Developing a Zero Carbon Plan for Sheffield:
Baseline Inventory

Green City Partnership, 10th June 2020
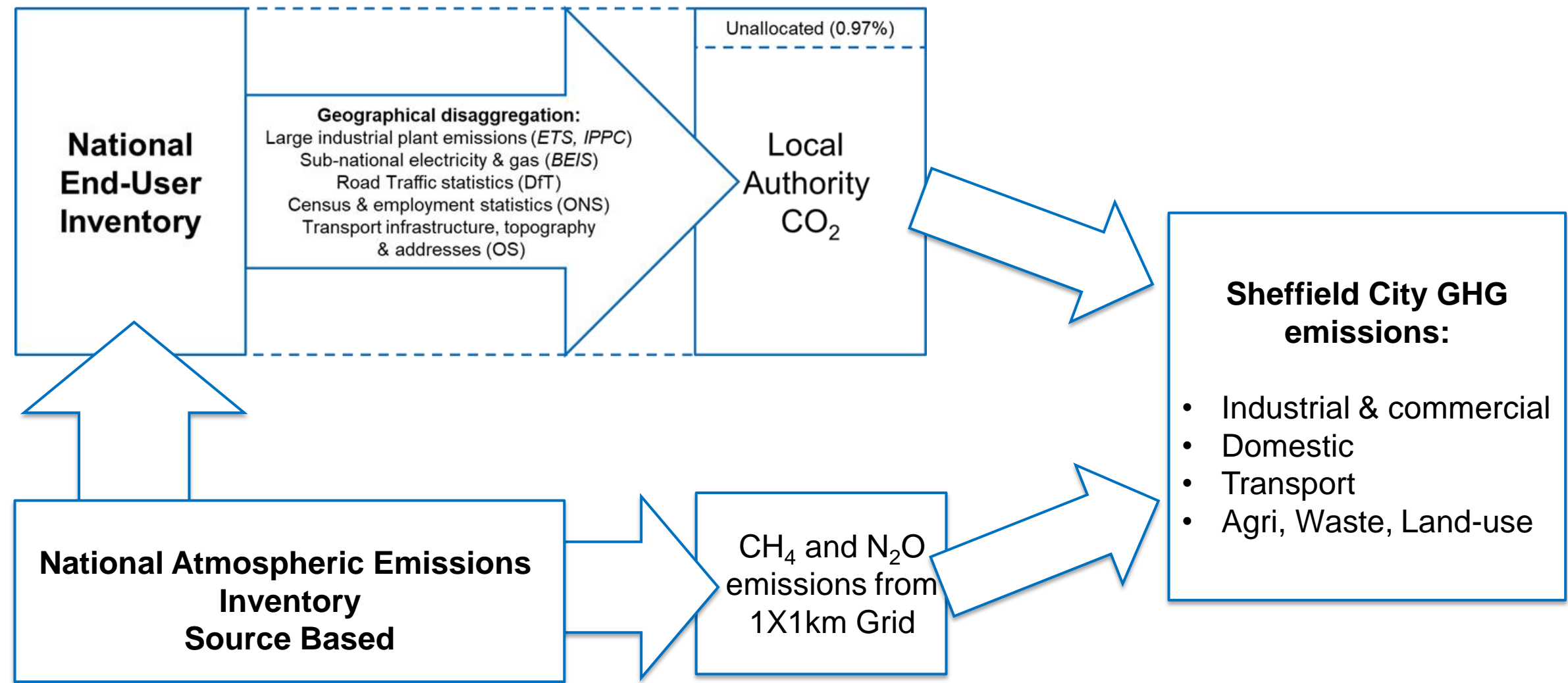
Guy Hitchcock, Ioannis Tsagatakis,
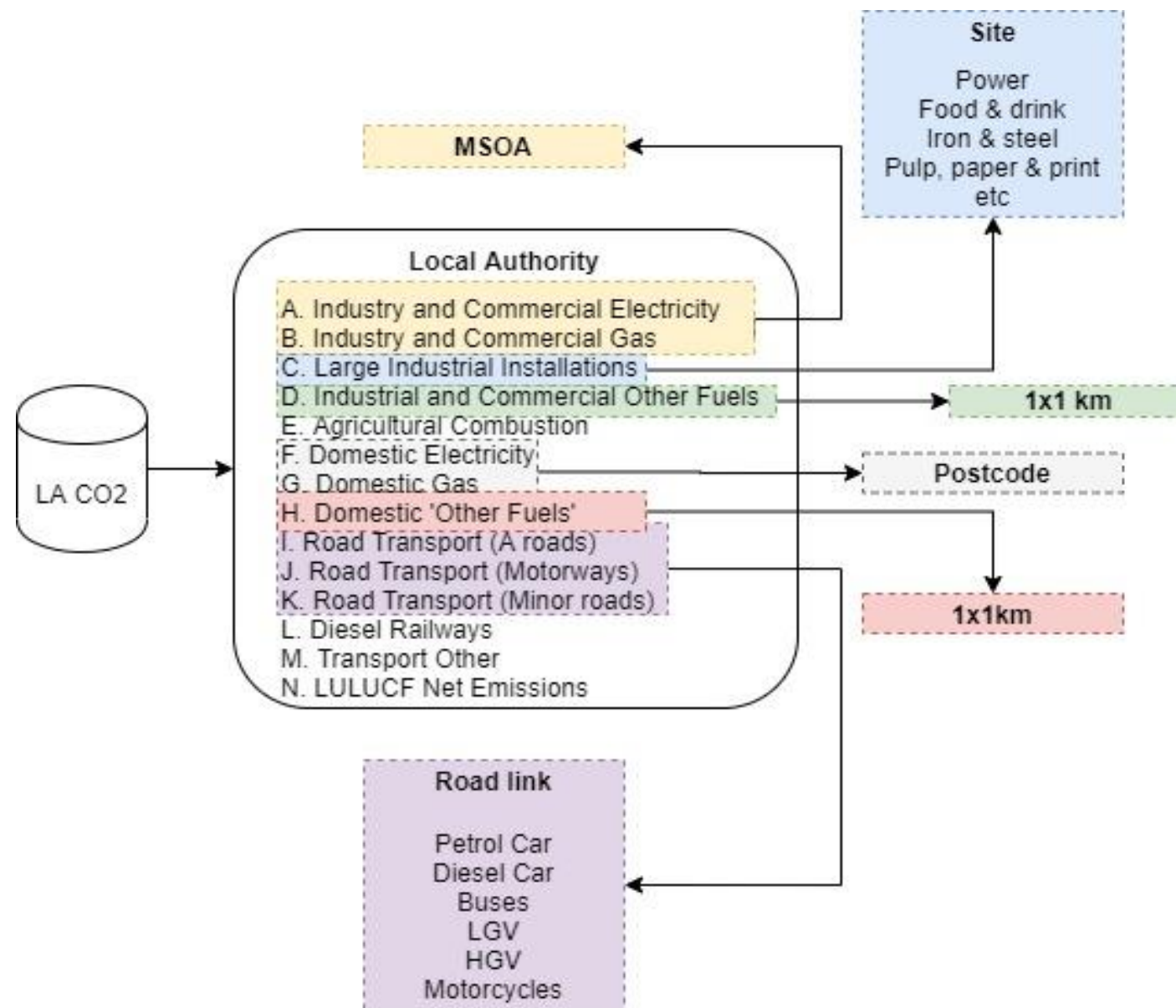
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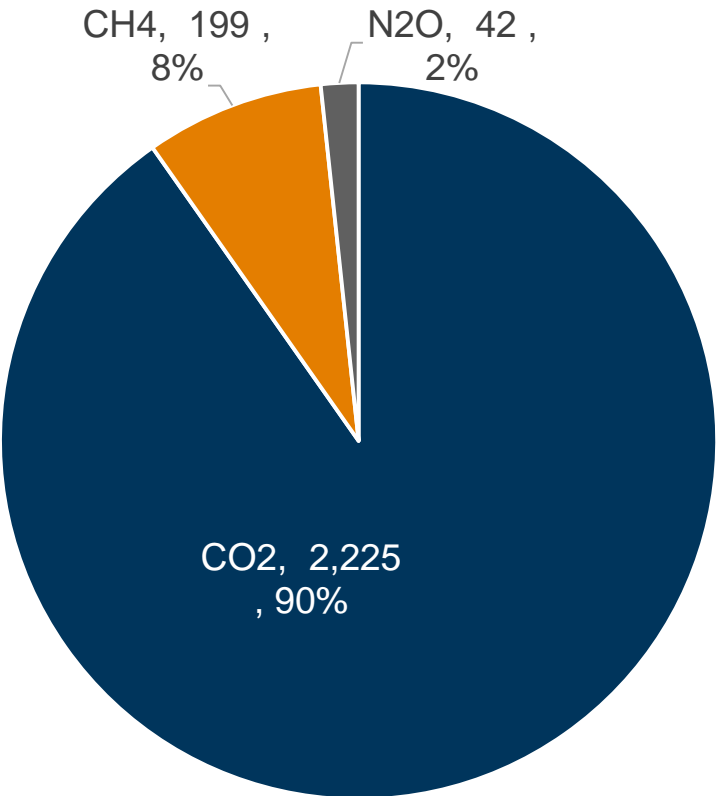
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Core underlying data

