Institution: University of Leeds

Unit of Assessment: 7 - Earth Systems and Environmental Sciences

Title of case study: City-scale carbon policy, planning, and management

Period when the underpinning research was undertaken: 2010 - 2020

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:
Andy Gouldson	Professor	01/01/2006 – 31/08/2014 01/09/2015 – present
Andrew Sudmant	Research Fellow	30/09/2013 – present
Joel Milward-Hopkins	Research Fellow	01/08.2016 – present
John Barrett	Professor	07/02/2011 – present
Kate Scott	Senior Research Fellow	27/10/2011 – 01/10/2018
Stephen Hall	University Academic Fellow	16/09/2013 – present
Paola Hernandez Montes de Oca	Research Fellow	09/12/2016 – present

Period when the claimed impact occurred: 2013 - 2020

Is this case study continued from a case study submitted in 2014? N

1. Summary of the impact (indicative maximum 100 words)

Leeds researchers have developed and supported delivery of detailed low carbon plans for cities through the creation of innovative city climate commissions resulting in local- to global-scale socio-economic and environmental benefits. Starting in Leeds, we provided the main forms of evidence leading to the adoption of ambitious carbon reduction targets, detailed low carbon action plans, and significant (hundreds of millions GBP) low carbon investments, especially in housing, transport and renewable energy. The research directly supported climate action in multiple UK cities. Internationally, it provided evidence cited in statements from world leaders that fed into the negotiation of the Paris Agreement on Climate Change and that encouraged international climate funds to focus their development assistance on enabling national governments in the global south to adopt and deliver climate friendly national urban plans.

2. Underpinning research (indicative maximum 500 words)

In the period since 2010, the Leeds research team, led by Professor Gouldson, has co-produced research with local governments and diverse stakeholders in multiple cities to enable them to a) adopt ambitious carbon reduction targets, and b) design and start delivering detailed, costed low carbon development plans.

More than half of the world's population now lives in cities (UNDESA, 2014). With the urban population growing by 1.2million people a week, 6.7billion people will live in cities by 2050 (WHO, 2014). This level and rate of urbanisation has massive implications for climate change – the IPCC (2014) concluded that 70-74% of global CO2 emissions from energy use is attributable to cities. International agreements on climate change focus on national level commitments – but ultimately these need local level implementation, especially in cities, if they are to be effective. Frequently, however, urban capacities to design and deliver ambitious carbon reduction plans are limited [1].

To address this issue, Leeds researchers pioneered the development of new methodologies that generate city-scale, place-based data and modelling on energy, environment and economy interactions [2,3,4,5,6]. The application of these methodologies helps cities to a) adopt science-

based carbon reduction targets, b) identify and evaluate all of the different low carbon options that they might adopt, c) rank these according to their cost and carbon effectiveness and their wider social and economic impact, d) use this evidence base to turn broad targets into detailed, deliverable climate action plans, and e) work with stakeholders from the public, private and third sectors to build cross-cutting support and raise finance for the delivery of such plans.

The research is unique/innovative in two main ways.

First, by analysing energy, environment and economy interactions in an integrated way, the research is able to evaluate the economic case for city-scale climate action [2,3,4,5,6]. For Leeds for example, the research found that with a population of 780,000 people and an economy worth GBP22billion a year, the city as a whole currently spends GBP1.2billion a year on energy, but that it could reduce its annual energy bill by GBP270million a year, and its carbon footprint by 41% through cost-effective investments in housing, public and commercial buildings, transport and industry. These investments would pay for themselves in 5 years whilst also creating 4,200 years of extra employment and helping to tackle fuel poverty, reduce congestion, improve air quality and enhance public health. The preparation of such an economic case for climate action has helped to secure support from senior city leaders and from stakeholders previously opposed to or disengaged from the climate debate.

Second, through co-production based on participatory appraisal, the research generates high-resolution, measure-by-measure, locally relevant data on all the low carbon options that might be adopted in a particular place that is trusted and 'owned' by local stakeholders [2,3,4,5,6]. Again using Leeds as an example, our approach has generated data on c.150 low carbon options, including on their carbon and cost effectiveness and their broader social, economic and environmental impacts. Access to such a detailed evidence base has enabled local decision makers to turn what can be an over-whelming structural challenge into a series of more deliverable priorities, programmes and projects that they can work towards funding and delivering.

The research team has received funding from the ESRC Centre for Climate Change Economics and Policy (CCCEP), the ESRC Place Based Climate Action Network (PCAN), and the Global Commission for Economy and Climate's New Climate Economy initiative (NCE)/Coalition for Urban Transitions (CUT).

