Leicester
City Council

MEETING OF THE ECONOMIC DEVELOPMENT, TRANSPORT AND CLIMATE EMERGENCY SCRUTINY COMMISSION

DATE: **WEDNESDAY, 31 AUGUST 2022**
TIME: **5:30 pm**
PLACE: **Meeting Room G.01, Ground Floor, City Hall, 115 Charles Street, Leicester, LE1 1FZ**

Members of the Commission

Councillor Joel (Chair)
Councillor Fonseca (Vice-Chair)

Councillors Porter, Rae Bhatia, Singh Sandhu, Whittle, Waddington and Valand

Members of the Commission are invited to attend the above meeting to consider the items of business listed overleaf.

A Sarang

For Monitoring Officer

***Officer contacts*:**
Sazeda Yasmin (Scrutiny Policy Officer)
Aqil Sarang (Democratic Support Officer),
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If you have any queries about any of the above or the business to be discussed, please contact:
Aqil Sarang, Democratic Support Officer on 0116 4545591.
Alternatively, email , or call in at City Hall.

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AGENDA

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1. APOLOGIES FOR ABSENCE

2. DECLARATIONS OF INTEREST

Members are asked to declare any interests they may have in the business to be discussed on the agenda.

3. MINUTES OF THE PREVIOUS MEETING **Appendix A (Pages 1 - 6)**

The minutes of the meeting of the Commission held on 23 June 2022 are attached and Members are asked to confirm them as correct record.

4. QUESTIONS, REPRESENTATIONS AND STATEMENTS OF CASE

The Monitoring Officer to report on any questions, representations and statements of case received in accordance with Council procedures.

5. PETITIONS

The Monitoring Officer to report on any petitions received in accordance with Council procedures.

6. TRAFFIC REGULATION ORDER - A50 FIVE WAYS JUNCTION **Appendix B (Pages 7 - 40)**

The Director for Planning, Development and Transportation submits a report on the Traffic Regulation Order.

Members of the Commission are recommended to pass any comments to the Director for Planning, Development and Transportation.

7. LEICESTER ENHANCED BUSES PARTNERSHIP **Appendix C (Pages 41 - 62)**

The Director for Planning Development and transportation submits a presentation providing the Commission with an update on the Leicester Buses Partnership.

Members of the Commission are recommended to note the presentation and pass any comments to the Director of Planning, Development and Transportation.

8. LEVELLING UP FUND 2 BID - CONNECTING ST MARGARET'S **Appendix D (Pages 63 - 76)**

The Director for Planning development and Transportation submits a report on the Levelling Up fund 2 bid.

Members of the Commission are requested to note the submission of the Connecting St Margaret’s bid to Round 2 of the Levelling Up fund and to pass any comments to the Director for Planning Development and Transportation.

9. CARBON NEUTRAL ROAD MAP **Appendix E (Pages 77 - 276)**

The Director for Estates and Building Services submits a report on the Carbon Neutral Road Map.

Members of the Commission are recommended to note the report and pass any comments to the Director for Estates and Building Services.

10. WORK PROGRAMME **Appendix F (Pages 277 - 284)**

For Members’ consideration, the work programme for the Commission is attached.

11. ANY OTHER BUSINESS

Leicester
City Council

Minutes of the Meeting of the
ECONOMIC DEVELOPMENT, TRANSPORT AND CLIMATE EMERGENCY SCRUTINY COMMISSION

Held: THURSDAY, 23 JUNE 2022 at 5:30 pm

P R E S E N T :

Councillor Joel (Chair)
Councillor Fonseca (Vice Chair)

Councillor Porter
Councillor Rae Bhatia
Councillor Sandhu
Councillor Valand
Councillor Whittle

*** ** ***

80. APOLOGIES FOR ABSENCE

The Chair took the opportunity to introduce the meeting and welcomed the new Members on the Commission.

Apologies for absence were received from Councillor Waddington.

81. DECLARATIONS OF INTEREST

Councillor Rae Bhatia declared that he had made comments to the Traffic Regulation Order (TRO) being discussed as part of the agenda, as it was within the ward he represented and opted to abstain from the discussions on this matter during the meeting.

82. MINUTES OF THE PREVIOUS MEETING

Councillor Porter requested that his virtual presence at the meeting of the Economic Development, Transportation and Climate Emergency Scrutiny Commission meeting on 23 March 2022 be recorded.

AGREED:

That the minutes of the meeting of the Economic Development, Transportation and Climate Emergency Scrutiny Commission be confirmed as a correct record.

83. TERMS OF REFERENCE

AGREED:

That the Terms of Reference for the Economic Development, Transportation and Climate Emergency Scrutiny Commission be noted.

84. MEMBERSHIP OF THE SCRUTINY COMMISSION 2022/23

AGREED:

That the Membership of the Economic Development, Transportation and Climate Emergency Scrutiny Commission 2022/23 be noted.

85. DATES OF THE SCRUTINY COMMISSION 2022/23

AGREED:

That the dates of the Economic Development, Transportation and Climate Emergency Scrutiny Commission be noted.

86. QUESTIONS, REPRESENTATIONS AND STATEMENTS OF CASE

The following question was presented to the Commission by Nicola Royale:

We (Climate Action Leicester and Leicestershire) fully support the new Beaumont Leys Park and Ride as, along with other Park and Ride sites, it has the potential to reduce car use within the city and improve connectivity for households without a car. We also support developments that include a provision for renewable energy generation where ever possible. So our question is: will the new Beaumont Leys Park and Ride site include installation of solar panels for renewable energy generation?

The deputy City Mayor for Environment and Transportation pointed out that the city Council were opening the new St Margarets Bus Station which was the first net Zero bus station in the UK, with a solar farm on its roof. It was also noted that the Council were participating in a program to decarbonise public sector buildings across the city with a £25 million investment.

In response to the question the Director for Planning, Transportation and Development noted that, the department was currently at the design stage and were looking at the inclusion of solar panels as part of the scheme.

The Chair thanked Nicola for the question and Officers for the response.

87. PETITIONS

The Monitoring officer noted that none had been received.

88. WORKPLACE PARKING LEVY - VERBAL UPDATE

At the Chair’s request, the City Mayor was invited to provide a verbal update on the Workplace Parking Levy (WPL) to the Commission.

As part of the update it was noted that:

- A definitive response was not yet available
- An overwhelming response to the consultation with over 4000 responses to the consultation including 20,000 comments
- There were a lot of responses in support of the proposal taking into consideration the positive impact on the environmental issues and also of people raising their concerns with the proposal on whether it was the equitable thing to do and who would be affected by the cost
- It was a manifesto commitment at the last election and it has gone to consultation
- Due to the large number of responses, Officers were now considering what has been said during the consultation, both pro and against before a summary is put together
- It was frustrating that a summary was not available due to the volume of responses, but when it is, it would be bought to Commission

It was further noted that if the proposal was to go ahead, it would not be something that can be implemented straight away and would take some time to deliver as there were processes that needed to be followed. As well as coming to the Commission it was noted that the proposal would need the sign off from the Secretary of State and would also go to Council for a decision.

Councillor Porter made a declaration that he was fronting a campaign against the WPL which had gathered 2000 signatures to date. The Member further raised his concerns on why this item was not brought to the Aylestone Ward Meeting the night before.

The Chair noted that this item was brought to commission on her request and that the Scrutiny Commission was not the place to discuss ward meeting matters.

The Member further enquired, if 25% of carbon emissions in Leicester came from road traffic, what percentage of Carbon emissions came from busses. With the Councils effort to introduce more electric busses to the City which was a step in the right direction and suggested that we needed more electric busses on the city to reduce the carbon emissions.

In response to the Members question, the Chair suggested that the Director for Planning, Development and Transportation be requested to provide a response to the Members question as part of the summary on the WPL consultation.

89. TRAFFIC REGULATION ORDER: BEAUVILLE DRIVE

Councillor Rae Bhatia abstained from the discussions on the item.

Councillor Dempster made a representation to the Commission as the local Ward Councillor for the Beaumont Leys ward and expressed her concerns for the safety of residents of Beauville Drive and the safety of school children.

The City Highways Director provided an overview of the Traffic Regulation Order (TRO) report and noted that a temporary scheme had been in place and had proved to be effective.

As part of the discussions Members noted that:

- The problem usually is a result of inconsiderate parking by parents during term time
- The objectors should not be dismissed, and their representations should be considered as part of the decision making process
- Term time restrictions should be considered

In response to the discussions, the City Highways Director noted that a response for term time restrictions had been provided and the option had not been dismissed.

AGREED:

1) That the City Highways Director be requested to consider the comments and responses from the Commission when making the delegated decision; and
2) That the report be noted.

90. CONSTRUCTION SKILLS HUB - UPDATE

The Assistant City Mayor for Jobs, Skills, Policy Delivery and Communications introduced the item on the Construction Skills Hub update.

The Regeneration Programme and Projects Manager delivered a presentation providing an overview of the Construction Skills Hub.

As part of the discussions, it was noted that:

- To look into the possibility of organising a specific group for women with an aim to increase female representation in construction
- Women in Construction was an existing project that the Housing Team were delivering, and there could be opportunities to engage with this initiative
- Members of the Commission welcomed the measures that the council was taking in a deprived area of the city

Officers noted that the service was now delivering targeted marketing and communications with certain groups.

A Member queried Officers on the cost of the course and whether the cost of the course could be reduced. It was noted that the pay back from investment was good, as there were a good success rate and people were going into long term work and noted that further information could be provided in the future as this course would continue. The Construction Industry Training Board (CITB) who were experienced in this sector had suggested that the cost of the course was fair.

The Chair noted that it was good to see a breakdown of ethnicity as part of the presentation and was pleased to see how service users had travelled the path into employment. It was suggested that these figures could be used to attract wider engagement across the city. The Chair requested that further updates on outcomes in the future and any information on obstacles for ethnic minority groups would be welcomed by the Commission.

91. EMPLOYMENT HUB - UPDATE

The Assistant City Mayor for Jobs, Skills, Policy Delivery and Communications introduced the item on the Employment Hub update and noted that there were a range of interventions for those who had been long term excluded, the strong positions people were in to take up work and the work being carried out to upskill the cities workforce.

The Employment Hub Manager delivered a presentation providing an overview of the Employment Hub.

As part of the discussions Members noted that:

- Members of the Commission had previously asked about the potential of providing HGV training courses. In response it was noted that the DWP and other private sector organisations already provided access to HGV training and the Employment Hub could help to signpost to these opportunities
- Support for SEND individuals was provided to help them find employment following which DWP supported any adaptations required. There was limited additional support on offer once employment had commenced
- Data concerning the project reach across sectors was being analysed to measure the effectiveness and to inform future targeting
- One of the benefits of the Employment Hub was how this brings together the support delivered by partner organisations. For example, the Prince's Trust supported young people, helping them into jobs via the Employment Hub. DMU offered higher level degree apprenticeships.

The Director for Tourism, Culture and Inward Investment noted that there was a range of work being undertaken and improvements had been made on collation and analysis of management information. Partner organisations that made referrals were being reviewed, with ongoing work to address under-represented communities also being supported via the Community Renewal Fund programme. The opportunity to provide further updates in the future was welcomed.

The Assistant City Mayor for Jobs, Skills, Policy Delivery and Communications noted that continuous reflection on how the interventions supported and benefitted service users and what and how improvements could be made supported future plans.

The Chair queried officers on the participation of people across the city and how Members could support increased participation across the city and the future plans to attract young talent with the Kickstart programme coming to an end. In response to the Chair the Director for Tourism, Culture and Inward Investment noted that there had been a complete change in terms of labour market supply and demand following the pandemic. Support from central Government was required to support future projects. It was further noted that a key priority for the organisation was considering various workforce planning and structures of services.

AGREED:

1) That the Director for Tourism, Culture and Inward Investment be requested to consider comments made by the Commission; and
2) That the report be noted.

92. WORK PROGRAMME

The Chair suggested that any proposed items for consideration be shared with the Chair or the Scrutiny Policy Officer.

93. ANY OTHER BUSINESS

There being no items of further business, the meeting closed at 7:22pm

WARDS AFFECTED:-
FOSSE/ABBEY

Leicester
City Council

Report for consideration by the Economic Development, Transport and Climate Emergency Scrutiny Commission **31 August 2022**

The Leicester (Consolidation) Traffic Regulation Order 2006 (Various Roads) (Amendment) Order (No. 329) 2022

1 **Purpose of Report**

1.1 To enable the Commission to give their views to the Director of Planning, Development and Transportation who will take them into account when considering whether or not to approve the proposed Traffic Regulation Order.

2. **Summary**

2.1 The Council plans to undertake work to reconstruct the junction of Groby Road/Blackbird Road/Woodgate/Fosse Road North (known as “Five Ways”) for the purpose of enabling development at Waterside, to improve road safety, to improve the amenity of Woodgate, to improve amenity and access for pedestrians, cyclists, and access for public transport and for the strategic management of traffic flow.

2.2 The scheme was presented to the EDTCE on 23 March 2022 alongside other Transforming Cities Fund projects. The Commission supported the scheme, with some concerns raised regarding flooding (see Appendix D)

2.3 Due to the changed nature of the roads, it was therefore proposed that a Traffic Regulation Order should be implemented on the grounds set out in paragraph 4.3.

2.4 The proposed Order was advertised from Monday 11th July 2022 to Monday 1st August 2022. Two objections were received within the objection period. One objection was received after the deadline, therefore has been rejected from the formal process although the objectors’ points have been included in the consultation report for the scheme. Written replies were sent to objectors and a meeting was held with two of the objectors on Thursday 11th August 2022. Officers explained to the objectors the reasons for proposing the scheme and asked the objectors to reconsider their objections in light of the information given. None of the objections have been withdrawn.

2.5 The Order does not advertise the introduction of the bus lane on Fosse Road North, but is instead limited to the amendment of waiting, loading, and manoeuvre restrictions. The bus lane will be introduced in a separate order.

3. Recommendation

3.1 It is recommended that:

(1) the members of the Commission give their views for the Director of Planning, Development and Transportation to take into account when considering whether or not to approve the proposed Traffic Regulation Order.

4. Background

4.1 As part of the Transforming Cities Fund, the highway around Groby Road and Woodgate will be redesigned to improve the highway for walkers and cyclists and improve the public realm along Woodgate.

4.2 The scheme was presented to the EDTCE on 23 March 2022. The full minute is included in Appendix D. In summary, the following comment was made by the Commission:

...Members noted that:

- *Members of the Commission was in support of the schemes presented as they drove the objective of sustainable transportation in the city...*
- *Concerns were raised with the 5 ways junction on Woodgate where there was an issue with flooding when there were heavy rains...*
- *The impact of proposals on existing roads and the consideration of restricting access during peak periods...*

In response to Members queries and concerns, Officers noted that: ...

- *The overall reconstruction of the 5 ways junction would address the flooding concerns as Severn Trent would ensure the drainage was sufficient...*

AGREED:

1) That the presentation be noted, and

2) That the Director for Planning Development and Transportation be requested to consider the comments and views raised by the Commission.

4.3 Due to the changed nature of the roads, it was therefore proposed that a Traffic Regulation Order should be implemented on the following grounds:

1. for avoiding danger to persons or other traffic using the road or any other road or for preventing the likelihood of any such danger arising,

2. for facilitating the passage on the road or any other road of any class of traffic (including pedestrians),

3. for preserving or improving the amenities of the area through which the road runs

4.4 The effect of the Order will be to:

- Prohibit waiting and loading at any time along the length of Fosse Road North.
- Prohibit waiting and loading at any time at major junctions in the scheme area.
- Prohibit waiting at any time and loading 7.30 – 9.30am and 4 – 6pm Mon – Fri along the length of Woodgate and Abbey Gate, where the restriction does not already apply.
- Introduce limited waiting and loading bays on Woodgate.
- Prohibit the right turn from Woodgate to Blackbird Road.
- Prohibit the left turn from Blackbird Road to Woodgate
- Prohibit the use of motor vehicles on a section of the service road on Groby Road and Blackbird Road.
- Exclude cyclists from the one-way restriction on Great Central Street.

4.5 The scheme will look to introduce a new bus lane on Fosse Road North (not part of this Order). In order to avoid danger to persons or other traffic using the road, and to facilitate passage on the road, no waiting or loading at any time is proposed. This will prevent vehicles having to enter the bus lane to pass a stationary vehicle.

4.6 No waiting or loading at any time is proposed at the junction of Groby Road / Blackbird Road and Woodgate / Abbey Gate. This is to avoid danger to persons or other traffic using the road, and to facilitate passage on the road, as it prevents stationary vehicles blocking visibility at the junctions.

4.7 Due to the narrower carriageway on Woodgate as a result of the cycleways being installed, no waiting at any time, no loading 7.30 – 9.30am and 4 – 6pm Mon – Fri is proposed. The road is largely already covered by this restriction, with a few exceptions. This is for the purpose of avoiding danger to persons or other traffic using the road, facilitating passage on the road, and preserving or improving the amenities of the area as it will prevent vehicles parking on the road or cycleway.

4.8 Two limited waiting bays and a loading bay are proposed on Woodgate. This will avoid danger to persons or other traffic using the road, and facilitate passage on the road, as they will provide the shops with an area for loading and parking spaces for shoppers.

4.9 The right turn from Woodgate to Blackbird Road, and the left turn from Blackbird Road to Woodgate are proposed to be prohibited. This is to avoid danger to persons or other traffic using the road by maintaining safe and efficient traffic signal control within the design of the new junction. Access to Woodgate is available through other routes.

4.10 Due to the new cycleway on the service road on Groby Road and Blackbird Road, a prohibition of motor vehicles at all times is required. This will avoid danger to and facilitate passage of cyclists and pedestrians.

4.11 A new bi-directional cycleway will be installed along Great Central Street. In order to facilitate passage of cycles, the one-way along Great Central Street will be amended to exclude cyclists.

4.12 The TRO was advertised on 11th July 2022 and two objections against the proposals were received. A further objection was received after the deadline but has been considered. Issues were raised around the banning of movement between Woodgate to Blackbird Road and Blackbird Road to Woodgate, parking issues, the impact of new development and the design of cycle ways and footways with regard to pedestrians.

4.13 The Council has tried to resolve the issues raised by the objectors. This includes written communication and a meeting with Objectors. None of the objections have been withdrawn and therefore two unresolved objections remain. The objections are discussed below and presented in full in Appendix C.

4.14 The proposal showing the waiting, loading and U turn restrictions can be seen on the plan in Appendix A – TRO Plan.

4.15 The proposed TRO is to amend the existing 2006 Consolidation Order and the proposed schedules are shown in Appendix B.

4.16 The formal purpose of the proposed TRO is to facilitate the passage of traffic (including pedestrians and cyclists), for avoiding danger to persons or other traffic using the road and to preserve amenity.

5. Consideration of Objections

5.1 Each objection is summarised below and is presented in full in Appendix C, along with the reply sent by officers. The comments in this report cover the objection to specific Traffic Regulation Orders for the scheme and not the scheme itself. The objectors make several points about the nature of the scheme. These have been added to the public consultation report on the project. A meeting was held with the objectors on the 11th August 2022 to discuss their objections.

5.2 Objector A is concerned about the prohibition of the left turn from Blackbird Road into Woodgate

5.3 Objector B is concerned about the prohibition of the left turn from Blackbird Road to Woodgate as well as the bus lane on Fosse Road North.

5.4 Objector C is concerned about the banning of movements from Blackbird Road to Woodgate and Woodgate to Blackbird Road.

5.5 In the meeting with Objectors, they explained that removing the left turn from Blackbird Road to Woodgate could have adverse effects on the residential streets by causing some residents to rat run through Central Road and or otherwise take other unsuitable routes to their destination. This may cause some routes, for example Bradgate Street, to be more congested and increase the risk of accidents. With regard to the proposed bus lane on Fosse Road North, it was said that this would make turning right from Central Road onto Fosse Road and right in from Fosse Road to Central Road more difficult, and that turning right from Fosse Road to Woodgate could be harder too as it meant joining the offside lane at the end of the bus lane and this may become congested. With regard to the prohibition of the right turn from Woodgate to Blackbird, the objectors said this would mean taking a different route to their home, perhaps through other residential streets. Issues raised by objectors in relation to parking issues, the impact of new development and the design of cycle ways and footways with regard for pedestrians are referred to in the public consultation report.

6. Conclusion

6.1 Objections have been received and officers have engaged with the objectors to explain the purposes of the order and to resolve their concerns.

6.2 In relation to the proposed prohibition of the left turn from Blackbird Road into Woodgate. Officers have noted this objection but do not agree that while there would be some limited inconvenience to some residents, that this would not be disproportionate when compared to the benefits of the overall scheme. Relatively few vehicles turn left from Blackbird Road into Woodgate and while this will be important to some drivers, removing this movement enables a more efficient junction with increased urban design and environmental benefits for Woodgate. The proposed bus lane (to be formally advertised separately to this Order) is intended to reduce delay for the 14, 14A and 162 bus services. On approaching the Fiveways junction the bus lane is set back to accommodate the estimated length of queueing traffic to allow right turning traffic to join that lane and turn right. This right turn is to be physically segregated from other traffic movements. Prohibiting the right turn from Woodgate into Blackbird Road is central to the scheme and the declassification of Woodgate from an “A” road, it’s reconstruction as a residential street, and the strategic diversion of through traffic to enable Waterside development.

6.3 Members of the commission are requested to give their views to the Director of Planning, Development and Transportation to take into account when considering whether or not to make the proposed Traffic Regulation Order. Commission members should note the proposed orders are intended to manage traffic for a scheme that the Council has decided to construct and the purpose of the orders is to facilitate the flow of traffic, preserve amenity and help ensure road safety.

7. Financial Implications

7.1 The estimated cost of processing the Traffic Regulation Order is £10,000 to be financed from the scheme.

7.2 The financial implications are written and confirmed by

Stuart McAvoy **Dated: 05.08.2022**

Stuart McAvoy, Acting Head of Finance - Finance

8. Legal Implications

8.1 The Council can introduce Traffic Regulation Orders under the Road Traffic Regulations Act 1984. In introducing these, the Council should comply with the provisions of the Local Authorities' Traffic Orders (Procedures) (England and Wales) Regulations 1996. Officers should have taken due regard to the requirements under Section 122 of the 1984 Act to ensure the safe and expeditious movement of traffic, whilst considering the requirements for parking facilities on and off the highway, and to undertake the appropriate consultation with the appropriate statutory bodies.

8.2 Officers need to be satisfied that for avoiding danger to persons or other traffic using the road to which the Order relates or any other road it is requisite that subsection 3(1) of the Act shall not apply to the Order. In determining the recommendations officers should have regard to the requirements of Section 16 of the Traffic Management Act 2004 to ensure the safe and expeditious movement of traffic.

8.3 The formal reasons for these proposals are for the reasons specified in section 1(1) (a), (c), and (f) of the 1984 Act.

8.4 The legal implications are written and confirmed by

Bina Tailor **Dated: 8/8/2022**

Bina Tailor, Legal Officer - Legal Services.

9 Powers of the Director

9.1 Under the constitution of Leicester City Council, delegated powers have been given to the Chief Operating Officer to approve amendments. The legislation that confers authority on Leicester City Council to make these amendments, is covered by the 1984 Road Traffic Regulation Act and the Local Authorities' Traffic Orders (Procedures) (England and Wales) Regulations 1996. The Chief Operating Officer has arranged for this power to be exercised by the Director of Planning Development. and Transportation.

Report Author

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Appendix A:

TRO Plan for scheme attached as PDF.

<u>Appendix B:</u>

Roads are shown in alphabetical order

Proposed amendments are shown in **bold**

ABBEY GATE

North-west Side

Part 200 **from its junction with Woodgate to a point 15 metres north-east of its junction with Woodgate**

Part 204 **from a point 15 metres north-east of its junction with Woodgate** to a point 73 metres north-east of its junction with Woodgate

Part 215 from a point 73 metres north-east of its junction with Woodgate to a point 37 metres north-east of the south-west side of its junction with Bradgate Street

Part 200 from a point 37 metres north-east of the south-west side of its junction with Bradgate Street to its junction with Ravensbridge Drive

South-east Side

Part 200 from its junction with Ravensbridge Drive to a point 37 metres north-east of a point opposite the south-west side of its junction with Bradgate Street

Part 215 from a point 37 metres north-east of a point opposite the south-west side of its junction with Bradgate Street to a point 73 metres north-east of its junction with Frog Island

Part 204 from a point 73 metres north-east of its junction with Frog Island to **a point 15 metres south-east of its junction with Frog Island**

Part 200 **a point 15 metres north-east of its junction with Frog Island to its junction with Frog Island**

ABBEY GATE SPUR

North-west Side

Part 215 from its junction with Abbey Gate to its north-east extremity

South-east Side

Part 215 from its north-east extremity to its junction with Abbey Gate

BLACKBIRD ROAD SERVICE ROAD SOUTH

Part 112 **Prohibition of driving of motor vehicles** from its junction with Groby Road Service Road to a point 7 metres south of its junction with Buckminster Road Service Road

BLACKBIRD ROAD

Part 101 Prohibited U Turn at its junction with Abbey Lane, from the east bound carriageway to the west bound carriageway

Part 101 Prohibited U Turn at the gap in the central reservation approximately 130 metres west of Abbey Lane, from the east bound carriageway to the west bound carriageway

Part 101 Prohibited U Turn at its junction with Parker Drive, from eastbound to westbound

Part 101 Prohibited U Turn at its junction with Anstey Lane & Ravensbridge Drive, from the south-west bound carriageway to the north-east bound carriageway

Part 101 Prohibited U Turn at its junction with Anstey Lane & Ravensbridge Drive, from the north-east bound carriageway to the south-west bound carriageway

Part 101 Prohibited U Turn At its junction with Groby Road, from the south-west bound carriageway to the north-east bound carriageway

Part 102 Prohibited Right Turn at the gap in central reservation, approximately 130 metres west of Abbey Lane, from the east bound carriageway to the superstore access road

Part 103 **Prohibited Left Turn at its junction with Woodgate from Blackbird Road to Woodgate**

North & West Side

Part 200 **from its junction with Groby Road to a point 43 metres north-east of its junction with Groby Road**

Part 204 **from a point 43 metres north-east of its junction with Groby Road** to a point opposite the south-east side of its junction with Bradgate Street

Part 216 from a point opposite the south-east side of its junction with Bradgate Street to a point 74 metres south-west of its junction with Anstey Lane

Part 204 from a point 74 metres south-west of its junction with Anstey Lane to a point 78 metres north-east of its junction with Anstey Lane, including the layby

Part 216 from a point 78 metres north-east of its junction with Anstey Lane to a point 15 metres south-west of its junction with Cornwall Road

Part 204 from a point 15 metres south-west of its junction with Cornwall Road to its junction with Cornwall Road, including the gap in the central reservation

Part 216 from its junction with Cornwall Road to a point 99 metres north of its junction with Cornwall Road

Part 204 from a point 99 metres north of its junction with Cornwall Road to its junction with Abbey Lane

South & East Side

Part 204 from its junction with St Margaret's Way to its junction with Devonshire Road, including the gaps in the central reservation

Part 501 from a point 27 metres west of its junction with St Margaret's Way to a point 53 metres west of its junction with St Margaret's Way

Part 216 from its junction with Devonshire Road to a point 15 metres north-east of its junction with Exmoor Avenue

Part 204 from a point 15 metres north-east of its junction with Exmoor Avenue to its south-east junction with Exmoor Avenue

Part 212 from its junction with Exmoor Avenue to a point 74 metres north-east of its junction with Ravensbridge Drive

Part 204 from a point 74 metres north-east of its junction with Ravensbridge Drive to a point 87 metres south-west of its junction with Ravensbridge Drive, including the layby

Part 216 from a point 87 metres south-west of its junction with Ravensbridge Drive to a point 146 metres north-east of its junction with Bradgate Street

Part 204 from a point 146 metres north-east of its junction with Bradgate Street to a point 44 metres north-east of its junction with Bradgate Street

Part 216 from a point 44 metres north-east of its junction with Bradgate Street to a point 10 metres north-east of its junction with Bradgate Street

Part 204 from a point 10 metres north of its junction with Bradgate Street to **a point 32 metres north-east of its junction with Woodgate**

Part 200 from a point 32 metres north-east of its junction with Woodgate to its junction with Woodgate

Part 501 from a point 14 metres south of its junction with Bradgate Street to a point 39 metres south of its junction with Bradgate Street

Bonchurch Street

Part 100	from its junction with Fosse Road North to its junction with Repton Street, in that direction

North-east Side

Part 207	from its south-eastern extremity to a point 9 metres north-west of its junction with Repton Street
Part 207	from a point 4 metres south-east of its junction with Dunton Street to a point 9 metres north-west of its junction with Dunton Street
Part 207	from a point 4 metres south-east of its junction with Bassett Street to a point 9 metres north-west of its junction with Bassett Street
Part 207	from a point 4 metres south-east of its junction with Marshall Street to a point 5 metres north-west of its junction with Marshall Street
Part 224	from a point 28 metres south-east of its junction with Fosse Road North to a point 9 metres south-east of its junction with Fosse Road North
Part 200	from a point 9 metres south-east its junction with Fosse Road North to its junction with Fosse Road North

South-west Side

Part 200	**from its junction with Fosse Road North to a point 8 metres south-east of its junction with Fosse Road North**
Part 207	**from a point 8 metres south-east of its junction with Fosse Road North** to a point 17 metres south-east of its junction with Fosse Road North
Part 207	from a point 5 metres north-west of a point opposite the north-west side of its junction with Dunton Street to its south-eastern extremity

CENTRAL ROAD

Part 100	One Way Street from its junction with Repton Street to its junction with Fosse Road North, in that direction

North-east Side

Part 200	from its junction with Fosse Road North to a point **10 metres** south-east of its junction with Fosse Road North
Part 215	from a point **10 metres** south-east of its junction with Fosse Road North to a point 9 metres north-west of its junction with Balfour Street

Part 207 from a point 9 metres north-west of its junction with Balfour Street to a point 9 metres south-east of its junction with Balfour Street

Part 207 from a point 5 metres north-west of its junction with Marshall Street to a point 9 metres south-east of its junction with Marshall Street

Part 207 from a point 5 metres north-west of its junction with Bassett Street to a point 9 metres south-east of its junction with Bassett Street

Part 207 from a point 5 metres north-west of its junction with Dunton Street to a point 9 metres south-east of its junction with Dunton Street

Part 207 from a point 9 metres north-west of its junction with Repton Street to a point 5 metres south-east of its junction with Repton Street

South-west Side

Part 207 from a point 5 metres south-east of its junction with Repton Street to a point 9 metres north-west of its junction with Repton Street

Part 207 from a point 9 metres south-east of its junction with Dunton Street to a point 5 metres north-west of its junction with Dunton Street

Part 207 from a point 9 metres south-east of its junction with Bassett Street to a point 5 metres north-west of its junction with Bassett Street

Part 207 from a point 9 metres south-east of its junction with Marshall Street to a point 5 metres north-west of its junction with Marshall Street

Part 200 from a point **10 metres** south-east of its junction with Fosse Road North to its junction with Fosse Road North

FOSSE ROAD NORTH

Part 101 **Prohibited U Turn at its junction with Groby Road from the north-east bound carriageway to the south-west bound carriageway**

Eastern Side

Part 200 **from its junction with Groby Road to a point 33 metres south-west of its junction with Groby Road**

Part 200 **from a point 66 metres north-east of its junction with Central Road to a point 10 metres south-west of a point opposite the south-west side of its junction with Stephenson Drive**

Part 204 **from a point 10 metres south-west of a point opposite the south-west side of its junction with Stephenson Drive** to a point 5 metres south-west of its junction with Tudor Road

Part 212	from a point 5 metres south-west of its junction with Tudor Road to a point 71 metres south-west of its junction with Tudor Road
Part 224	from a point 71 metres south-west of its junction with Tudor Road to a point 6 metres north-east of its junction with Empire Road
Part 216	from a point 71 metres south-west of its junction with Tudor Road to a point 6 metres north-east of its junction with Empire Road
Part 204	from a point 6 metres north-east of its junction with Empire Road to its junction with Battenberg Road excluding the lay-by between 14 metres and 48 metres south-west of its junction with Empire Road
Part 224	the lay-by from a point 14 metres south-west of its junction with Empire Road to a point 48 metres south-west of its junction with Empire Road
Part 204	from its junction with Battenberg Road to a point 22 metres south-east of its junction with Paget Road
Part 207	from a point 92 metres north of its junction with Bosworth Street to a point 41 metres north of its junction with Glenfield Road East
Part 204	from a point 41 metres north of its junction with Glenfield Road East to its junction with Glenfield Road East

Western Side

Part 204	from its junction with Glenfield Road to a point 39 metres north of its junction with Glenfield Road
Part 207	from a point 39 metres north of its junction with Glenfield Road to a point 39 metres south-east of its junction with Henley Road
Part 204	from a point 39 metres south-east of its junction with Henley Road to its junction with Tetuan Road
Part 200	from its junction with Tetuan Road to its junction with Pool Road
Part 204	from its junction with Pool Road **a point 10 metres south-west of its junction with Stephenson Drive**
Part 200	**from a point 10 metres south-west of its junction with Stephenson Drive to a point 66 metres south-west of its junction with Groby Road**
Part 204	**from a point 66 metres south-west of its junction with Groby Road to a point 15 metres south-west of its junction with Groby Road**
Part 200	**from a point 15 metres south-west of its junction with Groby Road to its junction with Groby Road**

FROG ISLAND

North-east Side

Part 200 **from its junction with Abbey Gate to a point 15 metres south-east of its junction with Abbey Gate**

Part 204 **from a point 15 metres south-east of its junction with Abbey Gate** to its junction with Northgate Street

South-west Side

Part 204 from its junction with Northgate Street to **a point 11 metres south-east of its junction with Woodgate**

Part 200 **from a point 11 metres south-east of its junction with Woodgate to its junction with Woodgate**

GREAT CENTRAL STREET

Part 128 **One Way street except cycles from its junction with All Saints Open to its junction with Soar Lane in that direction**

Part 103 north-west bound from Great Central Street into All Saints Road

Part 135 Prohibition of driving of motor vehicles at any time (except for loading 5am — 8am), introduce no waiting at any time and no loading between 8am and 5am the following day. Both sides from Friars Causeway to a point 80 metres north.

East Side

Part 200 from its junction with Northgates to a point 44 metres south of a point opposite the south side of its junction with Soar Lane including the slip road to Northgates

Part 204 from a point 44 metres south of a point opposite the south side of its junction with Soar Lane to a point 56 metres south of a point opposite the south side of its junction with Soar Lane

Part 224 from a point 56 metres south of a point opposite the south side of its junction with Soar Lane to a point 82 metres south of a point opposite the south side of its junction with Soar Lane

Part 207 from a point 82 metres south of a point opposite the south side of its junction with Soar Lane to a point 21 metres south of its junction with All Saints Open

Part 207 from a point 21 metres south of its junction with All Saints Open to a point 46 metres south of its junction with All Saints Open

Part 224 from a point 46 metres south of its junction with All Saints Open to a point 80 metres north of its junction with Friars Causeway

Part 251	From a point 80 metres north of its junction with Friars Causeway to its junction with Friars Causeway
Part 207	from its junction with Friars Causeway to its junction with Vaughan Way

West Side

Part 200	from its junction with Vaughan Way to a point opposite the north side of its junction with Friars Causeway
Part 251	from its junction with Friars Causeway to a point 72 metres south of its junction with All Saints Road
Part 207	from a point 72 metres south of its junction with All Saints Road to a point 56 metres south of its junction with All Saints Road
Part 215	from a point 56 metres south of its junction with All Saints Road to a point 48 metres south of its junction with All Saints Road
Part 207	from a point 48 metres south of its junction with All Saints Road to a point 30 metres south of its junction with All Saints Road
Part 200	from a point 30 metres south of its junction with All Saints Road to a point 13 metres north of its junction with All Saints Road
Part 204	from a port 13 metres north of its junction with All Saints Road to a point 31 metres north of its junction with All Saints Road
Part 200	from a point 31 metres north of its junction with All Saints Road to its junction with Soar Lane

Groby Road

Part 101	at its junction with Fosse Road North from the south-east bound carriageway to the north-west bound carriageway
Part 101	at the end of the central reservation 40 metres south-east of its junction with Brading Road from the south-east bound carriageway to the north-west bound carriageway
Part 101	at its junction with Garland Crescent and Brading Road in both directions
Part 102	at its junction with Brading Road from Groby Road into Brading Road
Part 101	at its junction with Heathley Park Drive in both directions
Part 109	into the north bound carriageway from the south bound carriageway at the gap in the central reservation near its junction with Combe Close

North-east Side

Part 207	from the City / County Boundary to a point its junction with New Parks Way
Part 200	from its junction with New Parks Way to a point 60 metres north-west of a point in line with the north-west side of the turning head of Amhurst Close
Part 204	from a point 60 metres north-west of a point in line with the north-west side of the turning head of Amhurst Close to a point 50 metres north-west of its junction with Heathley Park Drive
Part 207	from a point 50 metres north-west of its junction with Heathley Park Drive to a point opposite 69 metres north-west of its junction with Mary Road
Part 204	from a point 69 metres north-west of its junction with Mary Road to a point 9 metres south-east of a point opposite the north-west side of its junction to its junction with Combe Close
Part 204	from its junction with Combe Close to a point 25 metres north-west of its junction with Medina Road Close (Save as this restriction shall only have effect where it is applied to the carriageway and the footway or cycleway)
Part 200	from a point 25 metres north-west of its junction with Medina Road to its junction with **Woodgate** (Save as this restriction shall only have effect where is it applied to the carriageway and the footway or cycleway)

South-west Side

Part 200	from its junction with **Woodgate** to a point 25 metres north-west of a point opposite the north-west side of its junction with Medina Road
Part 204	from a point 25 metres north-west of a point opposite the north-west side of its junction with Medina Road to a point 136 metres south-east of a point opposite the south-east side of its junction with Brading Road
Part 200	from a point 136 metres south-east of a point opposite the south-east side of its junction with Brading Road to a point 69 metres north-west of its junction with Mary Road
Part 207	from a point 69 metres north-west of its junction with Mary Road to a point 244 metres north-west of its junction with Darlington Road
Part 204	from a point 244 metres north-west of its junction with Darlington Road

to a point 60 metres north-west of a point in line with the north west side of the turning head of Amhurst Close Excluding the lay-by between 288 and 324 metres north-west of its junction with Darlington Road

Part 200 from a point 60 metres north-west of a point in line with the north west side of the turning head of Amhurst Close to its junction with New Parks Way

Part 207 from its junction with New Parks Way to the City / County Boundary

GROBY ROAD SERVICE ROAD NORTH

Part 112 Prohibition of driving of motor vehicles from a point 20 metres west of its junction with Blackbird Road Service Road to its junction with Blackbird Road Service Road

North-east Side

Part 200 from its junction with Groby Road to a point 20 metres west of its junction with Blackbird Road Service Road

South-west Side

Part 200 from a point 20 metres west of its junction with Blackbird Road Service Road to its junction with Groby Road

Marshall Street

Part 100 from its junction with Central Road to its junction with Woodgate, in that direction

Part 100 from its junction with Central Road to its junction with Bonchurch Street, in that direction

North-west Side

Part 207 from its junction with Bonchurch Street to a point 4 metres north-east of its junction with Bonchurch Street

Part 207 from a point 5 metres south-west of its junction with Central Road to a point 5 metres north-east of its junction with Central Road

Part 200 from a point 5 metres south-west of its junction with Woodgate to its junction with Woodgate

South-east Side

Part 200 from its junction with Woodgate **to a point 5 metres south-west of its junction with Woodgate**

Part 207 from a point 5 metres north-east of its junction with Central Road to a point 5 metres south-west of its junction with Central Road

Part 207 from a point 9 metres north-east of its junction with Bonchurch Street to its junction with Bonchurch Street

STEPHENSON DRIVE

Northern Side

Part 207 from the Roundabout at Sandhurst Road to a point 25 metres south-east of its junction with Samson Road

Part 207 from a point 85 metres west of its junction with Fosse Road North to **a point 25 metres west of its junction with Fosse Road North**

Part 200 from a point 25 metres west of its junction with Fosse Road North to its junction with Fosse Road North

Southern Side

Part 200 from its junction with Fosse Road North to a point 25 metres west of its junction with Fosse Road North

Part 207 **from a point 25 metres west of its junction with Fosse Road North** to a point 85 metres west of its junction with Fosse Road North

Part 207 from a point 7 metres south-east of its junction with Beatrice Road to the Roundabout at Sandhurst Road

WOODGATE

Part 101 Prohibited U turn at its junction with Blackbird Road from the west bound carriageway to the east bound carriageway

Part 102 Prohibited right turn from Woodgate to Blackbird Road

North Side

Part 200 from its junction with Groby Road to a point 15 metres east of its junction with Blackbird Road

Part 204 **from a point 15 metres east of its junction with Groby Road to a point 30 metres north-west of its junction with Frog Island**

Part 200 from a point 30 metres north-west of its junction with Frog Island to its junction with Frog Island

South Side

Part 200 from its junction with Frog Island to a point 30 metres north-west its junction with Frog Island

Part 204 **from a point 30 metres north-west its junction with Frog Island to a point 1 metres east of its junction with Marshall Street excluding the laybys**

Part 224 **the layby from a point 44 metres south-east of its junction with Dunton Street to a point 17 metres south-east of its junction with Dunton Street**

Part 308 **the layby from a point 7 metres west of its junction with Dunton Street to a point 32 metres west of its junction with Dunton Street**

Part 200 **from a point 1 metre east of its junction with Marshall Street to a point 1 metre west of its junction with Marshall Street**

Part 204 **from a point 1 metre west of its junction with Marshall Street to a point 7 metres east of its junction with Groby Road excluding the layby**

Part 224 **the layby from a point 4 metres west of its junction with Marshall Street to a point 29 metres west of its junction with Marshall Street**

Part 200 **from a point 7 metres east of its junction with Groby Road to its junction with Groby Road**

Appendix C – Unresolved Objections

Objections Received by Email or Letter

OBJECTOR 'A'	1.1
Officers Response	1.2
OBJECTOR 'B'	2.1
Officers Response	2.2
OBJECTOR 'C'	3.1
Officer Response	3.2

The unresolved objection received by email and officer's response are as follows: -

OBJECTION FROM OBJECTOR 'A' – DATED 31.07.2022

1.1. Objector 'A' sent in these comments:

I understand that you are accepting commentary from residents on the road development plans for the Fiveways junction and Woodgate. I am writing, having looked at the plans, to share some concerns.

No left turn into Woodgate

The knock-on impact of this concerns me greatly. What is the plan for redirecting drivers who would otherwise use Woodgate to get to Slater School, the shops along Woodgate and off Pingle Street, the churches, or the shops along Abbey Gate (which cannot be accessed via Ravensbridge Drive and Vaughan Way, as there is no right turn when coming into the city centre from the Abbey Park direction)?

It is likely that car drivers will access Woodgate anyway using Bonchurch Street and the streets leading down to Woodgate in order to maintain straightforward access to the shops and facilities they usually use.

When the junction at the top of Buckminster Road was blocked off, the side effect of that was an 81% increase in traffic along Colwell Road, a street which is much narrower and less able to take the extra traffic than Buckminster Road, and one potential outcome is a higher risk of accidents. Likewise, this plan being introduced will increase traffic in the back streets of Woodgate – which has pedestrian traffic from the junior school and the adventure playground, and limited passing spaces on the terraced streets. It worries me that the Council is aware of this huge increase and is happy to leave things as they are, as it makes me feel that if this change is made, it will be kept despite the impact on Woodgate residents.

I don't want our streets to become less safe than they are now.

Removing car access to Groby Street Surgery

A disproportionate percentage of people who use doctor's surgeries are elderly and disabled, for obvious reasons. Removing all parking spaces will disproportionately impact a group of people who are very likely to have mobility problems (and their carers). There should be parking for disabled people and others who may not consider themselves disabled but nevertheless have significant difficulties in walking (it is very common attitude in elderly people for example to not define as disabled even when they have significant health limitations). Has an equality impact assessment been conducted on this part of the plan? What was the outcome?

Car parking outside the shops on Buckminster Road

The number of cars parked on the ground in front of the shops has increased since the flats above the shops were built, which suggests that giving planning permission for buildings with no accompanying plans for parking does not work to deter car usage when other options are available, it simply shifts the problem to a different area. Removing these spaces will not take away the need for parking spaces for shop staff or customers, some of whom may be working antisocial hours when public transport isn't available or where the distance or their personal circumstances mean they can't cycle.

Additional impact of new developments

There are two housing planning proposals currently in play for the car wash on Fiveways and the car hire business on Fosse Road North; there are existing plans for housing on the old foundry site at the end of Bonchurch Street, and the new school. All of these will greatly increase the number of local residents by several hundreds, and consequently, the local traffic using the back streets of Woodgate. Adding additional traffic to that, in the form of people using the streets as a rat run, is going to make the area unbearable to live in.

This is particularly the case given the two lanes for turning out of Central Road are being merged into one, as it will inevitably increase queues. Local residents and anyone trying to enforce parking restrictions will bear the brunt of this. There is no need for this change.

This concern isn't just about parking – though that will become far more difficult, as there is no way to restrict new residents from owning a car. It's also about safety and air pollution levels.

I appreciate that your focus is on transport rather than planning permission for housing, but the two are very closely related. The impression I get in terms of the attitude to planning permission for parking at new housing developments is that of deliberately making it much more difficult to park or drive anywhere as a deterrent to owning a car. However, I do not believe that this alone is a real deterrent - a real deterrent is a useful alternative which serves local needs; if this has been taken into account, it isn't clear in the plan, not least because it isn't clear the plans for the road are joined up with the plans for the school and new housing developments. The Fiveways redevelopment needs to go hand in hand with a local transport plan which includes, for example, bringing one of the national car clubs to Leicester, which would at least serve the needs of people who need occasional use of a car.

Not everyone can cycle and the people who can't tend to be the most disadvantaged. I appreciate the work on cycle lanes but where is the concurrent work on encouraging people to cycle, and providing a cost-effective alternative for people who can't? I speak as a cyclist who doesn't own a car; I always try to minimise my car use but appreciate that some people rely on their car. Fosse is a poor area. In current circumstances we need to be realistic and not just make life more difficult for people who are already struggling.

1.2 Officer's Response

Thank you for your email dated 31st July 2022. You have raised an objection to the proposed Traffic Regulation Order that looks to prohibit turning movements from Blackbird Road to Woodgate.

You have raised concerns about the effects of the Order restricting movements at the junction and that you think this would result *i*n an unnecessary diversion.

The purpose of prohibiting this/these movement/ is to make improvements to the junction of Woodgate/Blackbird Road/Groby Road and Fosse Road North. We expect this to achieve improvements in safety, to allow us to construct better crossings and a cycle route, to enable strategic re-routing of traffic so that Woodgate is no longer an "A" Road, to enable the Council to make environmental improvements in Woodgate, including better footways.

I do appreciate that this may mean that some journeys by car must be made by alternative routes.

I hope that this has answered your concerns. If you are satisfied and you would like to withdraw your objection, could you please let me know, either at the email address listed at the top of the letter or the Council's postal address shown at the bottom of the letter.

If I do not hear from you by Friday 12th August 2022, I will assume that you would like your objection to stand. Should this be the case, it is our intention to present an Objectors Report to the Director of Planning, Development and Transportation for his final decision.

If you would like to meet relevant officers to discuss this matter and others mentioned in your email further, we will hold an Objectors Meeting with you, the minutes of which will also be presented to the EDTCE. If so, please get in touch by the ***Wednesday 10th August 2022, 5pm*** using the contact details provided if this is the case.

OBJECTION FROM OBJECTOR ‘B’ – DATED 31.07.2022

2.1 Objector ‘B’ sent in these comments:

A member (personal information removed) of the Woodgate Residents Association and as a private resident (personal information removed) Comments reflect my own opinion and feedback we have had from our management committee and local residents.

REF: COMMENTS ON THE A50 TRANSORT PROJECT 2022.

We are pleased that we will at last see some action on the redesign of the junction, but we feel it has been "high-jacked" by the provision of cycling lanes and bus lanes. All we wanted was a simpler safer junction with better lane arrangements, clearly marked and the road mended!.

1. **Bonchurch Street/ Central Road junction with Fosse Road:** We are concerned that the narrowing of Central Road to one lane at the junction with Fosse Road North. Currently there are two exit lanes, (right and left turns onto Fosse). Reducing it to one lane will mean that left turners will have to queue behind the more difficult right turners causing congestion in the road and more pollution. Remember we are a residential street!!! This road is heavily congested at school times particularly, and is the main route onto the Fosse from the other Woodgate streets. The only positive here is that it will stop the "corner parkers".

2. Shared cycle/pedestrian route along Woodgate: We feel that this has some dangers. This route is two way cycling, plus pedestrians in limited space. This route crosses the entrance / exit to a busy Aldi store and the entrance / exit to ATS motor services. It is possible that vehicles using these access points will not see the cyclists. Pedestrians tend to stop and look at these points and are moving slowly. but from my observations cyclists do not and they can be travelling at up to 30 mph, often on their phones or music earphones as well!. Although the drivers must obviously ensure their access is clear I feel this is an accident waiting to happen. (and yes, we do know about the heirarchy of responsiblities for road users!).

3. Aldi access: The Aldi exit onto Woodgate is LEFT TURN ONLY, (condition of the planning permission for the store) but drivers are ignoring this and there have been many near misses where they have come head on into vehicles in the right turn box into Bassett Street. It must be made clearer that vehicles can exit into Bradgate Street at the rear of the store if they do not wish to travel towards town.

4. No left turn into Woodgate from Blackbird Road: This going to push all traffic wishing to access the "Woodgate Streets" and the shops from Blackbird Road, into Fosse Road North, Bonchurch Street and the other residential streets, to get back onto Woodgate.

5. Groby Road/Buckminster Road service Road. We understand that this will become part of the new cycle lane. How will the shops on the Groby Road part be able to take deliveries/unloading? Also access to the surgery. Vehicles will need to access the shops premises and this means parking or crossing in the cycle lane! Which is dangerous. At the consulation meeting at the Woodgate Resources Centre, I brought up this point and the person from the design team suggested they carry the stuff down the road!! How ridiculous. We hope you have consulted with these shops as promised. Also, from the plans we downloaded from the website it looks as though there is no parking on Buckminster Road for the shops, how will this work?? If access to the small parking area outside Buckminster shops will still be available, it seems vehicles will need to cross over a cycle crossing to access it – again not very safe.

6. Bus lane on Fosse Road. The bus lane is in the central part of the road. This means that vehicles turning right into Bonchurch Street from Fosse Road North will have to cross the bus lane. Vehicles turning right out of Central Road onto Fosse Road North will have to cross the bus lane into the now single lane traffic going in the direction of Groby Road. Coupled with the proposal to narrow the Central Road junction to one lane this will cause congestion. In addition vehicles travelling on Fosse Road North towards Groby Road, and wishing to turn into Woodgate, will have to cut in across the bus lane at the traffic lights. This can cause traffic to back up while waiting to move over. (see the chaos on the Lutterworth Road /Middleton Street junction for example) .

7. Traffic lights at Stevenson Drive / Fosse Road junction:- We feel that this change is unneccesary as the mini island works perfectly well.

8. Pedestrian safety:- There seems limited space for pedestrians given that the cycle lane is two way. We already have many near misses in the area between pedestrians and cyclists (and illegal e scooters) on the pavements. Will the illegal use of the pavements be policed now that there will be a cycle lane.

Finally, we submit our comments on the grounds of safety and in the hope that the junction redesign will deliver a simpler and less confusing situation for all. Looking at the plan we fear that the junction is even more complex as you have introduced the cycle lane crossings and bus lane into the mix. Also we fear that a lot of traffic will be forced onto residential side roads due to the restrictions on Buckminster Road, the no left turn into Woodgate from Blackbird Road.

We sincerley hope that thought has been given to all possible "unintended consequences".

2.2 Thank you for your email dated 31st July 2022. You have raised an objection to the proposed Traffic Regulation Order that looks to prohibit turning movements from Blackbird Road to Woodgate.

You have raised concerns about the effects of the Order restricting movements at the junction and that you think this would result *i*n an unnecessary diversion.

The purpose of prohibiting this/these movement/ is to make improvements to the junction of Woodgate/Blackbird Road/Groby Road and Fosse Road North. We expect this to achieve improvements in safety, to allow us to construct better crossings and a cycle route, to enable strategic re-routing of traffic so that Woodgate is no longer an "A" Road, to enable the Council to make environmental improvements in Woodgate, including better footways.

I do appreciate that this may mean that some journeys by car have to be made by alternative routes.

When advertising a Traffic Regulation Order the council is only legally required to publish an advert in a local paper so the posting of street notices is actually a step over and above the legal requirement.

I hope that this has answered your concerns. If you are satisfied and you would like to withdraw your objection, could you please let me know, either at the email address listed at the top of the letter or the Council's postal address shown at the bottom of the letter.

If I do not hear from you by Friday 12th August 2022, I will assume that you would like your objection to stand. Should this be the case, it is our intention to present an Objectors Report to the Director of Planning, Development and Transportation for his final decision.

If you would like to meet relevant officers to discuss this matter further, we will hold an Objectors Meeting with you, the minutes of which will also be presented to the EDTCE. If so, please get in touch by the ***Wednesday 10th August 2022, 5pm*** using the contact details provided if this is the case.

OBJECTIONS FROM OBJECTOR 'C' - DATED 03.08.2022

3.1 Objector 'C' sent in these comments:

A member of the (personal information removed) Woodgate Residents Association and as a private resident (personal information removed). Comments reflect my own opinion as an addendum to the comments already submitted by the Chair of the Residents Association previously.

REF: COMMENTS ON THE A50 TRANSORT PROJECT 2022.

1. No left turn into Woodgate from Blackbird Road: In addition to this pushing traffic to access the "Woodgate Streets" and the shops from Blackbird Road, into Fosse RoadNorth, Bonchurch Street and the other residential streets, to get back onto Woodgate, I also believe that people will cut down Bradgate Street and through the Aldi car park in contravention of Aldi's one way system there. That area is already an accident waiting to happen due to all the pavement parking and parking on double yellows by the garage on Bradgate Street. Constant parking on double yellow lines and the pavement means it is impossible to see if traffic is coming up and down Bradgate Street especially for those of us exiting our homes from the apartments at 69 Bradgate Street.

Aldi also do not enforce parking restrictions. None of the pavements are useable by people in wheelchairs or with pushchairs. More people will be cutting through Aldi and then out over the new cycle lane. Another accident waiting to happen.

2. No right turn into Blackbird Road from Woodgate. Again, people will be forced down residential side streets. We have already all been impacted by the closure of Buckminster Road, pushing cars down Colwell Rd, people in cars will now be driving further to get to their destinations, surely creating more pollution. For those of us living in the apartments on Bradgate Street, with one of our exit gates permanently locked, I genuinely feel like I am being fenced in with fewer and fewer options on which way I can actually get out of where I live, meaning I have to drive round in circles.

3. Parking for the shops. Removing all of the parking facilities from outside of the doctors and shops will create even more chaos than there already is. The Maxi Grosik supermarket was allowed to be opened with little thought to the amount of parking required and the area is constantly packed with cars parking on pavements and on double yellow lines. It's dangerous and you can't see cars coming. The pavements are regularly un-useable by people in wheelchairs or with pushchairs. Where are disabled people and those using the doctor's surgery suppose to park?

3. Crossing on Blackbird Road over the central reservation between Bradgate Street and Maxi Grosik, the Polish supermarket. I note you intend to remove the dropped curb and prevent people crossing there. It won't work. People have always crossed there, they will continue to cross there. That's what humans do, go the shortest way. You'll get a home-made path across the grass which will look terrible. It will also force those with wheelchairs / walking aids to travel further to get to where they are going.

All of these proposals will cause parking chaos as the Council does not send enough CEOs around to ticket, will add to the danger we already have with views blocked constantly by unlawful parking, and totally discriminates against the disabled, immobile, and those with pushchairs etc.

Bradgate Street parking issues

Blackbird Rd parking issues

3.2 Thank you for your email dated 3rd August 2022. You have raised an objection to the proposed Traffic Regulation Order that looks to prohibit turning movements from Blackbird Road to Woodgate and Woodgate to Blackbird Road

Your comments will be included in the Public Engagement report, but your objection will not be submitted as it was submitted too late with the objection deadline being Monday 1st August 2022.

Appendix D - Economic Development, Transport and Climate Emergency Scrutiny Commission - Wednesday, 23 March 2022 5:30 pm

The City Centre Streets Programme Manager delivered a presentation updating the Commission on the ongoing schemes.

As part of the discussions Members noted that:

- A Member of the Commission was in support of the schemes presented as they drove the objective of sustainable transportation in the city
- Some Member of the Commission supported the Park and Ride Scheme as it provided a good option to those who were visiting the city. Additionally, Members were keen to see continued efforts and similar schemes for the inner city
- Concerns were raised with the number of people using busses
- Concerns were raised with the 5 ways junction on Woodgate where there was an issue with flooding when there were heavy rains
- The Aylestone Meadows schemes which had not yet been funded should be made a priority as it would bring that part of the city into life and people have proven they would desire to use that route
- The impact of proposals on existing roads and the consideration of restricting access during peak periods
- A Member of the Commission also raised concerns over the development of the Beaumont Leys Park and Ride site on a greenfield site
- The route being proposed for the Great Central Way Scheme connecting Lubbersthorpe way via a cycle lane should be supported.

In response to Members queries and concerns, Officers noted that:

- Bus passenger numbers had decreased during the years and more during the pandemic, but new figures suggested bus usage was back to pre-pandemic figures
- The Transforming Cities work was also working on delivering an attractive service for bus users and changing behaviours to have a positive impact
- Councillors from the Country also supported the scheme for Aylestone Meadows as it would allow for residents from the county to also access the city in a more sustainable manner for work and leisure
- The Park and Ride site was to be developed on a brownfield site and that the development of the site would include new trees and vegetation
- 24/7 bus lanes ensure motorist are aware of the restrictions and do not use them at all, avoiding the likelihood of penalty notices
- The overall reconstruction of the 5 ways junction would address the flooding concerns as Severn Trent would ensure the drainage was sufficient

- Where there is an introduction of new walking/cycling routes efficient lighting is introduced without disturbing the ecology of the area.

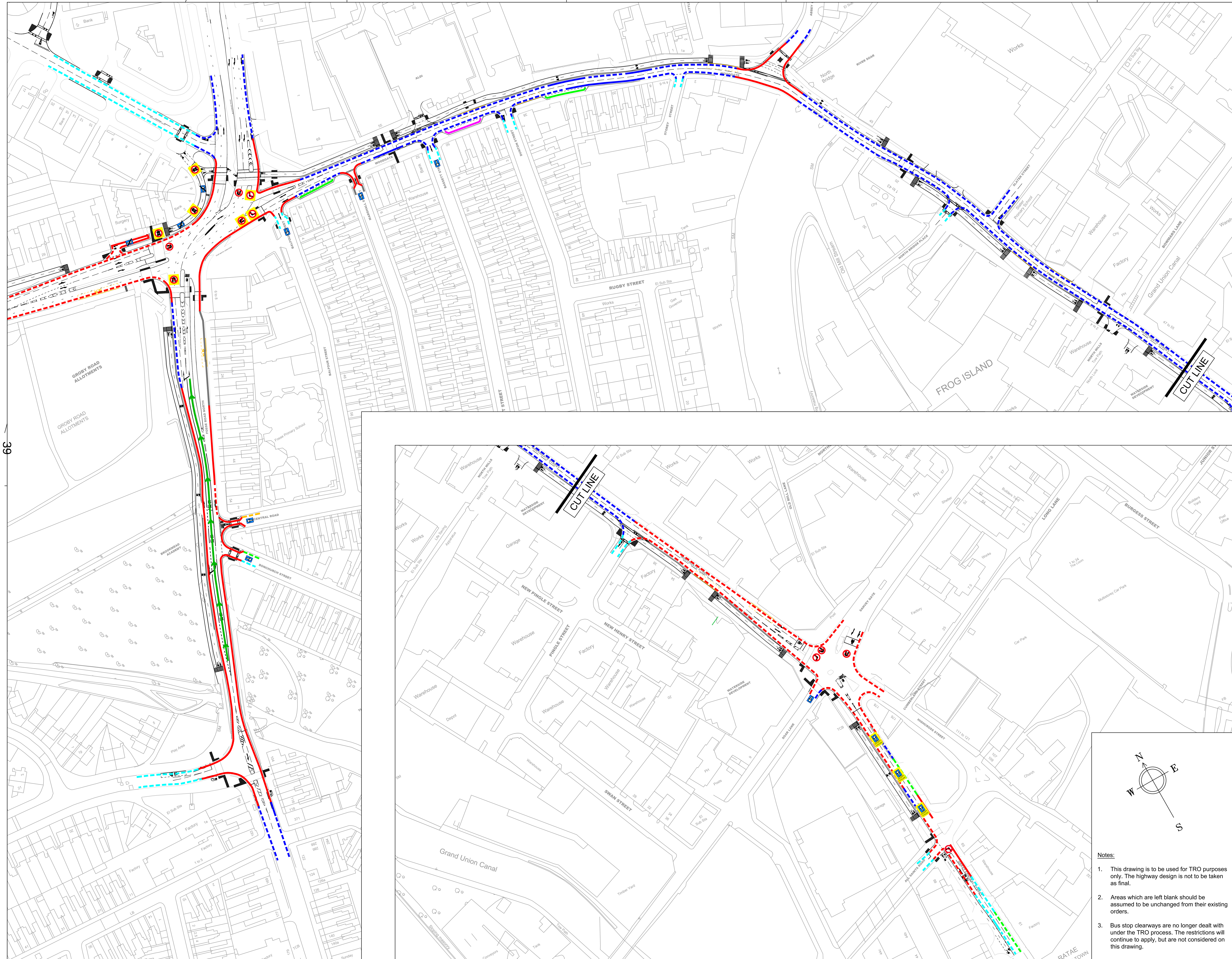
The Chair queried whether Electric Vehicle (EV) charging points are being considered as part of the proposals and whether accessibility groups had been consulted with. In response Officers noted that, LTAP had been engaged with and their contributions had been taken into account and that Officers were engaged with on street EV charging points provider Western Power in gathering info who had a 5-year contract to introduce EV charging points.

The Commission took the Opportunity to thank the City Centre Streets Programme Manager for his contributions and wished him all the best in retirement.

AGREED:
1) That the presentation be noted, and
2) That the Director for Planning Development and Transportation be requested to consider the comments and views raised by the Commission.

Drawing Number PDT-C301836-N116468C-TRO(01)

Notes



39

Existing restrictions to be revoked:

Part 100
one way to be revoked

Restrictions revoked
No restrictions apply

Existing restrictions to be retained:

Part 100
one way

Part 101
no U turn

Part 102
no right turn

Part 103
no left turn

Part 200
no waiting at any time
no loading at any time

Part 204
no waiting at any time
no loading, Mon-Fri 7.30-9.30am or 4.00-6.00pm

Part 207
no waiting at any time

Part 215
no waiting Mon-Sat 7.30am-6.00pm

Part 224
no waiting for more than one hour, no return within one hour, Mon-Sat 9.30am-4.00pm

Proposed new restrictions:

Part 101
no U turn

Part 102
no right turn

Part 103
no left turn

Part 112
prohibition of driving motor vehicles

EXCEPT CYCLES
Part 128
one way except cycles

Part 200
no waiting at any time
no loading at any time

Part 204
no waiting at any time
no loading, Mon-Fri 7.30-9.30am or 4.00-6.00pm

Part 207
no waiting at any time

Part 224
no waiting for more than one hour, no return within one hour, Mon-Sat 9.30am-4.00pm

Part 308
loading bay at all times

Part 800
24-hour bus lane

Notes:

1. This drawing is to be used for TRO purposes only. The highway design is not to be taken as final.
2. Areas which are left blank should be assumed to be unchanged from their existing orders.
3. Bus stop clearways are no longer dealt with under the TRO process. The restrictions will continue to apply, but are not considered on this drawing.

Revision	Amendment	Date

Leicester City Council

Planning, Development & Transportation

CLIENT

TRANSFORMING CITIES FUND

TITLE

FIVE WAYS - FROG ISLAND
HIGHWAY IMPROVEMENTS
Proposed Traffic Regulation Order

DRAWING No.	REV	SCALE	
PDT-C301836-N116468C-TRO(01)	B	1:1000	
DRAWN BY	JS	DATE	JULY 22
CHECKED	JED	SIZE	A1
ACAD FILE	(H:)\DATA\SUSTAINABLE_TEAM	UPRN	N116468C

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Leicester Buses Partnership

Update to EDTCE

August 2022

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Appendix C

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DfT National Bus Strategy – recap

Bus Services Improvement Draft Plan 2022-2030

Outline DfT additional funding bid 2022-25

Publish October 2021

Formal Enhanced Bus Partnership made by April 22

- Agreed 8 year Plan
- Agreed 3 year Scheme
- Binding on all parties – registration process

EP Board and EP Forum – quarterly and half-yearly

Yearly Variation mechanism – subject to agreement

BSIP funding settlement May 2022

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Enhanced Partnership Plan 2022-30

Aims: Electric, Frequent, Reliable, Easy, Great Value

Outputs

- 25 Mainlines - 360 electric buses, every 15mins, urban radial, commercial
- 5 Greenlines - 40 electric buses, every 15 mins, three cross-city, two orbital, wider area inc P&R, subsidised
- Line package - bus priority, real time, contactless ticketing, waiting facilities, integrated timetables, network colour branding
- Accessibility package - discounted fares, better linkages, information, flexilines

Targets : 40% trip increase, 90+% satisfaction, 100% electric

Picture of Partnership launch event showing branded bus and boards with aims and main deliverables

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Enhanced Partnership Scheme 2022-2025

- 130 Electric buses
- 6 Bus priority schemes
- 2 New P&R mini-sites
- 3 Fare discount schemes
- 2 Frequent orbital Greenlines (inner/outer)
- 2 Frequent cross-city Greenlines (joined P&R/HH)
- 650 Real time totems
- 500 Bus shelters
- 1 New Bus station
- 5 Integrated mainline timetables
- Network ‘best fare’ contactless ticketing
- Network planning and change dates

£100m Investment (£16m from operators),
Binding Commitments but ....
No DfT BSIP Funds awarded (£41m-£51m bid),
Increasing need for local financing

Aim	Project	Completion Date	Status	Partners
Electric	Greenlines : Park and Rides 11 Electric buses and charging depot	01 September 2021	Delivered	City Council, Roberts
Electric	Successful ZEBRA funding bid for 96 electric buses .	01 September 2021	Delivered - awarded in full	City Council, Centrebus, First, Arriva
Electric	Greenlines : Hospital Hopper 4 electric buses and charging depot	01 June 2022	Delivered	City Council, Centrebus
Electric	Greenline : Orbital 6 electric buses and electric charging depot	01 November 2022	On track. Buses ordered and shipped. Charging depot under construction	City Council, Centrebus
Electric	Mainlines : Firstbus new electric bus charging depot for whole fleet	01 March 2023	On track. Power and charging equipment ordered	Firstbus
Electric	Mainlines : Firstbus 20 electric buses	01 March 2023	On track. Buses ordered	Firstbus
Electric	Greenlines: City Centre Hop 3 electric buses	01 March 2023	On track. Buses and charging equipment ordered	City Council, Centrebus
Electric	Mainlines : Firstbus 48 electric buses	31 December 2023	On track. Buses ordered	Firstbus
Electric	Mainlines : Arriva 22 electric buses	31 December 2023	On track	Arriva
Electric	Mainlines : Stagecoach 22 electric buses	31 March 2024	On track	Stagecoach

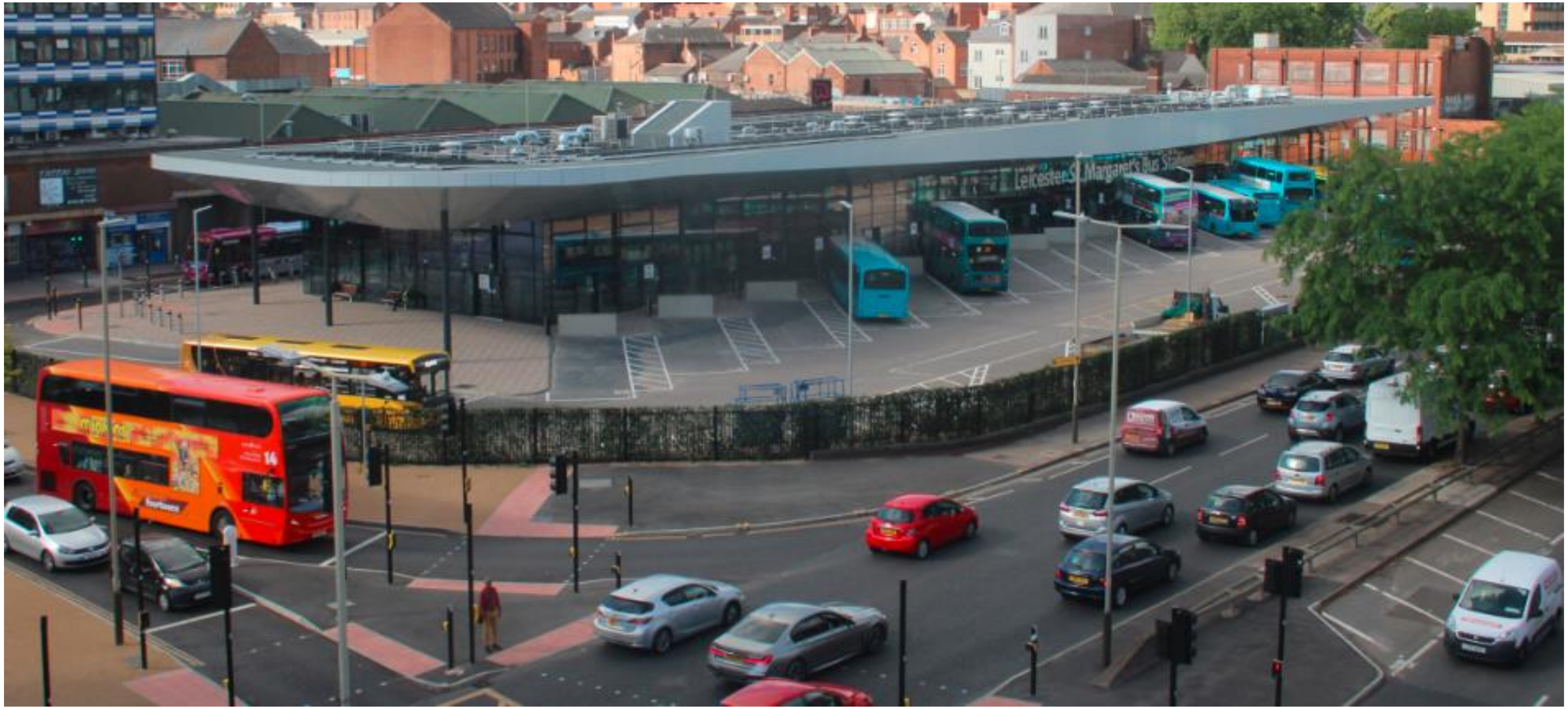
Greenlines electric project: Three Park and Ride services and Hospital Hopper

Aim	Project	Completion Date	Status	Partner/s
Frequent	Mainlines : DfT Funding to Oct 22 continue at high service following pandemic	01 April 2022	Delivered	All
Frequent	Greenlines : DfT Funding to Oct 22 continue at high service following pandemic	01 April 2022	Delivered	All
Frequent	Greenlines : Internal Funding package to maintain current frequencies post pandemic to 2024	01 July 2022	Delivered	All
Frequent	Mainlines : Post pandemic network review complete - no impact on commercial frequencies	01 July 2022	Delivered	All
Frequent	Mainlines : Cross-operator timetable integration on 5+ shared corridors.	01 September 2023	On track. Two already delivered, two agreed to implement from October 22	All
Frequent	Greenlines : Cross City (Birstall and Meynells or Enderby P&R joined up)	01 September 2023	On track	City Council, Roberts
Frequent	Greenlines : City Centre Hop - new free service	01 March 2023	On track - funding all in place, operating and bus purchase contracts both let	City Council, Centrebus

Aim	Project	Completion Date	Status	Partner/s
Reliable	New Savoy St bus link connecting Haymarket and St Margarets Bus Stations	01 July 2022	Delivered	City Council
Reliable	London Rd Red Route - made permanent	01 April 2022	Delivered	City Council
Reliable	Anstey Lane Bus lane - southern section	01 June 2022	Delivered	City Council
Reliable	Groby Rd Bus Lane inbound Mary Rd - Medina Rd	31 July 2022	Delivered	City Council
Reliable	Melton Road (A607) Bus Lane - inbound section	01 September 2022	On track. Designs agreed consultation complete and works ordered	City Council
Reliable	Abbey Park Rd Bus Lane - both ways	01 March 2023	On track. Designs agreed consultation complete and works ordered	City Council
Reliable	Roadworks Management Protocol - for bus operators	01 March 2023	On track	All
Reliable	Smart Signalisation for Buses - review and funding options	01 March 2023	On track	City Council
Reliable	Moving Traffic Offence Enforcment - review of extension options	01 March 2023	On track	City Council
Reliable	St Margaret's to Birstall A6 corridor Bus Lanes	01 May 2023	On track. Designs agreed consultation complete and works ordered	City Council
Reliable	Anstey Lane Bus lane - northern section	01 September 2023	On track. Design options under consultation	City Council

Savoy St Bus Link with completed waiting facilities

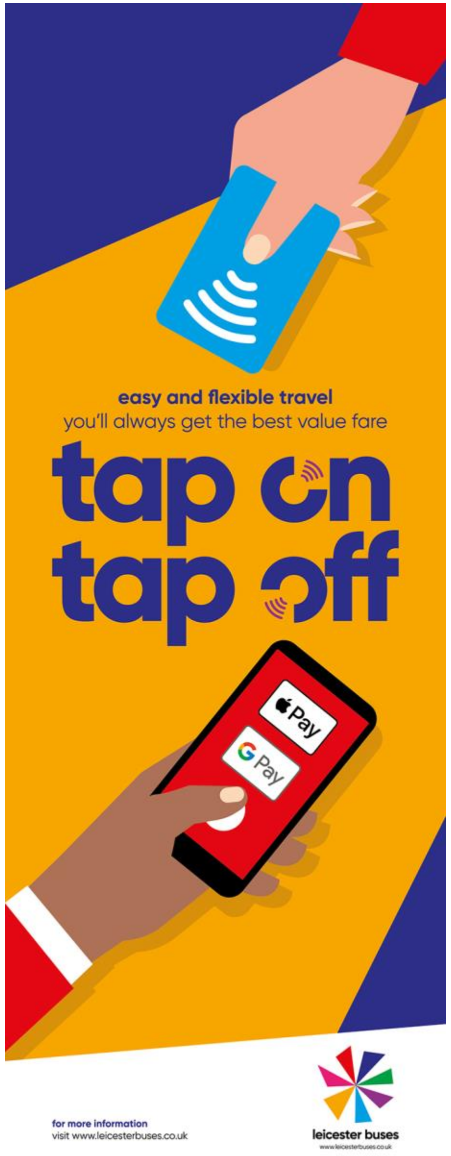
Aim	Project	Completion Date	Status	Partner/s
Easy	Leicester Buses Website - covering all areas of partnership working	01 April 2022	Delivered	City Council
Easy	Leicester Buses Enhanced Partnership Scheme and Plan - legally made	01 March 2022	Delivered	City Council
Easy	Leicester Buses Enhanced Partnership Scheme - starts operation	21 April 2022	Delivered	City Council
Easy	Leicester Bus Partnership Branding - across all council infrastucture channels - stops, bus station	01 July 2022	Delivered	City Council
Easy	New St Margarets Bus Station - opened	01 June 2022	Delivered	City Council
Easy	Leicester Buses Printed Guides - Maps, Ticketing, Plan	01 July 2022	Delivered	City Council
Easy	Targeted marketing campaign 1 : Tap-on-Tap-Off and Contactless	01 July 2022	Delivered	All
Easy	Leicester Buses Network - agreed fixed registration change dates	01 September 2022	On track	All
Easy	Leicester Bus Partnership Branding - across all operators channels	01 September 2022	On track	All operators
Easy	Bus Shelter Replacement Programme - complete at 480-500 stops. 400 installed to date.	01 September 2022	On track	City Council
Easy	Customer Charter developed and agreed	01 September 2022	On track. Draft to EP Panel	All
Easy	General Hospital P&R - new site opened (x80-100 spaces)	01 September 2022	On track with NHS	City Council
Easy	Real Time Bus Stop Totem programme completes installation at 650 stops. 350 installed to date	31 December 2022	On track. 360 installed to date	City Council
Easy	New illuminated glass bus shelters at 500 stops (30 with green roofs)	01 September 2022	On track. 400 installed to date.	City Council
Easy	Targeted marketing campaign 2 : Customer Charter	01 March 2023	On track	All
Easy	Beaumont Leys P&R - new site in operation (x280-300 spaces)	01 May 2023	Design in preparation	City Council



New St Margarets Bus Station

New real time information totems with text-to-speech facility

Aim	Project	Completion Date	Status	Partners
Great Value	Contactless Tap In ticketing on all buses, including park and ride	01 December 2021	Delivered	All
Great Value	Digital fare single operator capping on Firstbus, Arriva and Centrebus, Kinch, Stagecoach	01 December 2021	Delivered	All operators
Great Value	New mobile phone sales platforms for Flexi products	01 December 2021	Delivered	All
Great Value	Wider range of Flexi ticketing products including scholars, child and family variants	01 July 2022	Delivered	All
Great Value	Discounted fares on park and ride services - concessions and health workers	01 April 2022	Delivered	City Council
Great Value	Free annual Flexi tickets for eligible scholars 21/22 trial	01 September 2021	Delivered	City Council
Great Value	Half fare 'Travel Aid' bus tickets for unemployed	01 April 2022	Delivered	City Council
Great Value	Digital Capping: Multi-operator 'best fare' day and week capping	01 April 2022	Delivered	All
Great Value	Free annual Flexi tickets for eligible scholars 22/23	01 September 2022	All agreed and in place	All



Promotional material for 'best fare' all operator contactless ticketing

Promotions for wider range of Flexi tickets

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EP Plan – future funding required

2024-2030				
£m	Operators	LCC	DfT	Total
Electric Bus	78	5	61	144
Bus Priority	0	10	30	40
Bus Subsidy	0	35	0	35
Fare Subsidy	0	10	4	14
Total	78	60	95	233

DfT Minimum Funding Ask to 2025		
£m		
Electric Bus	14	First deckers, Greenlines
Bus Priority	17	Orbital, Humberstone Rd
Bus Subsidy	7	Orbital and Flexilines
Fare Subsidy	3	Young Persons
Total	41	

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Next Steps

58

- UK Bus Awards submission
- EP Forum – Sept 22
- Customer Charter
- Satisfaction surveys and monitoring
- New DfT funding bids – electric buses, other?
- Greenlines Orbital electric bus launch Oct 22
- Greenlines Hop electric bus launch Mar 23

Example of branded Greenline Orbital electric bus

City Centre Free Greenline : Hop!

