MANCHESTER 1824
The University of Manchester

To What Extent is Manchester's Scope 1 & 2 Decarbonisation Attributable to Grid Decarbonisation?

Dr Joe Blakey, April 2019

Executive Summary

- The decarbonisation of the grid is **not overly responsible** (~14%) **for Manchester's decarbonisation witnessed in the medium-term** (2005-2015).

- However, **the decarbonisation of the grid is becoming more significant** as it is responsible for around **half of Manchester's short-term decarbonisation** (2012-2015).

- **Manchester's carbon footprint would have increased in 2015** relative to 2014 levels **if the grid had not decarbonised**.

- **The decarbonisation of the grid is likely to have been more responsible over the long term**, where carbon intensity of the grid halved between 1970 and 2000.

- **The contribution of the grid to Manchester's decarbonisation is mostly consistent with the decarbonisation witnessed in Nottingham** (as an example of another UK Core City) **in the short term (**2012-2015).

- However, **the grid is less responsible in Nottingham** (~7%) **than in Manchester** (~14%) **in the medium term** (2005-2015).

- **The grid has not decarbonised linearly since 2005**, it instead increased in intensity between 2006 and 2008 and in 2012.

Background

This report considers the role of the grid in Manchester's decarbonisation between 2005 and 2015. The emissions footprint of the City of Manchester 2005-2015 presented in the Manchester Climate Change Board's Annual Report is based around its 'scope 1 and 2' emissions. These emissions relate to emission produced directly within the territorial bounds of the City of Manchester (scope 1) and those emissions that are consequent of the city's electricity and gas consumption (scope 2). This will change slightly with the adoption of the Greenhouse Gas Protocol for Community-Scale Greenhouse Gas Emissions (GPC) subsequent to the 2018 report. This new inventory will consider a limited amount of 'scope 3' emissions relating to transboundary transport (excluding aviation) and waste disposed of beyond the city's boundary. Nonetheless, our understanding of our relative progress up until this period is based around scope 1 and 2 alone. Figure 1, taken from the Manchester Climate Change Strategy 2017-2050 and Implementation Plan 2017-2022, shows this.

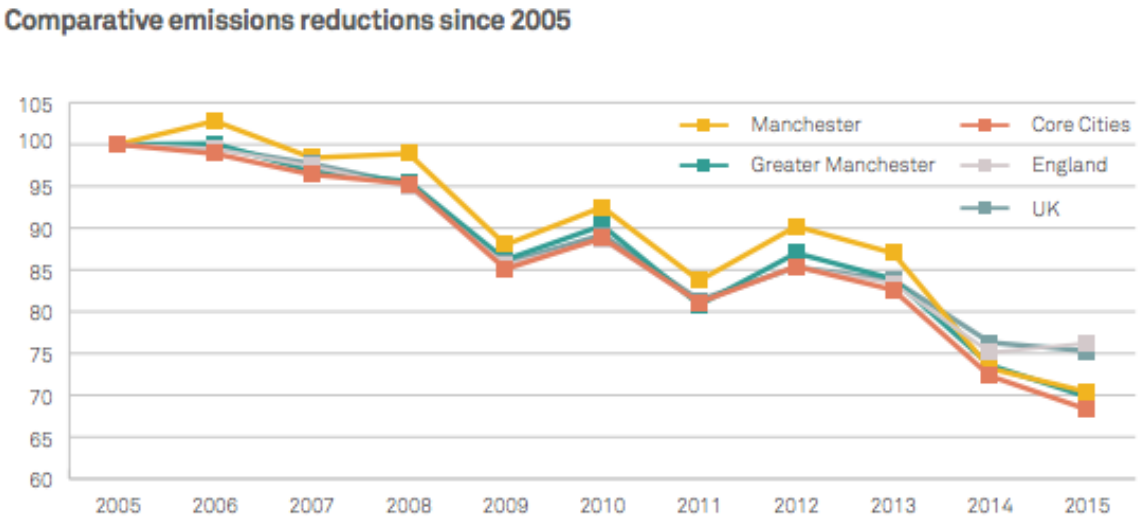

Figure 1 Comparative emission reductions since 2005. Taken from the Manchester Climate Change Strategy 2017-2050 and Implementation Plan 2017-2022 (Manchester Climate Change Board, 2018, p. 31).

