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Title: 'Doing Good Science': the impact of invisible energy policies on laboratory energy demand in Higher Education

Abstract: Education is the second largest consumer of energy in the service sector, however, little research to date has focused on the link between education policy and energy demand. Using a case study, this paper explores the role of *invisible* energy policies in Higher Education (HE). We make a distinctive contribution to debates about invisible energy policy by applying concepts from governmentality to show how different policies and technologies of governance come in to conflict in practice. And, we argue that although there are a number of institutional and national-level policies directly related to sustainability (including energy) there are also a number of conflicting priorities, most notably linked to the neoliberalisation of HE. Our case study focuses on teaching and research laboratories and empirically explores the impacts of both intentional and non-intentional energy policy in these spaces. Specifically this research highlights that the ability to 'do good science' has implications for demand management that go beyond research and teaching laboratory activities, and into the wider realm of HE institutions and policies.

Keywords: Higher Education, Energy demand, Invisible Energy Policy, Non-energy policy, Governmentality

1.0 Introduction

Recent research has explored the ways in which energy systems can be affected by a range of non-energy policies, or what are sometimes described as *invisible* energy policies (Cox et al., 2016). These are those policies that are not purposely designed to

intervene in the energy system but do so as a result of the indirect implication of their design. While recent research has explored this specifically in relation to energy demand (Royston, 2016, Royston et al., 2017, Royston et al., 2018, Butler et al., 2018), Cox et al., (2016) note that comparatively little research has focused on the education sector, in particular the link between education policy and energy demand (p.29). This is an important area of research given that education is the second largest consumer of energy in the UK service sector (Cox et al., 2016, Royston, 2016). Furthermore, within Higher Education (HE), research-intensive universities have been argued to be significant contributors to HE carbon emissions. For instance, the 20 institutions that belong to the Russell Group (known for their research intensity), collectively contribute to over half of the UK's Higher Education Institution's (HEI) carbon emissions (Wadud et al., 2019).

This paper builds on this growing, but small area of research. It adds a new perspective by exploring invisible energy policies using a governmentality approach, and is the first qualitative paper to explore the role of non-energy policies in teaching and research laboratory spaces. In doing so, we reveal points of tension in Higher Education (HE) in relation to sustainability (including energy) and most notably relating to the neoliberalised agenda of the HE sector. Indeed, it is these 'tensions' we wish to bring more readily to the fore, and in doing so create space for more debate and dialogue within and across the energy community, policy domains and higher education sector. We highlight the ways that neoliberalism can work *against* ideals of sustainability more widely, and reducing energy consumption specifically.

Based on a case study, this paper demonstrates the role of national and local-level invisible energy policies as experienced in research and teaching laboratories within a department of a UK university. This suggests that the way in which the ability to 'do good science' is perceived and practiced is driven by a broader university agenda on productivity, competitiveness, and income growth, which thus influences the activities and levels of energy demand in these spaces where science is done. This

paper uses a localised example of intentional energy policy (the 'Triad' warnings[1]) to explore and demonstrate how tensions between 'productivity' and energy demand emerge, and how governmentality can be used to understand the complex ways that policies and other technologies of governance act on researchers in multiple ways.

The framing for this paper is set across a number of key literatures including the current literature on invisible (non) energy policies, governmentality and also an emerging literature on campus sustainability. Although this research is focused specifically on energy, 'sustainability' is often the main framework with which institutions engage with energy in the context of carbon emissions. It is therefore important to engage with the setting of sustainability, to understand and explore how conflicting priorities emerge in relation to energy within HE. The following section (2) explores how sustainability, energy demand and invisible energy policies are positioned in the context of HE, section (3) then sets out our conceptual framing. Sections (4) and (5) set out our case study context and methodology, followed by our results and discussion and reflections (sections 6 and 7) before ending on our conclusion (section 8).