Buses ordered

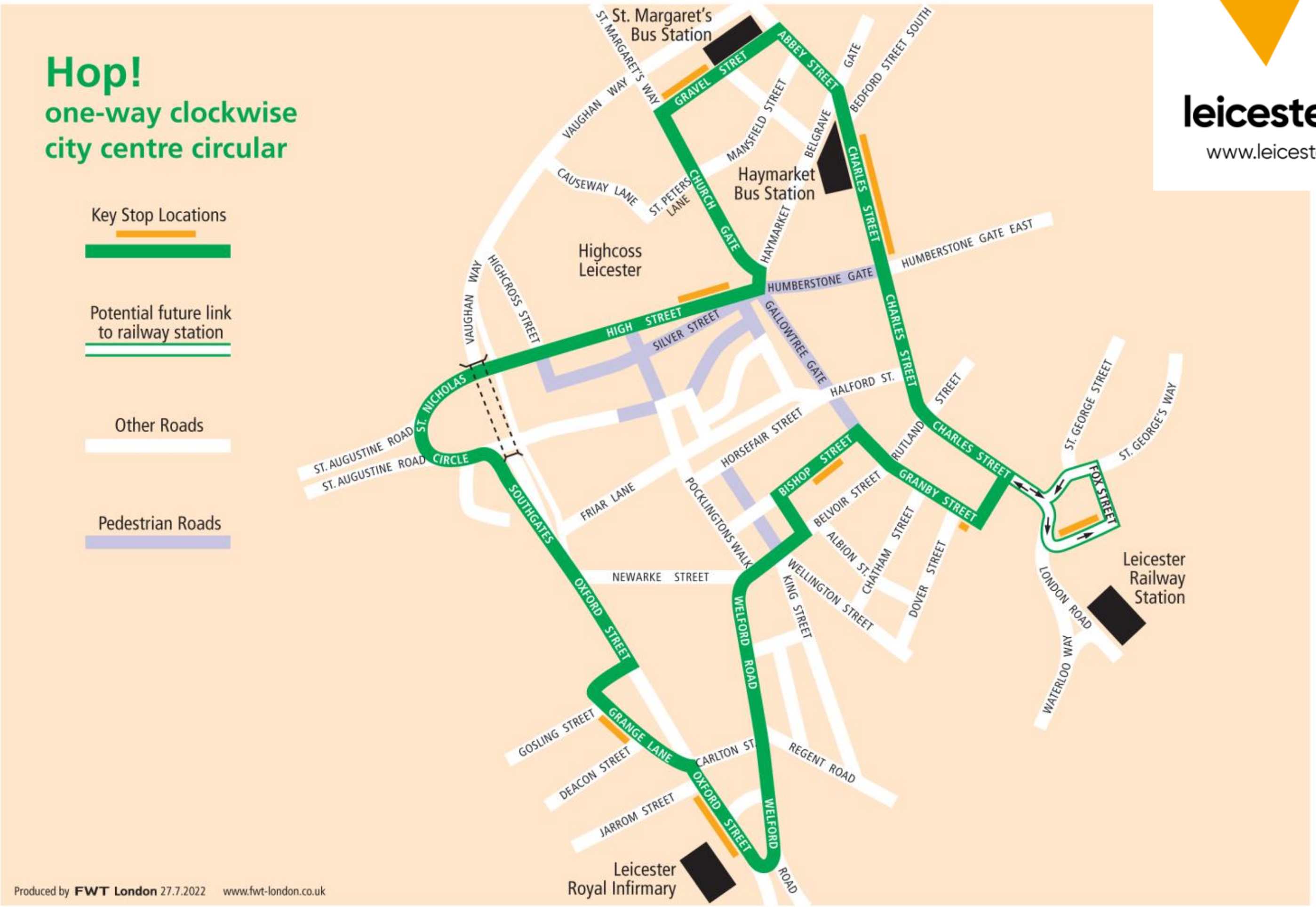
Operations out to tender

Risk assessment High St : ongoing

Stop infrastructure : ongoing

Consultation and EP Forum : Sept – Dec

Launch : March 2023



Draft proposed Hop route subject to assessment and consultation

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One branding option for new Hop! electric Greenline service

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Further Information and related documentation

www.leicesterbuses.co.uk

Any queries

Andrew.Gibbons@leicester.gov.uk

Bijel.Mistry@leicester.gov.uk

Appendix D

Levelling Up Fund 2 bid - Connecting St Margaret's

EDTCE Scrutiny

Date of meeting: 31st August 2022

Lead director/officer: Andrew Smith/John Dowson

Useful information

- Ward(s) affected: Abbey, Castle
- Report author: Jo Aitken
- Author contact details: Joanna.Aitken@leicester.gov.uk
- Report version number: v1.0

1. Summary

1.1 The Levelling Up Fund 2 was made available in March 2022 with an original submission deadline of the 6th July, subsequently revised to 2nd August.

1.2 The St Margaret's Way junction with Vaughan Way/Burleys Way was identified as a potentially strong scheme to bid for as it links with recent works to St Margaret's Bus Station and adjacent cycleways/paths, there is the potential for improved cycle, walking and bus connectivity, we would make safety improvements by removal of the pedestrian underpasses, we would unlock regeneration potential in the area, we would improve the environment (limited landscaping currently) including the potential to improve adjacent heritage e.g. St Margaret's Church.

1.3 We have received strong stakeholder support for the bid proposal.

2. Recommended actions/decision

2.1 Scrutiny commission members are requested to note submission of the Connecting St Margaret's bid to Round 2 of the Levelling Up fund.

2.2 Scrutiny commission members are asked to note that the design is only at the concept design stage and that there will be further stakeholder engagement throughout the design process should the bid be successful. Further comments can be made at the Scrutiny meeting and these can be considered as the scheme is developed in detail prior to scheme delivery.

3. Scrutiny / stakeholder engagement

3.1 This is the first time the scheme has been presented to the EDTCE Scrutiny.

3.2 Stakeholders were approached during the bid process to support the scheme. Responses were received from over 20 stakeholders including MPs, Emergency Services, Leicestershire County Council, Bus operators, BID, LLEP, East Mids Chamber, the universities and local walking and cycling groups.

3.2 Further work with these stakeholders will be carried out during the design process and public engagement is expected to be carried out on the scheme in summer 2023.

4. Background and options with supporting evidence

4.1 Several design options were considered, the design presented in the bid includes:

- Segregated cycle lanes and straight, segregated crossings – solving a major accessibility issue
- Inbound bus lanes on Sanvey Gate and St Margaret's Way
- Uni-directional, segregated cycle lanes from Abbey Street to Highcross Street – linking to other city projects
- Underpasses filled in and unnecessary road space removed
- Expanded/Improved green space north-east of the junction – improved connection to churchyard

5. Financial, legal, equalities, climate emergency and other implications

6.1 Financial implications

The scheme cost estimate is just over £15M
The bid requests grant funding of just over £12M
The City Council will supply the remaining £3M of match funding

Risks have been assessed and costed and planned for

6.2 Legal implications

n/a

6.3 Equalities implications

An Equality Impact Assessments has been produced for the scheme as part of the design process. This will be updated on an ongoing basis throughout the design process.

6.4 Climate Emergency implications

n/a

6.5 Other implications (You will need to have considered other implications in preparing this report. Please indicate which ones apply?)

None.

7. Background information and other papers:

None

8. Summary of appendices:

9. Is this a private report (If so, please indicate the reasons and state why it is not in the public interest to be dealt with publicly)?

No

10. Is this a "key decision"? If so, why?

No

Levelling Up Fund 2 Bid

Connecting St Margaret's

Economic Development, Transport and Climate Emergency Scrutiny Commission

31st August 2022

Leicester City Council

Bid for Levelling Up Funds

- The Levelling Up Fund 2 was made available in March with an original submission deadline of the 6th July, subsequently revised to 2nd August

- St Margaret's junction with Vaughan Way identified as a potentially strong scheme to bid for….

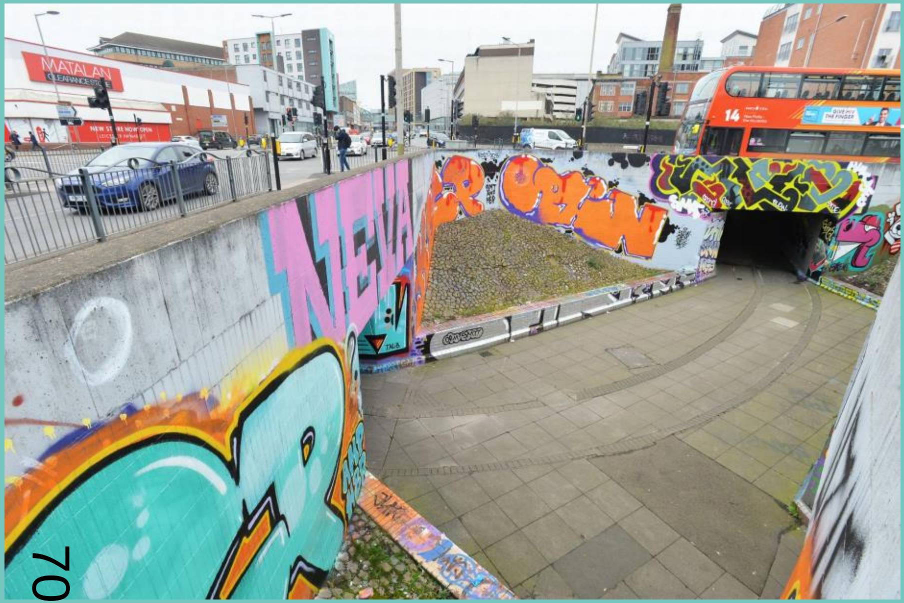
  - links with recent works to St Margaret's Bus Station and adjacent cycleways/paths
  - potential for improved cycle, walking and bus connectivity
  - safety improvements by removal of underpasses
  - unlock regeneration potential in the area
  - improve environment - limited landscaping currently and potential to improve adjacent heritage e.g. church
  - strong stakeholder support

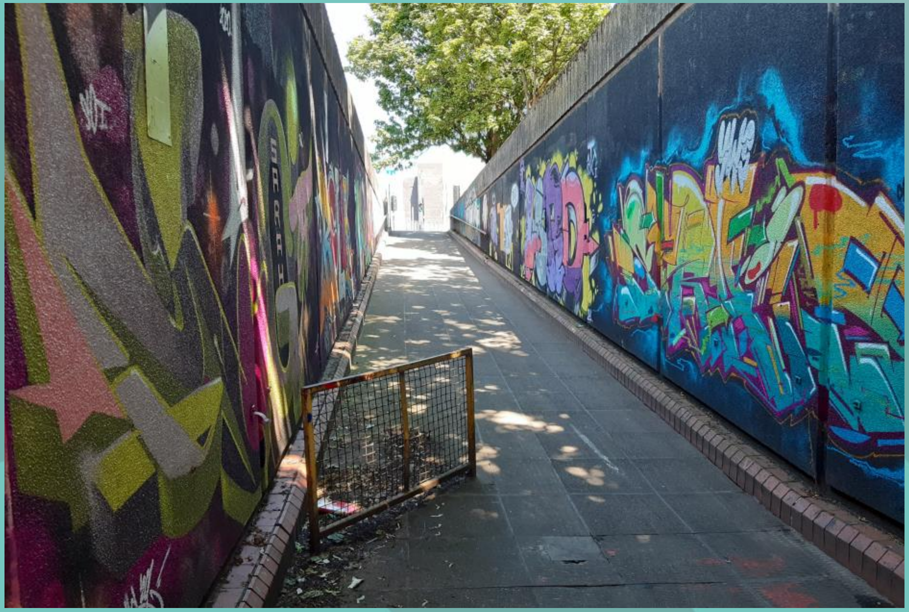
Leicester City Council

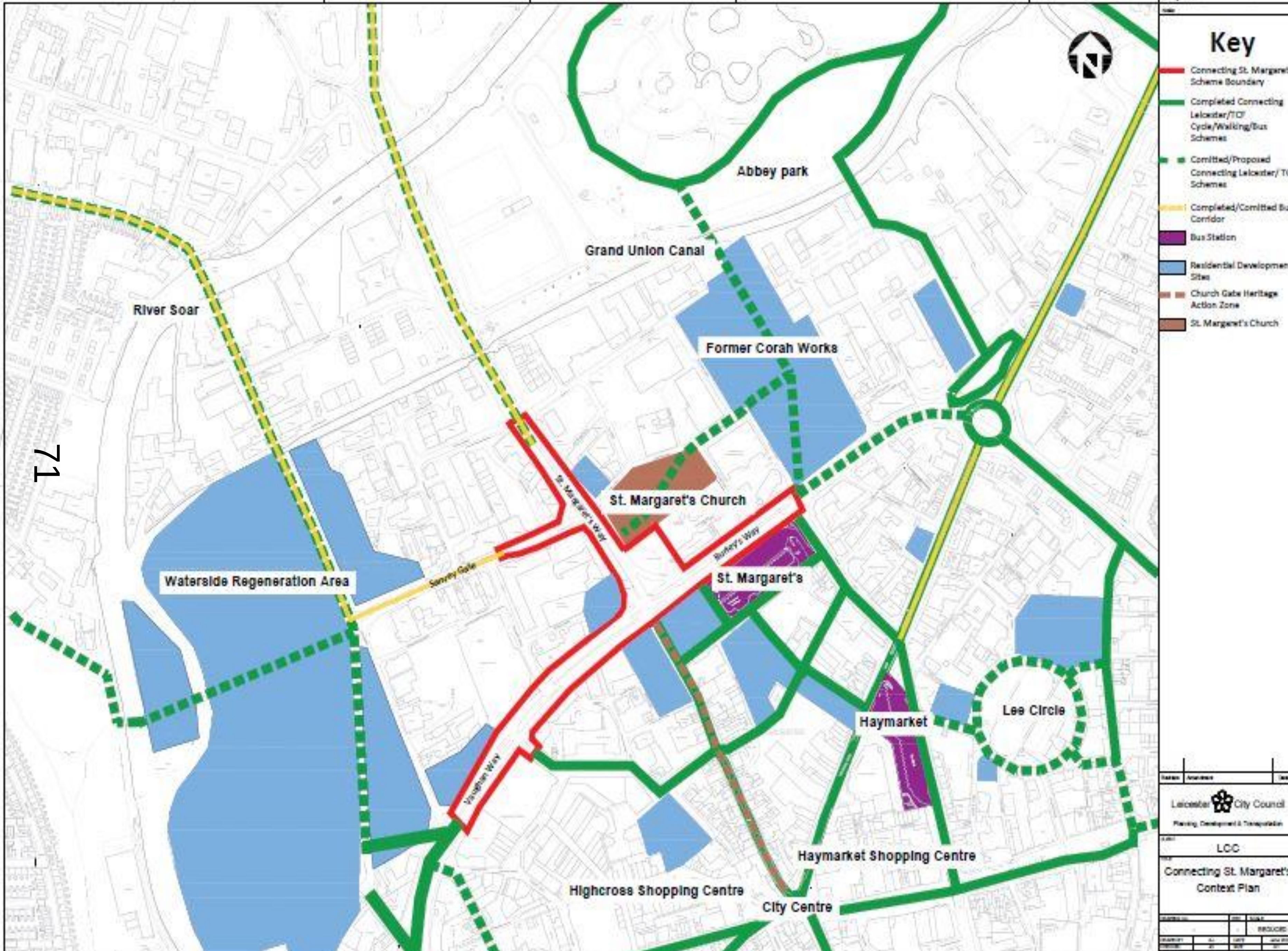
Project Location
St Margaret's/ Vaughan Way Junction

Leicester City Council

Existing underpasses






Key
Connecting St. Margaret's Scheme Boundary
Completed Connecting Leicester/TCF Cycle/Walking/Bus Schemes
Comitted/Proposed Connecting Leicester/ TCF Schemes
Completed/Comitted Bus Corridor
Bus Station
Residential Development Sites
Church Gate Heritage Action Zone
St. Margaret's Church
Abbey park
Grand Union Canal
River Soar
Former Corah Works
St. Margaret's Church
St. Margaret's Way
Burley's Way
St. Margaret's
Sanvey Gate
Waterside Regeneration Area
Vaughan Way
Haymarket
Lee Circle
Haymarket Shopping Centre
Highcross Shopping Centre
City Centre
Leicester City Council
Planning, Development & Transportation
LCC
Connecting St. Margaret's Context Plan

Concept Design

- Segregated cycle lanes and straight, segregated crossings – solves major accessibility issue

- Inbound bus lanes on Sanvey Gate and St Margaret's Way

- Uni-directional, segregated cycle lanes from Abbey Street to Highcross Street – links to other city projects

- Underpasses filled in and unnecessary road space removed

- Expanded/Improved green space north-east of the junction – improved connection to churchyard

Leicester City Council


park ride

Giving the bid its best chance of success

- We have a “ready to deliver” attractive scheme – we have a considered concept plan and a strong narrative backed up by the context plan and artist’s impression to help promote the bid

- Stakeholder support is critical — 21 Letters of support received (including local MPs)

- Cost estimates/Match funding £15M scheme, £12M grant bid and £3M match funding from the City Council

- Risks assessed and costed/planned for

- Clear delivery programme - construction completion in 2025

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City Council

Early Stopping – up of the underpasses

- Close the underpasses with Highways Act Powers – no procedure or consultation required – delegated to Director to authorise

- Issue a public notice and then install fencing

- Cost c. £30k

- Plan to action in early November 2022, following the LOROS marathon on 30th October

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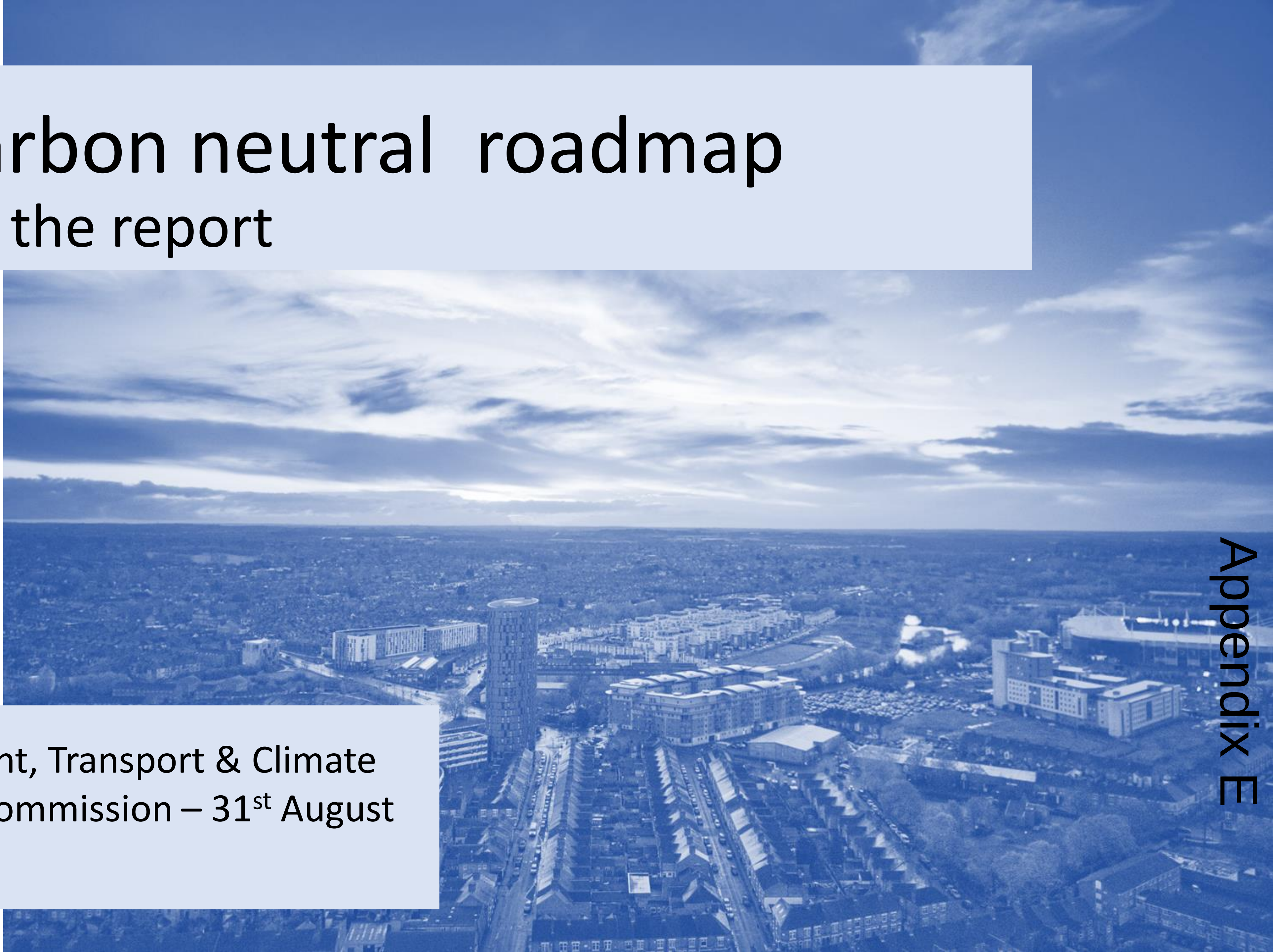
City Council

Leicester carbon neutral roadmap

The context for the report



Economic Development, Transport & Climate Emergency Scrutiny Commission – 31st August 2022

Appendix E

Climate change is happening and represents a critical threat across the globe

- Up to 3.6 billion people already living in a position of vulnerability to climate change
- 50-75% of global population exposed to ‘life-threatening’ heat or humidity by 2100 if we don’t act
- 10% of species at risk of extinction under a 2°C temperature rise
- Climate change impacting on food production and contributing to global tensions over land and resources
- Wildfires, floods and other impacts affecting much of the world – including the UK

Global warming of 1.5°C and 2°C will be exceeded during the 21st century unless deep reductions in CO2 and other greenhouse gas emissions occur in the coming decades.

(IPCC, 2021)

…. with risks and consequences for every one of us in Leicester

- Heatwaves
- Drought
- Flooding
- Storm damage
- Pressure on wildlife and risk of invasive species
- Threats to green spaces, trees and waterways
- Rising cost of food
- Increasing global insecurity

Health impacts and premature deaths

More pressure on NHS

Rising costs of damage to property

Rising costs of insurance

More families unable to afford the basics

Loss of biodiversity

Rising costs to keep buildings cool

…. and more

Climate change impacts in Leicester

2012 & 2019 Flooding

2022 Heatwave

The global response so far is not enough

- Global carbon dioxide emissions have rebounded after the pandemic
- UK greenhouse gas emissions have nearly halved since 1990, but also showed a rebound of nearly 5% in 2021
- So, we can’t rely on lifestyle changes post-pandemic – more needs to be done
- Current action and commitments by national governments are not yet enough

Cities must act

- Cities are estimated to be responsible for about 70% of CO_2 emissions from human activity
- No single organisation can solve the problem, but…
- Councils have control or influence over about a third of emissions in their areas and, as community leaders, are well placed to support and inspire action across society
- Our climate emergency declaration and our 2030 net zero ambition provides a rallying call, but what will it mean in practice?
- The roadmap starts to give us the detail

Creating a world
fit for the future

RICARDO

Leicester
City Council

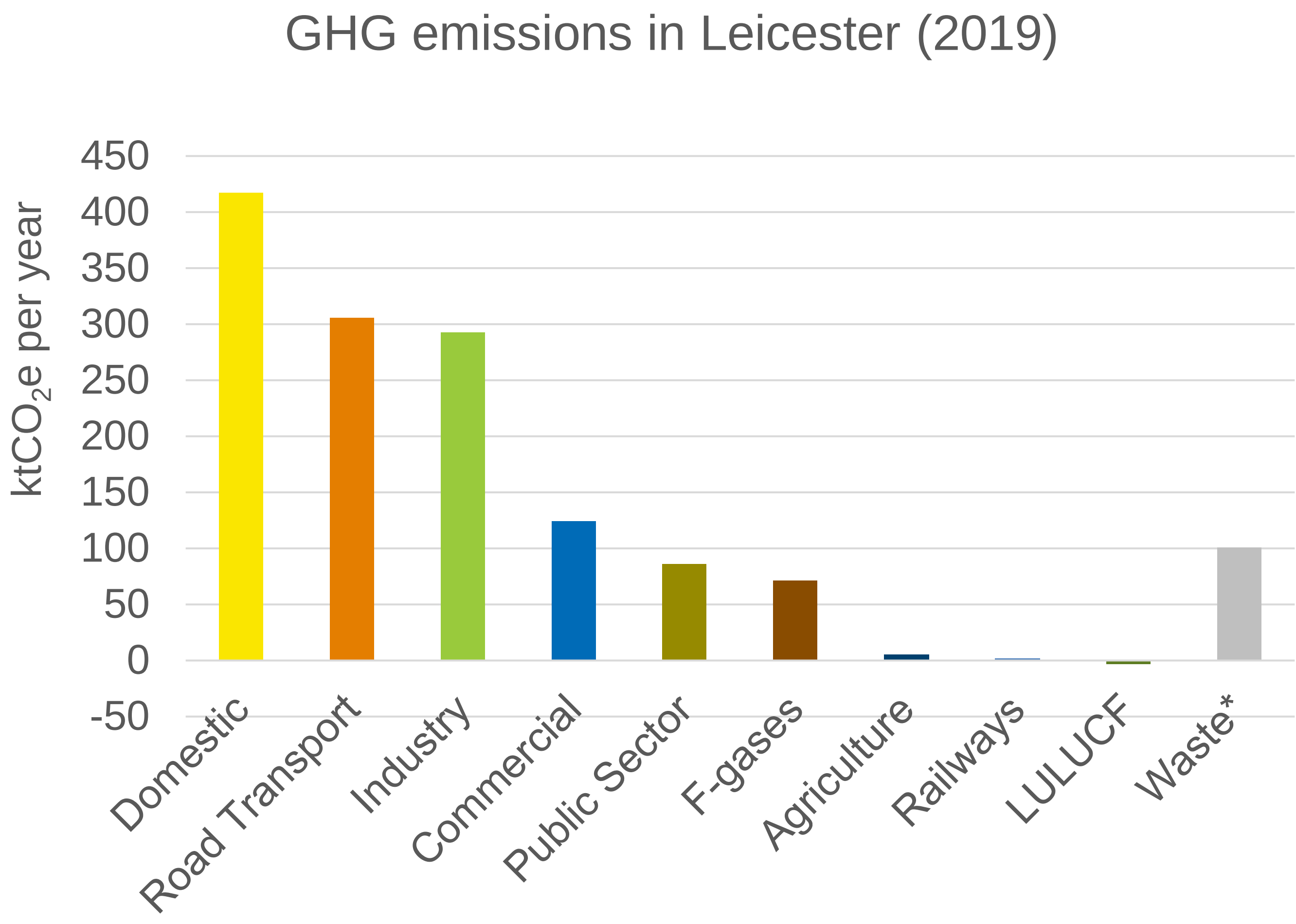
Leicester Carbon Neutral Roadmap Summary

Produced on behalf of Leicester City Council

www.ricardo.com

Current sources of greenhouse gas (GHG) emissions in Leicester

84



** Waste is reported for information but not within the scope of the Roadmap*

Note that LULUCF stands for 'Land Use, Land Use Change and Forestry'

Looking at this data another way, the major priorities are…

ELECTRICITY

HEAT

CARS/VANS

… and everything else

The 'Business-As-Usual' (BAU) scenario for Leicester

GHG scenario modelling has been used to evaluate the impacts on Leicester's emissions of changes that are considered most likely to occur between now and 2050, if **no further action is taken**. This is the BAU scenario.

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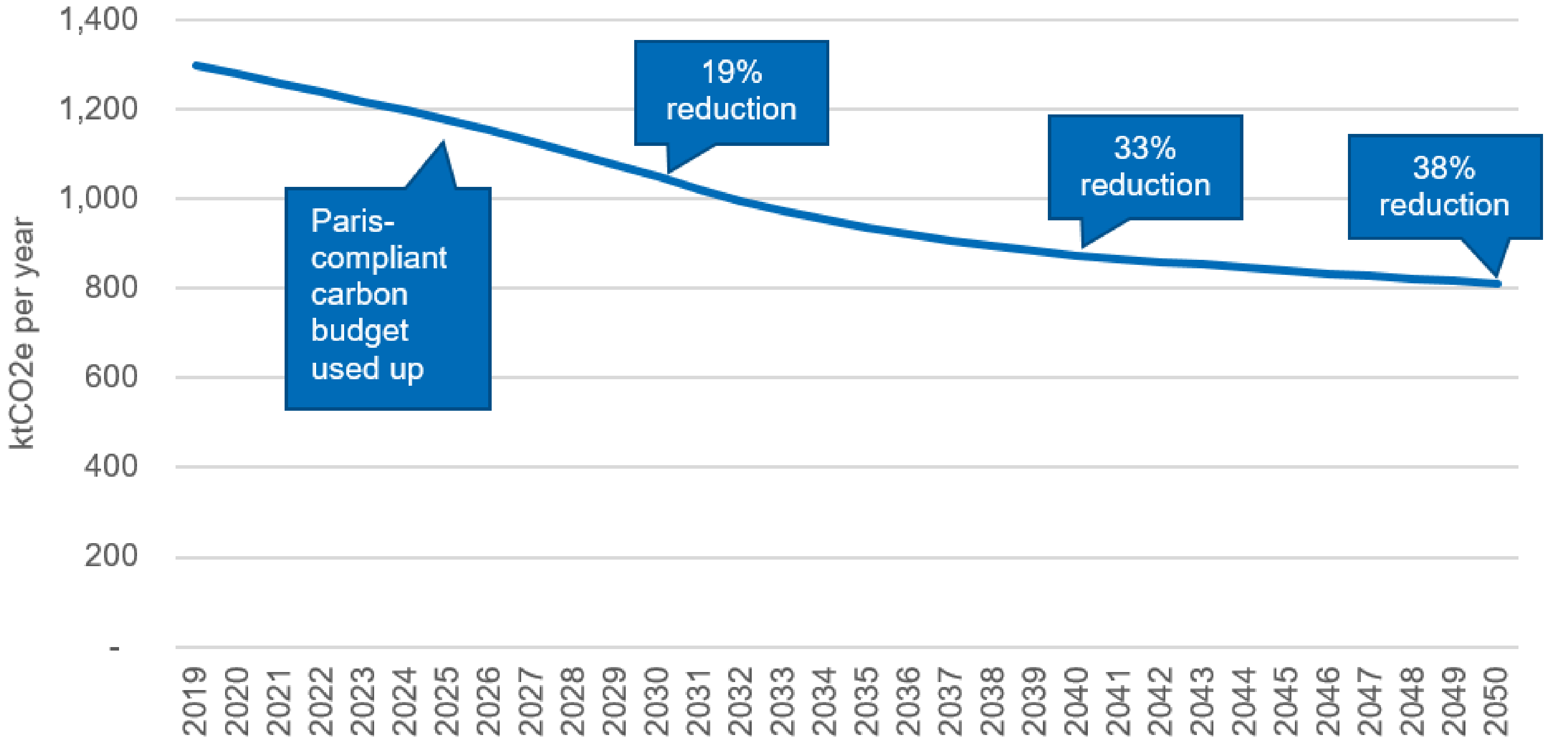

In this scenario, the **2030 ambition is not met** – in fact, according to the CCC, the UK as a whole does not have sufficient policies in place to reach net zero by 2050.

Raising the level of ambition

Four additional scenarios were modelled for Leicester representing higher levels of ambition than the BAU

- Scenario 3, which gets closest to net zero by 2030, does so by prioritising:
  - **(1) demand reduction**
  - **(2) electrification**
- These are the core themes of Leicester's strategic pathway to reach carbon neutrality

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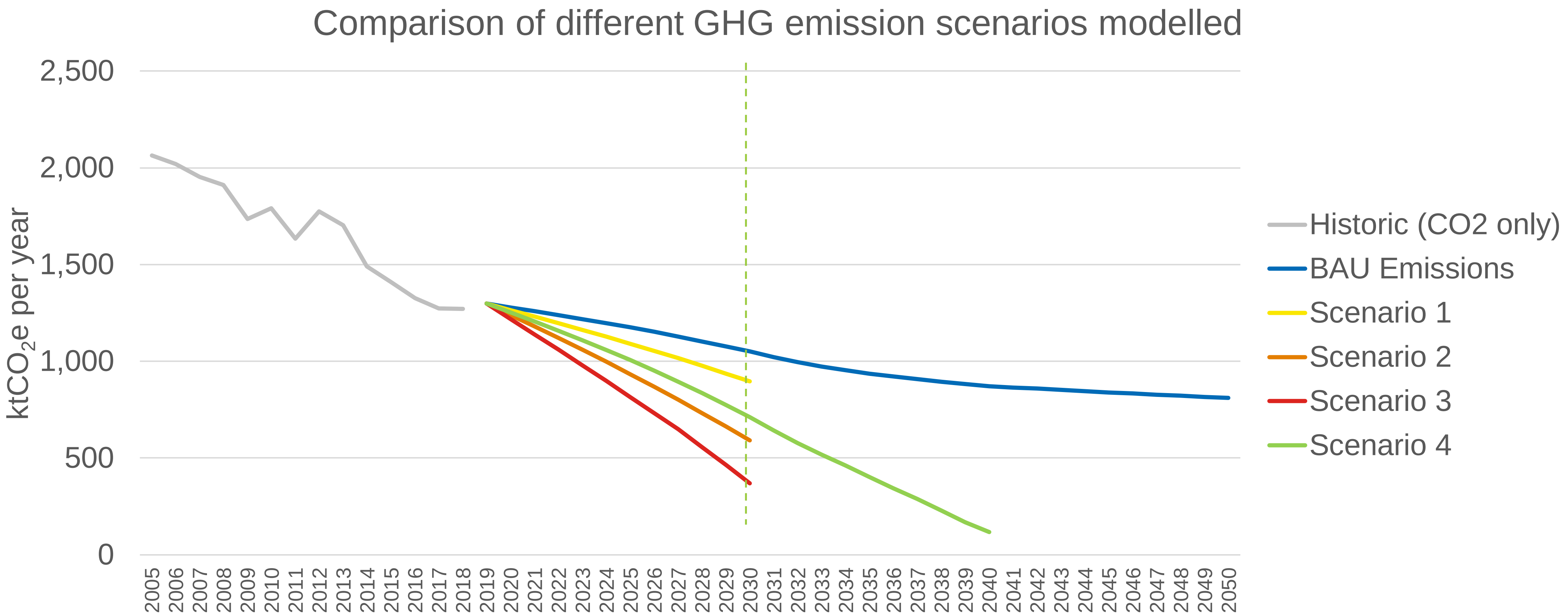

Impacts of mitigation measures in Scenario 3 for Leicester

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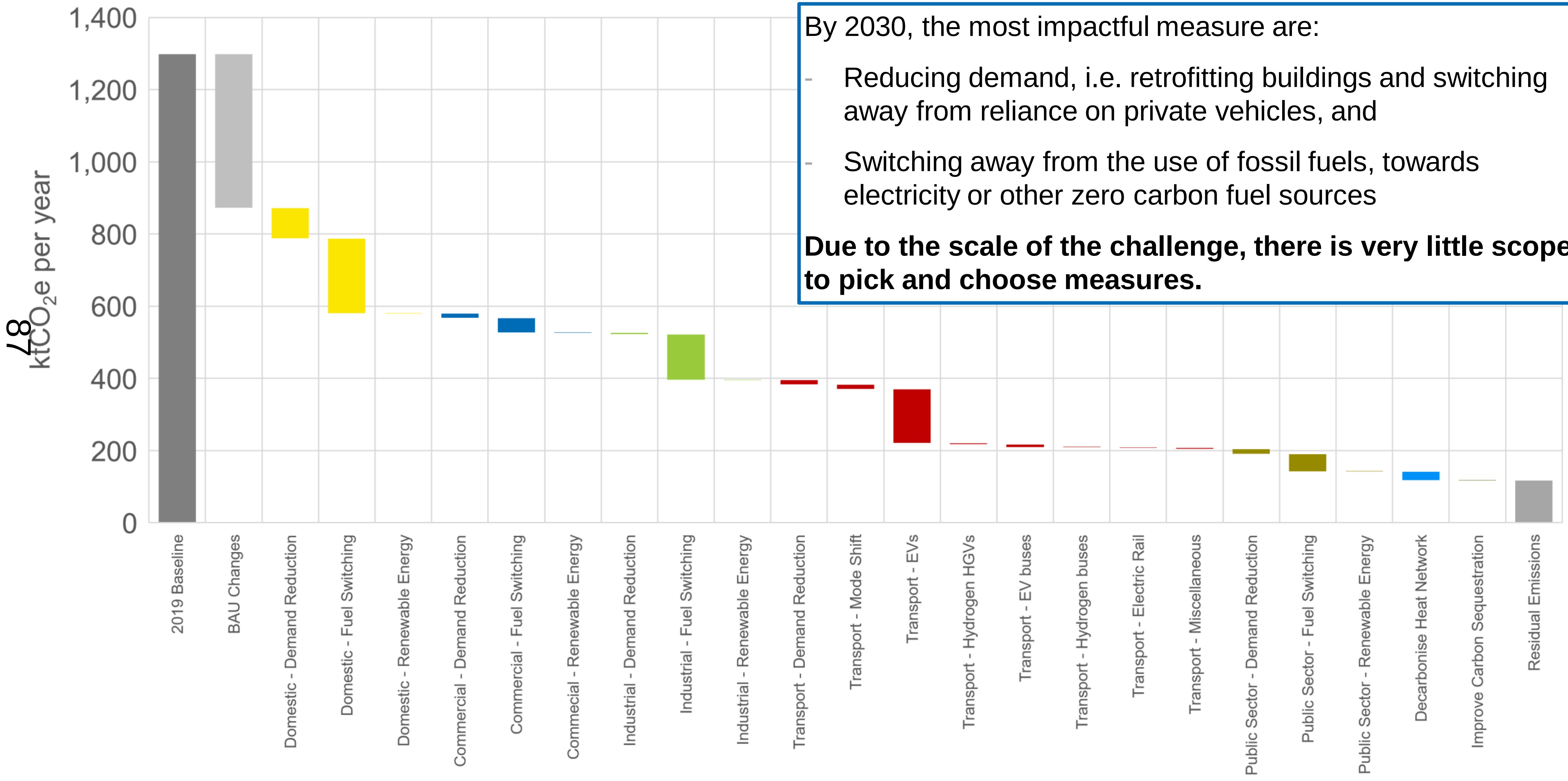
By 2030, the most impactful measure are:

- Reducing demand, i.e. retrofitting buildings and switching away from reliance on private vehicles, and
- Switching away from the use of fossil fuels, towards electricity or other zero carbon fuel sources

Due to the scale of the challenge, there is very little scope to pick and choose measures.



In practical terms, Leicester aligning with the most ambitious scenario would involve…

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Approx. 12,000
heat pumps
installed per year
Current total: <1000

50% of journeys to be
walking or cycling
(or more use of public transport)

Up to 100%
electric cars, vans, and buses
Current total: <1%

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Minimum 65,000
buildings to undergo energy efficiency
retrofits

3x increase
in use of public transport (or higher rates of walking and cycling)

Approx. 6,000
solar panel
installations each year
Current total: 4,600

… and <u>no further increase</u> in energy demand or GHG emissions from any source

Leicester’s Buildings (1)

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Priorities for:

Zero carbon buildings

Reduced energy demand	Decarbonised heat supply	Decarbonised electricity
Energy efficiency on its own will not reduce GHG emissions to zero, but *will* make it much easier to achieve. Retrofitting is a crucial prerequisite for heat decarbonisation, from both a cost and practicality standpoint.	The biggest challenge in buildings is to decarbonise the heating supply. This will require a massive scale effort to switch from fossil fuels to low carbon heating systems. Heat pumps will be the primary measure for doing this.	Leicester’s constrained area means that it is not practical for the city to produce all its own electricity, but uptake of local renewable energy generation (e.g. rooftop solar) should still be promoted.

Together, these measures reduce emissions by up to 35% in Scenario 3

Leicester’s Transport (1)

Priorities for:

Zero carbon transport

Reducing travel demand	Zero emission fleet	More efficient freight
To reduce the need for new infrastructure, it will be crucial to maximise opportunities to avoid journeys altogether, and shift remaining journeys towards walking, cycling and public transport.	The biggest GHG reduction in transport comes from switching to EVs. The shift will be primarily market-led, but will not be complete by 2030. Realistically, the focus will be on facilitating and incentivising uptake.	For technological reasons, zero emission HGVs are not likely to be widely in use by 2030, so the focus needs to be on demand reduction, journey consolidation, engine efficiency, and driver training.

Together, these measures reduce emissions by up to 16% in Scenario 3

Leicester's Energy (1)

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Priorities for:

Zero carbon energy system

Improved electricity grid	Increased renewables	Decarbonised heat network
Electrification of heat and transport could more than double electricity use. Existing grid infrastructure cannot accommodate this additional demand, so will need to be upgraded.	There is relatively limited scope for renewables within the City boundary, but across the country, both large- and small-scale renewable capacity will need to increase radically, and LCC can support this.	The heat network will need to stop using natural gas as fuel. This does not have a big impact overall, but it is important to reduce emissions wherever possible so that offsetting is a last resort.

The impacts of these measures are not assessed separately, but contribute towards carbon savings from BAU changes (19% in Scenario 3) and fuel switching (32% in Scenario 3).

Sources of Leicester's residual emissions

Even under the most ambitious scenario, 29% of today's annual emissions will remain by 2030.

The figure on the right shows some examples, and indicates how these can realistically be reduced.

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In order to achieve net zero emissions by 2030, some form of carbon offsetting measures would inevitably be required.

HGVs

- Reduce demand where possible
- Potential solutions could include hydrogen, electrification or sustainable biofuels

Industrial heat

- Work with businesses to understand the energy end uses and possible technological alternatives
- Promote R&D and pilot projects

F-gases

- Future regulations to encourage refrigerants with lower GWPs
- Demand reduction and technology breakthroughs

Rail

- Collaborative push for rail electrification in Leicester and surrounding lines

Options for addressing residual emissions

Key options:

1. Measures within Leicester: tree planting and other nature based solutions (but scope is limited)
2. Measures outside Leicester:
   a. Nature-based solutions, directly undertaken by LCC with partners
   b. Large scale renewables, directly undertaken by LCC with partners outside the city or
   c. Purchasing carbon offsets.

Examples of nature-based solutions include:

- Protecting existing carbon sinks (e.g. greenfield sites), while also protecting ecosystems, natural habitats and biodiversity
- Implementing best practices on Council-owned land (e.g. parks) and working with other local landowners and communities to do the same
- Increasing tree cover where possible and ensuring that it is sustainably managed in the long term
- Releasing Council-owned agricultural land for alternative uses (e.g. woodland or rewilding projects)

Working with Government and engaging with stakeholders

Considering the scale of ambition, and the scale of costs involved, it is clear that LCC cannot achieve net zero alone, and will need support from the Government. Some of the most important requests will be to…

1. Ensure that national-level programmes and funding are sustained and stable
2. Remove barriers to those pursuing further levels of ambition
3. Re-allocate funding away from projects that increase emissions
4. Provide additional funding to support new climate mitigation activities
5. Promote jobs and (re) training opportunities in low carbon sectors
6. Help to ensure that there are robust supply chains to deliver the measures

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Other key stakeholders include…

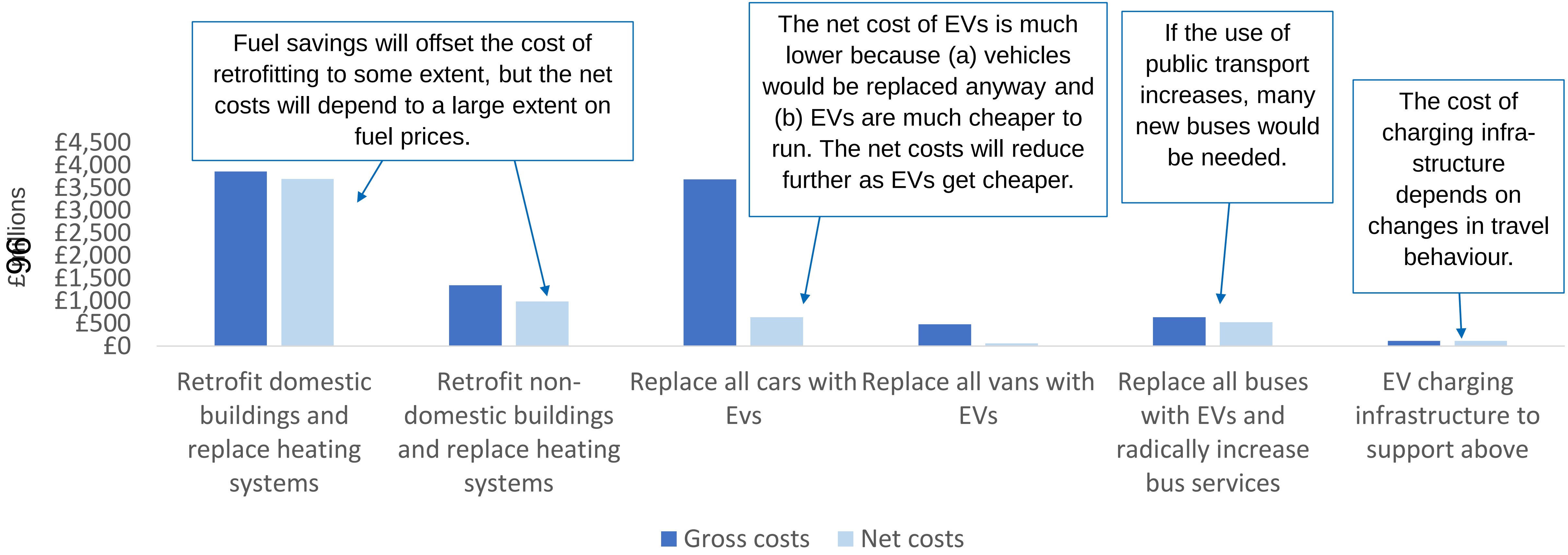
- **Other councils** (e.g. Leicestershire County Council, neighbouring district councils)
- **National-level stakeholders** (e.g. key Government departments, Ofgem, National Grid etc)
- **Business stakeholders** (e.g. Leicester and Leicestershire Enterprise Partnership)
- **Energy stakeholders** (e.g. Western Power Distribution and Cadent)
- **Housing providers** (e.g. housing associations)
- **Major energy users** (e.g. universities, the NHS, major landlords)

Key strategic decisions for Leicester

Topic	Description
Approach to offsetting	Decide whether to put effort and resources towards offsetting the residual emissions, or whether to focus on emissions reductions within the City itself (which would almost certainly make reaching net zero by 2030 impossible).
Decarbonisation of heat network	Decide what the role of district heating will be in the route to carbon neutrality, and whether it is worth expanding, given that it is unlikely that the heat network can decarbonise by 2030.
Local vs. large-scale renewables	If there are limited resources available to deliver or promote renewable energy projects, decide whether to focus resources on renewables within Leicester or outside of the City. Onshore wind and large-scale PV are the cheapest options, although they have a larger impact on the landscape.
Role of hydrogen **Gas grid upgrades (subject to decision on hydrogen)**	Decide to what extent the city wishes to invest in continuing to upgrade the gas grid, given that it will be necessary to phase out fossil fuels. This is subject to a decision first being made on the role of hydrogen, which could potentially utilise the existing gas grid. The Government has announced that they will decide on the role of hydrogen to heat buildings in/around 2026, so it may be necessary to wait until the national picture is clearer.

Potential investment costs for Leicester

Examples of 'big ticket' items include:



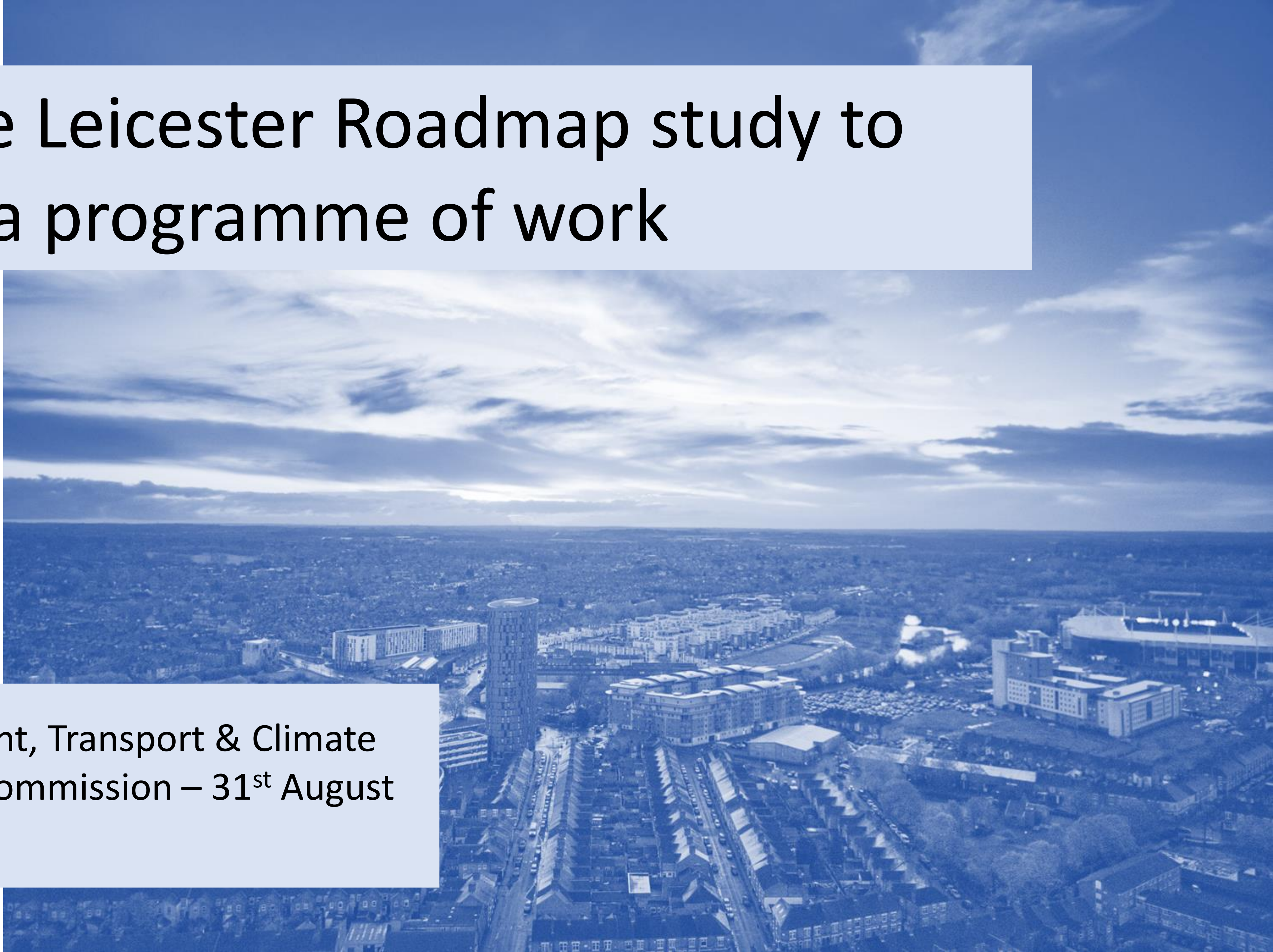
Remember: the costs of action are much less than the costs of inaction!

Conclusion

Whilst there are a huge number of actions that will need to be taken to transition to carbon neutrality, they can be simplified into four main areas:

- Start mainstreaming carbon neutrality considerations into all activity
- Accelerate activities to reduce emissions immediately
- Plan for larger emissions reductions longer-term
- Increase visibility of action on carbon neutrality to enhance support and buy-in

Using the Leicester Roadmap study to develop a programme of work



Economic Development, Transport & Climate Emergency Scrutiny Commission – 31st August 2022

A lot of good work to build on

Climate Emergency Partnership

BESS Energy

Dock 3-5 low carbon business units

St Margaret's carbon neutral bus station

Green Homes Grants

'A' rated council housing

Stocking Farm Sustainable Regeneration Project

London Road cycleway

Eco Schools

Santander e-bike hire scheme

Electric buses

Green BELLE

Smart ticketing

Loft insulation programme for council tenants

Public Sector Decarbonisation Scheme

Climate Woodland

Starting to ‘unpack’ the Leicester Roadmap….

- Housing
- Workplaces
- Transport
- Energy

- What are the specific outcomes needed by 2030?
- What rate and scale of delivery and investment does that imply? How much do we need to scale up?
- What should our approach be? What should we focus on?

Housing

2030 OUTCOMES – SCENARIO 3 MODELLING

Reduced heat demand – fabric retrofit	30% reduction
Smart heating controls	100% homes
Gas boiler replacement	100% boilers
New housing	100% is low-energy and all-electric

Workplaces

2030 OUTCOMES – SCENARIO 3 MODELLING	
Reduced space heating demand – fabric retrofit	20% reduction
Smart heating controls	100% workplaces
Air source heat pumps	95% workplaces
LED lighting (from 15% currently)	100%
New workplaces built	100% are low-energy and all-electric.

Transport

2030 OUTCOMES – SCENARIO 3 MODELLING

Car trips avoided	5%
LGV and HGV trips avoided	10%
Mode shift car to active travel	32%
Mode shift car to bus	10%
EVs – proportion of fleet	99% Cars, vans 100% buses
Hydrogen HGVs	2%

Energy

2030 OUTCOMES – SCENARIO 3 MODELLING

PVs on more *existing* houses and flats (2kW)	34,000 more houses
PVs on more *existing* commercial/public sector (5kW)	4,700 more buildings
PV arrays on more *existing* industrial buildings (5kW)	1,400 more buildings
Large-scale renewables – outside Leicester, but council-led	As much as possible – to reduce residual emissions
District heating decarbonisation	65%
Electricity grid	‘Grid balancing’ measures where possible e.g. battery storage, vehicle-to-grid

Scale of city-wide costs to 2030 – scenario 3

Housing – energy efficiency	£3,140M
Housing – heat pumps and electric cookers	£824M
Workplaces – energy efficiency, heat pumps and electric catering equipment	£1,353M
HGV driver training	£1M
EV cars, vans, motorcycles, buses	£4,841M
EV charge-points	£115M
Hydrogen HGVs	£2M
Housing - PVs	£97M
Non-domestic - PVs	£31M

Notes:

1. Figures are gross capital costs for Scenario 3 (not discounted) taken from Ricardo Carbon Neutral Roadmap - Evidence Report, Table 14, p99.
2. Figures don't account for savings accruing from certain measures e.g. reduced energy bills following energy efficiency measures, lower refuelling costs of EVs or cost savings/income from PV generated electricity.
3. Figures are total capital spend required from all sources. Includes investment by businesses, households, central government and others, in addition to the council.

Towards a programme of work

- What are the areas we should focus on?

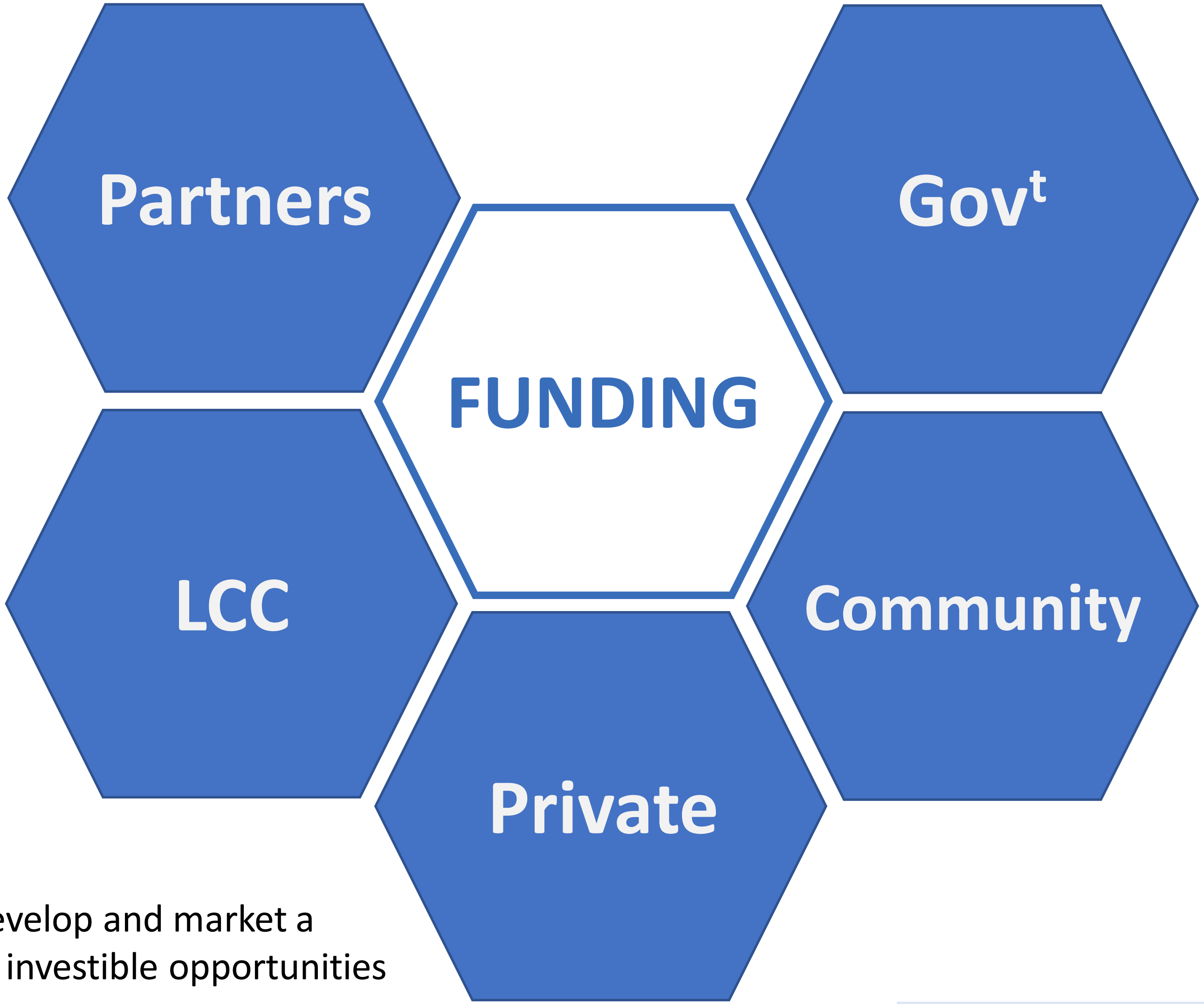
- How can we widen involvement and scale up funding?

Leicester City Council’s areas of control and influence

Control Around 7% of emissions	**Substantial influence** Up to perhaps a third of emissions	**Less influence** Remaining emissions
Council housing	Some private housing stock – via grants, regulation	Private housing stock – afford-to-pay
LCC operational estate	HA stock – via collaboration on retrofit	Private workplaces – non-engaged businesses/employers
LCC corporate estate	Some SMEs – via grants and support	Commercial/industrial processes
LCC school buildings	Key partners’ emissions	Community facilities – non-council
LCC construction	New development – particularly strategic sites and LCC owned land	Business-generated traffic – deliveries, haulage, business travel
LCC fleet and own EV chargers	Buses – services, infrastructure, electrification	Business fleets decarbonisation
LCC-led renewables, energy services	Active travel – infrastructure, promotion	Non-commuting, longer journeys – more difficult by bus or active travel
	EVs – via charging infrastructure	Rail services
	Traffic management and parking	
	District heating and partner-led renewables	

- Embed CE in all partnership agendas
- Key role for Climate Emergency Partnership
- Partner-led bids to access more funding sources

- Match-fund other sources
- Challenge ourselves to realign existing plans and budgets
- Robust plans and strategies – aligned with roadmap



- Push hard for much more funding and long term certainty
- Readiness for bidding – inc. inside track via engagement with Govt.

- City-wide promotion of community and business action
- Encourage individual investment by those who can afford it e.g. retrofit
- Crowd-funding opportunities

- Identify, develop and market a pipeline of investible opportunities
- Look at both commercial and CSR/philanthropic paybacks

Project-specific funding strategies

Next steps

- Widen involvement - share the roadmap report, develop and publicise key messages to public, work with partners through Climate Emergency Partnership and other partnerships
- New action plan – develop first iteration ready for end of current action plan – with future annual cycles of development and updating beyond that
- Use scenario 3 outcomes to provide aspirational goals closest aligned with our ambition - as context for action planning, but…..
- Develop targets and milestones based on specific areas and actions within our control
- Align key plans, strategies, decisions and funding bids to roadmap as they are developed, including – LTP, Housing Strategy, SPF Investment Plan
- Finance - how to attract new, scaled up and more diverse sources of investment into carbon reduction in Leicester
- Challenge ourselves to realign current plans and budgets to release more resources

Creating a world fit for the future

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Leicester Carbon Neutral Roadmap Evidence Base

Report for Leicester City Council

ED15531 | Issue Number 6 | Date 17/02/2022

Issue and Revision Record

Revision	Date	Originator	Checker	Approver	Description
01	02.09.21	KS, HR	HR	JH	First draft of Baseline chapter
02	26.10.21	KS, HR	HR	JH	Second draft of Baseline and first draft of Pathways chapters
03	22.12.21	KS, HR	HR	JH	First full draft of evidence report
04	21.01.2021	MR	HR	JH	Edits to section 5.2 (ensuring content aligns with that in roadmap) plus addressing previous comments
05	10.02.22	HR	JH	JH	Final draft
06	17.02.22	KS	HR	JH	Final draft with minor revisions

Table of contents

1 Introduction

1.1 Overview

On 1st February 2019, Leicester City Council (LCC) declared a climate emergency, stating an ambition of becoming a carbon neutral city by 2030 or sooner. There then followed some extensive stakeholder engagement, through the Leicester Climate Emergency Conversation, which ultimately led to the 'Leicester Climate Emergency Strategy' and 'Leicester City Council's Climate Emergency Action Plan: April 2020 - March 2023', both published in October 2020. [1,2]

This roadmap represents the next step in Leicester's journey towards carbon neutrality. It looks specifically at reducing those greenhouse gases emitted directly from within the city (Scope 1 emissions) and those outside the city caused by its use of energy generated elsewhere (Scope 2 emissions). Building on the work undertaken so far, this report presents a series of indicative pathways to 2030. In doing so, it will provide the evidence needed to understand the scale of the challenges and the key actions required to achieve carbon neutrality, also known as net zero emissions, for Leicester as a whole. It aims to address the following questions:

- What is the best strategic pathway for Leicester to become carbon neutral as quickly and cost-effectively as possible within a Paris-compliant carbon budget?
- What key actions will the council and other stakeholders need to take, when and at what scale?
- What are the main uncertainties, constraints, barriers, risks and opportunities? How should we respond to them?
- What measures and support will be needed from central Government or other external agencies?
- How can we maximise the co-benefits of climate action for our other strategic priorities and address any policy conflicts?
- What role would we need carbon sequestration, carbon offsetting or carbon removal technologies to play if Leicester is to become carbon neutral by 2030 and to remain within a Paris-compliant carbon budget?

The report is structured as follows:

- Section 1 gives an overview of the project, and key issues and terminology.
- Section 2 looks at current GHG emissions in Leicester, along with other key parameters.
- Section 3 sets out potential pathways to carbon neutrality.
- Section 4 considers who needs to do what to drive the transition to carbon neutrality.
- Section 5 sets out the costs and benefits from delivering carbon neutrality in Leicester.

[1] leicester-climate-emergency-strategy-2020-2023-final-version.pdf
[2] leicester-city-council-4ea2a6c.pdf (climateemergency.uk)

1.2 Definitions and scope

Carbon neutrality, also known as net zero, simply means achieving a balance between emissions of greenhouse gases (GHG) to the atmosphere and removals of carbon dioxide (the most widespread GHG) from the atmosphere, for example by nature-based solutions such as tree planting or by technological means such as carbon capture and storage. If the emissions and removals balance out, carbon neutrality has been achieved.

When looking at the emissions side of the equation, we are considering all greenhouse gases, so not just carbon dioxide from combustion of fuels, but also other gases such as methane emissions from waste or nitrous oxide emissions from agriculture.

The roadmap only covers scope 1 and 2 emissions. Scope 1 covers the direct emissions from within the City of Leicester (for example, from cars, gas boilers, industrial processes etc) while scope 2 covers the emissions from the generation of electricity consumed in Leicester. Scope 3 emissions – emissions taking place outside of the city boundary, but which may be created by activity in Leicester (for example disposal of waste outside of the city that is generated by residents and businesses in Leicester) is not covered. Nor are embedded emissions, for example emissions from the creation and transportation of products purchased and consumed in Leicester. That is not to say that tackling these sources of emissions is not important – it is. But they will be dealt with through other work streams.

Similarly, whilst the scope of this work is the city itself, joined-up working will clearly be important to tackle the climate emergency, for example working with Leicestershire County Council and its district and borough councils.

2 Baseline assessment

This section of the report establishes the baseline situation regarding fuel consumption and greenhouse gas emissions (GHG) emissions in Leicester. Consideration is also given to the energy efficiency of the building stock, deployment of local renewable and low carbon energy technologies, and electric vehicle (EV) uptake. These factors provide useful context to inform the assessment of potential future trends in later sections of this report.

Key messages

- Scope 1 and 2 **GHG emissions** for Leicester in 2019 were approximately 1,300 ktCO_2e. This includes carbon dioxide (mostly associated with energy use), methane (mostly associated with waste and agriculture), nitrous oxide (mostly associated with fossil fuel combustion and fertiliser), and f-gases (used in refrigeration technologies). Energy use in domestic buildings accounts for around 32% of these emissions, while energy use in non-domestic buildings (all sectors) accounts for around 39% and road transport 24%.
- In the domestic sector, a significant majority of emissions are associated with gas, which is used to supply space heating and hot water. This suggests that a key challenge will be **decarbonising the heat supply**. Although the same issue applies to energy use in non-domestic buildings and facilities, emissions from those sectors include a higher proportion of other **sector-specific energy uses**, due to specialist equipment, industrial activities, and so on. In many cases there is limited data available on those types of energy end uses, which makes it harder to identify suitable mitigation measures. This is another key challenge that will require particular engagement from businesses and local stakeholders.
- **Fuel consumption** in Leicester has decreased by around 20% since 2005, which is more than the national average of 16%. In the same time period, CO_2 emissions have decreased by more than 40%. The reason for this disproportionate change is due to **electricity grid decarbonisation**. This highlights the fact that, in addition to reducing fuel consumption, Leicester's ability to meet the net zero ambition will depend in significant part on how much fuel can be switched towards electricity and how much of that electricity is supplied via renewable energy.
- The **energy efficiency of the building stock** in Leicester, as measured by EPC ratings, is broadly in line with the national average. The efficiency varies by tenure, age and use. Maps have also been provided that show the average rating by postcode, which can potentially assist in targeting energy efficiency initiatives. The EPC ratings suggest that there is considerable scope to improve the current level of energy efficiency and doing so should be seen as a key priority for reaching net zero because it helps to alleviate pressure on grid infrastructure, minimise energy bills, improve thermal comfort, and reduce the amount of renewable technologies that need to be deployed.
- There are currently a range of **renewable and low carbon technologies** in Leicester producing both electricity and heat. The vast majority are roof-mounted PV arrays, but public statistics indicate that there are also a small number of micro wind turbines, biomass boilers, and heat pumps. At present, the amount of renewable electricity generated from these sources is equivalent to around 2% of the annual electricity demand for the whole city. In future, this amount will need to increase dramatically; the future renewable potential has been assessed as part of a separate study.
- There is also a **city centre heat network** and some smaller heat networks on council housing estates which between them serve thousands of council homes and other major civic buildings. Heat networks can offer carbon savings compared with individual heating

systems, and offer the advantage of potentially switching multiple buildings on to renewable sources of energy at the same time.

- Around 70% of emissions from **road transport** are associated with petrol and diesel cars. Of these, around 30% are short journeys, some of which could potentially switch to active travel or public transport. The remaining emissions are primarily associated with light goods vehicles (16%), heavy goods vehicles (9%) and buses (4%). All of these vehicle types aside from HGVs can in principle be replaced with electric vehicles, which will be a key method of reducing road transport emissions. However, by 2030, it is unlikely that a technological solution such as green hydrogen will be available for HGVs, and as a result it is probably not possible to reduce transport emissions by 100% by 2030.
- Uptake of **ultra-low emission vehicles** (ULEVs) has increased dramatically in recent years, rising from 181 in 2011 to 1,235 at the beginning of 2021. However, this only represents <1% of total vehicles in Leicester, and in order to meet the net zero ambition, in addition to radically decreasing demand for travel, nearly all vehicles would need to be zero emission.
- A very rough estimate of **Scope 3 emissions from waste and wastewater** indicates that this accounts for emissions in the region of c. 100 ktCO_2e per year. The majority of biodegradable municipal waste in Leicester (though not all) is processed at an anaerobic digestion plant in Wanlip and, compared with landfill, this reduces emissions considerably. However, when accounting for the amount that *is* landfilled, alongside other commercial & industrial (C&I), construction demolition and excavation (CD&E) and hazardous waste, the total is still equivalent to 5-7% of Scope 1 and 2 emissions.

2.1 Overview of the methodology

The following baseline assessment draws from a wide range of public datasets. In particular, it includes information about fuel consumption and CO_2 emissions which is disaggregated to a Local Authority level and published by the Department for Business, Energy and Industrial Strategy (BEIS). Where relevant, this information has been supplemented with local data and further analysis to provide a more detailed sectoral breakdown of the results.

Note that, due to the publication schedule of these datasets, a mix of 2018 and 2019 data has been used. In particular, at the time of writing, 2019 data on CO_2 emissions at local authority level has been published, whereas 2019 fuel consumption data at local authority level has not. This is not expected to affect any of the key take-home points, assuming that there were no radical changes in fuel consumption patterns in that time period.

2.2 Greenhouse gas (GHG) emissions

2.2.1 Scope of the assessment

Leicester City Council has set an ambition of becoming carbon neutral by 2030 or sooner. As explained in Leicester's Climate Emergency Strategy, the term 'carbon neutral' is understood to include not only carbon dioxide (CO_2), but all of the major GHGs, which include methane (CH_4), nitrous oxide (N_2O) and fluorinated gases or f-gases. Because these have different impacts on global warming, known as global warming potential or GWP, both the GHG emissions baseline and associated targets will be reported in units of CO_2 equivalent (CO_2e) to allow measurement and comparison of different gases.

In line with international reporting standards, GHG emissions from different sources are categorised into different 'scopes', as defined in the table below.

Type	Definition	Examples
Scope 1	Direct emissions from fuel combustion and fugitive emissions within the city boundary	• Fuel combustion in buildings and road vehicles • Emissions from agriculture, waste and wastewater treatment, or landfill activities taking place within Leicester
Scope 2	Indirect emissions from purchased electricity, heat, steam or cooling that is generated elsewhere	• Use of grid electricity within Leicester
Scope 3	Other indirect emissions	All other indirect emissions, such as: • Waste or wastewater treatment outside of Leicester • Transport of fuels that are used within the city • Supply chains for food, products and materials • Journeys to/from the city that are outside the Local Authority boundary • Shipping and aviation

This roadmap covers Scope 1 and 2 emissions from activities taking place within the City of Leicester Local Authority boundary. Most Scope 3 emissions are excluded from the assessment. Reliable figures are not readily available for most Scope 3 emissions, although a further study could seek to identify key sources and recommend opportunities to reduce them. Including Scope 3 emissions would represent a significant challenge for the Council, requiring the body to exert authority in areas where it already has limited influence. However, this report does include an estimate of Scope 3 emissions from waste and wastewater treatment. The vast majority of wastewater treatment takes place in Wanlip, which is outside the Local Authority boundary. Organic Municipal Solid Waste (MSW) is also treated in Wanlip, and the remaining waste is sent to several other locations. These Scope 3 emissions are reported in the interest of transparency, given the role that people and organisations in Leicester will need to play in reducing them.

2.2.2 Baseline emissions

2.2.2.1 City-wide total

Information on CO_2 emissions at a local authority level is published annually by BEIS, two years in arrears.[3] The dataset covers sectors and activities that emit CO_2. However, at a national level, CO_2 only accounts for around 80% of total GHG emissions, meaning that a significant portion of GHG emissions is excluded.[4] The remaining 20% comes from:

- Methane (CH_4), which is mostly associated with agriculture (e.g., livestock digestion) and waste management (e.g., organic waste decomposing in landfill);
- Nitrous oxide (N_2O), which is mostly associated with the use of fertilisers but is also emitted during combustion of fossil fuels and some forms of industrial activities; and
- Fluorinated gases (f-gases), which are used in refrigerants and air conditioning systems and can leak out during the manufacturing, operation or disposal process.

[3] BEIS, 'Emissions of carbon dioxide for Local Authority Areas; (published 2021). Available at: Emissions of carbon dioxide for Local Authority areas - data.gov.uk

[4] BEIS, '2019 UK Greenhouse Gas emissions' (published 2021). Available at: 2019 UK Greenhouse Gas Emissions, Final Figures (publishing.service.gov.uk)

Therefore, in order to provide a more comprehensive GHG emissions inventory for Leicester with a more detailed breakdown of emissions by fuel type and sector, we have taken the BEIS CO_2 data as a starting point and supplemented it with more detailed analysis based on various underlying and additional datasets such as sub-national fuel consumption, waste collection, and renewable energy statistics. These have been used to develop a CO_2e baseline for the City with our proprietary Net Zero Projections (NZP) tool.

Results are presented in Table 1 below. These have been split according to sector to facilitate a like-for-like comparison with the BEIS CO_2 dataset (illustrated in Figure 1).

Table 1. GHG emissions in Leicester by sector and fuel type, 2019

	Natural Gas ($ktCO_2e$)	Grid Electricity ($ktCO_2e$)	Petrol/ Diesel ($ktCO_2e$)	Other/Not Specified[1] ($ktCO_2e$)	Grand Total ($ktCO_2e$)
Scope 1 & 2 Emissions					
Sectors in the BEIS CO_2 dataset:					
Light industry	140.46	85.80		65.88	292.15
Large industrial installations	0.14	0.09		0.23	0.46
Agriculture (CO_2 from energy use) [2]				0.70	0.70
Commercial	54.73	69.20		0.14	124.07
Public sector	56.92	28.71		0.05	85.69
Domestic	317.08	92.72		7.30	417.09
Road transport			305.86		305.86
Railways			1.66		1.66
LULUCF net emissions [3]				-3.12	-3.12
Sectors not in the BEIS CO_2 dataset:					
Agriculture (non-CO_2 gases) [2]				4.68	4.68
F-gases [4]				71.24	71.24
TOTAL	569.32	276.52	307.52	147.11	1,300.47
Scope 3 emissions [5]					
Waste and wastewater treatment [4] [5]				c. 100	

Notes:

1. For some sectors, such as agriculture, emissions from energy use are not reported by fuel type, so these are listed in the 'Other/Not Specified' category, even though in reality they are likely to include some natural gas, grid electricity, petrol or diesel. The 'Other/Not Specified' category also includes some emissions that do not result from fuel use. For example, methane emissions in the waste sector arise due to the decomposition of biological material in landfill. Similarly, LULUCF emissions are affected by soil and plants absorbing CO_2 during respiration. In the case of light industry, the BEIS CO_2 dataset does not explicitly state what 'other fuels' contain, but by cross-referencing the fuel consumption data for Leicester, it is likely to include a significant proportion of petroleum products.[5]
2. The BEIS CO_2 data includes CO_2 emissions from energy use – that is, fuel use in agricultural facilities and processes – but does not include emissions from methane or nitrous oxide. In the agricultural sector, emissions are dominated by non-CO_2 gases. Total emissions from

[5] Examples of petroleum products used in the industrial sector include: Combustion plant for cement production, chemicals, food, drink and tobacco, pulp, paper and print; lime production; use in off-road machinery; For more information, see, 'UK sub-national residual fuel consumption: Methodology summary' (2021) available at: UK sub-national residual fuel consumption for 2025-2019 (publishing.service.gov.uk)

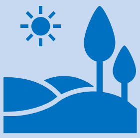
agriculture were therefore estimated by assuming that the ratio of CO_2 to other gases in Leicester matches the national average for this sector.

3. LULUCF stands for 'land use, land use change, and forestry'. This category represents the movement of CO_2 between the atmosphere and different natural 'reservoirs' such as forests, soil, etc. Some human-induced effects, such as tilling the soil, result in CO_2 being emitted to the atmosphere, while others, such as planting trees, result in CO_2 being absorbed from the atmosphere. This category quantifies the net impact of all such activities taking place within the Local Authority boundary.
4. Two estimates were made based on two different methods; results ranged from approximately 65 ktCO_2e to 103 ktCO_2e. See Section 2.6 for further details.
5. Some or all of the emissions from this category, such as those arising from the transportation of waste, may occur within the Local Authority boundary, in which case they would be classified as Scope 1 or 2 emissions and counted in the transport figures elsewhere in the table. However, it is not possible to determine the proportion based on available public information.

Overall, these calculations indicate that Scope 1 and 2 GHG emissions for Leicester as of 2019 were c. 1,300 ktCO_2e.

Energy use in domestic buildings accounts for the largest portion of the total, at around 32%, followed by road transport (24%) and energy use in light industrial buildings and facilities (22%).

Emissions from commercial buildings are estimated to account for roughly 10% of GHG emissions while public sector buildings account for around 7%. Emissions from f-gases account for roughly 5% of emissions, although it should be noted that these have been estimated based on national datasets rather than information specific to Leicester.