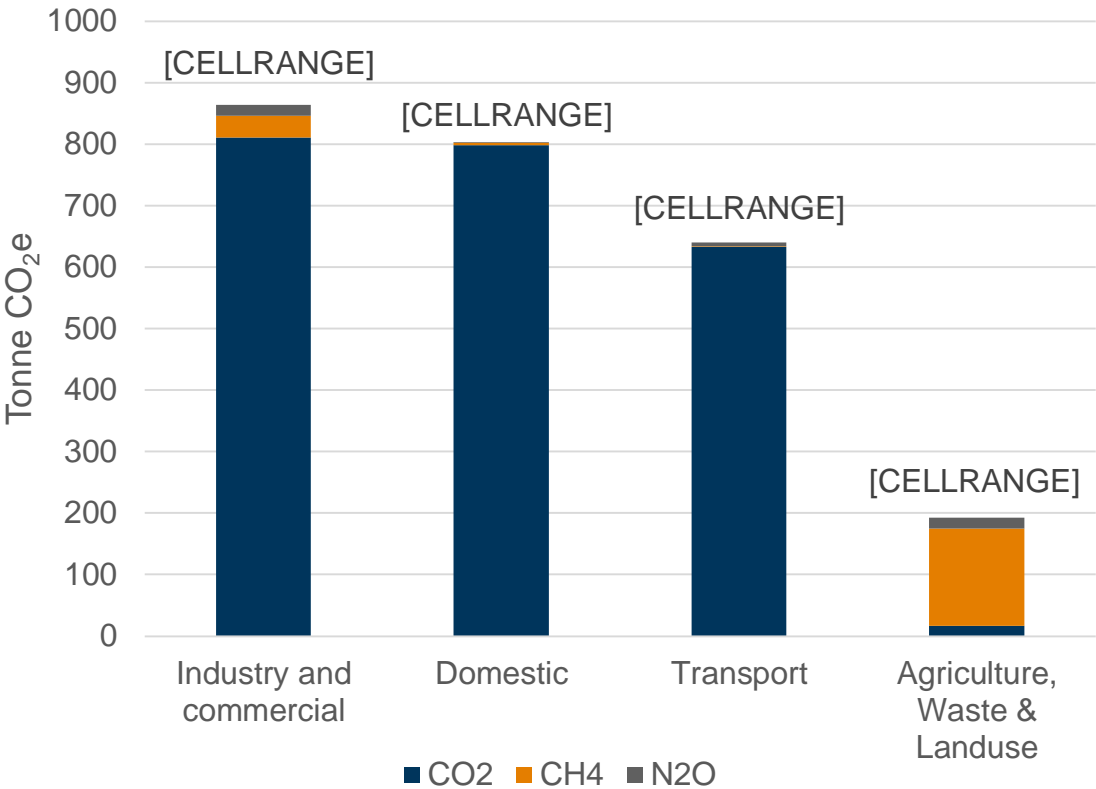# Spatial disaggregation of the local authority CO2 statistics.

Total GHG emissions in Sheffield by main sector

GHG breakdown from all sectors in Sheffield for 2017 (kt CO₂e)

CH4, 199, 8%

N2O, 42, 2%

CO2, 2,225, 90%

90% of total GHG emissions are CO₂ hence the focus for further analysis should be on this pollutant

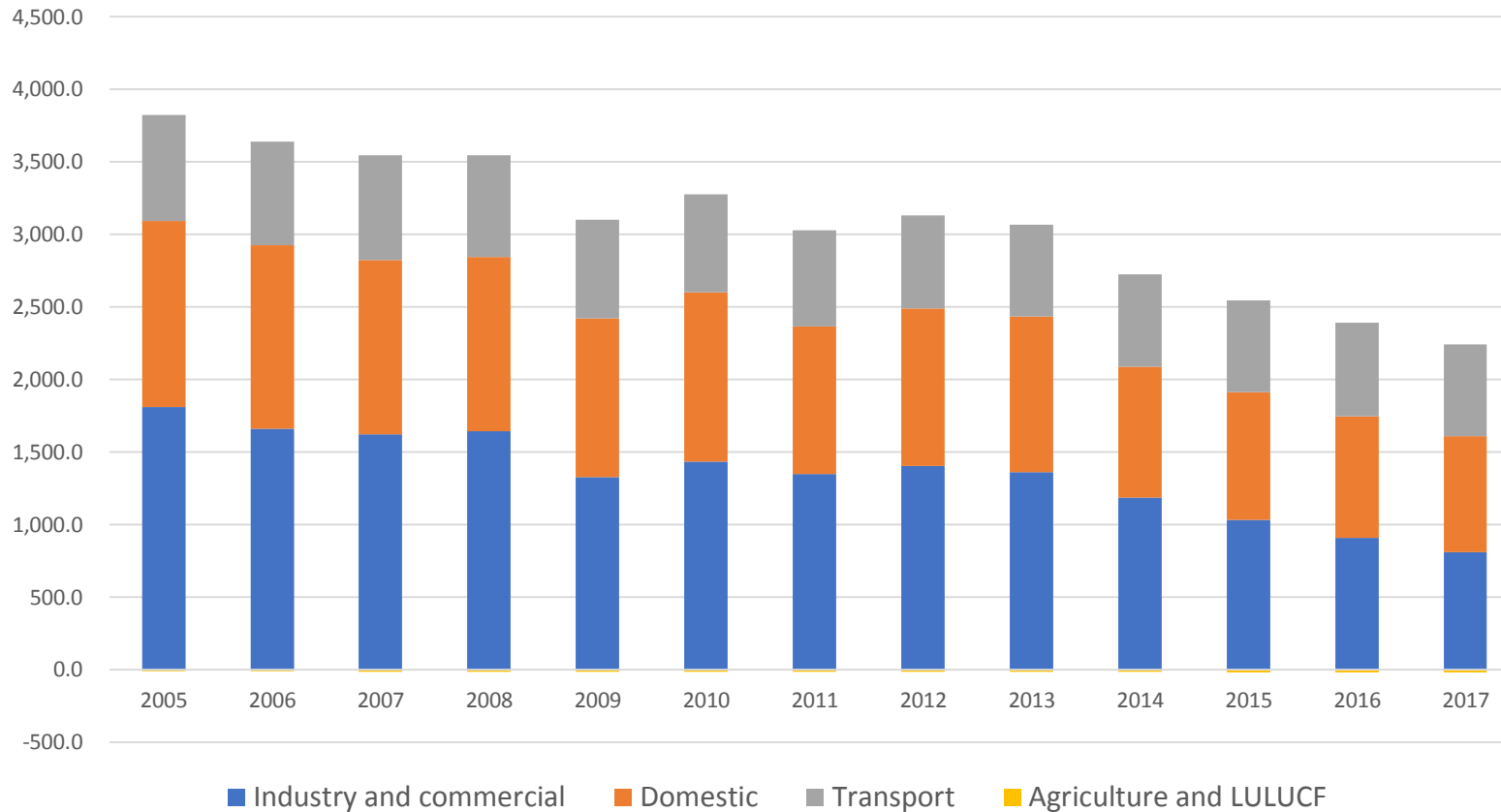## GHG by sector in Sheffield (2017)

Methane is the dominant non-CO2 GHG and is largely related to agriculture and waste disposal.