2.0 Universities, Sustainability and Energy Demand

In the Global North, universities are beginning to engage with concepts of sustainability and there are ongoing debates both within and across HE as to what extent sustainability should be embedded into the daily life of HE and its actors. Discussions relate to whether sustainability should be integrated into research and teaching, and how this might be achieved, as well as the level to which sustainability should influence wider day-to-day workings of the institution and infrastructural setting (Disterheft, et al., 2013, Lozano, 2006). This includes aspects of its activities such as purchasing and procurement, travel, and local-level consumption. Initiatives such as 'Living Labs', Food for Life and Green Gown awards offer incentives, both financial and in recognition of achievements within this sphere and which contribute

[1] Triad warnings: At times of peak demand on the GB electricity grid large consumers (e.g. Institutions such as the University) are asked to reduce their electricity demand, typically during 16.00 to 19.00 hours.

to the overall reputation of a given institution as a place that is 'sustainable'. Such initiatives are used to showcase an institution's (green) identity to prospective students, researchers and academics, as well as funders. As such, a narrative around 'campus sustainability' has emerged internationally (e.g. the United Nations' Rio+20 meeting in 2012, highlighted the importance of sustainability in education). It has also been suggested that Higher Education Institutions (HEI's) are uniquely equipped for practicing sustainability and for providing leadership to the sustainability movement – indeed, it has been suggested that they have a moral duty to do so, reaching the next generation of influencers and leaders (Croog, 2016, Disterheft et al., 2013).

In the UK, what was the Higher Education Funding Council for England (HEFCE) was driving this agenda through their policy framework on sustainable development in HE (HEFCE, 2014). This included initiatives such as the 'Sustainability Exchange' programme, a knowledge bank for the Higher Education Sector encouraging exchange of ideas and best practice on sustainability issues (Sustainability Exchange n.d.). The research funding and knowledge exchange parts of HEFCE have now been subsumed as part of the newly formed UK Research and Innovation (UKRI) alongside the UK's seven research councils and Innovate UK (HEFCE, 2017). As of 2018, UKRI's sustainability policy was still undergoing development (UKRI, 2018). Therefore the impact of this change on the campus sustainability agenda is currently unknown, but could suggest that there are opportunities to inform this agenda going forward.

Campus sustainability generally focuses on the physical (buildings), educational (teaching, curricula, research) and institutional dimensions as a perceived way to mainstream practices of sustainability into HE. Embedding themes of sustainability in this way is not without its critiques, with calls for 'Going Green' leading to greenwashing driven by market imperatives and economic benefits. Disterheft et al., (2013) argue that such a reductionist approach leads to sustainability initiatives losing meaning and credibility, reinforcing the "empty signifier" of sustainability. Therefore understanding, and unpicking, the motivations and challenges for embedding aspects of sustainability within physical, educational and institutional aspects of a given

university, is important – and not least for defining institutional and disciplinary values that underpin collective and individual academic integrity (Gormally, 2018).

This paper sits within this overarching HE landscape but also engages specifically with issues of energy and demand reduction. Energy is a key anchor point through which to tackle low-carbon transitions within the wider realm of sustainability (Skea et al., 2011). This includes implications for understanding and conceptualising the complex relationships between energy supply and demand in wider society. This paper has a specific focus on energy demand, which has risen to the fore in recent years, gaining increasing focus from policymakers and academics, attempting to better understand what demand is and how it is constructed. For instance, the Research Councils UK (RCUK)'s Energy Programme, invested significantly in six academic centres looking specifically at End Use Energy Demand (EUED)[2] to better understand how and why demand is created in society. Such investment suggests a recognized policy need to provide impact on society in this area. Building on this, in the next section we discuss specifically the links between invisible energy policies and neoliberalism in HE.