3. References to the research (indicative maximum of six references)

1. Gouldson, A., Colenbrander, S., Sudmant, A., Papargyropoulou, E., Kerr, N., McAnulla, F., Hall, S., 2016. Cities and Climate Change Mitigation: Economic opportunities and governance challenges in Asia. *Cities,* 54, pp. 11-19. https://doi.org/10.1016/j.cities.2015.10.010
2. Gouldson, A., Colenbrander, S., Sudmant, A., McAnulla, F., Kerr, N., Sakai, P., Hall, S., Papargyropoulou, E., Kuylenstierna, J., 2015. Exploring the Economic Case for Climate Action in Cities. *Global Environmental Change,* 35, pp. 99-105. https://doi.org/10.1016/j.gloenvcha.2015.07.009
3. Sudmant, A., Milward-Hopkins, J., Gouldson, A., Colenbrander, S., 2016. Low Carbon Cities: Is Ambitious Action Affordable? *Climatic Change*, 138, pp. 681-688. https://doi.org/10.1007/s10584-016-1751-9
4. Millward-Hopkins, J., Gouldson, A., Scott, K., Barrett, J., Sudmant, A., 2017. Uncovering Blind Spots in Urban Carbon Management: The Role of Consumption-Based Carbon Accounting in Bristol, UK. *Regional Environmental Change*, 17, pp. 1467-1478. https://doi.org/10.1007/s10113-017-1112-x
5. Sudmant, A., Gouldson, A., Colenbrander, S., Sullivan, R., McAnulla, F., Kerr, N., 2015. Understanding the case for low-carbon investment through bottom-up assessments of city-scale opportunities. *Climate Policy*, 17, pp. 299-313. https://doi.org/10.1080/14693062.2015.1104498

6. He, Q., Gouldson, A., Sudmant A., Guan, D., Colenbrander, S., Xue, T., Zheng, B., Zhang, Q., 2016. Climate Change Mitigation in Chinese Megacities: A Measures-Based Analysis of Opportunities in the Residential Sector. *Applied Energy*, 184, pp. 769-778. https://doi.org/10.1016/j.apenergy.2016.07.112

Research Funding
- ESRC Centre for Climate Change Economics and Policy Phase 2 (2013 – 2018), GBP4.4million (GBP2.1million to Leeds)
- ESRC Centre for Climate Change Economics and Policy Transition Phase (2018 – 2023), GBP1.1million (GBP454K to Leeds)
- ESRC Place Based Climate Action Network (2019 – 2023), GBP3.5million (GBP842K to Leeds)

4. Details of the impact (indicative maximum 750 words)

The research was first developed and applied in Leeds in 2010, and has been applied subsequently in multiple cities and local authorities around the UK and internationally.

Climate action, governance and investment in Leeds

Leeds is the UK's 4th largest city (population 780,000). The research was the main form of evidence that guided Leeds' climate action plans from 2012, when the research was first published, to 2019, when a climate emergency was declared, and 2020, when significant policy changes and investments were made [A]. Since 2013, the research has *"helped create the evidence base to secure approximately GBP12,500,000 of grant funding in a GBP45,000,000 district heating scheme which is currently supplying low carbon heat to approximately 2,000 households across the city"* [A]**.** This scheme is reducing carbon emissions by 11,000t a year and tackling fuel poverty and fire/carbon monoxide risks in those homes [B]. In March 2015, it provided the evidence that underpinned the creation of a GBP26,000,000 Domestic Energy Efficiency Programme in the wider Leeds City Region that has retrofitted 5,558 especially fuel poor households to the end of 2019/20 [A], thereby addressing inequality and improving public health.

In 2019, the research: *"provided the main evidence base underpinning Leeds' declaration of a climate emergency in March 2019* [C]*, committing the city to work towards net zero emissions by 2030"* [A], thus GBP270,000,000 was committed to a transport investment programme to promote public transport and active travel and the up-take of low emissions vehicles across the city, to be completed by 2021 [A]. In 2020, it also led to the cancellation of a proposed GBP100,000,000 link road, with support switching to building a new railway station and park and ride scheme [A]. It has also *"provided the model and analysis … to shape how the Council invests GBP80,000,000 a year of capital funding in the low carbon retrofit of the Council's 55,000 council homes across the city."* [A].