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Trend in Sheffield CO$_2$ 2005 to 2017

CO2 in kt

Total emissions have dropped by 42% since 2005

➢ Industrial and commercial emission have dropped by 55%

➢ Domestic emissions have dropped by 37%

➢ Transport emission have dropped by 13%

Legend: ■ Industry and commercial ■ Domestic ■ Transport ■ Agriculture and LULUCF
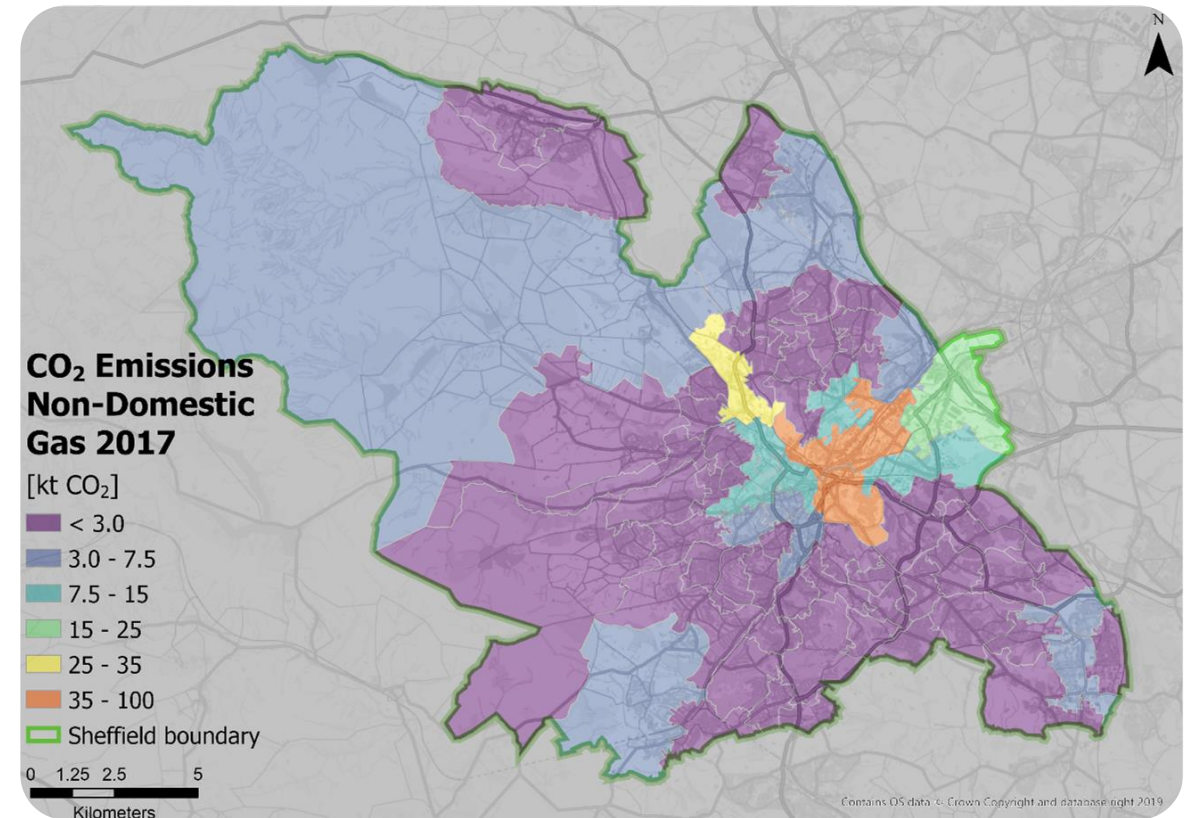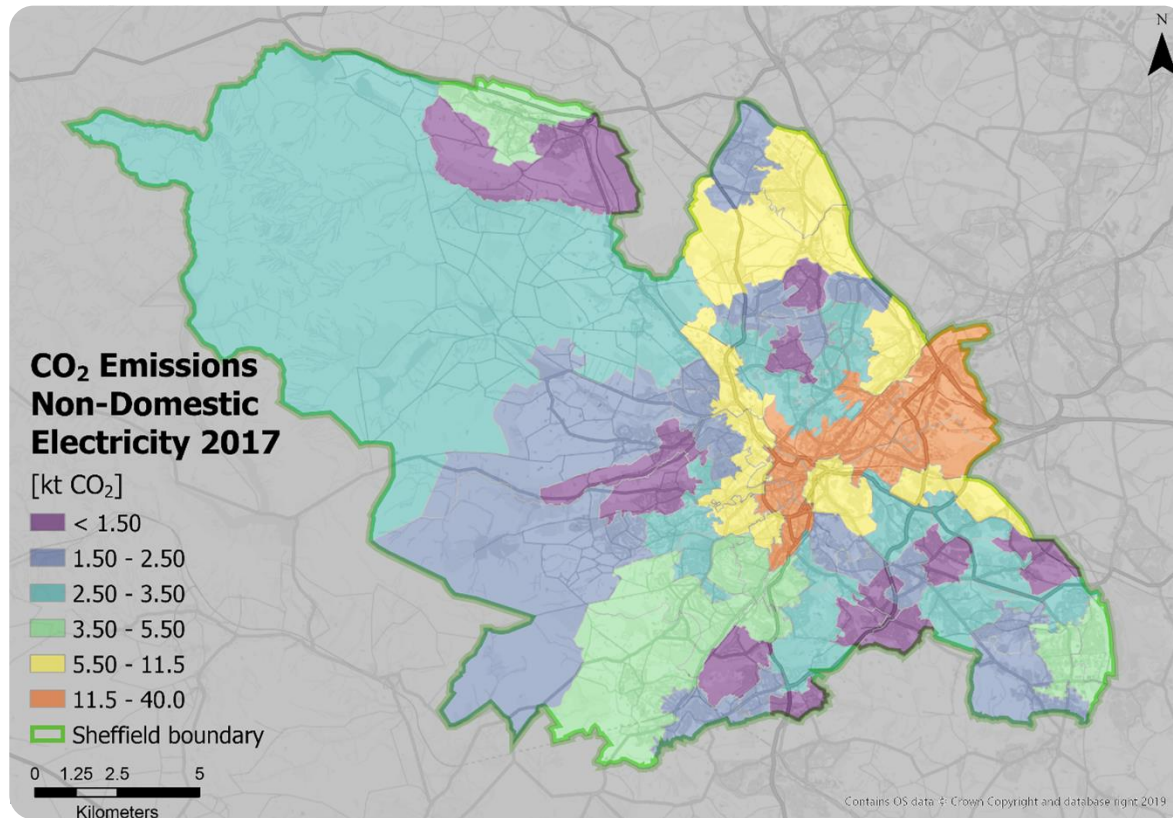
Industrial and commercial sector -1

➢ Energy consumption has decreased by ~ 33% since 2005 – the largest drop being in solid fuels and then gas.
➢ Overall energy intensity has drop by between 40% and 65%, dependent on fuel which will reflect a range of factors from structural change, with an increasing service sector, to efficiency improvements and some fuel switching.
➢ Most of the CO_2 emissions are related to commercial and light industrial activity, with only about <u>4% related to large industrial sources.</u>

Industrial and commercial energy consumption in Sheffield
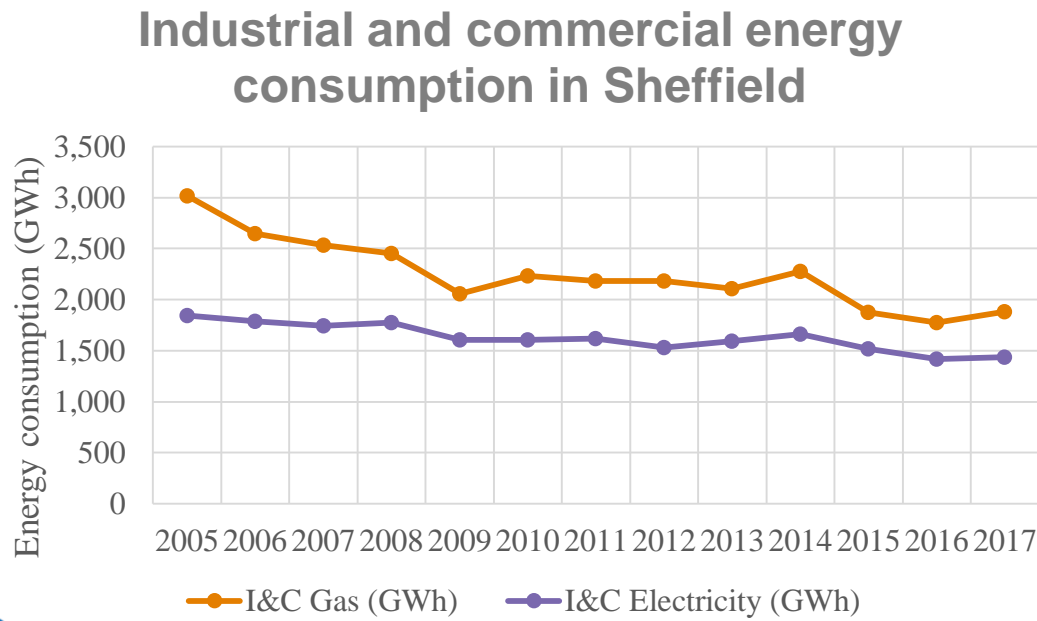
Property type	Proportion of businesses
Retail	36%
Offices	20%
Warehouse and storage	11%
Industry	15%
Other	18%

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Industrial and commercial - 2

➢ The geographical focus of the industrial and commercial emissions is the central area and the industrial area to the North East of the city along the Don Valley.

