

Quantifying the implications of the Paris Agreement for the city of Manchester

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NB: All views contained within this report are attributable solely to the authors and do not necessarily reflect those of researchers within the wider Tyndall Centre.

1 KEY MESSAGES

The development of post-2017 carbon budget ranges and carbon emissions pathways for Manchester City builds on detailed research (e.g. Anderson and Bows (1)), transposing the 2°C temperature target and equity commitments set by the Paris Agreement to the UK level. The carbon budgets presented apply to carbon dioxide emissions from the energy system only excluding Land Use, Land Use Change and Forestry (LULUCF), aviation and shipping. This report does not address the still more challenging commitment to “*pursue efforts to limit the temperature increase to 1.5°C.*” Based on our analysis, for Manchester to make its ‘fair’ contribution towards the 2°C commitment enshrined in the Paris Agreement, Manchester would need to:

1) Hold cumulative carbon dioxide emissions at under 15 million tonnes (range of 8 to 24 MtCO₂) from 2018 onwards. To give a sense of the scale of the challenge, at current (2015) CO₂ emission levels¹, Manchester would use its entire budget within 4 to 10 years.

2) Initiate an immediate programme of mitigation delivering an annual average of 13% (range of 8% to 20%) cuts in emissions in order to remain within its fair 2°C carbon budget. The 13% annual average reduction in emissions combines both national and local action and would be part of wider collaboration with Greater Manchester Combined Authority (GMCA) on meeting its emissions reductions goals. The recommended pathway, 13% per annum reductions, is similar to the annual rates of reduction achieved by Manchester in 2014 (18.8%) which was primarily driven by a change in the fuel mix for electricity (2); it is important to note that this reduction occurred over a single year only.

3) Manchester needs to begin a rapid programme of reducing emissions from Land Use, Land Use Change and Forestry (LULUCF). CO₂-only emissions from this sector should be tracked and aligned with Greater Manchester’s carbon neutrality ambition and should ensure that, from 2018-2100, the net level of sequestration is equivalent to both Manchester’s early LULUCF emissions and longer term non-CO₂ emissions.

2 Introduction

The UK Climate Change Act 2008 has enshrined a commitment to at least an 80 percent reduction in greenhouse gas emissions by 2050 from 1990 levels, with five yearly carbon budgets to act as stepping stones (3). The SCATTER project commissioned by GMCA developed a methodology for Local Authorities to set carbon emissions targets that are consistent with United Nations Paris Climate Agreement. The report “Quantifying the implications of the Paris Agreement for Greater Manchester” (4) from the SCATTER project recommended a carbon budget of 71 MtCO₂ for GM from 2018 onwards. This report complements the SCATTER report by downscaling global carbon budgets to Manchester.

¹ Based on Manchester’s 2015 CO₂ emissions (excluding aviation, shipping, process CO₂ emissions from cement production and those from LULUCF).

2.1 Apportioning the UK budgets to Manchester City

Three apportionment regimes (Grandfathering, Population and Gross Value Added), as detailed in the SCATTER report, are used here to allocate the UK (“well below 2°C”) energy-only CO₂ emissions budget (post-2017) to Manchester. Based on these apportionment regimes, the subsequent CO₂ emission budgets and illustrative mitigation rates are provided in Table 1. The recommended carbon budget for Manchester (final row in Table 1) is the mean of all the allocation regimes. The budgets are valid for 2°C provided aviation and shipping emissions are also reduced at the levels outlined by the allocations detailed in the SCATTER report (4). Any failure to hold aviation and shipping emissions within the SCATTER budgets will reduce emissions to the UK’s regions, including GMCA and Manchester.

Table 1: Apportionment regime², CO₂ budgets and annual mitigation rates for Manchester City, 2018-2100

Apportionment regime (bracket term is Manchester’s proportion of the UK)	UK mid-value budget ³ (MtCO ₂)	Manchester mid value budget (MtCO ₂)	Average annual mitigation rate (%)
Grandfathered to Manchester from UK UK CO ₂ based on population split of OECD GF-Pop (0.6%)	2463	15	12.1%
Population split to Manchester from UK UK CO ₂ based on population split of OECD Pop-Pop (0.8%)	2463	20	9.5%
GVA split to Manchester from UK UK CO ₂ based on population split of OECD GVA-Pop (1.0%)	2463	24	7.8%
Grandfathered to Manchester from UK UK CO ₂ grandfathered from OECD GF-GF (0.6%)	1350	8	20.1%
Population split to Manchester from UK UK CO ₂ grandfathered from OECD Pop-GF (0.8%)	1350	11	16.0%
GVA split to Manchester from UK UK CO ₂ grandfathered from OECD GVA-GF (1.0%)	1350	13	13.4%
Recommended carbon budget for Manchester		15	13.2%

The family of emission pathways for Manchester premised on the carbon budgets shown in Table 1 are illustrated in Figure 1a & 1b and Table 2. The recommended carbon budgets represent 21.4% of the GM budget.