2.1 Invisible Energy Policies and Neoliberalisation[3] in the Higher Education Sector

Royston (2016) suggests HE energy demand is affected not only by energy policies but also by a wide range of *non-energy* policies. For instance, an increasingly neoliberalised HE sector has led to reduced government funding which in turn has led to a drive to increase student numbers to fill funding gaps. In order to attract students, universities have invested in facilities, 'luxury' accommodation and 24-hour library

[2] http://www.eueduk.com/

[3] As Berglund (2018) has recognized, neoliberalism is a complex and contested term – she uses a definition from Patomäki (2009, p. 433), whose argument is that neoliberalism sees competitive markets as being efficient for solving problems, both in organisations and on an individual level. Mountz et al., (2015) draw on Sparke's work (2006: 153) where neoliberalism is defined as "a contextually contingent articulation of free market governmental practices with varied and often quite illiberal forms of social and political rule". We find both these definitions helpful.

provision, all impacting energy demand (Royston, 2016). Furthermore, pressures to bring in or attract greater research funding has led to more energy intensive scientific equipment (often bought through grant funding). And, in addition to education being the second largest service sector in the UK, Royston (2016) also reports that HE has seen an increase in energy use by 33% between 1990-2005. With targets for carbon reduction set at 80% against 1990 levels by 2050 and an interim target of 34% by 2020, the sector can be argued to be making slow progress (ibid).

Many dialogues in HE with regard to energy reduction and sustainability happen across different managerial and disciplinary perspectives (Goulden & Spence, 2015). Often, finding ways to 'change behaviours' is the general rhetoric used to conceptualise or practically tackle demand or consumption levels. This problematically places the responsibility on the individual, based on an assumption of individual agency, rather than appreciating that individual behaviours are entwined with wider social, culture and political norms, in addition to the surrounding infrastructure and provisioning systems that may be available (Walker, 2014). The aim of this paper is to use empirical data gathered from those working in teaching and research laboratories of our case study to demonstrate the relation between policies directed at energy, and invisible (non) energy polices at the department level.

3.0 Governmentality & Invisible Energy policy

Previous work, such as Whittle (2015), Hargreaves (2008) and Butler (2010), explore how policies act as a form of governmentality 'at work' in the workplace. We focus here on the ways that policies act in 'invisible' and more visible ways to govern how employees perform energy practices in the workplace, specifically in a science laboratory setting.

Many researchers have drawn on Foucault's work on governmentality to explore the contested means by which neoliberal forms of governance operate. This sees neoliberal forms of control operate in more diffuse and subtle ways, producing self-disciplining citizens. These are seen to internalise the values and norms of modern life, and thus who act in ways that are desired by institutions like government, HEI's,

corporate bodies and so on (see Rose, 1999). As a result, 'freedom has become, in our so-called "free societies", a resource for, and not merely a hindrance to, government' (Barry et al., 1996 p. 8. in Whittle, 2015 p. 585). Following this line of argument, these ideals and norms are then taken up as a personal project by citizens and employees who discipline their bodies and minds in order to fashion themselves into the 'ideal' citizen or employee, whose goals mirror those of the workplace and society at large (Whittle, 2015 p.586). This form of 'ideal' citizen here might relate to what Paterson and Stripple (2010) have termed 'calculative individuals', operating in 'calculative spaces', who are aware of, and act on, their own greenhouse gas emissions.

For many, governmentality is now seen to relate to consumption, responsible choices, and lifestyle. This is in contrast to previous forms of governing and governance that were more strongly connected to (state-based) obligations, duties, solidarity, and citizenship (Rose 1999, p.166, in Soneryd and Uggla, 2015 p.917). This results in a diffused form of self-governing, relying on reflexive 'consumers' to adhere to the agendas of institutions such as the state, the employer, and so on. Hobson's (2011) work on sustainable consumption for example, argues for a need to focus on the materiality of green living: her research focuses on the purchase and use of specific 'green goods', which she suggests allows individuals to "achieve a form of sustainability via the acquisition of particular 'green goods'" (p.195).