CO₂ Emissions
Non-Domestic
Electricity 2017
[kt CO₂]
- < 1.50
- 1.50 - 2.50
- 2.50 - 3.50
- 3.50 - 5.50
- 5.50 - 11.5
- 11.5 - 40.0
- Sheffield boundary

0 1.25 2.5 5
Kilometers
Contains OS data © Crown Copyright and database right 2019

CO₂ Emissions
Non-Domestic
Gas 2017
[kt CO₂]
- < 3.0
- 3.0 - 7.5
- 7.5 - 15
- 15 - 25
- 25 - 35
- 35 - 100
- Sheffield boundary

0 1.25 2.5 5
Kilometers
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Industrial and commercial sector - 3

➤ The largest industrial sources are still in the traditional iron and steel sector.
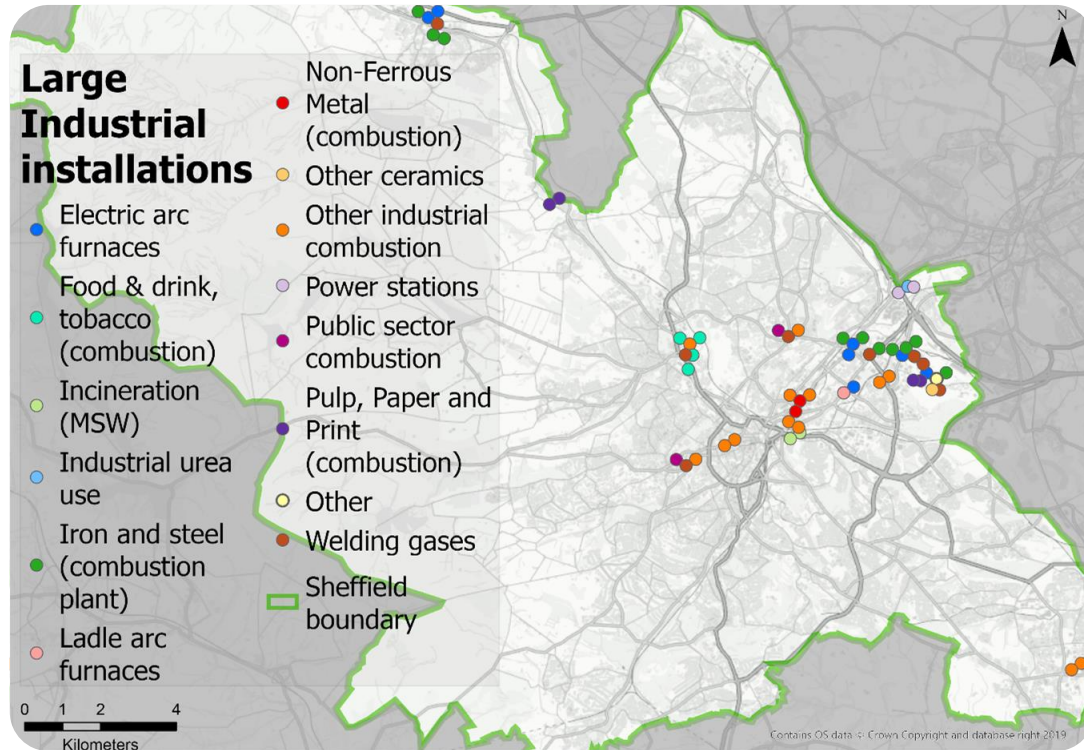
Source Name	2010	2011	2012	2013	2014	2015	2016	2017
Pulp, Paper and Print (combustion)	0.006	0.006	0.006	0.006	0.003	0.003	0.003	0.000
Electric arc furnaces	22.550	26.628	23.892	22.531	24.749	19.283	24.948	26.155
Food & drink, tobacco (combustion)	0.002	0.000	0.000	0.000	0.000	0.000	0.001	0.001
Iron and steel - combustion plant	56.554	72.943	68.194	67.782	72.989	62.087	54.454	1.953
Public sector combustion	0.141	0.102	0.109	0.140	0.038	0.180	0.086	0.229
Other industrial combustion	1.826	0.396	0.166	0.268	0.031	0.083	0.130	0.110
Non-Ferrous Metal (combustion)	0.002	0.002	0.002	0.002	0.000	0.000	0.000	0.000
Industrial urea use	0.000	0.000	0.000	0.000	0.000	0.000	0.811	0.710

