

Institution: The University of Manchester		
Unit of Assessment: 12 (Engineering)		
Title of case study: Empowering local climate change action and shaping local authority policy through adoption of carbon budgets		
Period when the underpinning research was undertaken: 2005–2019		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s):	Role(s) (e.g. job title):	Period(s) employed by submitting HEI:
Carly McLachlan	PDRA (2009–2010), Lecturer (2010–2016), Senior Lecturer (2016–2019), Professor (2019–present)	2009–present
Alice Larkin (prev. Bows)	PDRA (2003–2008), Lecturer (2008–2011), Senior Lecturer (2011–2013), Reader (2013–2016), Professor (2016–present)	2003–present
Kevin Anderson	Senior Research Fellow (2003–2011), Professor (2011–present)	2003–present
Jaise Kuriakose	Lecturer	2016–present
John Broderick	Knowledge Exchange Fellow (2011–2015), Lecturer (2017–2020)	2011–2015, 2017–2020
Chris Jones	Research Fellow (2019–present)	2013–present
Sarah Mander	PDRA (2003–2008), Research Fellow (2008–2010), Senior Research Fellow (2015–2019), Reader (2019–present)	2003–present
Ruth Wood	PDRA (2008–2010), Lecturer (2011–2016), Senior Lecturer (2016–present)	2008–present
Period when the claimed impact occurred: February 2017–July 2020		
Is this case study continued from a case study submitted in 2014? N		
1. Summary of the impact		
<p>A Tyndall-Manchester methodology to translate carbon budgets from global to local and sectoral scales has enabled local authorities (LAs) in the UK to develop 'Paris Agreement compliant' climate change strategies and policies. As a direct result, five major city regions have adopted new, ambitious strategies on climate change. This has shaped the operating approach of commercial and public sector organisations within these areas, changing their policies, processes and practices.</p> <p>Tyndall-Manchester's research has led to a shift in focus from long term 2050 targets to prioritise immediate action to cut emissions in the climate change plans in LAs covering circa 18% of the UK population. In a single combined authority, the research has shaped plans that include GBP40,000,000,000 of investment over 20 years. Tyndall-Manchester's Local Carbon Budget Tool is being used by 250 LAs and has been approved for inclusion in the United Nations' Race to Zero initiative.</p>		
2. Underpinning research		
<p>The United Nations Paris Agreement, adopted in 2015, is an international commitment by nations to a set of objectives for climate change action. It is the definitive framework for addressing this global challenge. Researchers from The University of Manchester (UoM) have combined four strands of research insights to develop a scientifically robust methodology for devising Paris Agreement aligned, sub-national carbon budgets. Prior to this project, Local Authorities did not have a way to identify their 'fair contribution' to delivering against this global agreement in their own climate change strategy. This work was conducted by researchers at Tyndall-Manchester, which is the UoM component of the world-leading Tyndall Centre for Climate Change Research.</p>		
1. Evidencing the importance of embedding a carbon budget-based approach in setting climate change targets.		
<p>Foundational research by Larkin, Anderson and Mander between 2003 and 2008 [1] identified the importance of embedding carbon budgets (rather than percentage reductions by a given</p>		

year) in setting long-term carbon reduction targets. This research made a major contribution to the literature on the role of carbon budgets in defining emissions reduction targets linked to specific global temperature changes (e.g. the 2 °C framing of 'dangerous' climate change and subsequent goal of 1.5 °C pursued under the Paris Agreement). This research on implications of cumulative CO₂, and the role of non-CO₂ gases [2] for target setting underpins the development of our sub-national carbon budget methodology.

2. Apportioning method for allocation of global carbon budgets between nations.

A key issue for determining national scale carbon budgets – and a 'fair' contribution - is having a robust method for apportioning between 'developed' countries and 'developing' countries. Detailed analysis in [3] and [4] of how different interpretations of the United Nations Framework Convention on Climate Change (UNFCCC) principle of 'common but differentiated responsibility' affects Annex I (developed) and non-Annex I (developing) carbon budgets, led to a new apportioning method for disaggregating global emissions that could be used to define local carbon budgets.