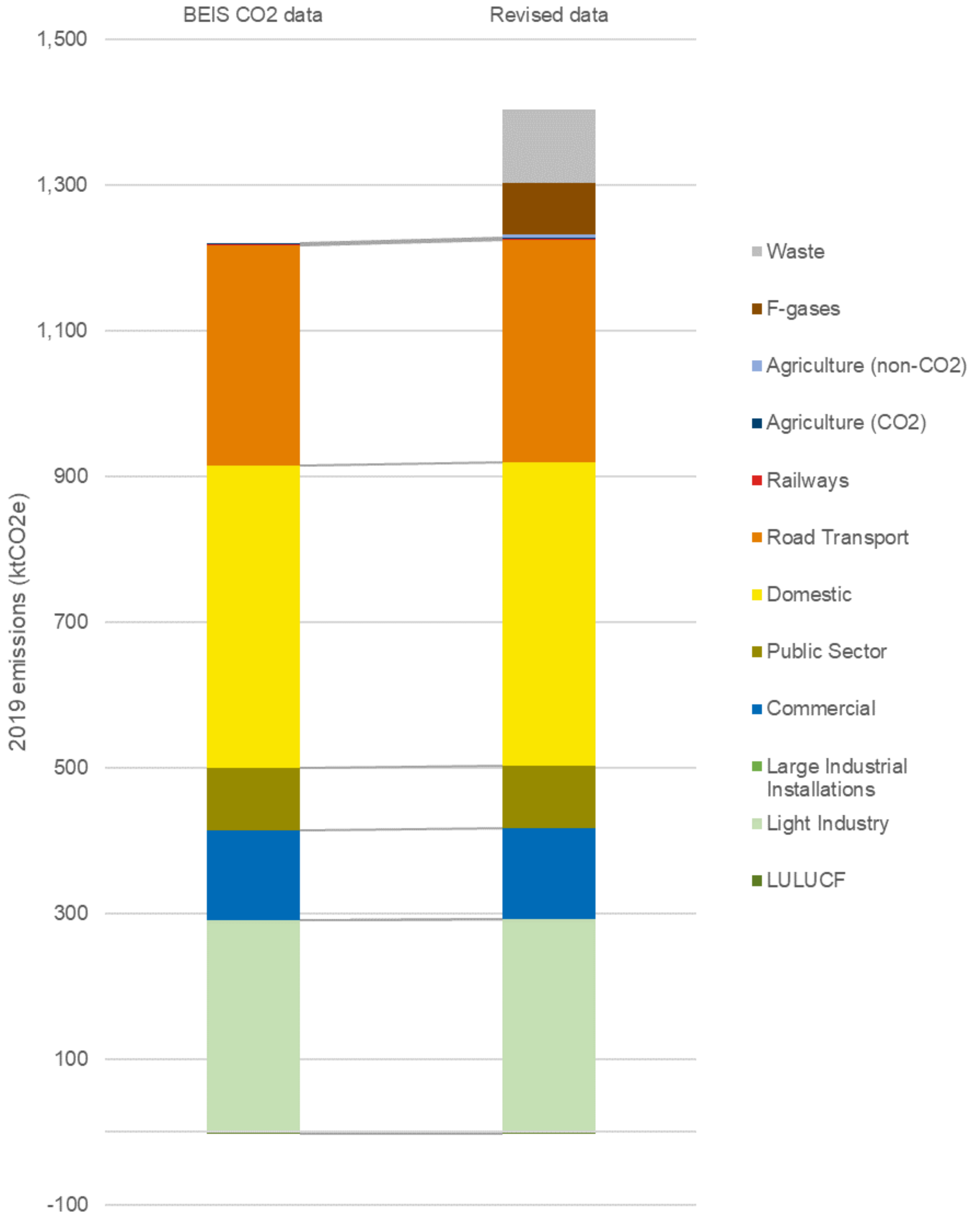
The remaining Scope 1 and 2 emissions are associated with agriculture, large industrial installations, railways, and LULUCF activities, all of which make up less than 1% of the total. The LULUCF sector results in net CO_2 *removals* from the atmosphere, rather than emissions to the atmosphere. However, these are very small, reflecting the urban setting. The constrained land area means that there may be less scope for additional CO_2 sequestration to be achieved via tree planting and other land management practices.

Emissions from waste and wastewater treatment combined are estimated to be roughly 100 ktCO_2e. These are assumed to be Scope 3 emissions and are therefore excluded from the total. However, for context, they are roughly the same order of magnitude as all emissions from commercial buildings.

Further details relating to the domestic, non-domestic and road transport sectors are provided in the following sections of this report.

Figure 1 below shows the gross GHG emissions for Leicester, and also highlights differences between the BEIS LACO_2 inventory and revised estimate.

Figure 1. Gross GHG emissions in 2019, comparing the BEIS CO_2 data and the revised GHG inventory



There are a few notable differences between the BEIS CO_2 data and the revised inventory:

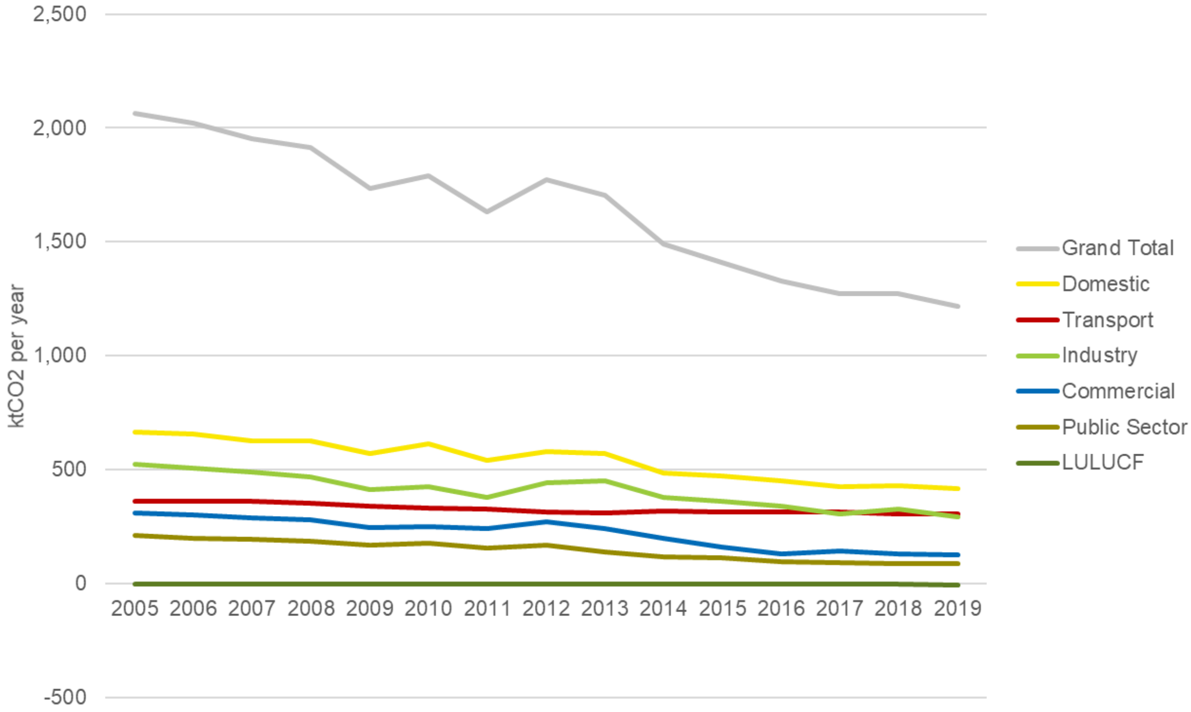
- For most sectors, there are small (<1%) differences simply due to the use of CO_2e conversion factors rather than CO_2 conversion factors.
- For agriculture, there is a large difference in the results which is due to the inclusion of methane and nitrous oxide. However, because emissions from agriculture are low, this makes a very small difference to the overall total.
- F-gases and waste/wastewater treatment are additional sources of emissions that were not included in the BEIS data.

In order to consider trends over time, we have referred to the BEIS Local Authority CO_2 dataset. As stated previously, this only considers CO_2 rather than all GHGs; however, it still offers useful insight into major changes that have occurred since 2005.

As shown in Figure 2 below, total CO_2 emissions in Leicester decreased by around 41% from 2005-2019. This is higher than the national and county-wide changes in the same time period, which saw decreases of around 36% and 30%, respectively. Part of this change is due to the decrease in fuel consumption, which was higher in Leicester than the UK as a whole (see Figure 8).

Another significant change in emissions was due to decarbonisation of the national electricity grid, which is associated with the phasing out of coal and increase in renewable power generation. While electricity use in Leicester decreased by around 20% in that time, CO_2 emissions per unit of grid electricity dropped by 55%, so emissions from electricity use decreased by nearly 70% overall. This highlights the importance that grid decarbonisation will play in the future when there is likely to be a widespread shift to the use of electricity for other purposes such as heating and transportation. The carbon intensity ($kgCO_2/kWh$) of most fuels other than electricity remains comparatively stable, so changes in emissions from sectors that rely on fossil fuels (such as transport) generally scale with changes in fuel consumption.

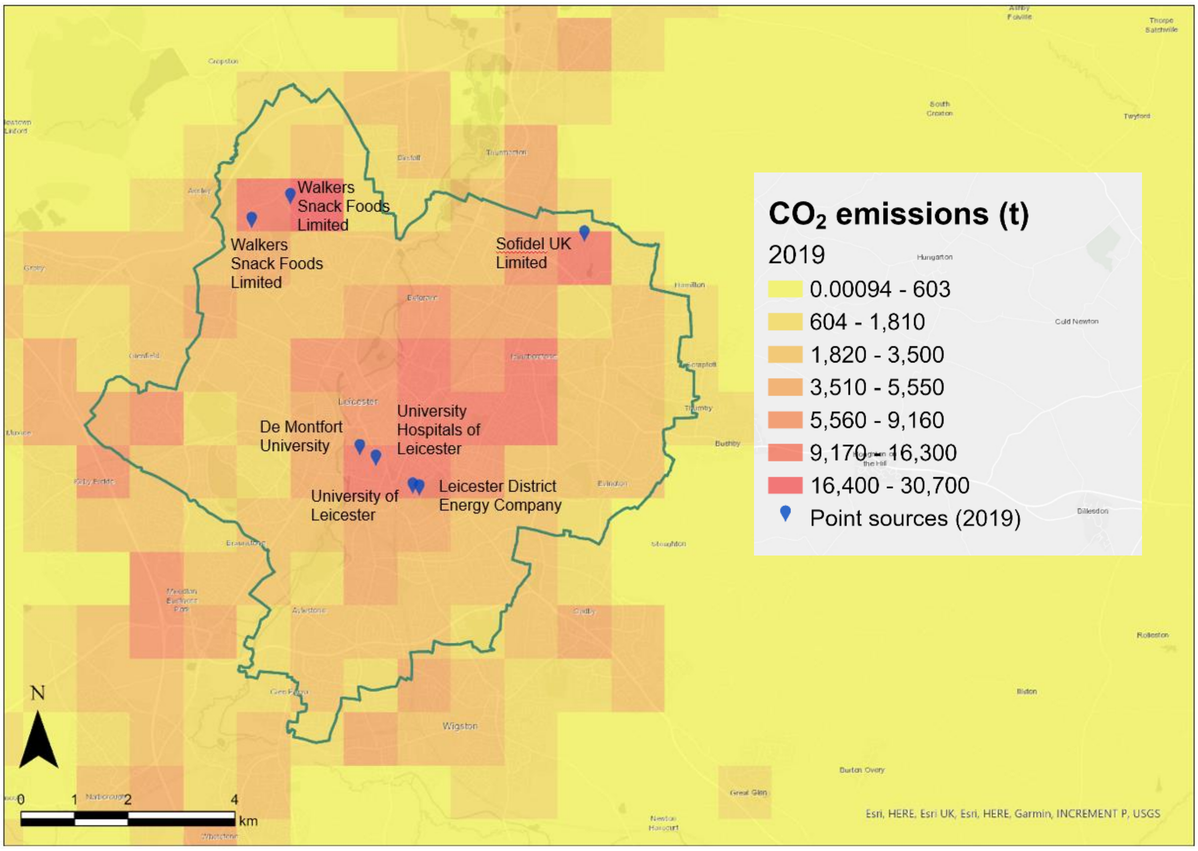
Figure 2. Trends in CO_2 emissions in Leicester, 2005-2019



The maps on the following pages show the spatial distribution of CO_2, nitrous oxide (N_2O) and methane (CH_4) emissions at a 1x1km grid level, as published within the National Atmospheric Emissions Inventory (NAEI) mapping database.[6] The gases are presented separately because the NAEI does not report f-gases, but these three GHGs in combination account for the majority of emissions.

[6] NAEI, 'UK Emissions Interactive Map' (2021). Available at: UK Emissions Interactive Map (beis.gov.uk)

Figure 3. Total CO_2 emissions in Leicester, 2019. Source: NAEI



CO_2 emissions in Leicester are generally higher in the city centre and tend to decrease nearer to the Local Authority boundary, which is unsurprising given the density of buildings and other activities in the city centre. Emissions are also slightly higher to the East of the city centre, which could be associated with the higher emission from manufacturing in those areas (see Figure 4). The NAEI also reports several point sources[7] of CO_2 emissions, which are shown on the map. The ones in the city centre include the Leicester District Energy Company, the University of Leicester, De Montfort University and the Leicester Royal Infirmary. As described in Section 2.3, these are associated with the district heating scheme and combined heat and power (CHP) plants. Around the perimeter of the city, there are several point sources associated with individual manufacturing or commercial facilities.[8]

[7] For an explanation of what types of facilities count as point sources and how the information is collected, refer to the NAEI website: Emissions from NAEI large point sources - NAEI, UK (beis.gov.uk)

[8] UK Emissions Interactive Map (beis.gov.uk)

Figure 4. CO_2 emissions from the manufacturing sector in Leicester, 2019. Source: NAEI

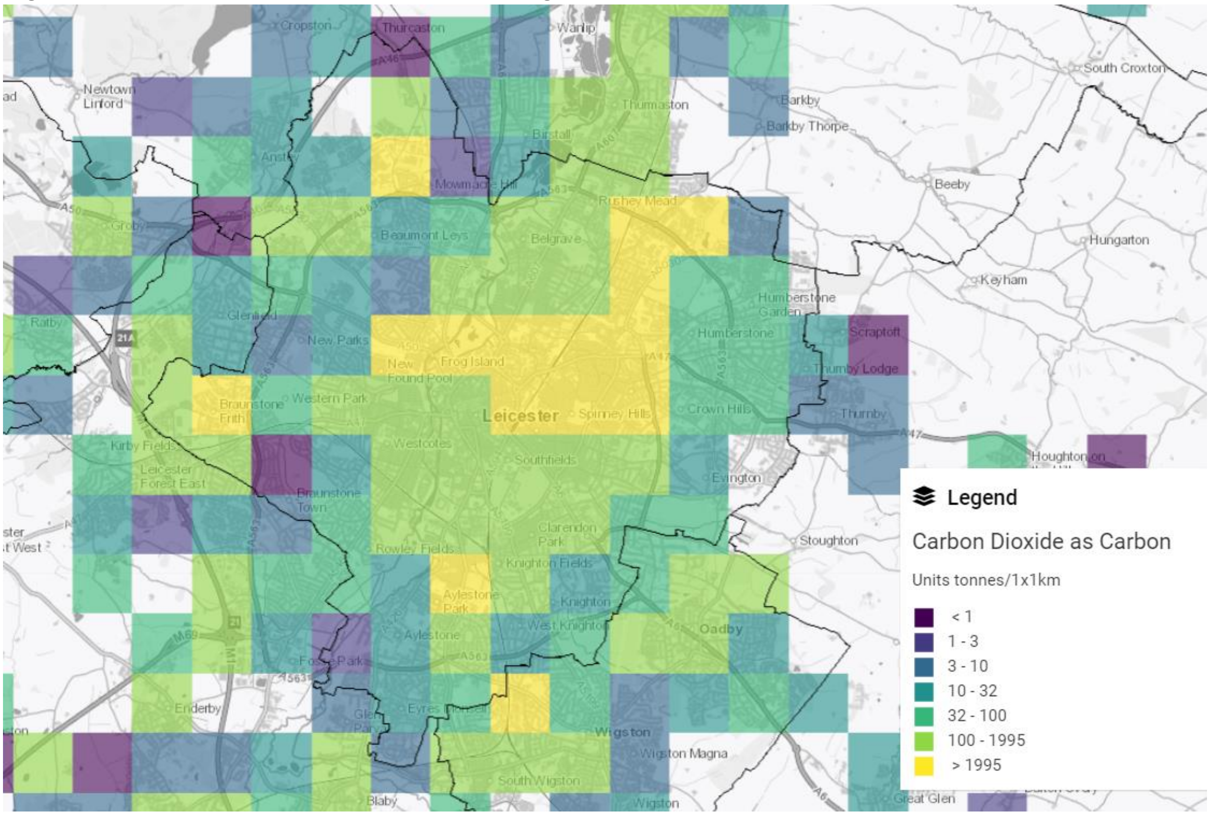
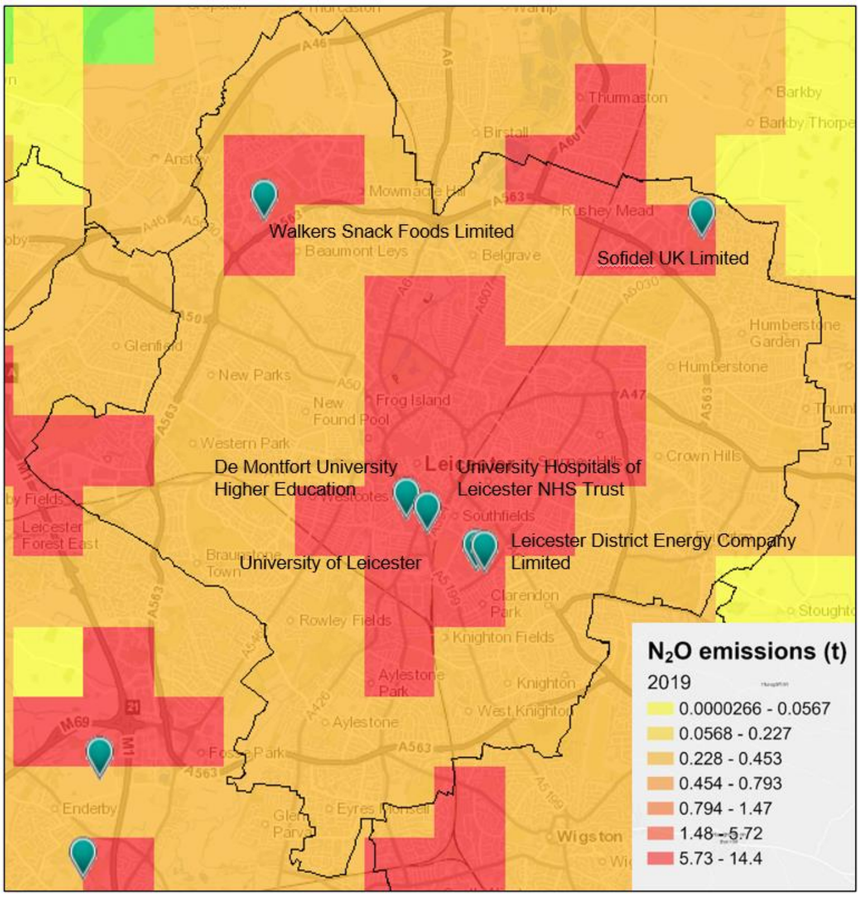
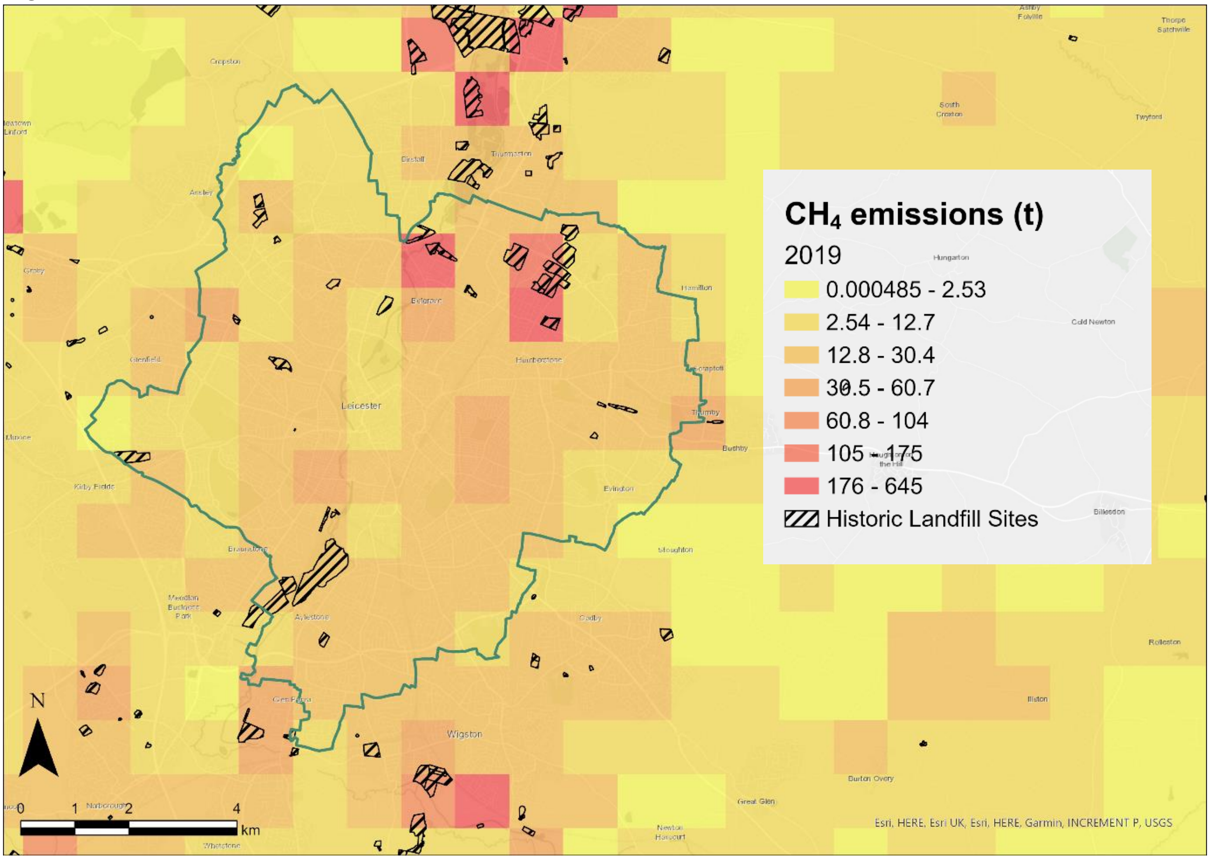


Figure 5. Total nitrous oxide emissions in Leicester, 2019. Source: NAEI



As is the case with CO_2 emissions, nitrous oxide emissions in Leicester are higher in the city centre. Since there is relatively little agricultural activity in Leicester, it stands to reason that N_2O emissions are more likely to come from fossil fuel combustion rather than fertiliser use. Outside of the Leicester boundary, there are slightly higher emissions in Wanlip which are assumed to be associated with the wastewater treatment plant, and also along the western edge of the city, due to the presence of the M1. Similar to the spread of carbon dioxide emissions, the map also demonstrates nitrous oxide emissions are higher to the east of Leicester's city centre.

Figure 6. Total methane emissions in Leicester, 2019. Source: NAEI



The map of methane emissions shows localised hotspots around the northern part of the city. This is potentially associated with the historic landfill sites in those areas, which will continue to emit methane while the organic material undergoes anaerobic decomposition. The outlines of historic landfill sites are shown on the map as well for information only, as it is not possible to directly attribute methane emissions to a specific site based on publicly available datasets.

As with nitrous oxides, there are also areas of significantly higher methane emissions around Wanlip likely due to the AD and wastewater treatment plants.

When interpreting GHG emissions data it is helpful to refer to the underlying information on fuel consumption. Emissions do not directly scale with fuel consumption because different fuels have different ‘carbon intensities’, but they can point to underlying trends and activities taking place.

The most recent fuel consumption data published by BEIS is for 2018.[9] Results are shown below. (Note that the ‘Non-Domestic’ category includes the following categories reported in the BEIS dataset: ‘Industrial’, ‘Commercial’, ‘Public Sector’ and ‘Agriculture’. ‘Other Fuels’ includes ‘Coal’, ‘Manufactured Fuels’ and ‘Bioenergy & Wastes’.)

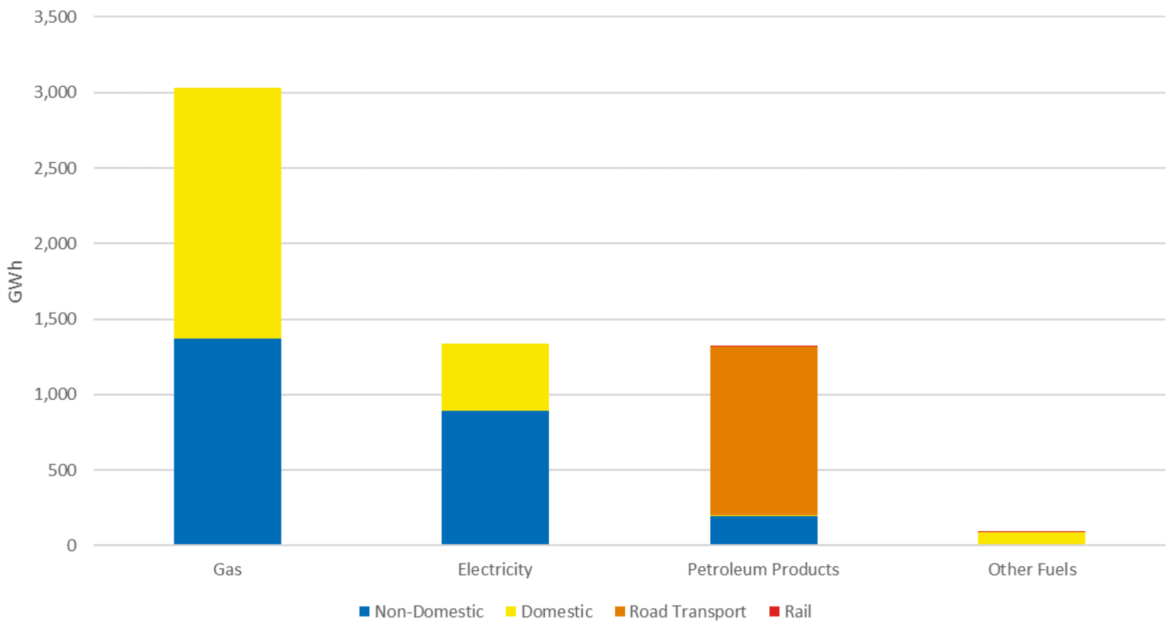
Table 2. Fuel Consumption by Sector, 2018. Source: BEIS

	Gas (GWh)	Electricity (GWh)	Petroleum Products (GWh)	Other Fuels (GWh)	Total (GWh)	% of total
Non-Domestic	1,368	891	196	4	**2,459**	43%
Domestic	1,665	446	6	85	**2,202**	38%
Road Transport	0	0	1,115	0	**1,115**	19%
Rail	0	0	6	0	**6**	<1%
Total	**3,033**	**1,337**	**1,323**	**89**	**5,782**	**100%**
% of total	52%	23%	23%	2%	**100%**	

These statistics show a relatively even split between fuel consumption in domestic (38%) and non-domestic (43%) buildings. Within the domestic sector, natural gas accounted for 76% of total fuel consumption, which typically supplies space heating and hot water, followed by electricity with 20%. Within the non-domestic sector, natural gas still makes up the majority fuel consumption with 56%, although electricity has a higher share with 36%. The remaining 8% are primarily from petroleum products. The road transportation sector accounted for around 19% of total fuel consumption in Leicester in 2018.

Figure 7. Fuel Consumption by Fuel Type, 2018

[9] BEIS, ‘Sub-national total final energy consumption data 2005-2018’ (published 2020). Available at: [Sub-national total final energy consumption data - data.gov.uk]



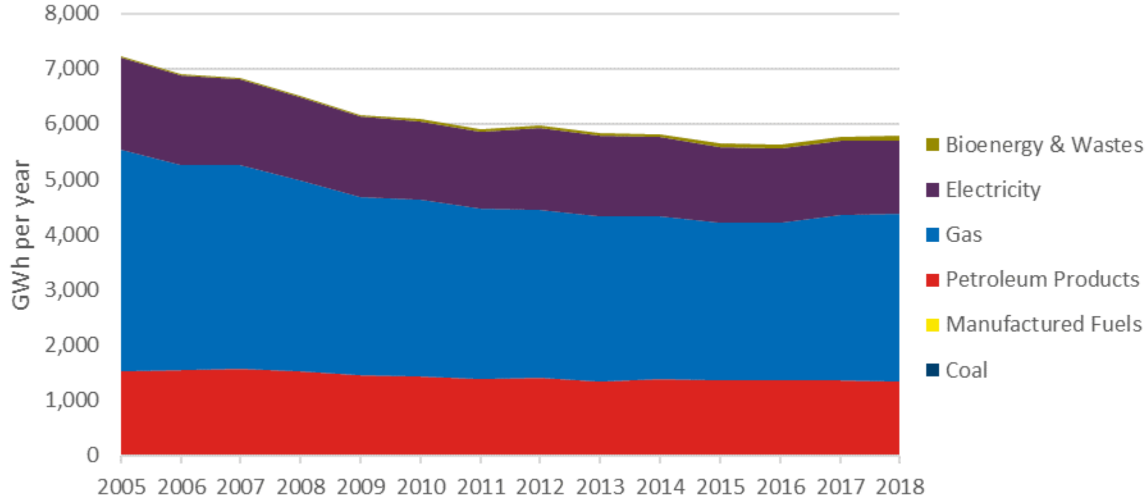
When considering fuel consumption by fuel type, gas was by far the largest contributor, accounting for 52% of all fuel used in 2018. Electricity and petroleum products each made up 23% of overall usage while other fuels (such as coal and manufactured fuels) only made up 8%. Gas use could be predominantly attributed to domestic use with 55%, followed by non-domestic buildings with 45%. The vast majority of petroleum products were used in the road transport sector (84%). This fuel type distribution is unsurprising considering the urban character of Leicester City.

As shown in Figure 8, total fuel consumption in Leicester decreased by around 20% between 2005 and 2018 for all sectors and all fuel types, with the exception of fuels derived from bioenergy and waste. (For comparison, the UK as a whole saw a roughly 16% decrease in total fuel consumption.) In particular, the use of natural gas decreased by around 24% in that time while petroleum products saw a reduction of 12%. This trend is likely due to a wide range of factors, including economic trends (which would have different impacts depending on the specific types of commercial and industrial activities taking place in Leicester, along with household incomes and residential energy use, but could also indicate an increasing prevalence of energy efficiency measures in buildings and industry. The change in fuel consumption was higher in the industrial and commercial sectors (25% decrease) than in the domestic sector (19% decrease) and transport (8% decrease).

It is worth recalling that CO_2 emissions fell by more than 40% in the same time period, which is disproportionate compared with the changes in fuel use. This highlights the importance of electricity grid decarbonisation on total GHG emissions. On one hand, it can be viewed as a positive factor, because so much progress has been made due to changes in the energy sector. On the other hand, it highlights that the actual levels of improvement from demand reduction are comparatively small. In essence, the reductions in this time period are low-hanging fruit; going forward, there will need to be a much greater emphasis on demand reduction in all sectors.

When looking at total fuel consumption over this period, the largest reduction occurred between 2005 and 2009. The rate slowed after that, but consumption still generally decreased until 2016, after which a small increase can be observed.

Figure 8. Trends in fuel consumption, 2005-2018. Source: BEIS



The maps below show the spatial distribution of domestic and non-domestic gas and electricity consumption, by Lower Super Output Area (LSOA) and Middle Super Output Area (MSOA) respectively.[10,11] They broadly reinforce the messages in Section 2.2.2 regarding the spatial distribution of CO_2 emissions.

The amount of gas and electricity used per LSOA or MSOA will depend in part on the number of domestic or non-domestic buildings and facilities in that geographic area, as well as the types of activities and level of energy efficiency. Note that BEIS allocates gas meters to ‘domestic’ or ‘non-domestic’ categories based on a threshold for annual consumption, not based on specific information about the building or facility. This means that, in principle, some small non-domestic buildings (e.g. corner shops) could be allocated to the ‘domestic’ sector and some large domestic buildings could be allocated to the non-domestic sector.

[10] BEIS, ‘Sub-national gas consumption data 2019’ (published 2021). Available at: Sub-national gas consumption data - GOV.UK (www.gov.uk)
[11] BEIS, ‘Sub-national electricity consumption data 2019’ (published 2021). Available at: Sub-national electricity consumption data - GOV.UK (www.gov.uk)

Figure 9. Domestic electricity consumption by LSOA, 2019. Source: BEIS

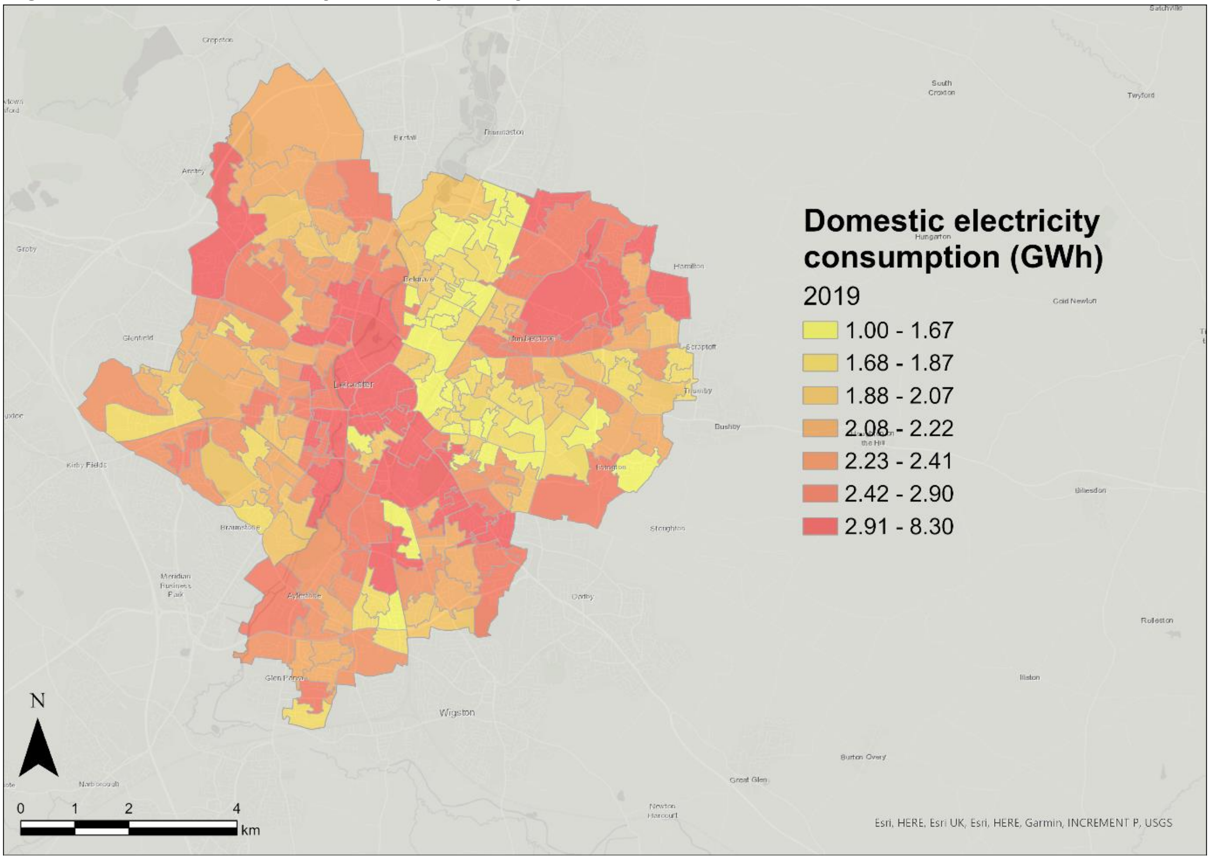


Figure 10. Domestic gas consumption by LSOA, 2019. Source: BEIS

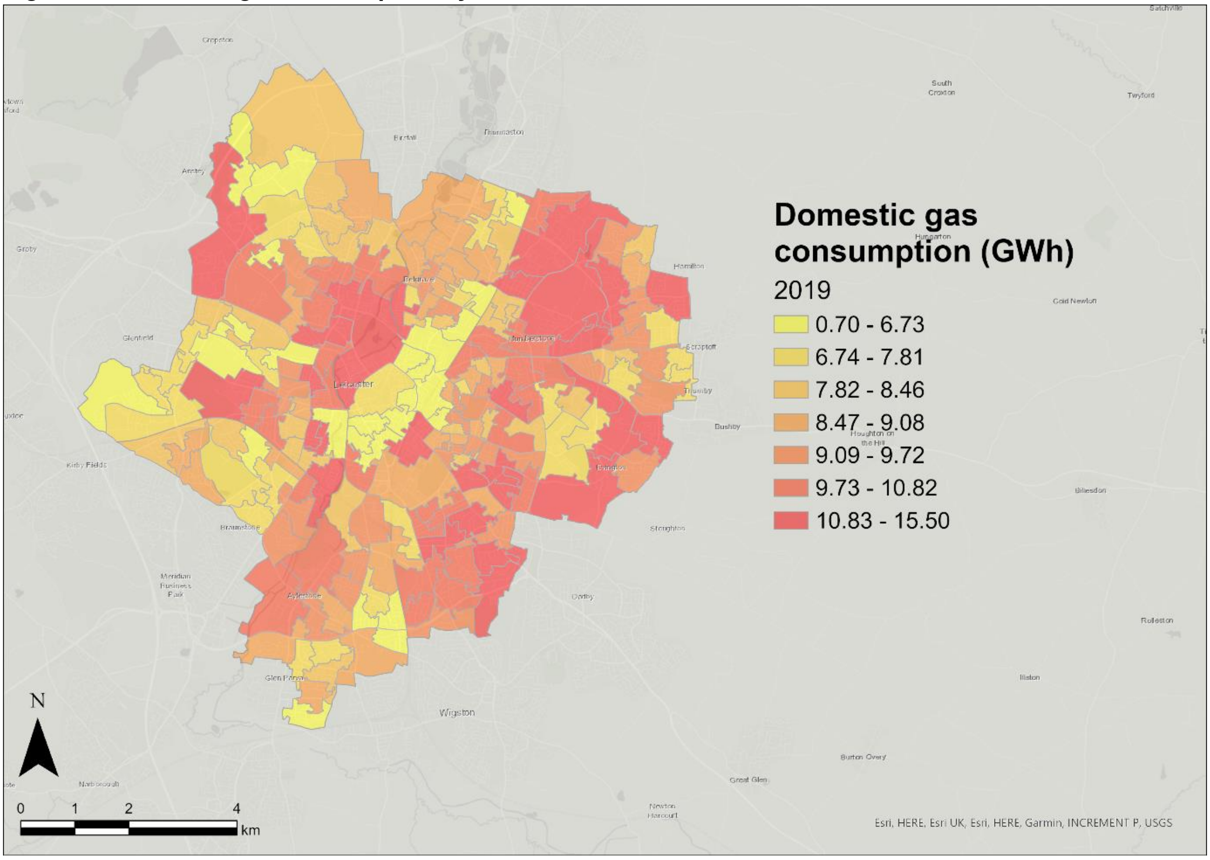


Figure 11. Non-domestic electricity consumption by MSOA, 2018. Source: BEIS

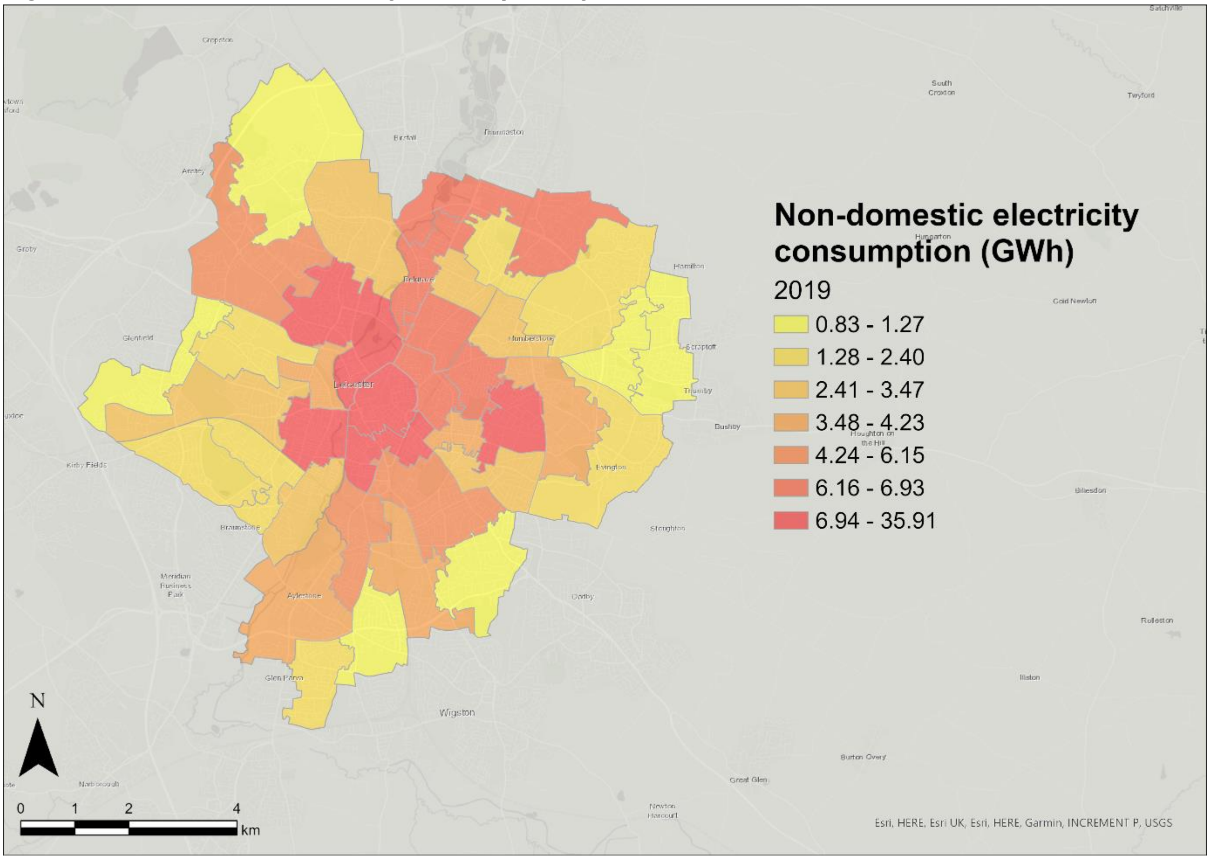
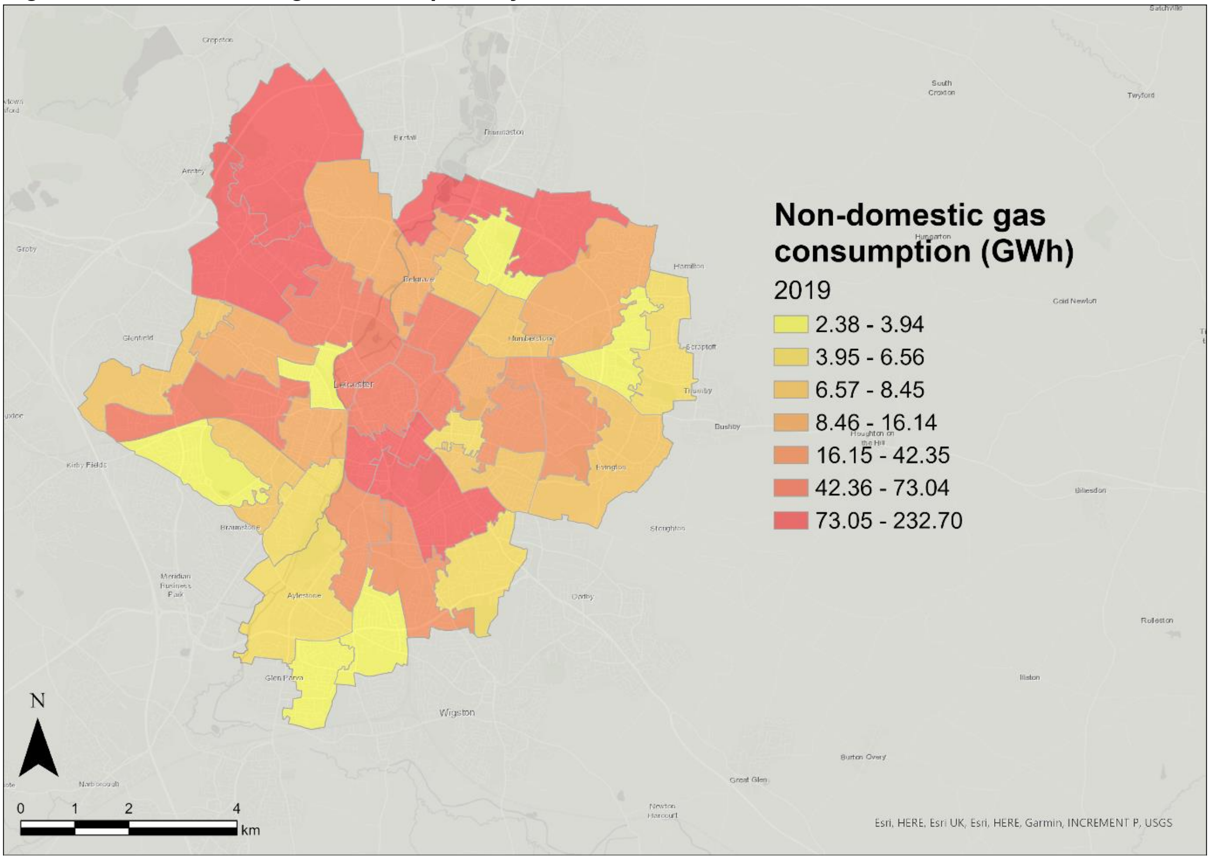


Figure 12. Non-domestic gas consumption by MSOA, 2018. Source: BEIS

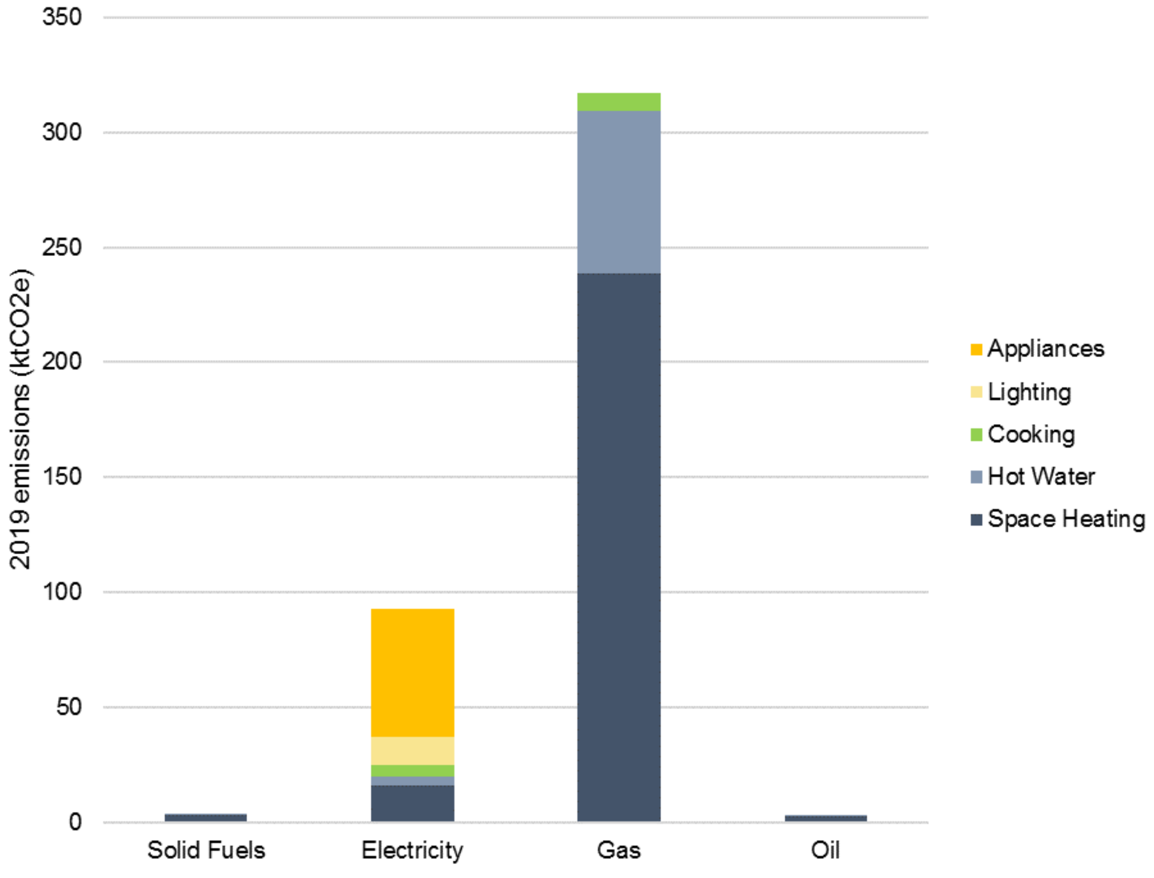


2.2.2.2 Emissions: Domestic buildings

To provide a more detailed understanding of the sources of domestic emissions in Leicester, the data presented in Figure 1 have been disaggregated by end use. This is based on national statistics for typical energy end uses in domestic buildings as set out in the BEIS publication, *'Energy Consumption in the UK'* (ECUK), which have then been applied to Leicester's GHG emissions inventory.[12]

As shown in Figure 13, the vast majority of emissions in the domestic sector stem from natural gas, roughly three-quarters of which is likely to be used for space heating, with the remainder used for water heating; a small proportion is also used for cooking. Electricity accounts for around 22% of emissions in the domestic sector in Leicester. The majority of emissions from electricity stem from appliances (60%), followed by space heating (17%) and lighting (14%). Fuel consumption data for Leicester indicates that only a very small amount of solid fuels and gas oil are used within the domestic stock.

Figure 13. Estimated split of domestic GHG emissions in Leicester by end use, 2019. Source: BEIS



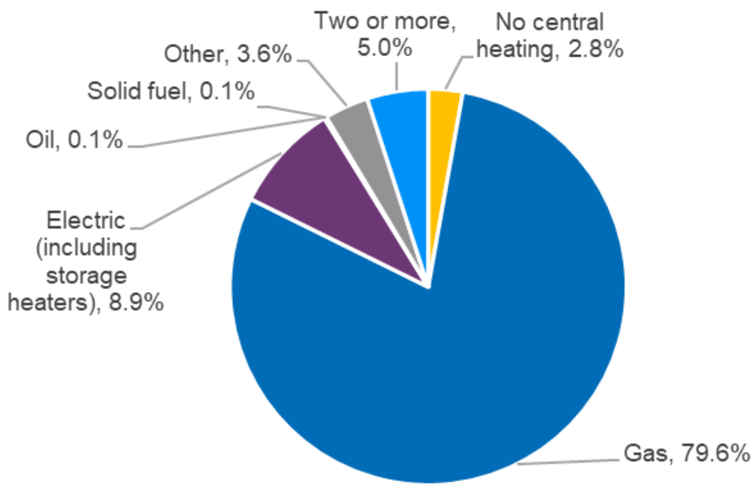
Over time, the emissions from electricity will continue to decrease due to grid decarbonisation. The emissions from gas, on the other hand, would generally remain stable assuming there is no major change in energy demand for heating, hot water and cooking. This shows that the major challenge of

12 BEIS, Energy Consumption in the UK, [Energy consumption in the UK - GOV.UK (www.gov.uk)]

decarbonising the domestic stock is associated with decarbonising heat demand – something that is acknowledged within the UK's 2017 industrial strategy and CCC studies.[13,14]

Another indicator of the current sources of emissions in the domestic building stock, and the types of interventions that might be required to mitigate these, is the split of heating systems. 2011 Census data was used to generate a rough estimate of how people in Leicester tend to heat their homes.[15] The vast majority of properties are heated using gas, with electric heating being the next major contributor. These results, which align very closely with national figures, suggest that in order for Leicester to achieve net zero emissions by 2030, it will be necessary to replace roughly 90% of all existing domestic heating systems in the city – essentially, all those that use fossil fuels – since it is unlikely that an alternative technology such as hydrogen gas would become available in that time period. Doing this would also result in a large increase in electricity demand which would need to be mitigated via energy efficiency measures and behaviour change.

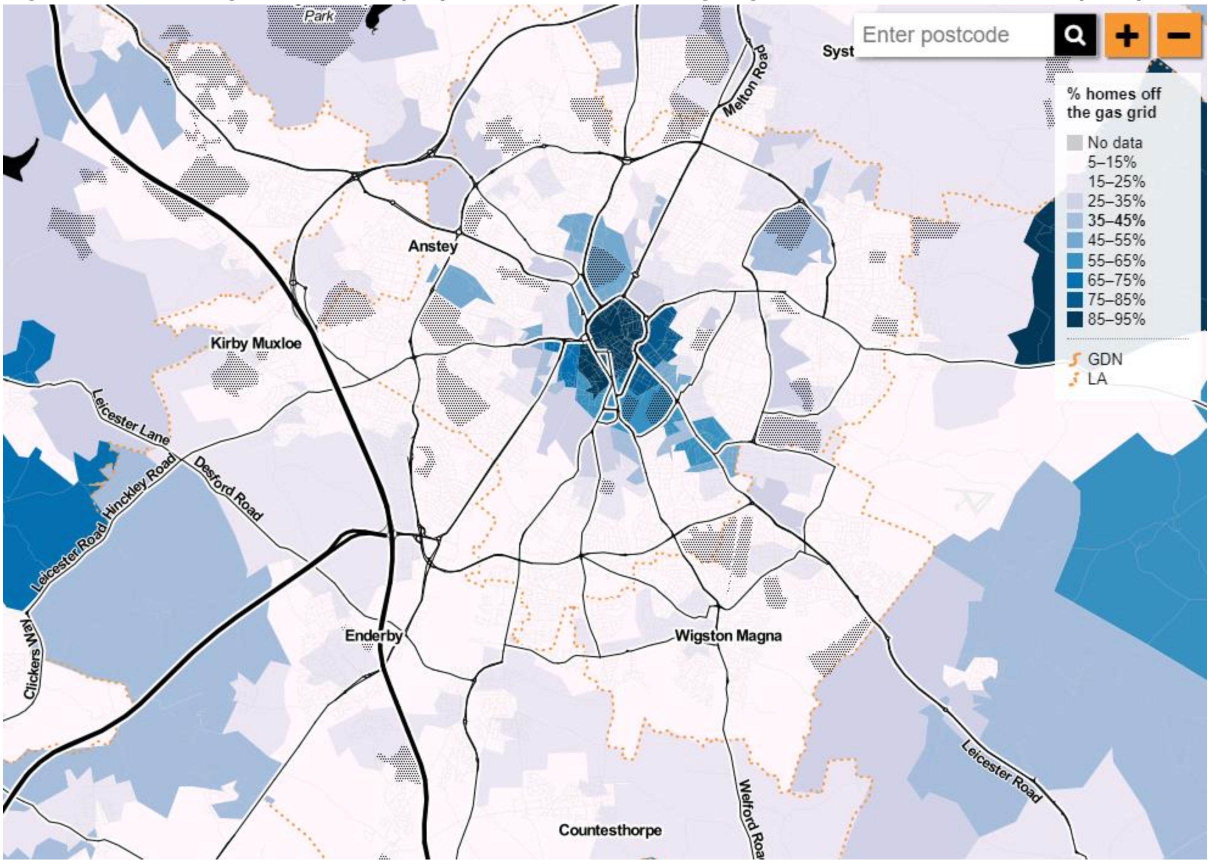
Figure 14. Types of domestic heating systems in Leicester. Source: Census 2011



There is a significant difference in types of heating system across the city, as shown in the map below, which was developed by Kiln in 2015 for Affordable Warmth Solutions in association with BEIS. Properties in the city centre are much less likely to use gas heating systems, suggesting that a geographically targeted approach may be required.

[13] The UK's Industrial Strategy - GOV.UK (www.gov.uk)
[14] CCC, *'Net Zero – The UK's Contribution to Stopping Global Warming'* (2019). Available at: Net Zero - Technical Report - Climate Change Committee (theccc.org.uk)
[15] Office for National Statistics, *'2011 Census, Table QS415EW'* (2011). Available at: QS415EW (Central heating) - Nomis - Official Labour Market Statistics (nomisweb.co.uk) Note that, although it is somewhat out of date, and is subject to some uncertainty due to the self-reported information, the Census data is nonetheless expected to capture the majority of the existing stock.

Figure 15. Percentage of domestic properties that are off the gas grid as of 2015. Source: Kiln (2015)



To understand the relative level of energy efficiency of the existing building stock in Leicester and put this into context with the rest of the UK, energy performance certificate (EPC) data was retrieved from the Ministry of Housing, Communities and Local Government website.[16]

As shown in Figure 16, the median 'current' EPC rating for buildings in Leicester is D, which is the same as the national average. The median 'potential' EPC rating is B. Although it is not possible to directly translate this into an equivalent carbon saving, for context the National Energy Efficiency Database indicates that adopting common, cost-effective energy efficiency measures can result in a c. 5-15% reduction in heating demands.[17] More ambitious retrofitting schemes can achieve much greater improvements, reducing heating bills by 80% or more. This suggests that there is considerable scope for improvement within the domestic stock, although it also highlights that there will be a significant challenge in achieving the Government's ambition for all homes to eventually reach a minimum rating of 'C'.[18]

Note, an explanation of EPCs is provided on the following page.

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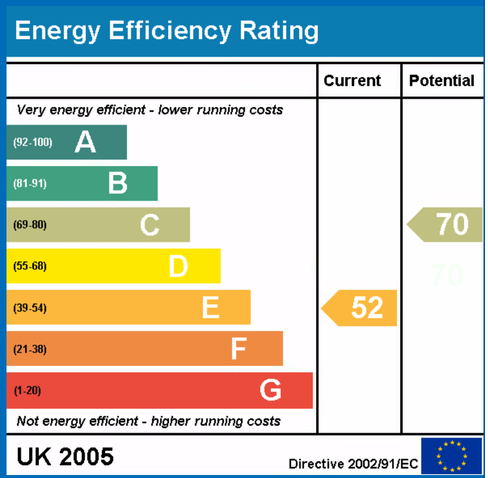
[16] https://epc.opendatacommunities.org/

[17] EPCs provide recommendations for energy efficiency measures that are tailored to each building. These include measures such as wall, roof, or floor insulation; upgrading to double or triple glazing; upgrading the heating system; installation of PV or solar thermal technologies, etc.

[18] The actual carbon savings would depend on which energy efficiency measures are implemented. In practice, these modifications are often costly, and uptake has historically been low in the absence of government or Local Authority funding / subsidies. Local Authorities generally have limited influence over the existing building stock, although it is possible to reduce barriers via permissive Local Plan policies and permitted development rights.

What are EPCs and why are they important?

EPCs provide a modelled estimate of the annual fuel consumption and CO_2 emissions from buildings, based on observations about their size, layout and construction. Although the results do not necessarily indicate the actual fuel consumption or emissions from a given building – this depends on many factors including occupant habits – EPCs allow a like-for-like comparison between buildings with equivalent geometry.



EPCs present an energy efficiency ranking for the building, based on a scale from A (best) to G (worst), as illustrated in the image on the right. Note that domestic EPCs show the potential rating that could be achieved if energy efficiency measures were introduced, but this is not the case for non-domestic EPCs.

The publicly available datasets are updated regularly and, at the time of writing, span the time period from 2008 through March 2021. Collectively, they cover the majority of the existing stock, as all buildings are required to undergo an assessment to obtain an EPC when they are constructed, sold, or rented; however, *it is likely to exclude buildings constructed prior to 2008 that have not been sold or rented in that period.* The dataset also contains some duplicate entries, where buildings have undergone multiple assessments. Duplicates were removed after being sorted by date, to ensure that only the most recent assessment was included in this analysis.

EPC ratings are not only useful to get a sense of the overall energy efficiency levels of existing buildings, but also because they underpin the Minimum Energy Efficiency Standards (MEES) regulations that came into effect in 2018. The MEES regulations are intended to encourage property owners and landlords to improve the energy performance of their buildings by making it unlawful to grant new tenancies for properties with an EPC rating less than 'E'.[19] (Exemptions apply and consideration is given to the maximum improvement that can be achieved via cost-effective measures.) The requirement was extended to all (new and existing) domestic tenancies in 2020, and it is expected that the same will apply for commercial tenancies from April 2023. Over time, the minimum EPC rating will progressively increase. The Government has set out an ambition that, by 2030, most rented non-domestic properties will be required to achieve a 'B' rating and homes will achieve a 'C' rating.[20,21] Local Authorities are responsible for ensuring compliance in the domestic sector and have the ability to issue fines for non-compliance with MEES. Responsibility for the non-domestic sector lies with the Local Weights and Measures Authorities.

The MEES regulations are relevant to this study because, as shown in Section 2.2.2.1, existing buildings account for a large proportion of total GHG emissions, and there are relatively few other mechanisms for Local Authorities or the Government to influence the energy performance of such buildings at present.

[19] Minimum Energy Efficiency Standards (MEES) for Landlords (elmhurstenergy.co.uk)
[20] Improving the energy performance of privately rented homes - GOV.UK (www.gov.uk)
[21] Non-domestic Private Rented Sector minimum energy efficiency standards: EPC B implementation - GOV.UK (www.gov.uk)

Figure 16. Current domestic EPC ratings in Leicester City

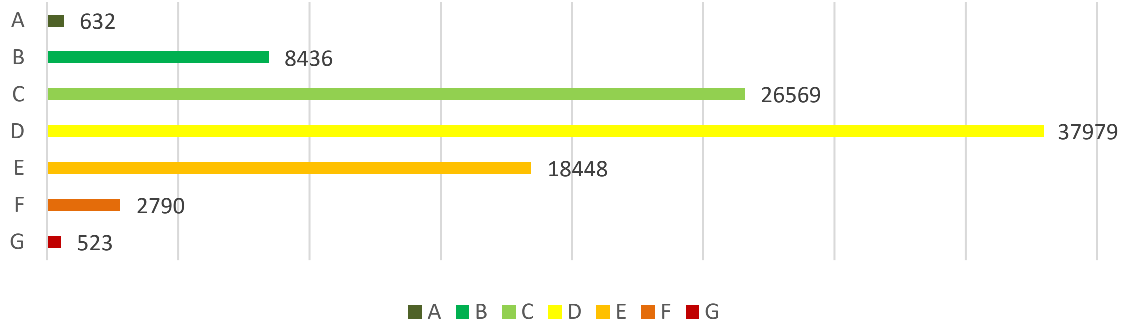
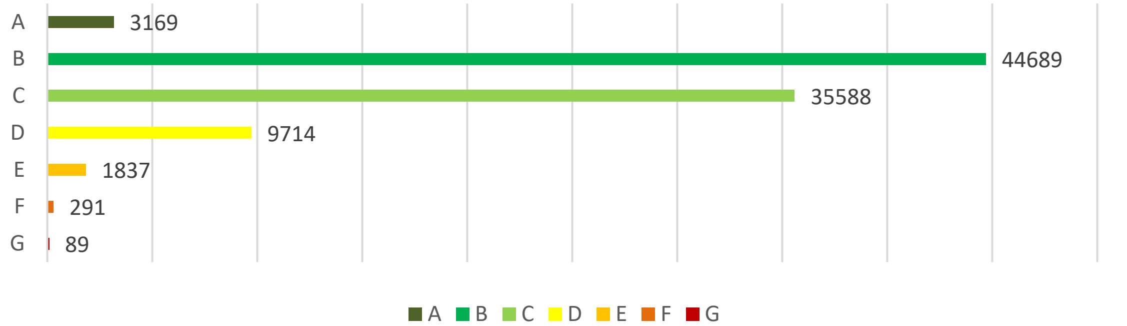
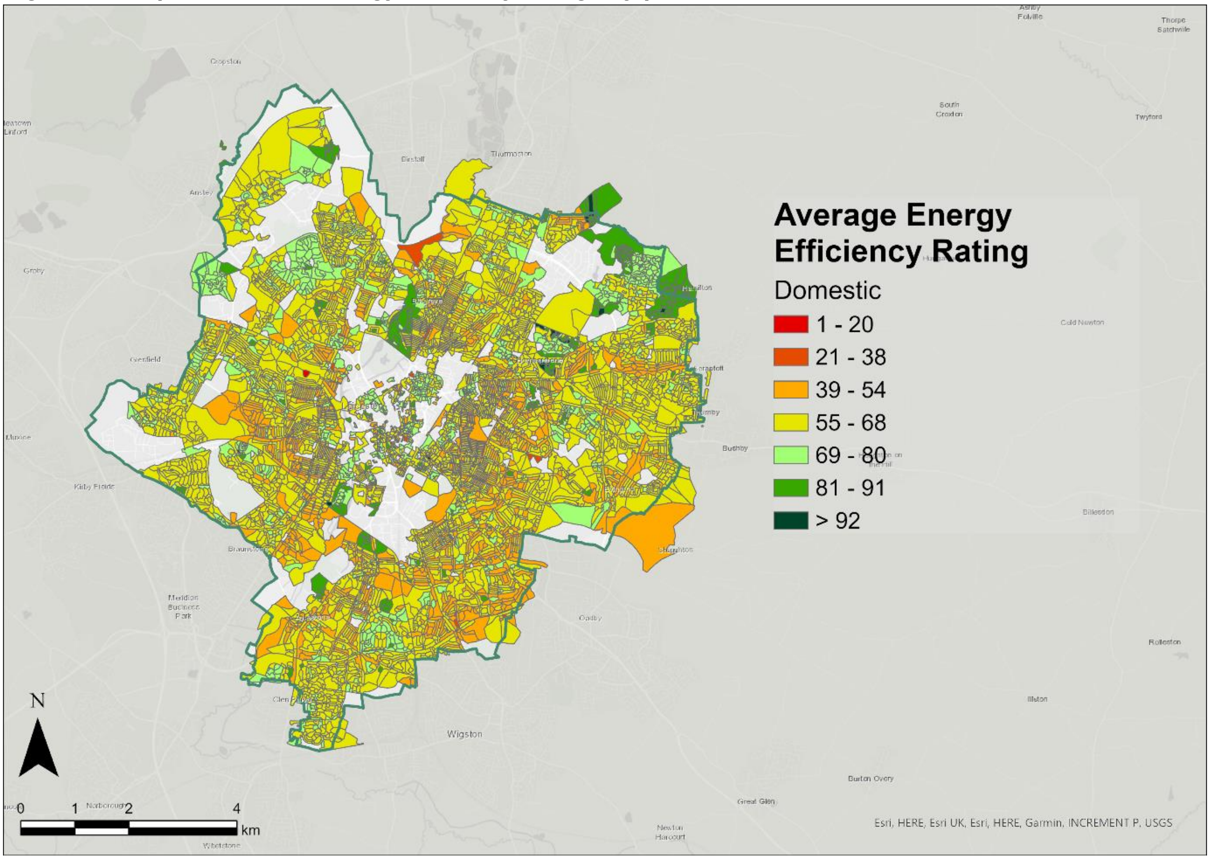


Figure 17. Potential domestic EPC ratings in Leicester City



The map below shows the average domestic energy efficiency rating by postcode, as listed in domestic EPCs. Higher energy efficiency ratings correlate to better EPC ratings although the latter also considers energy costs and CO_2 emissions. (Not all buildings have EPCs; see previous page.)

Figure 18. Map of domestic energy efficiency ratings by postcode, based on EPC data



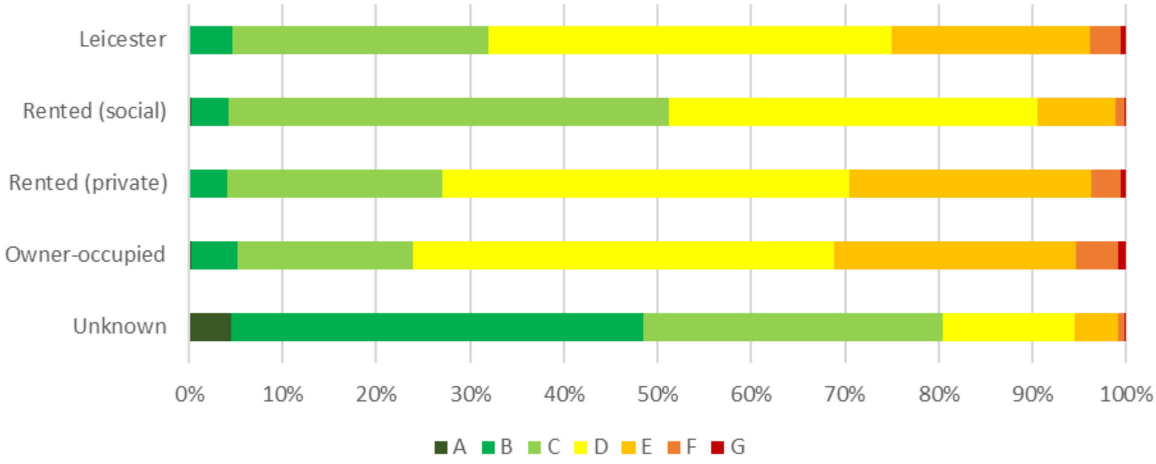
Note that some postcodes extend outside the Leicester city boundary. Gaps indicate that there are no domestic EPC records for that area. Areas shown with particularly good energy efficiency ratings will likely include newer developments and/or a high number of properties that have been retrofitted to a high standard.

Considering energy efficiency by tenure, the domestic EPC data for Leicester suggests that social rented housing tends to be more efficient than owner-occupied or private rentals, as shown in Figure 19. This is also true across the country as a whole, due to a variety of factors, which are likely to include differences in the typical type and age of property but could also relate to the availability of funding for energy efficiency improvements.

Taken as a whole, the EPC data indicates there is most potential for efficiency gains in private rented housing stock, where the average EPC rating is lower. In addition, as demonstrated in Figure 17, there is significant potential to upgrade a significant number of homes from EPC D to EPC B. Identifying data to help identify where these homes are concentrated in the council and their ownership could allow the council to deliver a targeted scheme to maximise the impact on efficiency, thermal comfort and emissions.

(Note that the 'Unknown' category includes EPCs where there is no record of tenure, but mostly comprises new buildings where the tenancy is not yet determined. This likely explains the higher level of energy efficiency in this category. New buildings are more energy efficient than older buildings, due to the progressive increase in standards set out within the Building Regulations; statistics for 2019 suggest that energy costs for new build homes are roughly half that of existing homes.[22])

Figure 19. Current domestic EPC ratings by tenure



[22] Office for National Statistics, 'Energy efficiency of housing in England and Wales' (2021). Available at: [Energy efficiency of housing in England and Wales - Office for National Statistics (ons.gov.uk)](https://www.ons.gov.uk)

2.2.2.3 Emissions: Non-domestic buildings and facilities in Leicester City

As mentioned previously, there is greater variability in the way that energy is used in non-domestic buildings and facilities when compared with the domestic sector.
Figure 20 below shows a breakdown of fuel consumption in industrial buildings, and Figure 21 shows the same breakdown for other non-domestic buildings, based on national statistics as set out in the BEIS ECUK publication (see previous section). This does not necessarily represent the situation in Leicester but provides further insight into how energy use differs in these sectors. In both cases, heat accounts for the majority of energy use. However, whereas in most non-domestic buildings this comprises space heating, hot water and cooking/catering – as for domestic buildings – in industrial buildings most of the heat is used for other purposes. This indicates that:

- decarbonisation of heat will need to be a major area of focus for all sectors; and
- some uses of heat are industry- or sector-specific, which makes it difficult to identify suitable mitigation measures, both because of a lack of reliable information on how the energy is used in Leicester specifically, and because there might not be suitable alternative technologies as there are for space heating, hot water and cooking.

Figure 20. Industrial fuel consumption by end use in 2019. Source: BEIS

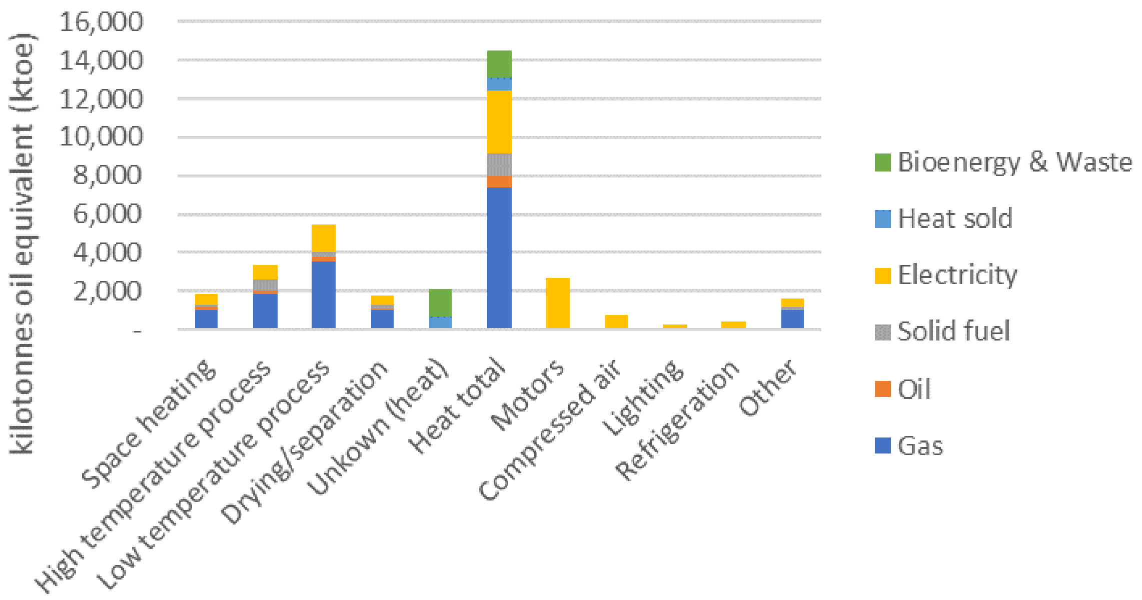
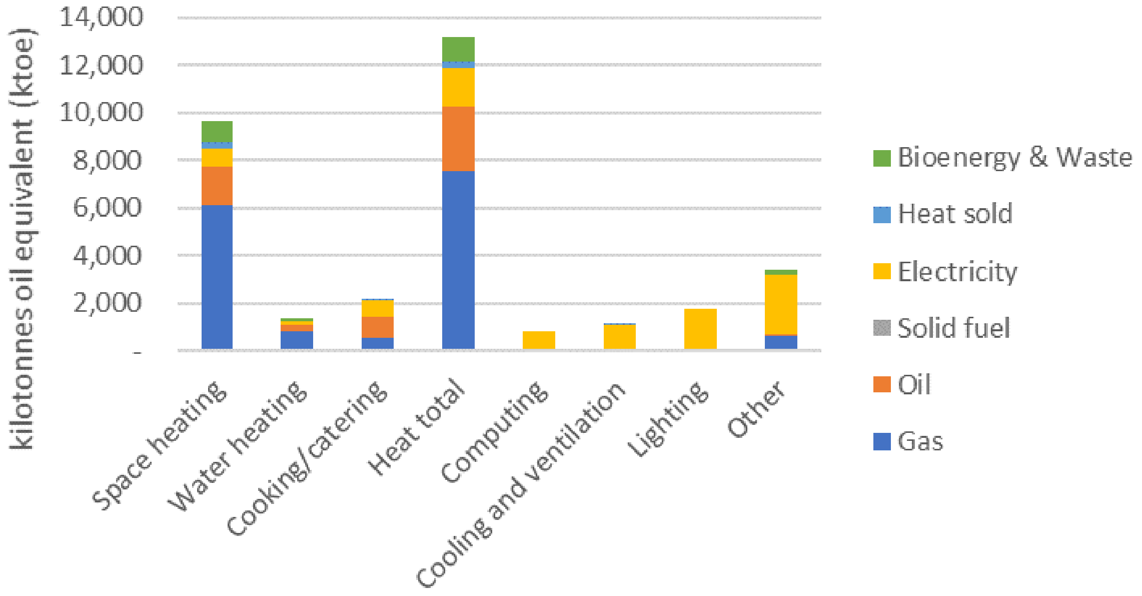


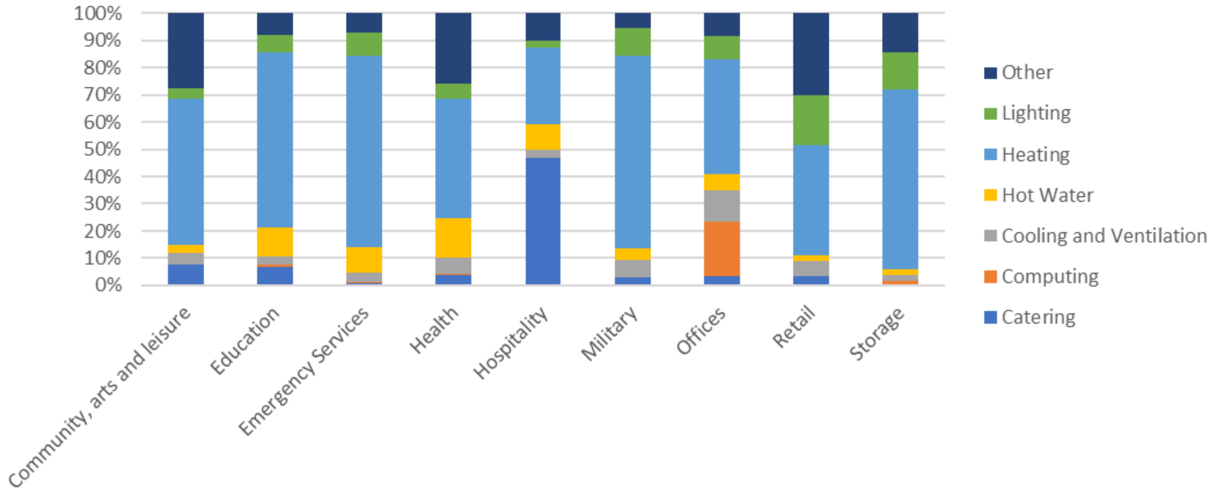
Figure 21. Other non-domestic fuel consumption by end use in 2019. Source: BEIS



Some of the energy end uses shown above are impacted by retrofitting the 'building fabric' by improving the insulation, windows, draughtproofing, and so on. For the most part this affects space heating and cooling demand although other energy end uses can have an indirect effect (think of waste heat in IT rooms). Others would need to be mitigated via other types of efficiency improvements, such as switching to LED lighting, better cooling and ventilation systems, smart controls, and so on.

