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Carbon management at universities: a reality check

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ABSTRACT

Carbon dioxide emissions from the higher education sector are globally significant. This study compares the performance of 20 institutions in English research-intensive universities to their self-set targets, using three key performance indicators. Emissions increased for all but two institutions and consequently, targets are extremely ambitious and almost certainly unachievable. Observations are supported by a 10-point appraisal that measures the environmental value of each carbon management plan and a 'reality check' equation to classify them as either pragmatic or ambitious. A paradox is highlighted: institutions that set realistic but relatively low targets can be penalised in league tables and lambasted for apparent lack of ambition even when they may be more likely to succeed in delivering environmental improvements. The results of a staff and student questionnaire at the University of Southampton suggest that increasing awareness on impacts of energy usage will promote a cultural shift towards becoming more energy efficient to reduce emissions. Current carbon management plans are not a good indicator of future performance. The English higher education sector has underestimated the challenge of carbon emissions reduction. Pledged targets seem unlikely to be met by English universities and the likely environmental costs may jeopardise the global competitiveness of the sector. Methods for assessing Scope 3 emissions need refining and standardizing, given they are likely to be the most significant portion of a typical university's carbon footprint. The use of appropriate key performance indicators to foster action and promote realistic target-setting is required at sector-level to achieve the 2020 goal.

1. Introduction

1.1. Rationale

There is little doubt in the scientific community that significant and reliable evidence reveals that anthropogenic Greenhouse Gases (GHGs) directly influence the climate system (IPCC, 2007; Hoffman et al., 2009; Collins et al., 2010). The United Kingdom's (UK) Climate Change Act 2008 is the world's first carbon-related regulation and drives the UK towards an 80% reduction in scope 1 and 2 carbon emissions by 2050; each sector of the UK must be committed to emission reduction in order to attain this. Scope 1 emissions are direct emissions within the organisational boundary from sources the organisation owns or controls i.e. combustion of fuels and scope 2 emissions are emissions from purchased electricity which occur as a result of its activities and are not directly owned or controlled (Ranganathan et al., 2004; Pino et al., 2006).

There is a clear need to reduce the emissions of the United Kingdom's Higher Education (HE) sector; carbon emissions have increased steadily from 1.78MtCO_2 in 1990 to 2.05MtCO_2 by 2005 (HEFCE, 2010b). With more than 2.4 million students (Williams and Ongondo, 2011), 380,000 staff (HESA, 2012) and 129 universities (Universities UK, 2013), the HE sector contributes 11% of the UK's public sector emissions (Ward et al., 2008). In response to this and external government pressure, responsibility for carbon management within the English HE sector has fallen on the Higher Education Funding Council for England (HEFCE), which has prescribed a sector target of 34% reduction below 1990 levels in scope 1 and 2 emissions by 2020, equating to a reduction of 43% of the 2005/06 baseline (HEFCE, 2010a). How these targets will be met remains to be seen and forms the focus of this paper.

This study compares the carbon performance of the English Russell Group[1] institutions by creating an emissions baseline and

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[1] The Russell Group represents 24 UK (England, Wales, Scotland and Northern Ireland) institutions dedicated to world-leading research and teaching. Member institutions garner 80% of the HEFCE's research funding (Lipsett, 2009), produce over 80,000 graduates and contribute £22.3 billion to the UK economy per annum (Russell Group, 2011).

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using the University of Southampton (UoS) as a case study to identify emission-generating behaviours. The study also critically reviews the HEFCE's carbon strategy and its likely effectiveness as a way to initiate carbon reduction in HE and appraises institutional carbon management plans (CMPs), with a special focus on their self-imposed targets and the likelihood of success. The Russell Group is of particular interest as it comprises institutions that have the greatest challenge in altering behaviour, being among the UK's highest-emitting as a result of energy-intensive research programmes (University of Cambridge (2010); Williams, 2011).

Table 1 shows the targets proposed by the Russell Group Institutions up to 2020. An average reduction of 35.6% has been pledged, although 14 institutions have proposed targets that fall considerably short of the overall sector target. A number of notable examples considerably exceed the HEFCE requirement i.e. London School of Economics (LSE), Warwick and York. The remaining three, Durham, Kings College and Newcastle proposed targets that will match emissions with the sector requirements.

Universities are big business: the UoS for example is the largest HE institution (HEI) by student numbers in south-east England. The institution boasts a student population of 16,805 undergraduate and 7325 postgraduate students, 5510 staff, and a £437.8 million income through its teaching, research and enterprise activities in the academic year 2011/12 (HESA, 2014). Although seen traditionally as preserved for the social elite, universities are now open to all (Anderson, 2009), benefitting the global community/economy through the training of highly qualified professionals across a myriad of disciplines, in addition to the development of new academic ideas (Collini, 2012).