Problematically, it is hard to discern the extent to which this decarbonisation is attributable to actions taken by decision makers and citizens of Manchester. As demonstrated in Figure 2, the electricity supply has also seen a relative decarbonisation during this period (Staffell, 2017). Though notably this is not as marked as in previous years. It is also important to note that this does not exactly correspond to the intensity of electricity supply (Figure 6) as of imported electricity and transmission and distribution losses.

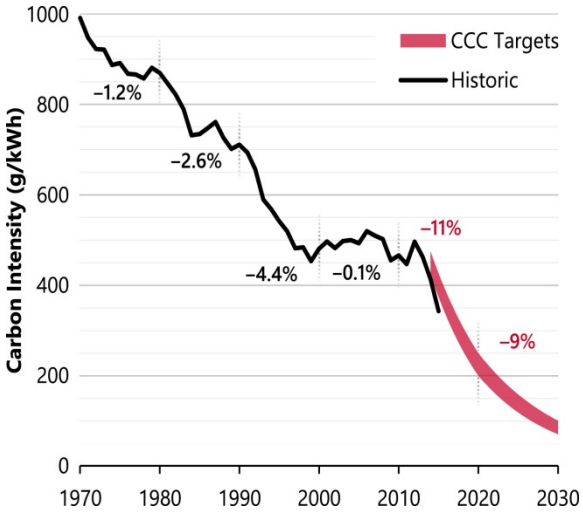

Figure 2 Carbon Intensity of the UK electricity grid (Staffell, 2017, p.464).

The Manchester: A Certain Future 2010-2017 report outlines "Some of this carbon reduction is due to the decarbonisation of the national grid and the substantial proportion of our electricity now generated from renewables, but the fall in energy consumption reflects some implementation of improved technology and some change in behaviour indicating a positive trend in low-carbon culture overall" (Manchester: A Certain Future, 2017, p. 24). However, it is not clear the extent to which this is attributable to energy usage or the decarbonisation of the national grid. This report, in turn, attempt to consider the extent to which the decarbonisation national grid (Figure 2) has played a role in reducing Manchester's scope 1 and 2 emissions shown in Figure 1.

Findings

For the purposes of this report Nottingham, as another UK Core City, has been selected as a comparator city. The UK Core Cities are a group of 10 cities in the UK which, amongst other things, aim to demonstrate leadership on climate change. The period compared was between 2005 and 2015. In this period the City of Manchester has reduced its cumulative emissions by 10% against if they remained at 2005 levels. In the same period Nottingham's cumulative emissions were reduced by 16% against hypothetical levels in the same period. Notably, the grid has exerted both a positive and negative skew on the emissions profiles of these cities over time. Figure 3 and Table 1 show the grid factor influence on a yearly basis against 2005 levels. Figures 4 and 5 outline the actual and adjusted emissions profiles of the City of Manchester and Nottingham respectively. The contribution of the grid to this decarbonisation is relatively small over the course of this entire period (2005-2015)[1], with 14% of the decarbonisation seen attributable to the grid in Manchester and 7% for Nottingham[2]. Notably, decarbonisation between 2012 and 2015 is more closely related to grid decarbonisation with 50% of cumulative decarbonisation (against if emissions remained at 2012 levels) attributable to the grid decarbonisation for Manchester and 44% for Nottingham[3]. Emissions in both Manchester and Nottingham would have increased in 2015 if it were not for the decarbonisation of the grid.

[1] In other words, the difference between the red line and the black line in Figures 4 and 5.

[2] Denoted by the blue line Figures 4 and 5, which holds the grid emissions factor to **above 2005 levels**. The dotted green line shows what would have happened if emissions were **fixed at 2005 levels**.

[3] Denoted by the purple line in Figures 4 and 5.