The graph below provides more detail on how energy is used in different commercial and public sector buildings and facilities nationally.

Figure 22. Split of fuel consumption by end and sub-sector. Source: BEIS

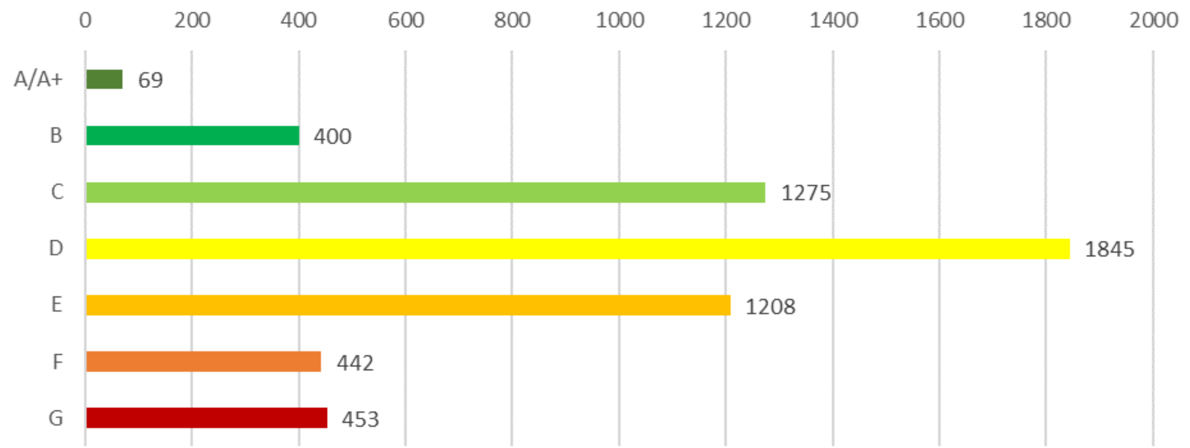


As will be discussed on the following pages, a significant majority[23] of non-domestic properties in Leicester are retail, restaurants, and offices, so based on this graph some general observations can be made about opportunities for reducing emissions from these sectors in Leicester:

- In retail, nearly half of energy use is for lighting and 'other' unspecified uses. This means that retrofitting measures will have proportionally less of an impact in this sector.
- For restaurants and hospitality, energy use is dominated by catering (which mostly uses gas) and hot water. Catering would need to switch to electric systems in order to reduce emissions in this sector.
- Offices use a significant amount of energy for computing, as well as cooling and ventilation. Rather than decreasing, these could in fact increase over time, depending on future trends in the use of electronic equipment, as well as future changes in weather and heatwaves. These are examples of energy uses that are difficult for LAs to influence.

Considering the energy performance of buildings themselves, which would primarily impact energy use for space heating, the median non-domestic EPC rating in Leicester is D, and the majority (nearly 70%) have a D rating or below. Perhaps unsurprisingly, the distribution is not symmetrical; there are more buildings with lower ratings than higher ratings. As with the domestic stock, this broadly mirrors the national picture.

Figure 23. Non-domestic EPC ratings



The maps below show the average EPC asset rating for non-domestic buildings, and the average display energy certificate (DEC) operational rating for public buildings. The terminology is slightly different from that used for domestic EPCs but all of these broadly indicate the energy performance of the building. Note that, whereas higher ratings for domestic buildings indicate better performance, for non-domestic and public buildings better performance is indicated by lower ratings.[24]

[23] Based on the numbers of EPC certificates, which can be used as a proxy for numbers of buildings (including tenanted properties). It is not necessarily based on their relative contribution to total energy use or emissions in Leicester since these businesses can vary dramatically in size.
[24] In rare cases this can include negative numbers, indicating an A+ rating, i.e. a building that reduces or offsets more CO_2 than it emits.

Figure 24. Average EPC Asset Rating for non-domestic buildings, by postcode

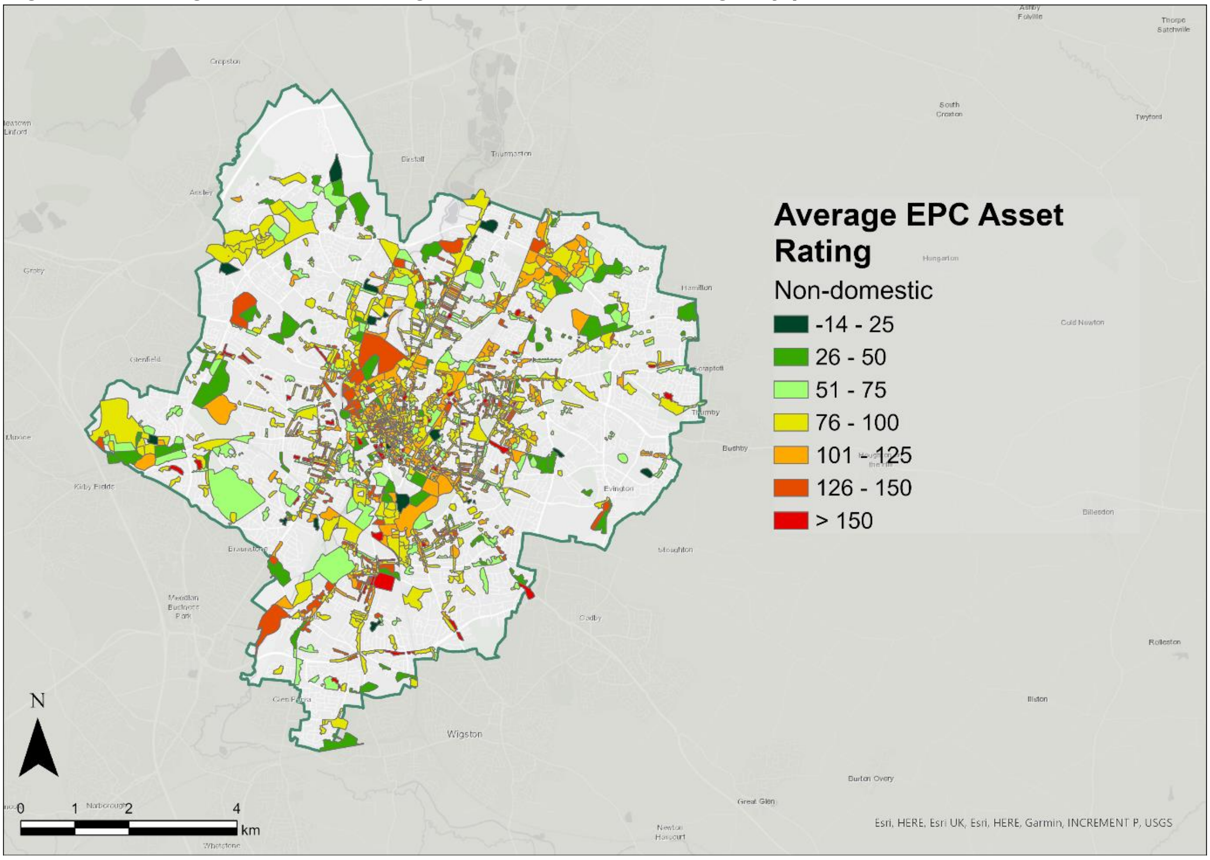
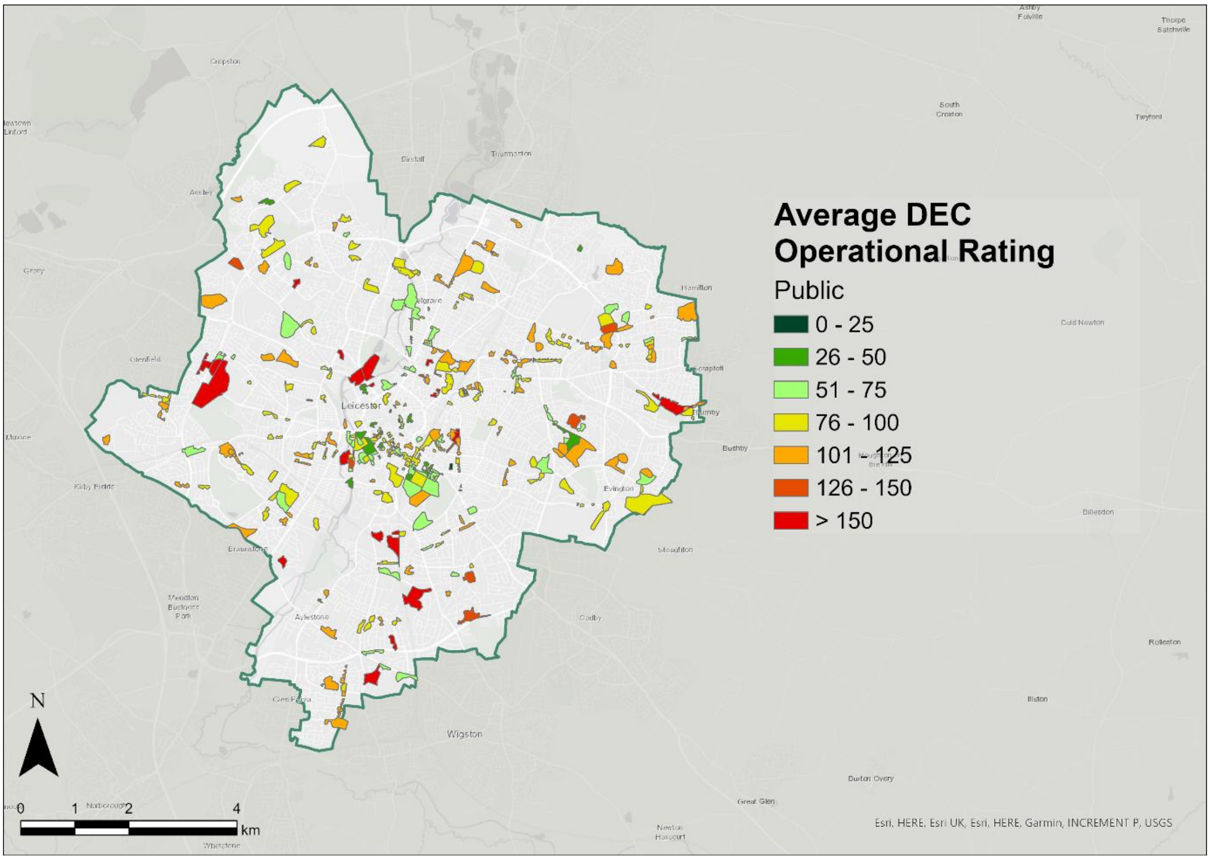


Figure 25. Average DEC Operational Rating for large public buildings, by postcode



Non-domestic EPCs report the planning use category of a property, rather than tenure. Figure 26 shows a breakdown of results by use category, indicating the proportion of buildings that achieve different ratings. (Note that this is affected by how many buildings of each type are included in the dataset. For instance, the result for 'D1 Non-residential institutions – Libraries Museums and Galleries' is based on the EPC records for just two buildings.) These results reinforce one of the key messages of the domestic EPC analysis, which is that a significant portion of the existing stock would need to be upgraded by 2030 in order to meet the Government's 'B' rating requirement.

Figure 26. Non-domestic EPC ratings by use category (# per sub-sector)

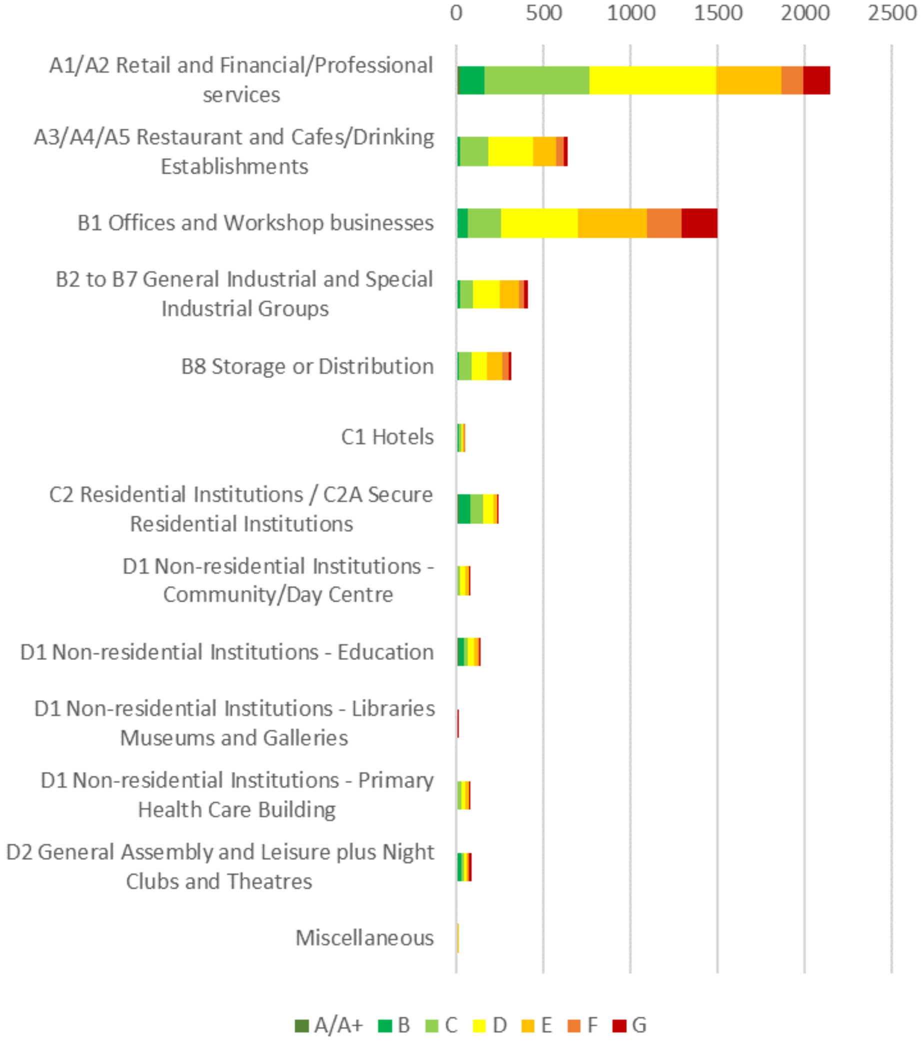
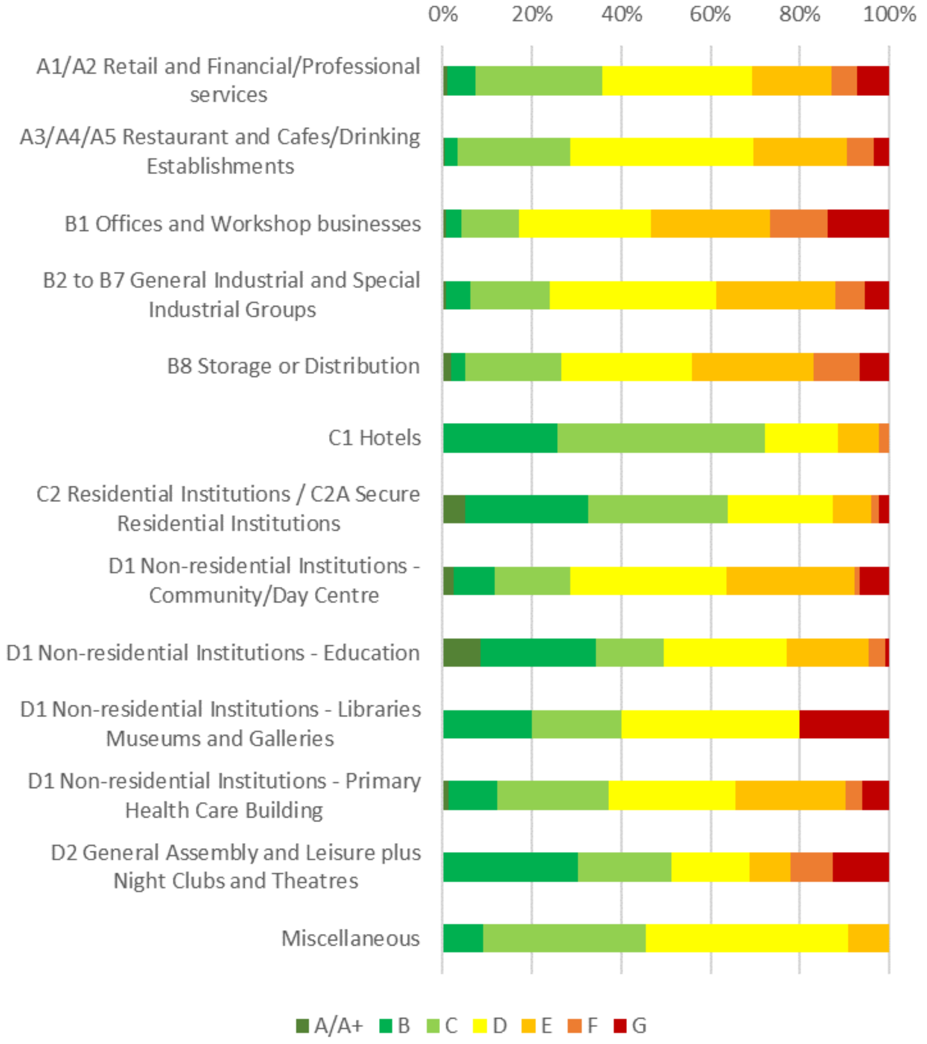


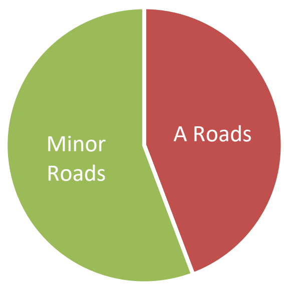
Figure 27. Non-domestic EPC ratings by use category (% of total per sub-sector)



2.2.2.4 Emissions: The transport sector

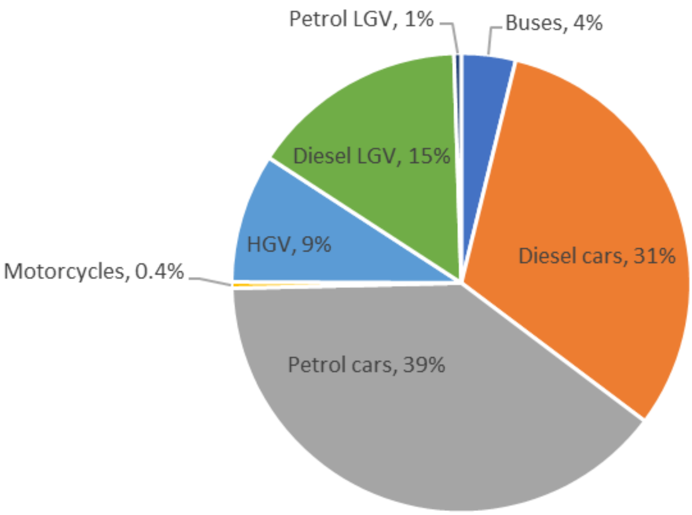
As shown in Figure 28, based on the BEIS CO_2 statistics, there is a relatively even split between emissions from A roads and minor roads in Leicester. There is no motorway within the administrative boundaries.

Figure 28. Road transport emissions by road type, 2019. Source: BEIS



Although not reported in the BEIS dataset, it is assumed that road transport emissions will broadly mirror the split of road transport fuel consumption. As shown in the pie chart below, around 70% of fuel is used in petrol or diesel cars. Around 15% is used for diesel light goods vehicles (LGVs) and 9% is used for heavy goods vehicles (HGVs). The remainder is associated with buses, petrol LGVs, and motorcycles.[25]

Figure 29. Split of road transport fuel use by vehicle type, 2019. Source: BEIS



Aside from HGVs, all of these vehicle types can be replaced with battery electric vehicles (BEVs) based on current technology. In principle, if these were supplied with 100% renewable electricity, this would reduce emissions from road transport by roughly 90% (the remainder being associated with HGVs). The scale of emissions reductions in road transport by 2030 will therefore depend in significant part on the proportion of vehicles that switch to EV, and the scale of electricity grid decarbonisation. There are several potential implications:

- Consumers are likely to start to shift towards EVs as the costs come down, so LCC could potentially focus efforts on areas other than promoting EV uptake. The key challenge here is that these trends are not expected to result in full adoption of EVs by 2030.
- If the grid does not decarbonise as rapidly as anticipated, the benefits of switching to EVs will decrease. Therefore, it will be important to guard against this risk by promoting measures that reduce demand for vehicle journeys in the first place, and also maximising local renewable electricity generation.
- Emissions from HGVs will be extremely difficult to mitigate by 2030, so the focus will need to be more on marginal efficiency improvements in HGV technologies, driver training, freight consolidation and optimising logistics.

2.3 Renewable electricity

At present, renewable electricity technologies provide only a small portion of Leicester's electricity demands. However, in a net zero future, both large- and small-scale renewable capacity will need to increase radically in order to meet higher electricity demands in a sustainable way.

To estimate the current number, size, and type of renewable energy installations within Leicester, we have referred to the following sources:

[25] BEIS, 'Sub-national road transport consumption data 2005-2019' (published 2021). Available at: Sub-national road transport consumption data - GOV.UK (www.gov.uk)

- The Regional Renewable Statistics (RRS) – Published annually by BEIS, this dataset only includes renewable electricity technologies and excludes those that only produce heat. The most recent data is for the end of 2019.
- Renewable Heat Incentive (RHI) statistics – This dataset covers technologies that provide renewable heat, including ground and air source heat pumps, biomass, and solar hot water.
- The Renewable Energy Planning Database (REPD) – An up-to-date list of renewable energy planning applications published quarterly by BEIS.
- The Heat Networks Planning Database (HNPD) – An up-to-date list of heat network planning applications published quarterly by BEIS.

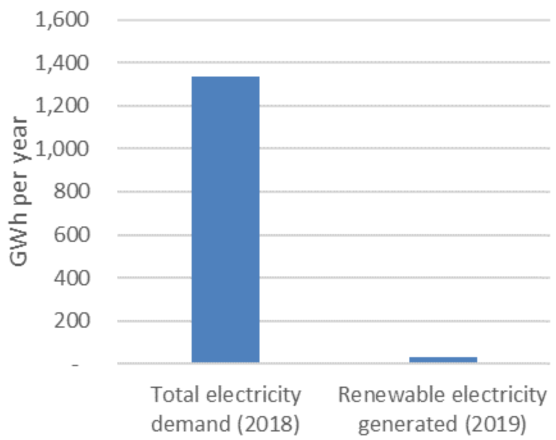
Results are shown in Table 3 below.

Table 3. Renewable electricity technologies in Leicester, at end of 2019. Source: BEIS (RRS)

	No. Installations (#)	Installed Capacity (MW)	Generation (MWh per year)
Photovoltaics	4,606	17.86	17,510
Onshore Wind	4	0.02	51
Anaerobic Digestion	1	2.0	11,038
Plant Biomass	2	0.27	1,190
Total	4,613	20.16	29,788

As of the end of 2019, there were 4,613 renewable electricity-producing installations in Leicester. Almost all of these (99.8%) were solar photovoltaics (PV). It is likely that most PV installations are small, roof-mounted systems given the urban nature of Leicester City. However, according to the REPD, there is one large-scale renewable energy site (PV) at the National Space Centre in Leicester with an installed capacity of 0.2 MW, which is operated by Leicestershire County Council.[26]

In addition to PV, the RRS indicates that there are four wind turbines with a total capacity of around 0.02 MW. The small capacity suggests that these are small- or micro-scale turbines; there are known to be two vertical axis turbines at Leicester College sites, but it is not clear whether these are in fact operational. Two other types of electricity-producing installations in Leicester are one anaerobic digestion (AD) facility and two plant biomass facilities.



To put these figures into context, Leicester's electricity demand in 2018 was 1,337 GWh, but renewable technologies in the city only produced around 30 GWh, which is around 2% of Leicester's total annual electricity demand.

In practice, some of this electricity feeds into the national grid, so it is not possible to state the exact proportion of demand that is met through renewables. Although it is not necessary for each Local Authority to meet all of its own electricity needs via technologies that are installed within the red line boundary, it is nonetheless clear that energy demands would need to reduce significantly, and renewable uptake would need to radically increase, in order for Leicester to achieve net zero emissions.

[26] BEIS, Renewable Energy Planning Database, Renewable Energy Planning Database | BEIS & Barbour ABI (barbour-abi.com)

The RRS lists one AD plant in Leicester, which may refer to a facility at the Walkers factory.[27]

[27] https://www.summers-inman.co.uk/projects/anaerobic-digester-project/

2.4 Renewable and low carbon heat

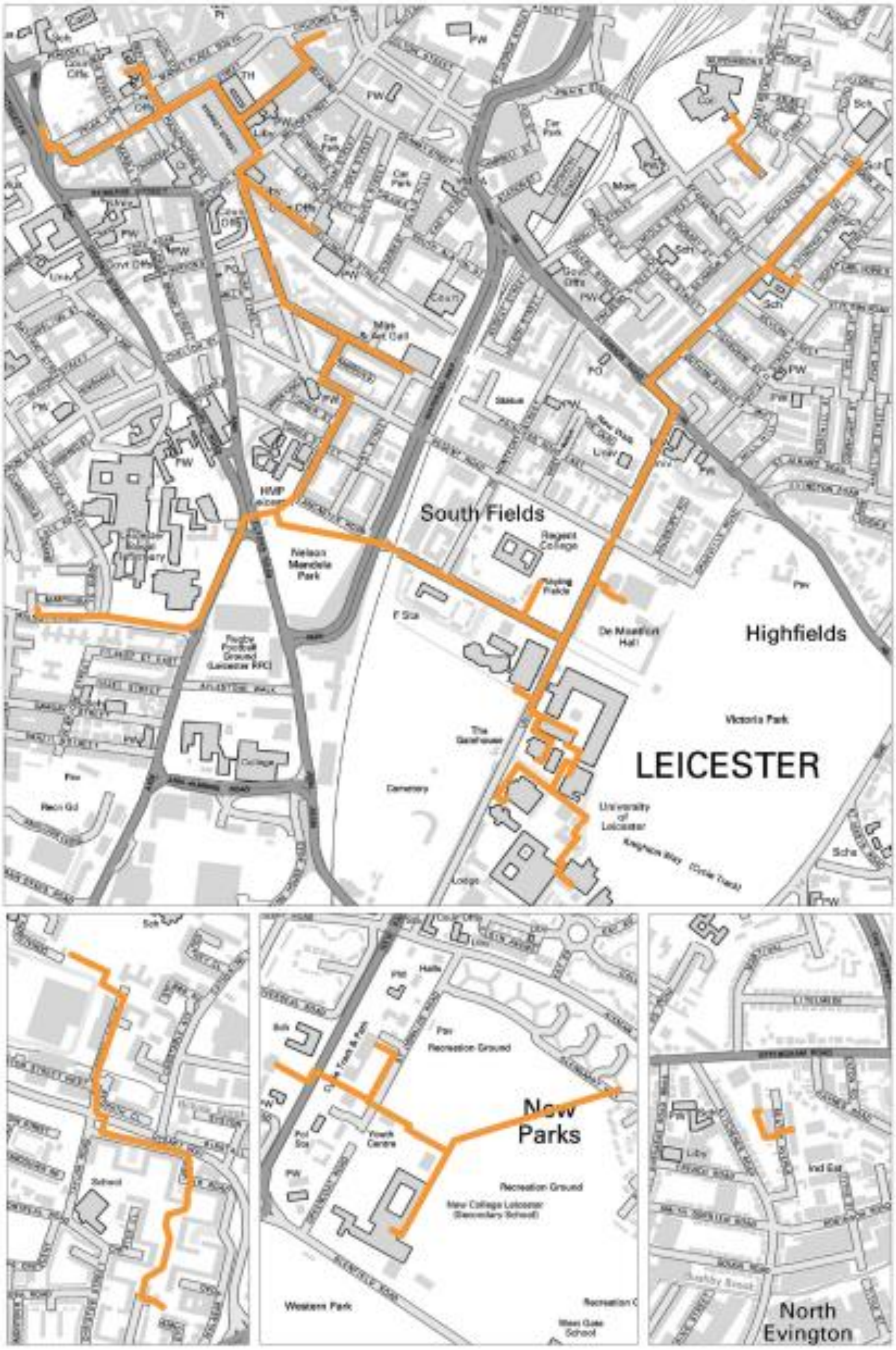
Regarding renewable heat technologies, RHI statistics suggest that there are 7 non-domestic RHI installations in Leicester, with a total installed capacity of around 1MW, and 123 domestic RHI installations, for which the capacity is not reported.[28]

In addition, there are existing and planned district or communal heat networks. These are not classed as renewable energy per se because they are powered by fossil fuels (or a mix of fossil fuels and biomass). However, they can offer low carbon heat compared with individual heating systems on account of the efficiency gained from operating a centralised heating system. They also have the benefit of being able, in principle, to switch to alternative energy sources such as heat pumps or green hydrogen, achieving carbon savings without the need to further replace the heating systems in each individual building.

There is a city centre heat network in Leicester operated by Engie which has a capacity of 79 GWh of heat per year according to the operator. It supplies at least 19 civic buildings with heating and warm water, including the Town Hall, schools, libraries, the University of Leicester and around 3,000 council homes. Part of this energy is produced by a Combined Heat and Power (CHP) plant at the University of Leicester, which has joined the city-wide scheme.[29]

[28] Public RHI statistics do not include details of the types and sizes of individual RHI installations in Leicester. However, to gain a rough indication of the likely technology split, it is useful to refer to the nation-wide RHI statistics: For non-domestic RHI installations, the vast majority of applications (over 80%) are for biomass boilers, mostly small (<200kW) or medium (200-1000kW) scale. Most of the other applications are for water or ground source heat pumps (GSHPs). For domestic RHI installations, the majority of applications are for ASHPs, with the remainder roughly evenly split between GSHPs, biomass boilers and solar thermal systems.
[29] Engie, Leicester, Leicester District Energy Scheme (engie.co.uk)

Figure 30. Map of the existing heat network. Source: Draft Leicester Local Plan (2020)



There are another two CHP engines separate from the city-wide scheme, located at Leicester Royal Infirmary and Glenfield Hospital, both operated by Vital Energi. Both locations already had CHP engines (in the case of Glenfield since the early 1990s) but recently commissioned upgrades. According to the operator, the plant at Leicester Royal Infirmary has a capacity of 1.6MWe which they estimate will result in a CO_2 saving of 2,701 tonnes per year. The plant at Glenfield Hospital has a capacity of 770kWe and is said to reduce CO_2 emissions by 1,474 tonnes each year.[30] Emissions savings from CHP installations depend on the GHG intensity of the fuels that are used to generate the heat and power, and the GHG intensity of the fuels that are displaced, so these figures may fluctuate.

Finally, we note that a planning application for a gas-fired communal heat network serving student accommodation was submitted in 2021, which would be operated by Urbanite Leicester Limited and located at All Saints Place. [31]

2.5 Transport

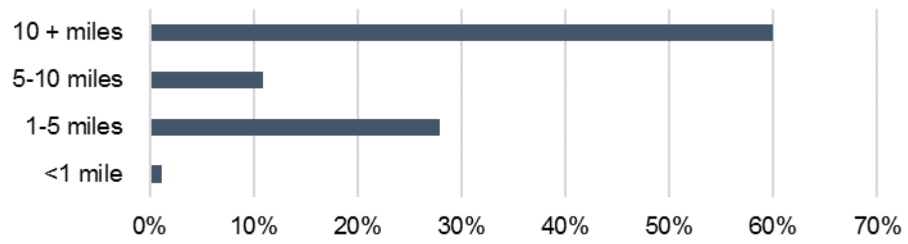
This section provides additional information on modes of travel and vehicle types, including recent rates of ULEV uptake, to provide further context regarding the GHG emissions for road transport.

2.5.1 Baseline situation in Leicester

According to evidence provided by LCC in support of the draft Local Transport Plan (see Figure 31), the majority of vehicle emissions in Leicester stem from trips with a length of 10+ miles (60%), followed by short trips of 1-5 miles. When disaggregating this further by vehicle type, cars make up 55% of emissions from the 10+ miles journeys, followed by HGVs with 28% and vans with 17%.

Roughly 30% of vehicle emissions are from journeys less than 5 miles long. This suggests that, while not the full solution, there could be scope for significant emissions reductions if these short journeys could switch to walking or cycling. Some could also be undertaken via e-bikes or e-scooters.

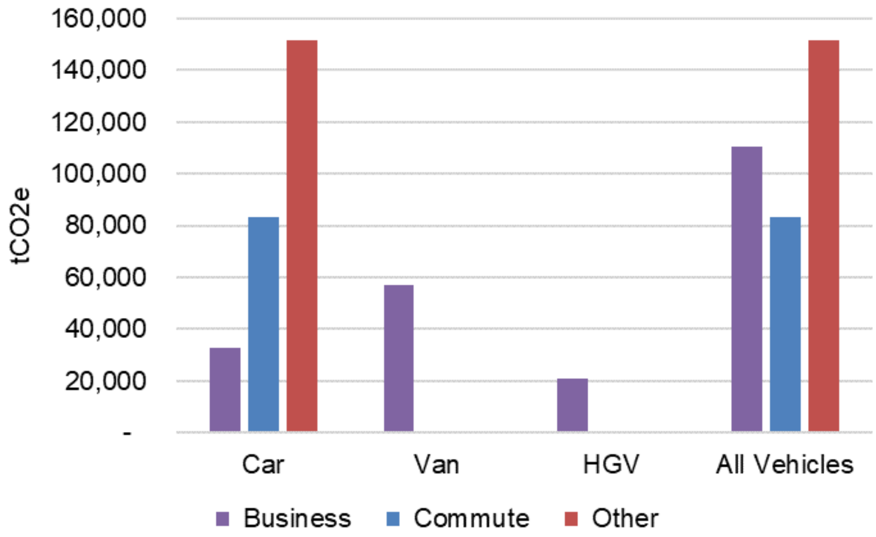
Figure 31. Vehicle emissions by trip length, 2019. Source: Midlands Connect



As shown in Figure 32, non-work-related journeys make up the majority of road transport emissions in Leicester with 44% overall, followed by business trip with 32% and commutes with 24%. Vans and HGVs only cause emissions on business journeys while cars are predominantly on the road for leisure or other non-work purposes, followed by commuting and finally business.

[30] Vital Energi, Leicester Royal Infirmary & Glenfield Hospital CH, Leicester Royal Infirmary & Glenfield Hospital CHP (vitalenergi.co.uk)
[31] BEIS, Heat Networks Planning Database, Heat Networks Planning Database: quarterly extract - GOV.UK (www.gov.uk)

Figure 32. Transport emissions by vehicle type and journey purpose, 2019. Source: Midlands Connect



These results can help to prioritise intervention measures to reduce transport emissions. For example, among car journeys, the majority are neither for business or commuting; these may comprise general shopping, errands, school runs and leisure trips. Therefore, it is possible that some of these can be avoided in future as technology changes and more activities and shopping take place online. The next highest proportion of emissions is from business travel, indicating that a combination of strategies aimed at improving logistics and/or encouraging individual business car journeys to consider active travel, public transport, ridesharing, e-scooters, and so on could be beneficial.

It should be noted that, at present, the BEIS sub-national fuel consumption statistics do not distinguish between electricity used in buildings and other stationary applications, and electricity used to charge electric vehicles (EVs). Depending on where the EV charging point is located, this electricity consumption would either be allocated to the domestic or non-domestic building sectors.

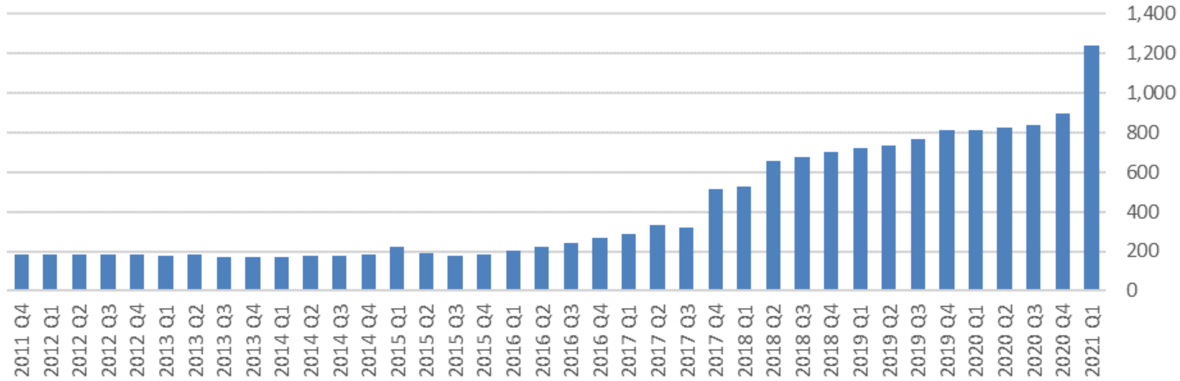
In terms of non-road transport, available data shows that there is a small contribution from diesel railways, which accounts for around 0.1% of total GHG emissions. Emissions from waterborne transport are also assumed to be very small although not disaggregated within the available datasets; depending on the type of fuel used and how it is purchased, this would be included within the GHG emission figures for ‘petrol/diesel’ or ‘other fuels’.

2.5.2 ULEV uptake

ULEV uptake has increased exponentially in recent years across the UK, albeit from a low base, and Leicester is no exception. As shown in Figure 33, by the beginning of 2021 there were 1,235 licensed ULEVs in the City, compared with just 181 in 2011.[32]

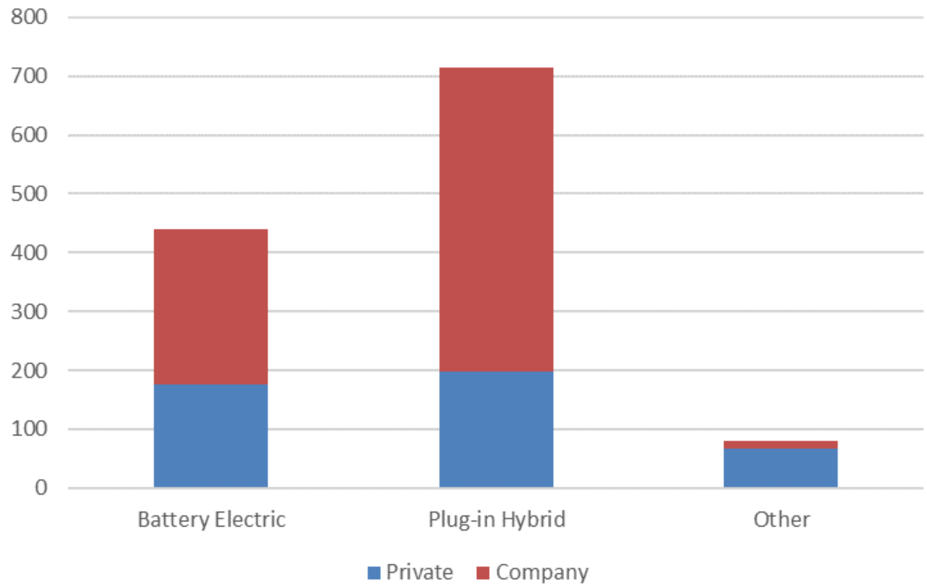
[32] DVLA/DfT, ‘Statistical data set. All vehicles’, VEH0132 Dataset, (last updated July 2021). Available at: Vehicle Licensing Statistics - GOV.UK (www.gov.uk)

Figure 33. Licensed ULEVs in Leicester, 2011-2021. Source: DVLA/DfT



A further breakdown of the latest figures shows that company cars make up 64% of all ULEVs in Leicester.[33] Plug-in Hybrid Electric Vehicles (PHEVs) are the most common type of company ULEVs with 72%. Private vehicles display a more even split between Battery Electric Vehicles (BEVs) and PHEVs as shown in Figure 34. The remaining 15% of private cars which fall into neither of the two categories cannot be broken down further at the city-level but could be any of the following ULEV types: Range-Extended Electric, Hybrid Electric, Fuel cell electric, or other fuels.[34]

Figure 34. Types of ULEVs in Leicester, 2021. Source: DVLA/DfT



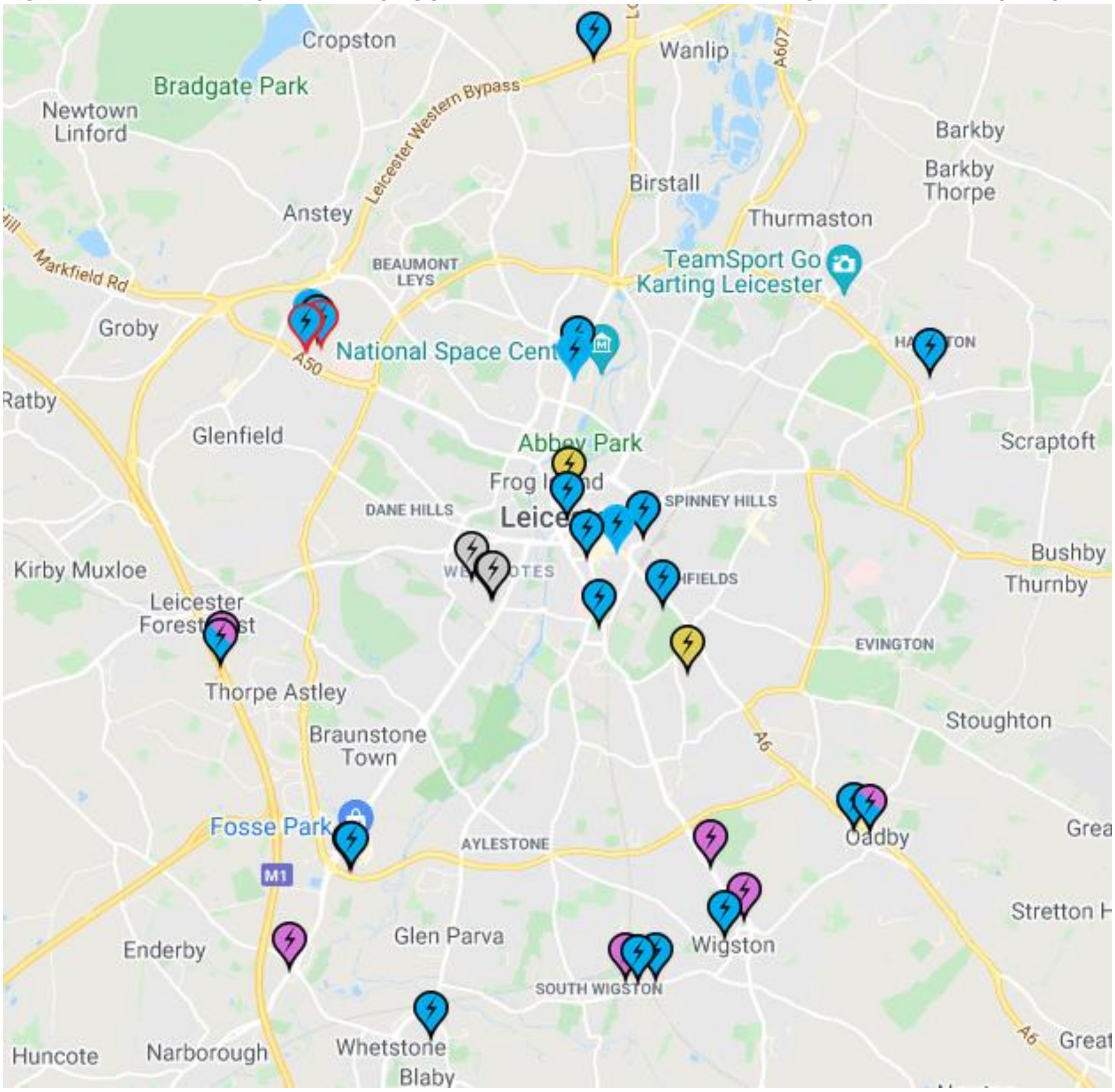
Although the increase in uptake is an encouraging trend, ULEVs still represent a tiny proportion (<1%) of licensed vehicles in Leicester. In order for Leicester to reach net zero emissions by 2030, there would need to be no use of fossil fuels in the transport sector – which would require not only a transformation in the use of renewable electricity and hydrogen powered vehicles, but also a decrease in the number of journeys travelled, and the rate of private vehicle ownership.

[33] DVLA/DfT, 'Statistical data set. All vehicles', VEH0132 Dataset, (last updated July 2021). Available at: [Vehicle Licensing Statistics - GOV.UK (www.gov.uk)](http://www.gov.uk)

[34] DVLA/DfT, 'Statistical data set. All vehicles', VEH0133 Dataset, (last updated July 2021). Available at: [Vehicle Licensing Statistics - GOV.UK (www.gov.uk)](http://www.gov.uk)

As of July 2021, there were 76 public charging points in Leicester, including 1 rapid charging point.[35] These are shown below.

Figure 35. Locations of public charging points in Leicester and surrounding area. Source: Zap-Map



Putting these figures into context, this equates to around 22 public charging points per 100,000 head of population.[36] As illustrated in Figure 36, this is somewhat lower than the average number of charging points per 100,000, with Leicester appearing in the bottom 20 to 40%.

[35] DfT/OZEV, 'Electric vehicle charging device statistics: July 2021' (published August 2021), Available at: Electric vehicle charging device statistics: July 2021 - GOV.UK (www.gov.uk)

[36] DfT, 'Electric vehicle charging devices by local authority' (published July 2021). Available at: maps.dft.gov.uk/ev-charging-map/

Figure 36. Number of public charging points per 100,000 by Local Authority. Source: DfT

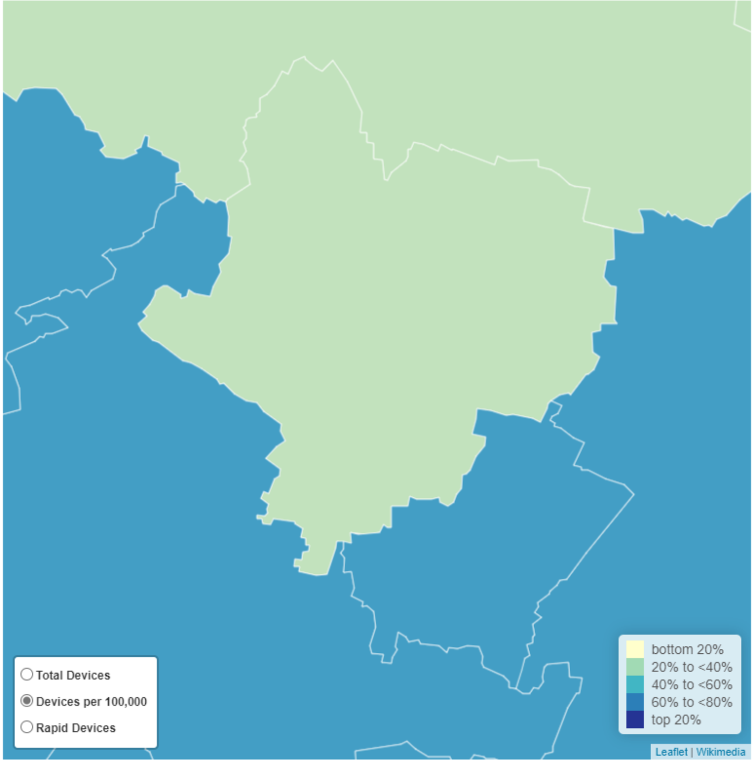
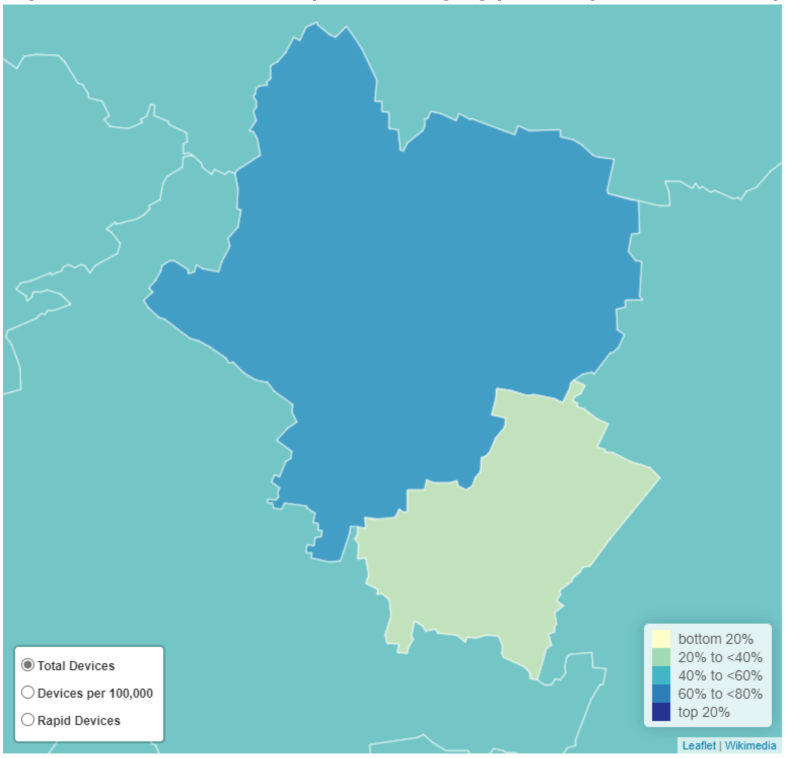


Figure 37. Total number of public charging points by Local Authority. Source: DfT



It is anticipated that the price of EVs could converge with that of traditional combustion engines within the next few years. This would create a ‘tipping point’ in consumer choices and require a huge increase in EV infrastructure and renewable energy provision within a very short timescale.

2.6 Waste

While this study was commissioned to principally look at Scope 1 and Scope 2 emissions (as there was insufficient data about Scope 3 emissions, these will be tackled in a future report), it was decided to include information about those Scope 3 emissions arising from the treatment and disposal of Leicester's waste. This is in recognition that these emissions are part of Leicester's net zero ambition even if they fall outside of the City boundary.

A rough estimate of emissions from waste and wastewater treatment has been made via two methods.

Method 1
Total figures for emissions from waste were taken from the national greenhouse gas emissions inventory and pro-rated by population. This includes emissions from wastewater treatment. On this basis, emissions are estimated to be c. 101 ktCO_2e per year.

This is only a rough estimate, and it is important to note that the calculation does not account for the following:

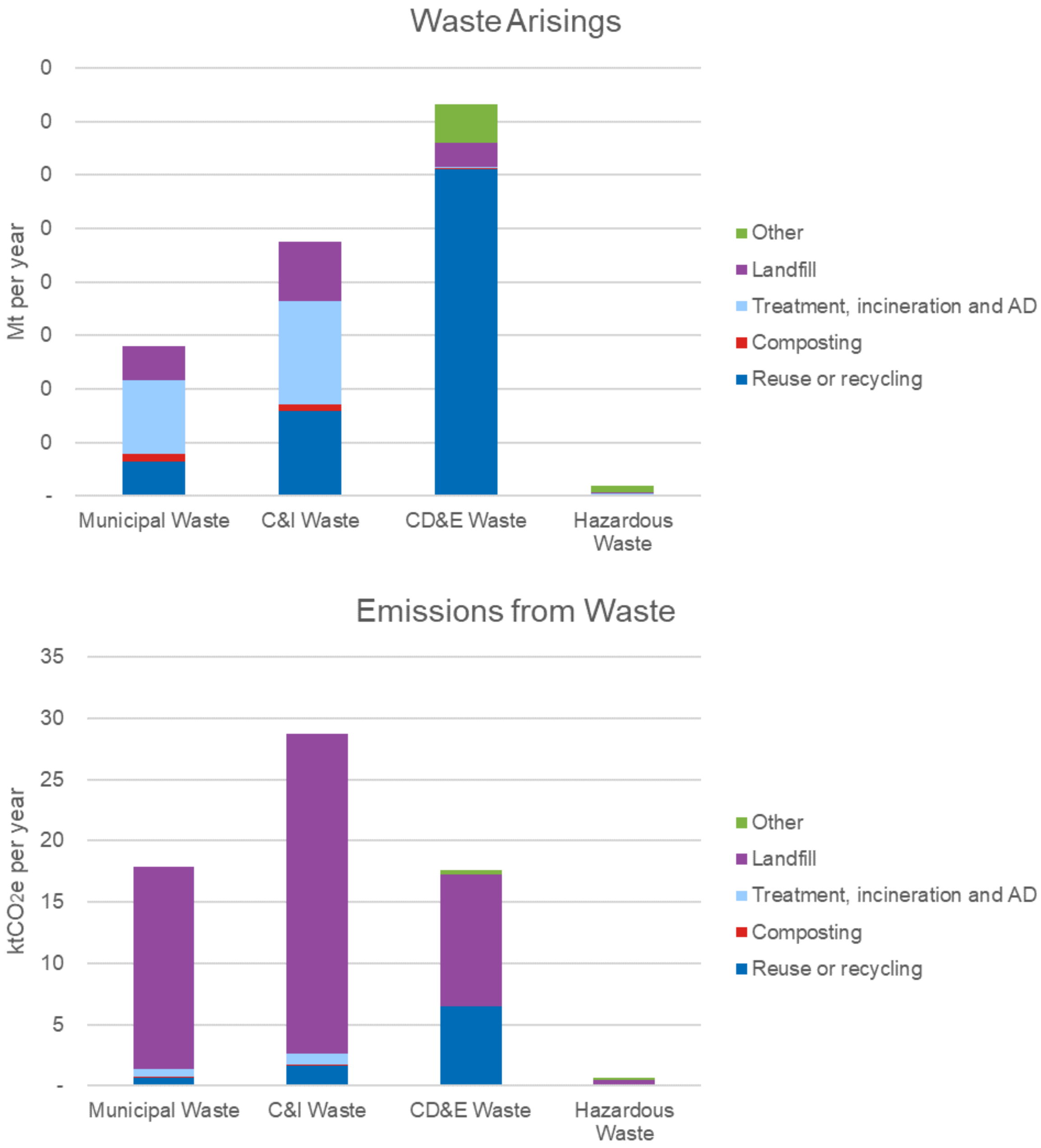
- Because it is based on population, it will include waste generated by residents of Leicester even if they leave the City boundary. Conversely it will not include waste generated by visitors to Leicester.
- It will also not reflect the specific types of economic activities, construction, and so on that takes place in the City.
- Recognising that a significant portion of Leicester's municipal waste is treated via anaerobic digestion rather than landfill, this does not account for the specific methods of waste management that are employed.

Method 2
Data on waste arisings in Leicester (excluding wastewater) were taken from the Waste Needs Assessment (2021) provided by LCC. An estimate of emissions from different sectors and waste management methods was then made by referring to the UK Government GHG Conversion Factors for Company Reporting.

On this basis, emissions from waste are estimated to be c. 65 ktCO_2e per year. This is broken down by source of waste in Figure 38 below.

The conversion factors do not distinguish between commercial and industrial (C&I), construction, demolition and excavation (CD&E) or hazardous waste so assumptions had to be made in order to allocate conversion factors to each category reported in the Waste Needs Assessment. The figures also do not include wastewater so are not directly comparable with those presented for Method 1. Nonetheless, this can provide a rough breakdown of the relative contributions of different waste streams.

Figure 38. Estimated waste arisings and emissions from waste generated in Leicester in 2019



The main notable finding is that emissions per tonne of waste sent to landfill are very high in comparison with other waste treatment methods, so this accounts for the majority of emissions even though much of the biodegradable municipal waste is processed via AD. To sense-check the calculations, they were repeated, this time assuming that the municipal waste treated via AD was instead sent to landfill, and this resulted in emissions of c. 103 ktCO_2e.

Although these are very rough calculations, they confirm that a key option for reducing emissions from waste produced in Leicester – aside from demand reduction, which should be prioritised as a key first step – would be to ensure that it is treated and managed via AD or another form of energy recovery.

3 Potential routes to 2030… and beyond

This section of the report describes potential future GHG emissions trajectories for Leicester, based on a range of scenarios that consider various possible mitigation measures, levels of ambition, and implementation rates. These findings indicate the scale and direction of possible changes over time, which helps to identify and prioritise key actions for inclusion in the Roadmap.

Key messages

- **The major finding that emerges from this analysis is that, in order to stand the best chance of meeting the 2030 net zero ambition, there is very little scope to pick and choose mitigation measures and no scope to accommodate increases in emissions.** In blunt terms, all activity that is counter to net zero – such as installing new gas boilers, buying new petrol or diesel cars, and so on – will need to stop immediately, and even then, it will be necessary to retire some systems and vehicles earlier than planned. LCC will therefore need to exercise all available policy levers and other areas of influence.
- A **'Business as Usual' (BAU) scenario has been modelled** to show the potential scale of changes that could occur in the future. This takes the BEIS Energy and Emissions Projections as a starting point and tailors them to reflect local circumstances where needed. The BEIS projections account for future economic, population and technological trends, along with adopted Government policy, excluding ambitions which have not been enshrined in policy or law. Relative to the 2019 baseline, **the BAU scenario would result in a roughly 19% decrease in emissions by 2030 and 38% decrease by 2050**. This leaves a significant gap to achieving net zero emissions that would need to be addressed through other means. *[Note: This analysis was produced prior to the publication of the Net Zero Strategy on 19th October 2021. See Appendix A: for a discussion of the potential implications.]*
- **Four additional pathways have been modelled** using Ricardo's Net Zero Projections (NZP) tool. These scenarios **explore the impact of a range of behavioural and technological measures aimed at mitigating energy use and GHG emissions**. They represent different levels of ambition, and also contribute towards an understanding of key risks, sensitivities, and opportunities for Leicester. Some notable findings include:
    - **Electrification of heat and transport has the potential to deliver the largest reduction in GHG emissions.** However, this means that progress towards the 2030 ambition will rely heavily on the pace of national grid decarbonisation, given that there is limited scope for local renewables compared with the scale of energy demands. This is the major risk of adopting a strategy that includes high levels of electrification (i.e. switching from fossil fuels to electricity).
    - **Demand reduction on its own does not deliver such large emissions reductions in comparison – but it is a crucial prerequisite for fuel switching**, to reduce the strain on grid infrastructure, and mitigate the demand for materials needed to provide renewable electricity technologies. It also helps to mitigate against the risk of slower grid decarbonisation, rising energy prices/bills, and so on.
    - **All scenarios include some level of residual GHG emissions that are hard to address** based on current technologies and policy levers. They primarily include:
        - Energy use in homes and non-domestic buildings that falls outside the scope of Building Regulations (such as electrical appliances or other devices that

building users install but which are not crucial to the operation of the building's heating, hot water, lighting and ventilation systems);

- Energy uses associated with specific commercial and industrial sectors; and
- Non-CO_2 emissions, including methane and nitrous oxide (primarily associated with waste treatment and agriculture) and f-gases (primarily associated with refrigeration and cooling, and also present in heat pumps which are assumed to become more common in future).

➢ **Carbon offsetting and sequestration alone cannot deliver the scale of emissions reductions that is required.** In the timescales from now to 2030 or even 2040, carbon capture and storage (CCS) is not likely to be available at scale, and there is limited scope for tree planting. This is a further argument in favour of demand reduction.

3.1.1 Drivers of change

Achieving the GHG emissions reductions required to reach carbon neutrality in less than a decade, while also responding to the needs of a growing population, and maintaining economic development, poses a significant challenge to the City of Leicester. Economic growth, population increase, higher incomes, new buildings, electric vehicles, and greater use of electronic appliances all tend to increase energy demands. Although improvements in technology, energy efficiency measures, and better awareness of environmental issues can help to reduce energy demand in some sectors, these are at risk of being cancelled out without further policy interventions. Of course, there are many unknowns – factors such as energy prices and weather changes, for example, that are hard to predict and can influence energy demand in either direction.

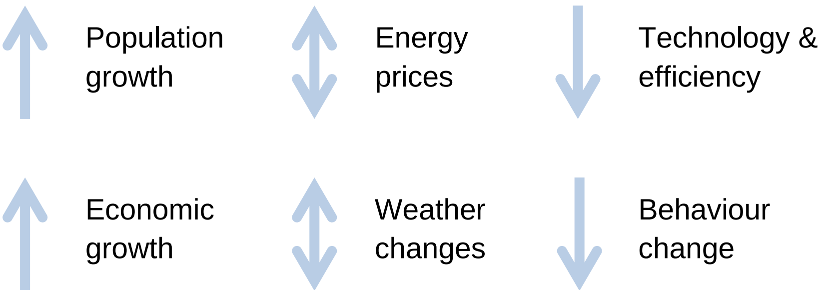


Figure 39. Drivers of changes in energy use and emissions

3.2 Overview of the methodology

3.2.1 Modelling approach

Future GHG pathways were modelled using the Ricardo Net Zero Projections (NZP) tool, which enables users to model the impact of implementing mitigation measures on a Local Authority's GHG emissions over time. It is a flexible tool that can be quickly configured to model the change in energy use and GHG emissions (including non-energy related emissions) by specifying the breakdown structure of the energy and non-energy related emissions that aligns with the area's base year datasets and reporting requirements, and factoring in changes in demand (e.g., due to growth) and emission factors over time.

The tool is designed to enable the development of scenarios for reaching net zero by any given target year and allows the users to define mitigation measures for each line in the energy and emissions inventory. These scenarios can be used to build a baseline projection, assess the likely impact of planned measures and model the impact of alternative strategies to reaching net zero. The scenarios can also be used to undertake sensitivity testing around the impact of changes in assumptions.

The tool is essentially a 'What if?' calculator tool that relies on external validation of inputs, assumptions and outputs to ensure its projections are sensible. At its core the tool is an accounting system that calculates the change in energy use and fuel mix as a result of series of mitigation measures.

It is important to understand that this modelling is based on assumptions about the magnitude of energy or emissions reduction that is technically achievable within each sector. However, it makes no assumptions about the types of policies that would be needed to achieve this. To give an example, the NZP tool can estimate the change in emissions that would result from a 10% reduction in miles travelled by private car, but it cannot assess the impact of specific policy measures, such as 'Introduce a workplace parking levy to discourage people from commuting in private cars' unless the user inputs an assumption about the quantitative impact this would have. That type of information must be established via separate modelling, research, case study evidence or expert judgment.

3.2.2 What pathways were explored and how were they developed?

This work has explored five future pathways for GHG emissions in Leicester: A 'Business as Usual' (BAU) scenario, and four additional net zero pathways.

The BAU scenario is intended to show the changes that could occur if no additional local action was taken to mitigate GHG emissions in Leicester, beyond those that are already planned and committed.

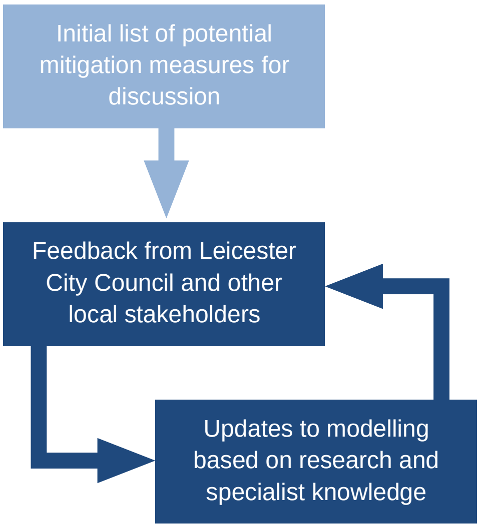
This primarily includes national-level economic and demographic trends, along with projected energy prices and likely technological improvements (e.g. better vehicle efficiency). Those assumptions are based on the BEIS Energy and Emissions Projections (EEP), which also considers the anticipated GHG reductions that are expected to occur due to adopted Government policies *'where funding has been agreed and where decisions on policy design are sufficiently advanced to allow robust estimates of policy impacts to be made'*.[37] Taking Leicester's baseline emissions as a starting point, growth curves based on the EEP data were then applied to each sub-sector and fuel type in Leicester. This means that the overall change in emissions reflects the baseline situation in the City.

A sense-checking exercise was carried out to assess whether it was appropriate to apply these national trends at a local level – for example, by cross-checking national population growth projections with those for Leicester (see Figure 40). Adjustments were then made to reflect local factors, most notably in the domestic sector, where growth rates are assumed to be lower, on the basis that up to half of Leicester's future housing need is likely to be met outside of the City boundary.

In addition to the BAU scenario, this work has explored four net zero pathways, which explore the impact of a range of behavioural and technological measures aimed at mitigating energy use and GHG emissions.

[37] For further information, see Energy and emissions projections - GOV.UK (www.gov.uk)

The net zero scenarios were developed through an iterative approach. After reviewing the baseline information for Leicester, the Ricardo team developed an initial set of mitigation measures based on technical research and expert knowledge of climate change actions that could be taken across different sectors. These were submitted to LCC and other stakeholders for feedback.



The modelling assumptions were then revised as necessary, to ensure that stakeholders' views on which measures were more or less likely to be achievable were accounted for wherever possible.

Scenarios 1-3 reflect increasing levels of ambition. The general approach to determining mitigation measures was as follows:

- **Scenario 1** generally assumes that mitigation measures will be implemented in line with the Climate Change Committee's (CCC) analysis of what can be achieved by 2030 on a national level.
- **Scenario 2** takes the CCC's assumptions for what can be achieved by 2050 and then shows what would happen if the same level of progress was to be achieved by 2030 instead. We have adjusted these where necessary to account for certain technologies not being widely available by 2030.
- **Scenario 3** is largely illustrative. It shows the scale of GHG emissions reduction that would be achieved through maximum levels of demand reduction and near-complete eradication of fossil fuels. It is important to note that this scenario makes some assumptions that are theoretically, but not practically, achievable. In particular, it assumes that nearly all industrial and commercial processes can switch to electricity, while this may not be the case.

Scenarios 1-3:
2030 target date
Scaling up the level of ambition and thereby reducing the need for offsetting

Scenario 4 is distinct from the others because it looks towards 2040 rather than 2030. The reason for including a scenario with a later target date is not to lower the level of ambition, but to consider the impacts of changes that are more likely to occur on a longer time horizon. Most of the assumptions are similar to those used for Scenario 2 (i.e. highly ambitious but technically feasible by 2050 according to the CCC). Key differences are:

Scenario 4:
2040 target date
Exploring the impact of further technological developments

(1) The national electricity grid is expected to decarbonise further, meaning that the GHG benefits of fuel switching will be amplified.
(2) Some technology assumptions are different, e.g. inclusion of hydrogen for vehicles and some buildings, and slightly better PV efficiency.

(3) From a practical standpoint, there will be more time to implement local mitigation measures (such as retrofitting), and there may be positive shifts in consumer behaviour that reduce the reliance on Government action (as in the case of EV uptake).

Appendix B contains a list of the mitigation measures and variables used in each scenario, along with references and commentary.

3.3 The Business-as-Usual scenario

3.3.1 Assumptions about future changes

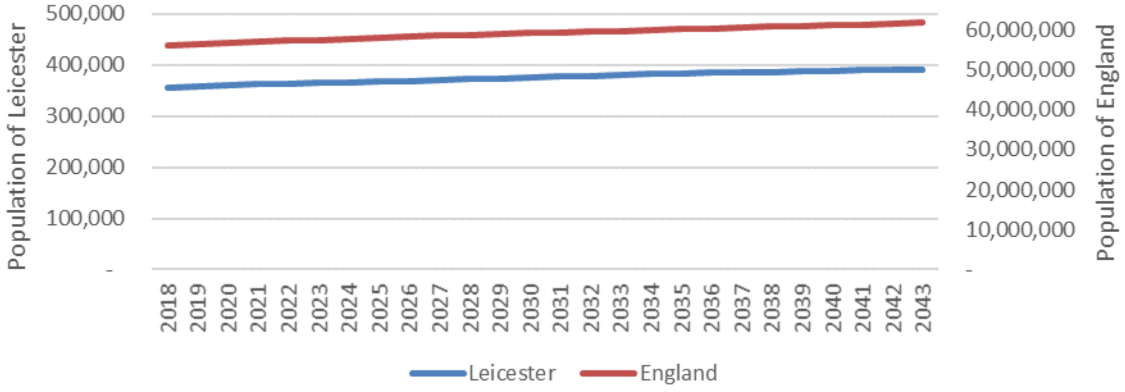
The EEP data incorporates a range of information, including projections for:

- Annual growth rates for population and number of households
- Annual growth rates for economic parameters:
    - Real UK GDP
    - GDP Deflator
    - Real household disposable income
    - Industrial production
- Weather changes (winter degree days)
- Retail and wholesale energy prices, carbon prices, and exchange rates

For more information, refer to the BEIS EEP Methodology Report.

The Office of National Statistics (ONS) projections indicate that the population of Leicester, which was 355,218 in 2018, could reach around 376,000 by 2030 (a 5.86% increase) and 389,000 by 2040 (a 9.4% increase). This closely aligns with the ONS forecasts for England as a whole (which would see population increases of 5.72% and 9.26% by 2030 and 2040, respectively), as shown in the chart below.

Figure 40. Population growth projections for Leicester and England, 2018-2043. Source: ONS



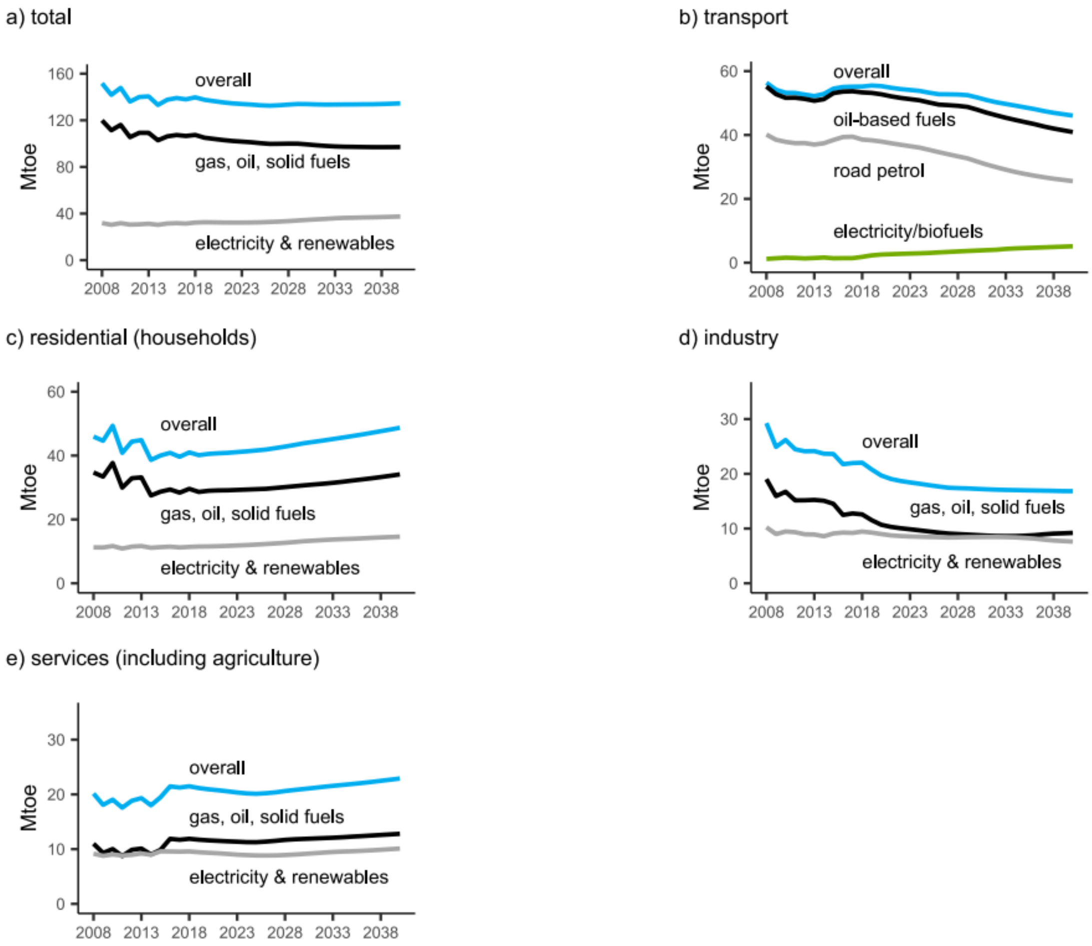
Note, the EEP data was developed prior to the publication of the Government's Net Zero Strategy on 19th October 2021 and, as such, does not account for any of the policy proposals set out in that report. It also does not account for various policy proposals that were announced previously, of which notable examples include:

- The proposed 2030 ban on the sale of new petrol and diesel vans and cars; and
- Future changes to UK Building Regulations for new developments

In practical terms, what this means for the Roadmap is that some of the mitigation measures modelled in Section 3.4 may in fact form part of the BAU scenario, i.e. they would not need to be delivered via additional policy measures and actions taken at a local or regional scale.

The charts below, which are extracted from the EEP Methodology Report, shows the future changes in fuel consumption that form the basis of the emissions projections. Broadly speaking, emissions from transport (primarily road transport) are expected to decline, emissions from the residential sector would tend to increase, and emissions from other non-residential sectors (including commercial, industrial and public sector buildings and facilities) exhibit an initial decline before tending to level out in the 2030s. Total fuel consumption would be slightly lower than it is at present, but this would lead to a proportionally larger change in GHG emissions which is primarily due to the effects of electricity grid decarbonisation.

Figure 41. Final energy demand by fuel and consumer sector. Source: BEIS



In the transport sector, there is a general shift towards the use of electric vehicles, and because these are more efficient than combustion engines, this leads to an even larger proportional reduction in the use of petroleum products. Demand for petroleum products will also tend to decrease, which is attributed to the introduction of more stringent emissions standards for cars, vans and HGVs.

Nationally, according to the EEP, the domestic sector would see a larger increase in both fuel use and emissions, driven by changes in population, income levels, weather and fuel prices. Note that our BAU pathway has reduced this growth rate by roughly 50% to account for the introduction of the

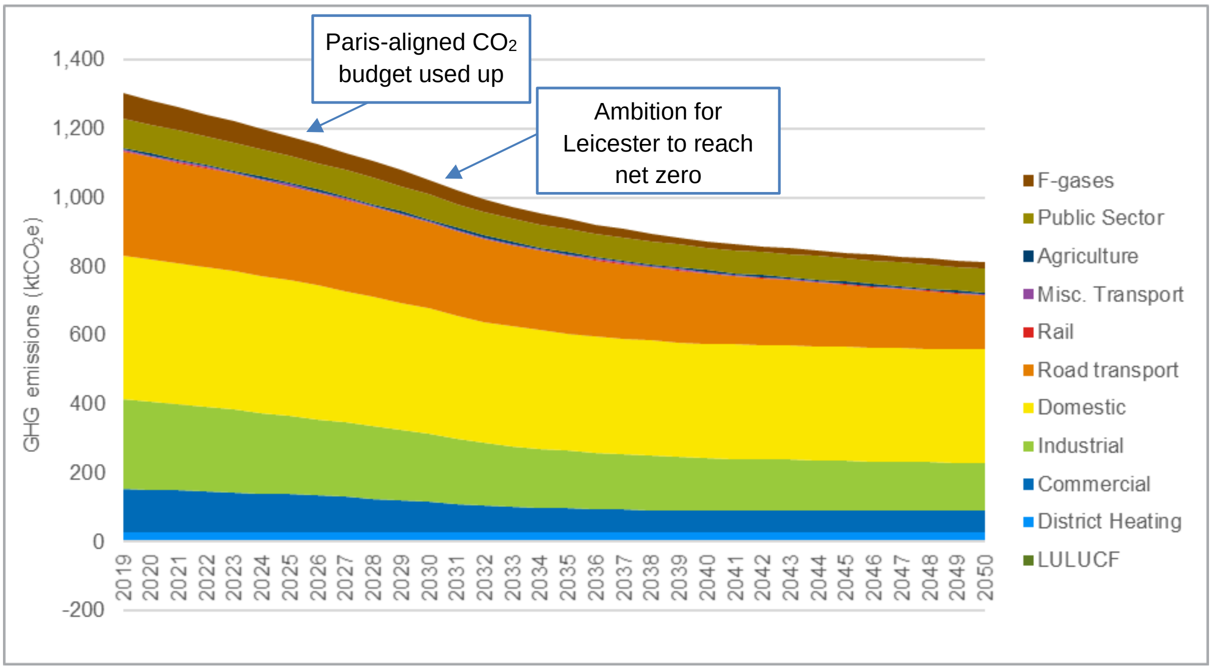
Future Homes Standards, as well as the fact that a significant proportion of new homes would be delivered outside of the area boundary.

In the industrial sector, demand for electricity and renewables would rise slightly, while demand for gas, oil and solid fuels would remain roughly the same. In other non-industrial sectors (referred to as 'Services' in the chart above), demand for all fuels would increase slightly. For these sectors, economic growth, weather, energy prices and changes in industrial production are key drivers.[38]

3.3.2 Impact on GHG emissions

In the BAU scenario, GHG emissions in Leicester would fall by roughly 19% by 2030, 33% by 2040 and 38% by 2050.

Figure 42. Changes in GHG emissions by sector in the BAU scenario



Although some of this change is attributed to falling energy consumption, the other major factor is decarbonisation of the electricity grid, which is assumed to fall from 0.2556 $kgCO_2e/kWh$ in 2019 to approximately 0.11 $kgCO_2e/kWh$ in 2030 and 0.02 to 0.03 $kgCO_2e/kWh$ in 2050. This can clearly be seen when comparing Figure 43 and Figure 44, which look at energy use and GHG emissions by fuel type. The change in emissions from grid electricity is disproportionately large compared with the change in electricity consumption.