1.2. Themes in Institutional Carbon Footprinting

Carbon footprinting is an emerging subject area and it is only recently that a widely-accepted definition and standards for applying it to various applications i.e. a city boundary, have furthered the discipline (e.g. Wright et al., 2011; Publicly Available Specifications 2050, 2070). Very few papers have focused on emissions from HEIs and their management approach.

Table 1
Targets pledged by the 20 English Russell Group Institutions to be met by 2020.

Higher education institution	Carbon reduction target 2020/21 (%)	Baseline year	Notes
University of Birmingham	20	2005/06	
University of Bristol	35	2005/06	
University of Cambridge	34	2005/06	
University of Durham	43	2005/06	
University of Exeter	28	2005/06	
Imperial College London	20	2008/09	30% incl. growth
King's College London	43	2005/06	
University of Leeds	35	2005/06	
University of Liverpool	30	2006/07	
London School of Economics and Political Science	57	2005/06	
University of Manchester	40	2009	
University of Newcastle upon Tyne	43	2005/06	
University of Nottingham	34	2005/06	
University of Oxford	33	2005/06	
Queen Mary, University of London	34	2005/06	
University of Sheffield	20	2005/06	by 2016/17
University of Southampton	**20**	**2005/06**	
University College London	34	2005/06	
University of Warwick	60	2005/06	
University of York	48	2005/06	
Mean ± Standard Deviation	35.55 ± 11.4		

Previous studies that have been conducted on HEI carbon footprinting have primarily focused on scope 1 and 2 emissions, largely because they are easiest and cheapest to assign and calculate (Bastianoni et al., 2004). Riddell et al. (2009) identified that electricity consumption accounted for 40% of the direct emissions of Rowan University in the United States of America (the rest attributable to steam and heat production), with emissions amounting to 4 tonnes CO_2 per full time student per annum. Larsen et al. (2013), using the Norwegian University of Technology and Science (NTNU) as a case study, found that an annual footprint of 4.6 tonnes CO_2 per full time student was emitted per annum. Scope 3 emissions, the remaining indirect proportion of the carbon footprint result from the upstream (indirect emissions from purchased/acquired goods and services) and downstream (indirect emissions from sold/distributed goods and services) activities of the organisation, are inherently more challenging to quantify as a wide variety of primary and secondary data sources, as well as modelled, extrapolated and proxy data need to be researched and combined (Peters, 2010). Few studies have addressed this, although it has been suggested that scope 3 emissions account for at least 80% of an organisation's carbon footprint (Ranganathan et al., 2004; Lee, 2011; Ozawa-Meida et al., 2013). The methods of calculating Scope 3 emissions need refining and standardizing (Turner et al., 2012) so early research conclusions must be treated with caution.

Presenting reported organisational emissions is a contentious issue for many authors, with literature presented on both sides of the argument. Basing targets on appropriate key performance indicators (KPIs), a business/financial metric i.e. revenue, employees or floor space (Defra, 2009) ensures fairness across different institutional settings (Weber, 2008), whilst representing a more practical methodology due to inertia present in university-sized organisations (Samarasekera, 2009). However, issues such as operating hours, endowment and efficiency of floor space can all influence and be obscured by KPIs (Reidy and Daly, 2010; Klein-Banai and Theis, 2013). The sector target reductions are based on absolute emissions and the implications of this will be discussed further in this paper.

1.3. ESD and university institutions

The importance of analysing different education and research activities in terms of carbon management in HEIs should not be underestimated, as an understanding of the carbon intensity of different activities is important in the development of institution-specific strategies. Larsen et al. (2013) demonstrated the greater carbon contributions of teaching and research in science, engineering and medicine compared to the humanities and social science. Klein-Banai and Theis (2013) provided an account of the environmental implications of different academic activities and sizes of HEIs, showing that office and teaching areas have lower emissions than laboratory and research spaces. This can allow targeted and holistic emission reduction strategies to be implemented in HEIs (Disterheft et al., 2012), and is of particular relevance to the research and equipment intensive English Russell Group Universities.

The relevance of education to carbon management goes further than the identification of the relevant carbon consumption of different academic study areas and equipment usage. Education for Sustainable Development (ESD) is considered critical for altering values and behaviours to move towards sustainable universities (Lozano, 2006), especially in the context of HEI carbon management (Barth et al., 2013; Williams and Kemp, 2013). In order for sustainable development and the carbon consequences of decision making to be understood by students, an interdisciplinary approach to learning and teaching is required due to the multidimensional

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