² The UK mid-value budgets used here are taken from the report “Quantifying the implications of the Paris Agreement: what role for the UK’s energy system?” Anderson (2017).

³ Assumes a peak in non-OECD emissions between 2022 and 2023 (6). After deducting an emissions budget for aviation, shipping and military transport of 1537 MtCO₂.

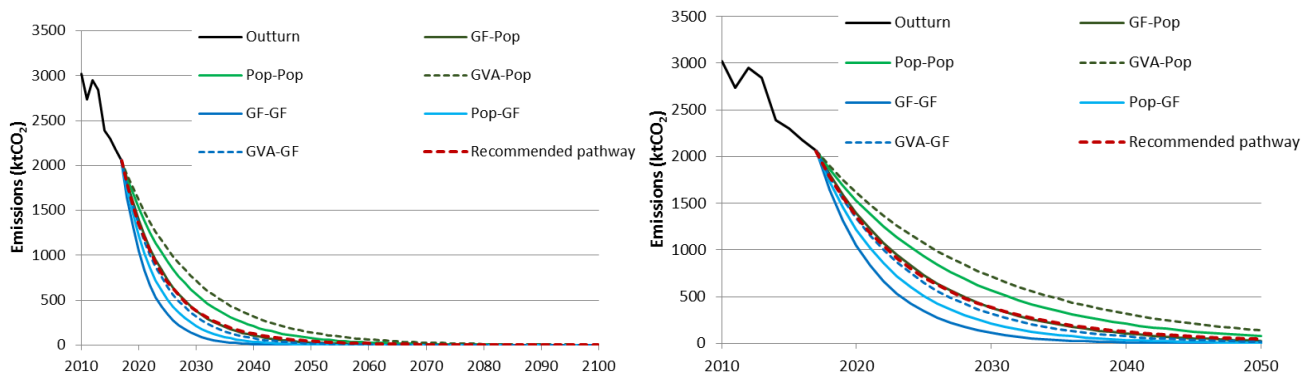


Figure 1a (left): Fossil fuel CO₂ only emissions pathways (2010-2100) for Manchester City premised on carbon budgets shown in Table 1. **Figure 1b (right):** Fossil fuel CO₂ only emissions pathways (2010-2050) for Manchester City premised on carbon budgets shown in Table 1.

Table 2: Periodic carbon budgets from 2018 under various regimes for Manchester City

		GF-Pop	Pop-Pop	GVA-Pop	GF-GF	Pop-GF	GVA-GF	Recommended Manchester CO ₂ budget
Carbon budget period	2018-2022	7.1	7.7	8.1	5.5	6.3	6.8	6.9
	2023-2027	3.8	4.7	5.4	1.8	2.6	3.3	3.6
	2028-2032	2.0	2.9	3.6	0.6	1.1	1.6	2.0
	2033-2037	1.0	1.7	2.4	0.2	0.5	0.8	1.1
	2038-2042	0.5	1.1	1.6	0.1	0.2	0.4	0.6
	2043-2047	0.3	0.6	1.1	0.0	0.1	0.2	0.4
	2048-2100	0.3	1.0	2.1	0.0	0.1	0.2	0.6

2.2 Allocating a carbon budget for the LULUCF sector

Land Use, Land Use Change and Forestry (LULUCF) consist of both emissions and removals of CO₂ from land and forests. The CO₂-only emissions from LULUCF in 2015 were about 0.1% (~1.5 ktCO₂) of Manchester's total CO₂ emissions (5). The Manchester city budgets and pathways for LULUCF CO₂-only emissions are tracked separately to, but consistent with, the Manchester energy only five-year carbon budgets (Figure 2). The detailed methodology for considering emissions from the LULUCF sector is outlined in the SCATTER report, where the cumulative emissions from 2018 to 2038 (area A) is compensated with carbon removals from 2039 to 2100 (area B). The current trend in emissions reduction (a mean of 7.7% for 2010-2015) is also shown.