[38] For more information, see Energy and emissions projections: methodology overview (publishing.service.gov.uk)

Figure 43. Energy use by fuel type in the BAU scenario

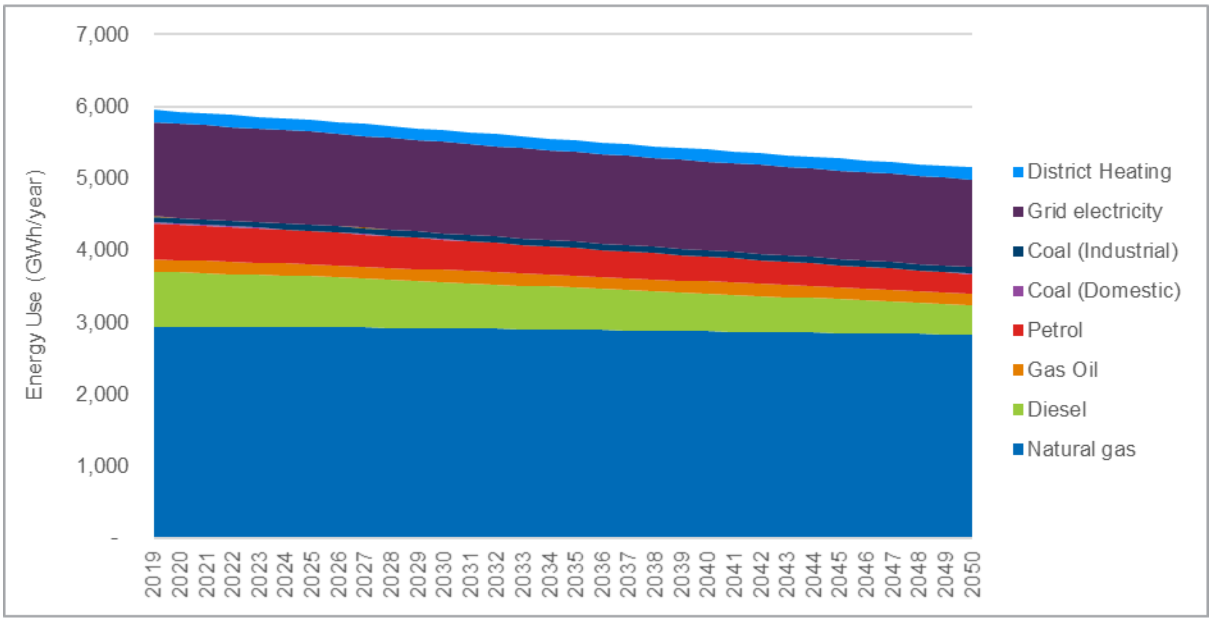
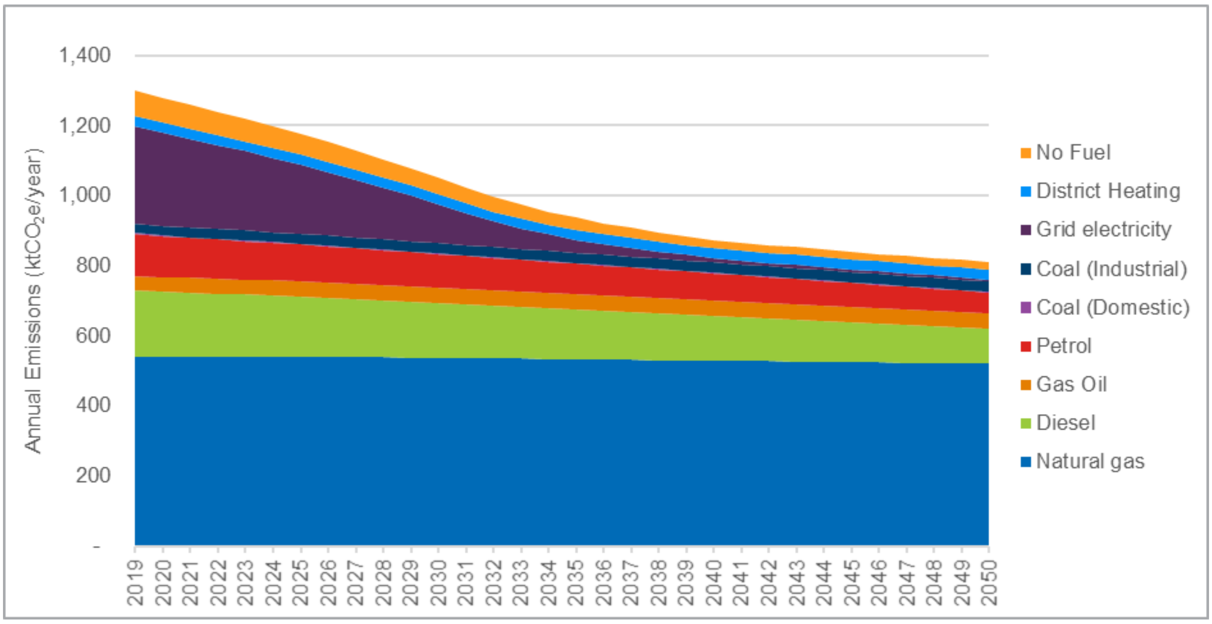


Figure 44. Emissions by fuel type in the BAU scenario



The cumulative emissions over this time period would be approximately 14,100 $ktCO_2e$, so the Paris-aligned carbon budget for the time period through the year 2100 would be used by 2025.

Although it is not within the timescale for Leicester's net zero ambition, it is also worth noting that the anticipated GHG reductions are generally steeper in the 2020s to early 2030s and then tend to taper off from the mid-2030s onwards. Again, this is due to the rate of grid decarbonisation over time; once grid electricity is largely decarbonised, most of the remaining improvements are due to relatively slow changes in fuel consumption. This emphasises that any mitigation measures introduced in Leicester will need to be sustained in the long term and there will be a need for continuing local action post-2030.

With this as a starting point, in broad terms, reaching net zero in Leicester prior to the national 2050 target date will require:

- Reducing demand for energy and other resources as much as possible via energy efficiency, behavioural change and technological means
- Switching all (or nearly all) fuel consumption to electricity instead of fossil fuels, including energy use in buildings and transport
- Radically decarbonising the electricity supply by increasing deployment of renewable power, phasing out fossil fuels, and delivering associated infrastructure upgrades
- For sectors or activities that cannot use electricity, mitigating emissions by using other renewable or low-carbon energy sources and making use of carbon capture and storage
- Changing agricultural practices and land uses to increase carbon sequestration and reduce emissions of other GHGs
- Offsetting residual emissions by delivering further GHG reductions outside the boundary of Leicester – *as a last resort*

Opportunities to achieve these changes are discussed as part of the net zero pathways analysis in Section 3.4.

3.3.3 Uncertainties, risks and opportunities

This section describes some of the uncertainties, risks and opportunities highlighted by the BAU analysis. This is not a comprehensive list but highlights some of the main points.

Uncertainties in the BAU scenario	
What are they?	**What are the implications?**
There are inherently high levels of uncertainty in any form of GHG or energy scenario modelling. Unforeseen events can have a major impact. The COVID pandemic is a good example, but others could include economic changes, major political events, extreme weather, etc.	It is important to acknowledge that the pathways are not forecasts. They are instead intended to highlight the scale and direction of changes that may occur, to help inform the development of local mitigation measures.
The Government has recently announced a range of policies and other ambitions as part of a nationwide net zero strategy that are not currently accounted for.	Many of the measures announced by the Government are modelled as additional mitigation measures in the subsequent sections of this report, so their effects are at least partially quantified. However, responsibility for achieving or implementing those measures may shift away from local stakeholders, to the central Government.
Changes in fuel consumption in the commercial and industrial sectors will be more dependent on	The lack of information makes it harder to comment on the likelihood that local trends

the specific types of industries and activities taking place in Leicester. As discussed in the Baseline chapter, there is less information available on this topic than, for example, on domestic and road transport energy use.	would align with the national trends in this regard. Findings relevant to the industrial and commercial sectors should therefore be treated with some additional caution.
The rate of national electricity grid decarbonisation in the model is based on Government figures but the speed of decarbonisation has been generally viewed as optimistic. On the other hand, this may now change in light of recent announcements on achieving a net zero electricity grid by 2035.	At the time of writing (October 2021) it is too early to comment on the potential rate of future grid decarbonisation. As will be discussed throughout this report, this is a key issue because it is one of the major sensitivities in the model.

Risks to achieving net zero	
What are they?	**What are the implications?**
The BAU scenario shows a very large gap to reaching net zero, which means there will be huge pressure to deliver additional mitigation measures locally or regionally.	LCC will need to collaborate with a range of stakeholders and utilise all available policy levers / areas of influence. This includes lobbying the Government for additional support.
If national grid decarbonisation is slower than assumed, the reduction in GHG emissions would be even lower than shown.	This is a particular challenge because there are very few ways that LCC or local stakeholders can have an influence. LCC should aim to maximise local renewable generation, which will help to provide zero carbon electricity locally, and facilitate this broader shift by supporting larger-scale renewables where possible.
Weather extremes, which are expected to be more likely due to climate change, could result in both short- and long-term changes in energy use. Heatwaves are an example as they could prompt more people to install artificial cooling systems.	LCC should consider developing strategies for adapting to climate change as well as mitigating climate change. In broad terms, for an urban setting such as Leicester, design and masterplanning of the built environment and green infrastructure will be key. However, detailed information on climate adaptation is outside the scope of this report.

Opportunities	
What are they?	**What are the implications?**
Changes in emissions in the domestic sector will depend in large part on consumer behaviour, income levels, and so on; however, the increase will also depend on the level of new housing that is delivered within the City and the energy and CO_2 performance standards that those buildings are required to meet.	LCC can influence the design of new developments and major refurbishment projects in its role as a Local Planning Authority. The updated Local Plan should include measures that would limit emissions from new developments while promoting uptake of local renewable energy technologies.
It is understood that LCC, the NHS, and other local public sector bodies have introduced, or are considering, plans to decarbonise their own assets and operations prior to the national 2050 deadline.	Although the public sector does not contribute very much to total GHG emissions, if there are any specific commitments then these could be incorporated into the BAU scenario. In practical terms this would mean that the Roadmap could

	focus more on defining interventions in other sectors.
It is likely that the BAU scenario shown above underestimates the potential changes in emissions from road transportation, in the event that EV uptake happens more rapidly. This would be the case if the proposed 2030 ban on new petrol and diesel cars and vans comes into place. Moreover, it is anticipated that the price of electric vehicles will reach parity with combustion engine vehicles in the next few years, which could have a major impact on consumer choices even without additional policy incentives.	In this instance, LCC would not need to do as much to promote local uptake of EVs and would play more of a facilitation role by helping to provide adequate charging infrastructure. The focus would also shift towards promoting active travel modes and use of public transport.

3.4 Net Zero pathways

3.4.1 Assumptions about future changes

The net zero pathways all include the same core assumptions about population, weather, fuel prices and economic trends as are used in the BAU scenario, which is used as the starting point for the analysis. All of the other changes are modelled as mitigation measures that would need to be adopted, whether via additional Government policies, local/regional initiatives, or through voluntary changes in consumer behaviour, business and industrial practices. The table below summarises the mitigation measures that are modelled in each scenario; further details are provided in Appendix B.

Category	Mitigation measures considered
Energy use in buildings	• Reducing heat and electricity demand due to fabric energy efficiency, smart heating controls, uptake of LED lighting and upgrades to non-domestic heating, ventilation, and air conditioning (HVAC) systems. • Connecting some buildings to heat networks, and then converting these to use renewable heat (e.g., electric heat pumps). • Buildings that do not connect to heat networks are assumed to switch to electric heating, heat pumps or (in Scenario 4 only) hydrogen gas to provide space heating and hot water. • Switching any remaining fossil fuel demands to electricity (in Scenario 3) or a combination of electricity and hydrogen (in Scenario 4). *Note, this is largely illustrative and only applies to industrial energy demands.*
Road transport	• Avoiding car journeys via behavioural and technological change, e.g., working from home • Replacing a proportion of remaining car journeys with walking, cycling and public transport • Reducing demand for LGV and HGV movements through trip consolidation and changes in logistics • Improving HGV efficiency through technology improvements and driver training initiatives • Uptake of electric vehicles (cars, vans, buses and motorcycles) • Uptake of hydrogen (buses and HGVs) – *Scenario 4 only*
Other transport	• Electrification of rail network
Energy system	• Electricity grid decarbonisation taking place in line with national projections • Massive increase in deployment of roof-mounted solar technologies on suitable buildings
Miscellaneous	• Increase in carbon sequestration via tree planting within Leicester

These pathways are intended to highlight the scale and direction of changes that could occur if the above measures were implemented. They are not intended as a projection or forecast of future energy use and emissions. It is also worth noting that, in reality, implementing these types of changes would almost certainly lead to dynamic impacts across different activities and sectors, thus affecting wider trends such as fuel prices. Those interactions are highly complex and have not been quantified in this study. Nonetheless, these scenarios provide a useful way to assess and prioritise potential interventions – and understand LCC’s level of influence when it comes to achieving net zero emissions.

3.4.2 Impact on GHG emissions

Scenario 1

This scenario results in residual emissions of 896 $ktCO_2e$ per year by 2030, which is a 31% decrease compared with 2019. Emissions decrease in all sectors due to the mitigation measures selected, as illustrated in Figure 45.

Figure 45. Emissions by sector in Scenario 1

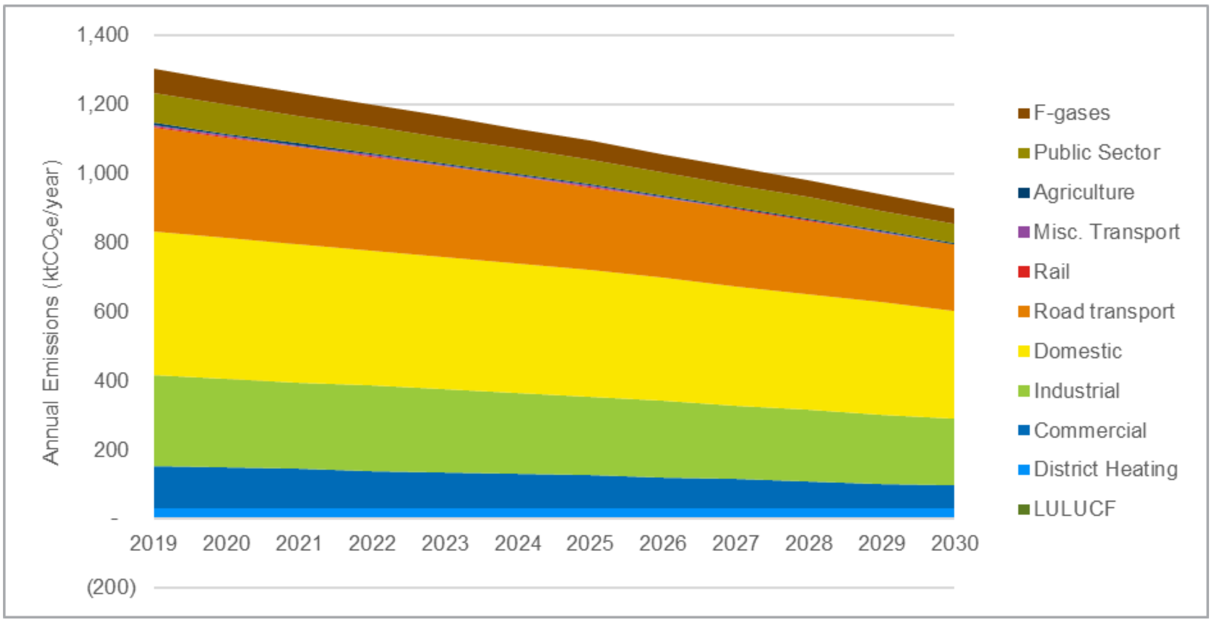


Figure 46 shows the changes in emissions by fuel type between 2019 and 2030, and Figure 47 shows the underlying changes in energy use. These graphs make it clear that electricity grid decarbonisation is a key driver of emissions reduction in this timeframe, because (as in the BAU scenario) the change in emissions from electricity is disproportionately large compared with the change in electricity consumption.

Figure 46. Emissions by fuel in Scenario 1

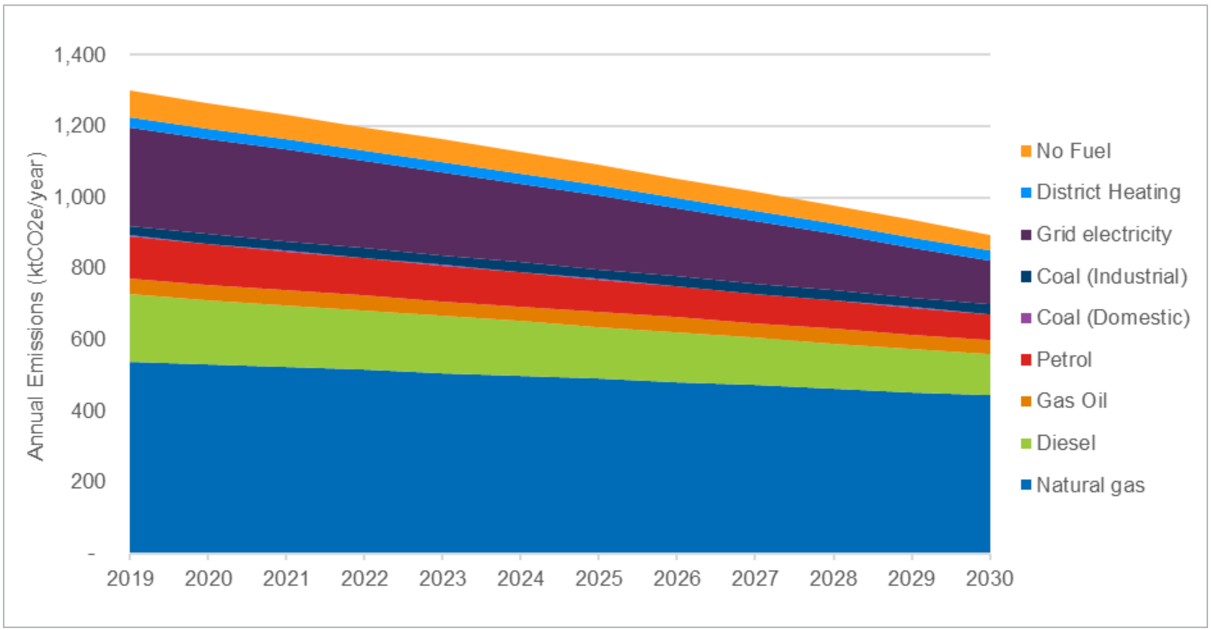


Figure 47. Energy use by fuel in Scenario 1

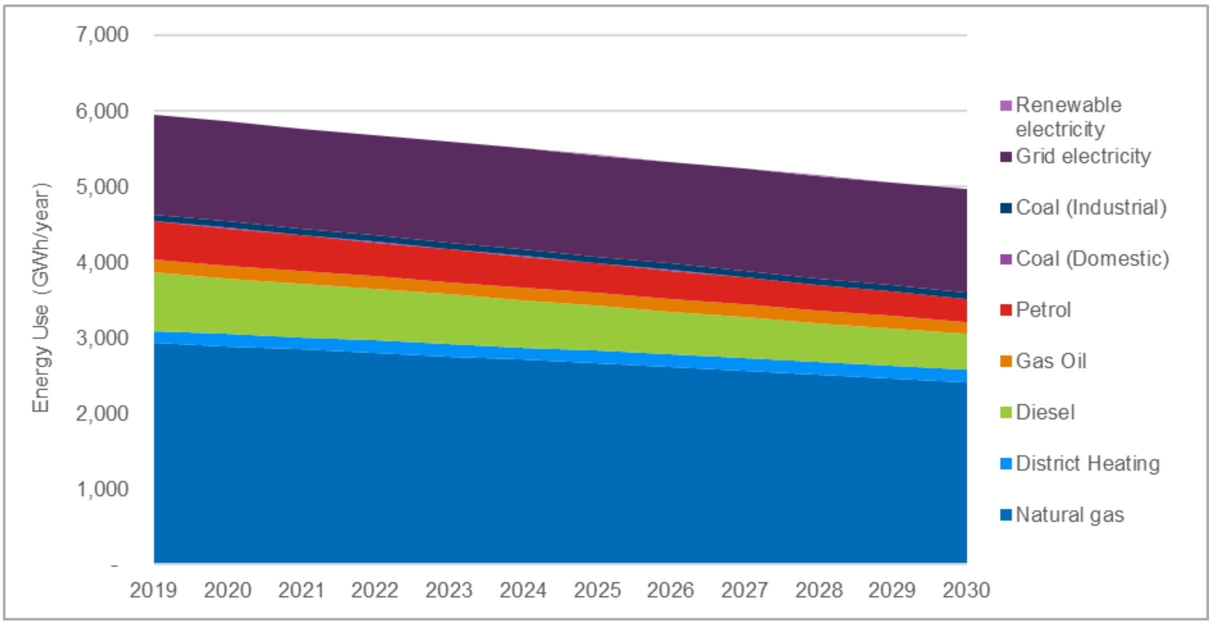
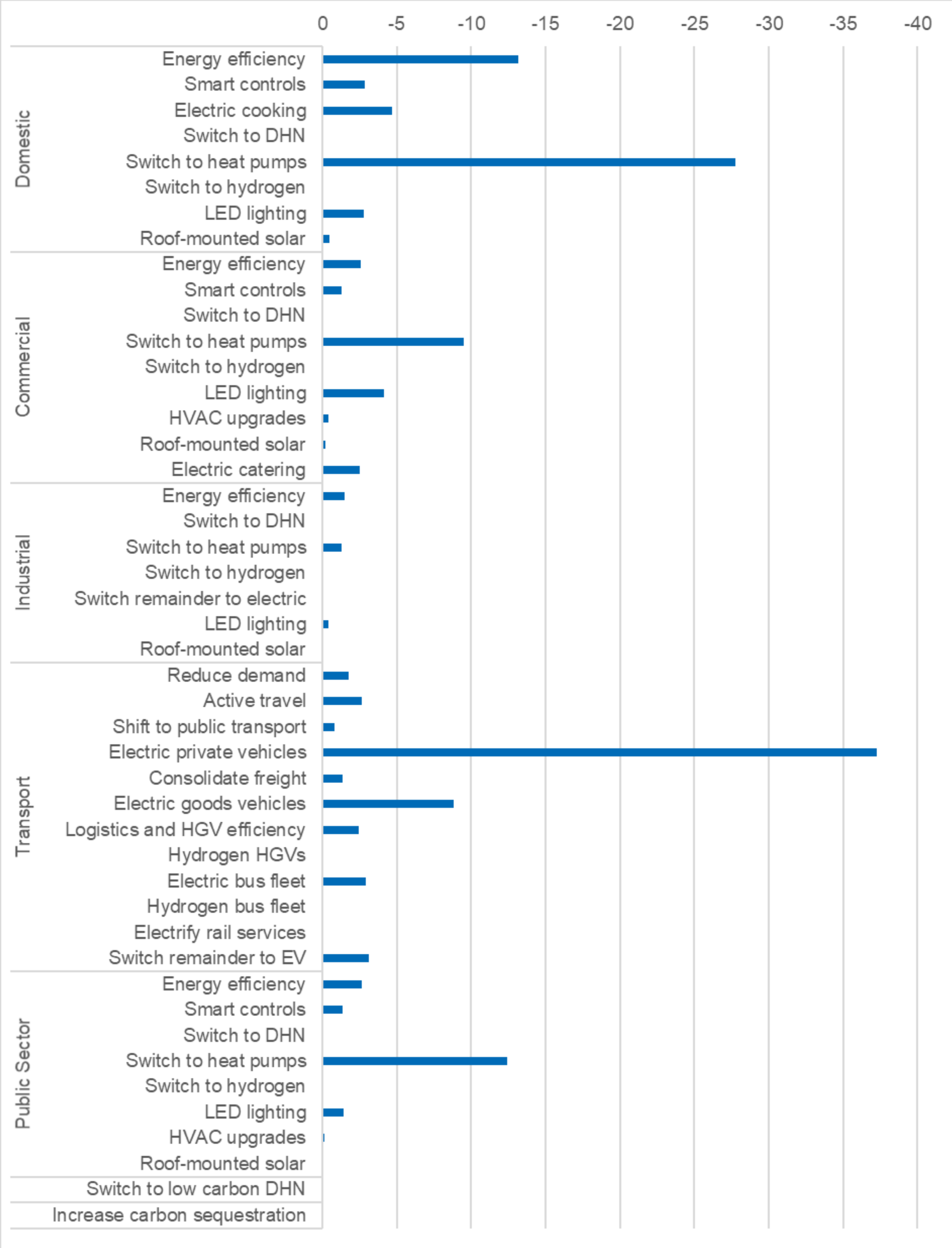


Figure 48 on the following page shows the estimated impact that each mitigation measure has on GHG emissions by 2030.

Figure 48. Impact of mitigation measures in Scenario 1 ($ktCO_2e$)



It is clear that the biggest reductions come from fuel switching. For buildings, ‘fuel switching’ is assumed to mean switching away from the use of natural gas for heating, towards the use of electrically powered heat pumps. These could either be individual heat pumps, or form part of a communal or district heat network. In the transport sector, it means switching from petrol, diesel and other fossil fuels, towards the use of electric vehicles wherever possible. This is why achieving net zero will rely heavily on grid decarbonisation: it amplifies the benefits of switching to electricity.

However, as mentioned previously, there are numerous challenges associated with such high levels of electricity demand. Energy demand reduction is therefore a crucial prerequisite for transitioning to a low carbon energy system – even though, in the net zero pathways presented here, demand reduction measures have a lower impact on GHG emissions than fuel switching.

The level of demand reduction modelled in buildings in this scenario, while low compared with the other net zero pathways, is considered achievable based on common and cost-effective retrofitting measures in buildings. At present Government or Local Authority funding for this is extremely limited, and Local Authorities have relatively few areas of policy influence, so achieving this would rely on owner-occupiers and landlords.

LCC would also need to ensure that the Local Transport Plan includes strong measures that can achieve this level of demand reduction, active travel, and use of public transport.

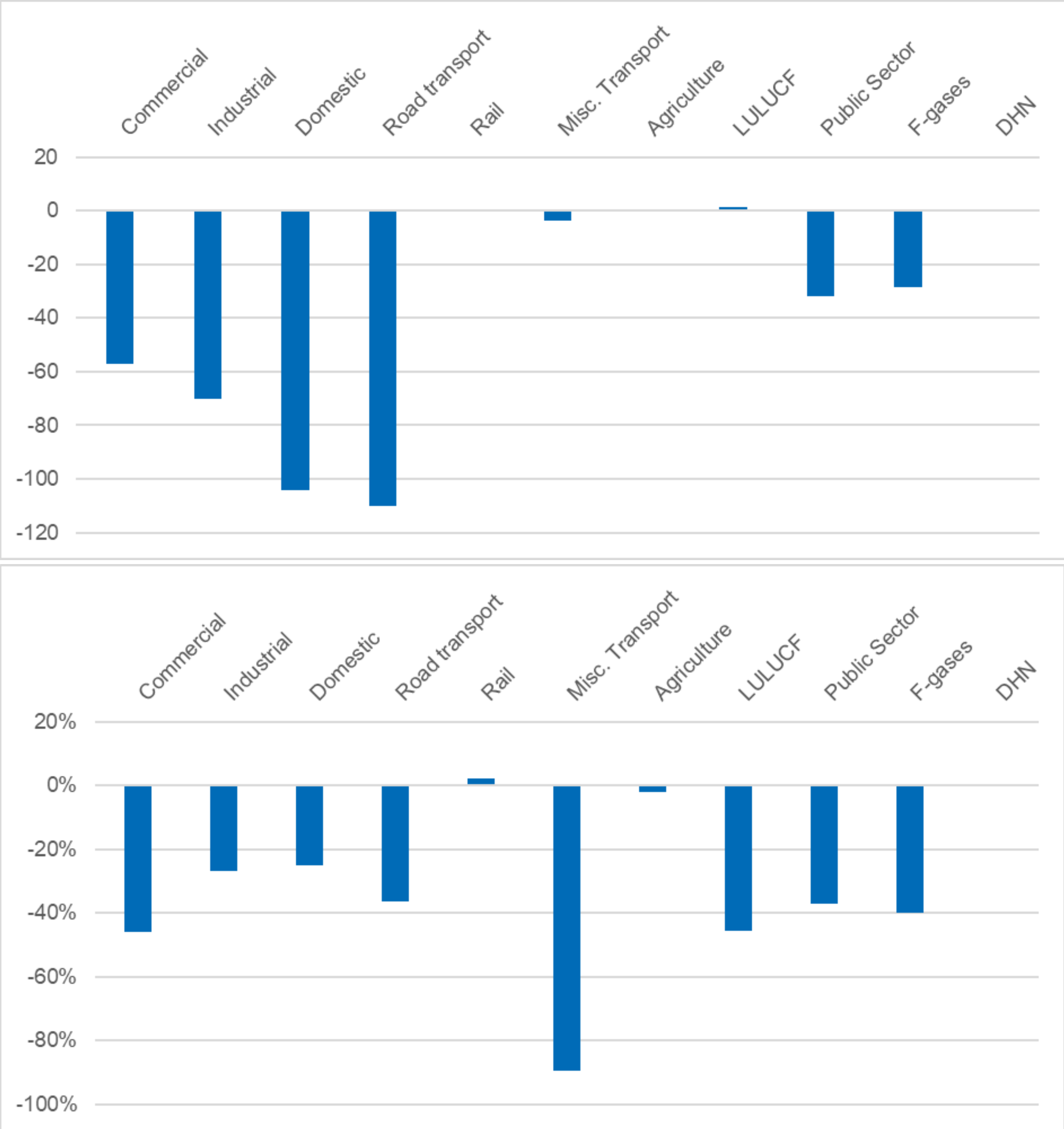
Some further points of clarification on Figure 48 are outlined below:

- Some measures show no GHG impacts because they are excluded from Scenario 1. This includes, for example, the use of hydrogen boilers or HGVs.
    - The exception is roof-mounted PV on public sector buildings, which at present is combined with commercial sector buildings.
- Although the same types of measures have been modelled for the industrial sector as for the commercial and public sectors, these have proportionally less of an impact. This is because a higher percent of fuel consumption is associated with industrial processes and, as mentioned in Section 2, there is comparatively limited data on precisely how the fuel is used. The most significant carbon reductions in the industrial sector in Scenario 1 are from roof-mounted PV. This assumes that there are larger roof areas, with shallower pitches that are less likely to create overshading, and that aesthetic or planning considerations will not present a barrier. It is worth noting that although the geometry of industrial roofs may be suitable, in many cases they would need reinforcement to accommodate this much PV, which presents a significant financial and practical challenge.

Below, Figure 49 shows the absolute and relative change in emissions by sector, by 2030. The highest reductions are from the domestic sector and road transport because these account for higher proportions of the current baseline emissions. The next largest reductions are in the industrial sector although as explained above, this is due to the assumptions around roof-mounted PV. Miscellaneous transport is assumed to switch to electricity by 2030, so this shows a large relative change in emissions despite having a small impact overall. Based on conversations with Engie, it is understood to be unlikely that the district energy network will switch to an alternative fuel source between now and 2030, so no change has been modelled for district heating. For the same reason, we have not assumed that the network will expand, since there would be other, lower carbon heating options available.

No additional mitigation measures have been modelled for agriculture or f-gases, so the changes shown are based on the BAU scenario and are in line with the BEIS EEP assumptions.

Figure 49. Change in emissions by sector in Scenario 1. ***(Top: Absolute change, ktCO₂e. Bottom: Relative change, %)***



Despite these improvements, it is clear that Scenario 1 does not come close to achieving Leicester's net zero ambition. The cumulative emissions in this time period would be roughly 13,250 $ktCO_2e$, meaning that the Paris-aligned carbon budget (recommended by the Tyndall Centre) would be used up by approximately 2025.

For context:

To offset the remaining annual emissions in 2030 (896 $ktCO_2e$) via tree planting would require roughly 25 km^2 of land area to be turned into new woodland, which is equivalent to roughly 34% of Leicester's land area. If that woodland was correctly maintained over the course of decades and centuries, this would be enough to offset those emissions – but to be clear, just that one year's worth of emissions.

Looking at the challenge another way, if all of the electricity demand in 2030 in Scenario 1 was to be met with 100% renewable electricity, this would require *approximately*:

- 1600 MW of PV (occupying c. 20 square kilometres, around 27% the area of Leicester); or
- 650 MW of onshore wind power (c. 325 large-scale turbines).

None of these offsetting options is feasible. Therefore, in order to credibly reach net zero, it is clear that Leicester would need to implement mitigation measures that are significantly more ambitious than those set out in the CCC pathways to 2030.

Scenario 2

This scenario results in residual emissions of 591 $ktCO_2e$ per year by 2030, which is a 55% decrease compared with 2019. Figure 50 shows the changes in emissions by sector. Along with the subsequent charts, it shows that the trends seen in Scenario 2 are broadly similar to those seen in Scenario 1. This is to be expected given that the same types of mitigation measures are included. The main difference is that the scale of emissions reduction is higher, due to higher rates of implementation. This is especially apparent for the domestic sector, which shows a notable difference to Scenario 1 primarily due to the higher uptake of heat pumps to replace gas boilers.

Figure 50. Emissions by sector in Scenario 2

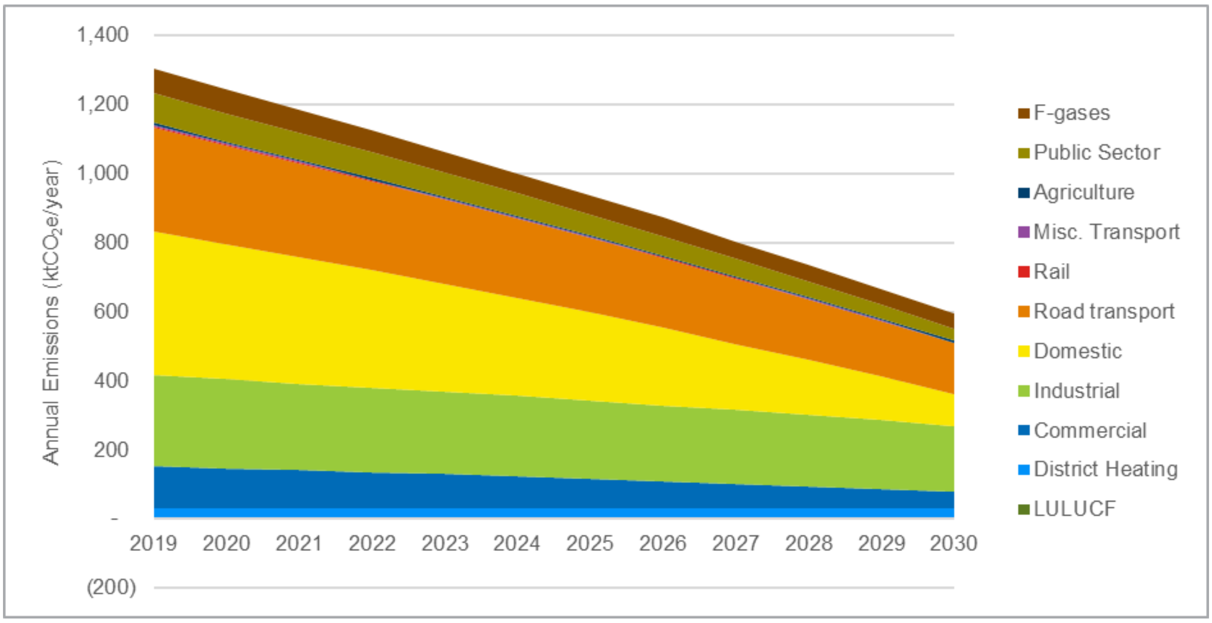


Figure 51. Emissions by fuel in Scenario 2

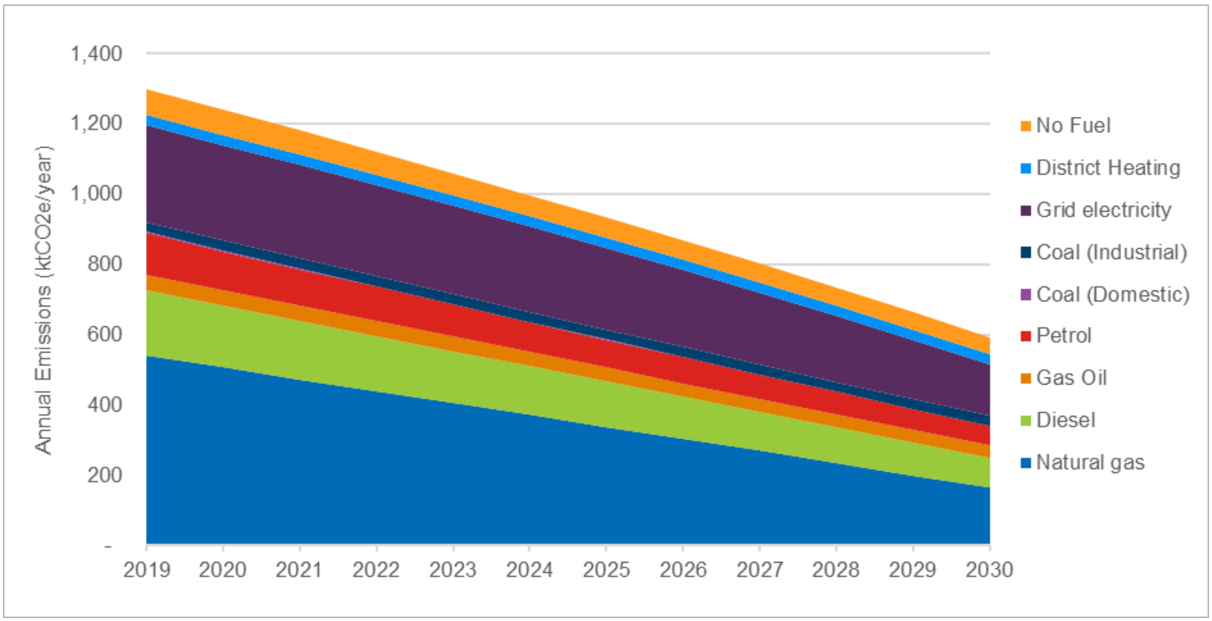
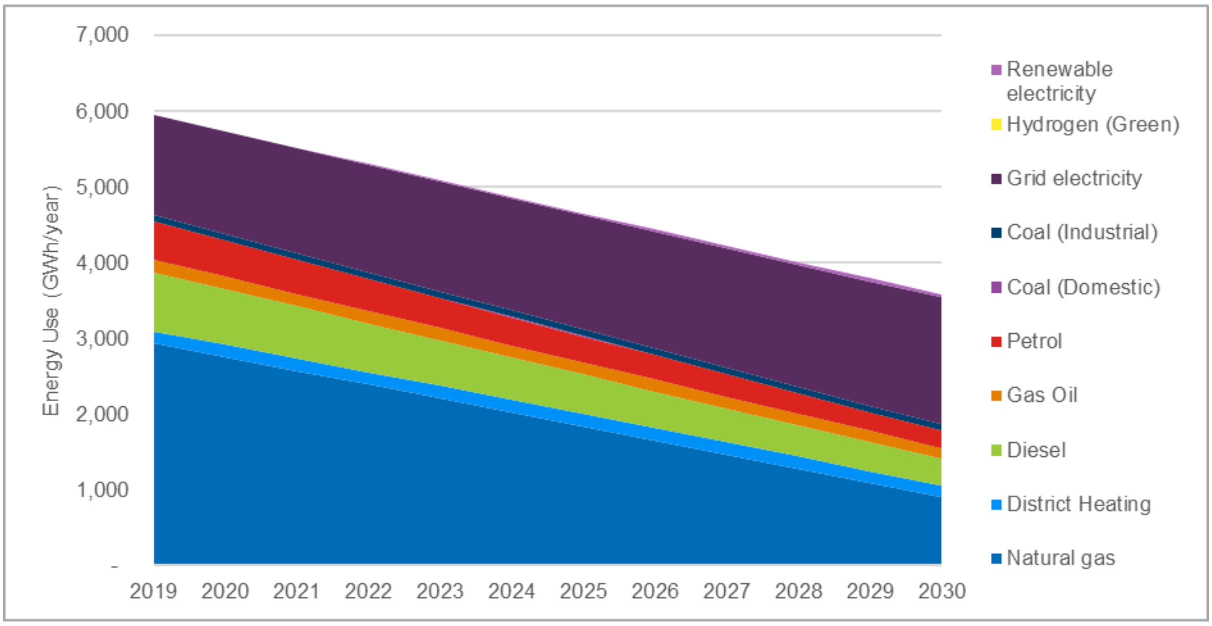


Figure 52. Energy use by fuel in Scenario 2

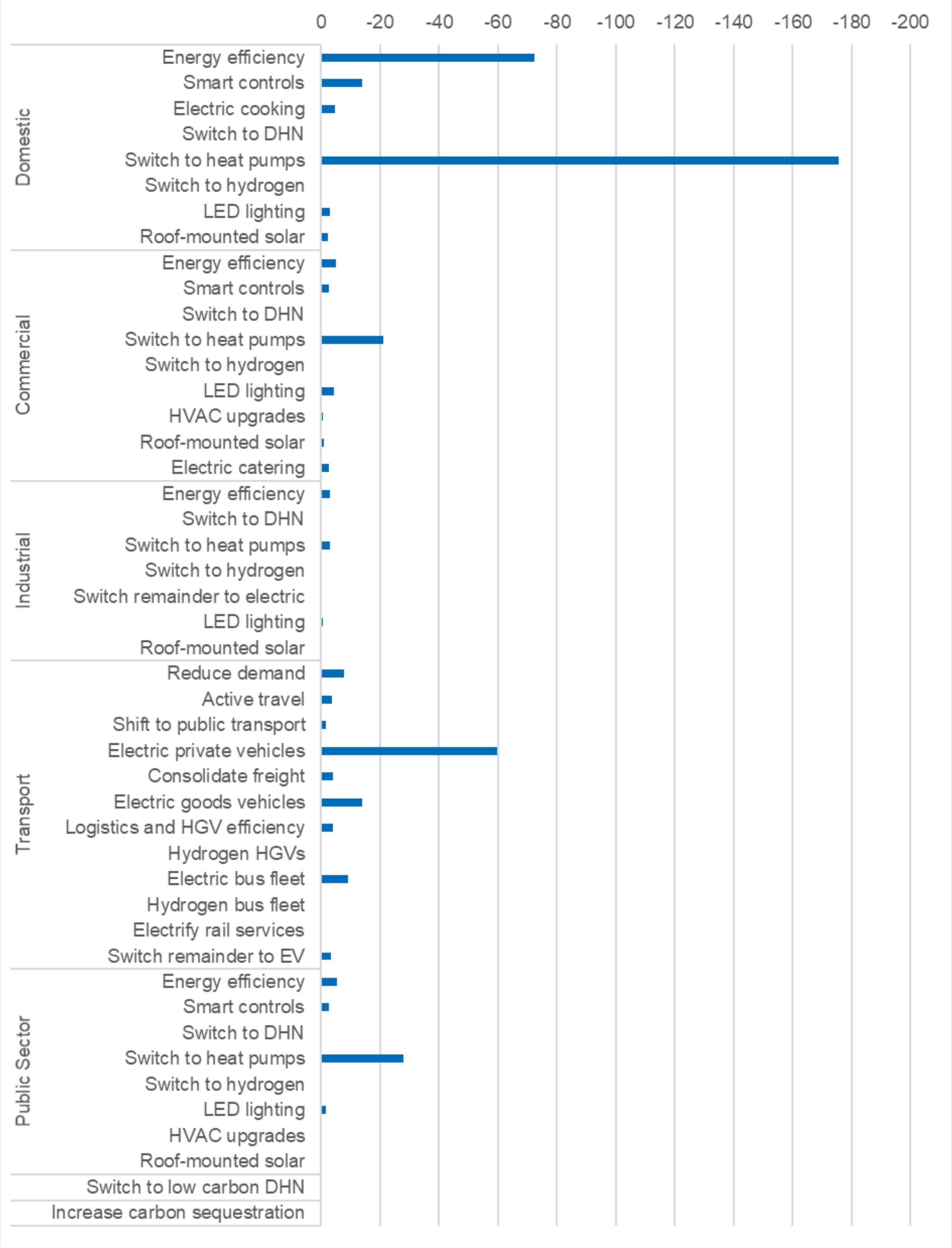


Looking at the chart of energy use by 2030 allows for a comparison between 2019 and 2030. By 2030, there is a much lower contribution from gas, and a higher contribution from grid and renewable electricity (supplied via roof-mounted PV on buildings within the City). Electricity demands will increase because of the electrification of heat and transport, but this is outweighed by the decrease in emissions due to grid decarbonisation. There is still some use of petrol and diesel in vehicles; in particular, the decline in use of diesel is proportionally lower than for petrol because it is assumed that HGVs cannot switch to electric.

By 2030 there is some remaining natural gas demand, which is associated primarily with heating in the domestic sector, and other industrial uses. As for Scenario 1, it is assumed that the district energy network does not decarbonise in this timescale and that no further connections are made. The residual quantities of coal, gas oil and fuel oil are primarily associated with light industry.

Figure 53 below shows the estimated impact that each mitigation measure has on GHG emissions by 2030. Compared with Scenario 1, the major difference is in the domestic sector, because it is assumed that there is a much higher standard of energy efficiency retrofitting, and a radical increase in the use of heat pumps (10% by 2030 in Scenario 1 and 86% by 2030 in Scenario 2). The reason for this is because Scenario 2 uses CCC assumptions for 2050, which anticipate much higher uptake of heat pumps post-2030 than pre-2030.

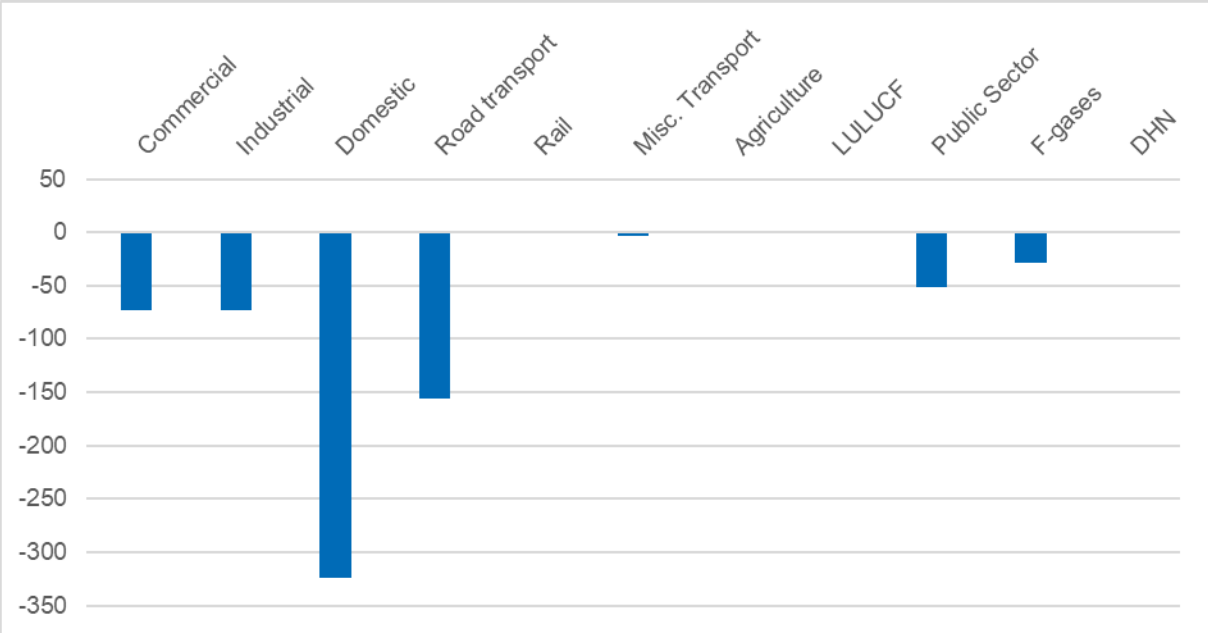
Figure 53. Impact of mitigation measures in Scenario 2 ($ktCO_2e$)

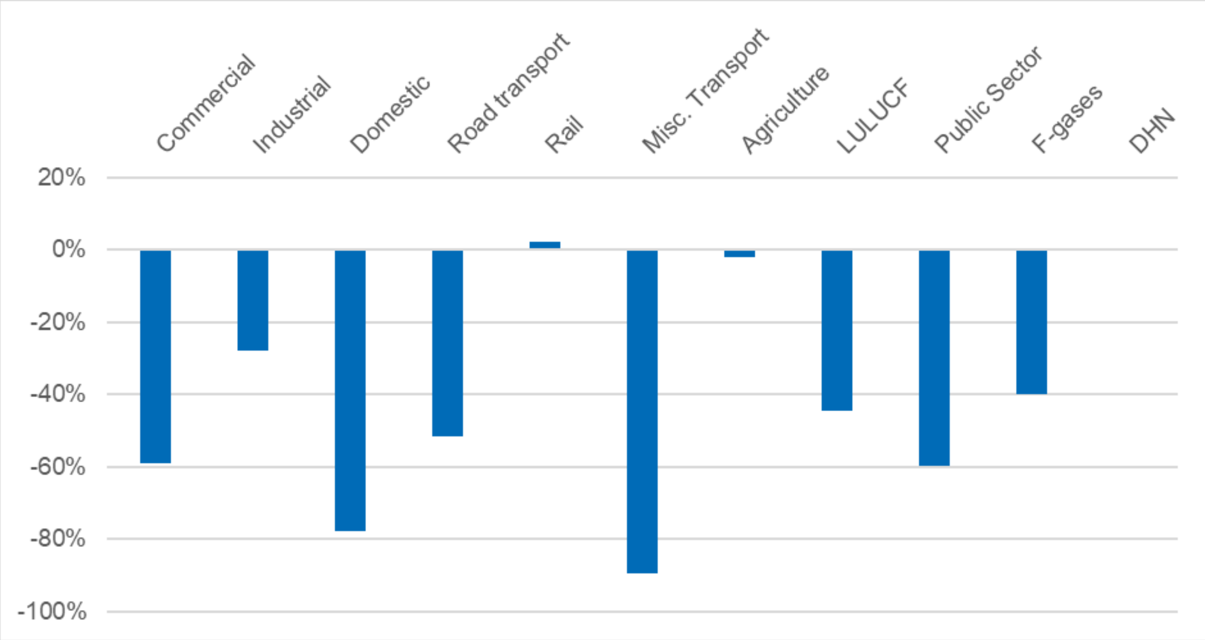


It is worth emphasising again that energy efficiency in buildings must be prioritised alongside fuel switching. Although heat pumps work in poorly insulated buildings, they operate much less effectively. The heat pump may struggle to maintain a comfortable temperature in the building during colder weather if the building is poorly insulated as it provides a lower temperature of hot water into the heating system and hence heats the building more slowly. Electricity consumption will be higher and the efficiency of the heat pump will drop, leading to greater demands on grid infrastructure. Furthermore, the current higher cost of electricity compared to natural gas per kWh will lead to higher heating bills if gas boilers are replaced like-for-like with heat pumps without any accompanying insulation, despite the much greater energy efficiency of heat pumps. Such issues would potentially cause consumers to have a negative view of heat pumps and thereby inhibit market growth. A key challenge for LCC will be to promote uptake as much as possible while also working to ensure that the wider conditions are suitable. This will also need to include a focus on developing a skilled local workforce that can correctly specify, install and maintain the heat pumps.

Below, Figure 54 shows the absolute and relative change in emissions by sector, by 2030. The most notable difference compared with Scenario 1 is the higher proportional improvement in the domestic, commercial and public sectors, for the reasons described above.

Figure 54. Change in emissions by sector in Scenario 2. (Top: Absolute change, $ktCO_2e$. Bottom: Relative change, %)





Overall, Scenario 2 results in greater reductions than Scenario 1, but still falls short of the net zero ambition. The cumulative emissions in this time period would be roughly 11,490 ktCO_2e, so the Paris-aligned carbon budget for the time period through the year 2100 would still be used up by approximately 2026.

For context:

To offset the remaining annual emissions in 2030 (591 ktCO_2e) via tree planting would require roughly 17 km^2 of land area to be turned into new woodland, or around 23% the land area of Leicester.

While the area of woodland would decrease compared with Scenario 1, due to the lower residual emissions, the amount of PV or wind energy that would be required to meet 100% of Leicester's electricity demands would increase, simply because there is more demand for electricity in Scenario 2 than in Scenario 1. This would require *approximately*:

- 1,950 MW of PV (occupying c. 25 square kilometres, around 34% the area of Leicester); or
- 800 MW of onshore wind power (c. 400 large-scale turbines).

Again, these figures are provided to highlight the scale of the challenge, not to suggest that either of these represents a feasible offsetting strategy.

Scenario 3

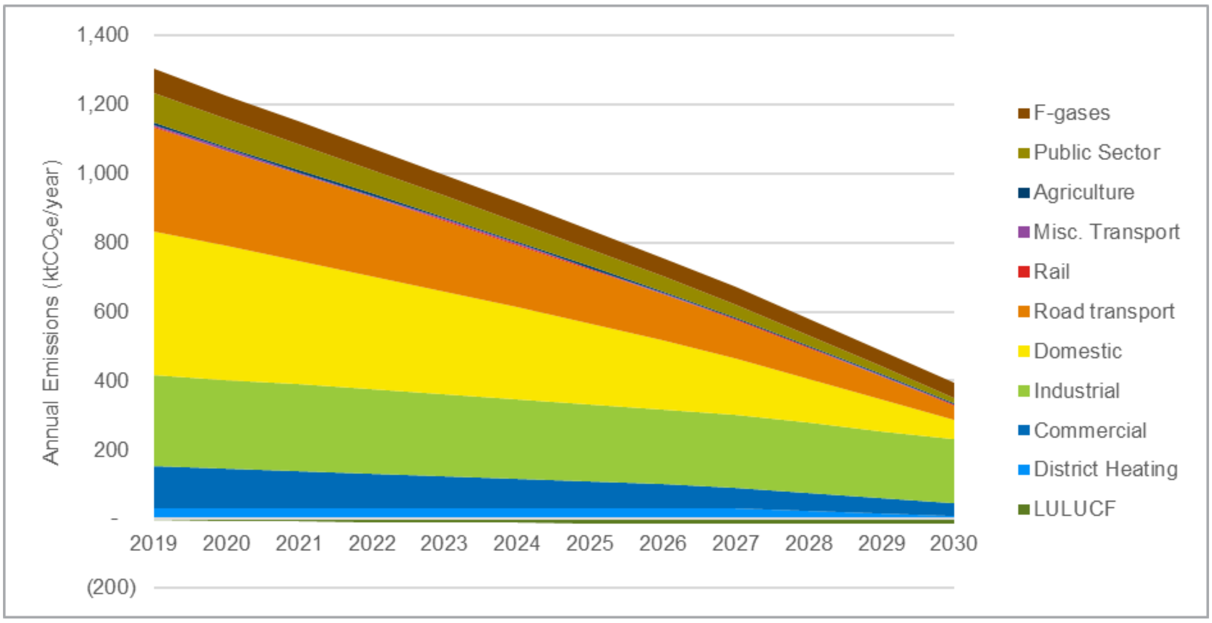
As mentioned previously, Scenario 3 aims to avoid the need for any type of offsetting as much as possible. Most of the assumptions therefore reflect the maximum **theoretical** GHG reductions that could be achieved in each sector, based on existing technologies as much as possible. The purpose of Scenario 3 is to understand how close Leicester could get to net zero, **if practical and cost considerations were no barrier.** Scenario 3 is useful insofar as it highlights what technical options would deliver the greatest reductions by 2030, but it is important to understand that **it is not a projection and does not imply the reductions are necessarily feasible. In practical terms many**

of the interventions may be impossible to achieve without a step change in consumer behaviour, major additional funding, and wider changes in the energy system and economy.

This scenario results in residual emissions of 379 $ktCO_2e$ per year by 2030, which is a 71% decrease compared with 2019. The cumulative emissions in this time period would be roughly 10,260 $ktCO_2e$, meaning that the Paris-aligned carbon budget would be used up by approximately 2026 or 2027. The fact that even Scenario 3 fails to meet that carbon budget reflects the scale of the challenge in reducing emissions from their current levels, and the need to implement the deepest reductions in the next few years.

Figure 55 shows the changes in emissions by sector in Scenario 3. It shows that there are large GHG reductions in all sectors due to high levels of demand reduction and switching to the use of grid or renewable electricity. By 2030 the industrial sector accounts for the largest single proportion of emissions; this is because, aside from space heating and lighting, there are no specific demand reductions modelled, recognising that this is highly industry-specific.[39]

Figure 55. Emissions by sector in Scenario 3



A brief recap of some of the headline interventions for buildings and transport is provided below, with commentary on some of the major challenges that would need to be addressed.

Buildings:

[39] 'Demand reduction' here is used as a description to distinguish energy efficiency measures that only reduce demand, such as fabric improvements and LED lighting, from those that also involve switching from one fuel type to another, which is referred to as 'fuel switching'. Due to the use of EEP data, the BAU scenario will implicitly include some energy efficiency improvements in the industrial sector where these are associated with adopted Government policies. The other specific measures modelled for the industrial sector (of which only the first two are classed as 'demand reduction') are:

- Reducing space heating via fabric improvements and smart controls (modelled together due to lack of data on their separate impacts)
- Switching to LEDs
- Uptake of heat pumps and (in Scenario 4 only) hydrogen boilers
- Scenario 4 also includes an illustrative scenario where the remaining industrial fossil fuel demand switches to electricity or an alternative zero carbon fuel source such as green hydrogen, to assess the scale of impact of future technological changes.

- Scenario 3 assumes a 30% reduction in demand for space heating and hot water across the domestic building stock, on average. In practical terms, given that different properties will be easier or harder to upgrade, this would require deep energy retrofits (achieving savings in excess of the average 30%) in as many buildings as possible. Case study evidence suggests that heating demand can be reduced by upwards of 75-80% in some instances, which would help to make up for cases where such a large reduction is unachievable. For domestic buildings, the cost of energy efficiency retrofits generally ranges from £10,000-65,000 per dwelling, with the higher end of the scale associated with greater levels of energy efficiency. The level of demand reduction in non-domestic buildings is generally lower (20% on average across the building stock) which reflects the greater variability in these types of buildings, but a similar principle applies, i.e. it will be necessary to retrofit nearly all buildings to a lesser or greater degree. Aside from the financial and logistical implications, this would significantly alter the appearance of many buildings. There is also a risk of unintended consequences if the measures are not installed correctly, which can lead to damp and moisture problems, or exacerbate the risk of overheating.
- Scenario 3 also involves replacing *all* non-electric domestic heating systems with heat pumps.[40] The main reason why Scenario 3 (in line with the Government's Net Zero Strategy) focuses on heat pumps is because the technology is already available, but nonetheless there are major financial and practical obstacles associated with doing this. Key issues include: (a) needing to improve the energy efficiency of buildings as a prerequisite, whether that happens first or at the same time as the heating system is replaced; (b) the high cost of heat pumps relative to other systems; (c) the high cost of electricity compared with natural gas and other fuels, and the associated impact on energy bills; (d) low levels of consumer awareness of, and confidence in, the product, which operates differently than boilers; and (e) a lack of skilled tradespeople to specify, install, and maintain the heat pumps. The Government has announced modest levels of funding to address these issues but the Net Zero Strategy appears to place a heavy reliance on market forces to bring costs down gradually.
- Although it does not include any further expansion of the district energy network, Scenario 3 assumes that the existing network switches away from the use of gas to an alternative low carbon heating source before 2030, resulting in a c. 65% decrease in emissions from the network. There are several technological options available to achieve this, which could include air or water source heat pumps.

Transport:

- Scenario 3 assumes that there is a 5% reduction in demand for car journeys due to a combination of behavioural and technological change such as working from home and internet shopping, along with the introduction of the Workplace Parking Levy. It further assumes that the Government's ambition for 50% of journeys to take place via active travel is achieved, which results in a large decrease in car journeys (32%). However, the model does not make any assumptions about the specific measures needed to achieve this. In practice it would require a major shift in the design and use of the road network and public realm to support a considerable change in behaviour, likely also requiring a large-scale awareness campaign and potentially other forms of support to encourage A further 10% of car journeys are assumed to switch to public buses, which for context would be roughly triple the current

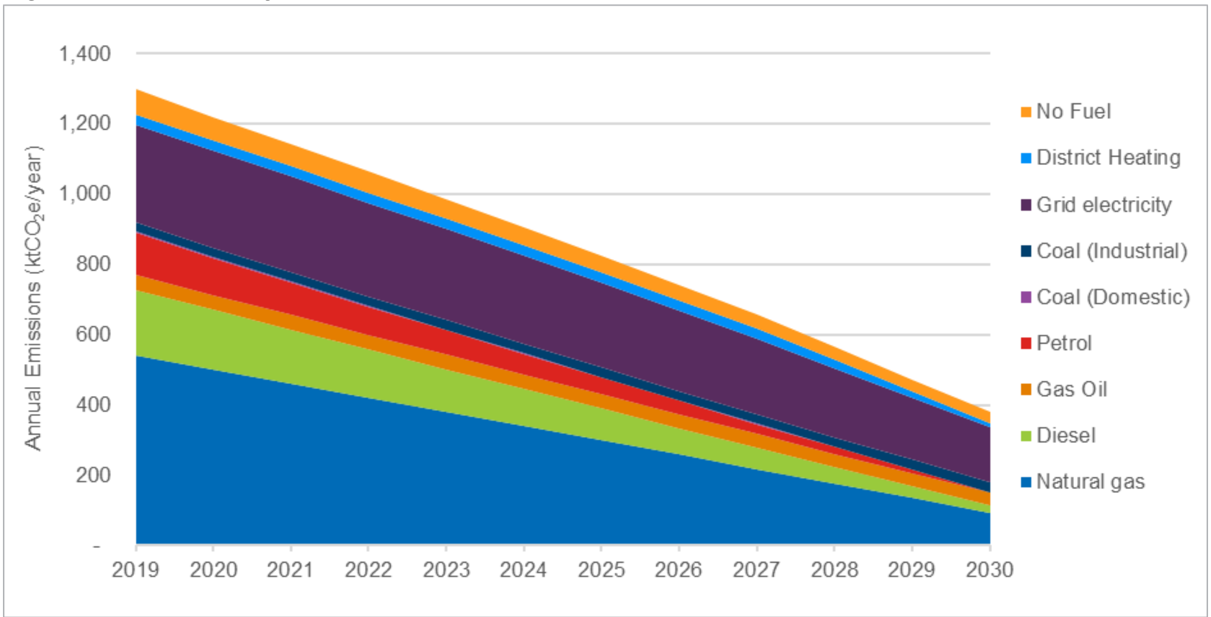
[40] These are likely to be individual heat pumps based on information provided by Engie, but the overall emissions reduction would be broadly the same if a small proportion of these were supplied via communal or district heat network(s).

proportion. **Based on conversations with LCC, the above measures are considered to significantly overestimate the realistic scale of demand reduction and mode shifting[41] that can be achieved in practice.** Cities and large towns generally offer better opportunities for reducing car use than rural areas, due to the relative density of amenities and public transport connections. However, in Leicester, around 40% of Leicester's population has no access to a private car, so the scope for *further* reductions in car journeys may be smaller than elsewhere. There is also a risk of unintended consequences or 'leakage', whereby reducing vehicle journeys in the City itself might increase emissions elsewhere, due to changes in travel patterns and/or higher traffic. So, this would need to be underpinned by a complete transformation in how people travel in Leicester, backed up by strong Local Transport Plan policies and targets, and urban planning design guidelines.

- After reducing demand for travel, this scenario assumes that nearly 100% of cars, vans, motorcycles, and buses are battery electric vehicles (BEVs) by 2030. Considering the average lifespan of vehicles, if this transition were to follow the natural replacement cycle, it would potentially require all new vehicles in Leicester to be BEVs starting almost immediately. There are no clear policy levers for LCC to make this happen – and, given that EVs are still more expensive than traditionally fuelled vehicles, it would require considerable financial incentives. LCC would also need to be able to guarantee that adequate charging infrastructure is in place to support the shift.

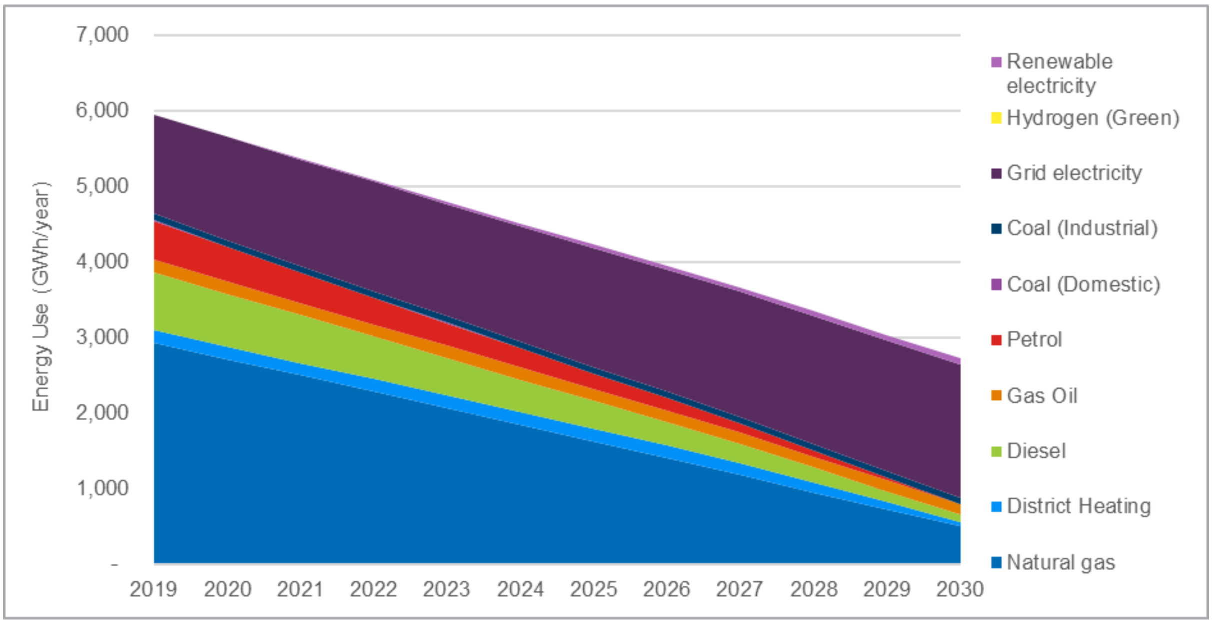
The challenge in reaching net zero even in this highly ambitious scenario is illustrated below. By 2030, as shown in Figure **56**, almost all energy use is either grid electricity or local renewable electricity (currently modelled as roof-mounted PV), and the former accounts for nearly all residual emissions, as shown in Figure 57. In other words, once all of the demand reduction and fuel/technological measures are adopted, the gap to net zero is almost entirely determined by the level of grid decarbonisation that is achieved by 2030.

Figure 56**. Emissions by fuel in Scenario 3**



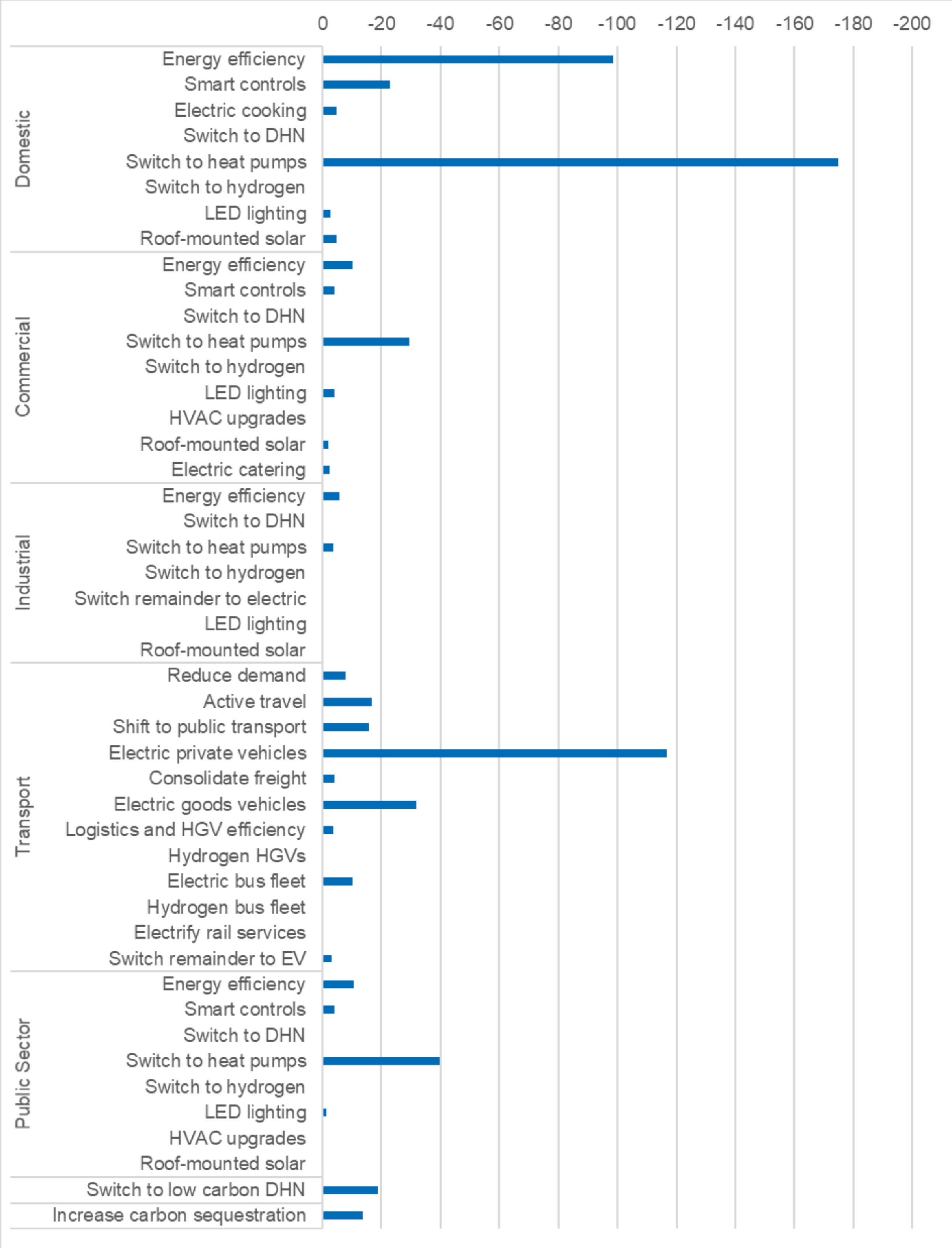
[41] Mode shifting refers to journeys that shift from one mode of transport to another, e.g. from private cars to cycling. This is distinct from fuel switching, which refers to switching from one source of fuel to another, e.g. from a petrol car to an EV.

Figure 57. Energy use by fuel in Scenario 3



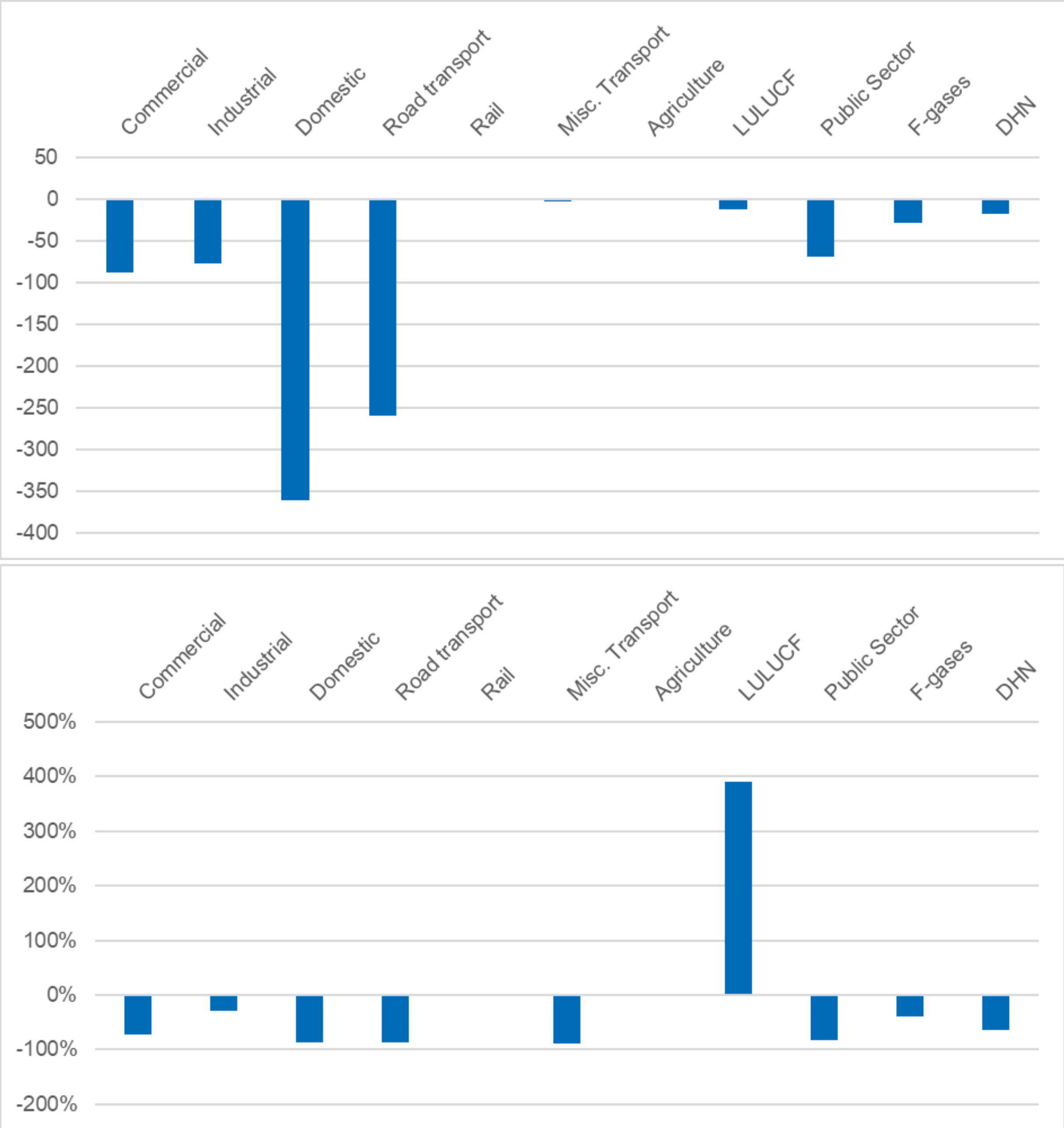
The chart below shows the estimated impact that each mitigation measure has on GHG emissions by 2030. Similar to previous scenarios, this shows that the biggest impacts come from demand reduction in the domestic stock and transport, and fuel switching.

Figure 58. Impact of mitigation measures in Scenario 3 ($ktCO_2e$)



Below, Figure 59 shows the absolute and relative change in emissions by sector, by 2030.

Figure 59. Change in emissions by sector in Scenario 3. (Top: Absolute change, $ktCO_2e$. Bottom: Relative change, %)



Notes:

- The assumed changes in the LULUCF sector are based on maximising all potential opportunities within Leicester, as per a previous study on carbon sequestration. However, this is not considered feasible in reality. This is partly due the level of new development that is planned for the area, and partly because it would require all available land area to be managed to maximise carbon sequestration, whereas in practice, there are other competing requirements. Nature-based solutions such as woodland creation also take time to establish and sequester carbon and it is also not clear whether this could be achieved between now and 2030 – in other words, the trees would simply not grow fast enough. The measure has been modelled mostly to assess the maximum theoretical impact it could have – and this is shown to be small. Therefore, it is not considered a major part of Leicester's route to net zero

– although there are numerous other benefits associated with sustainable land management practices which support their adoption.

- These results show high GHG reductions in the non-domestic building sectors compared with other scenarios. However, in the industrial sector, this assumes that 100% of remaining energy uses are converted to electricity or green hydrogen. This has been included as an illustrative measure, to show how even if this was possible, it does not achieve net zero due to the national grid.
- Because rail electrification is very much outside of the control of organisations based in Leicester, it has not been modelled as part of Scenario 3. Even if the railway line was electrified in that timescale, it would not be possible to ensure that all railway services entering or passing through Leicester are 100% electric by 2030. Even if the railway was fully electric, it would not have a large impact on GHG emissions as rail represents a small portion of total emissions.
- Scenario 3 assumes no change in emissions from agriculture or f-gases aside from the declines that are already included in the BAU assumptions.
    - In the case of agriculture, this is because energy use in agricultural buildings (e.g. electricity and natural gas) is impossible to disaggregate from the other industrial and commercial sectors, and the majority of emissions are non-CO_2 gases from the use of fertiliser, livestock, and so on. Agriculture makes very little difference as it accounts for a small portion of total emissions.
    - The BEIS EEP assumes a decline in emissions from f-gases, partly on the basis that there will be greater use of low-GWP refrigerants. However, the EEP model does not account for a large-scale shift to heat pumps or a potential increase in the use of air conditioners due to more frequent hot weather. Therefore, it may be overly optimistic. This underlines the importance of minimising the demand for refrigeration and cooling where possible, using low-GWP refrigerants, and (in the case of larger systems such as would be needed to supply heat networks) refrigerant leakage prevention and alarm systems.

For context:

Offsetting the residual 268 ktCO_2e via tree planting would require roughly 8 km^2 of land area to be turned into new woodland, which is equivalent to around 10% of the land area of Leicester.

Given that this would only offset one year's worth of emissions (and that it would take over a decade for the woodland to reach maturity), an offsetting strategy based on woodland creation would still be extremely challenging, even though the requirement is much lower than in Scenarios 1 and 2.

Meeting 100% of the 2030 electricity demands would require *approximately*:

- 2,110 MW of PV (occupying c. 26 square kilometres); or
- 860 MW of onshore wind power (c. 430 large-scale turbines).