3. Principles for including international transport in national carbon inventories.

Through their research into the role of international transport in national carbon budgets between 2008 and 2018, Larkin, Anderson and Wood produced the rationale and allocation principles for including international aviation in UK national carbon inventories [5]. This research is used to inform how international aviation is considered in the methodology for sub-national carbon budget setting.

4. Quantifying negative emissions technologies in global emission scenario models.

Detailed analysis and quantification of negative emissions technology (NETs) by Larkin, Kuriakose and Anderson between 2016 and 2018 [6] illustrated the high level of reliance of climate change integrated assessment models (IAMs) on the global deployment of technologies not yet operating commercially or at significant scale. This analysis underpins the carbon budget methodology by evidencing the need to set national and sub-national carbon budgets without reliance on NETs, therefore driving more urgent and substantial reductions in emissions.

3. References to the research

The following publications present the underpinning research for setting sub-national carbon budgets. All the publications are in SJR Q1 ranked journals in their respective fields. The work in this case was runner-up in the Guardian University Research Impact Award 2020. UoM researchers are highlighted in bold text. Citations are from Google Scholar, and accurate as of 7 March 2021.

- [1] **Anderson, K., Bows*, A. and Mander, S., 2008.** 'From long-term targets to cumulative emission pathways: reframing UK climate policy.' *Energy Policy*, 36(10), pp. 3714-3722. DOI: [10.1016/j.enpol.2008.07.003](https://doi.org/10.1016/j.enpol.2008.07.003) [133 citations]
- [2] **Bows-Larkin*, A., McLachlan, C., Mander, S., Wood, R., Röder, M., Thornley, P., Dawkins, E., Gough, C., O'Keefe, L., Sharmina, M., 2014.** 'Importance of non-CO₂ emissions in carbon management' *Carbon Management*, 5(2) pp. 193-210. DOI: [10.1080/17583004.2014.913859](https://doi.org/10.1080/17583004.2014.913859) [13 citations]
- [3] **Anderson, K., Bows*, A., 2011.** 'Beyond 'dangerous' climate change: emission scenarios for a new world.' *Philosophical Transactions of the Royal Society of London A: Mathematical, Physical and Engineering Sciences*, 369(1934), pp. 20-44. DOI: [10.1098/rsta.2010.0290](https://doi.org/10.1098/rsta.2010.0290) [648 citations]
- [4] **Anderson, K., Broderick, J. F., Stoddard, I., 2020.** 'A factor of two: how the mitigation plans of 'climate progressive' nations fall far short of Paris-compliant pathways' *Climate Policy*, 20(10), 1290-1304. DOI: [10.1080/14693062.2020.1728209](https://doi.org/10.1080/14693062.2020.1728209) [32 citations]
- [5] **Wood, F. R., Bows*, A., Anderson, K., 2010.** 'Apportioning aviation CO₂ emissions to regional administrations for monitoring and target setting', *Transport Policy*, 17(4), pp. 206-215. DOI: [10.1016/j.tranpol.2010.01.010](https://doi.org/10.1016/j.tranpol.2010.01.010) [30 citations]
- [6] **Larkin, A., Kuriakose, J., Sharmina, M., Anderson, K., 2017.** 'What if negative emission technologies fail at scale? Implications of the Paris Agreement for big emitting nations.' *Climate Policy*, pp. 1-25. DOI: [10.1080/14693062.2017.1346498](https://doi.org/10.1080/14693062.2017.1346498) [87 citations]

*'Bows' and 'Bows-Larkin' are also the author 'Larkin'.

Grants:

Tyndall Centre for Climate Change Research Phases 1 and 2, EP/D508037/1, EPSRC, NERC and ESRC (total GBP17,000,000), 2000–2010.

Resilient Electricity Networks for Great Britain (RESNET) EP/I035757/1, EPSRC, PI Kevin Anderson, (GBP977,839), 2011–2016

A Consumer-Based View to Mitigation and Adaptation to Climate Change (Theme 3 flagship), Sustainable Consumption Institute, PI Alice Larkin, (GBP742,631), 2010–2012

RACER - Rapid Acceleration of Car Emission Reductions, UKERC, PI Kevin Anderson, (GBP331,125) 2016–2019

Setting City Areas Targets and Trajectories for Emissions Reductions, BEIS and Greater Manchester Combined Authority, PI Carly McLachlan (GBP180,000 total, GBP20,000 to UoM), 2017–2018

Uppsala Fellowship, Zennström Philanthropies, Kevin Anderson, (GBP224,966) 2018–2019.