There has been a particular focus on the home as the key space where pro-environmental behaviour is enacted in the UK (McNaghten 2003). Hobson's focus is also the domestic sphere: her argument of 'green goods' and the materiality of green practices may be harder to apply in the workplaces, where it can be harder for 'subjects' to exert control over the materiality of their workspace and where low energy equipment may not be available. Individuals can be quite restrained at work, in terms of the 'solutions' they are able to enact. The workplace potentially represents a hybrid space; simultaneously public *and* private, and employees may feel unable to negotiate green practices in the workplace. There may be, then, a limit to the extent to which individual employees switching off devices, closing windows and using natural lighting can significantly reduce energy consumption. As such, 'doing your bit'

at work may be outside of employees' control, especially when it involves changing practices (of one's own and others) rather than just acquiring 'green goods'. Gram-Hanssen (2017) recognizes that discussions of certain issues, such as saving energy, may thus be avoided to prevent conflict, and in this case may be particularly acute in a workplace setting where people feel unable to project their politics onto others.

Further to this, technologies of governance (Rose, 1999), can work to constitute political subjectivities as desired by the state and other institutional actors, prompting the performance of 'ecological', 'environmental' or 'energy' citizenship (Hobson 2011, p.198). Indeed, Rose (1999, p.52) states that technologies of governance are those "imbued with aspirations for the shaping of conduct in the hope of producing certain desired affects and averting certain undesired events", and recognising the socio-material nature of such technologies. Additionally, Rutland and Aylett (2008, p.642), in their study of climate policies in Portland, Oregon, discuss how policies and discourses imagine "a responsible, carbon-calculating individual. Assumed and encouraged by the initiatives … is the vision of a self-reflexive individual taking responsibility for knowing and reducing his or her emissions." These policies and their discourses that attempt to create 'carbon-calculating individuals' may compete with other, already existing, forms of governance.

As Whittle (2015, p.582) argues, "there is a governance – and thus a politics – to the micro practices of everyday life in the workplace, with environmental concerns playing an increasingly important role." In this way, we explore the 'conduct of conduct', or how people 'work on themselves at work' (Whittle, 2015 p.584) by applying a governmentality lens to our empirical data in relation to work based energy demand and consumption. In so doing, we depart from the existing literature on invisible energy policies and offer a fresh perspective by employing a governmentality approach, to better understand the ways that non-energy (neoliberal) policies can directly impact energy consumption. Focusing on the individual is unlikely to result in the scale of change necessary, and so a broader focus is needed on the interconnecting bundles of practices that cut across multiple spheres of daily life. Indeed, Butler et al., (2018, p.75, drawing on Shove et al., 2012) suggest, that there is

a need for policy to reflect the 'transitions in daily practices that consider the interrelations between materials, meanings and knowledge, and address more fundamental patterns of social action, trajectories and trends'. And so in relation to HE, this might involve considering both the visible and invisible energy policies and practices that lead to an increase in energy demand, driven by not only localised policies around energy reduction, but the wider policy trends that are shaping HE's targeted trajectories.

The multiple expectations of what it is to be a 'responsible consumer' (cf. Hobson 2004, 2013), a 'productive' or 'good' employee (Whittle, 2015; Hargreaves, 2008), and a self-reflexive individual taking responsibility for knowing and reducing their own emissions (Rutland and Aylett 2008 p. 642), all suggests that energy consumption and reduction in the workplace may be a thorny issue and that other imperatives may be prioritised. In a university setting, as with many workplaces, multiple layers and forms of governance exist and compete with one another. As Hargreaves' (2008) work suggests, we need to pay attention to the ways in which these different forms of power come together and 'work' in complex and unexpected ways. The following sections explore these themes in relation to our case study and empirical results.