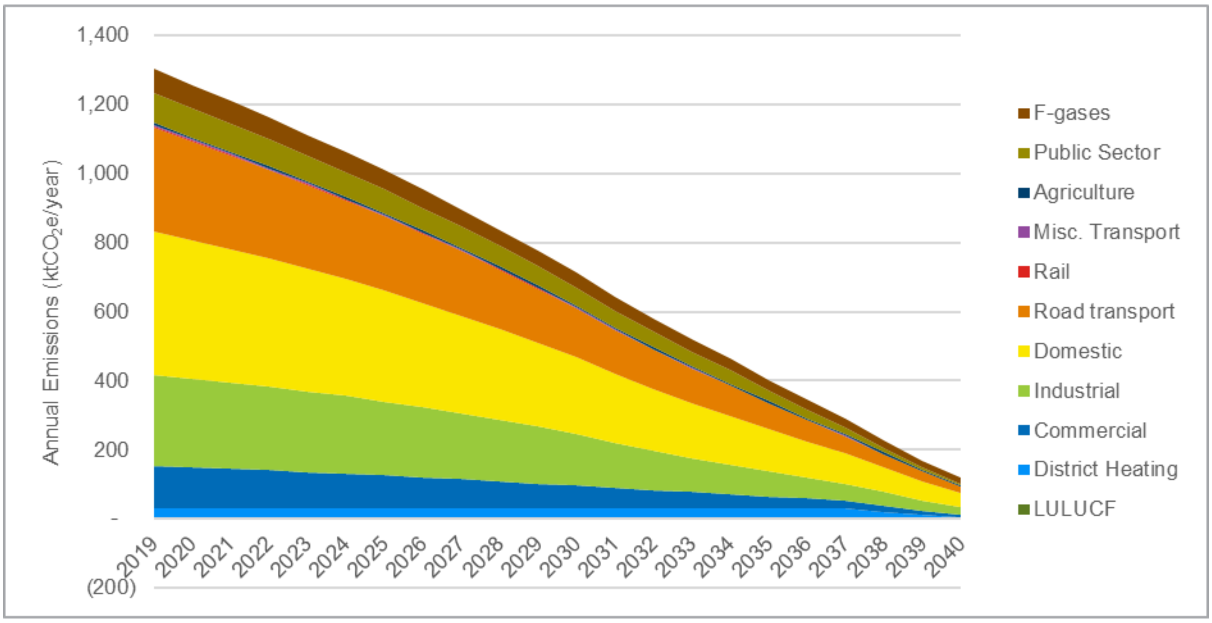
The overarching message in Scenario 3 is that even if almost all systems switched towards electricity, the constraint on reaching net zero by 2030 will primarily be due to emissions from the national electricity grid. (If the electricity grid was net zero by 2030, emissions in this scenario would decrease by 83% instead of 71%.) In that sense, Scenario 3 can be thought of as a 'net zero ready' scenario.

The remaining emissions are then dealt with by, over time, meeting 100% of electricity demands with renewables via the electricity grid, and looking towards other technological changes, carbon capture, offsetting, and so on to address the small amount of non-electricity GHG emissions.[42]

Scenario 4

The level of ambition for different intervention measures in Scenario 4 is generally similar to Scenario 2, but the impact of fuel switching is greater because of the additional electricity grid decarbonisation. The other main difference is the inclusion of some green hydrogen for space heating, hot water, HGVs and other industrial fossil fuel use. This scenario also assumes that c. 5% of public sector heat demand and 5% of domestic heat demand is met via an expanded district energy network, which also switches to electric heat pumps in the late 2030s.[43] Compared with Scenario 3, total energy use is higher due to the lower levels of demand reduction. This scenario results in residual emissions of 118 $ktCO_2e$ per year by 2030, which is a 91% decrease compared with 2019.

Figure 60. Emissions by sector in Scenario 4



In most instances, the level of ambition for energy demand and GHG reduction measures is the same in Scenario 4 as for Scenario 2; that is to say, it is based on the maximum level of ambition in the CCC scenarios and brings those changes forward to 2040. From a practical standpoint, however, Scenario 4 is likely to be more achievable overall, due to the longer timescales for implementation. This consideration needs to be weighed against the fact that the cumulative emissions until 2040 are 16,000 $ktCO_2e$, which is nearly twice as much as the Paris-compliant carbon budget through to the year 2100 (8.5 $MtCO_2e$).

The other major difference between this scenario and the others is that, by 2040, hydrogen would account for 5-10% of energy use. It is assumed to be green hydrogen, i.e. made by electrolysis using

[42] These would primarily comprise f-gases, HGVs, and various other sector-specific energy uses (i.e. energy uses other than space heating, hot water, lighting, ventilation and cooking/catering).

[43] It is understood that the heat network would likely only expand to include large public sector anchor loads although in principle it could supply denser residential developments nearby. In the absence of more detailed information 5% has been used as an indicative figure.

renewable electricity, and is therefore modelled as having zero GHG emissions. However, the actual emissions from hydrogen will depend on how it is produced. If it is produced using natural gas, emissions would be much higher than if it is produced using renewable electricity. Another possibility is that a UK hydrogen market would develop based on a mixture of technologies, so it would be produced using some combination of natural gas and electricity, which would again mean that emissions are non-zero. Therefore, assumptions about how the hydrogen is produced are an important sensitivity in the model. The possible supply of some hydrogen produced from natural gas *without* CCS would be a key risk for Leicester if pursuing a strategy that relies on hydrogen.

Figure 61 shows the changes in emissions by fuel type between 2019 and 2030, and Figure 62 shows the underlying changes in energy use. 'Renewable electricity' in this instance refers to roof-mounted PV located within Leicester.

Figure 61. Emissions by fuel in Scenario 4

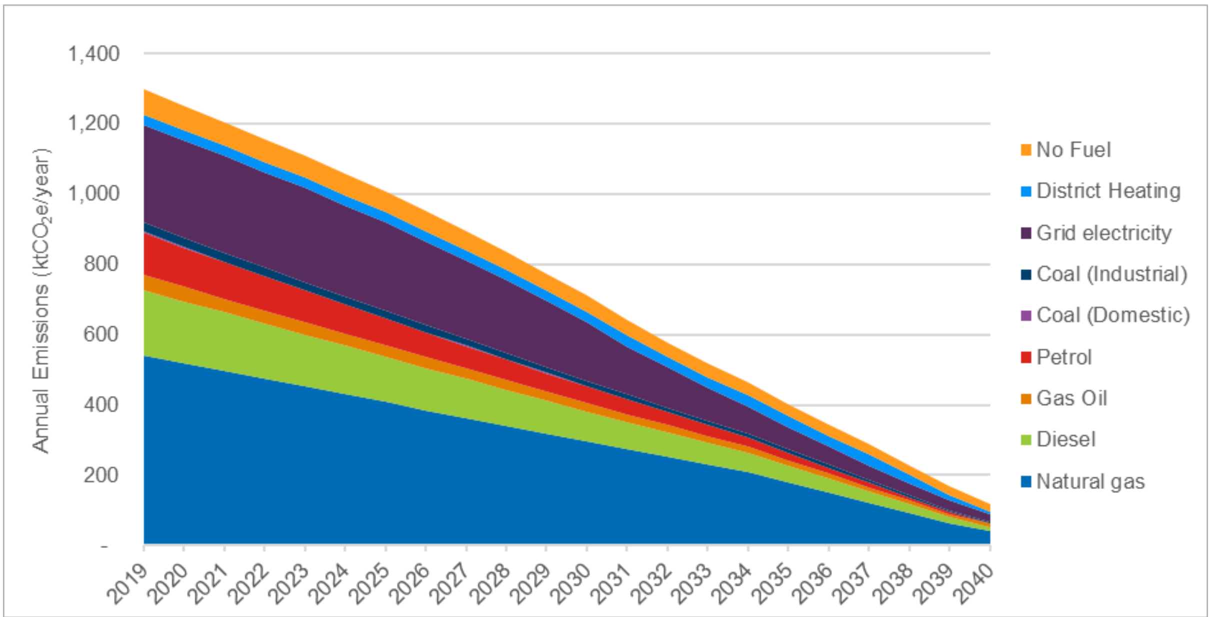
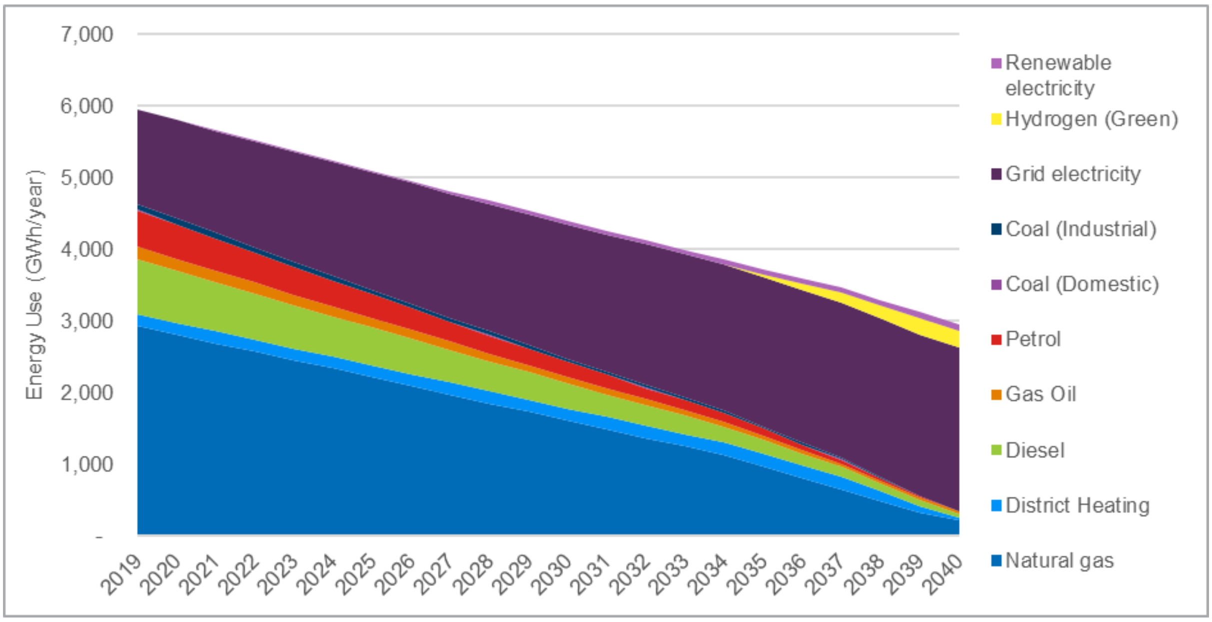


Figure 62. Energy use by fuel in Scenario 4



The same considerations related to the importance of demand reduction, and the sensitivity to electricity grid decarbonisation, apply to Scenario 4 as for the other scenarios that have been described previously.

Figure 63 shows the estimated impact that each mitigation measure has on GHG emissions by 2030.

Figure 63. Impact of mitigation measures in Scenario 4 ($ktCO_2e$)

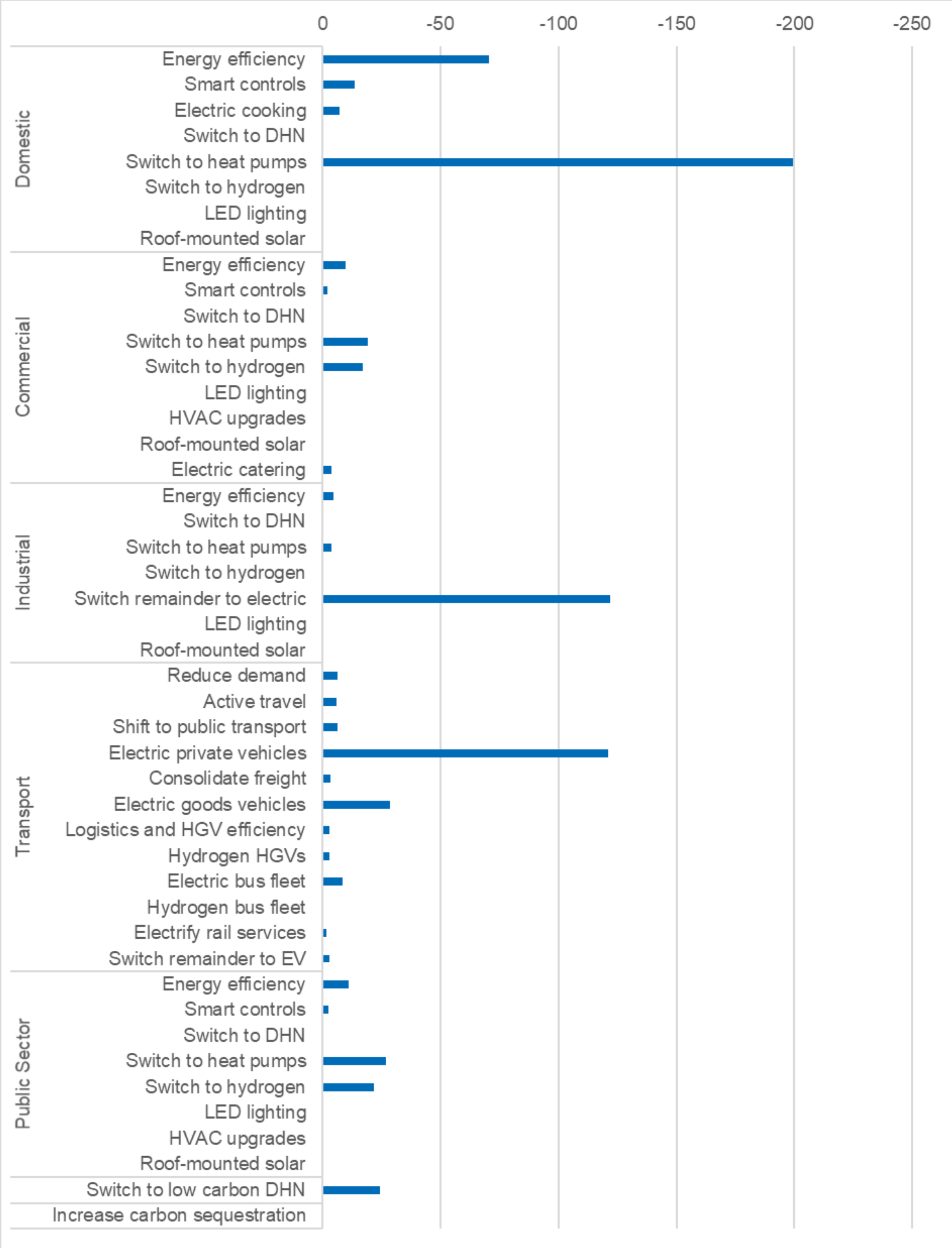
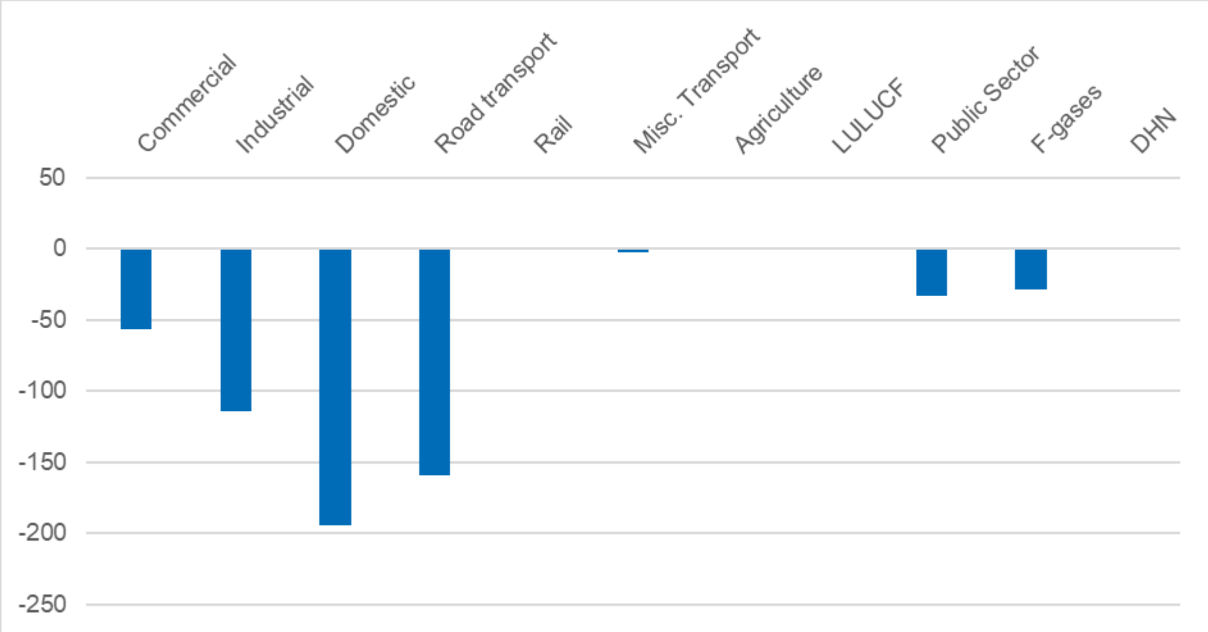
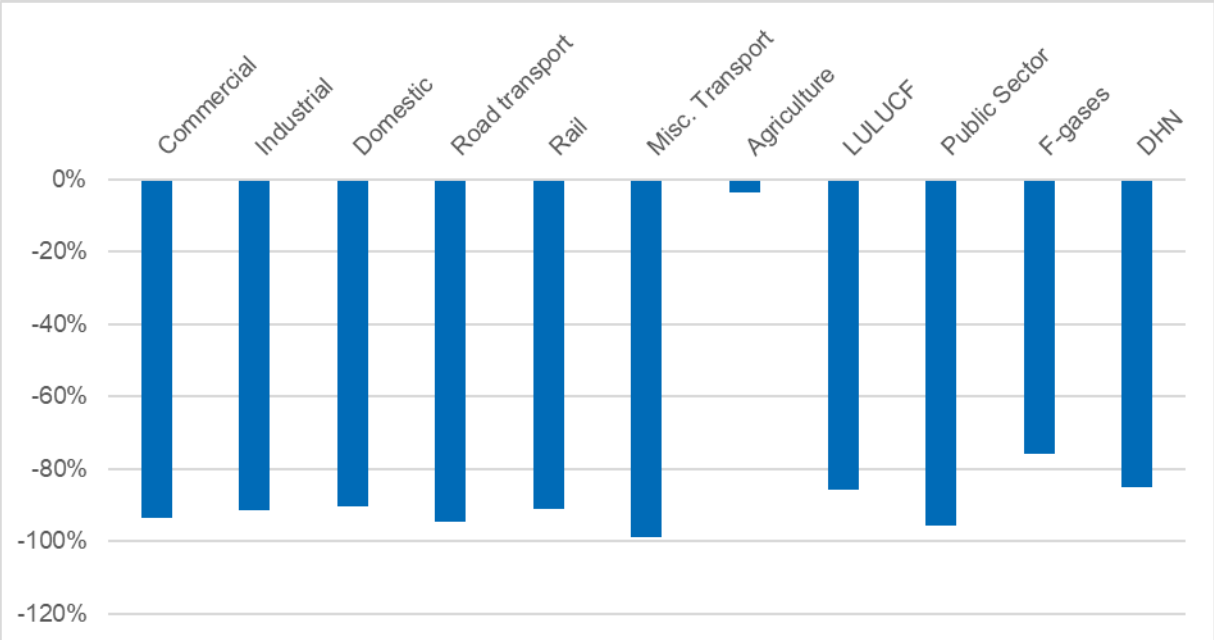


Figure 64 shows the absolute and relative change in emissions by sector, by 2030. Most sectors in Scenario 4 see emissions reduce by 80-95%. The exceptions are agriculture (for the reasons described previously, mitigation measures have not been modelled) and LULUCF, which only sees small improvements.

Figure 64. Change in emissions by sector in Scenario 4. ***(Top: Absolute change, ktCO₂e. Bottom: Relative change, %)***





For context:

Offsetting this much residual CO_2 via tree planting would require roughly 3 km^2 of land area to be turned into new woodland, which is equivalent to roughly 5% of Leicester's land area. If that woodland was correctly maintained over the course of decades and centuries, this would be enough to offset the annual emissions in 2030 – to be clear, just that one year's worth of emissions.

Looking at the challenge another way, if all of the electricity demand in Scenario 4 was to be met with 100% renewable electricity, this would require *approximately*:

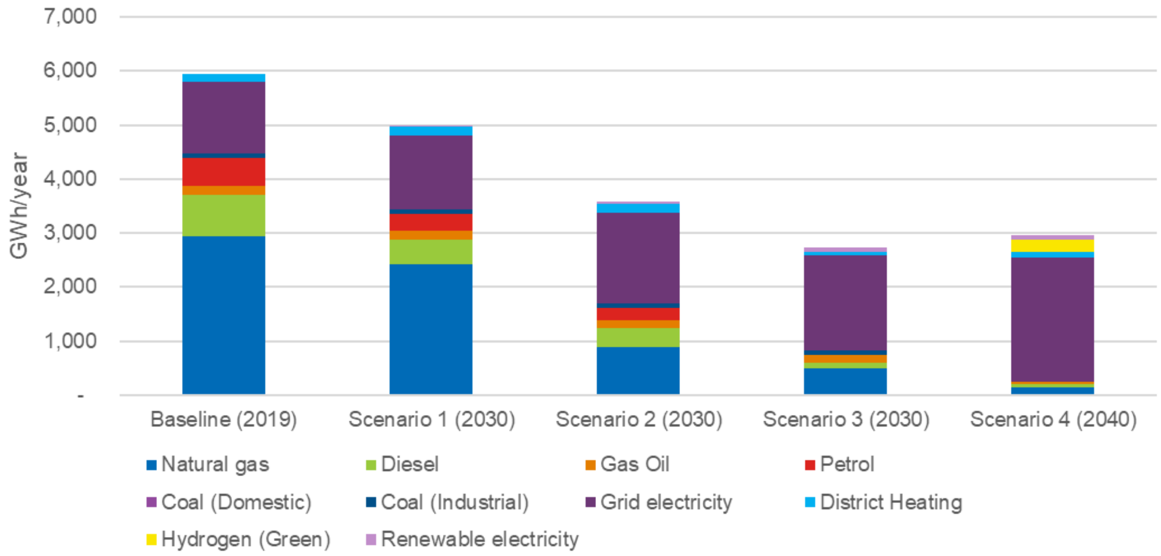
- 2,130 MW of PV (occupying c. 27 square kilometres); or

- 860 MW of onshore wind power (c. 430 large-scale turbines).

Changes in fuel consumption

Figure 65 below shows the levels of fuel consumption in the BAU and the four decarbonisation scenarios. It shows that in Scenario 3, the bulk of fuel consumption is from grid electricity, so this therefore is the biggest constraint in achieving carbon neutrality by 2030. Other fuel consumption, notably natural gas, are reduced significantly.

Figure 65. Fuel consumption in different carbon neutrality scenarios



Strategic decisions: Demand reduction vs. reliance on technological change

The following charts illustrate the implications of a strategic route to net zero that relies more heavily on demand reduction compared with one that places greater emphasis on technological solutions.

First, Figure 66 shows the impact of different mitigation measures in Scenario 3 as a waterfall chart, so their respective impact on GHG emissions can be clearly seen. In this chart, the most significant measures are demand reduction (energy efficiency in buildings and modal shift in transport), and electrification of both heating and transport. Figure 67, meanwhile, considers the impact of retrofitting the domestic building stock to a radically better standard. Perhaps counterintuitively, it shows that the overall level of decarbonisation achieved is roughly the same. That is because heat pumps are so much more efficient than gas boilers, and when they are supplied with renewable or decarbonised grid electricity, any remaining emissions will be very small. So, given the difficulty of retrofitting the building stock, does this mean that Leicester's residents can instead rely on technological solutions to reduce their space heating emissions?

Figure 66. Scenario 3, assuming 30% reduction in domestic space heating demand

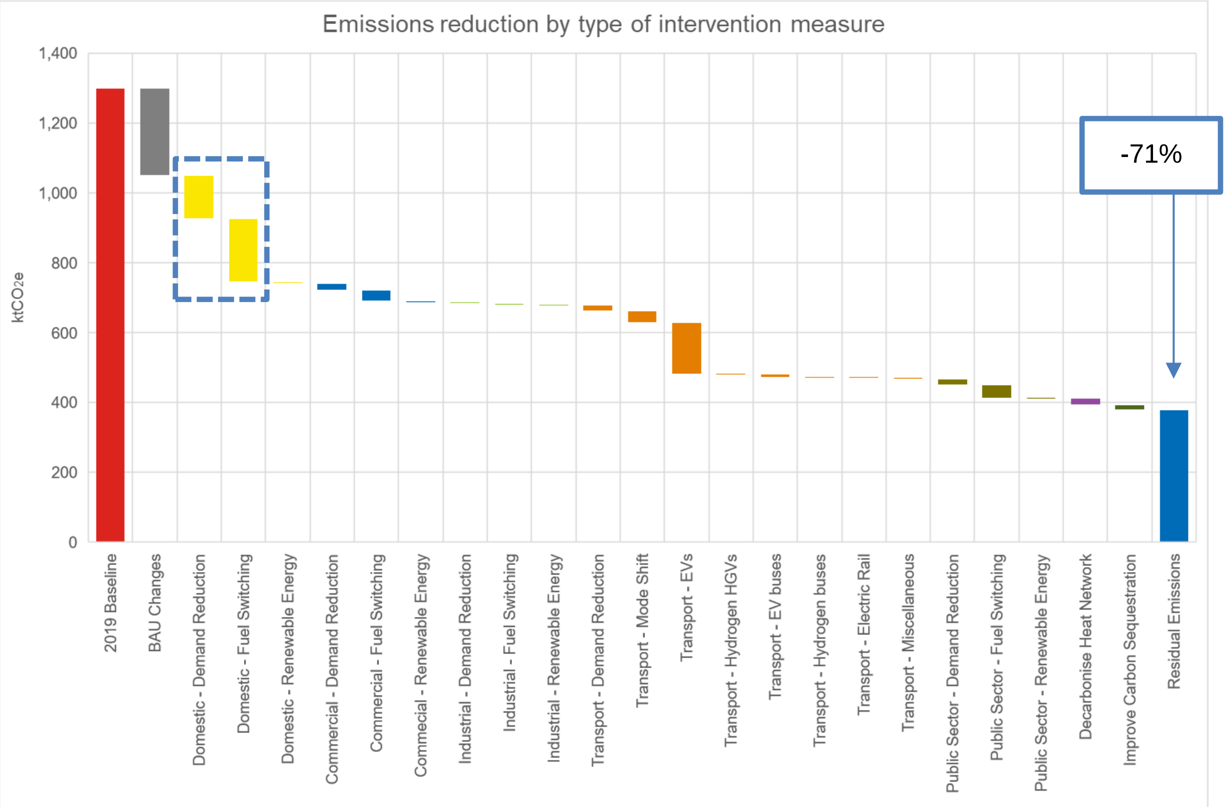
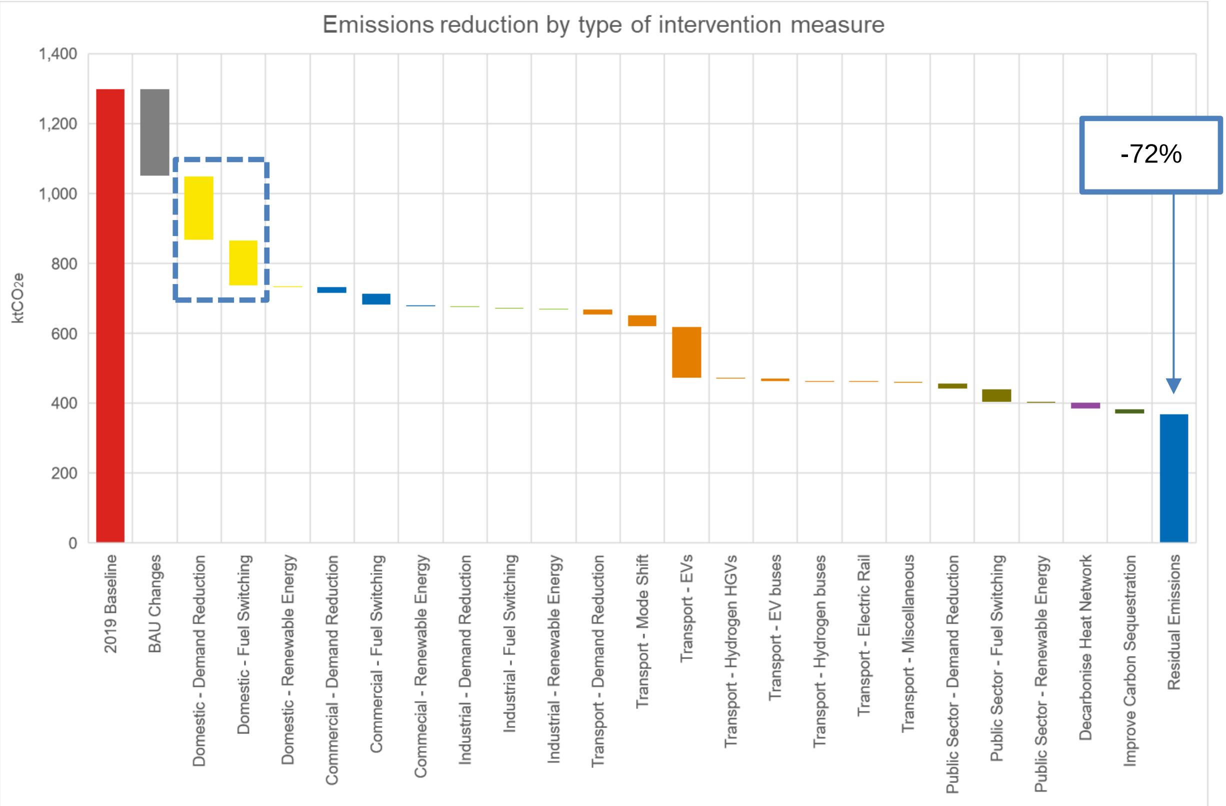
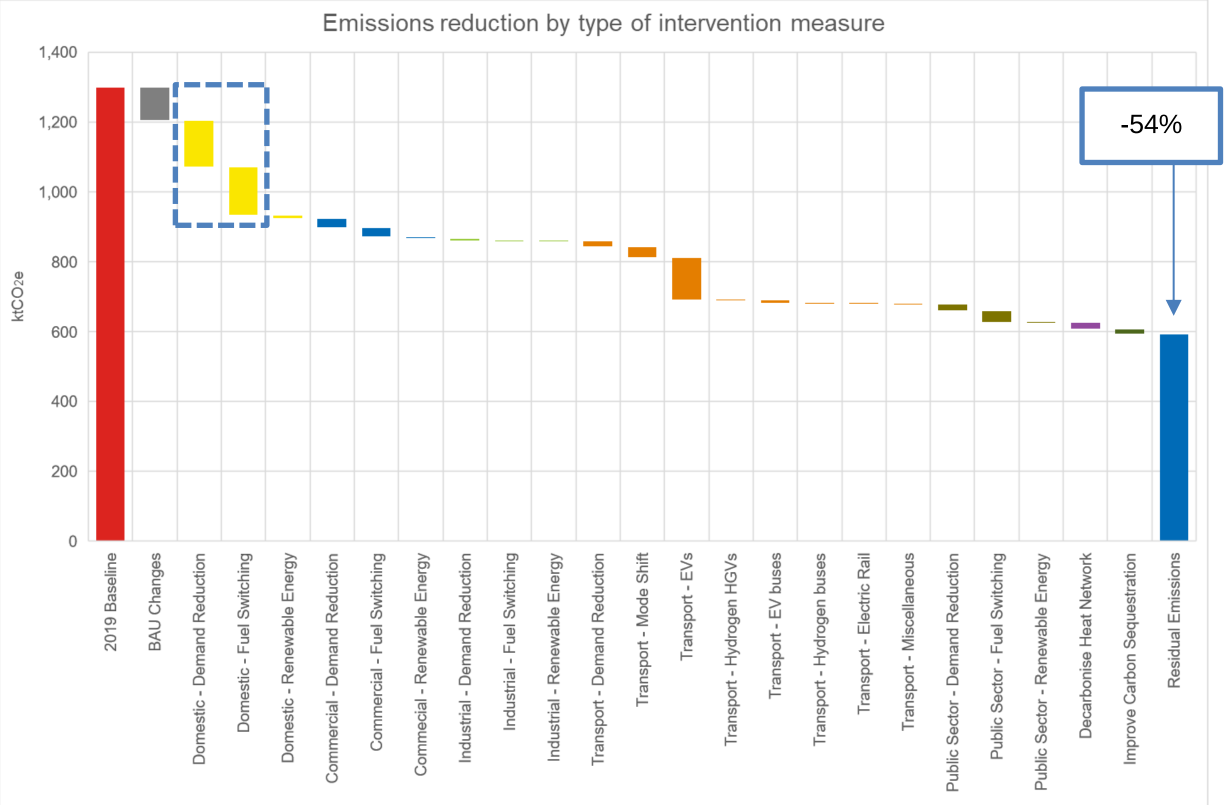


Figure 67. Scenario 3, assuming 50% reduction in domestic space heating demand



There are two very important reasons why demand reduction should still be a priority. The first is that grid decarbonisation is not guaranteed to occur at the necessary pace. A strategy that relies on technological solutions is inherently riskier – it involves more factors that are completely outside the influence of LCC, households, businesses and other stakeholders within Leicester. This is highlighted in Figure 68, which shows the same assumptions about demand reduction as in Figure 66, but without electricity grid decarbonisation. Whereas both of the previous graphs achieved a c. 71-72% reduction in emissions by 2030, this one only achieves a 54% reduction.

Figure 68. Scenario 3, assuming 30% reduction in space heating demand but no grid decarbonisation



The second reason is that, although there are different routes to reducing Leicester's own area-wide emissions, these calculations do not account for the wider resource implications, such as the need for more heat pumps, more batteries, more renewable energy and other materials. These all rely on finite resources, often coming from supply chains that do not promote the needs of workers and local communities, and have the potential to create waste at the end of the product lifecycle.

Similar issues apply to transport (in terms of EV uptake) as well as buildings. For these reasons, the pathways modelling presented in this report does not suggest that there is a certain minimum threshold for demand reduction that *must* be achieved. What it does highlight are the different levels of risk, along with other practical considerations, e.g. trade-offs in terms of who shoulders the cost burden and who the key players are in each of these scenarios. However, prioritising demand reduction should clearly be the preferred option in order to meet the target from a climate change mitigation standpoint, both for Leicester and more broadly.

3.4.3 Risks, opportunities, and uncertainties

This section describes some of the uncertainties, risks and opportunities highlighted by the net zero pathways analysis, considered as a whole.

Many of the same points apply as for the BAU scenario so the two sections should be read in conjunction; refer to Section 3.3.3 for details.

Uncertainties in the modelling	
What are they?	**What are the implications?**
The amount of evidence that is available to support assumptions about mitigation measures varies significantly. In many cases, estimates of the scale of GHG reduction that can be achieved draws from evidence relating to similar, but different, interventions. Sometimes this evidence is based on substantial, real-world datasets (e.g. the difference in heating bills when retrofitting domestic properties as measured by changes in metered energy bills) whereas sometimes it draws on case studies, (e.g. improvements in HGV efficiency due to driver training) or theoretical assumptions (e.g. switching to more efficient solar panels). Particularly for Scenario 3, some of the changes are based on policy 'ambitions' that are not backed up by specific measures (e.g. 50% of journeys in cities being made by active travel by 2030).	There are different levels of uncertainty associated with the modelled scale of impact of different mitigation measures, and across scenarios. There is also some risk of double counting the benefits of intervention measures, although expert opinion has been sought to avoid this wherever possible. An example would be when trying to establish the scope for demand reduction in car journeys. Some figures indicate the proportion that could switch to public transport, and the proportion that could be avoided entirely through behaviour change, but it is not always straightforward to establish whether these measures should be applied together or sequentially. As a general principle (and unfortunately), where we have made assumptions about the potential scale of GHG reductions, the lower/more modest/conservative assumptions are likely to be more realistic and achievable.
Different intervention measures are likely to have dynamic effects that are not accounted for in the model. There is also the potential that some could result in 'leakage', which is when a GHG reduction measure in one location results in an unintentional increase in emissions elsewhere. An example would be if businesses in Leicester are required to meet higher standards of energy and GHG performance, and consumers choose to purchase goods from places with fewer restrictions, even if these result in higher emissions.	Any mitigation measures that are adopted need to consider the potential for dynamic effects and unintended consequences as much as possible – recognising that these are major unknowns.
There is a trade-off between modelling scenarios that get closer to achieving Paris-compliant emissions reductions, and modelling	A significant part of LCC's net zero roadmap will need to rely on other stakeholders and, in particular, seeking Government support and funding. There is likely to be a gap between the

ones that are plausible given the political, social, and financial realities involved.	GHG reductions that Leicester can achieve via direct action/policy intervention, and the overall level of ambition, based on their current levers of influence.

Risks to achieving net zero	
What are they?	**What are the implications?**
The feasibility of reaching net zero, particularly where this requires fuel switching, depends on high levels of demand reduction which will be challenging to achieve.	LCC will need to make demand reduction a high priority. However, at the same time, it is important to make contingency plans (e.g. working with DNOs on infrastructure upgrades) to mitigate against the possibility that those measures do not deliver the scale of reduction needed.
As stated previously, assuming the intervention measures are adopted, the major obstacle to reaching net zero would be inadequate electricity grid decarbonisation.	Key options for addressing this include: • Maximising local renewable energy uptake • Working with stakeholders / lobby Government to support changes in the energy system that will accelerate grid decarbonisation • Potentially planning to focus on measures that make Leicester 'net zero ready', i.e. high electrification
Certain sectors and activities are more challenging to address, either because it is difficult to identify suitable measures (due to lack of data) or because of technical/practical challenges (e.g. lack of viable technological alternatives). These include non-CO_2 gases and energy uses in the industrial and commercial sectors.	If any offsetting measures are adopted, they should address the sources of emissions that are hardest to mitigate otherwise. As shown in the previous sections, due to the scale of offsetting that would be required, it will not be possible to rely on carbon offsetting for sectors or activities where alternatives exist. In some cases, technologies may become available in the future that can address these sources of emissions. LCC will need to keep abreast of developments in this area. Key examples include carbon capture and removal technologies and hydrogen gas.
There is the potential for a social and/or political backlash against many of the mitigation measures, which would have a major impact on spending and lifestyles. There is also a high risk that some of the intervention measures will place a disproportionate burden on vulnerable members of society, fuel poverty being one example. This is particularly important to consider in the context of the local and national response to the COVID-19 pandemic. (See also the previous point about 'leakage'.)	This should be a consideration up front when developing policies, but the potential response also needs to be considered on an ongoing basis as part of monitoring programmes.

Opportunities	
What are they?	**What are the implications?**
District heating, as Leicester already has a well-established network, and some clearly identified anchor loads.	An early decision will be needed on the role that expanding the network, and switching to low carbon sources, should play in achieving carbon neutrality in Leicester – is it OK if emissions reductions will only fully be realised after 2030?
Due to the compact urban nature of the city, there is more scope than in more rural local authorities to fully maximise scope for transport demand reduction and modal shift.	According to the (Draft) Transport Plan, 100,000 residents live within a 10-minute cycle of the city centre. Additionally, the average car journey has a distance of 5km and 25% of car trips are shorter than 2km. This means that uptake of walking and cycling should face fewer hurdles. It is upon LCC and other relevant stakeholders (see section 4.1.2) to ensure that active travel can be done safely and in an enjoyable way.
A shift to active travel instead of a focus on EV uptake reduces the associated energy demand and thereby reduces the challenge of installing EV infrastructure.	LCC will still need to support the uptake of EVs and EV infrastructure. However, a focus on active travel and – to some extent – public transport significantly reduces this challenge due to the much lower energy demand. Additionally, active travel has a vast number of co-benefits as shown in Table 17.
Synergies between carbon neutrality measures and wider public benefits, such as health, cleaner air, improved road safety etc.	To fully realise these benefits, LCC needs to consider them prior to implementation (e.g., green spaces with both carbon sequestration targets and biodiversity co-benefits). In the transport sector, it also means increasing the focus on active travel, perhaps more so than overarching government policies. More detail on co-benefits is provided in 4.3.

Concluding points regarding the net zero pathways analysis

This analysis highlights that the path to zero is extremely narrow, but achievable – if LCC, the Government, individuals, businesses and other stakeholders work together to take immediate action. However, there is very little scope to pick and choose mitigation measures and no scope to accommodate increases in emissions. LCC will therefore need to exercise all available policy levers and other areas of influence. While this is clearly a huge challenge, the scientific consensus is clear on the urgency of reducing emissions, and the cost of failing to act. These considerations should drive actions across all sectors.

Subsequent sections of this report will provide further discussion of the practical considerations, including LCC's level of influence over each of these factors. They will also set out the co-benefits of the measures that are being proposed and, where possible, quantify what these might be, to illustrate the broader reasons for pursuing net zero emissions.

4 Delivering Carbon Neutrality

This section looks at what needs to happen to deliver the level and pace of change outlined in Section 3 above. It considers who the key stakeholders are and what actions they might take and, in particular, what LCC's role will need to be. This is followed by a high-level discussion of the potential costs and wider co-benefits of action.

4.1 Influence mapping

As shown in Section 3.3, in the Business-as-Usual (BAU) scenario, by 2050 there would be a significant 'gap' to net zero emissions. Bridging the gap will require urgent action to be taken in all sectors, across all policy areas. This can only be achieved through close collaboration among national, regional, and local governments, public, private, and voluntary sector organisations, communities, individuals, businesses, researchers, and innovators.

Typically, UK Local Authorities are only directly responsible for a small proportion of GHG emissions. In Leicester, public sector emissions account for roughly 7% of the total (see Section 2.2), which is somewhat higher than the national average.[44] While this figure may still appear small, the opportunity for reaching net zero within the Council should not be disregarded – both because it has significant direct effects (emissions reduction) and because these efforts can exert influence over other sectors through leading by example.

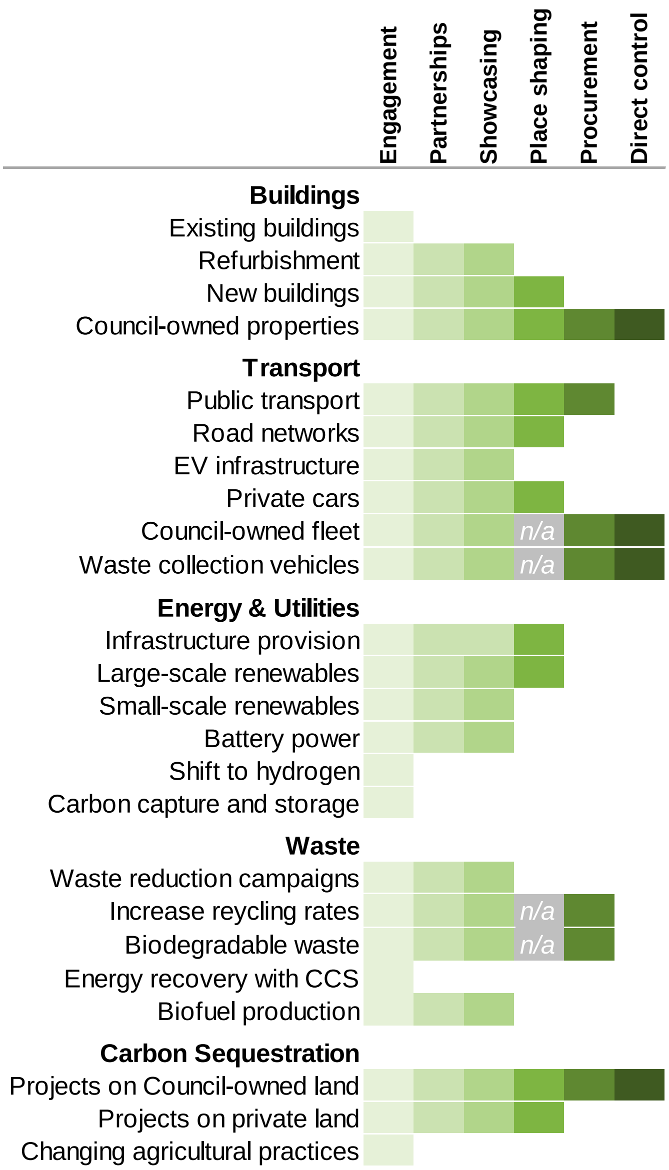
There is usually an inverse relationship between the level of control they exert and the scale of emissions reduction that they can achieve. However, Local Authorities have a wide range of options for exerting indirect influence over emissions that they do not directly control, as shown in Figure 69.

Figure 69. Ways in which local authorities can influence GHG emissions across the area. Adapted from CCC, '*Local Authorities and the Sixth Carbon Budget' (*2020)

[44] This figure includes all public sector buildings and facilities i.e. not just LCC. The Council's 2019/2020 emissions have previously been reported as c. 20 $ktCO_2e$, which is closer to 1-2% of the total.

Figure 70 below summarises how Leicester City Council can influence decarbonisation across key policy areas. The colour coding is used to indicate the ways that LCC can play a role. Indirect methods of influence are shown in lighter green and direct methods in darker green. Grey shading with 'n/a' means that a method is not applicable or not likely to be used.

Figure 70. LCC influence over emissions in different sectors



As highlighted in the figure, the Council has the most control over its own properties and vehicle fleet, although it is understood that not all of these are both owned and operated by LCC.

LCC also has an influential role in its capacity as a Local Planning Authority (LPA), setting planning policy and determining the spatial strategy for the City. This is primarily relevant to energy and sustainability standards for new developments, but development management policies can also affect the rate of retrofitting and uptake of small-scale renewables across the City. There is also an impact in terms of the design of the public realm and spatial strategy impacting the way that people travel, and goods are transported, around the City. Overall, however, much of the Council's influence will be more reliant on engagement with stakeholders to promote carbon reduction projects, showcasing best practice, raising awareness, partnerships and lobbying for change. It is also important to note that local planning policies are required to meet a viability test, which places a significant limitation on what requirements can be put in place.

The following sections of this report provide more detail on each of the policy topic areas, describing the types of changes that need to occur to reach net zero, key policy drivers, major challenges, and important stakeholders. This will be used to inform the development of future carbon pathways for LCC and a feasibility assessment of reaching net zero.

Each section begins by summarising some of the major changes that need to happen to reach net zero, along with an overview of relevant national, regional, and local policy documents or strategies. Then, consideration is given to the key challenges, who are the key players, and finally, where the biggest opportunities are for LCC to play a role.

4.1.1 Buildings

What needs to happen to reach net zero?

- Energy demand in all buildings needs to decrease significantly – including both new and existing buildings. This will require much higher levels of insulation and airtightness and more efficient building services (e.g. heating, ventilation, hot water and cooling), along with smart controls and energy management systems. It is also likely to require changes in user behaviour.
- All buildings will need to be capable of operating with 100% renewable energy, which will involve replacing all heating systems and other building services that rely on fossil fuels. Until and unless hydrogen gas is commercialised, it is likely that heat pumps and district heating will be the main options for heat decarbonisation. Uptake of small-scale renewables and battery storage will also need to be radically scaled up.
- The construction industry as a whole, which is currently responsible for around 60% of waste produced in the UK, will need to adapt to new methods of design and construction that prioritise refurbishment, design for disassembly, and contribute towards a circular economy.

Table 4. Relevant policies and strategies in the buildings sector

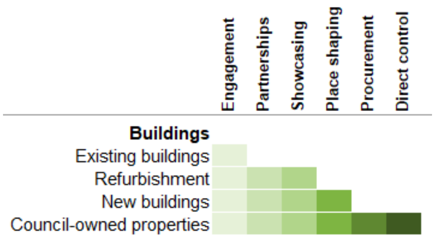
National	Regional	Local
UK Building Regulations (which will be revised in the coming years in line with the proposed Future Homes and Future Buildings Standards) Net Zero Strategy & Heat and Buildings Strategy: • Reach 600,000 heat pump installations per annum by 2028 • No new gas boilers sold by 2035 • Upgrade all rented properties to EPC Band C by 2028 and all homes to EPC Band C by 2035	N/a	Leicester Climate Emergency Strategy 2020-2023: • Promote the Green Homes Grants (Local Authority Delivery) • Warmer Homes, Green Homes Scheme • Continue to enforce national energy efficiency standards City of Leicester Local Plan – Draft for Consultation (March 2020) • All development must demonstrate how it will minimise energy demand and carbon emissions based on the energy hierarchy (Policy CCFR01) • In line with the energy hierarchy, where feasible, deploy low carbon heat networks such as district heating Leicester City Core Strategy (adopted 2014)

Key challenges and the relevant major players are shown in Table 5.

Table 5. Key challenges and major players in the buildings sector.

Key challenges include…	Major players
Reducing energy demand in the existing building stock	Owner-occupiers, landlords and (to a lesser extent) building tenants have the greatest ability to influence energy demand. The Government has introduced the Minimum Energy Efficiency Standards (MEES) to encourage uptake of energy efficiency measures in the private rented stock and Local Authorities are responsible for enforcement. The Government recently announced that it will provide £4.3 million to councils in an effort to clamp down on landlords not complying with energy efficiency regulations.
Decarbonising heat and switching away from natural gas and other fossil fuels	As with demand reduction, owner-occupiers, landlords and (to a lesser extent) building tenants have the greatest ability to influence the choice of heating systems. BEIS is responsible for setting energy policy at a national level. National, regional, and local governments can play a role by offering financial incentives to switch heating systems such as the Renewable Heat Incentive. For more information on energy, see Section 4.1.3.
Ensuring that new buildings are compatible with a net zero future	MCHLG is responsible for UK Building Regulations on energy and carbon emissions, and Local Authorities are responsible for certain aspects of enforcement. Most of the direct enforcement is done through private sector inspection companies that are regulated by Local Authorities. LPAs can currently set higher performance standards subject to viability considerations, but this may change in the future. Developers are also major players, and many have voluntarily adopted higher sustainability standards for their projects.
Adopting Circular Economy principles across the entire construction industry	County Councils and Unitary Authorities are responsible for waste management, but in practice there are few levers to achieve this type of fundamental shift in construction practice. LPAs can play a role through planning policy but most of the influence lies with industry bodies, developers, construction companies, manufacturers, and designers.

What areas can LCC influence the most?



- LCC's main area of influence will be in the Council-owned housing stock and other non-domestic properties. The Council will need to primarily rely on engagement and partnerships to reduce emissions in the rest of the building stock, e.g., continuing to provide energy saving advice. Local Authorities can enforce MEES regulations, although to date very few have done so due to lack of resources, local opposition, and other issues. This may improve in the near future as a result of additional funding.
- LCC has more influence over new buildings and major refurbishments via the Local Plan and building control, and direct influence over council-owned properties or developments.
- LCC can also play a coordinating role in helping to decarbonise and potentially expand the energy network, (e.g., feasibility studies and engaging with stakeholders), and developing a spatial strategy that facilitates the use of waste heat, where available.

4.1.2 Transport

What needs to happen to reach net zero?

- To reach net zero, all vehicles will need to utilise 100% renewable energy – whether that is renewable electricity, hydrogen, or biofuels. Based on current technologies, electric vehicles (EVs) are likely to be the first choice for cars, vans, and most other vehicles, with the exception of heavy goods vehicles (HGVs), which are more likely to run on biofuels or hydrogen.
- This transition will require a massive increase in the provision of EV charging facilities, along with much more renewable electricity generation. This will be much more achievable if there is a radical reduction in demand for travel, which includes changes in consumer habits and switching towards walking, cycling, car clubs/ridesharing, e-scooters (where appropriate) and public transport.

Table 6. Relevant policies and strategies in the transport sector.

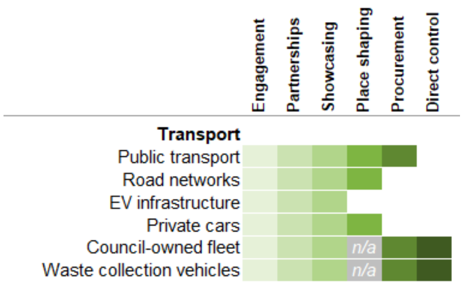
National	Regional	Local
The Transport Decarbonisation Plan • Ambition for half of journeys in towns/cities to be walking or cycling by 2030 • Delivery of 4,000 zero emission buses and associated infrastructure • Phase out diesel trains by 2040 and achieve a net zero rail network by 2050 • Increase average road vehicle occupancy • National e-scooter trials • Local Authority toolkit on sustainable transport expected to be released in 2022 • Ban sale of new petrol and diesel cars and vans by 2030, and all new cars and vans to be zero emission at tailpipe by 2035 • Consult on phase-out of internal combustion engine HGVs	'Leicester and Leicestershire Working Together - Strategic Transport Priorities 2020-2050' • Continue to promote rail as an alternative to private cars for travel between cities • Support commercial coach services to continue to deliver an alternative to rail for mid- and long-distance journeys. • Encourage active travel to and from stations	Leicester Transport Plan (Draft) 2021-2036: • Public transport, Park & Ride, cycling or personal e-mobility as the first choice for longer journeys for most people. • Active transport as the first choice for shorter journeys for most people. Leicester Climate Emergency Strategy 2020-2023: • Behavioural changes in businesses, schools, and through public campaigns • New bus lanes & services • 127 EV charging points planned for 2021/22 • 24km of new cycleway planned • E-bike hire scheme planned (500 bikes)

Key challenges and the relevant major players are shown in Table 7.

Table 7. Key challenges and major players in the transport sector.

Key challenges include…	Major players
Influencing consumers to choose low emission vehicles	National and local governments can play a role via awareness campaigns, but this is largely down to market forces. Analysis by organisations such as Cambridge Economics, Element Energy and Deloitte indicates that the price of traditional fuel vehicles and EVs will converge in the next few years. Local employers can also encourage faster uptake by the public if they bring ULEVs into their own fleets, as staff driving them will experience the technology first hand and become more comfortable with it.
Behaviour change and travel habits	As above, the role of local government may involve awareness campaigns and other initiatives – for example, LCC is already involved in a cycle training and e-bike hire scheme – but they can also have an influence by delivering towns and places that facilitate sustainable travel (see below).
Design of towns, cities, and roads to facilitate sustainable travel	Urban planning is within LCC's remit as an LPA, and the Council is also the Local Highways Authority for most of the roads in Leicester. Responsibility for the major road network lies with National Highways. DfT plays a strategic role in setting transport policy nationally while Local Transport Plans are produced by LCC.
Providing renewable electricity and other supporting infrastructure	LCC is likely to continue to be involved in the procurement of some EV charging infrastructure, but this will also be provided by businesses and home/landowners. For more information on energy, see section 4.1.3.

What areas can LCC influence the most?



- LCC will need to rely on showcasing, partnerships, and engagement to successfully encourage uptake of private EVs. This will include working with the County Council and National Highways to make sure that the road network prioritises pedestrians, cyclists, and public transport. The Council could also use parking policy or charges to incentivise uptake.
- Additionally, the Council needs to ensure that all new developments are located and designed to reduce demand for travel and encourage active/sustainable transport options, including via EV charging provision, and the Local Plan. This could involve, for example, setting maximum rather than minimum parking standards, and identifying sites for consolidation centres to reduce the number of commercial goods vehicles operating in town centres. This would have co-benefits for air quality, public health, etc.
- For assets directly controlled by LCC, the planned EV charging points (co-located with renewable power generation and battery storage) need to be rolled out and it needs to be ensured that the vehicle fleet is 100% low emission.
- It is understood that funding has already been granted to convert some buses to EV; LCC should continue to seek funding for the rest of the fleet to be EV by 2030. The 'Leicester Bus Services Improvement Plan' published in 2021 includes a target to do so.

4.1.3 Energy & Utilities

What needs to happen to reach net zero?

- A fundamental transformation of the UK energy system is needed to phase out fossil fuels by 2050 at the latest. In the Energy White Paper (2020) the Government envisions that electricity use could double in that timeframe, meaning that the deployment of renewable technologies – along with battery storage and improvements to grid infrastructure – will need to scale up at an unprecedented rate.
- The Government has announced an ambition to deliver 40GW of offshore wind power by 2030, potentially enough to power all homes in the UK. However, to ensure security of supply, it will be important to work towards a diverse system that includes large- and small-scale solar, wind, tidal power, hydropower, and bioenergy, among other technologies. This will require a shift in thinking such that there is a presumption in favour of renewable energy projects of all scales.

Table 8. Relevant policies and strategies in the energy sector.

National	Regional	Local
'Net Zero Strategy: Build Back Better' HM Government (2021) • Fully decarbonise the power system by 2035 • Increase offshore wind from 10GW (2019 levels) to 40GW by 2030 • Support renewables with nuclear power including small modular reactors	Energy Infrastructure Strategy for Leicester and Leicestershire (2018) • 100% clean energy by 2050	Leicester Climate Emergency Strategy 2020-2023: • Rapidly increase renewable energy generation in the city and encourage storage of surplus to help meet demand at peak times. • Carry out a feasibility study, secure funding and develop a programme to install solar PV panels on council housing.

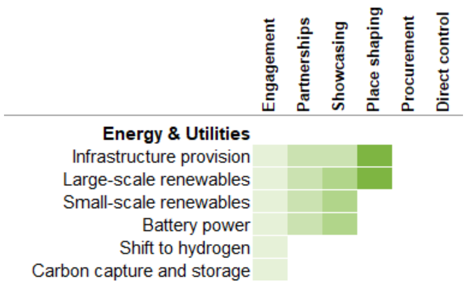
Key challenges and the relevant major players are shown in Table 9.

Table 9. Key challenges and major players in the energy sector.

Key challenges include…	Major players
Reducing costs and financial barriers to enable further uptake	At a national level, Ofgem regulates gas and electricity markets and funds certain types of energy infrastructure projects. It also manages financial incentive schemes such as the Renewables Obligation, Renewable Heat Incentive, and the Smart Export Guarantee. BEIS provides funding for emissions reduction projects (SALIX), heat network feasibility studies (via the Heat Network Deployment Unit), and other research.
Upgrading existing grid infrastructure	National Grid is in charge of transmission of both electricity and gas. The distribution network operator (DNO) for electricity in Leicester and surrounding areas is Western Power Distribution, while the DNO for gas is Cadent.

Identifying and allocating areas for large-scale renewable energy projects	There are very limited opportunities to deliver large scale renewable energy projects within Leicester itself. In general, Local Authorities play a role by identifying suitable areas for renewable energy projects and setting planning requirements. Other key players include community energy groups, along with organisations and businesses that deliver renewable energy projects.

What areas can LCC influence the most?



- LCC has relatively limited influence over the decarbonisation of the national grid, but can play an indirect role through engagement, partnerships and in its capacity as an LPA. For example:
    - Demonstrating and showcasing the feasibility and benefits of projects, particularly small-scale renewable energy and battery power projects on council-owned land or properties, or innovative pilot projects
    - Playing a coordinating role (e.g., through community energy projects)
- In terms of infrastructure provision and large-scale renewables, there are limited options within the City boundary. LCC should therefore seek to engage with neighbouring Local Authorities and the County Council and try to support or promote suitable projects where possible. This will also need to involve engaging with Western Power Distribution, energy companies, and landowners to identify any suitable locations and support infrastructure improvements.
- The Council should also seek to lobby the Government for additional support and funding.
- There are limited opportunities for LCC to influence the use of some technologies such as hydrogen gas and carbon capture usage and storage, initiatives which will be driven predominantly at the national level. LCC's role in this regard will primarily be to keep abreast of new developments. There could potentially be opportunities to engage in pilot schemes in future.

4.1.4 Land Use and Carbon Sequestration

What needs to happen to reach net zero?

- According to the Committee on Climate Change (CCC), some reduction in greenhouse gas emissions can be achieved by adopting low carbon farming practices e.g., better soil and livestock management, less use of fertilisers, and increased diversification. However, the CCC also states that a net zero future will require a large increase in natural carbon sequestration through afforestation, peatland restoration, and similar projects. This can only be achieved if large areas of agricultural land are released for alternative uses – which, in turn, would rely on shifts in consumer behaviours and diets, reducing food waste, and new farming technologies to maintain per capita food production.
- Land use policies will therefore need to recognise the value of natural capital and reward activities that deliver environmental benefits. Although carbon sequestration through land use is not a major part of Leicester's roadmap, it is vital that existing carbon sinks are protected and continue to be enhanced in line with biodiversity considerations. Green urban infrastructure further comes with a vast number of co-benefits (see Section 4.3).

Table 10. Relevant policies and strategies in the land use sector.

National	Regional	Local
The Environment Act The 25 Year Environment Plan • Embed environmental net gain as a principle for development (including housing and infrastructure) • Improve soil health and expand tree cover • Green towns and urban areas The England Trees Action Plan 2021-2024 • 12% woodland cover by mid-century Note, the CCC and Woodland Trust both recommend 19% tree cover Agriculture Bill (2020)	• n/a	Leicester Climate Emergency Strategy 2020-2023: • Use existing, or introduce new, planning policies which encourage the provision of green infrastructure and maximising the benefits it has to mitigate and adapt to a changing climate. • Identify suitable locations and tree species for mass tree and hedge planting to create new 'climate woodland' in the city. Leicester Biodiversity Action Plan 2021-2031 Leicester Tree Strategy 2018-2023 Leicester Green Infrastructure Strategy 2015-2025

Key challenges and the relevant major players are shown in Table 11.

Table 11. Key challenges and major players in the land use sector.

Key challenges	Major players
Protecting existing carbon sinks, while also protecting ecosystems, natural habitats, and biodiversity	DEFRA is responsible for Government policy on a range of environmental topics including but not limited to land management, conservation, biodiversity, and climate adaptation. Natural England is responsible for designating and managing certain nature reserves, parks, and other areas of the countryside. The Environment Agency (EA) is responsible for protecting the environment which includes regulating environmental pollution. Local Authorities play a part in their role as LPAs, with responsibility for areas protected for biodiversity. The Council is also the major landowner of most open space in Leicester, so can have a big influence on use and management of those spaces.
Low carbon agricultural practices (livestock and land management)	Policy, regulations, and enforcement are primarily the responsibility of DEFRA and the EA, but the decision to exceed minimum standards and adopt low carbon practices would largely fall to landowners. Farming tenants are key stakeholders but have less influence over land use.
Increasing tree cover and ensuring it is sustainably managed in the long term	Policy is set at a national level by DEFRA, although LCC can contribute directly as a major landowner within the City, and indirectly via its role as an LPA. The Council has already set out a number of relevant strategies such as the Leicester Biodiversity Action Plan (2021-2031) and the Leicester Tree Strategy (2018-2023).

Releasing agricultural land for alternative uses e.g., woodland or rewilding projects	As above, the spatial strategy for the City can have a small impact; however, most of the changes will happen outside Leicester. The major players include consumers (whose dietary and lifestyle habits influence production), private landowners, businesses, industry bodies, communities, and researchers/innovators in the field of agricultural production.

What areas can LCC influence the most?

- LCC can potentially deliver carbon sequestration projects on council-owned land outside of the city boundaries although this is clearly subject to practical constraints such as existing lease agreements. It needs to be ensured these projects also consider biodiversity requirements, tackling the Ecological Emergency alongside.
- The Council can further provide business support to landowners and farmers to enable them to adopt low carbon practices, and support research initiatives or pilot projects on these topics as appropriate.
- There is scope for LCC to partner with other local authorities or organisations to deliver projects within (or outside of) the City such as woodland creation.
- LCC can promote tree cover and other green infrastructure via the Local Plan and spatial strategy, although in practice this would primarily impact new developments. The requirement for certain developments to achieve Biodiversity Net Gain should lead to woodland and other habitat creation, both on development sites and elsewhere. Note that biodiversity should be given high importance alongside carbon emissions and energy use in planning policy, although that is not the focus of this report.

4.2 Costs

4.2.1 Introduction

This section presents a rough assessment of the resource costs (present value[45]) of the proposed mitigation measures described in Section 3, *where sufficient data was available to support an estimate.*

Market research and case study evidence show that there is considerable variation in the costs of these measures even today. Bearing in mind the limited scope of this project and very high level of uncertainty in predicting the costs of climate mitigation measures years and decades into the future, the costs presented in this report are solely intended to indicate the order of magnitude of investment that may be required. This enables a rough comparison (a) between different measures and (b) across different scenarios. Further work would be needed to validate these findings and to get more detailed and robust estimates.

4.2.2 Approach to estimating costs

Broadly speaking, the assessment considers the typical unit costs of each measure (e.g. price of a typical whole-house energy efficiency retrofit) and the number of units that are required (e.g. number of homes). The latter is based on outputs from the NZP tool and data collected as part of the baseline assessment, so the results align with the other modelling assumptions used in this report.

Where it is considered likely that the cost of a technology could decrease in future, either due to adopting measures at scale or other market factors, this has been modelled implicitly by selecting typical prices that are at the lower end of the range. This applies to the cost of heat pumps, domestic retrofits and electric vehicles. Fuel bill savings are based on the changes in energy demand associated with each measure, as modelled in the NZP tool, and 2021 typical fuel prices.

This information is used to calculate:

- *Capital expenditure*, i.e. the unadjusted level of investment that would be required.
- *Net capital expenditure*, which covers the investment required, minus costs saved on fuel bills (where relevant) or costs that would have been incurred anyway without the transition to net zero (where there is a comparable alternative). This can be thought of as ‘extra over’ costs, e.g. the difference in price between a heat pump and boiler.

The calculations consider intervention measures taking place within Leicester, but do not include the costs of wider enabling measures that would also be needed. Examples include, but are not limited to:

- Upgrading the wider UK electricity grid network to support grid decarbonisation,
- Changes to the physical road network to facilitate a shift away from the use of private vehicles
- Any initiatives/campaigns that would be needed in order to promote or administer the measures.

Results are presented as totals and as average annualised figures. For the sake of comparison, they are also shown as a percentage of Leicester’s current and forecast GDP[46]. However, these figures should be interpreted with great caution given the levels of uncertainty involved, and bearing in mind

[45] Discounted to reflect the fact that costs and benefits in future years are valued less than nearer term costs and benefits.
[46] Nominal GDP (not adjusted for inflation). Figures from ONS, 2021.

that some measures could not be costed due to data and resource limitations. Also note that some of the measures could have beneficial impacts on Leicester's economy overall (see Section 4.3) but those effects have not been quantified as part of this study.

4.2.3 Results and discussion

Overall, the cost of delivering the intervention measures, where data was available to support an assessment within the scope of this study, ranges from £950m to £5.3bn. The most ambitious scenario (#3) is understandably the most expensive. Divided equally over 9 years, the costs of aligning with Scenario 3 would be between £550-600m, which for context is approximately 5% of Leicester's forecast GDP and 6% of current GDP.[47] Results for each scenario are outlined in Table 12 below.

Table 12. Estimated net capital investment costs

Scenario	Present value (£bn)	Annualised (£m/year)	As a proportion of forecast GDP	As a proportion of 2019 GDP
1	£0.95	£100	1%	1%
2	£3.5	£400	3%	4%
3	£5.3	£600	5%	6%
4	£3.8	£200	4%	2%

Those are the estimated 'net costs', i.e. the additional cost over and above what would otherwise have been spent; they also include cost savings, for example from reduced fuel bills. If these are removed, we get an overall gross capital investment cost of £2-9bn across the scenarios modelled. For Scenario 3 the gross capital costs would be around £1bn per year (8-9% of forecast GDP or 10% of current GDP) over the time period to 2030.

Table 13. Estimated capital investment costs

Scenario	Present value (£bn)	Annualised (£m/year)	As a proportion of forecast GDP	As a proportion of 2019 GDP
1	£1.9	£200	2%	2%
2	£5.3	£600	5%	6%
3	£9.1	£1,000	9%	10%
4	£7.1	£350	7%	4%

Table 14 and Table 15 provide a more detailed breakdown of the costs of each measure and key assumptions. **Note that those figures are not discounted, so they do not add up to the totals shown above.**

Overall, they show that refurbishing the existing building stock, and then replacing fossil fuel heating systems, is expected to incur the highest resource costs. Depending on the level of energy performance, the capital investment required to retrofit the entire domestic stock is estimated in the region of £2.5-3bn, while replacing all domestic gas boilers with air source heat pumps as in Scenario 3 is estimated to cost an additional £700-800m (capital costs would increase if some switch to ground source heat pumps, although these would also offer greater energy savings). The Government hopes that the price of heat pumps will decrease in future[48] and has promised[49] to take steps to ensure that

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[47] ONS, 2021
[48] Boiler Upgrade Scheme (BUS) | Ofgem
[49] Plan to drive down the cost of clean heat - GOV.UK (www.gov.uk)

they are comparable with gas boilers, although this is likely to be limited in the timescale between now and 2030.

The cost of implementing energy saving measures in the non-domestic building stock is estimated at roughly £1-1.5bn (although note that this includes other measures such as smart controls, LEDs and heat pumps).

Although improving the energy efficiency of buildings would tend to decrease energy bills, the savings associated with that measure will be partially offset in buildings that switch from fossil fuel to electric heating systems, due to the higher current cost per unit of electricity. This is accounted for in the calculations.[50] Upgrading buildings to a higher energy efficiency standard is important to help keep bills down for building occupants when heating systems are electrified.

The other most significant capital costs are those associated with replacing existing petrol and diesel vehicles with EVs, which is estimated to require capital investment in the region of £3-4bn if the entire fleet was to be replaced. However, the *net* costs are expected to be much lower, considering the replacement of vehicles that would happen anyway, the decreasing difference in the cost of combustion engine vs. electric vehicles, and the very significant savings in fuel bills. If EVs reach cost parity with petrol and diesel cars and vans by the mid-2020s as predicted, then some progress will be made at no net additional cost by those who will buy a new car before 2030.
Another very important consideration when interpreting the costs of the transport measures is that they are based on the investment required to replace the entire existing vehicle fleet, on the assumption that even if there is a reduction in private vehicle journeys, ownership rates might stay the same. If this is *not* the case, and car/van ownership decreases, then the costs of replacing the vehicles would be lower.

The cost of installing EV charging points is also reliant on the assumed mixture of public and private charging points, and how fast they can recharge a vehicle. In terms of the mix of EV charging points, these calculations are based on evidence that has been collected for other UK cities but there is obviously a large amount of uncertainty regarding the future mix of charging technologies at a city scale. There is also the potential for new technologies (such as vehicle-to-grid systems) to emerge that would have a big impact on the preferred mix of technologies and vehicle charging practices.

Note that the calculations assume that, in Scenario 3, there is a roughly three-fold increase in bus journeys which results in more EV buses being purchased. This also means that, while the fuel costs for existing buses would go down, overall fuel costs for buses will go up as there are more vehicles.

Some measures are more likely to pay back the initial investment due to reducing energy bills, namely smart controls, LED lighting and PV. As with fabric efficiency measures, the benefits of smart controls may be partially offset by higher costs when switching from gas to electric heating systems. For PV, the capital costs have decreased radically in the last decade, which has reduced the payback period to as little as a few years even when accounting for the cancellation of the Feed-in Tariff; the benefits are greater when more of the electricity generated can be used on-site.[51]

The cost of switching to hydrogen boilers and HGVs has been estimated based on an assumed price premium, but due to the fact that these technologies are not yet commercialised, should be

[50] Depending on future Government policies, which may aim to shift the tax burden off electricity and onto fossil fuels, it is possible that the cost disparity will begin to decrease, but the timing and scale of that change is uncertain.
[51] Smart Export Guarantee (SEG) | Ofgem

interpreted with additional caution. This is another example of a measure that would incur wider enabling costs (to adapt the gas grid to accommodate hydrogen) that have not been estimated.

Table 14. Estimated Capital Investment Costs (£million) – not discounted

Sector	Description of measure	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Comments
Domestic	Fabric efficiency measures	£459	£2,524	£3,078	£2,524	Domestic energy efficiency retrofits can cost anywhere from £10,000 to £30,000, while very high specification retrofits such as Energiesprong can cost £65,000 or more. The calculations assume that there will be some cost savings due to the large-scale rollout of domestic retrofitting measures.
	Smart controls	£28	£28	£31	£28	Typical installation costs are £200-£300 per household. These calculations assume that there is already some level of uptake.
	Replace gas cooker with electric	£38	£38	£38	£38	Based on typical prices of domestic induction, gas and electric cookers.
	Expand DHN to meet c. 5% of domestic heat demand currently supplied by gas				£12	A benchmark (£/MWh) was developed based on the existing city centre energy network. This aligns with other published research on DHN costs in the UK. Heat demand is based on NZP tool outputs.
	Replace gas or fossil fuel boiler with air source heat pump (ASHP)	£79	£676	£786	£676	Domestic heat pumps can cost anywhere from £7,000-£18,000 depending on the system type.
	Install LED lighting	£31	£31	£31	£31	Replacing all household lights can cost around £250-£350. These calculations assume that there is already a significant level of uptake.
	Install PV	£10	£49	£97	£97	Based on typical costs (£1500/kWp) of small-scale roof-mounted PV (<4 kWp).
Non-Domestic	Energy efficiency retrofitting, smart controls, LED lighting and heat pumps	£336	£672	£1,344	£1,344	Costs of refurbishing non-domestic buildings varies widely but the CCC indicates these are often in the region of £300-400/m2 floorspace. These metrics include fabric efficiency, smart controls, lighting, and HVAC upgrades; individual measures have not been disaggregated.
	Replace gas cooker/catering equipment with electric	£9	£9	£9	£9	Based on typical prices of commercial induction, gas and electric cookers.
	Expand DHN to meet c. 5% of non-domestic heat demand currently supplied by gas				£9	A benchmark (£/MWh) was developed based on the existing city centre energy network. This aligns with other published research from BEIS on DHN costs in the UK. Heat demand is based on NZP tool outputs.
	Replace gas boilers with hydrogen boilers				£76	Based on typical costs of commercial boilers, and assuming there is a 25-50% price premium on hydrogen boilers. However, the technology is not yet commercialised so this is considered highly speculative.

	Install PV	£3	£15	£31	£31	Based on typical costs (£1000/kWp) of small-scale roof-mounted PV (5-10 kWp).
Transport	HGV driver training	£0.2	£0.3	£1	£1	Available training courses vary in price from roughly £400-£700 per HGV driver.
	Replace cars with EV	£931	£1,563	£3,685	£3,685	Based on typical costs of a new car and the number of cars that would switch to EV as per the NZP tool.
	Replace vans with EV	£122	£204	£481	£481	Based on typical costs of a new van and the number of vans that would switch to EV as per the NZP tool.
	Replace motorcycles with EV	£8	£13	£31	£31	Based on typical costs of a new motorcycle and the number of motorcycles that would switch to EV as per the NZP tool.
	Replace buses with EV (and increase bus fleet)	£76	£205	£644	£400	Calculations account for the fact that LCC has funding to convert c. 200 buses to EV plus the need to purchase more buses if expanding the public transport network. Electric single decker buses cost up to £340,000 per bus.
	Replace HGVs with hydrogen	£0.2	£2	£2	£21	Research suggests there will be a 25-50% price premium on hydrogen HGVs. However, the technology is not yet commercialised so this is considered highly speculative.
	EV charging infrastructure to support above	£29	£49	Up to c. £115		The costs shown for Scenarios 3 and 4 represent high estimates based on the number of chargers that would be needed to supply the entire current vehicle stock with no reduction in transport demand or change in car ownership. Costs shown for Scenarios 1 and 2 are pro rated based on the relative scale of EV uptake in those scenarios. These costs could decrease by as much as 50% if demand reduces. The estimates are also highly sensitive to assumptions about the mix of public vs private chargers, and whether they are slow, fast or rapid. Between half to two thirds of the costs shown would be for private residential chargers.