Centre for Climate Change and Social Transformation (CAST), ESRC, (GBP4,903,413), Co-I Carly McLachlan 2019–2024.

4. Details of the impact

Tyndall-Manchester research on carbon budgeting methodologies, and their translation to sub-national carbon budgets has had a major impact across the UK by directly changing how numerous LAs set carbon targets and the associated policies to deliver them. UoM researchers have worked directly with eight local government organisations, held workshops with representatives from ~13% (52) of UK authorities and have had 3,713 unique visitors to the online tool in the first six months from Oct 2019. These organisations are at various stages of: setting both short- and longer-term carbon mitigation targets for the authority area; formally adopting these as targets; translating the targets into policies and then delivering changes in operations and practices. Greater Manchester Combined Authority (GMCA), West Midlands Combined Authority (WMCA), Manchester City Council and Leeds City Region are all at the stage of delivering changes in their operations and practices.

Currently at least 18% of the UK population live in areas that have formally adopted our carbon budgets. According to GMCA, *“the SCATTER model, developed by the combined efforts of GMCA, Tyndall-Manchester and Anthesis Consulting, is now being utilized by over 250 [60% of LAs] local authorities”* [A]. The Climate Change Committee state that at least 27 LAs, including combined authorities have gone as far as setting targets for their areas using the Tyndall Carbon Budget Tool [B].

Changing policy, processes and expenditure in Greater Manchester (GMCA) and the city of Manchester

The impact is most well developed in the GMCA area. Tyndall-Manchester research [1-6] established the credibility of UoM researchers as leading authorities on carbon budget setting. This enabled the award of funding from the UK's Department of Business, Energy and Industrial Strategy (BEIS) for the Setting City Area Targets and Trajectories for Emissions Reduction (SCATTER) project (2017–2018) to develop climate change targets for UK Core Cities, in collaboration with GMCA and sustainability consultancy Anthesis [C]. This research [1-6] was essential for translating a global carbon budget to the local region in a way consistent with the objectives of the Paris Agreement. Prior to this, LAs did not have a robust and transparent way to do this. As noted by Andy Burnham, the Mayor of Greater Manchester, *“Tyndall Manchester's research [...] has underpinned a shift in our understanding of the scale and urgency of action needed”* [A].

The research, evidence and engagement (through workshops and discussions) was instrumental in both the success of the SCATTER project with GMCA, and in Manchester City Council formally adopting Tyndall's carbon budgets as policy in November 2018 [D] before official adoption of the budgets by GMCA in March 2019 [A]. By adopting the budgets, Manchester is committed to a new and radically different climate change strategy, with significantly higher greenhouse gas emissions mitigation than in previous policy – shifting from

an 80% reduction by 2050 target to a carbon neutral by 2038 target [D]. The spending associated with policy changes shaped by Tyndall-Manchester research is approximately GBP65,000,000 over the period 2017–2020 along with future spending of circa GBP250,000,000. As explained by the Mayor of Greater Manchester, “*Tyndall-Manchester research findings are now firmly embedded in policy-making across the entire GMCA portfolio, directly shaping all strategic policies for the city-region, such as the BEIS-endorsed Local Industrial Strategy and the GM Spatial Framework*” [A]. Policy proposals shaped by the research include: Greater Manchester Covid-19 Recovery Plan, Greater Manchester Investment Programme and the Greater Manchester Local Industrial Strategy [A]. Beyond LA impact, major organisations representing 20% of the city’s emissions (including Electricity North West (ENWL), Manchester City Football Club, Bruntwood and Manchester Housing Providers Partnership) have publicly committed to incorporating budgets based on Tyndall-Manchester research into their operations [D]. For example, ENWL has committed to investing GBP63,500,000 between 2019 and 2023, to drive down their own carbon emissions by 10% per year, and to help GMCA and other stakeholders meet their carbon targets based on Tyndall-Manchester research. ENWL have also commissioned further analysis from Tyndall-Manchester to support business customers to make immediate emissions reductions [E].