4.0 Case Study Context

The case study location of this research is a university in the UK: it is both a *consumer* and *producer* of on-site heat and electricity. As with many universities, this university has ambitious policies in relation to energy reduction and carbon management. The university's Carbon Management Plan (2015) sets goals and objectives for carbon reduction and directs its sustainability targets. The university also engages externally, providing a Community Benefit Fund to enable 'sustainable' initiatives in the local community to take place. These include, as an example, small food growing projects on allotments or funding solar PV for community buildings. It also works with local primary schools and charities through the 'Sustainability Exchange' programme. Within the university specific departments, such as Facilities, Estates Management, and other organisations such as those making up the Students' Union, support and run projects that align with the university's sustainability goals. These include the

campus allotments and orchards, edible campus initiatives and the 'community fridge' on campus (where food that is still in date but would otherwise be thrown out can be put and used for free), as well as coordinating student research projects with academic departments in the university on aspects of sustainability. For instance, these include but are not limited to student projects on food, energy or water often linked to reducing consumption or changing practices (Gormally, 2018).

One particular department within the university was the focus of this study. This was chosen because of the diverse nature of research and teaching related activities in laboratory spaces that take place within it (from ecology to volcanology). It also has a high electricity demand profile and complex building structure, with a property portfolio ranging in age and energy efficiency. The research and teaching undertaken in these spaces is environmentally focused, and the people that work in and manage these spaces are conscious of this. It therefore provides an interesting setting to explore the way in which different cultural and social norms shape practices and patterns of consumption in a research setting. The department is large, with approximately 80 members of academic staff, and includes a large number of PhD and research associates, technical support and administration staff (not all related to laboratory activities).

5.0 Methodology

A broadly ethnographic approach was used that employed semi-structured interviews, participant diaries and observation days. This research explored energy practices in relation to energy demand and therefore, the interviews focused on exploring participants' daily routines, disruptions and knowledge sharing. Participants were recruited using a mixture of purposive and snowball sampling, and included a range of lab users, from laboratory managers, post-doctoral researchers and PhD students, to senior management with respect to the laboratory spaces, both within the department and wider university. In total, eleven semi-structured interviews took place with participants, each lasting approximately between 30-90 minutes.

Following this, four key participants were recruited who were members of the research communities within this department and active members of the laboratories. This included a lab technician, two post-doctoral research associates and a PhD student, although additional lab users were also encountered during this part of the research. They were recruited using personal networks within the department. Each of the four participants took part in a semi-structured interview at the start of the project (in addition to the eleven interviews mentioned above). They then kept a diary of activities that they filled out for one week each month over a 6-month period (roughly Sept 2015 – Feb 2016 but this varied slightly across the participants). The participants were encouraged to record their day in a variety of ways including free form "tell us about your day" to photo diary entries. These were also complemented by four one-off participant observation days where the lead and second authors spent time in the labs with participants, helping with their lab tasks for that day.

This approach enabled us to capture the role of 'enactment, performance and practice' with respect to the participants' daily interactions in laboratory spaces (Latham, 2003). The participants knew a focus of the study was energy demand, but they were encouraged to recount the routines of their day, highlighting things that went well or not so well, rather than try to account for energy *per se*. All data from these interviews has been anonymised as far as possible. All qualitative data was coded using thematic analysis, with codes derived from the literature and those that emerged from the data during the coding process (Cope and Kurtz, 2016). It is these emergent themes, specifically on the role of policies and their implications for governance and governmentality that are the focus of the results and discussion in this paper.

6.0 Results

The following sections present our empirical analyses, and explores the tensions between visible energy policies and invisible energy policies (e.g. other institutional policies or goals) at this HE institution. As such, the following presents contentions around the 'Triad Warnings' as a form of direct energy policy intervention (and one of the 'technologies of governance'). This is followed by findings linked to invisible energy policies e.g. institutional and national policies in academic outputs and income.

It does this through discursive framing around the need to 'do good science', another form of 'technology' affecting the 'conduct of conduct'.