Figure 71. Estimated Capital Investment Costs (£million) – not discounted

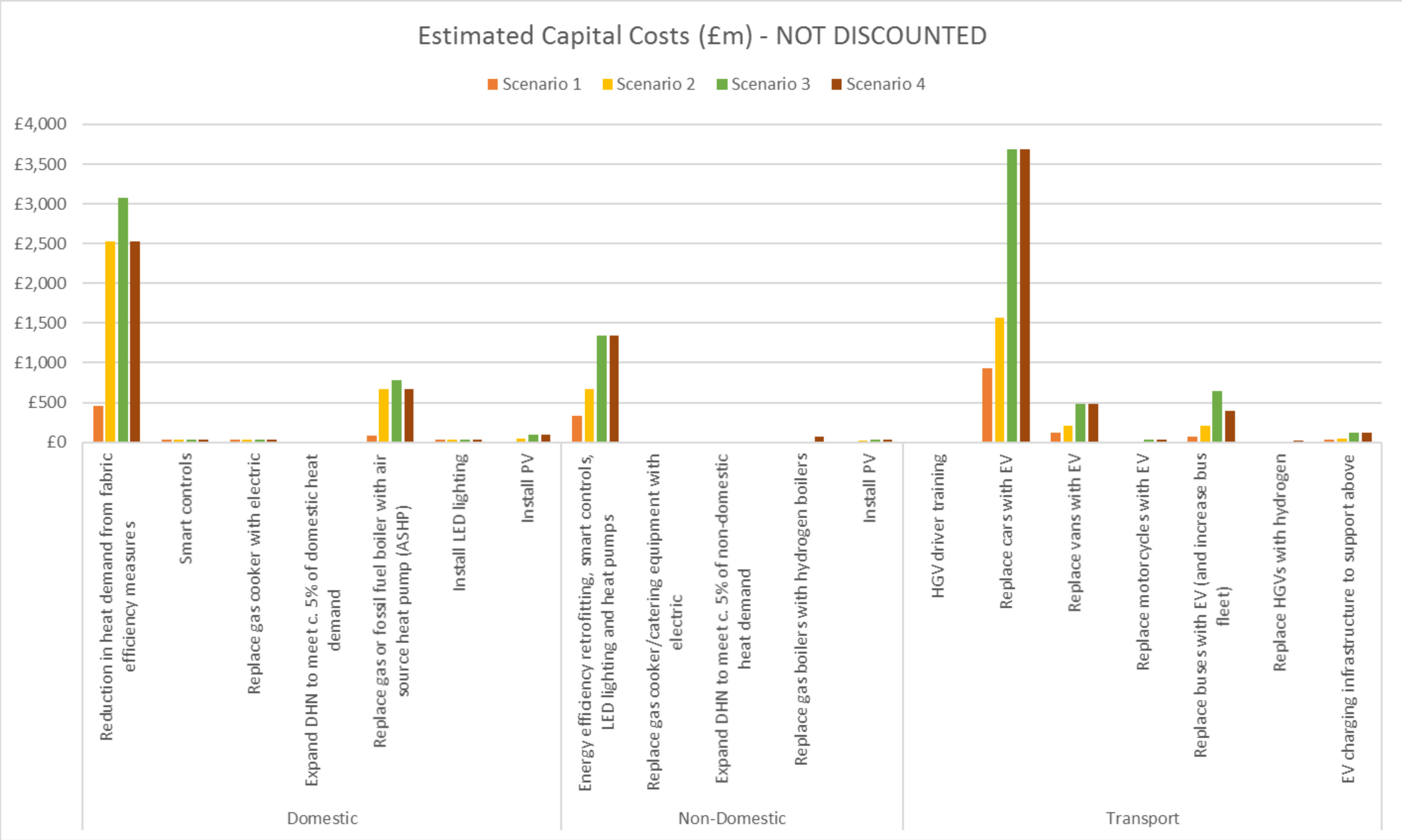

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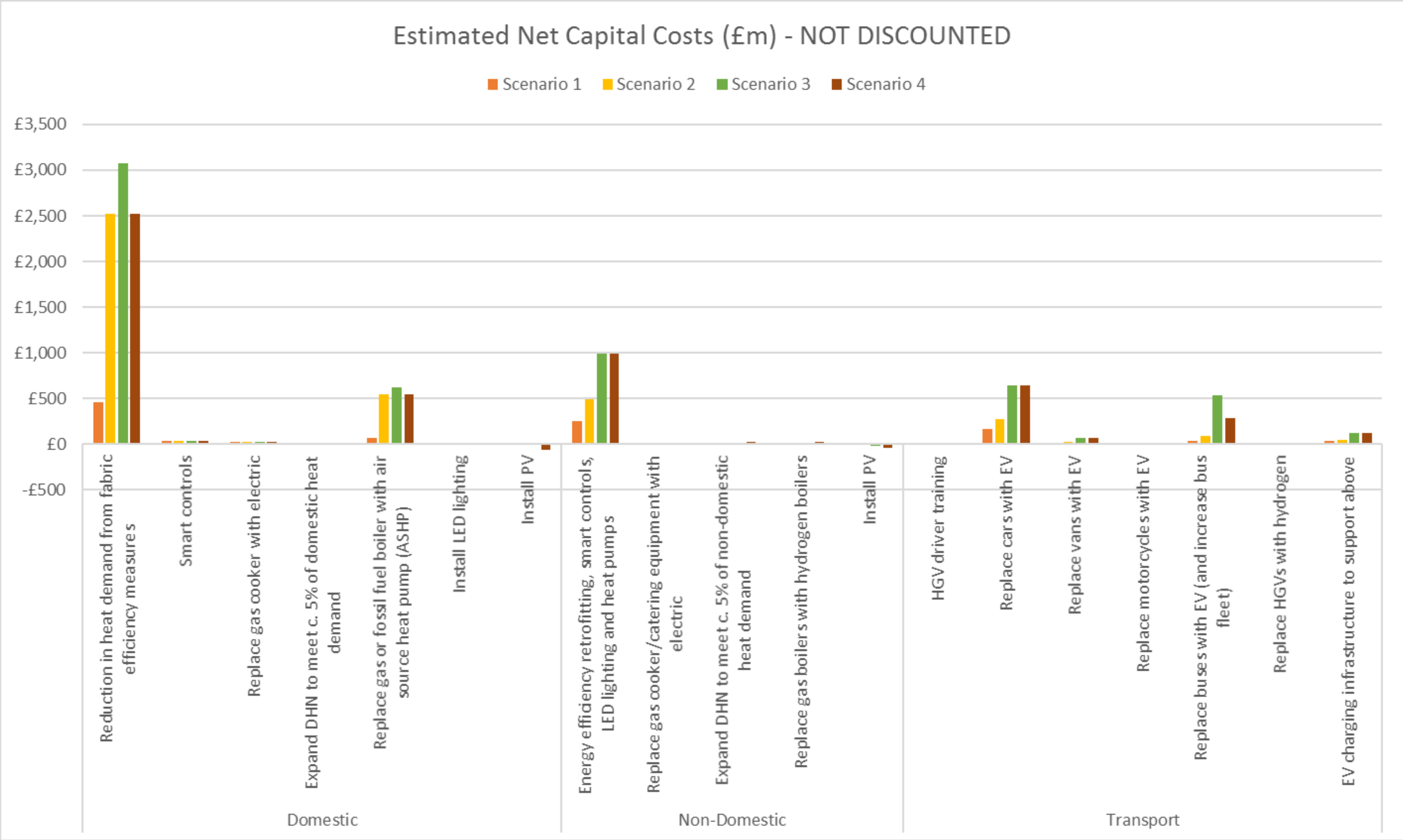
Table 15. Estimated Net Investment Costs (£million) – not discounted

Sector	Description of measure	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Comments
Domestic	Fabric efficiency measures	£459	£2,524	£3,078	£2,524	Same as gross capital costs on the basis that (a) the measures would not happen anyway and (b) fuel bill savings are affected by subsequent heat pump uptake so the overall impact is calculated as part of the ASHP measure (see below)
	Smart controls	£28	£28	£31	£28	As above
	Replace gas cooker with electric	£18	£18	£18	£18	Fuel bills will tend to increase due to the higher cost of electricity, despite the higher efficiency of induction hobs compared with gas
	Expand DHN to meet c. 5% of domestic heat demand currently supplied by gas				£12	Same as capital costs as difference in fuel bills is unknown
	Replace gas or fossil fuel boiler with air source heat pump (ASHP)	£62	£541	£621	£542	The fuel bill savings here account for the fact that domestic heat demands will decrease due to fabric efficiency measures (see above)
	Install LED lighting	-£4	-£4	-£4	-£4	Due to the ban on incandescent bulbs, it is assumed that all new lightbulbs will be LED anyway, so these lead to a net cost saving due to lower bills
	Install PV	-£1	-£5	-£11	-£60	This calculation assumes that approximately 50% of the electricity generated by PV is used onsite and the rest is exported to the grid, resulting in significant energy bill savings. These benefits would increase if more electricity is used onsite.
Non-Domestic	Energy efficiency retrofitting, smart controls, LED lighting and heat pumps	£247	£493	£988	£988	Accounts for measures that reduce energy demand as well as potential increases in bills due to switching from gas to electric heating.
	Replace gas cooker/catering equipment with electric	£9	£9	£9	£9	Fuel bills will tend to increase due to the higher cost of electricity, despite the higher efficiency of induction hobs compared with gas
	Expand DHN to meet c. 5% of non-domestic heat demand currently supplied by gas				£17	Same as capital costs as difference in fuel bills is unknown
	Replace gas boilers with hydrogen boilers				£19	Net costs account for the fact that some boilers would be replaced anyway but do not account for differences in fuel bills as the impact is unknown
	Install PV	-£2	-£9	-£18	-£40	As for domestic PV
Transport	HGV driver training	-£0.1	-£0.5	-£2	-£1	Net costs account for lower fuel costs following training. This results in near zero net costs for Scenarios 1 and 2 and net savings in Scenarios 3 and 4. Changes in fuel use based on the NZP tool.

	Replace cars with EV	£159	£267	£637	£646	Net costs account for the fact that some cars would be replaced anyway, plus significantly lower fuel costs. Changes in fuel use based on the NZP tool.
	Replace vans with EV	£15	£24	£61	£61	As for cars
	Replace motorcycles with EV	£1	£2	£6	£6	As for cars
	Replace buses with EV (and increase bus fleet)	£37	£86	£528	£283	Net costs account for difference in price of technology as well as lower fuel costs, however, note that due to the modelled increase in use of buses, there are still new buses that would not have been purchased otherwise, and these will incur additional fuel costs to run.
	Replace HGVs with hydrogen	£0.1	£0.6	£0.8	£7	Net costs account for higher price of technology but no difference in fuel bills due to lack of data to support an estimate.
	EV charging infrastructure to support above	£29	£49	£115	£115	Same as capital costs. See associated notes.

Figure 72. Estimated Net Investment Costs (£million) – not discounted



Although these numbers are large, there are some important factors to note:

First, these figures are high-level estimates intended to illustrate the order of magnitude of the funding required. There is huge uncertainty around future costs and the speed with which they can come down. As it stands, at present many of the individual measures can vary by up to 50% in cost.

It is possible – perhaps likely – that meeting carbon neutrality after 2030 would lower some of these costs, whether due to market maturity, or additional Government funding. Clearly, it would also reduce the annual investment needed. But such an approach would not be consistent with the city's desire to be a leader on the climate emergency, as evidenced by its ambition to achieve carbon neutrality by 2030 or sooner.

Second, some of the costs will not be truly new or additional – they would require reassignment of investments that would otherwise be spent on 'business as usual' measures such as refurbishing buildings without improving their energy performance, or expanding roads to accommodate traffic growth.

Third, not all of these costs would fall on the Council – many will need to be met by other stakeholders, including businesses, householders, landlords, and other public sector bodies. One of the major challenges will therefore be to ensure that 'conventional' investments by all these stakeholders are reassigned towards measures that help Leicester along the path to carbon neutrality.

Finally, some of the most important benefits of investing in carbon neutrality are 'common goods' – such as 'helping to avert climate catastrophe' – that are critical to achieve, but do not necessarily generate streams of income for any particular investor. Others are classified as co-benefits, which may have a range of positive, but indirect, financial impacts as well as environmental and social ones. These factors are not reflected in the numbers above but are discussed further in Section 4.3.

Priority measures

Because Leicester is aiming to achieve net zero emissions 20 years in advance of the national deadline, there will understandably be less public funding available to support these measures. Realistically, in the immediate term, there is likely to be more of a focus on:

- Investments that are known to be cost-effective, such as LED lighting and smart energy controls
- Opportunities for LCC and other public sector organisations to access low-cost borrowing and public funding
- Engaging with, and showcasing, examples of businesses or households implementing best practice in reducing their own emissions
- Identifying alternative or innovative sources of funding such as green bonds

However, clearly this approach will not be enough to deliver net zero by 2030, which makes it all the more important to avoid actions that could either directly increase emissions (e.g. less efficient new developments or road network expansion), or lock in future emissions (e.g. replacing old gas boilers with new ones).

4.3 Benefits

As well as the costs, there will also be significant benefits to this climate action. Some examples of likely co-benefits for each sector are outlined in Sections 4.3.1 to 4.3.4. Aside from cost savings due to lower energy bills, the investment costs outlined above do not take account of the potential cost savings from these co-benefits. Some of these could be quite significant and would help reduce overall net costs. As an example, the cost savings from the improvement in air quality (see Table 17 and Table 18) could save Leicester City up to £7.2m annually – the current cost of air pollution to Leicester's economy.[52] Nor does it take account of the cost of not taking action on climate change, which will be huge.

Care will need to be taken to ensure that the actions to deliver carbon neutrality do not worsen social inequality by hitting certain groups harder. For example, households experiencing fuel poverty would risk seeing their bills increase if they switch from gas boilers to electric heating without a significant reduction in energy demands. It is also especially important to ensure that any retrofitting measures are undertaken to a high standard to avoid issues such as damp and moisture problems, which would have negative health impacts – disproportionately impacting those who are already vulnerable – and potentially exacerbate issues with poor quality housing.

4.3.1 Buildings

There are also a large number of co-benefits which can be realised from measures in the buildings sector, especially through the implementation of energy efficiency measures. Energy efficiency measures cover a vast range of interventions from fabric improvements and smart heating controls to the installation of heat pumps and hydrogen boilers. As LCC follows the 'fabric first' approach (LCC, 2020), initial measures for most Leicester residents are likely to be fabric improvements – although an upgrade to low emission heat systems will need to either be undertaken at the same time or follow swiftly to achieve carbon neutrality. An overview of co-benefits from local energy efficiency measures including an explanation of what this means in more detail can be found in Table 16.

Table 16. Common co-benefits of energy efficiency measures in buildings.

Co-Benefits	Elaboration
Boost local employment	Retrofitting measures have the potential to facilitate job creation in construction, manufacturing, installation, and design. The UK Government's Green Jobs Taskforce[53] aims to create a total of 2 million "green" jobs by 2030; for Leicester, this could translate to between 5,000-10,000 new jobs.
Socio-economic development	This will especially be realised for deprived areas through factors such as local employment, spending, and increased property values (Gillard et al., 2017).
Reducing fuel poverty	Enhancing energy efficiency in buildings reduces the amount of fuel required to heat homes, thus contributing to the reduction of fuel poverty (Ashden, 2020). Leicester is particularly affected by this issue with 19% of households being classed as fuel poor as of 2019 compared to the national average of 13.4% (England) (BEIS, 2021). The 2018 Leicester Health and Wellbeing survey further showed that the by far most affected group experiencing food or fuel poverty are off work long-term sick or disabled residents – 41% of which were affected by this issue. Additionally, while only 7% of homeowners experienced food or fuel poverty, 17% of private and 18% of social renters did compared to the 12% average determined by the survey (LCC, 2019).

[52] LCC, 2015: Healthier Air for Leicester. Leicester's Air Quality Action Plan (2015-2026)
[53] UK government launches taskforce to support drive for 2 million green jobs by 2030 - GOV.UK (www.gov.uk)

Reduced adverse health impacts	Fuel poverty has various adverse effects on the population, and it is estimated that nearly 1/3rd of excess winter deaths (EWDs) in the UK each year are directly or indirectly linked to fuel poverty.[54] This is primarily due to respiratory and cardiovascular diseases being exacerbated by cold conditions, along with higher incidences of trips and falls, in addition to hypothermia. In Leicester, that would translate to roughly 50-60 deaths per year.[55] Some of these could be avoided by introducing more energy efficient housing. Adequate heating can also reduce the risk of mould in homes and improve thermal comfort. Aside from physical health, mental health was also found to be affected negatively by fuel poverty with the risk for these issues increasing fivefold if an individual experiences fuel poverty. Finally, children are a particular risk group as negative effects on their education, diet, and physical fitness have been observed (Friends of the Earth & the Marmot Review Team, 2011).
Cost savings	People commonly undertake energy efficiency measures in the hope that this will lead to long-term savings. The payback time of various measures differs substantially depending on the current state of the home, the insulation type / efficiency improvement, and the energy prices. (Note that, as of spring 2022, energy prices have risen dramatically in the last year. This would reduce payback times and make more expensive measures such as external wall insulation more attractive. It also illustrates how efficiency measures reduce the vulnerability of households and businesses to energy price rises, which is an important co-benefit and positive in its own right.) Overall, comprehensive insulation projects have a longer payback time due to the high upfront costs but are important measures to undertake when possible, especially given the likely switch to heat pumps in the coming decades. Smaller measures such as smart meters quickly recoup the upfront costs (Prince, 2014; CSE, 2019). Retrofitting also reduces the need for costly demolition and/or new builds.
Resilience	Improved energy efficiency can enhance resilience to climate change by reducing the susceptibility of the housing stock to events such as extreme cold or heatwaves (Ashden, 2020). This, in turn, enhances to resilience of the community, as less energy is needed to heat/cool the home when energy efficiency is enhanced (leaving more energy for other uses).

4.3.2 Transport

Both of the two core interventions in the transport sector – the modal shift and the required uptake of ULEVs – are crucial for reaching net zero in Leicester's transport sector. However, active travel and public transport have benefits that cannot be realised by personal EV travel. For example, EVs still cause air pollution due to the emission of particulate matter through tire abrasion, brake disks, clutches, and secondary dust entrainment (Sendek-Matysiak, 2019). A reduction in vehicles on the road through car sharing, home working, public transport use, and active travel can alleviate this problem. From a local perspective, promoting modal shift is more within the control of the local authority as a majority of the emission savings from EVs relies on the decarbonisation of the national grid which the local council alone cannot influence.

[54] https://committees.parliament.uk/writtenevidence/8749/html/
[55] E06000016 (phe.org.uk)

Co-benefits have been segregated into active travel and public transport – although there is naturally some overlap. Table 17 shows common co-benefits from active travel and Table 18 co-benefits from increased public transport use in place of individual car travel. Both of these interventions, along with EV uptake, have the potential to deliver economic benefits including jobs creation, whether in construction, EV charge point installation/maintenance, and in the supply chain for manufacture and supply of bicycles and zero emission vehicles. Even if the jobs are not based in Leicester directly, they could be within commuting distance of Leicester residents. An example of this is in a Government-supported EV battery research and development facility near Coventry.[56]

Table 17. Common co-benefits associated with active travel.

Co-Benefits	Elaboration
Improved health	A common co-benefit cited in relation to active travel (walking and cycling) is the improvement in physical health. The use of motorised vehicles is commonly associated with increased mortality, most commonly as a result of chronic diseases such as heart disease, stroke, type 2 diabetes, breast cancer, and osteoporosis (Creutzig et al., 2012; CIHT, 2015; DfT, 2021). In fact, physical activity of 150 minutes per week (e.g., 30 minutes of cycling to commute to and from work) has been found to reduce the risks of heart disease by 40%, type 2 diabetes by 40%, dementia by 30%, depression by 30%, breast cancer by 25%, and osteoporosis by 50% (McNally, 2019). A study from New Zealand further showed that interventions geared towards active travel results in 34.4 disability-adjusted life years (DALYs) and two lives saved resulting from reductions in cardiac disease, diabetes, cancer, and respiratory illness (Chapman et al., 2018). Assuming that some of these same benefits would apply to Leicester, active travel would thereby not only improve the general wellbeing of Leicester's population, but also potentially alleviate pressures on the NHS.
Societal benefits	Increasing active travel, and thus reducing motorised transport, presents the opportunity to repurpose spaces previously allocated to roads (Ashden, 2020). This space can be reclaimed for social purposes. An example of this already exists in Leicester, where a car park has been converted into a new public social space, Jubilee Square, as part of the Mayor's Connecting Leicester programme. Furthermore, improving the environment for active travel can facilitate improved access to jobs and services for people without access to a private vehicle.
Resilience	Encouraging active travel over motorised transport may allow road space to be reallocated to green space (Ashden, 2020), which acts to enhance resilience by helping reduce flood risk and urban heat island effects (CCC, 2019).
Reduced traffic congestion	Cycles take up vasty less road space than cars, especially when vehicle occupancy is low (see Figure 73), thereby alleviating congestion (DfT, 2021). Congestion currently costs the average driver over £1000 PA, thereby these measures would also result in significant cost savings (Inrix, 2019).
Air quality improvements	Road traffic is responsible for 70% of the most damaging pollutants: nitrogen dioxide, particulates, and ozone. Decarbonising transport can

[56] UK BATTERY INDUSTRIALISATION CENTRE - UKBIC

	therefore deliver significant air quality co-benefits, alongside GHG emissions reductions (CSE, 2019). To maximise on air quality benefits, especially short trips need to be replaced with active travel (short car trips are especially harmful due to cold starts) (CIHT, 2015; DfT, 2021). This is well-suited for an urban local authority such as Leicester where 80% of NO2 is currently produced by road transport (LCC, 2021b). Additionally, improving air quality helps with addressing health inequalities. Across the UK, communities with higher levels of deprivation are shown to be most affected by air pollution – even though they are generally least responsible for causing it (Ashden, 2020).
Noise pollution reduction	Combustion engine vehicles cause high levels of noise pollution which adversely affects public health and wellbeing (Chapman et al., 2018). A study from Copenhagen also found that noise pollution can negatively impact the local economy with house prices experiencing a drop by 1.2% per dB provided that the base level exceeds 55dB (Gossling and Choi, 2015).
Economic gains	Economic gains can be realised by strengthening the local economy through increased footfall. Additionally, higher quality pedestrian areas have been shown to lead to increased house values (CIHT, 2015).
Cost savings	A switch to active travel (and EVs) can have cost-saving co-benefits, by reducing the amount of money spent on fuel. Active travel also reduces demand for other costly materials/resources (e.g. motor vehicles, infrastructure).

Figure 73. Road space taken up by 69 bus passengers, cyclists, and car passengers. Source: Cycling Promotion Fund

Table 18. Common co-benefits associated with public transport.

Co-Benefits	Elaboration
Improved health	If adequately planned for, increasing use of public transport can have indirect health benefits if people generally walk or cycle to and from the bus stop/train station. Additionally, the availability of public transport options has been shown to result in a more positive image of walking as a mobility option (Soest et al., 2019).

Societal benefits	Lack of reliable and safe public transport can lead to isolation among vulnerable people such as the elderly. Improving services with these groups of the population in mind can thereby aid in reducing social isolation (Hemingway and Jack, 2013). Furthermore, improving public transport infrastructure can facilitate improved access to jobs and services for people without access to a private vehicle.
Reduced social inequalities	Research from Birmingham has shown that deprived communities are especially negatively affected by the lack of affordable and reliable public transport options with sufficient service coverage (Soest et al., 2019). This means that without such options, deprived individuals are unable to adequately participate in society.
Reduced traffic congestion	As buses take up significantly less space to transport the same number of passengers (see Figure 73), increased use of public transport options can reduce traffic volumes and thereby congestion issues (Jacyna et al., 2017).
Noise pollution reduction	Similar to the benefits surrounding decreased traffic congestion, noise pollution also can be reduced through a switch to public transport – albeit to a lesser extent than active travel. This effect is much stronger if the buses are electric.

4.3.3 Energy

While most of the interventions will need to happen at the national level, small-scale renewable energy projects can still play an important role for Leicester. These can realise a number of co-benefits for Leicester city and its residents which are outlined in Table 19.

Table 19. Common co-benefits of small-scale renewable energy installations.

Co-Benefits	Elaboration
Boost local employment	Renewable energy is on the rise globally – this includes small-scale renewable energy installations. To meet the increasing demand, new jobs need to be created (IRENA, 2017). As mentioned previously, the UK Government has established a taskforce that aims to create 2 million “green” jobs by 2030 which would include work in the renewable energy sector. If this is done locally (e.g., through upskilling programmes) it can tackle other issues such as unemployment (Ashden, 2020).
Long-term cost savings	Individual installations, such as rooftop PV usually generates cost savings after the upfront investment has been paid off. Based on 2021 typical electricity prices, an average household could therefore potentially save £100-£300 per year in electricity bills. Savings would increase if the cost of electricity increases or if more electricity can be used onsite rather than exported. There are also payments available via the Smart Export Guarantee which would improve the financial benefits.
Generation of revenue for the council	Local renewable energy projects have the potential to generate revenue for the council as well as their communities. They can provide long-term income as well as increased control over the available finances (Ashden, 2020).
Pollution reduction	Renewable energy sources are often associated with lesser levels of air pollution and noise pollution compared to fossil fuel sources. For example, flue gases from gas boilers can contain particulates, heavy metals and acidic gases alongside CO_2 and water vapour, and also incur a risk of carbon monoxide, which are not present with renewable electricity systems.
Resilience	Diversifying and localising energy sources increases the resilience of the energy sector to external shocks such as disruption to supply (e.g.

	due to extreme weather events) and price fluctuations influenced by overseas imports and weather changes (Ashden, 2020).

4.3.4 Land Use and Carbon Sequestration

When green spaces are well-planned, they can tackle climate mitigation through carbon sequestration, address the ecological emergency through enhancing the local biodiversity, and finally, achieve several other co-benefits. Some of the most common co-benefits of urban green space management with the primary goal of carbon sequestration are listed in Table 20.

Table 20. Common co-benefits associated with carbon sequestration through urban green infrastructure.

Co-Benefits	Elaboration
Resilience	Green urban infrastructure can help alleviate adverse effects of climate change. Green spaces can alleviate flooding by balancing water flows or help counteract the urban heat island effect by providing shade (Demuzere et al., 2014).
Air quality improvements	Trees and other green infrastructure can aid in improving air quality by absorbing pollutants such as particulate matter (Demuzere et al., 2014).
Improved physical health	There are many health benefits from urban green spaces. This ranges from decreased air pollution (see above) to improvements in physical fitness as a result from available sports grounds as well as increased uptake of walking and cycling (Demuzere et al., 2014). Therefore, green urban infrastructure can be seen as an enabling factor of active travel.
Improved mental wellbeing	Green urban infrastructure has been shown to increase the overall wellbeing of residents (Mansor et al., 2009). Several mental health issues such as anxiety and depression have been shown to see improvements as a result of well-managed urban green spaces. However, *poorly* managed green spaces can have the opposite effect (Tzoulas et al., 2007).
Societal benefits	Well-managed green spaces can increase social cohesion, i.e., the connectedness and solidarity amongst community members. This is primarily a result of providing community members from different backgrounds with a space to interact with nature and each other (Jennings and Bamkole, 2019).
Economic gains	Similar to well-planned pedestrian zones and walking/cycling routes, urban green spaces can result in economic gains by increasing property values of the local area. Additionally, improvements in public health alleviate financial pressures on the health care system (McDonald, N.D.).
Noise pollution reduction	Some green spaces can provide screening from noise pollution, e.g., from road traffic (Cohen et al., 2014). Additionally, green spaces can act as a 'psychological buffer' for noise pollution. This means that the presence of green space nearby lessens the perception of noise and thereby the associated adverse health effects (Dzhambov and Dimitrova, 2014).

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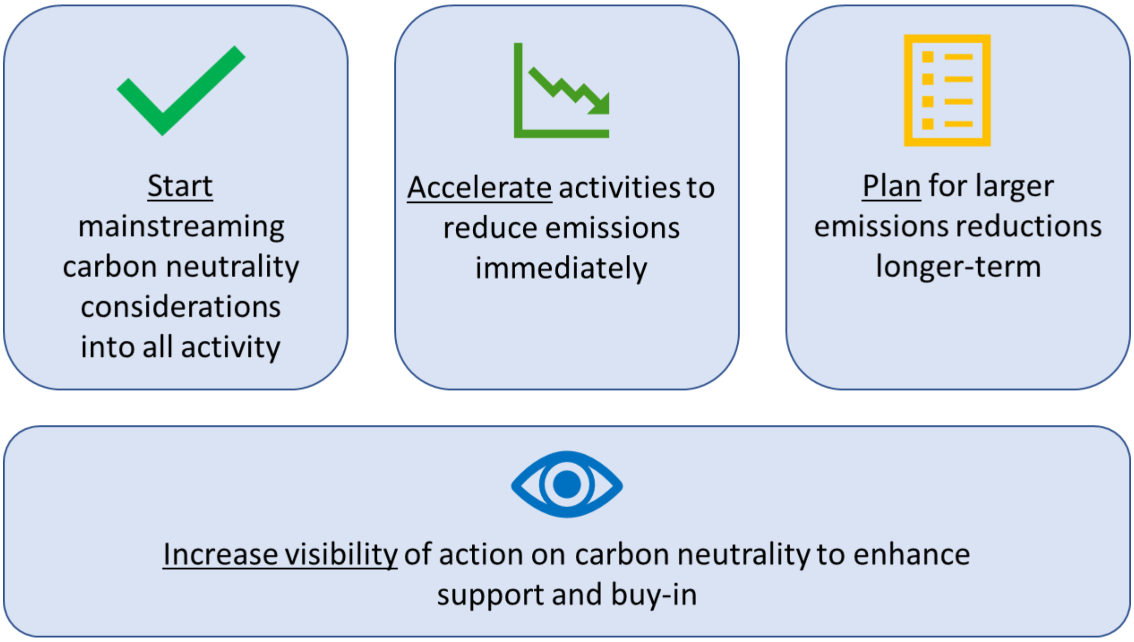
4.4 A framework for delivering carbon neutrality

Building on the evidence provided above, an overall framework for action has been developed in discussion with LCC which considers four main areas for action – stop, accelerate and plan, alongside greater visibility. This is shown in Figure 74 below.

Figure 74. A framework for action on carbon neutrality



The components of this framework are set out below:

- **Start** mainstreaming carbon neutrality considerations into all activity

With so little time before 2030, not only is there an imperative on the Council and other stakeholders to take radical action to reduce emissions, steps need to be taken to ensure that the situation is not being made more difficult by actions that run counter to carbon neutrality. This is particularly the case when it comes to typical replacement rates of certain technologies. For example, the average lifespan of a condensing gas boiler, or a car, is around 15 years. This means that any action in recent years, or over the coming months and years, that add to the stock of fossil fuel boilers and cars, make the possibility of attaining carbon neutrality even slimmer. Examples of the kinds of things that could be happening now in Leicester that run counter to the carbon neutrality goal include

- Building new homes with gas boilers
- Building homes and offices that are not insulated to the highest possible standards
- Any measures that might increase road traffic
- Developing road infrastructure that doesn't actively encourage walking or cycling, and that has assumptions regarding increased road traffic built into it

In some cases, this requires a mindset shift. Some activities might appear to be the right ones because they are low carbon. But they may not be compatible with carbon neutrality (at least not in the timescales that Leicester is aiming for). One example of this is replacing current boilers with more efficient ones. This will undoubtedly help reduce GHG emissions, but the hard fact is that fossil fuel infrastructure is still being installed, and this is simply not compatible with reaching carbon neutrality by 2030.

What this clearly points to is the need to embed carbon neutrality considerations into every activity within the city. Climate emergency actions should be checked against the pathways set out in this report to consider whether they are sufficiently ambitious. And all non-climate emergency actions (e.g. economic development, health policy, social policy etc). This would benefit from having an agreed approach to carbon accounting for projects, so they can be appraised against the carbon neutrality goal. But even in the absence of this, an assessment of any proposed actions, plans or policies against the pathways in this report will help check their compatibility with carbon neutrality. The sooner in the process of development that this can be done, the better.

- **Accelerate** activities to reduce emissions immediately

It goes without saying that urgent action is needed to reduce emissions. As with most local authorities, and the UK as a whole, emissions have been falling steadily since 2005 (as shown in Section 2.2) – by 41% between 2005 and 2019. This masks quite variable year-to-year reductions. The biggest annual reduction was in 2014 – a 12.5% reduction from 2013. But in some years, emissions went up (2010 and 2012). The average annual reduction was 4.2%. And yet we know from the pathways work in Section 3 that reductions of almost 11% a year will be needed. Not only that but to follow a Paris Agreement-aligned emissions pathway, the steepest emissions reductions will be needed in earlier years.

So this means that whilst time will be needed for some actions to be implemented and to take effect on rates of emission reductions, just allowing emissions to fall by around 4-5% a year for the next few years will likely put the carbon neutrality goal out of reach. Much more significant emissions reductions are needed immediately. And to achieve this, the Council should focus on those key stakeholders that have the most influence over the widest number of people. For example, when it comes to buildings, the Council themselves and housing associations are the key landlords in the city and could potentially enact a rapid and ambitious programme of thermal efficiency improvements and heat decarbonisation. Working with major energy users in the city, such as the universities and the NHS, along with other members of the Climate Emergency Partnership will also help drive real energy savings and emissions reductions in the near term.

- **Plan** for larger emissions reductions longer-term

As mentioned above, whilst emissions reductions need to be ramped up in the near term, careful planning will also be needed to ensure that much greater levels of activity and of emissions reductions are seen later in the decade as the city pushes towards carbon neutrality. Coming back to the housing example cited above, whilst the Council and housing associations have an important role to play in rolling out thermal insulation and heat decarbonisation in their building stock, the planning stage looks to address the much wider proportion of homeowners and private tenants that will also need to take action. Therefore, over the next couple of years, urgent action is needed to review options for (and to design) local policy mechanisms that could potentially drive action at a faster pace than at the national level, putting in place appropriate coordination and governance mechanisms and addressing possible skills gaps (e.g. qualified heat pump installers).

A key element of this planning stage will be reviewing options for funding accelerated action. Any local authority that has decided to aim for carbon neutrality faster than the national target should not expect to rely on national government funding – there simply will not be enough of it and it will not likely be commensurate with the pace and scale needed. Leicester will need to consider innovative mechanisms for funding, such as issuing green bonds, using existing instruments such as council tax or business rates, or enabling and supporting enhanced private sector investment into climate action.

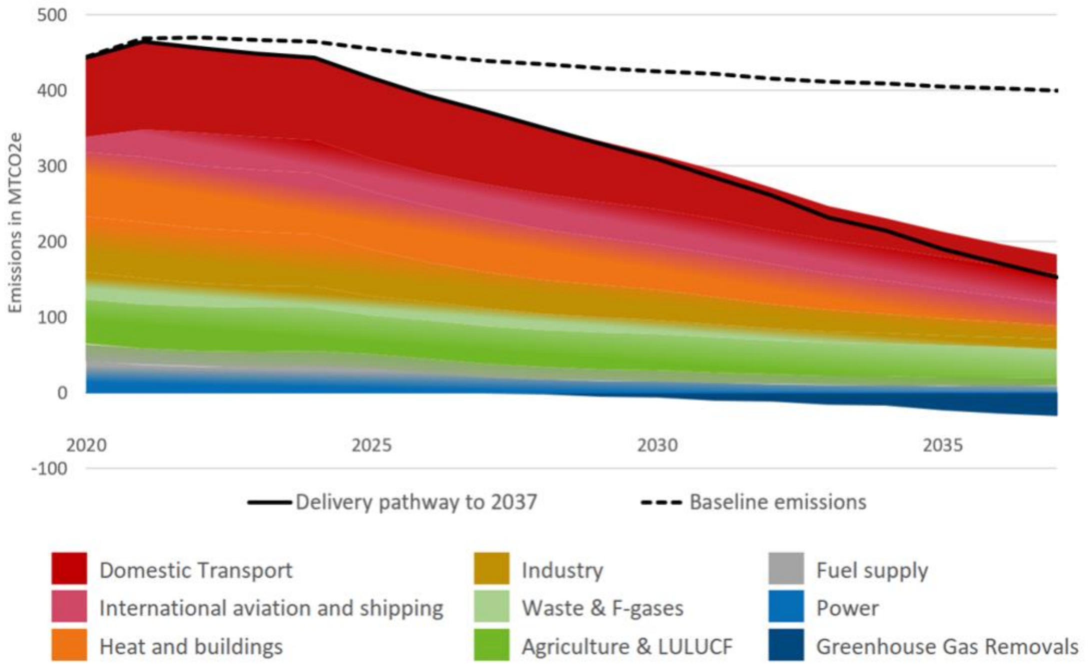
- **Increase visibility** of action on carbon neutrality to enhance support and buy-in

All of the above needs to be done in a way that increases visibility of the carbon neutrality goal and actions being done to meet it. Studies of behavioural psychology show us that people are more likely to act if they see others are taking similar action. Whilst awareness of the climate emergency and the need to take action is arguably greater now than it has even been, until people start coming across evidence of climate action in their day-to-day lives, they may be unwilling to make changes to their own lives, be it changing their behaviours with regards to heating their homes or travelling to the shops, or for purchasing decisions such as when replacing an old vehicle or a gas boiler.

Visibility of the need for urgent action on carbon neutrality can be increased through various media, for example more frequent coverage of climate actions in the city in the local press, or on social media. But a more effective approach is to couple this with greater visibility of the actions themselves. We can look to the response to the Covid-19 pandemic for an example of what this might look like. It is barely possible to spend a day without being reminded of the emergency, be it traffic cones on roads to secure space for cyclists and socially-distanced pedestrians, signs in shops for one-way systems or limits on numbers of people, announcements reminding people of the need to wear face coverings. Something similar for the climate emergency response could include all businesses putting signs in their windows detailing the steps they are taking to reduce their energy consumption, all plumbers and gas engineers being given pamphlets on heat decarbonisation options, to give to clients, or pedestrianisation of areas to encourage walking and cycling.

Appendix A: Implications of the UK Government's Net Zero Strategy for Leicester's Roadmap

The UK Government published its Net Zero Strategy (NZS) in October 2021. The chart below indicates how the Government expects the UK's future GHG emissions trajectory will progress, compared against a baseline prior to the introduction of the NZS, which largely aligns with the EEP 'reference case'.[57] It shows that, compared with a 2020 baseline, emissions would drop by approximately 30% by 2030. This compares favourably against the 'baseline emissions' reported within the NZS. It is a larger reduction than the BAU scenario calculated for Leicester (see Section 3), which would result in a roughly 19% reduction in emissions by 2030 compared with a 2019 baseline.



As of January 2022 BEIS has not yet published an updated version of the EEP figures that accounts for the policies set out in the NZS. An independent assessment conducted by the CCC found that the future trajectories outlined in the NZS are 'broadly similar' to the CCC's Balanced Pathway.[58] However, neither BEIS nor the CCC has published detailed information enough to support a quantitative assessment of how the NZS would impact Leicester.

The one potential exception relates to the Government's stated ambition for the UK electricity grid to be net zero emissions by 2035. Depending on the speed of grid decarbonisation, this would potentially result in emissions (kgCO_2e/kWh) from electricity in 2030 being lower than was assumed in the NZP modelling tool – although this would depend on the timing of any changes. However, the NZP tool uses future emission factors based on the Treasury Green Book, which assume that there will be dramatic levels of electricity grid decarbonisation in the next 10-15 years before tapering off in the late 2030s, so the actual impact on the scenarios modelled is expected to be small. The impact would be more significant if the grid became net zero by 2030. In that case, emissions in Scenario 3 would drop by 83% instead of 71%.

[57] For more details, refer to Net Zero Strategy baseline: covering note - GOV.UK (www.gov.uk)
[58] Independent Assessment: The UK's Net Zero Strategy - Climate Change Committee (theccc.org.uk)

The NZS restates some earlier commitments that are relevant to this study, such as:

- **Ban on petrol and diesel cars**: The NZS reaffirms the Government's intention to phase out the sale of new combustion engine cars and vans; this is already accounted for in the NZP tool.
- **Active travel:** As announced in May 2020, £2 billion will be invested into walking and cycling over five years to support the ambition for half of all journeys in towns and cities to be walked or cycled by 2030. Scenario 3 assumes that the ambition is achieved but does not consider funding sources, so potentially this investment could help introduce additional active travel measures in Leicester.

It also contains a few other new announcements that are particularly relevant to Local Authority decarbonisation planning:

- **Gas boiler ban:** A proposed ban on the sale of new gas boilers from 2035. This would mean that any homes in Leicester still using gas boilers by that time would be required to replace them. In the context of the 2030 ambition, this measure is considered less relevant to Leicester. It remains the case that Local Authorities do now have the power to implement such a ban independently.
- **Boiler Upgrade Scheme**: Grant funding towards the purchase of heat pumps, providing up to £5,000 per home for up to 90,000 homes. The Government's hope and expectation is that this will stimulate demand and help to reduce the costs of installing heat pumps, which in future will then promote uptake. LCC should seek to identify ways of helping local residents access this funding, although clearly it will not be sufficient to achieve the pace of change that is needed for Leicester.
- **Funding for MEES enforcement**: The Government will provide £4.3 million to Councils in an effort to clamp down on landlords not complying with energy efficiency regulations. Since April 2020, landlords have had to upgrade all rented properties to EPC Band E with non-compliance resulting in a fine of up to £5,000, but few Local Authorities enforce this. The new support can potentially start to ensure that action is ramped up over the course of this decade.
- **Hydrogen**: A decision on the role of hydrogen to heat buildings will be announced in 2026. In practical terms, this could result in more gas heating systems being installed between now and then on the assumption that hydrogen will save the day, risking further delays on short-term low-regret actions. This means that, although LCC should not yet write off the possibility of hydrogen as a solution for low carbon heating in Leicester until the announcement is made, the focus should still primarily be on heating technologies that are already available.
- **Sustainable transport**: Within the NZS, uncertainty remains on how the national and local governments will work together to shift away from motorised travel. While local action will play a key role in decarbonising travel, with the NZS pledging to embed this into spatial planning processes, how and if this will be done in co-operation with local authorities remains unanswered. The NZS further states that the Government is in the process of "building [the] evidence base to understand the barriers and potential policies to increase the uptake of shared mobility", such as car sharing, which the central government plans to do in co-operation with local authorities.

The NZS also states that the Government is committed to "set clearer expectations on how central and local government interact in the delivery of net zero". Further details are yet to be announced.

Overall, it is not yet clear whether the policies in place will actually deliver the emissions reductions that are required. For example, there is a heavy reliance on market forces bringing down the costs of technologies such as heat pumps but almost no mention of energy efficiency in buildings, which is a prerequisite. More importantly for Leicester, the targets are designed for a carbon neutrality goal of 2050. It therefore remains the case that national level action will not deliver the major, short-term emissions cuts that are needed.

Appendix B: Modelling assumptions

Provided separately.

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Creating a world fit for the future

Leicester Carbon Neutral Roadmap

Recommendations for achieving carbon neutrality

Report for Leicester City Council

Final report for Leicester City Council

ED15531 | Issue number 4 | Date 17/02/22

Ricardo Confidential

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Leicester City Council

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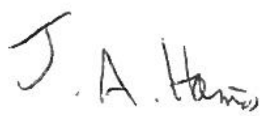

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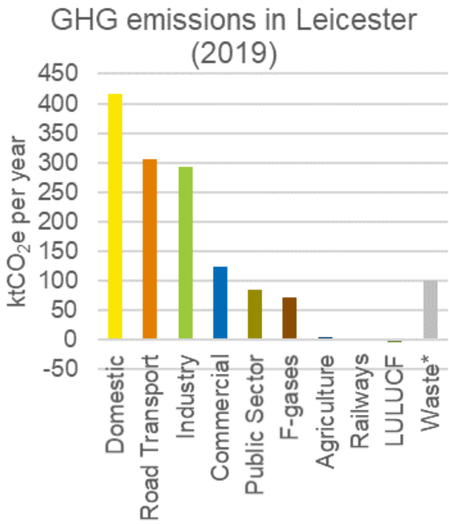
Executive summary



The scale and urgency of the challenge

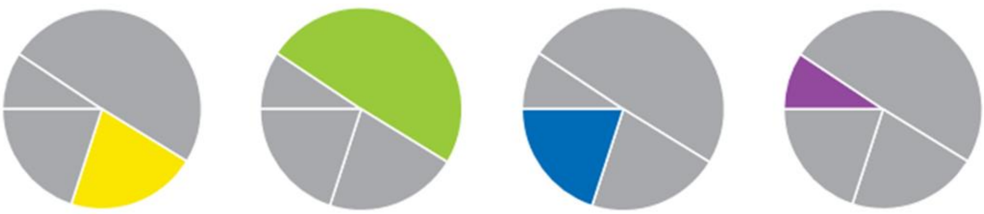
The need for climate action is clear and unequivocal. Leicester is in the vanguard of local authorities that are aspiring to achieve carbon neutrality before 2050, having set the ambition for the city to become carbon neutral by 2030 or sooner.

As of 2019, Leicester's total greenhouse gas (GHG) emissions were c. 1,300 ktCO_2e – having fallen by approximately 40% since 2005. Although this is a positive sign, if emissions continue at this rate, according to the Tyndall Centre for Climate Change, Leicester's entire 'Paris Agreement compliant' carbon budget for the next 80 years would be used up by the mid-2020s.[1]

Aiming for carbon neutrality by 2030 will require a step change in the mindset of the Council and other stakeholders, to an emergency footing more akin to the response to the Covid-19 pandemic, both in terms of scale and urgency. It will require carbon neutrality to be embedded in everything that the Council does, but more importantly, everyone in Leicester will need to engage with the process.

The pathway to carbon neutrality

Taking Leicester's baseline emissions as a starting point, in broad terms, the main priorities are:



Electricity Heat Cars & Vans … and everything else.

Leicester's strategic route to carbon neutrality:

Demand reduction

Minimising energy use and emissions at source

+

Electrification

Switching away from fossil fuels, towards renewable electricity – particularly for heat and transport

Recognising that there are limits to the scale of technological change that will take place between now and 2030, Leicester's strategic route to carbon neutrality will need to make use of existing, proven technologies.

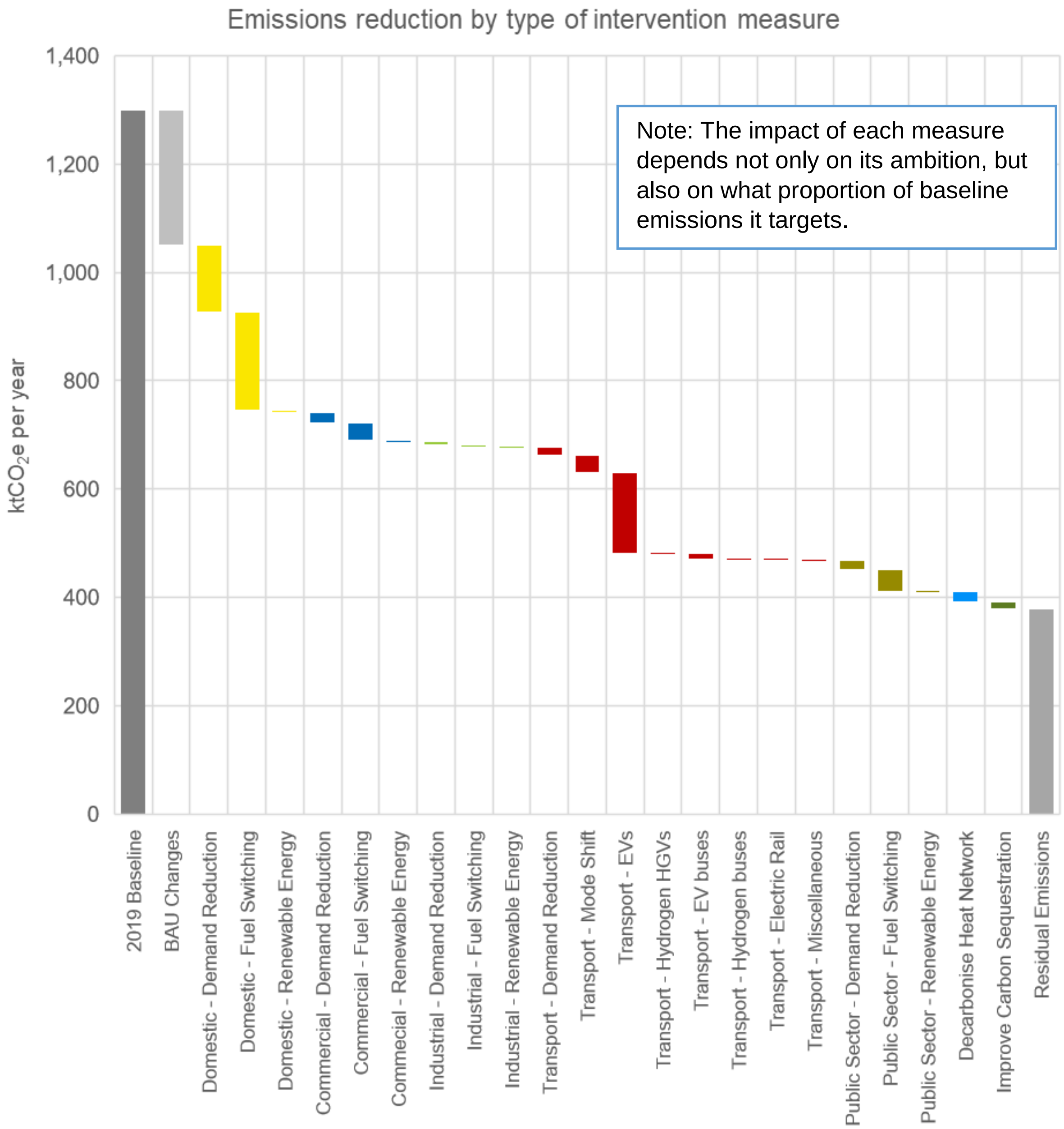
Because of that constraint, none of the scenarios modelled as part of this study reach zero emissions by 2030.

[1] This refers to the cumulative emissions that could occur in Leicester between now and 2100 if the City plays its part in helping the UK meet its commitments under the Paris Agreement. Source: Tyndall Centre for Climate Change Research

Impact of GHG reduction measures

The biggest carbon savings will come from efficiency improvements in buildings, switching from fossil fuel to electric heating systems, and roll-out of electric vehicles in transport. This will need to be facilitated by an upgrade to the electricity grid to accommodate the increased demand, and demand reduction measures to make the increase manageable.

Figure 1. Emissions reduction by type of intervention measure for Scenario 3

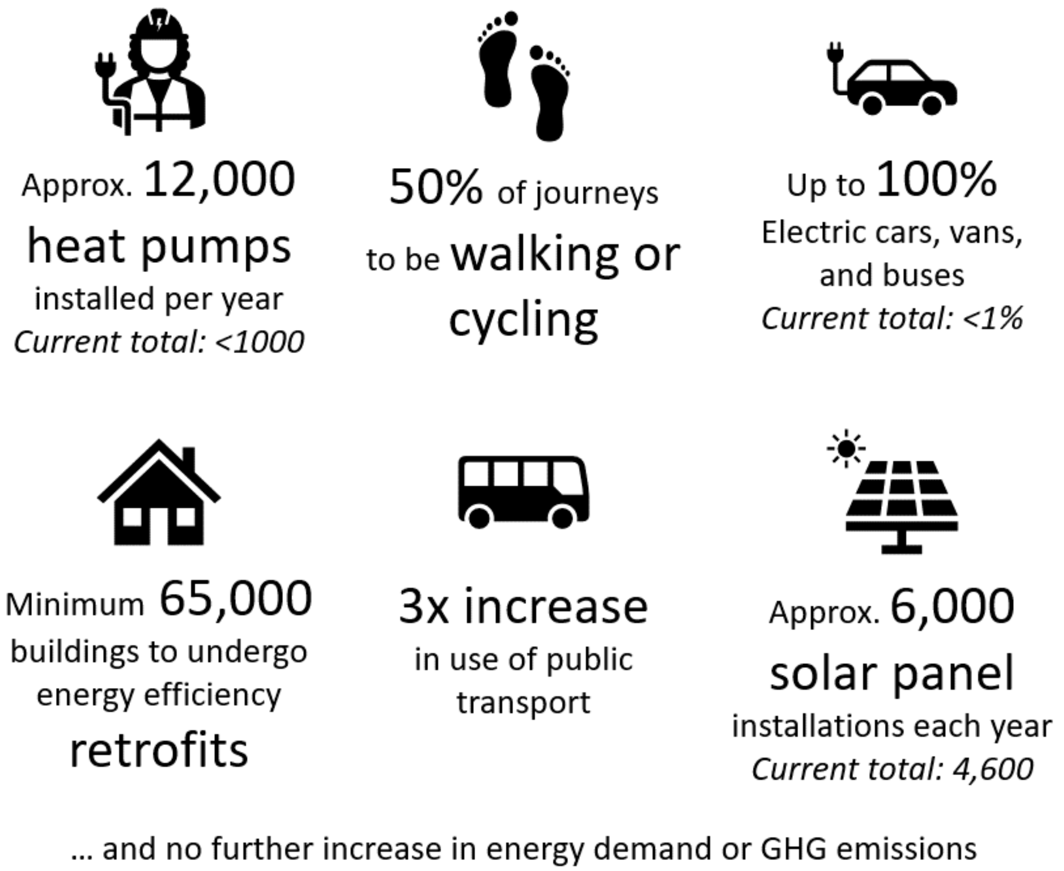


There are also several key strategic decisions that will need to be made in coming years, including the role of and approach to offsetting, the decarbonisation and expansion of the city centre district energy scheme and the approach to renewable energy generation (for example, whether to prioritise rooftop solar or large scale renewables outside of the city).

One of the most important findings from the carbon neutral pathways analysis is that in many cases, the same level of emissions reduction can be achieved through different combinations of demand reduction and electrification. However, this is not an excuse for complacency – if the electricity grid decarbonises more slowly than anticipated, there will need to be an even bigger push for demand reduction to make up the difference.

More broadly, demand reduction is also a 'common good' – with benefits that reach far beyond Leicester – because it minimises the quantity of finite resources, including materials, infrastructure, and renewable energy, that would be needed to meet demand.

The scale and pace of change needed to achieve this is significant. In the next 8 years, for Leicester to match the most ambitious scenario modelled would require measures such as:



Delivering carbon neutrality

The cost of delivering the intervention measures modelled as part of this study ranges from £950m to £5.3bn between now and 2030 (see the Evidence Report for further details of what this estimate includes).

Although these numbers are significant, the green economy offers huge opportunities for Leicester, including the potential for 5,000-10,000 jobs by 2030. According to the Climate Change Committee (CCC): *"The UK's low carbon economy could grow at around 11 per cent a year between 2015 and 2030, some four times faster than the average growth rate for the UK economy overall."*

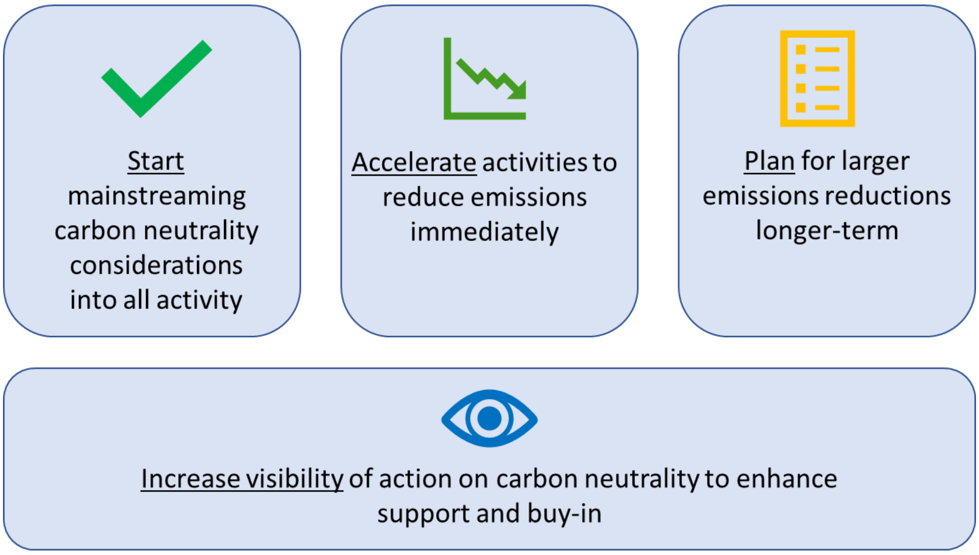
GHG reduction measures can also deliver a wide range of other environmental, social, and economic co-benefits, including but not limited to:

Table 1. Co-benefits associated with key climate mitigation measures

	Economy	Health	Society	Resilience	Resources
Retrofitting buildings	Creates jobs (construction, manufacturing installers, designers)	Reduced risk of cold, mouldy homes; improved thermal comfort	Can help to alleviate fuel poverty if done correctly	Housing stock less susceptible to weather extremes (cold or heatwaves)	Reduces the need for either demolition or new build
Active travel	Reduced congestion, fuel cost savings, increased property values	Physical and mental benefits of exercise, significant reduction in air and noise pollution	Facilitates access to jobs/services for residents with no car	Change to reclaim road space for social space and green space	Less demand for materials/ resources (fuel, motor vehicles) and infrastructure
Renewable energy	Generate revenue, e.g., through community-owned installations	Reduction in noise pollution, some reduction in air pollution	New employment opportunities	Diversified and localised renewable energy systems	Lower lifecycle carbon emissions than fossil-fuelled alternatives

Conclusions

Whilst there are a huge number of actions that will need to be taken to transition to carbon neutrality, they can be simplified into four main areas:



Emissions reductions need to accelerate over the very short term and planning needs to take place now for much greater cuts later in the decade. Everyone in Leicester will have a role to play, but the Council in particular has a strategic role in demonstrating leadership, driving change through its planning powers and facilitating collaboration with and action by others.

Table of Contents

1 Introduction and background

1.1 General introduction

The need for urgent action to reduce harmful greenhouse gas (GHG) emissions has never been clearer. The Glasgow Climate Pact, agreed at the COP26 climate conference in Scotland in November, resolved to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels. The Pact recognises that doing so would require a reduction in global GHG emissions of 45% below 2010 levels by 2030 and to net zero around 2050. It is positive that around 90% of global emissions are now covered by net zero targets[2], many of them for 2050. However, some countries will not be expected to reach net zero emissions until after 2050. It is therefore only right that more developed countries like the UK consider acting even faster. In this context, large numbers of local authorities in the UK have declared a climate emergency and some are aiming to reach net zero before 2050.

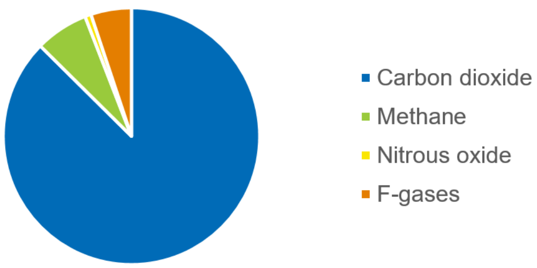
Leicester was one of these local authorities, declaring a climate emergency in February 2019[3] and setting an ambition to become a carbon neutral and climate adapted city by 2030 or sooner. This was followed by the Climate Emergency Strategy[4] published in October 2020. The latter sets out a high-level vision of what is needed to deliver carbon neutrality but does not quantify what needs to happen and how quickly. This roadmap builds on that strategy by providing a clearer idea of exactly what is needed to deliver carbon neutrality and who would need to do what to achieve it. The council also published a Climate Emergency Action Plan in October 2020, which sets out a raft of near-term actions to reduce GHG emissions across the city. The roadmap will be used to inform future updates of the action plan, to help ensure that the near-term actions are the right ones and are being done at the right pace to deliver carbon neutrality.

1.2 Definitions and scope

Carbon neutrality, also known as net zero, simply means achieving a balance between emissions of GHGs to the atmosphere and removals of carbon dioxide (the most widespread GHG) from the atmosphere, for example by nature-based solutions such as tree planting or by technological means such as carbon capture and storage. If the emissions and removals balance out, carbon neutrality has been achieved.

In addition to carbon dioxide, emissions include other GHGs, with the approximate breakdown shown below. Note that the methane emissions are almost entirely associated with waste, which is not included in the 1,300 ktCO_2e total because these occur outside of the area boundary.

Figure 2. GHG emissions in Leicester in 2019



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[2] https://climateactiontracker.org/publications/glasgows-2030-credibility-gap-net-zeros-lip-service-to-climate-action/
[3] https://cabinet.leicester.gov.uk/ieDecisionDetails.aspx?ID=1024
[4] https://www.leicester.gov.uk/media/dbxlmrxw/leicester-climate-emergency-full-strategy-2020-2023.pdf

This roadmap only covers emissions that occur within the geographic boundary of Leicester or are caused by energy used within Leicester, such as:

- Fuel combustion in cars, gas boilers, industrial processes, etc.
- Electricity consumption – although the emissions to generate the electricity largely take place outside of Leicester, they are considered part of the emissions baseline based on where the electricity is used
- Emissions from fluorinated gases (f-gases), which are primarily associated with refrigerants and cooling systems
- Emissions from land use, land use changes, agricultural activities, and so on – which are small compared with the overall total.

Emissions taking place outside of the city boundary, but which may be created by activity in Leicester, are not covered (with the exception of emissions caused by electricity generation at power stations), even though they are likely to represent a large portion, if not the majority, of total emissions. Examples include:

- Waste, which is managed outside of the area boundary
- Journeys or commutes taking place outside the city (by any travel mode)
- Production and transportation of goods purchased and consumed within Leicester.

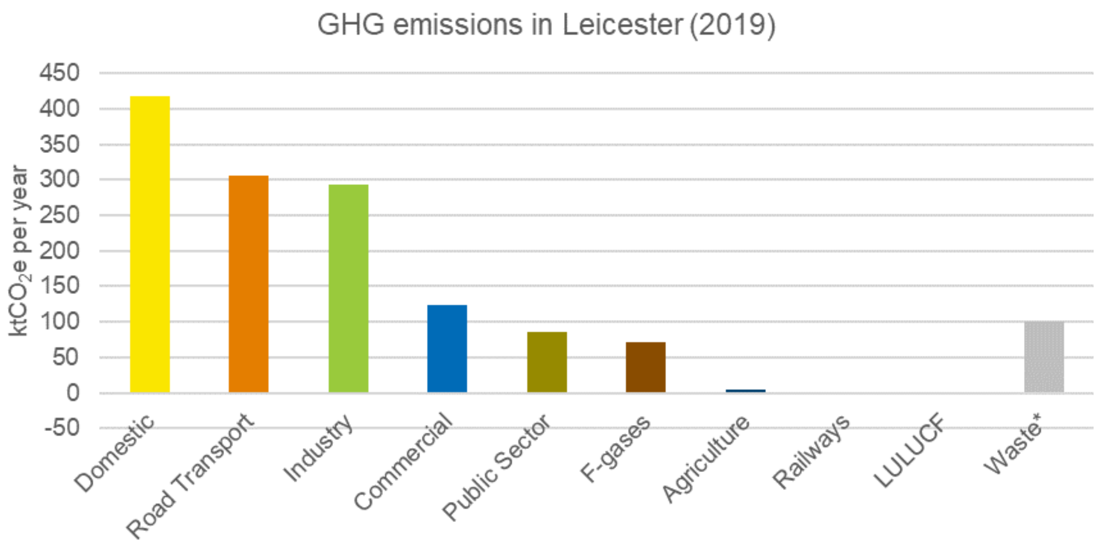
Tackling these sources of emissions is important but will be dealt with through other work streams.

On the other hand, whilst the scope of this work is the city itself, joined-up working will clearly be important to tackle the climate emergency, for example working with Leicestershire County Council and its district and borough councils.

2 Current sources of emissions in Leicester

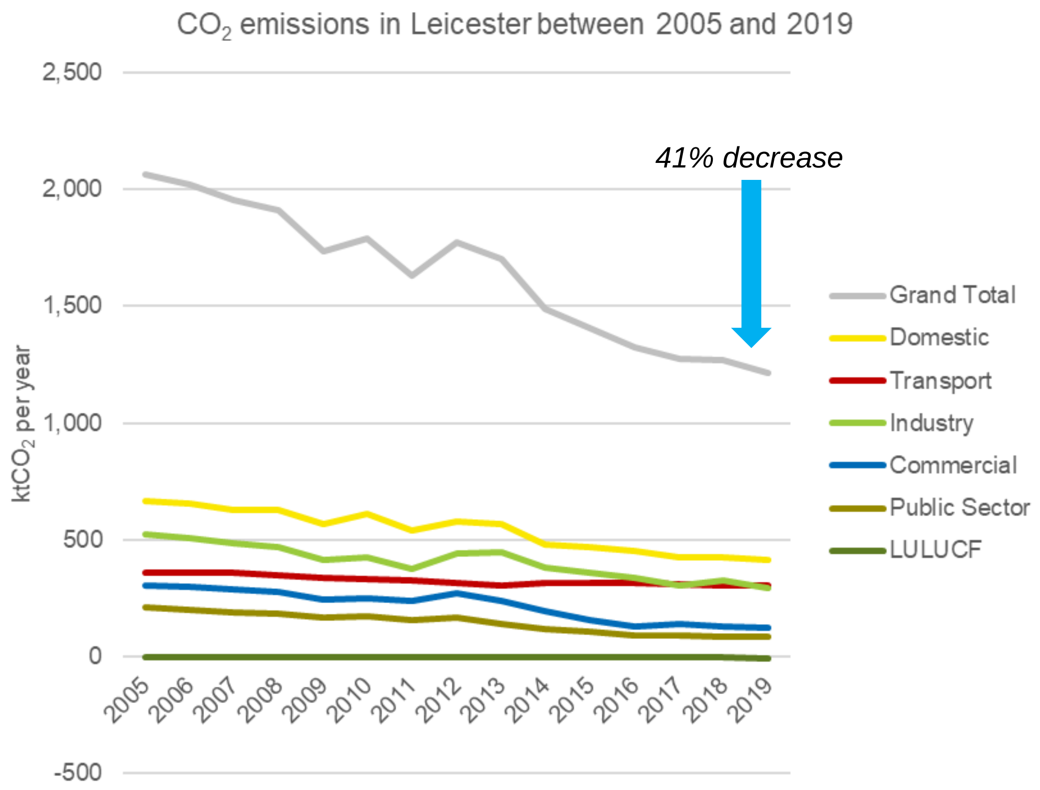
2.1 GHG emissions

An assessment has been made of overall GHG emissions in Leicester by using the UK Government statistics on local authority CO_2 emissions, and adding non-CO_2 emissions such as methane and nitrous oxide. Doing this shows overall GHG emissions in 2019 (the latest year for which there is data) to be approximately 1,300 ktCO_2e. This number does not include emissions from waste, but for context, these are estimated to be approximately 100 ktCO_2e per year.



** Waste is reported for information but is outside the scope of this Roadmap.*

CO_2 emissions in Leicester have fallen by 41% between 2005 and 2019, which is more than the national average. All sectors have seen steady reductions in CO_2 emissions apart from transport, which has broadly remained steady.

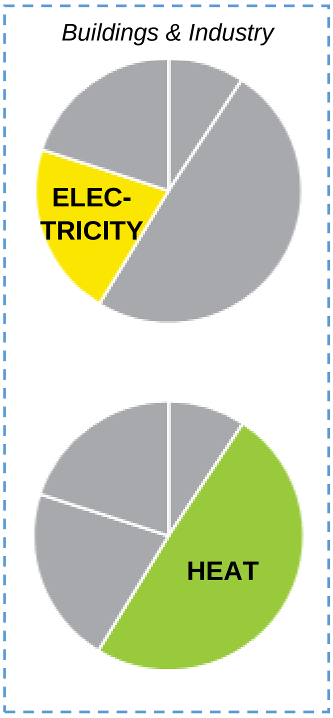


When interpreting trends in emissions, it is important to understand that:

- There have been decreases in energy use, but that is likely to be more influenced by economic trends than energy efficiency measures; and
- Most of the change in emissions is due to decarbonisation of the national electricity grid, which means that emissions have reduced even when electricity use remains the same.

Therefore, although the reduction in emissions is a good sign, if this trend is to continue/accelerate, much greater efforts will be needed – the remaining emissions are much harder to mitigate.

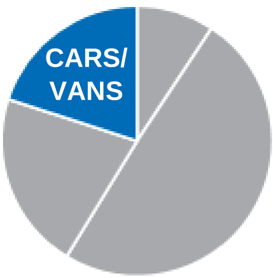
The emissions baseline immediately highlights some of the key challenges for Leicester. Heat and electricity use in buildings, plus emissions from cars and vans, together account for nearly 95% of Leicester's emissions, so these are the major areas requiring intervention.



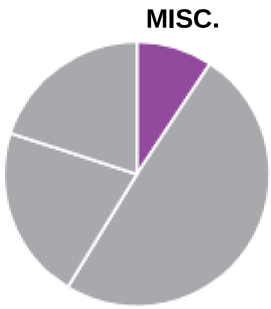
Electricity use in buildings accounts for roughly 21% of GHG emissions in Leicester. Electricity demand is expected to increase in future, so a major priority will be upgrading grid infrastructure.

However, given that electricity has decarbonised rapidly, and the Government has announced an ambition for the grid to be net zero by 2035, these emissions will decrease – to some extent – even if no further action is taken. Therefore, the main challenge for buildings will be addressing the use of fossil fuels to supply heat, which accounts for just under half of emissions.

Some of this heat is simply used to keep buildings at a comfortable temperature, so there needs to be a major push on replacing heating systems. This needs to be accompanied by high levels of retrofitting and behaviour change to reduce heat demand. However, some heat is used in industry-specific applications, such as manufacturing, where (a) there is less information about the processes using heat and (b) there might not yet be technological alternatives that can use renewable energy. These emissions (around 15% of the overall total for Leicester) might be hard to mitigate using current technologies.



Emissions from cars and vans account for around 20% of the total. The shift to EVs is already underway as the costs of battery technologies have come down, so this is likely to be primarily market-led. The challenges in Leicester will be to accelerate uptake and provide supporting infrastructure (charging points and renewable electricity). However, this will still not result in zero emission transport until electricity is fully decarbonised, so to address that risk while minimising impacts on infrastructure and resources, the city also needs to take radical steps to reduce demand for private car travel.



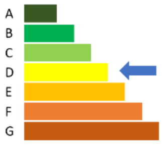
Most of the remaining GHG emissions will be hard to mitigate without technological advances or wider changes outside Leicester's control. For example:

• HGVs could run on biofuels or hydrogen, but renewable supplies of these fuels are very limited.
• Reducing f-gas emissions will rely primarily on the introduction of new cooling technologies and refrigerants.
• Emissions from railways are small, and electrification of the rail network requires major infrastructure projects beyond Leicester.

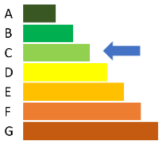
The GHG baseline therefore tells us that, in a best-case scenario, as of 2022 we only have solutions to address around 85-90% of Leicester's current emissions. To get to net zero, any residual emissions would need to be dealt with via some form of carbon removals or offsetting (discussed further in Section 3.3).

2.2 How is Leicester doing so far?

Housing



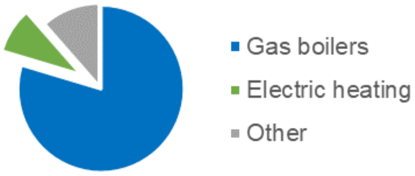
The energy efficiency of domestic buildings in Leicester is the same as the national average.



Council-owned housing in Leicester, however, is generally more energy efficient than the average.

On the plus side, this means that the Council has made some good progress – but the real challenge lies with improving the non-council housing stock.

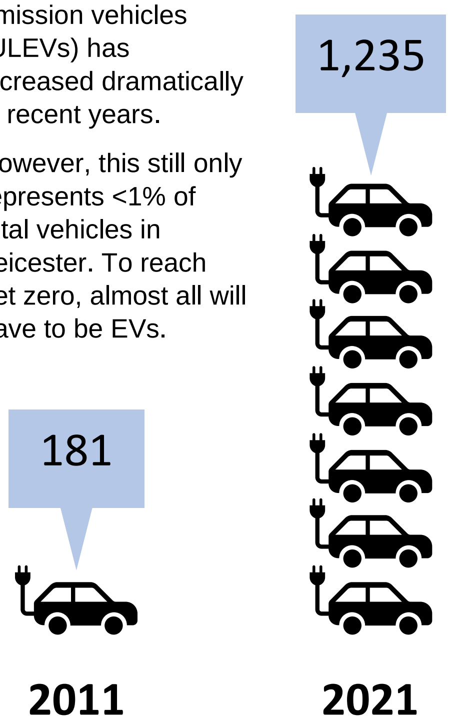
Furthermore, more than 80% of homes use fossil fuel heating systems – and all of them will need to be replaced.



Electric Vehicles

Uptake of ultra-low emission vehicles (ULEVs) has increased dramatically in recent years.

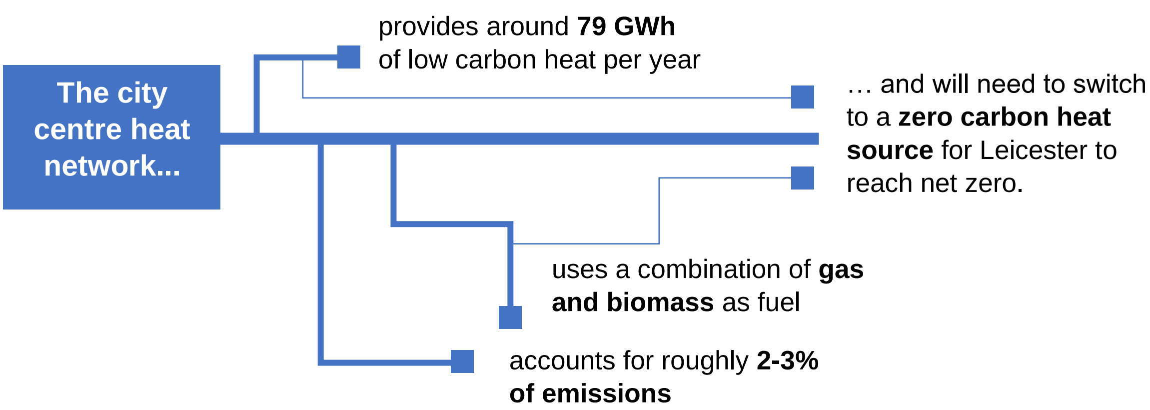
However, this still only represents <1% of total vehicles in Leicester. To reach net zero, almost all will have to be EVs.



Charging Infrastructure

Leicester has a relatively high number of EV charging points compared with most other UK local authorities, but when adjusted for population it is below average. The shift to EVs will only happen if there is adequate charging infrastructure to support them, so Leicester will need to both:

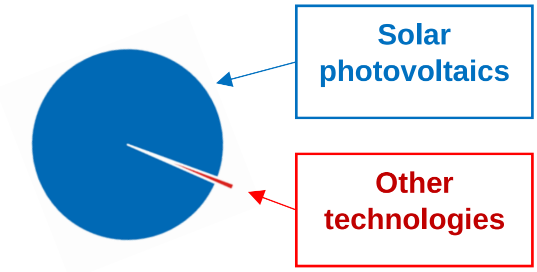
- **reduce demand for trips, particularly car and van journeys, and**
- **radically increase the number of charging points.**



Renewable electricity

As of 2019, there were **4,613** renewable electricity-producing installations in Leicester. Almost all are roof-mounted solar PV.

Collectively, these produce **30 GWh** of electricity per year, which is equivalent to **roughly 2%** of the city's electricity use.



Leicester will need to produce as much of its own renewable electricity as possible to mitigate against the possibility that the UK grid does not decarbonise sufficiently to reach net zero.

LCC has already taken significant steps towards reducing emissions, many of which are set out in the Climate Emergency Strategy and Action Plan 2020-2023. Some of the notable examples include:

- Proposing to introduce a Workplace Parking Levy and Local Transport Plan measures to generate funding for a dramatically enhanced electric bus network with integrated London-style ticketing, along with an expanded cycle route network
- Using money from the Salix Public Sector Decarbonisation Fund to deliver a programme of demand reduction and electrification measures in schools and corporate operational buildings
- Participating in the Green Homes Grants Local Authority Delivery programme which helps to improve the energy efficiency of homes for low income households
- Voluntarily setting a standard for all new council housing to be 'carbon neutral compatible', i.e. capable of operating with net zero emissions once the grid decarbonises, via high levels of energy efficiency and electric heating

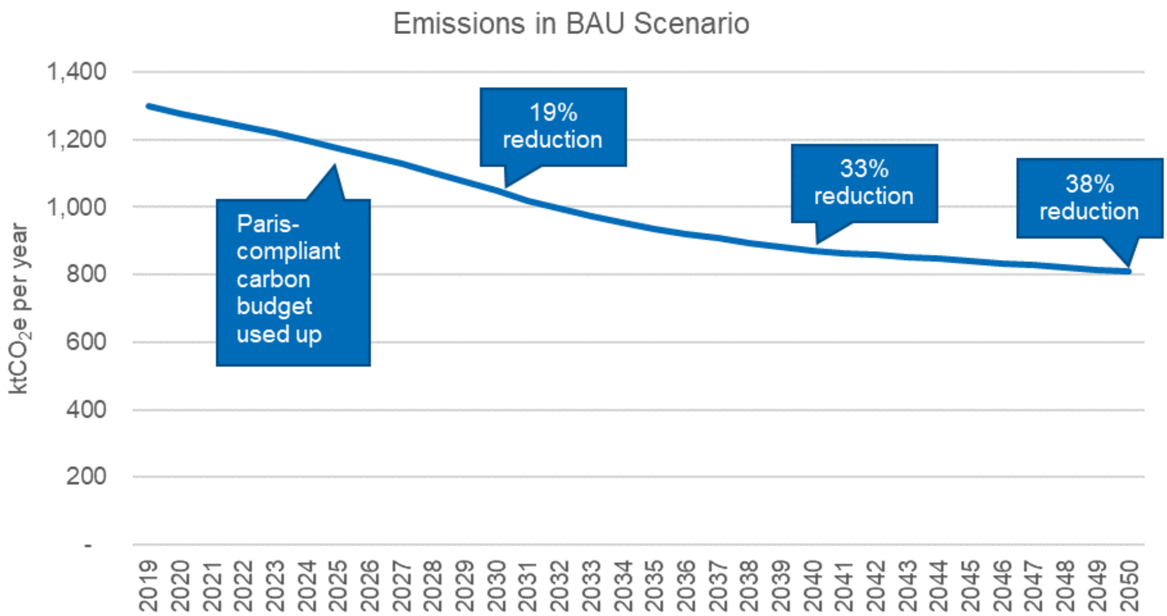
3 Potential future emissions pathways

3.1 The ‘Business as Usual’ scenario

This project used GHG scenario modelling to evaluate the impacts of changes the Government considers most likely to occur between now and 2050:

population growth	economic trends	national policy	technological changes

This is referred to as the ‘Business as Usual’ (BAU) scenario.



In the BAU scenario, although there are some changes in fuel consumption, the main driver of emissions reduction is due to electricity grid decarbonisation. It is clear that the 2030 ambition is not met – in fact, according to the CCC, the UK as a whole does not have sufficient policies in place to reach net zero by 2050.

This, combined with the fact that Leicester’s ambition is 20 years ahead of the national target, means that, like other local authorities have set ambitious decarbonisation goals, Leicester will face special challenges:

- There are fewer technological solutions available, so there is very little room to pick and choose measures. The focus has to be on reducing demand and making use of existing technologies.
- The scale and timing of changes must be vastly accelerated. There is probably no precedent in the UK for the type of transformative change that is required, other than COVID or wartime-era measures.

- For most of the priority interventions, there is currently little or no funding, and few levers of influence for the Council. Leicester will need to find innovative ways to effect change.

3.2 Carbon neutral scenarios

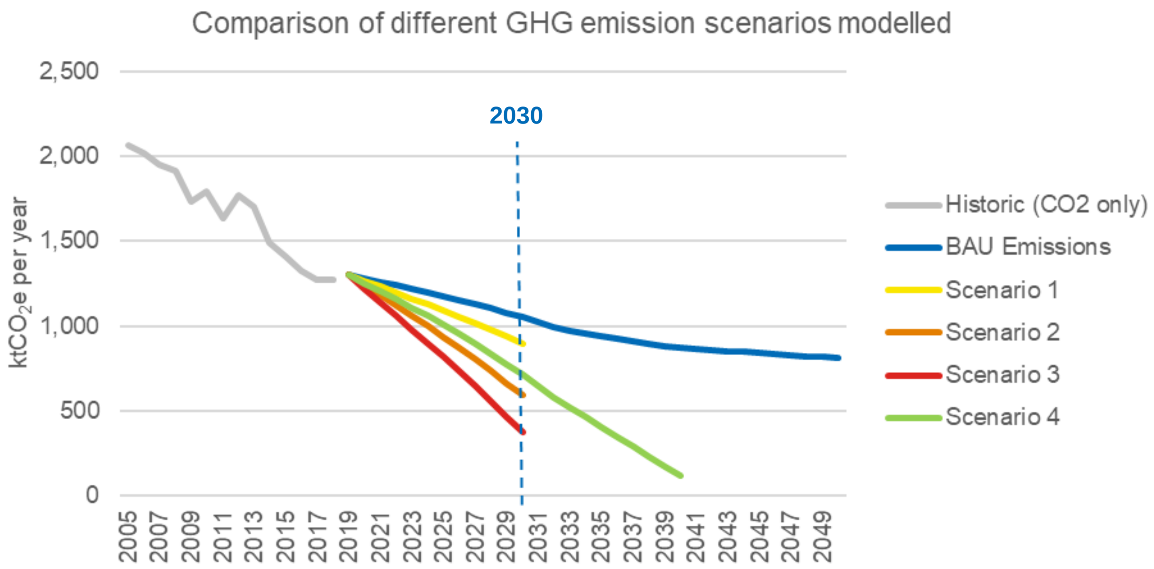
With the BAU as a starting point, additional mitigation measures were modelled to represent a series of alternative pathways with increasing levels of ambition.

Scenarios 1 and 2 are based in large part on the CCC's assumptions about changes in each sector that could happen in the coming decades. Scenario 1 reflects the level of change that would need to occur by 2030 for the UK to be broadly on track to reach net zero by 2050. Scenario 2 takes the major changes that could occur by 2050 under the CCC's assumptions, and brings them forward to 2030, 20 years ahead of schedule.

Scenario 3, meanwhile, is meant to represent a 'best case' scenario that pushes the boundaries of what is technically achievable. Of the scenarios modelled, Scenario 3 gets closest to net zero by 2030.