Domestic sector - 1

➢ Energy use dropped by 25% overall with a 30% reduction for gas, indicating both boiler and fabric efficiency improvements) and a 15% reduction for electricity indicating improvements in appliance efficiency.
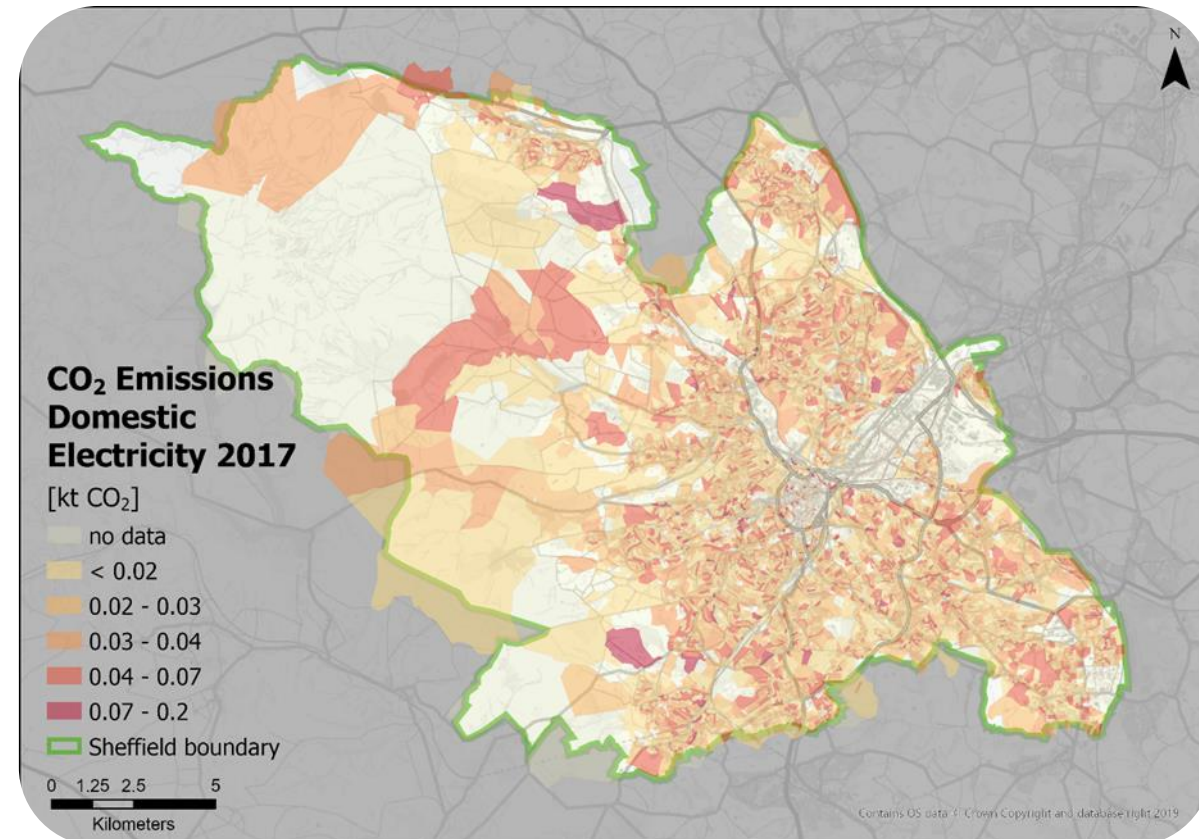
Domestic energy consumption in Sheffield
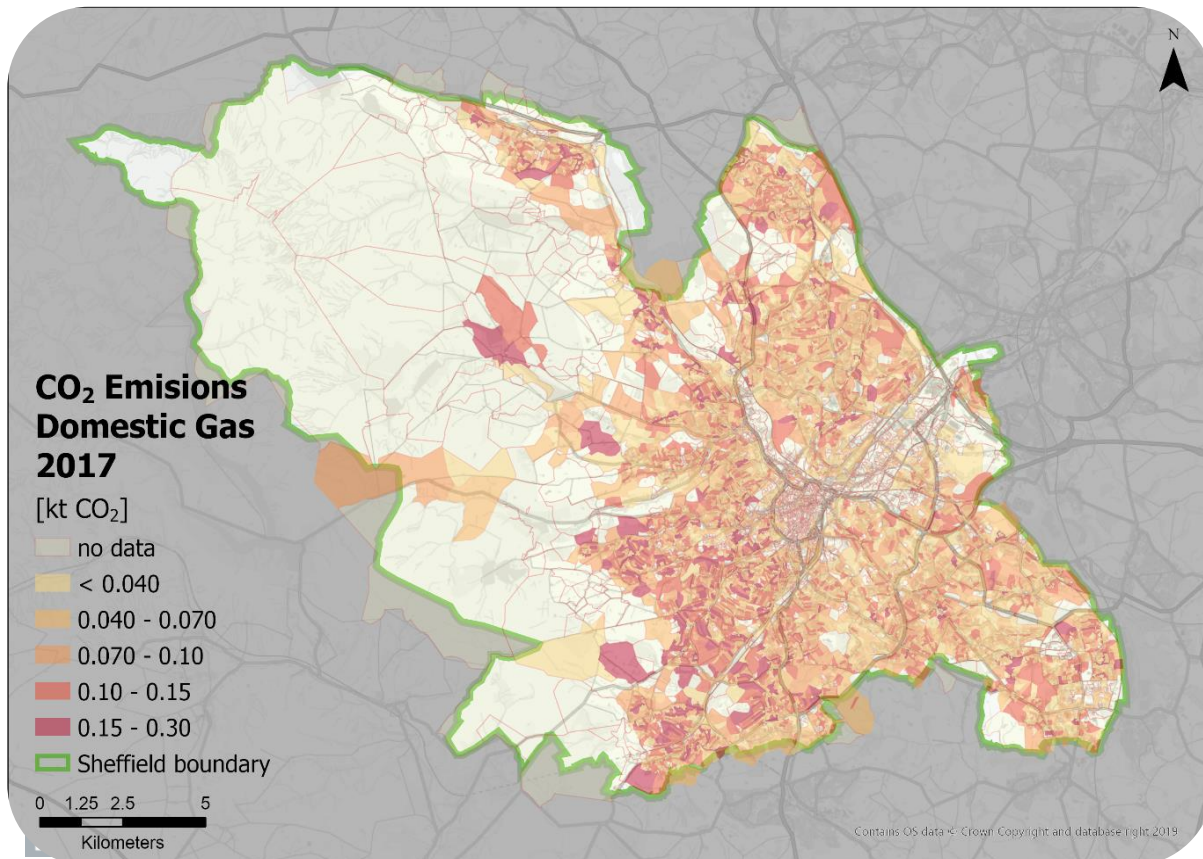
Intensity per capita relative to 2005
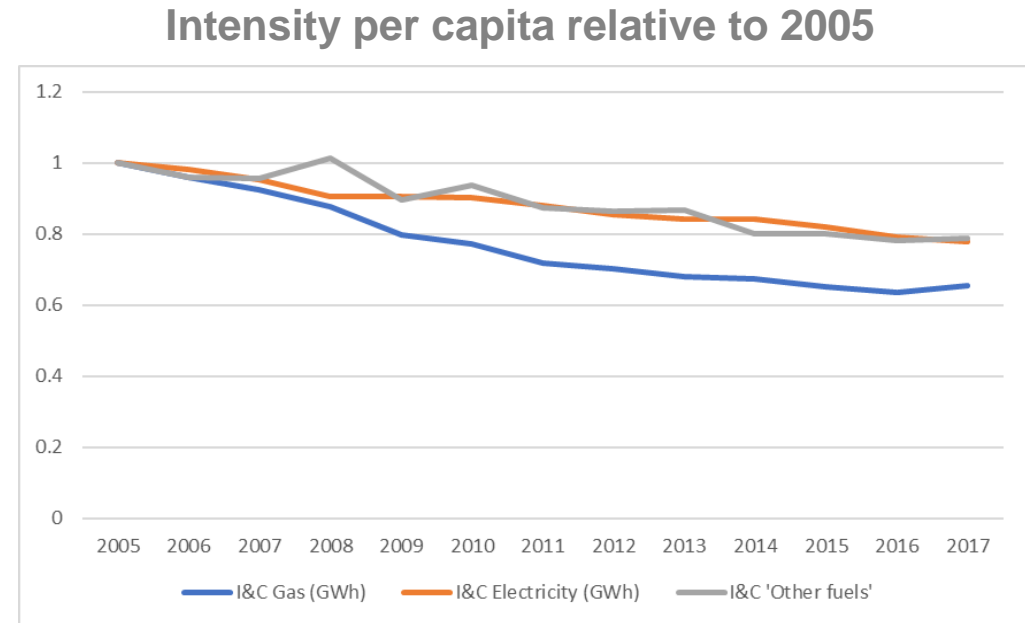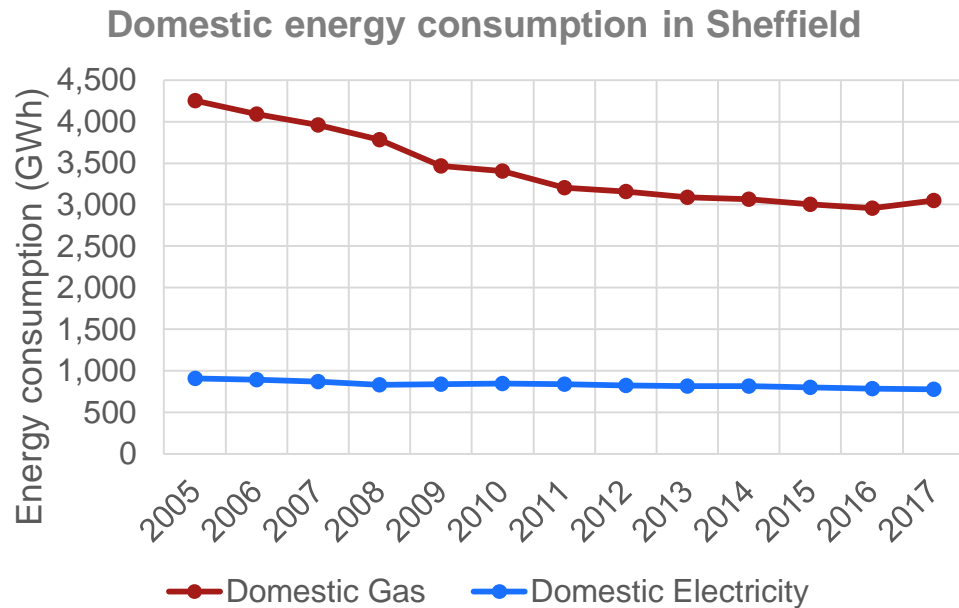
➢ Energy intensity per capita matches the overall patter for energy use - so indicates all the reduction relates to efficiency rather than structural change.

Domestic sector - 2

➤ Geographically the emissions distribution mirrors that of industrial and commercial sector, with energy use being in the south west of the city (potentially larger, detached housing).
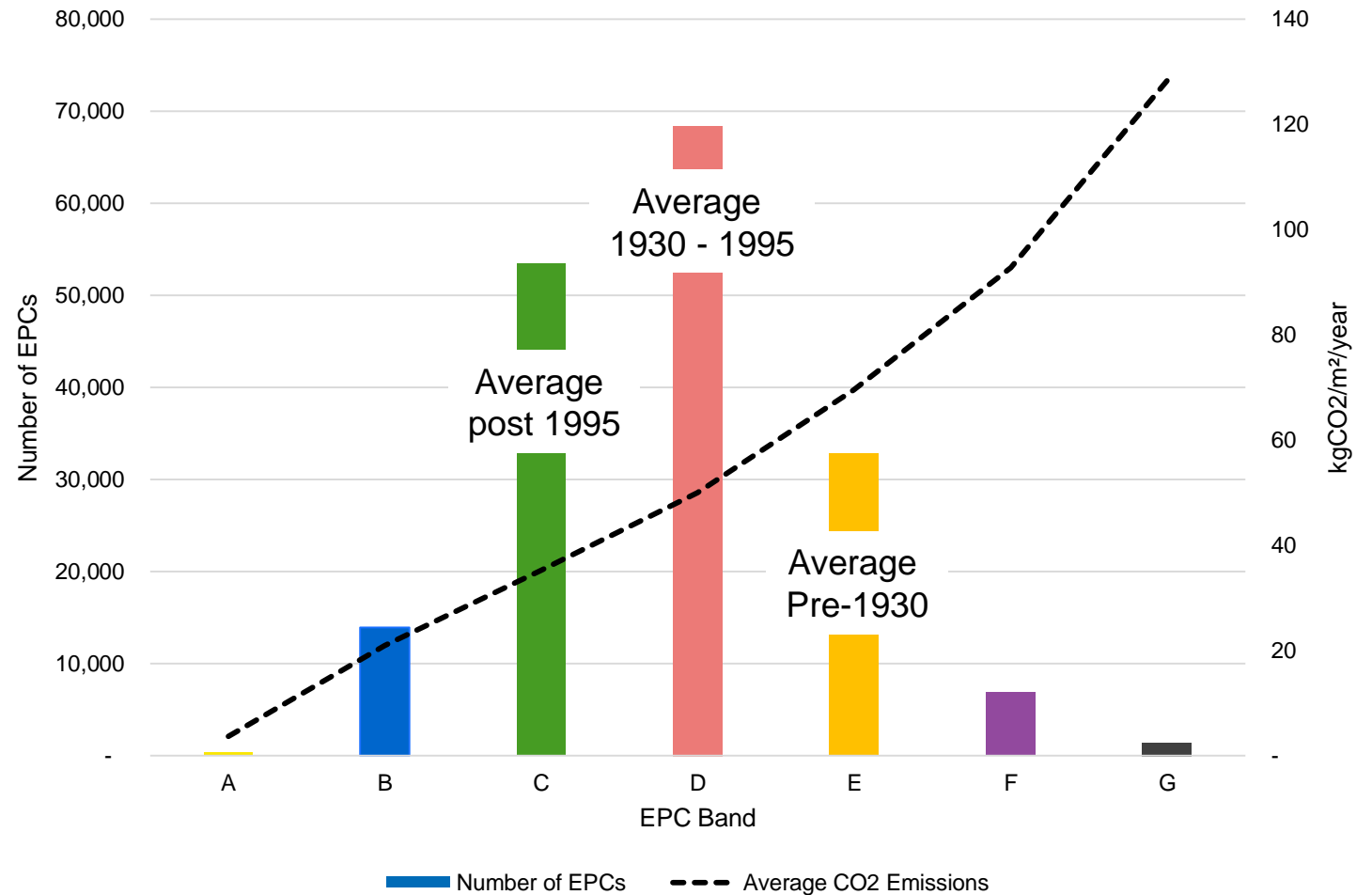➤ Electricity use also indicates off grid electric heating in the north west.