Improved goals and policy practices across England

Following the GMCA pilot, the methodology for sub-national carbon budget setting has changed the approach to climate change action in West Midlands Combined Authority [F], Sheffield City Council [G] and Leeds City Region [H]. These organisations have publicly declared not only a revised long term target, but a new understanding of the near term action required: “*By receiving the independent report of the Tyndall Centre today, we are making a major step forward in our understanding of the climate emergency... We know the exact scale of the challenge – and that if we don’t change course, we’ll spend our carbon budget within six years*” Sheffield City Council [G]; “*the proposed target [zero carbon by 2041]...has been set independently based on scientific evidence from the Tyndall Centre. Shorter term targets...have also been set to ensure steady progress*” (WMCA [F]). WMCA’s whole #WM2041 strategy has been shaped by Tyndall-Manchester’s analysis with immediate implications for the 2020–2025 period and an estimated investment of GBP40,000,000,000 expected for the 2020–2041 budget period [F]. As well as introducing near term targets and a cumulative budget framing, the wider experience of local climate change action gained by researchers in Manchester has been translated into impactful engagement with authorities. “*As the work by the Tyndall Centre for Climate Change makes clear – meeting our 2038 target will not be easy [and requires]...coordinated action by local government, industry, business and people of all ages*” (Leeds City Region Enterprise Partnership [H]). 52 local authority and local enterprise partnership bodies have attended Tyndall-Manchester’s workshops in England, Northern Ireland and Scotland on setting local climate change targets. The free online carbon budget tool allows any LA in the UK to calculate a target using this approach and the site had 3,713 unique users in six months with reports generated for 375 geographic areas across the UK [I].

The increased ambition for decarbonisation in Greater Manchester has led Electricity North West to request the regulator Ofgem change its policy to allow district network operators (DNOs) to be able to plan for, and invest to support, local plans for more rapid decarbonisation than the UK 2050 net zero target. In its recent Decarbonisation Action Plan, Ofgem has recognised this need, paving the way for DNOs across the country to actively support LAs more rapid decarbonisation plans [E].

Accreditation and international adoption

Tyndall-Manchester’s approach is aligned with, and recommended by, the global sustainability organisation CDP, who work with over 650 cities worldwide. The Tyndall-Manchester methodology is one of three accredited for use by the Science Based Targets Network (a global partnership of leading environmental organisations and associations) in their guidance for cities participating in the United Nations ‘Race to Zero’ initiative [J]. The first application of translating Tyndall-Manchester’s research impact beyond the UK is taking place in Sweden, where 5 of the 21 Läns and 11 of 290 Kommuna have requested or received a carbon budget. Järfälla kommun has already adopted the carbon budget set based on Tyndall-Manchester’s research [K].

5. Sources to corroborate the impact

- [A]** Greater Manchester Combined Authority related documents, including a letter from the Mayor of the GMCA
- [B]** Climate Change Committee – Local Authorities and the Sixth Carbon Budget
<https://www.theccc.org.uk/wp-content/uploads/2020/12/Local-Authorities-and-the-Sixth-Carbon-Budget.pdf>
- [C]** SCATTER Project. Tyndall Manchester develop a sub-national carbon budget method for Core Cities, February 2018
https://www.research.manchester.ac.uk/portal/files/83000155/Tyndall_Quantifying_Paris_for_Manchester_Report_FINAL_PUBLISHED_rev1.pdf. (Report presented to audience of 700 at the Manchester Mayor’s Green Summit, 23 March 2018, and live-streamed by the BBC and Invited presentation to BEIS, May 2018.)
- [D]** Manchester City Council Documents
- [E]** Electricity North West statement and documents
- [F]** WMCA Statements
- [G]** Documents and statements from other local authorities
- [H]** Statement by Roger Marsh OBE, Chair of the Leeds City Region LEP
<https://www.westyorks-ca.gov.uk/all-news-and-blogs/politicians-businesses-and-young-people-join-forces-as-leeds-city-region-climate-coalition/>
- [I]** Online carbon budget tool website data
- [J]** Global Science-Based Target Network Guidance for Cities -
<https://sciencebasedtargetsnetwork.org/science-based-targets-for-cities/> (PDF download)
- [K]** Carbon budgets based on research developed for Järfälla kommun Sweden, October 2018
<http://www.web.cemus.se/oct-17-the-path-to-a-fossilfree-society-the-case-of-jarfalla-kommun/>