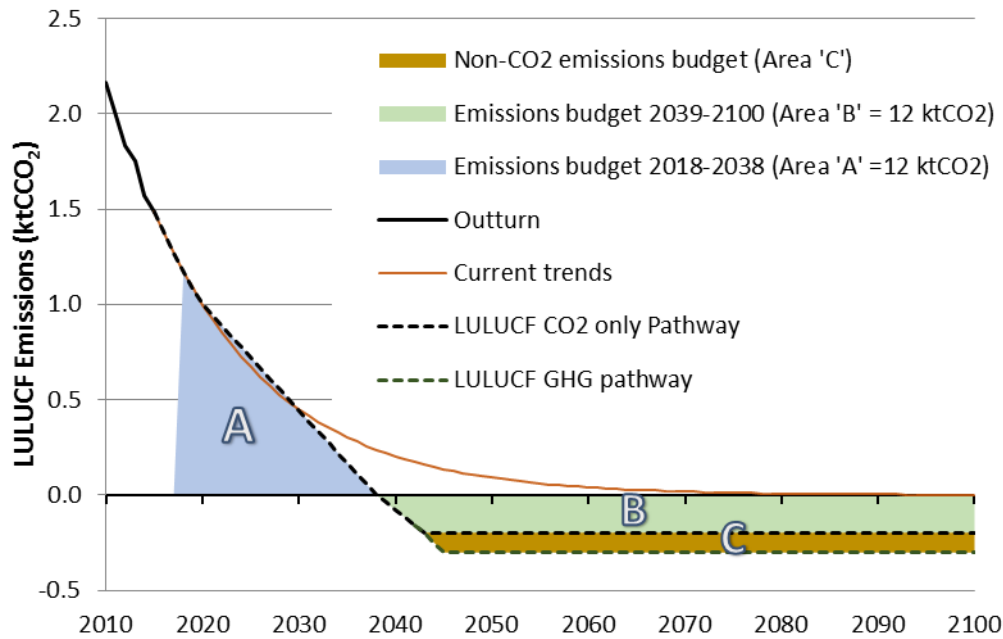


Figure 2: Cumulative emissions budget for LULUCF sector within Manchester City

3 Non-CO₂ emissions for Manchester

The Department of Business Energy and Industrial Strategy’s Local Authority emissions statistics do not provide non-CO₂ emissions data at the regional level. Given the absence of robust non-CO₂ emissions data, we recommend the LULUCF pathway shown in Figure 2 should be adopted so as to include sequestration equivalent to area C in order to help compensate for any cumulative non-CO₂ emissions within the Manchester boundary. The pathway for non-CO₂ emissions is illustrative as the requisite data is not available.

4 Conclusion

The pathways demonstrate that if Manchester is to make its ‘fair’ contribution to delivering on the Paris 2°C temperature commitment then it needs to begin an immediate and rapid programme of decarbonisation to remain within the necessary carbon budget range of 8 to 24 MtCO₂ (for the period from 2018 onwards). To give a sense of the scale of the challenge, at current (2015) CO₂ emission levels⁴, Manchester will use its entire budget within 4 to 10 years. However, existing trends and policies have led Manchester CO₂ emissions to reduce at an average rate of 8.8% per annum since 2012, similar to the lowest emissions reduction objective presented here, but still over 4% lower than our recommended mitigation rate of 13% per annum.

To provide a smooth transition in line with the above budgets, average annual mitigation rates of CO₂ from energy need to be between 8% and 20%, with our recommended approach requiring 13% p.a.; all of these begin from the start of 2018. Some of the annual mitigation rates for Manchester are slightly lower than those for the GM as a whole; this is because Manchester starts from lower per capita emissions (4.3 tCO₂, compared with the 5.5 tCO₂ for GM⁵). The percentage reduction of

⁴ Based on GM’s 2015 CO₂ emissions (excluding aviation, shipping, process CO₂ emissions from cement production and those from LULUCF).

⁵ These values are for 2015 and exclude aviation, shipping, process CO₂ emissions from cement production and those from LULUCF. Emissions from Manchester account about 18% of the GM emissions.

emissions for the years 2020, 2030, 2040 and 2050 under each of the scenarios compared to 2015 are shown in Table 3.

Table 3: Percentage reduction of emissions for the CO₂-only scenarios out to 2050 in relation to 2015

	GF-Pop	Pop-Pop	GVA-Pop	GF-GF	Pop-GF	GVA-GF	Recommended pathway	LULUCF
2020	39%	34%	30%	54%	47%	42%	41%	33%
2030	83%	75%	69%	95%	91%	86%	83%	70%
2040	95%	91%	86%	99%	98%	97%	95%	105%
2050	99%	97%	94%	100%	100%	99%	98%	113%

A separate regional LULUCF CO₂-only emissions budget of 12 ktCO₂ from 2018 to 2038 is also provided aligning with the GM LULUCF sector pathway. The LULUCF emissions should reach zero by 2038 with net sequestration thereafter to compensate the cumulative LULUCF emissions from 2018 to 2038 by the end of the century.

In summary, we recommend Manchester initiate an immediate, rapid and deep reduction in its annual carbon dioxide emissions of 13% p.a. If instead it chooses a lower rate, then to make its fair contribution to Paris, we recommend this rate be rapidly ramped up to a minimum of 13% p.a. At the same time Manchester must maintain ongoing progress in reducing its non-CO₂ emissions for several decades to come.

5 Reference List

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