The research led directly to the creation of the Leeds Climate Commission in 2017 [D], an innovative independent body that builds capacities for climate action in the city, which is critical when there is little resource and no statutory responsibility for them to do so. The Commission draws together key actors from approximately 50 public, private and third sector organisations from across the city to drive, guide and track progress towards climate targets in the city. Directly informed by the research, the Leeds Climate Commission also ran a citizens' jury in 2019 [E], *"whose recommendations have helped to shape the city's response to the climate emergency"* [A]. The Leeds Climate Commission has been instrumental in building capacities for climate action and in supporting Leeds City Council in its climate action policies, programmes and plans. The Leader of the Council states: *"Research led by Professor Gouldson has directly led to the establishment of an independent Climate Commission in the city, which has drawn together actors from the public, private and third sectors across the city to support, guide and track progress towards both low carbon and climate resilient targets"*, [A], and in its White Paper Motion of March 2019, Leeds City Council states that *"through collaboration with the Leeds*

Climate Commission, it is now one of the leading local authorities in the country in this area. This is underlined by the unprecedented scale of investment prioritised by this Council towards carbon reduction measures" [C]. The Council identifies the benefits of *"participating in innovative and enterprising approaches to public administration and governance that other local authorities may then seek to emulate"* [A].

Climate action in cities and regions across the UK

The Leeds research team have replicated the research methodology developed and applied in Leeds to provide detailed evidence to underpin the adoption and delivery of climate action plans and/or climate commissions across UK cities and regions. Leeds researchers published carbon accounts and summary climate action plans for every local authority in the UK in 2018. In 2019/20, detailed accounts and plans fed directly into the climate policies and action plans of 45 local authorities across the UK. In Belfast for example, the preparation of a climate action plan *"had a transformative effect on Belfast's work on climate change - both at a city-wide level, and within Belfast City Council… and on the city's Innovation and Inclusive Growth Commission… This will ensure that* [the research] *continues to impact on the city's economic strategy through this decade."* [F]. In Surrey, the regional carbon calculations produced by Leeds researchers formed the main item of evidence underpinning the Surrey Climate Change Strategy [G], thereby directly informing 19 carbon reduction targets and 164 other climate action areas for the county [H]. In York, the research led to the preparation of a new climate action plan, to the establishment of a new Climate Commission, to new planning policies requiring new buildings to be zero carbon, to the development of a 'blue and green' nature-based resilience strategy, and to a revised low carbon transport plan for the city [I].

International influence

Internationally, the research has been replicated to support and guide climate action in cities in China, India, Malaysia, Indonesia, Rwanda, Peru and Brazil [J]. The Coalition for Urban Transitions (CUT), states that the Leeds researchers: *"…have then been able to scale-up their work to provide robust assessments of the investment needs and economic returns from low carbon urban development for over 800 cities worldwide. These cities are home to over half of the world's population and are responsible for around three quarters of the world's GHG emissions."* [J]. Through the Global Commission on Economy and Climate and the associated CUT, Leeds research was cited in a statement by world-leaders published in advance of the UN's climate negotiations in Paris in 2015 [J], with the statement including Leeds research findings that *"investing in sustainable cities could save around USD17 trillion globally by 2050. Investing in energy efficiency could boost cumulative economic output globally by USD18 trillion by 2035 and create jobs"* [K]. Through this statement, and through research presented in Global Commission on Economy and Climate's 2014 report (Better Growth, Better Climate) and its 2015 report (Seizing the Global Opportunity), Leeds research also *"directly enabled* [the Commission] *to provide robust evidence and a compelling economic case for climate action in the world's cities"* as inputs to the discussions that led to the Paris Agreement on Climate Change [J].

This research also helped to *"ensure that the international climate funds administered by the UK Dept. for International Development (DfID) and for Business, Energy, Innovation and Skills (BEIS), as well as the German and Swedish environment ministries, focussed significant parts of their development assistance on enabling national governments in the global south to adopt and deliver climate friendly national urban plans"* [J].

5. Sources to corroborate the impact (indicative maximum of 10 references)

A. Letter from the Leader of Leeds City Council
B. Website. Leeds District Heating Network. Provides details of the network's benefits
C. White paper. Leeds City Council Meeting, 27 March 2019. Declaring a climate emergency

D. Website. Leeds Climate Commission. Provides details of the organisations that are members of the Commission
E. Report. Shared Future and University of Leeds. *The Leeds Climate Change Citizens' Jury.* November 2019
F. Letter from the Resilience Commissioner for Belfast
G. Strategy document. Surrey County Council. *Surrey's Climate Change Strategy.* April 2020. Foreword by Gouldson and acknowledgements to the research team for "their work on the development of Surrey's emissions baseline and carbon neutral pathways".
H. Letter from Environmental Commissioning Group Leader, Surrey County Council
I. Letter from Councillor and Executive Member for Environment and Climate Change, City of York Council
J. Letter from the Director of Coalition for Urban Transitions
K. Statement. Global Commission on Economy and Climate in advance of the UN Climate Change Conference COP21, November 2015