Domestic gas and electricity consumption at post code level

CO₂ Emissions Domestic Gas 2017

[kt CO₂]
- no data
- < 0.040
- 0.040 - 0.070
- 0.070 - 0.10
- 0.10 - 0.15
- 0.15 - 0.30
- Sheffield boundary

0 1.25 2.5   5
Kilometers

CO₂ Emissions Domestic Electricity 2017

[kt CO₂]
- no data
- < 0.02
- 0.02 - 0.03
- 0.03 - 0.04
- 0.04 - 0.07
- 0.07 - 0.2
- Sheffield boundary

0 1.25 2.5   5
Kilometers

Domestic sector - 3

- The EPC data shows a normal distribution around a D rating, so there is significant scope for improvement. A shift from D to B would reduce emissions by about 40%, and a shift to A by about 90%.

- As might be expected older houses have worse EPC ratings, but even more modern properties built since 2000 have an average rating of C – a rating which could to be improved.

- In terms of main heating sources 81% are gas boilers, 10% are electric and 5% some form of district heating. This indicates a need for a major shift away from gas boilers to zero carbon heating sources.


EPC rating and average CO2 emissions

Average 1930 - 1995

Average post 1995

Average Pre-1930

Number of EPCs

EPC Band

kgCO2/m²/year

Number of EPCs — — Average CO2 Emissions

Transport sector - 1

➢ Transport energy use has only dropped by 17%, with a clear dieselisation of the light duty fleet seen
➢ Car mode share remains fairly constant but bus share has dropped and along with bus energy use