Scenario 4 sees broadly the same types of changes occurring as are modelled in Scenario 2, but they happen by 2040 instead of 2030. It also looks at the impacts of a few measures that are not likely to occur until the 2030s, namely the introduction of hydrogen for HGVs and certain industrial uses, plus decarbonisation of the city centre heat network.

Note: The emissions pathways are not predictions, but can be used to help identify key priorities, risks, and opportunities for Leicester, because they indicate the scale and direction of changes that each intervention could produce.

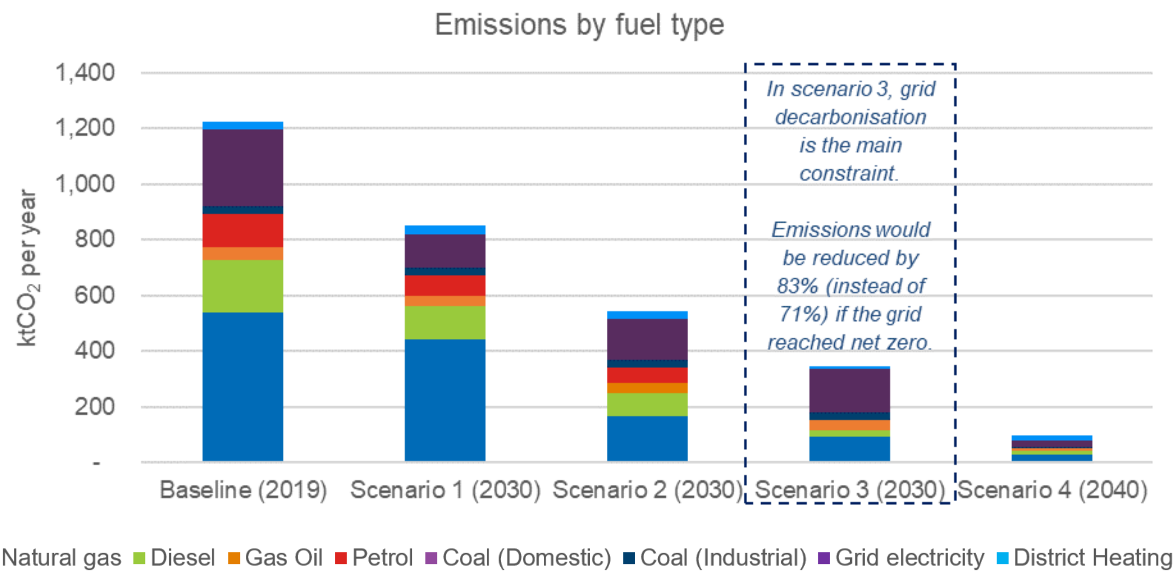


SCENARIO 1	SCENARIO 2	SCENARIO 3	SCENARIO 4
31% REDUCTION BY 2030	55% REDUCTION BY 2030	71% REDUCTION BY 2030	91% REDUCTION BY 2040

The headline finding is that none of the pathways reach zero emissions by 2030. All of them require some form of carbon offsetting or removals from outside the city boundary. This is due to two main factors:

1. As mentioned in Section 2.1, some sources of emissions are difficult or impossible to mitigate in this timeframe based on available technologies; and
2. The best option for decarbonising heat and transport is to switch to electricity, since this can be supplied with renewables – but the UK grid will not be zero carbon by 2030.

Scenario 3 is the pathway that Leicester should aspire to if the focus is on achieving carbon neutrality by 2030 with minimal residual emissions. It relies heavily on demand reduction and electrification.



3.3 Impacts of GHG mitigation measures

The table below shows the scale of emission reduction from each measure modelled in Scenario 3. It is important to understand that Scenario 3 is largely illustrative and, in some instances, represents the maximum theoretical changes that could occur. The numbers are helpful for understanding the *relative* scale of change, taking into account both the differences between measures/sectors as well as the other scenarios modelled.

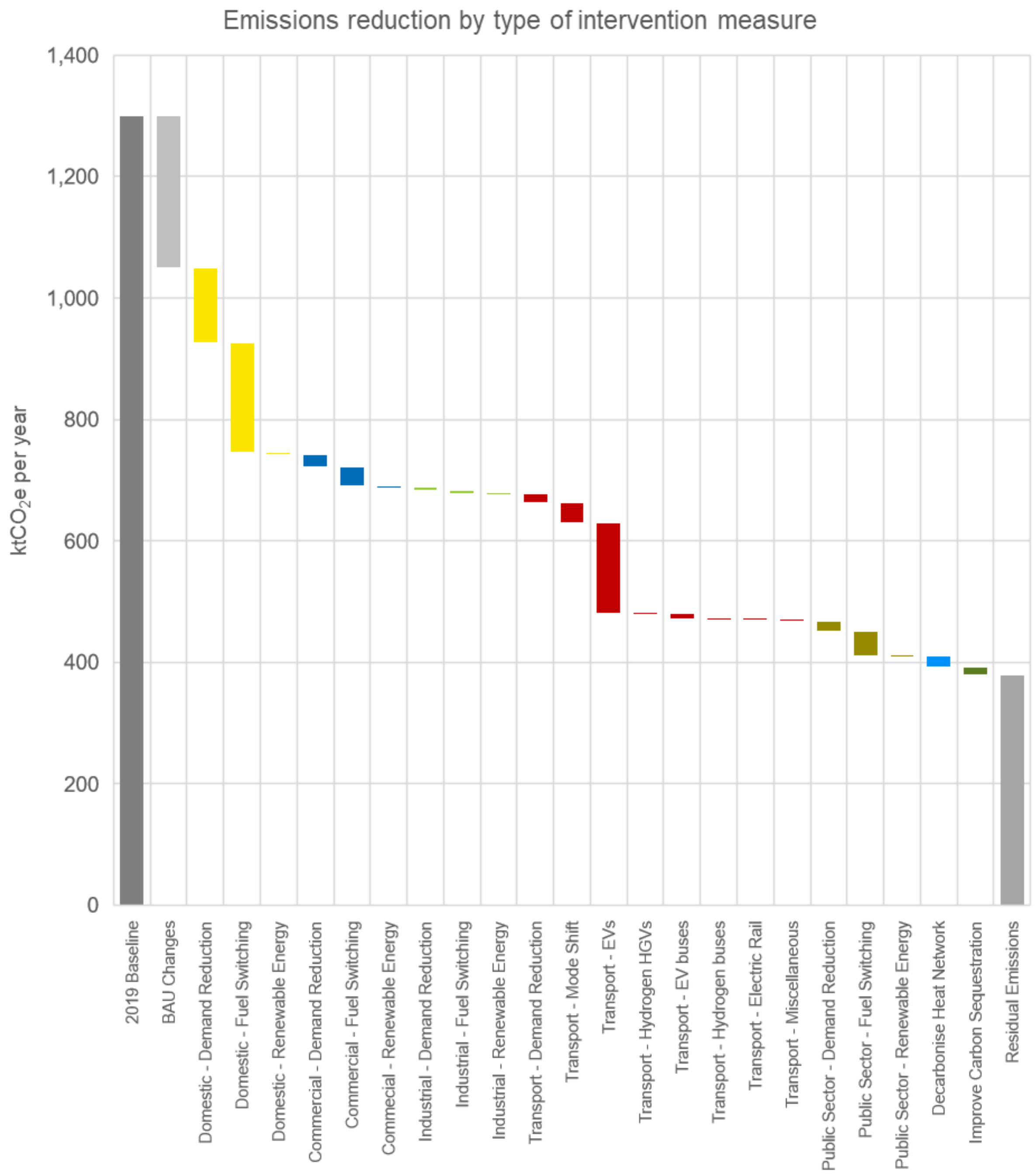
Also note that the impact of each measure depends not only on its ambition, but also on what proportion of baseline emissions it affects. Hence, reductions in the domestic sector are the largest because that is the single largest-emitting sector.

Values may not sum due to rounding.

Sector	**Mitigation measure**	**Potential impact on emissions for each…**	
		Measure	Sector
BAU	BAU Changes	-19%	-19%
Domestic	Domestic - Demand Reduction	-10%	-24%
	Domestic - Fuel Switching	-14%	
	Domestic - Renewable Energy	-0.4%	
Commercial	Commercial - Demand Reduction	-1.5%	-4%
	Commercial - Fuel Switching	-2.4%	
	Commercial - Renewable Energy	-0.1%	
Industrial	Industrial - Demand Reduction	-0.5%	-1%
	Industrial - Fuel Switching	-0.3%	
	Industrial - Renewable Energy	-0.04%	
Transport	Transport - Demand Reduction	-1.2%	-16%
	Transport - Mode Shift	-2.5%	
	Transport – EV cars and vans	-11%	
	Transport - Hydrogen HGVs	n/a	
	Transport - EV buses	-0.8%	
	Transport - Hydrogen buses	n/a	
	Transport - Electric Rail	n/a	

	Transport - Miscellaneous	-0.2%	
Public Sector	Public Sector - Demand Reduction	-1.3%	-4%
	Public Sector - Fuel Switching	-3.1%	
	Public Sector - Renewable Energy	*	
Heat Network	Decarbonise Heat Network	-1.4%	-1%
Land Use	Improve Carbon Sequestration	-1.0%	-1%

n/a = not modelled in Scenario 3; see Evidence Report for more details
** = included in the total for 'Commercial renewable electricity' due to estimation methodology*



In practical terms, achieving Scenario 3 would require actions across all sectors, with a level of ambition enough to achieve at least the following scale of changes:

In buildings:

- Making the building stock as efficient as possible, with at least half of all buildings (65,000) being retrofitted to a very high energy performance standard by 2030 – equating to roughly 7,000-8,000 retrofits each year, on average
- Decarbonising heat by installing an average of 11,000-12,000 heat pumps per year, switching the heat network from gas CHP and biomass to heat pumps, and ensuring all new buildings are electrically heated
- Switching to 100% LED lighting, compared with around 50% at present (estimated)

In the transport sector:

- Nearly 100% of cars, vans and buses being replaced with EVs by 2030. On average, that would involve replacing roughly 20,000 vehicles per year based on current numbers – however, measures should also be taken to reduce reliance on private vehicles which could reduce the number required.
- Achieving a 5% reduction in demand for transport through new ways of working and living (e.g. working from home and online shopping).
- An increase from 30% to 50% of all journeys being walking or cycling, in line with the ambition set out in the Government's road transport decarbonisation strategy.
- Shifting up to 10% of car journeys to public transport – this would more than triple the proportion of trips that are made by bus.
- A 10% reduction in emissions from commercial vehicles through consolidation and logistics.
- A further reduction in emissions from HGVs, from "eco driving" training and vehicle efficiency.

In the energy sector:

- Emissions from grid electricity dropping to less than half their current levels by 2030, which would require a massive increase in large-scale renewables across the UK
- Installing PV on roughly 40% of roofs, equivalent to 52,000 total or 5,800-6,500 annual installations – more than the current total of approximately 4,600

And furthermore:

- Using all available land within the city boundary to maximise carbon sequestration, potentially switching some agricultural land on the perimeter to woodland, and avoiding development on greenfield sites

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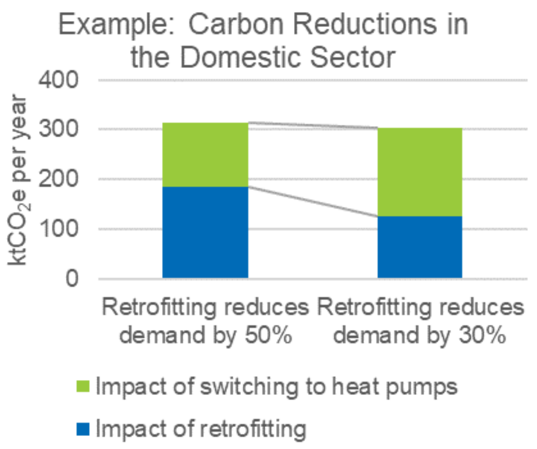
An important finding from the carbon neutral pathways analysis is that in some cases, the same level of emissions reduction can be achieved through different combinations of demand reduction and electrification. Therefore, it is not possible to say that a certain level of demand reduction ***must*** be achieved, either in buildings or transport.

However – if the electricity grid decarbonises more slowly than anticipated, there will need to be an even bigger push for demand reduction to make up the difference.

It is therefore crucial to prioritise demand reduction as the most certain way to reduce emissions by 2030 with the least reliance on grid decarbonisation.

More broadly, demand reduction is also a 'common good' – with benefits that reach far beyond Leicester – because it minimises the quantity of finite resources, including materials, infrastructure, and renewable energy, that would be needed to meet demand.



As mentioned previously, in order to reach net zero, any remaining emissions would need to be addressed through some form of carbon offsetting, comprising permanent removal of CO_2 from the atmosphere, even if that takes place outside Leicester. However, offsetting should be seen as a last resort for a variety of reasons, including the fact that it is open to criticism as potentially being a clever 'carbon accounting' mechanism that does not deliver real GHG reductions.

Even if, somehow, there were sufficient resources to purchase enough carbon offset credits for any residual emissions in Leicester by 2030, consideration needs to be given to whether it would be a worthwhile use of resources. Focusing on direct emission reductions would provide more immediate, realistic, local benefits. On the other hand, this would almost certainly put the 2030 ambition out of reach, unless there is a major shift in UK government policy, funding, and implementation, and/or technological breakthroughs.

KEY STRATEGIC DECISION:

Decide whether to put effort and resources towards offsetting the residual emissions, or whether to focus on emissions reductions within the City itself (which would almost certainly make reaching net zero by 2030 impossible).

4 The carbon neutral roadmap

This section looks at major sources of emissions in turn and considers:

- What the main mitigation priorities are
- Key sectoral changes that need to occur
- Risks, barriers, and opportunities

4.1 Buildings

To achieve carbon neutrality in Leicester, CO_2 emissions from all buildings (domestic and non-domestic) will need to be reduced to zero. There are three sectoral goals to achieve this – decarbonising heat, reducing energy demand, and contributing to decarbonising electricity.

Headline messages for achieving zero carbon buildings in Leicester

Priorities for:
Zero carbon buildings

Reduced energy demand	**Decarbonised heat supply**	**Decarbonised electricity**
Energy efficiency on its own will not reduce GHG emissions to zero, but *will* make it much easier to achieve. Retrofitting is a crucial prerequisite for heat decarbonisation, from both a cost and practicality standpoint.	The biggest challenge in buildings is to decarbonise the heating supply. This will require a massive scale effort to switch from fossil fuels to low carbon heating systems. Heat pumps will be the primary measure for doing this.	Leicester's constrained area means that it is not practical for the city to produce all its own electricity, but uptake of local renewable energy generation (e.g. rooftop solar) should still be promoted.

Together, these measures reduce emissions by up to 35% in Scenario 3

4.1.1 Reducing energy demand

Behavioural change represents important easy wins to take advantage of and to support immediate emissions reductions. However, evidence to date suggests that it would only have a limited impact on overall emissions. Reduced energy demand therefore needs to be driven more by improved thermal efficiency of buildings.

Such efficiency measures are generally more cost-effective than heat decarbonisation measures and are also needed to enable heat pump uptake (as heat pumps only operate effectively in well-insulated buildings). They are also likely to benefit households, especially fuel poor low-income ones, by reducing fuel bills and increasing levels of comfort.

It is not possible to insulate your way to carbon neutrality – but energy efficiency is a key prerequisite for other necessary changes.

It therefore would make sense to push particularly hard on thermal efficiency in the next few years, with a more concerted push on heat decarbonisation (see below) in the latter half of the decade.

Opportunities should be sought to implement whole house retrofits that cover both thermal efficiency and heat decarbonisation measures, to minimise upheaval for residents and businesses, and avoid a situation where occupants are too worried about energy bills to make a switch to electric heat pumps.

4.1.2 Heat decarbonisation

The focus for heat decarbonisation will need to be on heat pumps, in particular in existing buildings. Whilst numbers of installations are only likely to ramp up later in the decade, action is still needed in the next few years. Firstly, it is suggested that the installation of heat pumps in coming years be driven by a small number of stakeholders that have significant property portfolios, for example the Council, social housing providers and key commercial landlords.

Alongside this, the Council should work with other relevant stakeholders to plan now for greater levels of low carbon heat uptake in later years, by addressing skills gaps to make sure there are enough qualified installers (e.g. working with schools and colleges) and scoping innovative financing options.

Given that the average lifespan of a boiler is 15 years, reaching carbon neutrality by 2030 would require some systems to be replaced before the end of their natural life.

Hydrogen is not expected to play a significant role in heating buildings – there will be limited supply of renewable hydrogen by 2030 and it will be needed to tackle emissions from other sectors that are less able to switch to electricity (e.g., some heavy industry and HGVs). Furthermore, the Government will only take a decision in 2026 on the future role of hydrogen in heating, leaving little time for it to have an impact on emissions in Leicester by 2030.

District heating, which accounts for 2-3% of current emissions, is only compatible with carbon neutrality if the heat comes from renewable sources. But any expansion of the existing network and switching to low carbon sources is only likely to happen after 2030. If the heat network is not expanded or switched to a low carbon heat source, these will form part of the residual emissions that would need to be offset in order to meet the ambition.

KEY STRATEGIC DECISION:

Decide what the role of district heating will be in the route to carbon neutrality, and whether it is worth expanding, given that it is unlikely that the heat network can decarbonise by 2030.

4.1.3 Decarbonised electricity – within Leicester

Although it is not necessary for each local authority area to meet all of its own electricity needs via technologies that are installed within the local authority boundary, supporting increased local renewable energy generation is important for many reasons:

- Reducing reliance on grid electricity will reduce the emissions associated with electricity use
- As a way for Leicester to play its part in the energy transition
- Helps to ensure a diverse energy supply which contributes to resilience
- Protects against rising energy prices
- In addition, making use of existing infrastructure (i.e., building roofs) reduces the land take from installing renewables elsewhere

As the grid decarbonises, the carbon savings from local renewables will decrease, since they are calculated based on the amount of grid electricity that they offset. Given Leicester's urban environment, the main opportunity is for increased installation of rooftop solar on buildings, which reduces emissions by around 0.5% in Scenario 3.

Large industrial roofs in particular offer a significant surface area for solar power generation, and some new developments (if designed correctly) could get most or all of their energy from PV.

As this is not a critical element of achieving carbon neutrality in Leicester, it could be decided to focus more on thermal efficiency and heat decarbonisation in buildings and carry out less resource intensive activities to help encourage some uptake of rooftop solar, for example ensuring informational materials are available for those that may wish to install.

On the other hand, local renewable energy can help residents and businesses save on energy bills, help form part of a diverse renewable power system, and helps reduce reliance on national-level grid decarbonisation. Moreover, given the challenge of reaching carbon neutrality and lack of land for other types of large-scale renewables, it should not be overlooked as an opportunity.

Another key consideration is whether resources should go towards roof-mounted PV, when onshore wind and PV farms are much more cost-effective; see Section 4.3.2 for details.

4.1.4 Uncertainties, constraints, barriers, risks and opportunities

Potential challenges or opportunities	Potential responses
Uncertainties: • Price of heat pumps is expected to come down and could even become price comparable with boilers – but how quickly? • Minimal national policy framework for driving heat pump uptake • Lack of information on industrial uses of heat and whether/when technological alternatives will become available	Work to make sure that available funding (heat pumps grant) is targeted at properties that are best suited for heat pumps Engage with businesses to understand more about energy end uses and identify industry-specific mitigation measures
Constraints/barriers/risks: • As heat pumps only work effectively in well-insulated buildings, if an insulation programme is not rolled out quickly then this could become a constraint to heat pump uptake • Potential to increase heating bills, if not done at the same time as energy efficiency measures • Lack of trained workforce to specify, install, and maintain the systems • Public perception could be damaged due to early examples of poorly installed or wrongly specified heat pumps • Lack of tried-and-tested local policy mechanisms or incentives for driving uptake • District heat network could be expanded but may not deliver substantial emissions savings in 2030 timeframe	Pilot projects to demonstrate best practice for retrofitting and heat pumps, to build up local supply chains and skilled trades An early decision will be needed on the role that expanding the heat network, and switching to low carbon sources, should play in achieving carbon neutrality in Leicester
Opportunities: • There is already an established heat network with potential to expand, which could help to switch more buildings to low carbon heat all at once	LCC can make immediate use of available studies that have already looked at options for decarbonising the heat network

4.2 Transport

To achieve carbon neutrality in Leicester, CO_2 emissions from transport will need to be reduced to zero. There are three sectoral goals to achieve this: reducing demand for trips (especially car use), moving to a zero-emission fleet, and encouraging more efficient freight.

Headline messages for achieving zero carbon transport in Leicester

Priorities for: Zero carbon transport

Reducing travel demand	Zero emission fleet	More efficient freight
To reduce the need for new infrastructure, it will be crucial to maximise opportunities to avoid journeys altogether, and shift remaining journeys towards walking, cycling and public transport.	The biggest GHG reduction in transport comes from switching to EVs. The shift will be primarily market-led, but will not be complete by 2030. Realistically, the focus will be on facilitating and incentivising uptake.	For technological reasons, zero emission HGVs are not likely to be widely in use by 2030, so the focus needs to be on demand reduction, journey consolidation, engine efficiency, and driver training.

Together, these measures reduce emissions by up to 16% in Scenario 3

4.2.1 Reducing demand for travel, and especially car usage

Leicester should aim to push as hard as possible on minimising the need to travel. Given that a very significant proportion of emissions comes from the use of private cars, this should be a particular area of focus. This is crucial for reducing emissions from transport, given that it is unlikely that the entire vehicle fleet will switch to being electric by 2030.

As a compact urban area, Leicester has an opportunity to strongly promote non-car options, i.e., walking, cycling and public transport. The Local Plan can be used to encourage a ‘15 minute city’ approach which would ensure that would facilitate this. LCC can further support digital access to services and raise awareness among businesses and employers about the need to reduce trips. Doing so, building on many of the good initiatives already being taken, will help manage the impact on the grid of increased demand for electricity, as well as having numerous other benefits, such as reduced air pollution, improved health, better safety, reduced congestion and so on.

Previous initiatives have had a strong focus on air quality impacts.

Going forward, transport planning, strategies and funding all need to be re-focused to aim for carbon neutrality.

However, reaching carbon neutrality will require more than the "typical" measures that local authorities generally use to manage transport demand. The most certain way of reducing emissions from transport, recognising that LCC has relatively little control over private vehicle purchases, is to minimise demand for trips. LCC should consider further constraints on car and van travel/access, but it is acknowledged that these would be very controversial.

The Council should therefore use all its powers within the Local Transport Plan and in its role as a Local Planning Authority to ensure that walking, cycling, and public transport are the preferred modes for journeys and actively disincentivise unsustainable alternatives. The Council is already planning to introduce a Workplace Parking Levy, which is one option for rebalancing the relative attractiveness of private car travel. According to LCC estimates, the WPL could bring in £450 million to invest over 10 years (including the matched funding it could attract), which is more in line with the scale of investment required to deliver on the Council's ambition. Another example of the types of measures within the Council's remit would be establishing a Clean Air Zone.[5]

Major investments will be needed in order to reconfigure the public realm and transport network to prioritise sustainable travel. Road space that is reclaimed from cars can be used to provide high-quality walking, cycling and bus routes. An example of this already exists in Leicester, where a car park has been converted into a new public social space, Jubilee Square, as part of the Mayor's Connecting Leicester programme. Such interventions would also fundamentally change the look and feel of the city. In addition to the GHG and air quality benefits, doing so will also benefit the c. 40% of the population in Leicester who do not have a car or cannot afford an EV – but there will also be potential economic implications that need to be explored in consultation with local residents and businesses.

4.2.2 Zero emission vehicles

Although as much emissions reduction as possible will need to be achieved by reducing car travel (for the reasons explained above), switching to electric vehicles will have an even larger impact – and both are necessary to reach net zero.

Shifting the entire passenger car fleet to electric will be extremely challenging as it would mean effectively phasing out sales of new petrol and diesel cars immediately – and even then, scrapping some cars early. LCC has very little influence over private purchases of EVs and the carbon intensity of the electricity grid, but *can* take steps to facilitate and incentivise uptake, such as:

- Physical infrastructure – making charging facilities more easily available (including by using planning powers to make sure charging points are provided) and co-locating these with renewables where possible (e.g., PV with battery storage on car parks)
- Other incentives – such as preferential parking charges, perks for employees or preferential access
- Providing or signposting information about the benefits of EVs and showcasing them in the Council's own vehicle fleet

[5] It is understood that this was being considered until recently (2021) to meet air quality regulations, but that Leicester has now come in line with these regulations; however, those same powers can be used to lower carbon emissions from transport.

Transport infrastructure: How much is enough?

The provision of charging points (particularly in new housing) needs to carefully weigh up how much power would be needed in a carbon neutral future where most journeys happen on foot, cycle, or public transport.

The bus fleet will need to be fully zero carbon by 2030. Leicester has funding to electrify part of the bus fleet and are hoping for more funding for a 100% electric fleet by 2030. However, the network must also be expanded to enable modal shift, so additional funding will be required.

Any road improvement projects need to assess whether the project would be necessary if demand reduction measures have been fully implemented. They should also consider the embodied carbon of the materials and construction process.

4.2.3 More efficient freight

Based on current technologies, electric vehicles (EVs) are likely to be the first choice for cars, vans, and most other vehicles – with the exception of heavy goods vehicles (HGVs), which are more likely to run on biofuels or hydrogen. This is due to a range of issues, notably the challenge of developing batteries that can cope with the vehicles' weight and range requirements. Since renewable biofuels and hydrogen are not currently widely available, it is very likely that some residual emissions will remain for HGVs by 2030 – so this is one of the few areas where some form of offsetting or carbon removal would need to be considered to reach net zero by 2030.

Options for addressing freight emissions will therefore rely more on incremental efficiency improvements in the vehicle technologies, along with changes in logistics, driver training, and so on. There is also the potential to consider freight consolidation centres, provided that the risk of induced demand was carefully managed. This would need to be done in close collaboration with local businesses. Case study evidence suggests that combinations of these measures can reduce fuel use and emissions by more than 15%. The UK government has previously announced its support for a voluntary industry-wide target of achieving this reduction by 2025 (compared with 2015 levels).

4.2.4 Uncertainties, constraints, barriers, risks and opportunities

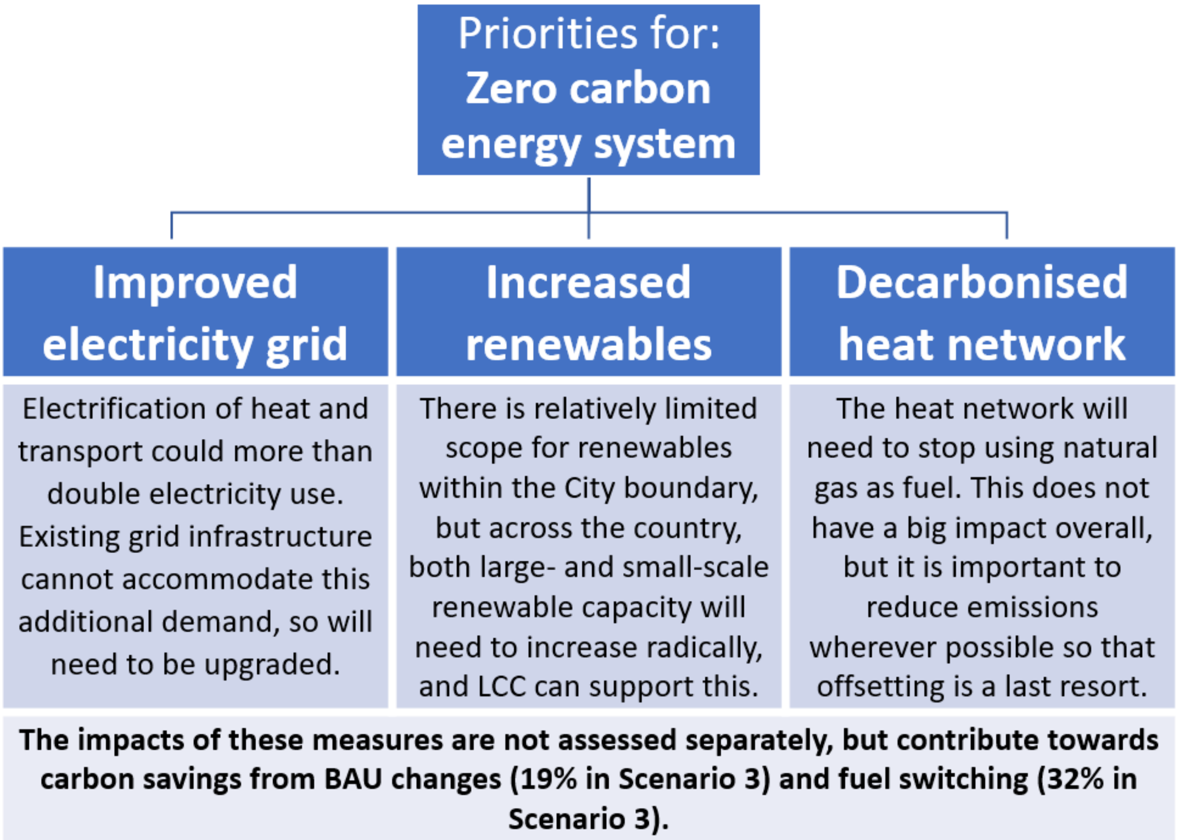
Potential challenges or opportunities	Potential responses
Uncertainties: • Ongoing impact of Covid-19 and the potential impact on travel choices – could support low carbon objectives (such as greater levels of working from home) or work against them (for example, reduced appetite for shared public transport)	Seek to understand the beneficial travel reductions from COVID while addressing issues such as reluctance to use public transport
Constraints/barriers/risks: • Potential unpopularity of measures to limit car usage • Cost differential of electric cars putting them out of reach for parts of the population of Leicester • National framework for low carbon vehicles not sufficiently ambitious (phasing out petrol and diesel vehicles by 2030)	To ensure buy-in, need to develop a public and business engagement programme that highlights the co-benefits of modal shift Businesses may need support for switching to electric cargo bikes or vans, for example capitalising on funding such as the Government's plug-in grant

Opportunities: • Due to compact urban nature of the city, more scope than some local authorities to maximise transport demand reduction and modal shift • Synergies between carbon neutrality measures and wider public benefits, such as health, cleaner air, road safety, etc.	Ensure clear links between the climate emergency, air quality, public health, and road safety agendas Coordinate with other cities that have delivered, or are delivering, large-scale modal shift programmes, to learn lessons and share best practice

4.3 Energy system

Decarbonisation and reinforcement of the wider energy system are needed to support the implementation of other measures in the buildings and transport sectors.

Headline messages for achieving zero carbon energy systems in Leicester



4.3.1 Improved electricity grid

Upgrading grid infrastructure is potentially the most important enabling activity for Leicester, given that the strategic pathway to reach carbon neutrality by 2030 relies on high levels of electrification. The other most important actions all relate to demand reduction (see previous sections), which is crucial for mitigating pressure on the grid.

LCC and other stakeholders will need to collaboratively push for an accelerated upgrade programme for the distribution network. This will require engagement with Western Power Distribution (WPD), the National Grid and Ofgem to ensure that they plan, design, and approve investment plans. In the meantime, ongoing/upcoming local improvement work and maintenance should consider future energy demands and futureproofing as much as possible – recognising that the current grid cannot support the scale of future electricity demand (which could more than double).

Where relevant, LCC should also seek to support and facilitate grid balancing projects such as renewable energy storage, vehicle-to-grid technologies and demand flexibility services.

Why the focus on electrification?

At present, electricity is the most readily available source of energy that can be made using renewable technologies. There are several other fuels that could potentially be zero carbon, including hydrogen gas and biofuels, but those rely on technological developments that are uncertain within the timescale to 2030 or even 2040.

Hydrogen in particular has been cited by the Government as a potential solution, particularly for applications that cannot use electricity.

What is the likely role for hydrogen in Leicester?

Hydrogen gas can be made using a variety of techniques. When made using renewable electricity, it is known as 'green hydrogen', and offers a low emission alternative to burning fossil fuels. Green hydrogen could help us to heat buildings, power HGVs, or be used in manufacturing and industry. 'Blue hydrogen' is derived from natural gas, but still emits CO_2, meaning that it will not offer a zero carbon energy source until and unless carbon capture and storage technologies become commercially available.

It is unclear when green hydrogen will become widely available, but the CCC does not expect this to happen by 2030. Therefore, it does not provide a viable option for Leicester to meet its carbon neutral ambition.

To the extent that hydrogen is considered as a solution, it will need to be reserved as an option for applications where electrification is not possible. This is likely to be limited to HGVs and certain energy-intensive industries such as steel, glass, brickworks, cement, from the 2030s onwards.

KEY STRATEGIC DECISION:

Decide to what extent the city wishes to invest in continuing to upgrade the gas grid, given that it will be necessary to phase out fossil fuels.

This is subject to a decision first being made on the role of hydrogen, which could potentially utilise the existing gas grid.

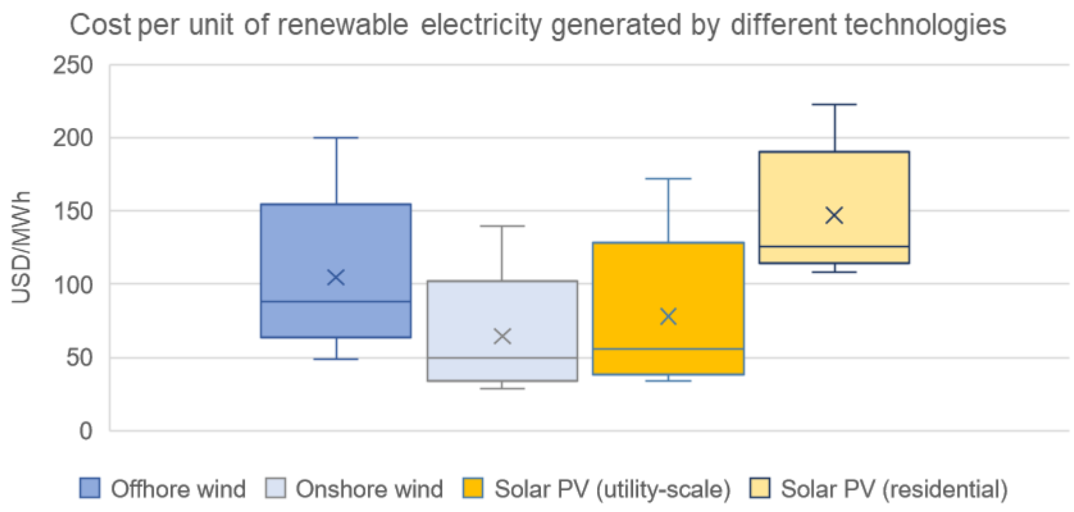
The Government has announced that they will decide on the role of hydrogen to heat buildings in/around 2026, so it may be necessary to wait until the national picture is clearer.

4.3.2 Decarbonised electricity – beyond Leicester

Without grid decarbonisation, emissions in Scenario 3 would drop by -56% (instead of -71%) and emissions in Scenario 4 would drop by -56% (instead of -91%).

If, theoretically, all buildings and vehicles switched to electricity, and the infrastructure could support this, then the carbon emissions from grid electricity would be the biggest constraint on achieving carbon neutrality. Grid electricity is not expected to be zero carbon by 2030 – the Government has recently announced an ambition for this to happen by 2035 – so Leicester will need to 'do its part' to accelerate this shift.

As mentioned previously, although the main opportunity within Leicester is roof-mounted PV, currently the cheapest option (in terms of £ invested per unit of electricity produced) is large-scale onshore wind, followed by ground-mounted solar, which would need to be located outside the City boundary.



Source: IEA[6]

KEY STRATEGIC DECISION:

If there are limited resources available to deliver or promote renewable energy projects, decide on the balance between focusing resources on renewables within Leicester or outside of the City. Onshore wind and large-scale PV are the cheapest options, although they have a larger impact on the landscape. This would require cooperation with the County Council and neighbouring local authorities.

Subject to the outcome of that decision, the main areas of focus are likely to include:

- Lobbying Government for more funding/subsidies, changes to planning law and energy regulations, and more legal powers to deliver local renewable energy systems; and
- LCC and relevant local stakeholders coordinating with the County Council and other local authorities to plan for large-scale renewable installations, including PV and wind.

At a local level, businesses, households, public and voluntary sector organisations can also help to stimulate demand for renewables by selecting 100% renewable tariffs and engaging with peak demand reduction initiatives. Again, these have not been modelled as separate mitigation measures and the impacts cannot be directly linked to emissions in Leicester, but they represent ways that people and organisations in Leicester can help to promote grid decarbonisation.

4.3.3 Decarbonised heat network

The existing heat network in Leicester is estimated to account for around 2-3% of annual emissions. It is currently partly served by gas boilers, which (along with all other fossil fuel heating systems) would need to be replaced with an alternative technology in order to reach net zero by 2030. It is understood that there are ongoing conversations between LCC and the operator; although it does not represent a large portion of total emissions, as stated previously there is no scope for picking and choosing when it comes to net zero. Therefore, LCC should continue to engage in finding an appropriate solution, bearing in mind both the technical and practical constraints.

Note: Due to the global warming potential (GWP) of refrigerants, it is important that any large scale heat pump system (like those that would be suitable for use in the heat network) use low-GWP refrigerants, and also include refrigerant leakage alarms and other leakage prevention measures. This issue applies to all heat pumps but is particularly important for large-scale systems.

[6] Projected Costs of Generating Electricity 2020 – Analysis - IEA

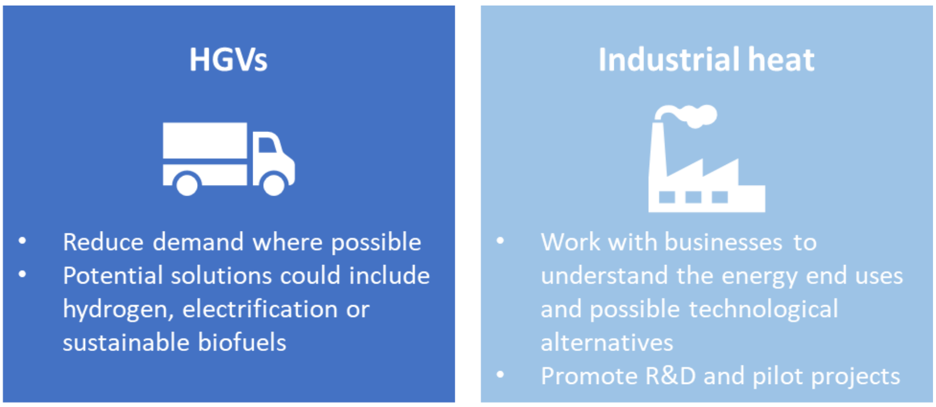
4.3.4 Uncertainties, constraints, barriers, risks and opportunities

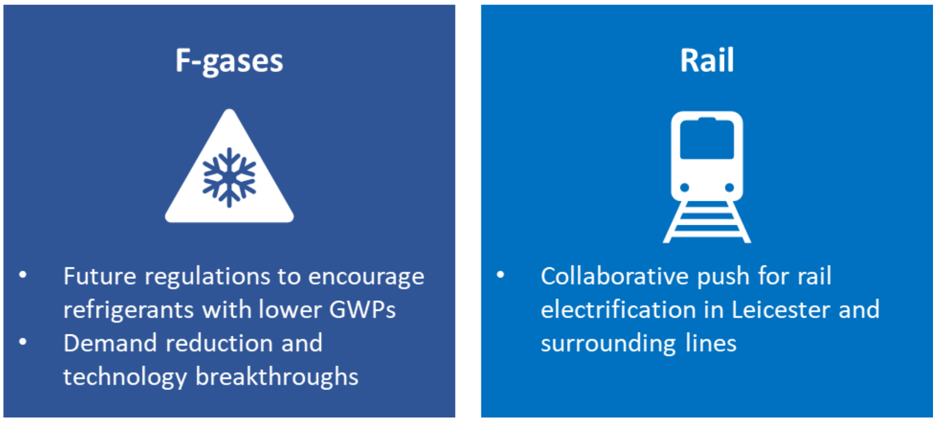
Potential challenges or opportunities	Potential responses
Uncertainties: • The capacity that the grid will need to cope with will depend on the levels of demand reduction in sectors such as buildings and transport	Aim to reduce demand as much as possible, but when engaging with WPD and other stakeholders, plan for a range of scenarios
Constraints/barriers/risks: • The rate of decarbonisation in the national grid. This has been rapid to date, and the Government has committed to fully decarbonised electricity by 2035 but has not yet outlined the policy mechanisms it intends to use to drive this. • Restrictions on anticipatory network investment by Ofgem • Cancellation of FiT subsidies	Prioritise local renewable energy generation to mitigate these risks Lobby for regulatory changes to allow for anticipatory network upgrades Consider innovative sources of funding e.g., green bonds
Opportunities: • Make use of LCC-owned land to free up space for renewables • Co-locate renewable energy on Council-owned car parks, linked with batteries and EV charging infrastructure • Undertake a more detailed feasibility study of roof-mounted solar to identify suitable large-scale industrial roofs for PV • Potential to influence decarbonization of existing heat network	Assess Council-owned landholdings and engage with large industrial organisations/landowners Continue to engage with stakeholders to facilitate use of alternative technologies for the heat network e.g., water source heat pumps

4.4 Tackling residual emissions

As shown in Section 3, even in the most ambitious scenario modelled, there will be some emissions that cannot be eliminated by 2030 using present technologies. The CCC acknowledges that, even by 2050, there will be some types of emissions that are hard to abate, which would need to be dealt with via some form of carbon removal, whether technological or nature-based.

The following diagrams show some of the main sources of what these emissions are likely to be for Leicester, and how they can realistically be addressed by LCC and other local stakeholders:





Even then, some emissions would remain. Theoretically, carbon removal technologies could help to mitigate these emissions – but such technologies are not expected to be widely available by 2030, if at all. Therefore, the main option for Leicester to reach carbon neutrality would be to explore nature-based solutions such as tree planting or peatland restoration.

In an urban environment like Leicester, it is to be expected that carbon sequestration will play a limited role in delivering carbon neutrality. Nevertheless, due to the ambitious decarbonisation goal, it is vital that existing carbon sinks and greenfield sites are protected and continue to be enhanced in line with biodiversity considerations. Therefore, LCC should continue to realise and expand biodiversity and green infrastructure efforts such as the ones outlined in the Biodiversity Action Plan, the Green Infrastructure Strategy and Tree Strategy. Within Leicester, LCC and other local landowners should work to adopt best practices in land management such as letting grass grow in parks, reducing fertiliser use, and so on.

As this alone will not bring Leicester's emission to net zero, actions outside of the city boundaries would potentially need to be considered as an additional action alongside within-city mitigation efforts. This would likely be done on council-owned land outside of the city boundary if suitable sites are under council ownership. Some of the actions may involve converting land into woodland (potentially seeking Woodland Carbon Code accreditation) and working with farmers to develop and implement best practices, such as minimum tillage (or no-till), reducing fertiliser use, and diversifying crop rotations.[7] The environmental benefits go beyond GHG emissions and should not be underestimated.

It is important to acknowledge that carbon offsetting is highly controversial. For a variety of reasons, participation in carbon offsetting schemes does not guarantee that CO_2 has been removed from the atmosphere. As mentioned previously, a strategic decision must be made on whether it is worth putting resources towards solutions outside of Leicester. There is also the question of who would be paying for offsetting measures – issues that are outside the scope of this roadmap.

The key take-home point is that the amount of land that would be required to offset Leicester's emissions through tree planting is vast – hundreds, more likely thousands, of hectares – which again emphasises the importance of reducing emissions at source.

[7] Liu et al., 2016: Farming tactics to reduce the carbon footprint of crop cultivation in semiarid areas. A review. Available at: [Farming tactics to reduce the carbon footprint of crop cultivation in semiarid areas. A review | SpringerLink]

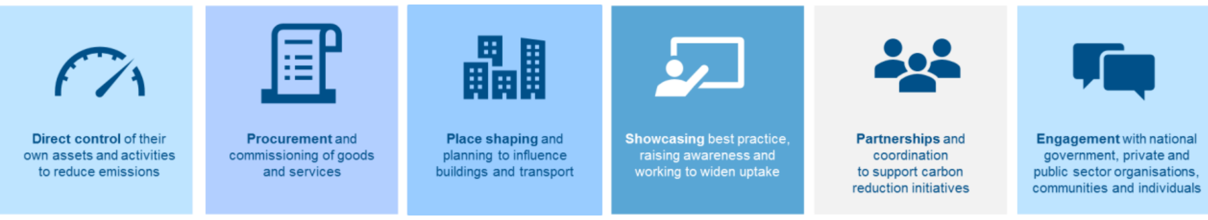
5 Delivering carbon neutrality

5.1 Roles and responsibilities

LCC's climate emergency declaration aspires to achieve carbon neutrality for the entire city – not just the Council. However, it cannot deliver on this target alone. Much of the Council's influence will be more reliant on engagement with stakeholders to promote carbon reduction projects, showcasing best practice, raising awareness, partnerships and lobbying for change.

Local authority influence over GHG emissions in their area

Adapted from CCC, '*Local Authorities and the Sixth Carbon Budget*' (2020)



The Council will need to take a leadership role in this process, by:

- Taking immediate action to drive down its own emissions
- Showing leadership to others and to inspire action
- Creating a conducive policy framework to drive climate action
- Developing coordination mechanisms and platforms for sharing information and collaboration.

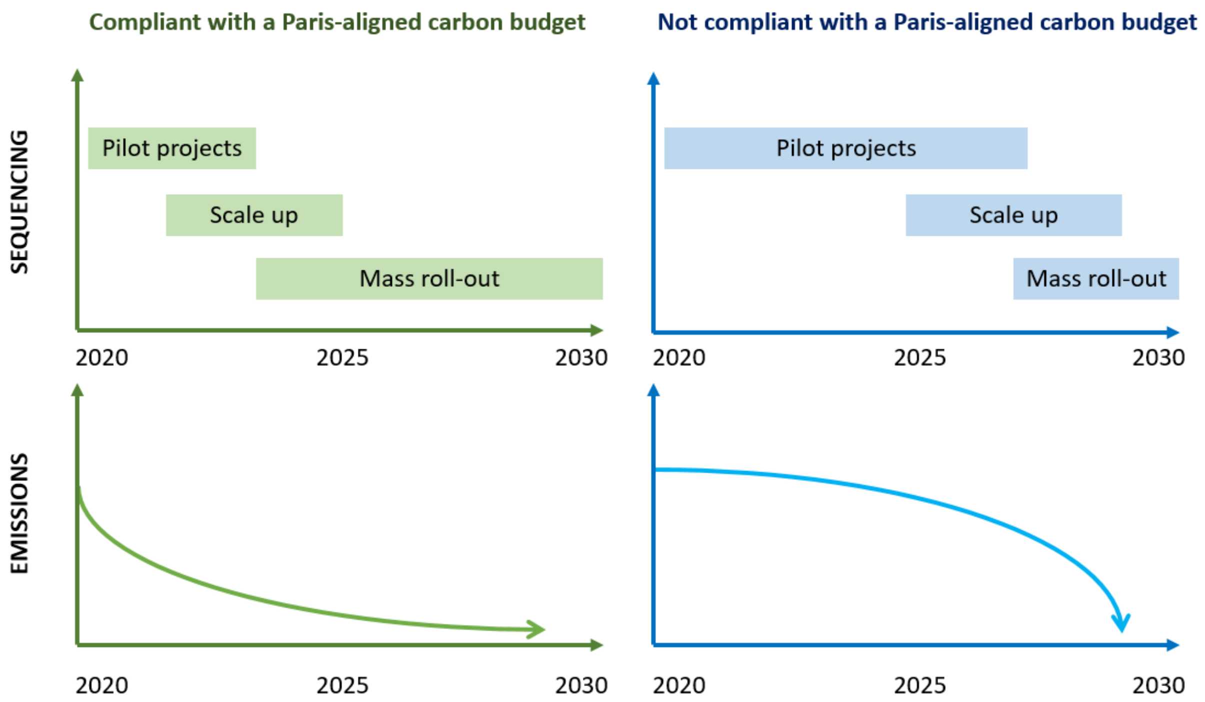
But they will need to work with a range of stakeholders to tackle GHG emissions across the city, with some key stakeholders being:

- Other councils, specifically Leicestershire County Council and neighbouring district councils.
- Business stakeholders, such as the Leicester and Leicestershire Enterprise Partnership.
- Energy stakeholders, such as Western Power Distribution and Cadent.
- Housing providers, such as housing associations.
- Major energy users, such as the universities, the NHS and major landlords.
- National-level stakeholders, including key Government departments, Ofgem, National Grid etc.

5.2 Key actions: Timescales, sequencing and stakeholders

From a legal standpoint, the UK is committed to reaching net zero by 2050, but there are not (yet) any mandates for specific actions to take place in Leicester, nor any set dates for them to be achieved. **From an environmental standpoint however, the urgency cannot be overstated – and the deadline is 'as soon as possible'.**

None of the pathways modelled show a credible emissions trajectory that is within a Paris Agreement-compliant carbon budget. As illustrated below, it is more likely that intervention measures will ramp up over time, resulting in greater carbon savings later in the 2020s, and higher cumulative emissions. But the faster these measures can be achieved, the better our chances of limiting global warming to well below 2°C.



With that said, the table below shows indicative timings for different types of decisions and interventions. These timings are intended to be more realistic but clearly all actions should be brought forward as much as possible.

Note: Interventions prefaced by → are dependent on one or more prior measure(s) being introduced.

	Now / 2025 / 2030	Major stakeholders
Strategic decisions		
Approach to offsetting		LCC
Decarbonisation of heat network		LCC, Engie
Local vs. large-scale renewables		LCC, County Council + other nearby Local Authorities
Role of hydrogen	*Gov't decision*	LCC
Gas grid upgrades (subject to decision on hydrogen)		
Ask of Government		
Push central Government for more support (funding, legislation, etc.)		LCC
Buildings & Industry		
Take all available steps to promote efficiency retrofits and secure access to funds		LCC
Plan, deliver and promote pilot/flagship retrofitting and heat pump projects		LCC, social housing providers, landlords, public sector bodies
Large-scale retrofitting rollout		LCC + everyone in Leicester
→ Large-scale heat pump rollout		LCC, Gov't (funding), landlords, homeowners, businesses, community groups
Engage businesses on options for reducing fossil fuel use in industrial applications		LCC, local businesses, industry bodies, DMU/UoL
→ Implement solutions for hard-to-abate industrial emissions when available		LCC, LLEP, local businesses, industry bodies
Transport		
Incorporate net zero thinking into routine road network upgrades and maintenance		LCC, National Highways
Develop an EV charging strategy for Leicester		LCC
→ Electrify buses (Note: Some funding already secured)		LCC, County Council, Arriva Leicester, First Bus
→ Large-scale shift to use of EVs		LCC, businesses, residents, LLEP
Potential shift to hydrogen/other zero emission HGVs		LCC, logistics companies, local businesses
Engage with National Highways to plan for infrastructure changes to prioritise active travel and public transport and EV charging		LCC, National Highways
→ Deliver large-scale changes (as above)		LCC, National Highways, local residents and businesses
Engage community on car travel demand reduction measures		LCC, residents, community groups, businesses, DMU/UoL
→ Pilot any additional demand reduction measures beyond those already proposed (e.g. Workplace Parking Levy)		LCC, neighbourhood groups
→ Larger scale roll-out of successful demand reduction measures		LCC + everyone in Leicester
Energy		
Incorporate net zero thinking into routine infrastructure upgrades and maintenance		WPD
Engage with WPD, National Grid, Ofgem, etc. to plan for upgrades		LCC, WPD, National Grid, Ofgem
→ Deliver large-scale infrastructure upgrades to accommodate future demand/generation		WPD, National Grid
Engage with neighbouring LAs and County to plan for renewables		LCC and neighbouring planning authorities, County Council
Deliver (and promote) pilot/flagship renewable projects		As above
→ Deliver (and promote) larger renewable projects out of boundary		As above + renewable energy developers, community energy groups
Decarbonise heat network		LCC, Engie, residents and heat network customers
Land Use		
Engage with landowners to identify and plan for carbon sequestration initiatives		LCC, local landowners
→ Adopt best practices across all landholdings (parks, agricultural land, etc.)		LCC, local landowners and other public sector bodies
Develop a carbon offsetting strategy (if applicable)		LCC
→ Deliver carbon offsetting projects out of boundary (if applicable)		LCC plus developers, investors, etc.

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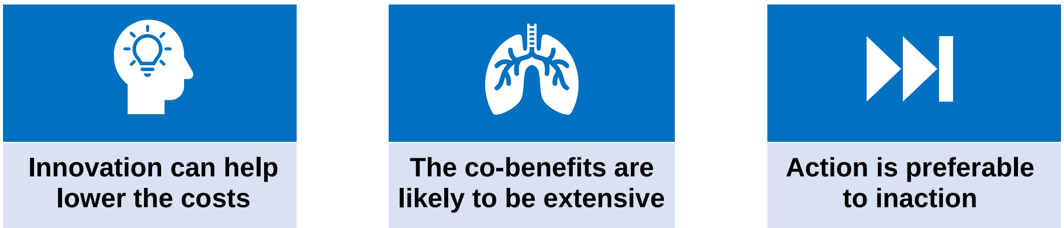
5.3 Costs and benefits of carbon neutrality

5.3.1 Potential investment required

Achieving carbon neutrality will require significant resources. The CCC estimates that, for the UK as a whole, the cost of net zero by 2050 could be 1-2% of GDP – although they also note that:

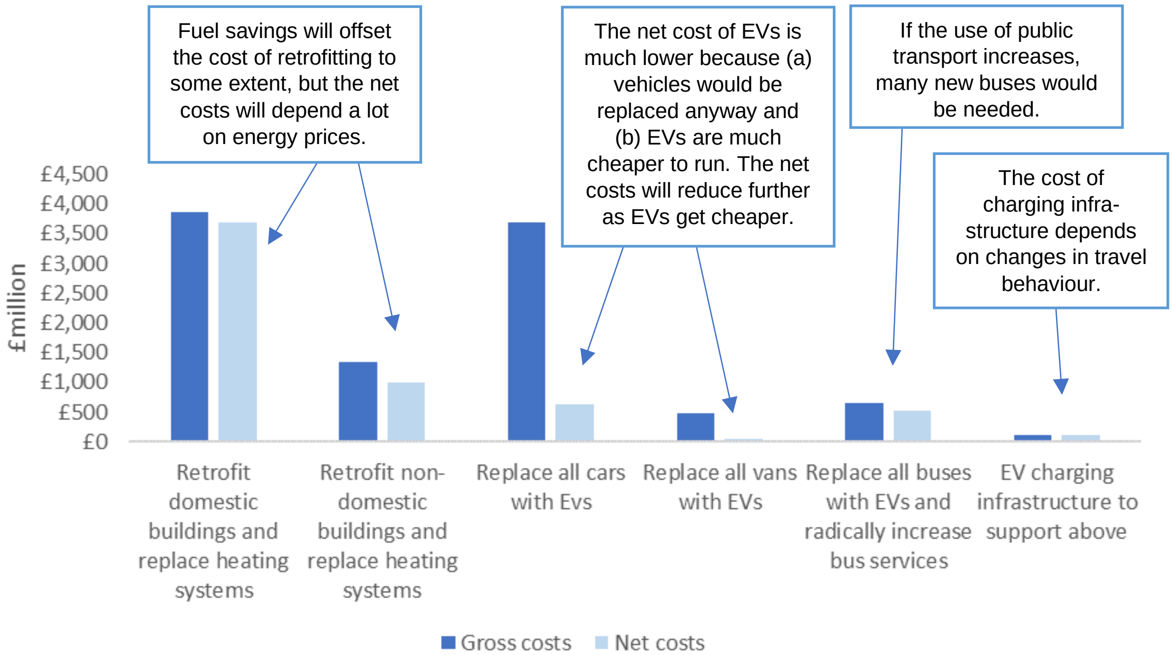


Overall, the total cost[8] of delivering the intervention measures modelled as part of this study ranges from £950m to £5.3bn. The most ambitious scenario (#3), which gets closest to carbon neutrality by 2030, is understandably the most expensive. Divided equally over 9 years, the annual costs of aligning with Scenario 3 would be between £550-600m, which is approximately 5% of Leicester's forecast GDP and 6% of current GDP.[9]

Those are the estimated 'net costs', i.e. the additional cost over and above what would otherwise have been spent; they also include cost savings, for example from reduced fuel bills.[10] If these are removed, we get an overall gross capital investment cost of £2-9bn across the scenarios modelled.

It is important to recognise that these costs are highly uncertain and intended only to illustrate the potential magnitude of investment that is required; refer to the Evidence Report for details.

Estimated costs for some of the 'big ticket' items are shown below:



[8] The net present value, i.e. future costs discounted to reflect the fact that costs and benefits in future years are valued less than nearer term costs and benefits. The figures include intervention measures taking place within Leicester but do not include the wider costs of changing the UK energy system or road network, or the cost of any initiatives/campaigns that would be needed in order to promote or administer the measures.
[9] ONS, 2021
[10] Based on current energy prices.

Although these numbers are large, there are some important factors to note:

First, these figures are high-level estimates intended to illustrate the order of magnitude of the funding required. There is huge uncertainty around future costs and the speed with which they can come down. As it stands, at present many of the individual measures can vary by up to 50% in cost.

It is possible – perhaps likely – that meeting carbon neutrality after 2030 would lower some of these costs, whether due to market maturity, or additional Government funding. Clearly, it would also reduce the annual investment needed. But such an approach would not be consistent with the city's desire to be a leader on the climate emergency, as evidenced by its ambition to achieve carbon neutrality by 2030 or sooner.

Due to "rapid cost reductions for key technologies like offshore wind and batteries for electric vehicles", the CCC now estimates that the cost of reaching net zero by 2050 is the same as previous cost estimates for reducing emissions by just 80%.

Second, some of the costs will not be truly new or additional – they would require reassignment of investments that would otherwise be spent on 'business as usual' measures such as: replacing gas boilers with new ones, refurbishing buildings without improving their energy performance, purchasing new petrol and diesel vehicles, and expanding roads to accommodate traffic growth.

Third, not all of these costs would fall on the Council – most will need to be met by other stakeholders, including businesses, householders, landlords, and other public sector bodies. One of the major challenges will therefore be to ensure that 'conventional' investments by all these stakeholders are reassigned towards measures that help Leicester along the path to carbon neutrality.

For carbon neutral solutions to become the default choice, a mix of strategies will be required:

- Regulatory requirements and enforcement, for example, minimum energy efficiency standards in existing buildings
- Initiatives aimed at re-training, developing new skills and trades
- Large-scale public engagement programmes aimed at securing buy-in and promoting behaviour change and sustainable consumer choices

However, realistically, for some of the measures that are needed, private sector investment is not likely to be forthcoming until and unless new regulatory requirements are brought into place, or there is a major shift in carbon pricing – so that the 'polluter pays'.

Finally, some of the most important benefits of investing in carbon neutrality – such as 'helping to avert climate catastrophe' – are critical to achieve, but do not necessarily generate streams of income for any particular investor. Others are classified as co-benefits, which may have a range of positive, but indirect, financial impacts as well as environmental and social ones. These factors are not reflected in the numbers above.

5.3.2 Co-benefits and wider impacts

The co-benefits of these climate actions are varied and cross-cutting. Some examples include:

	Economy	Health	Society	Resilience	Resources
Retrofitting buildings	Creates jobs (construction, manufacturing installers, designers)	Reduced risk of cold, mouldy homes; improved thermal comfort	Can help to alleviate fuel poverty if done correctly	Housing stock less susceptible to weather extremes (cold or heatwaves)	Reduces the need for either demolition or new build
Active travel	Reduced congestion, fuel cost savings, increased property values	Physical and mental benefits of exercise, significant reduction in air and noise pollution	Facilitates access to jobs/services for residents with no car	Change to reclaim road space for social space and green space	Less demand for materials/resources (fuel, motor vehicles) and infrastructure
Renewable energy	Generate revenue, e.g., through community-owned installations	Reduction in noise pollution, some reduction in air pollution	New employment opportunities	Diversified and localised renewable energy systems	Lower lifecycle carbon emissions than fossil-fuelled alternatives[11]

It is important to note that the scale of some of the co-benefits will depend on policy choices and how specific interventions are implemented.

Boosting the local economy

The Government has set up a Green Jobs Taskforce that envisions 2 million green jobs being created across the UK by 2030.[12] For Leicester, this could mean 5,000-10,000 new jobs spanning sectors such as construction, manufacturing, renewable energy and heating system installers/engineers, and innovative or community-led initiatives.

Leicester would also be attractive to new talent; a survey carried out in 2018 found that 65% of young people are interested in a career in the 'green economy'.[13]

In addition to local employment, several carbon reduction measures have cost-saving co-benefits, such as less money spent on fuel through a switch to active travel and EVs, as well as revenue generated directly for communities through local renewable energy installations. Figures from 2018 further show that congestion currently costs Leicester over £1,000 per driver per year[14] – amounting to over £104 million per annum (number of cars adjusted for vehicle occupancy). The reduction in congestion further results in health benefits through reduced air pollution.

"The UK's low carbon economy could grow at around 11 per cent a year between 2015 and 2030, some four times faster than the average growth rate for the UK economy overall."

Source: UK Clean Growth Strategy

[11] Understanding future emissions from low-carbon power systems by integration of life-cycle assessment and integrated energy modelling | Nature Energy
[12] UK government launches taskforce to support drive for 2 million green jobs by 2030 - GOV.UK (www.gov.uk)
[13] Views on the green economy: survey of young people - GOV.UK (www.gov.uk)
[14] Congestion Costs U.K. Nearly £8 Billion in 2018 - INRIX

Shift to active travel

There are a wide range of health benefits from walking and cycling. Regular physical activity has been shown to reduce the risk of conditions such as:

Cardiovascular disease:	Type 2 diabetes:	Cancer:	Depression:
20-35% lower risk (comparing 'most active' vs. 'least active' people)	**30-40% lower risk** (comparing 'moderately active' vs. 'sedentary' people)	**30% lower risk of colon cancer** **20% lower risk of breast cancer**	**20-30% lower risk** (among people participating in daily physical activity)

Source: Sustrans[15]

Reducing air and noise pollution

In 2010 it was estimated that air pollution in Leicester might contribute to more than 160 deaths per year. A study of GHG reductions and air quality improvements in Bristol found that measures taken to decarbonise transport could have a major positive impact on air pollution, reducing NOx emissions by 92% and PM 2.5s by 37%.[16] If similar improvements could be achieved in Leicester, this would be expected to deliver public health benefits, with the potential to save dozens of lives per year. The costs to Leicester's economy previously estimated at around £7m per year, would also be reduced. [17]

In addition to air quality, a shift away from combustion engines would also decrease noise pollution – although, for safety reasons, EVs are unlikely to be silent.[18]

Tackling cold homes and alleviating fuel poverty

According to the Building Research Establishment, poor housing costs the NHS around £1.4bn each year.

Roughly 19% of households in Leicester experience fuel poverty. An ambitious retrofitting programme would help to reduce space heating demands which, for some households, could reduce energy bills by £50-£300 per year. (The picture is more complicated for households switching from gas to electric heating systems due to differences in the price of fuel, but they too can benefit from lower fuel bills provided that the standard of retrofitting is high.)

In addition, cold homes also come with significant health impacts. Nationally, almost 1/3rd of excess winter deaths are directly or indirectly linked to fuel poverty or cold housing conditions.[19] In Leicester, that would translate to roughly 50-60 deaths per year. Some of these could be avoided by introducing more energy efficient housing.

In addition to causing respiratory ailments, mould and condensation in cold buildings can also cause physical damage to buildings over the long term. When done correctly, retrofitting measures can therefore help to alleviate this problem, leading to lower property maintenance costs.

Local renewable energy systems

Community-owned energy installations can bring great benefits to the city beyond supporting the decarbonisation of the energy grid. Diversified local installations (e.g., wind *and* solar power) increase

[15] 4471.pdf (sustrans.org.uk)
[16] https://www.bristolonecity.com/wp-content/uploads/2020/02/Bristol-net-zero-for-direct-emissions.pdf
[17] air-quality-action-plan.pdf (leicester.gov.uk)
[18] New noise systems to stop 'silent' electric cars and improve safety - GOV.UK (www.gov.uk)
[19] e3g-nea-cold-homes-and-excess-winter-deaths.pdf (precarite-energie.org)

resilience to fluctuations in energy prices which are influenced by overseas imports and weather changes.[20] This effect is strongest when these can be coupled with energy storage solutions.

Care will need to be taken to ensure that the actions to deliver carbon neutrality do not worsen social inequality by hitting certain groups harder. For example:

Electricity is currently more expensive than natural gas, so to avoid occupants facing higher fuel bills, retrofitting and specification of heating systems must be done carefully.

Steps taken to reduce car travel can be disruptive to businesses and vulnerable individuals. It is important to ensure that the expanded public transport system is the cheapest option for travel, and businesses may need support to switch.

There is evidence that improving the energy efficiency of homes and buildings, alongside public realm improvements, will increase property prices and rental values – but this could 'price out' lower income communities or smaller businesses.

It is crucial that Leicester implements its decarbonisation actions while ensuring that the benefits of this journey will be shared equally with all residents and be done through close community consultation to maximise the benefits for everyone.

5.4 What support will LCC need from the Government?

Considering the scale of ambition, and the scale of costs involved, it is clear that LCC cannot achieve net zero alone. It is crucial that policy at the national level is supportive of local authorities like Leicester that are aiming to achieve carbon neutrality ahead of the national 2050 target. Examples of key 'asks' are provided below. However, this list is not exhaustive and is subject to change over time in light of a fast-moving policy landscape.

Ensure that national-level programmes and funding are sustained and stable

- Recent cuts to public transport, and the cancellation of the Feed-in Tariff, Renewable Heat Incentive and Green Homes Grant have not helped support net zero ambitions at the local level.
- On issues such as public transport and heat decarbonisation, consider changing the way that national funding pots are allocated, recognising that they often have a very short turnaround and strict restrictions, in addition to being highly uncertain/variable which makes it extremely difficult for operators and authorities to plan services.
- The Government should elaborate concrete plans as soon as possible for implementation of recent net zero ambitions. For example, a clear mechanism to support the petrol and diesel car phase out.

Provide additional funding to support new actions

- Building retrofits remain a key priority, recognising that multiple schemes have been implemented unsuccessfully in recent years. In addition to funding for energy efficiency measures, also provide more support for local authorities in enforcing the Minimum Energy Efficiency Standards regulations.
- Continue to support the Boiler Upgrade grant while reinstating or introducing new incentive schemes that target heat decarbonisation and renewable energy.

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[20] CAC-Chapters-all_new-brand.pdf (ashden.org)

- Provide additional funding for electric buses (already under consideration in Leicester) along with support for bus services outside of Leicester, to reduce the need for people to commute using private cars.

Remove barriers to further ambition

- Regarding energy policy, reform the existing system of planning for future demand for electricity and gas. As part of any reform, DNOs could be given a duty to prepare forward plans for supporting net zero, with a duty to work with the local authority – and a duty on the local authority to work with them.
- Change the requirements for viability testing of planning policies to consider the future costs of retrofitting (likely to be borne by the occupants/homeowners and potentially the public purse) and the wider cost of failing to reach net zero, not just the up-front cost of development.
- Develop and implement long-term recovery plans to address the impacts that the COVID-19 pandemic has had on public transport.

Re-allocate funding away from projects that increase emissions

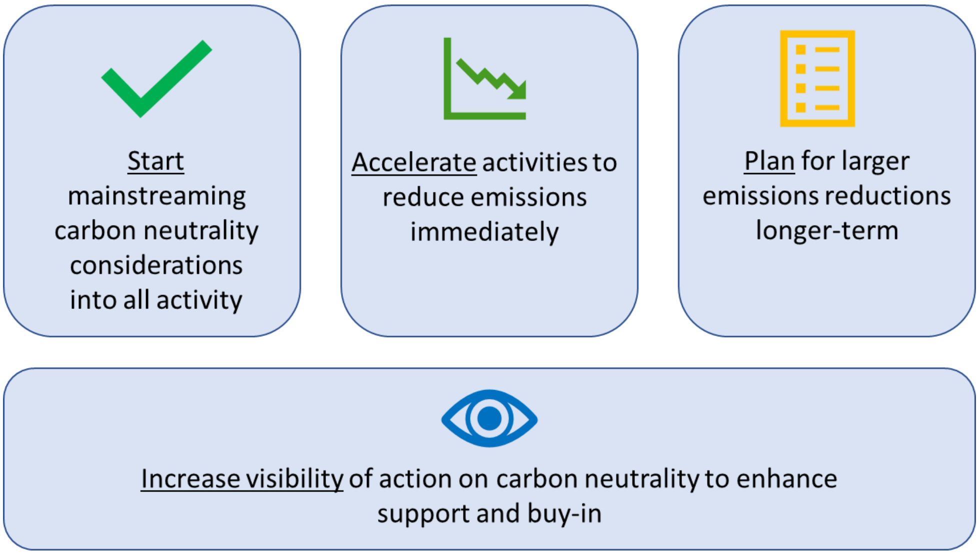
- For example, re-focus Government spending away from large road infrastructure projects, towards projects that enable car-free lifestyles.

Promote jobs and training in low carbon sectors

- Address skills gaps in the workforce by introducing training schemes for renewable energy and heat installers, along with re-training opportunities for gas boiler installers.
- Fund more research and development, and promote low carbon jobs, especially related to:
    - Energy storage and grid balancing (to facilitate the shift towards renewables)
    - Heat pumps (to help lower costs and improve performance)
    - Cooling technologies (to reduce the impact of refrigerants)
    - Green hydrogen (for sectors that cannot switch to electricity)
    - Carbon capture and storage technologies (to mitigate residual emissions)

6 Conclusions

Whilst there are a huge number of actions that will need to be taken to transition to carbon neutrality, they can be simplified into four main areas:



- **Start** mainstreaming carbon neutrality considerations into all activity. All actions that are not compatible with carbon neutrality, such as installing more gas boilers or building more road infrastructure, should be challenged, and economic and social policies need to be 'carbon-proofed'.
- **Accelerate** activities to reduce emissions immediately. Even continuing the recent pace of emissions reductions for a few more years could put the 2030 ambition out of reach. Activities that can get the market moving, working with key stakeholders that have significant influence, such as social housing providers and key commercial landlords, are needed to speed up the rate of emissions reductions over the next few years.
- **Plan** for larger emissions reductions in the longer-term. In the meantime, work needs to be done in the next few years to prepare the ground for much greater scale of change later in the decade, for example addressing skills gaps, or developing innovative local policy and financing mechanisms.
- **Increase visibility** of action on carbon neutrality to enhance support and buy-in. All of the above needs to be done in a way that demonstrates what is happening and inspires others to act.

Delivering carbon neutrality is a huge challenge. But Leicester has many advantages and opportunities – for example good work has already been started on walking and cycling, and the nature of the city means there is considerable scope for moving away from private car usage. Consideration of the pathway to carbon neutrality shows that the urgency of action is very high. Emissions reductions need to accelerate over the very short term and planning needs to take place now for much greater cuts later in the decade. Everyone in Leicester will have a role to play, but the Council in particular has a strategic role in demonstrating leadership, driving change through its planning powers and facilitating collaboration and action in others.

This roadmap, and the accompanying evidence report, aims to provide a clear framework for future discussions and work in Leicester. By outlining the scale and pace of change needed, and the strategic priorities, risks and opportunities, it is hoped it will support decision-making over the coming years, including any updates to the Council's Climate Emergency Action Plan.

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Economic Development, Transport and Climate Emergency (EDTCE) Scrutiny Commission

Work Programme 2022-23

Date	Meeting Items	Actions Arising	Progress
23 Jun 22	1. TROs – standing item (Beauville Drive) 2. Construction Skills Hub update and Employment Hub Update 3. Verbal update re: Workplace Parking Levy Consultation	Items 2 deferred from the previous civic year.	
31 Aug 22	1. TROs – standing item • A50 FiveWays 2. Leicester Enhanced Bus Partnership (from 23rd June) presentation 3. Carbon Neutral Road Map report 4. Levelling Up Fund Round 2 – Connecting St. Margaret's submission presentation.		

Date	Meeting Items	Actions Arising	Progress
12 Oct 22	1. TROs – standing item (if any) 2. TCF Schemes: tbc (if any) 3. LLEP Update 4. Economic Recovery Dashboard 5. Corporate Estate Management 6. Waterside Regeneration (from 31st Aug) 7. Inward Investment & Place Marketing Update 8. Findings and Analysis of Workplace Parking Levy Consultation 9. Local Transport Plan 10. Local Plan (to be confirmed) – might need a separate session on this.	Item 3 will require co-ordination with LLEP officers to include information on future funding. Item 5 was deferred from the previous year.	
30 Nov 22	1. TROs – standing item (if any) 2. TCF Schemes: tbc (if any) 3. Leicester Labour Market Annual Report (delivery of the successful CRF bids, which includes the project placed within the textiles sector 4. Accessibility Update 5. Levelling Up 1/2 Update	Item 3 will combine information on the delivery of successful CRF bids and further details on the initiatives in the textile sector.	
26 Jan 23	1. TROs – standing item (if any) 2. TCF Schemes: tbc (if any) 3. City Centre Economic Plan - Update 4. Draft General Fund Revenue Budget & Draft Capital Programme 2023-24 5. Biodiversity Action Plan 6. Cycle Action Plan		

Date	Meeting Items	Actions Arising	Progress
22 Mar 23	1. TROs – standing item (if any) 2. TCF Schemes (if any) 3. Adult Education Service – Update 4. Connecting Leicester/TCF Programme Update		

Draft Forward Plan / Suggested Items for 2022-23

Topic	Details	Proposed Date
ONGOING **City Mayor & Executive Plan of Key Decisions** **Leicester Smart City Strategy – Richard Sword** **Local Plan – Andrew Smith**	Commission to keep a watching brief and receive regular reports / updates on executive key decisions planned to relate to this portfolio. Adoption of a strategy that combines Leicester's digital, physical, and social environment to deliver an inclusive, thriving, and sustainable city for all.	Ongoing Not before 1 June 2022 TBC – a special meeting in 2022
ONGOING Spending Review Programmes linked to: a) **Councils General Fund Revenue Budget Report** b) **Capital Programme Projects**	Commission to keep a watching brief and receive regular updates on issues related to budgets with this portfolio. Decisions consequential to the monitoring of expenditure in 2023-24 (if any) – General Fund Budget Report, prior to OSC in Feb 2023	Ongoing
ONGOING **Consultations** Workplace Parking Levy	Members to consider relevant items to this commission from planned or live consultations to provide scrutiny comments and views The consultation was completed in March 2022 and a special meeting was held in Feb 2022 on this.	Findings and Analysis of Consultation to be considered in Summer 2022.
Connecting Leicester Projects	Commission agreed to be involved at the early stages of development of plans	Ongoing updates
Economic Recovery Plan Update – now the - City Centre Economic Plan	Review of progress – this was split into 2 updates. First update was in February 2021 and included a	Second update completed in June 2021; follow up update in late 2022.

Topic	Details	Proposed Date
	LLEP update. Format of latest update to be considered by the service	
Local Plan	Item to be considered by all Commissions	Deferred to Summer 2022 and will require an additional special meeting.
Smart Cities	Information on proposed strategy	Deferred from Dec 2019 meeting to 2022/23.
Healthier Air for Leicester – Air Quality Action Plan 2015 – 2026	Progress update on actions (joint with health & wellbeing scrutiny)	TBC
Cultural Quarter	Update	TBC
Waterside regeneration	Deferred to new municipal year due to the number of items on the agenda.	Summer 2022
Major Transport Projects (including NPIF projects)	Report on progress	TBC
Neighbourhood Highway Safety schemes	Report on progress	TBC
Inward investment and Place Marketing	Report on progress including recent web site investment and general progress e.g., Visit Leicester.	Completed in Aug 2021. Next update in October 2022.
Leicester, Leicestershire Enterprise Partnership (LLEP)	Last update given in March 2021 and was linked to Economic Recovery Plan.	Next update expected in Summer 2022.
Transforming Cities Programme	A series of TCF schemes will be coming to the Commission throughout the year.	a. Soar Valley Way – Summer 2022
Bus services/ bus related issues: Leicester Enhanced Bus Partnership	Enhanced Bus Partnership Plan 2022-2030: sets out a range of commitments by all partners to be delivered from 1 May 2022 to 31 March 2025.	Expected in Summer 2022.

Topic	Details	Proposed Date
Workplace Parking Levy	Item considered in September 2021 and February 2022 (mid-consultation). Findings and analysis of the consultation to be presented in Late Summer 2022.	Summer 2022.
Corporate Estate Management	More information on corporate managed estate (Estates and Building Services) was raised on 19 November 2020 meeting, where the Executive Members confirmed an annual report would be put together on this. Last update was in April 2021. An updated report was deferred to this municipal year due to a busy agenda.	Next update expected in October 2022.
Emergency Active Travel Fund (EATF) Overview	Report on government scheme to encourage walking or cycling. Informal sessions would be planned before this.	TBC where updates are available.
LASALS Update	Annual Report from the service. Latest update was given in March 2022.	March 2023.
Accessibility Update	Report taken to the Commission in June 2021, with a request for a further update in the next civic year.	November 2022.
Draft Revenue Budget 2022-23	Report to go to all Commissions – an Officer from Finance to be present at the scrutiny meeting.	January 2023.
Draft Capital Programme 2022-23		
Leicester Labour Market Partnership and the delivery of the successful CRF bids, which includes the project placed within the textiles sector	This update follows the Leicester's Textile Sector (Modern Slavery and Exploitation) item that was considered by the Commission since September 2020, along with CRF bids in January 2022.	Initial reports taken in October 2020 and April 2021. Next update will be in Summer 2022.
Carbon Neutral Road Map	A report from the Sustainability Team.	Deferred to August 2022
Construction Skills Hub and Employment Hub Update	Report on progress – deferred to the next municipal year due to length of the agenda for March 2022.	Scheduled for Summer 2022.

Topic	Details	Proposed Date
Discussion on Potential Items for Upcoming Commission Meetings	In the March 2021 meeting, Commission Members were asked to give suggestions on potential items. This was added to by the previous Commission in June 2021: Included: • An item on “Reserving Rights of Way of former Central Railways”. • Exploring issue of space in the urban realm and potential for building a fixed mass transit system for the future • An item to discuss The Impact on Climate Emergency in terms of Construction Projects • Insight into “Leicester Rangers proposing a new stadium using sustainable building”	TBC .