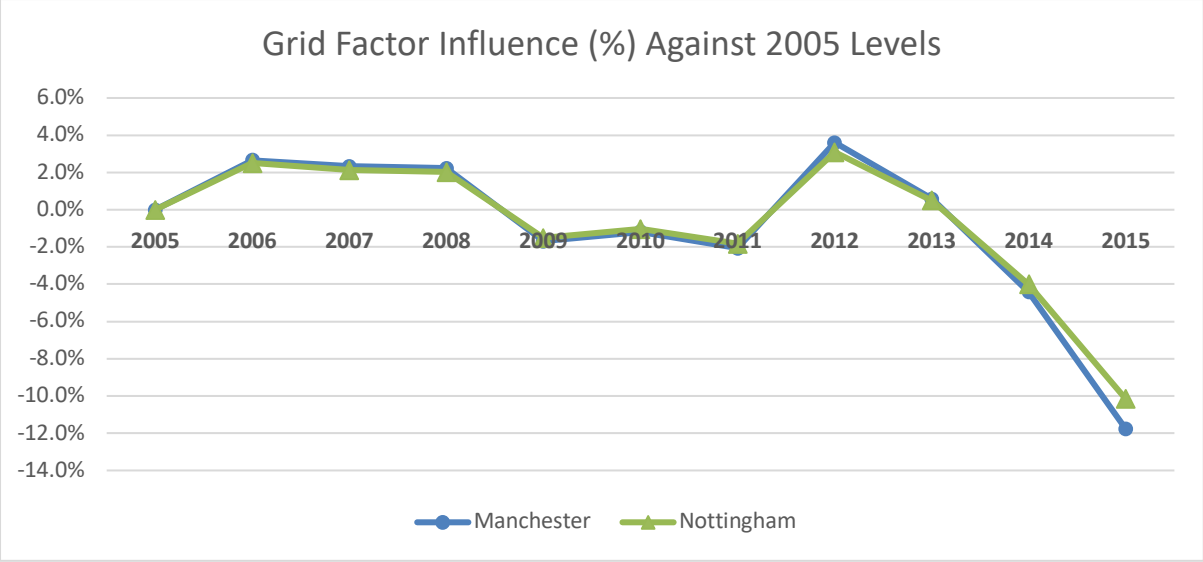

Figure 3 Grid Factor Influence (%) on Manchester and Nottingham's Carbon Footprint Against 2005 Levels

Grid Factor Influence (%) Against 2005 Levels		
	Manchester	**Nottingham**
2005	0.0%	0.0%
2006	2.6%	2.5%
2007	2.3%	2.1%
2008	2.2%	2.0%
2009	-1.7%	-1.5%
2010	-1.2%	-1.0%
2011	-2.1%	-1.8%
2012	3.6%	3.1%
2013	0.6%	0.5%
2014	-4.4%	-4.0%
2015	-11.8%	-10.2%
Average Contribution of Grid to Carbon Footprint	**-0.9%**	**-0.8%**