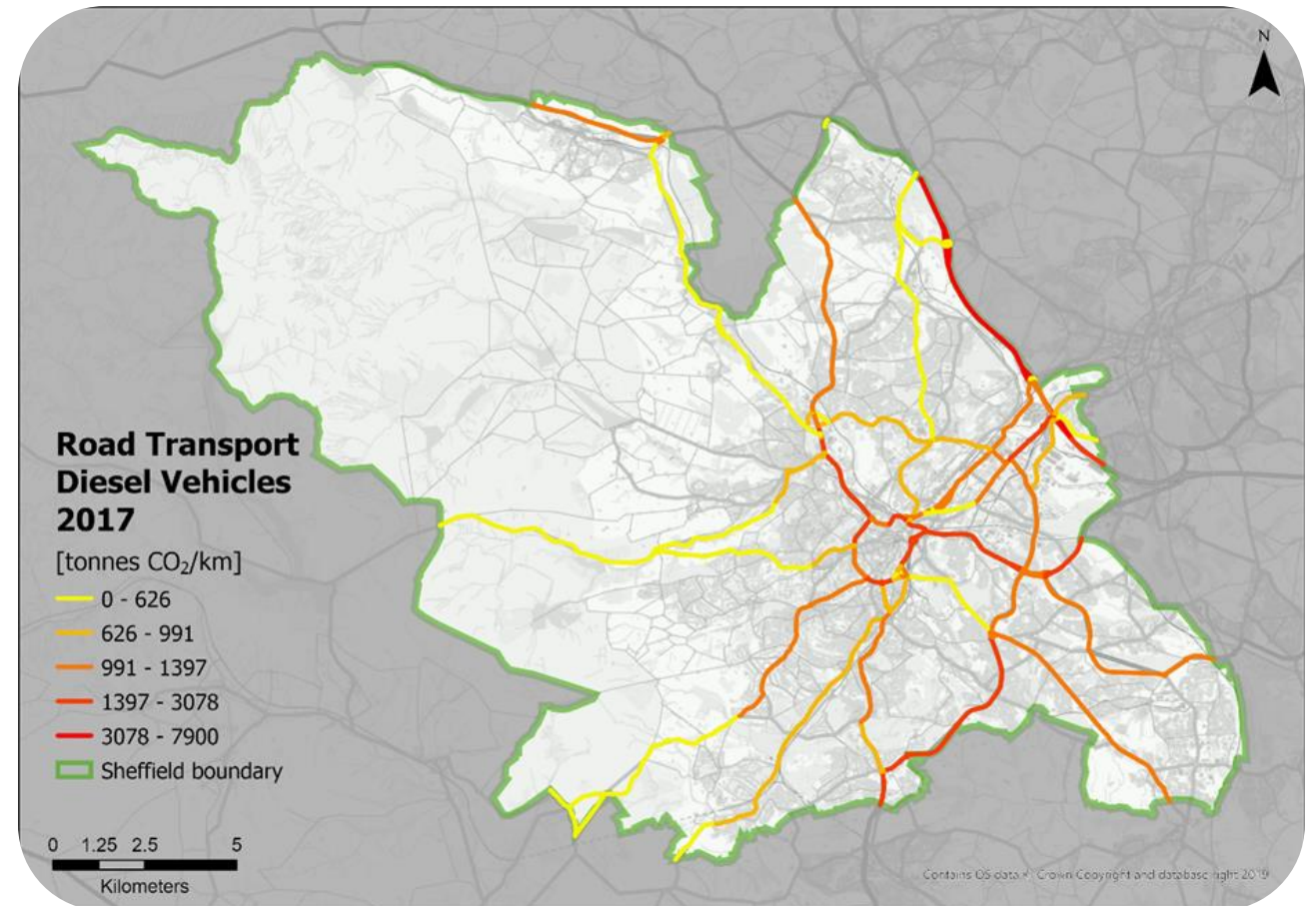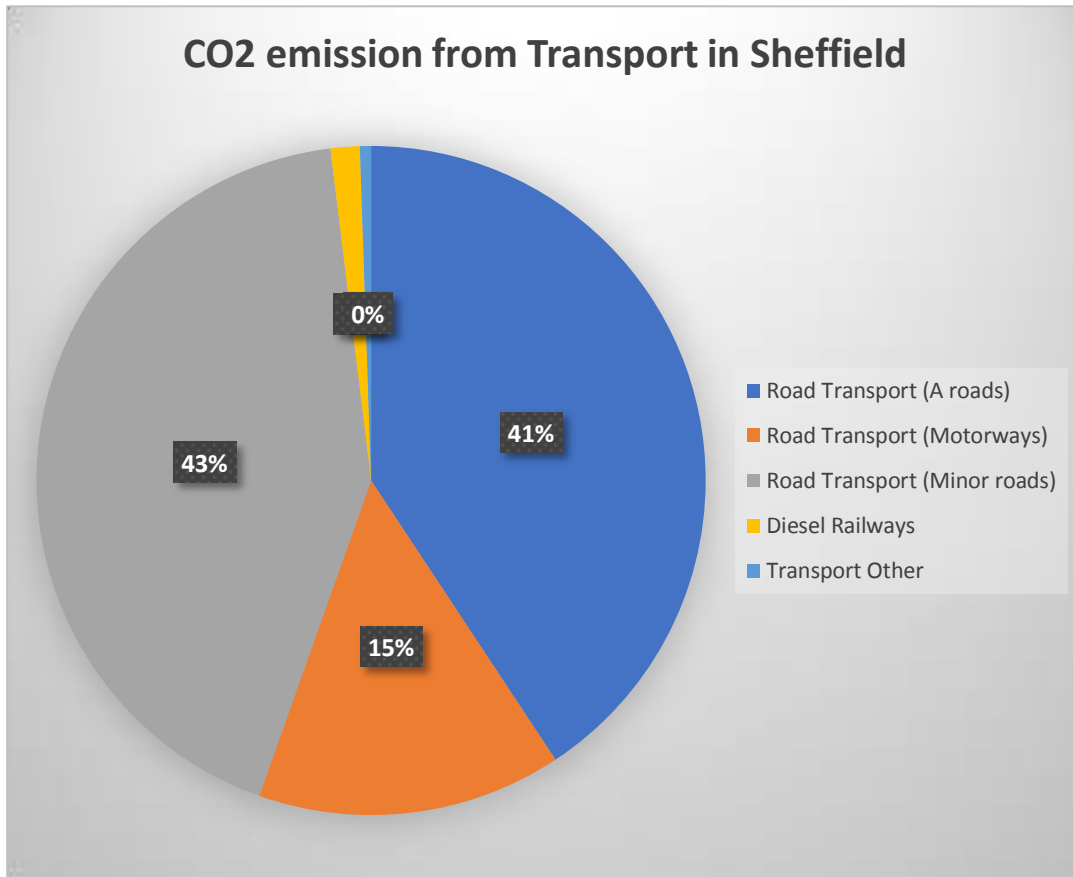Change in energy use relative to 2005
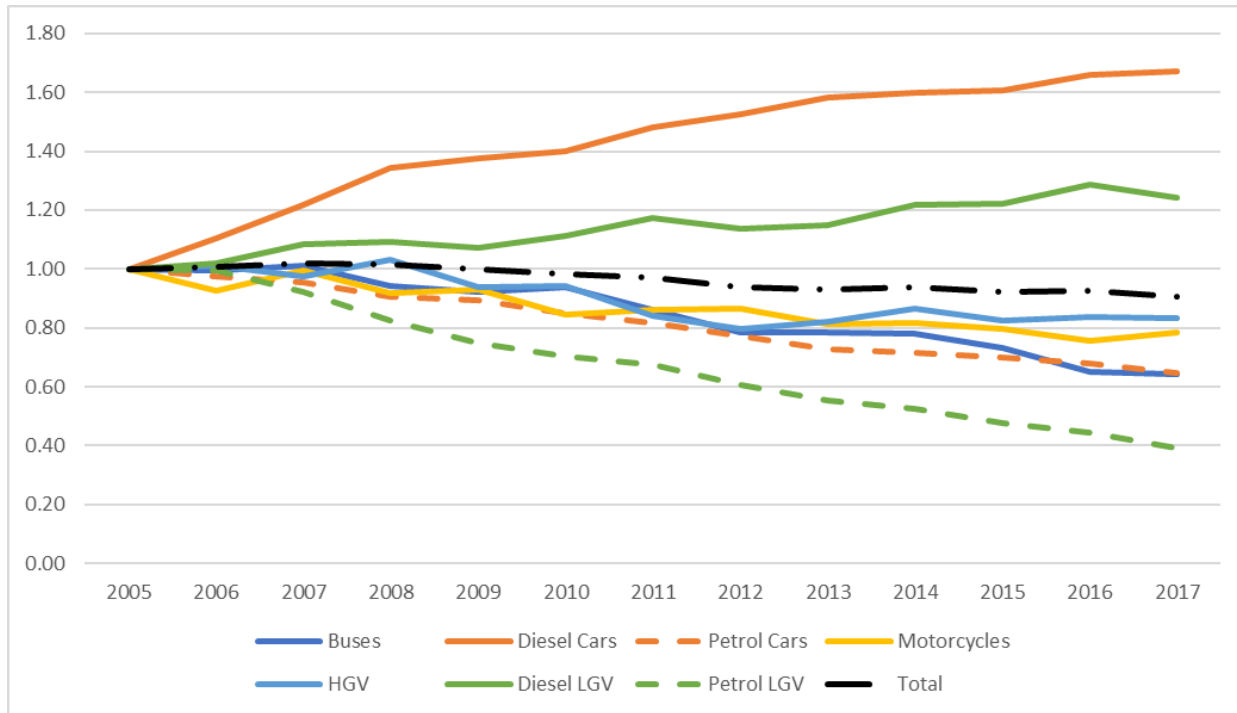
Mode share of trips 1995 to 2019
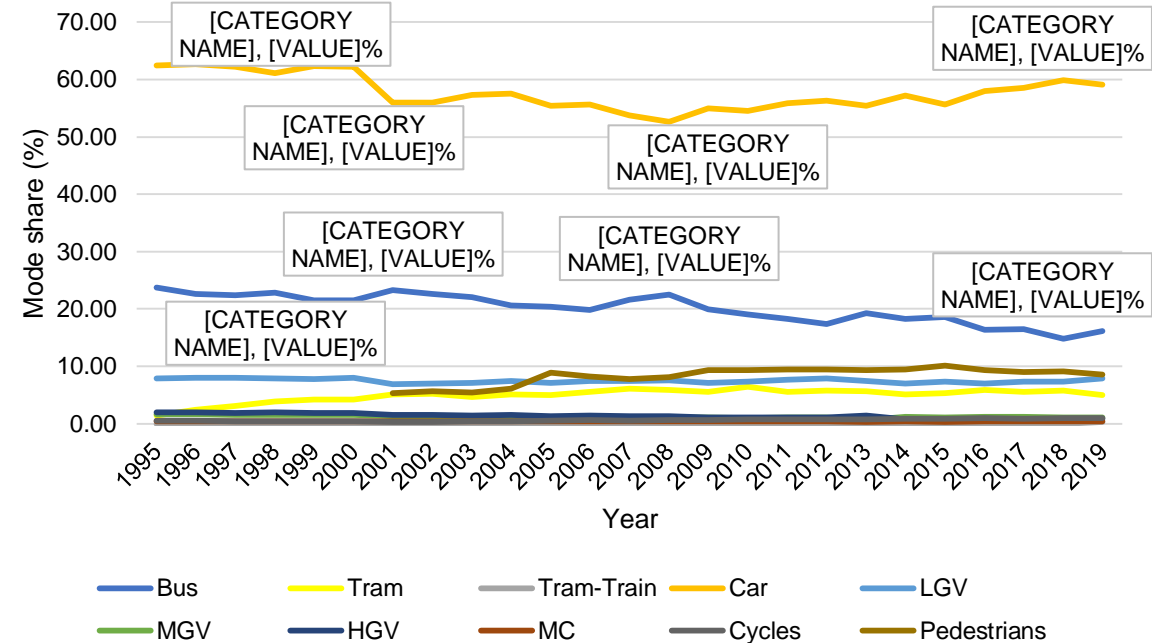
Transport sector - 2

➢ 98% of transport emissions are from road transport
➢ Emissions are highest on the main road network around the city as would be expected.

CO2 emission from Transport in Sheffield

- Road Transport (A roads) — 41%
- Road Transport (Motorways) — 15%
- Road Transport (Minor roads) — 43%
- Diesel Railways — 0%
- Transport Other

Road Transport Diesel Vehicles 2017
[tonnes CO$_2$/km]
- 0 - 626
- 626 - 991
- 991 - 1397
- 1397 - 3078
- 3078 - 7900
- Sheffield boundary

Agriculture, waste and land-use - 1

- The smallest sector at approximately 6% of GHG emissions.

- The only sector where methane dominates the GHG emissions (82%; 158 kt CO2e).

- CO_2 emissions have slightly decreased between 2005 and 2017 (7% decrease)

- The CO_2 emissions attributed to LULUCF, show an increasing net decrease (40%) with an average annual decrease of 2.9%. Continuing or enhancing this trend will help the net carbon emissions balance.

