From Paris to Manchester

2°C, integrity & action

Jaise Kuriakose, Kevin Anderson,
John Broderick, Carly McLachlan
If we’re interested in temperature change (e.g. avoiding +2°C) …it’s not long-term targets (e.g. 80% by 2050) that matter
Carbon budgets

...but cumulative emissions, *the area under the curve*
To limit warming to a 2°C rise ...

we have a set
global carbon pie

i.e. total CO$_2$ that can be emitted from now to forever ...
So to limit warming to a 2°C rise ...

... this needs to be split **equitably** amongst all of the world’s nations
What is a fair slice (carbon budget) for the UK?
What is a fair slice *(carbon budget)* for the UK?
What is a fair slice *(carbon budget)* for the UK?
Of the UK carbon budget ...
Fair slice for Manchester...
Headline Conclusions

- **Full decarbonisation** of energy system is necessary under Paris Agreement
- Manchester City should aim to achieve this **before 2040**
- **Aviation and shipping** are important but considered at a national level
- Multiple **allocation regimes** calculated for a range of pathways
- The use of **offset credits** to achieve this is unlikely to be feasible.
How to share out the carbon budget

1. Identify Paris Agreement compatible emissions budgets
2. Deduct global emissions to date
3. Make allowance for poorer countries
   - Range of peaking dates (2025 latest)
4. Divide the remainder between richer countries (OECD)
5. Deduct aviation, shipping, military transport at the national level
6. Allocate the carbon budget within the UK – Manchester City
Aviation and shipping considered at national level

DfT aviation forecast
Aviation and shipping considered at national level

Aviation (carbon budget 2018-2100=1262 MtCO2)
Aviation and shipping considered at national level

Aviation (carbon budget 2018-2100=1262 MtCO2)
Aviation and shipping considered at national level

- Aviation (carbon budget 2018-2100=1262 MtCO2)
- Shipping (carbon budget 2018-2100=275 MtCO2)
Recommended carbon budget for Manchester City

Recommended carbon budget for Manchester City (2018-2100) - 15 MtCO₂

Average annual mitigation rate - 13%

UK carbon budget (2018-2100) - 1907 MtCO₂ + aviation & shipping

NB: Recommended budget for Manchester City is the central value of the six apportionment regimes
Recommended pathway for Manchester City

- Outturn
- Recommended pathway

Emissions (ktCO₂)

- 2010: 3000
- 2015: 2500
- 2020: 2000
- 2025: 1500
- 2030: 1000
- 2035: 500
- 2040: 0
- 2045: 0
- 2050: 0

- 2010: 41%
- 2015: 83%
- 2020: 95%
Five year carbon budgets for Manchester City

![Graph showing cumulative CO₂ emissions from 2018-2022 to 2048-2057. The emissions peak in 2018-2022 and decrease significantly thereafter.](image-url)
Manchester City’s fair Paris 2°C energy budget:

15 MtCO\textsubscript{2} for 2018 onwards (range 8-24 MtCO\textsubscript{2})

- i.e. around 4 to 10 years of current CO\textsubscript{2} emissions
Green infrastructure - Land Use, Land Use Change and Forestry (LULUCF)

CO₂ emissions released from land-use change

CO₂ emissions released from land-use change
Green infrastructure - Land Use, Land Use Change and Forestry (LULUCF)

CO₂ sequestered from land use

LULUCF Emissions (ktCO₂)

2010 2020 2030 2040 2050 2060 2070 2080 2090 2100
GM’s fair Paris 2°C energy budget: 71 MtCO₂
Manchester City’s fair Paris 2°C energy budget: 15 MtCO₂
Five year carbon budgets for GM and Manchester City

Greater Manchester’s fair Paris 2°C energy budget: 71 MtCO₂
Manchester City’s fair Paris 2°C energy budget: 15 MtCO₂
Long period of very low emissions

Over 97% lower than 1990 levels. Threshold year relates to less than 5% of carbon budget remains as residual emissions (annual average of less than 75 ktCO$_2$).

Date of carbon neutrality determined by the end of Greater Manchester’s carbon budget period 2037/38.
Final thoughts...

For Manchester City to remain within its fair Paris 2°C target needs immediate programme of mitigation delivering 13% reduction in carbon emissions per annum from its energy use.

Both national and local action in collaboration with Greater Manchester Combined Authority is essential to meet this ambitious goal.
Contact

Carly McLachlan – Project lead
c.mclachlan@manchester.ac.uk

Jaise Kuriakose – Downscaling
jaise.kuriakose@manchester.ac.uk

John Broderick – Aviation & Shipping
john.broderick@manchester.ac.uk

https://www.tyndall.manchester.ac.uk/

http://www.mace.manchester.ac.uk/media/eps/schoolofmechanicalaerospaceandcivilengineering/research/centres/tyndall/pdf/Tyndall-Quantifying-Paris-for-Manchester-Report-FINAL-PUBLISHED.pdf

https://www.pscp.tv/MayorofGM/1gqGvpBjeZkxB?t=24m50s
Emissions pathways for non-OECD (poorer) countries

non-OECD fossil-fuel only CO₂ (2015-2100)
with 2017-2100 budget range of 500 to 620GtCO₂

Post January 2018 cumulative emissions range from 502GtCO₂ for S1 to 620GtCO₂ for S6.
Why are these budgets different to current UK policy?

1. The **probability of exceeding 2°C** is more than 50% under UK targets. We interpret the Paris Agreement as less than 33% chance of 2°C, “...*keep well below 2°C* ...*and to pursue efforts to limit the temperature increase to 1.5°C.*”

2. UK targets implicitly assume substantial uptake of speculative **negative emission technologies (NETs)**, reducing the necessary levels of ‘real’ mitigation.

3. Current UK budgets under represent the **equity** steer of the Paris Agreement:
   i. No allowance for cement production risks hindering development
   ii. Deforestation is considered as national responsibility only
   iii. UK delays annual global emissions parity until 2050 despite historic responsibility

**NB**, The UK’s “80% by 2050” framing includes emissions from **international aviation and shipping**, but these emissions are excluded from current five-year carbon budgets.