Table 1 Grid Factor Influence (%) Against 2005 Levels

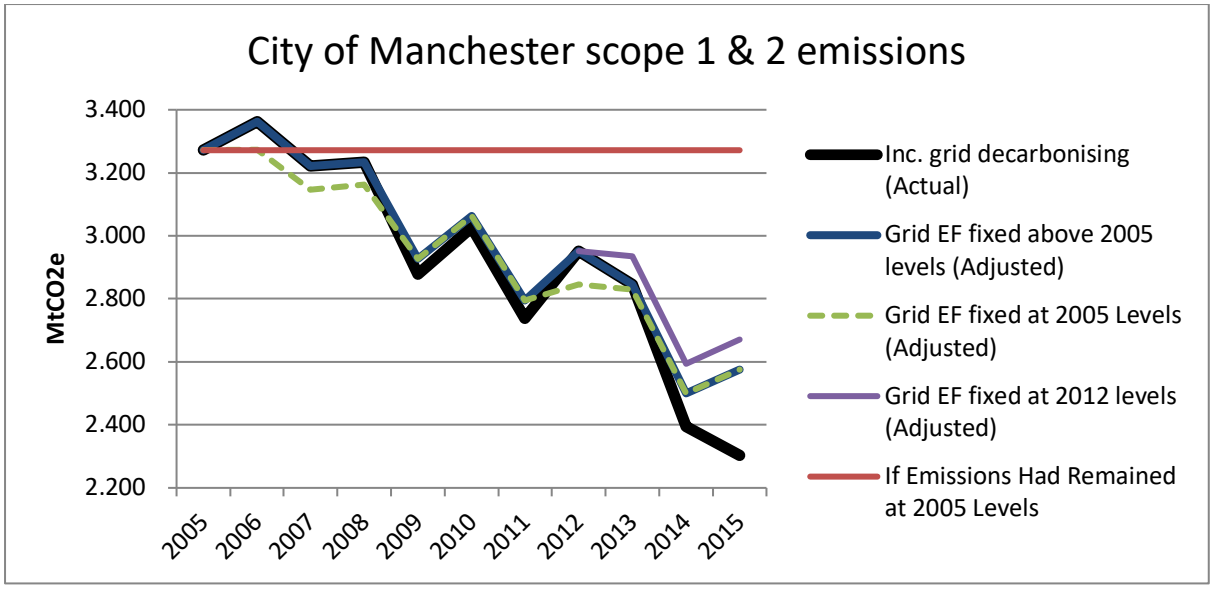

Figure 4 City of Manchester Scope 1 & 2 Emissions Footprint, the bold line reflects the official figures. The blue line reflects an adjusted profile to consider what the footprint would have been if the grid remained at – or above[4] - the carbon intensity that it was in 2005. The green dotted line fixes the grid intensity to 2005 levels. The purple line demonstrates what the period 2012-2015 would look like if grid intensity remained at 2012 levels, which is the highest during this period. The red line shows if emissions remained at 2005 levels.

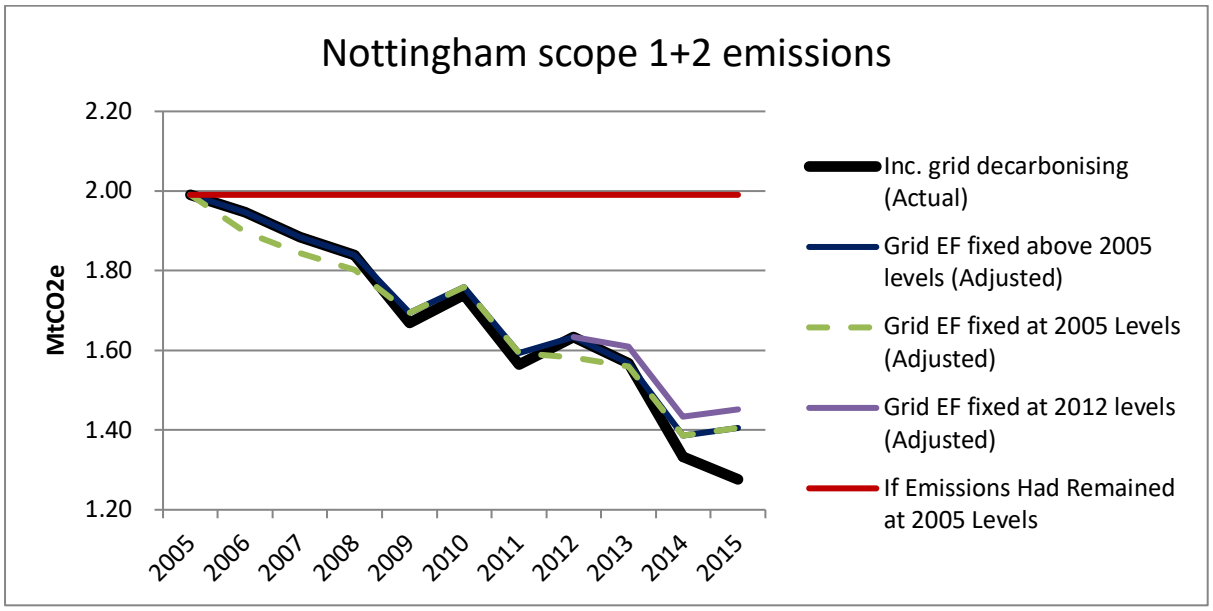

Figure 5 Nottingham Scope 1 & 2 Emissions Footprint, the bold line reflects the official figures. The blue line reflects an adjusted profile to consider what the footprint would have been if the grid remained at – or above[4] - the carbon intensity that it was in 2005. The green dotted line fixes the grid intensity to 2005 levels. The purple line demonstrates what the period 2012-2015 would look like if grid intensity remained at 2012 levels, which is the highest during this period. The red line shows if emissions remained at 2005 levels.

[4] The carbon intensity of the grid increased at various points after 2005, as such this line attempts to capture increases in emissions intensity, but not decreases below 2005 levels.