GHG breakdown from agriculture, waste and land use (ktCO2e)

N2O, 18, 9%

[CATEGORY NAME], 17, 9%

[CATEGORY NAME], [VALUE], 82%

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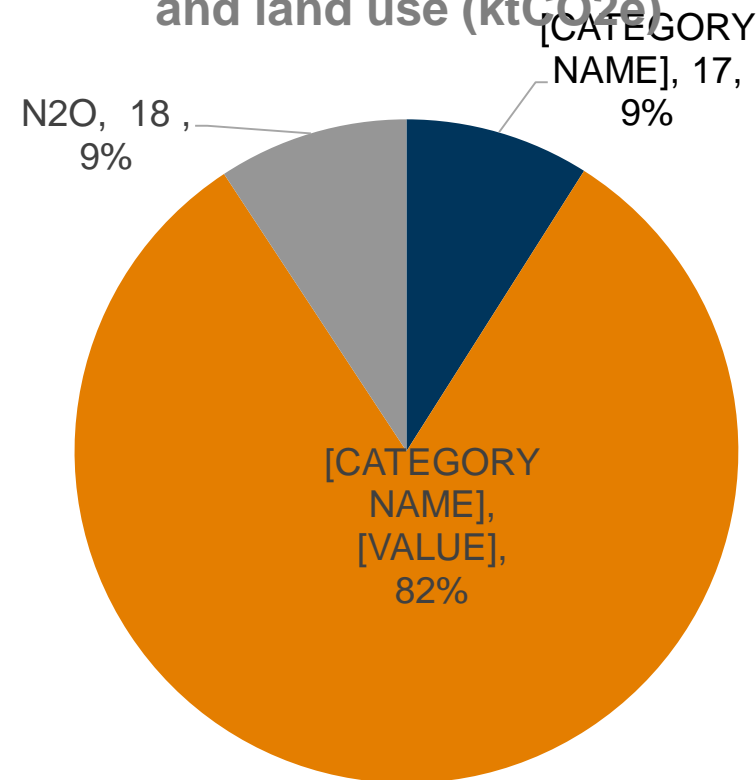
Agriculture, waste and land-use - 2

➢ The hotspots of methane emissions are much higher in emissions than the cold spots – by 2 orders of magnitude and much greater than the other GHG.
➢ High methane emission spots are located near the eastern region of the Peak District National Park and near the M1 motorway.

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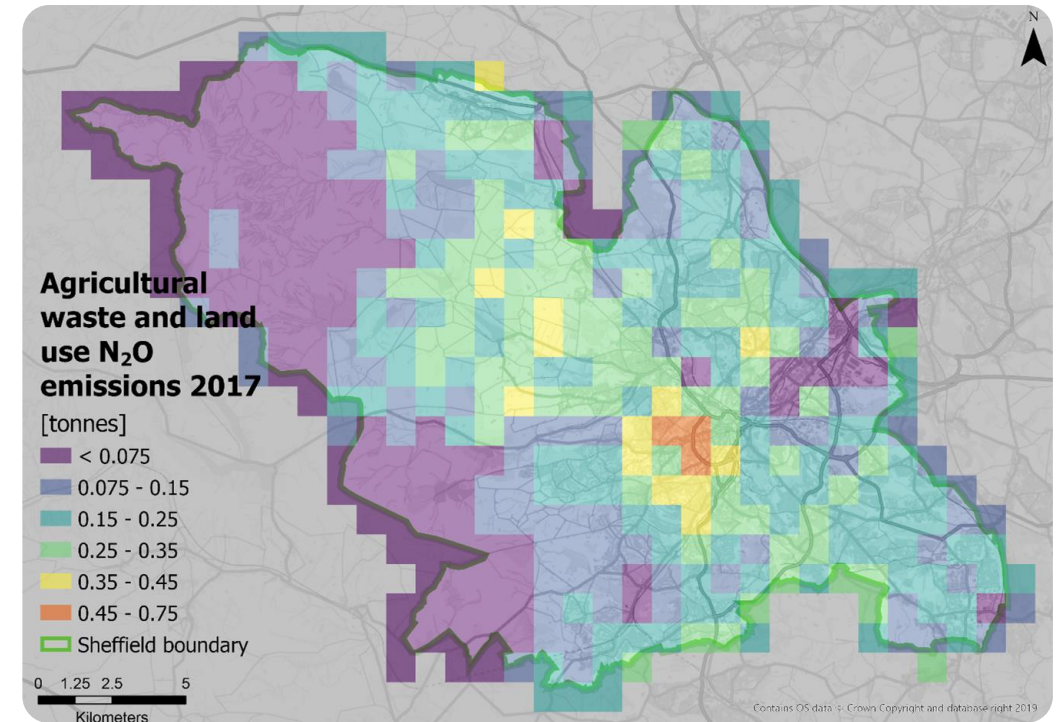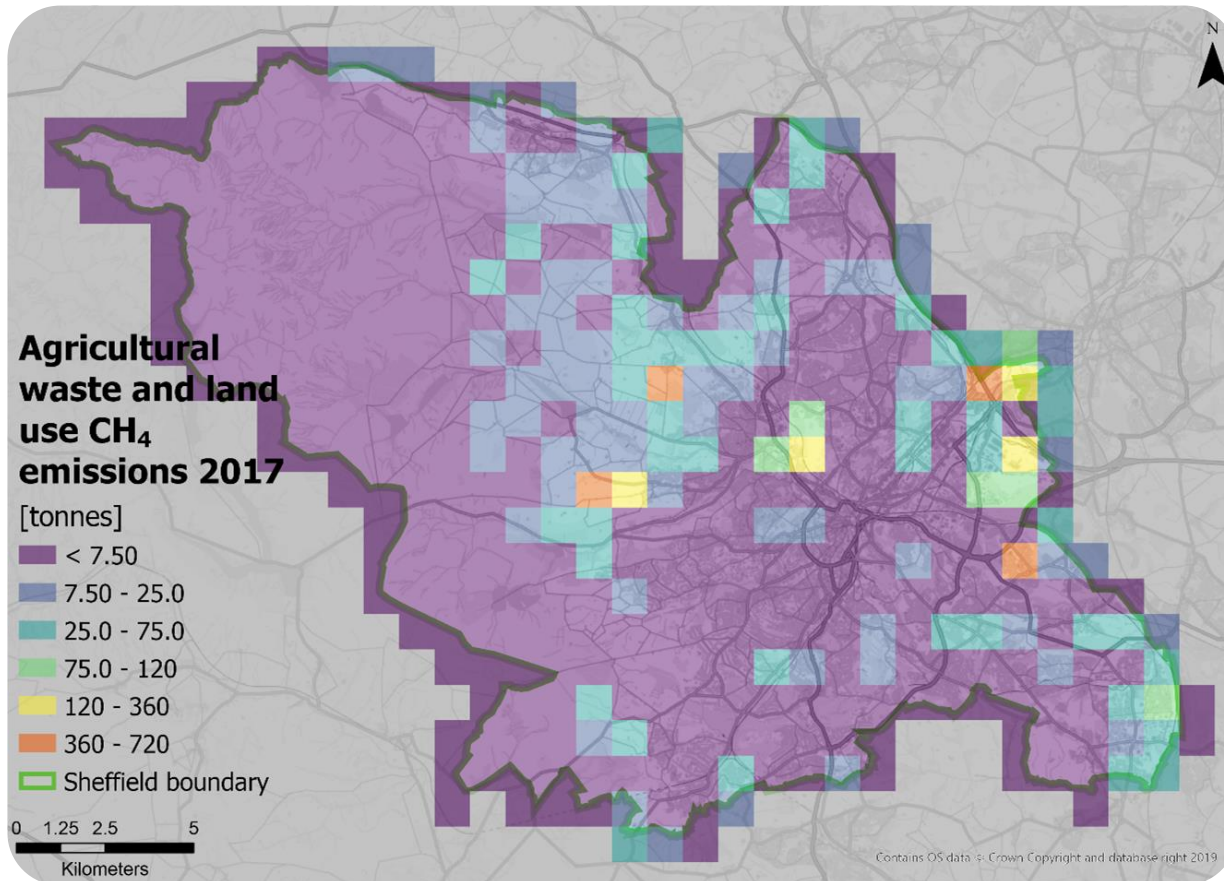
Local energy generation

Technology	No of installations	Capacity MW$_{th}$	Generation GWh/year
Domestic RHI installations	252	3.2	15.1
Non-domestic RHI installations	63	11.0[18]	140.6[19]
Sheffield ERF which supplies heat to the Sheffield District Energy Network	1	Up to 45MW available. Typical peak load is 40-42MW.	97.4
Blackburn Meadows Biomass CHP which supplies heat to a district heating network in the Don Valley area	1	Up to 25MW available. Typical peak load is currently unknown	Currently unknown
Total	**317**	**54.2**	**253.1**

This equates to 7% of current gas use in the city

Electricity generation

Technology	No of installations	Capacity MW	Generation GWh/year	Emissions tCO$_2$e/year
Photovoltaics	5,451	22.1	20.8	0
Onshore Wind	9	0.1	0.1	0
Hydro	3	0.6	2.2	0
Sewage Gas	1	2.0	11.1	2.32
Landfill Gas	3	4.9	17.8	3.55
Municipal Solid Waste	1	19.0	105.9	4,335
Plant Biomass	8	62.3	315.9	4,938
Total	**5,476**	**111.0**	**473.8**	**9,279**

This equates to 21% of current electricity use in the city

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Questions ?