Unlike many other sectors, it is not expected that the Covid-19 -pandemic or recovery will have had major impacts on these figures.

5.9 Agriculture

	2005	2020	2021	Change on 2020	Change on 2005
Agriculture Electricity	0.2	0.3	0.5	+82.7%	+97.0%
Agriculture Gas	0.3	0.6	0.7	+19.7%	+145.0%
Agriculture 'Other'	0.7	0.6	0.7	+16.9%	+2.4%
Agriculture Livestock	2.6	1.6	1.4	-13.9%	-46.5%
Agriculture Soils	0.8	0.5	0.4	-34.9%	-54.6%
Agriculture Total	**4.6**	**3.6**	**3.6**	**+0.5%**	**-21.5%**

Table 7. Leicester's agriculture carbon emissions for 2005, 2020 and 2021.

Emissions from agriculture remain a very small part of the footprint, at 3.6 $ktCO_2e$ in 2021, a 0.5% increase on 2020. This reflects the very small amount of agricultural activity occurring within the city boundaries, with this sector responsible for just 0.3% of the city's emissions. The specific reasons for the changes within each category are unclear from the available data but may reflect changes at the small number of sites making up this sector.

5.10 Waste Management

	2005	2020	2021	Change on 2020	Change on 2005
Landfill	6.3	1.8	4.5	+148.1%	-28.8%
Waste Management 'Other'	17.3	19.0	20.3	+6.6%	+17.4%
Waste Management Total	**23.6**	**20.9**	**24.8**	**+18.9%**	**+5%**

Table 8. Leicester's waste management carbon emissions for 2005, 2020 and 2021.

Emissions from waste management have increased by 18.9% against 2020, and by 5% since 2005, and make up 1.9% of Leicester's carbon footprint (with data for these emissions categories being added to the footprint in full for the first time in 2021). There has been a very significant increase in emissions from landfill of 148.1% for the year, however these emissions are 28.8% lower than in 2005, and are also below their 2019 levels. The reasons for the specific changes in this category are unclear, with major variations in emissions experienced over the last 5 years.

Emissions from other waste management increased by 6.6% in 2021 and are 17.4% higher than in 2005. These emissions cover water treatment, sewage decomposition, composting and anaerobic digestion. The reason for the annual

change is unclear, as figures have fluctuated within a very similar range since 2006 but could potentially relate to the general increase in activity and emissions seen in other sectors for the year.

5.11 Carbon Emissions Per Person

Dividing the city's emissions by the number of city residents is another way of showing how emissions have fallen. Since the 2005 baseline Leicester's population has increased by around 64,500, an increase of 21.4%. As the city's carbon emissions have fallen in this time, emissions per capita (per person) have therefore fallen faster than for the city as a whole. As such, the overall change in emissions alone may not fully reflect progress made in decarbonisation in many sectors.

In 2021 Leicester's carbon emissions per capita were 3.6 tCO_2e, compared to 7.6 tCO_2e in 2005. This current figure is similar to a range of other cities of a similar size to Leicester, and below the national figure of 4.1 tCO_2e. Leicester's emissions per capita have fallen by 52% since 2005, which is also in line with other cities and ahead of the nation-wide reduction of 45%.

6. Approach

This report uses figures published by the UK Government's Department for Energy Strategy & Net Zero (DESNZ) for local authorities in the UK. More details about these figures, and how they are calculated is available here: UK local authority and regional carbon dioxide emissions national statistics - GOV.UK (www.gov.uk)

7. Boundary & Scope

The figures in this report cover emissions from fuel and energy (including generation and transmission of electricity), agriculture, land-use and waste management within Leicester. They do not cover the following areas:

- Emissions from some areas outside of local authority influence, including aviation and shipping.
- Emissions generated by the production of goods and services elsewhere, that are consumed within the city.

8. Baseline Year

The baseline year for discussion and analysis of emissions has been set as 2005. This has been chosen as it is the first year for which the UK Government-produced emissions data used to produce this report is available.

9. Targets

Following Leicester City Council's declaration of a climate emergency a new ambition was declared, for the city and council to reach net zero emissions by 2030 or as soon as possible, subject to the necessary support from national government.

10. Contact Details

This report was prepared by Aidan Davis, Sustainability Officer, on behalf of Leicester City Council.

For further information about Leicester City Council's climate action, please visit: https://www.leicester.gov.uk/your-council/policies-plans-and-strategies/environment-and-sustainability/climate-emergency/

If you wish to contact us, please email: sustainability@leicester.gov.uk