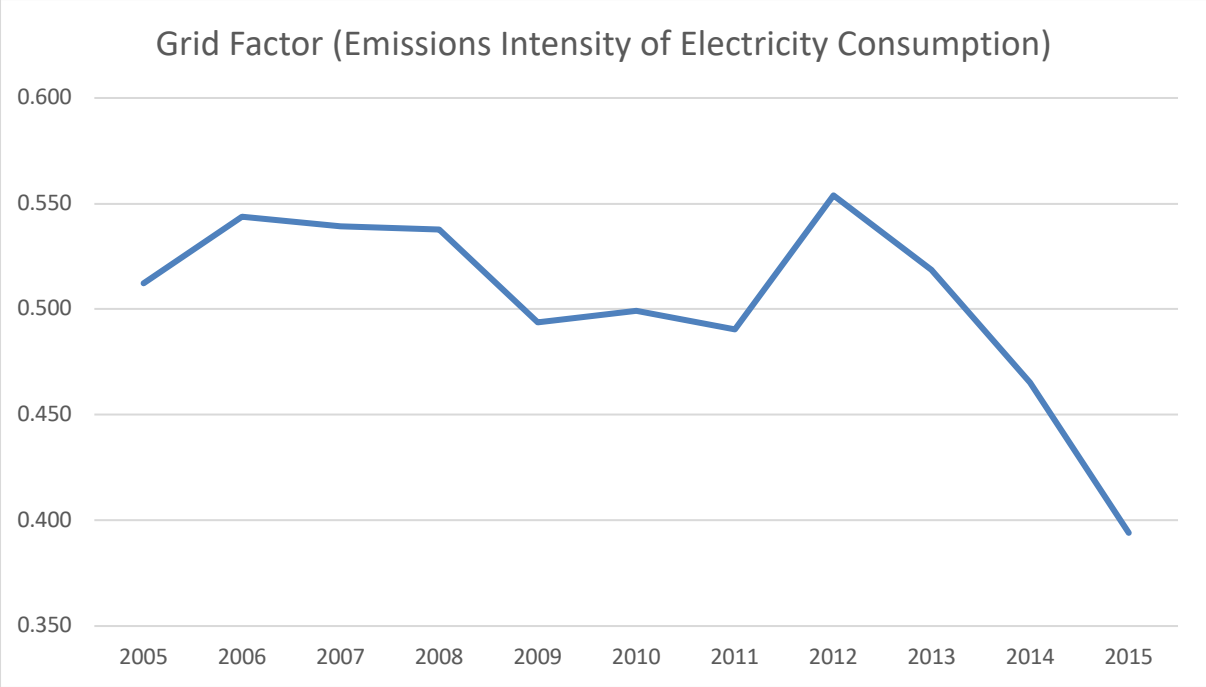

Figure 6 The emissions intensity of electricity consumption, otherwise known as the emissions factor.

Methodology

This report draws upon two datasets primarily, UK local authority and regional carbon dioxide emissions national statistics 2016 (Department for Business, Energy & Industrial Strategy, 2018a, p. 23-24 and the 2018 dataset of grid emissions factors (Department for Business, Energy & Industrial Strategy, 2018b, p. 23-24). The footprints of local authorities are divided between different sectors (such as industrial and commercial electricity, industrial and commercial gas or domestic electricity). The hypothetical projections included in this report were generated by dividing the 'domestic electricity' and 'industrial and commercial electricity' categories by the emissions factor for the corresponding year and multiplying them by a hypothetical emissions factor (such as if the grid remained at 2005 levels). This enabled the approximate footprint of the city if the grid had not changed. Owing to increases in emissions intensity during 2005-2015 an alternative footprint was calculated that incorporated increases in the grid emissions factor about 2005 levels but disregarded emissions factors that went under 2005 levels. It was this that was used in the calculation of the statistics in the findings section.

List of References

Staffell, I. (2017). Measuring the progress and impacts of decarbonising British electricity. *Energy Policy*, *102*, pp.463-475.

Department for Business, Energy & Industrial Strategy (2018b). LOCAL AUTHORITY CARBON DIOXIDE EMISSIONS ESTIMATES 2016 [online]. Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/719182/Local_Authority_CO2_Emissions_Statistical_Release_2016.pdf

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