6.1 The Triad Warnings

As outlined in section (4), the institution has clear priorities around energy and sustainability with the institution committing to ambitious targets around CO_2 reductions and introducing a first carbon management plan in 2010. At the institutional level, this university has ambitions not only for a change in infrastructure e.g. through renewable energy generating technologies, but also for a change in the wider cultural approach, as a manager highlights:

"...at the university we've signed up for a long term target in carbon reduction terms. So we are about an 83% reduction, compared to like 2005 baselines and we're probably some 30% of the way there at the moment with investments in things like the wind turbine, biomass boilers [etc]…..I mean it's such a large organisation but you know, there is definitely, what I find is changing is that rather than a collection of individuals we're becoming a bit more of a community, which I think is a step on the right track. Urm there were people…you know organising themselves so hopefully over time we will see them translating into a change in culture." (**Senior Manager No. 1)**

This fits with the wider HEI rhetoric, both in the UK and internationally, around 'campus sustainability' that aims to embed sustainability measures across the physical, educational (teaching, curricular, research) and institutional aspects of the university (Disterheft et al., 2013). Many of these endeavors can be seen in promotional material for prospective students and researchers, and are also displayed around the campus. This feeds into the identity of the university and how it positions itself into the wider framing of what it is to be a 'sustainable campus'.

Alongside these measures is the day-to-day running of the university and there are many instances where institutional procedures influence related activity within the departments. For laboratories, these include implementing regulations for disposal of

waste laboratory materials, deep clean procedures (such as the autoclaves[4]), and procurement and travel procedures. However, the most prominent institutional example that explicitly addresses energy consumption is the issuing of Triad warnings, which relate directly to reducing electricity demand. A Triad warning occurs at times of peak demand on the nationwide UK electricity grid. Large consumers (e.g. Institutions such as the university) are asked to reduce their electricity demand, frequently occurring between 16.00 and 19.00 hours on winter weekdays, for a reduced tariff (i.e. per unit costs of electricity are higher during 'Triad' warning and reducing consumption can thus reduce costs). Within the university, departments are issued with a 'Triad warning' (via email, see Figure 1) asking all staff to reduce electricity consumption during these periods. In this way, the Triad warnings are a visible form of energy policy but simultaneously act as a technology of governance that aims to facilitate certain forms of conduct (energy and money saving) whilst minimising other forms of conduct. An example of a typical email received in the department of this study is shown below:

Dear all,

We have received a Triad warning for today, Monday 15th February 2016, 17:00 to 19:00. Triads are periods of highest electricity demand on the UK national electricity grid and electricity prices are at their highest during these periods. During Triad periods, electricity demand is charged at £25 per kW. This compares to average electricity consumption price of £0.10 per kWh.

Where possible, please reduce your electricity demand by switching non-essential equipment off, or temporarily changing set-points, for the duration of the Triad warning. It may also be possible to reschedule some activities outside of this period.

Please consider reducing demand from:

- Electric heaters
- Electric ovens
- Lighting
- IT, AV and communications equipment
- Air conditioning equipment (turn set-point up)
- Unused fume cabinets
- Other electric equipment
- Reduce setting on thermostatic radiator valves

Please circulate this triad response widely. If you have any questions or comments, please contact me using the details below. Please note that domestic electricity costs are not affected by Triad charges. These apply to large electricity consumers only.

Kind regards,

Figure 1. Example of email sent out during a 'Triad' warning.

[4] An autoclave is a pressure chamber used to steam sterilize samples and equipment through the use of very high temperatures and pressures.

The Triads clearly offer an economic incentive and are framed as such in the communications with staff, rather than as a sustainable or low-carbon measure. Given the potential impact the Triads can have on reducing electricity consumption, they became a focal point during many of the interviews, and also were captured and noted on participants' energy diary entries. However, the impact of this varied across participants. For instance, in this study the impacts of the Triads were found to stimulate action (and inaction) in various ways, and to create tension between staff. Although this warning is given top-down through the institution, it does require individual (and sometimes collective) autonomy and choice as to the extent of action taken. This included some laboratory managers and laboratory users purposefully turning off equipment and apparatus not needed during the Triad warning. They did not necessarily actively change their routines or patterns of work, but were more conscious of what appliances were not needed during that time frame, as outlined by a researcher:

"So if we get a Triad warning one of us will try and think about what equipment is being used and turn it off. Mainly like, you probably saw the drying ovens, and that's like the sole drying, the big like cupboards....You know, all those appliances are on with nothing in them. So we'll just shut those off. But again if nobody's, if we're busy or away that doesn't happen" (**PhD Researcher No. 1)**

This was a typical response from participants in this study and we suggest the most representative of the ways in which laboratory users engage with the Triad warnings. There was one example however, where one person's actions around the Triads had implications for other lab users, taking the decision to close the lab during the Triad warnings, as they describe below:

"So I have got laminated signs now that whenever I get the Triad warning... then the signs go up, saying the Lab will be shut between this time and this time, please sign, please reschedule your work, students you know can sometimes complain....I say you've got three years, four years if you are thinking about writing it up so you can manage your time. OK we have had a few Triad warnings recently but you've got three years, you know, two hours in an afternoon

it's not going to make or break it…..I did have quite a heated exchange with someone, someone who is... looking after a particular lab and they said, unequivocally that they, it doesn't, the Triad warning doesn't affect them, doesn't affect them and they have their lab running and that's that, because their research is so important and the people's research. Personally I think, I don't agree with it" (**Laboratory Manager No. 1)**

It is at this juncture where ideals of governance start to collide. Where someone's identity as both a responsible (and to some extent environmentally sound) citizen is at odds with their role as a 'productive', 'successful' and 'efficient' environmental researcher, and this can cause tensions over which aspect takes priority. This can lead to difficult decisions about the way in which they govern themselves and others within the laboratory and wider workplace. The above quote provides a good example of how governmentality can shape or refine the working practices of others and the conflicts that can arise through the positioning of one's identity (and values) as a scientist and through individual, departmental and institutional values and expectations around economic savings, and, more broadly, sustainability.

This was also demonstrated through the sharing of micro-practices around 'ideal' laboratory use, and in turn, what is it to be a 'good' scientist as the below quote demonstrates:

"But a lot of it is, you know, trying to get some people early in their first year [of PhD study] and you know, really start good practice right away and letting them know, "here's what you can and can't do, or should and shouldn't do" (**PhD Researcher No. 2)**

This researcher illustrates the ways that power, agency and governmentality 'work' in the workplace. As Whittle (2015) notes, the neoliberal ideals of the self-disciplined citizen defined by social norms can encapsulate the working patterns of researchers and staff in higher education institutions, to be responsible and productive employees. These themes will be discussed in more depth below as we move on to exploring how invisible energy policies can inform the social norms and working practices of our participants in laboratory spaces.

6.2 Doing 'Good Science'

Moving on from exploring the effects of visible energy policies (the Triads), this section now explores the implications of invisible or unintentional energy policies. It does this through the framing of the ability to do 'good science' with emphasis on two further salient themes around identity, and productivity and growth. In particular, it explores the institutional pressures associated with academic life and the various modes of workplace governance that are applied in these spaces. For example, the following quotes demonstrate the pressure that can emerge from the competitive nature of contemporary, neoliberalised, academic environments focused on productivity and income generation:

"And people are very focused on their research and that can blinker them from the wider picture even from within the department. They might just be really focused on… their specific area of science and it could be that you've got to say to somebody, you know, "look there's more than us in this department, we've got to share facilities" and that kind of thing. "I'm sorry but you've not got sole use of the equipment". And when it's people's career and livelihood it can be difficult." **(Senior Manager No. 2)**

"Academia is tough, tougher than people think, definitely, you are competing and you are having to get funding and money and having to keep up your reputation…win awards and you know, there is a lot of pressure" (**PhD Researcher No. 3)**

This pressure can be seen as a form of workplace governance as it disciplines researchers into intense working practices and processes of comparison and competition which, as Whittle (2015) suggests, brings with it a politics to the micro-practices of everyday work life, and in this instance, laboratory life. Here we can observe how wider institutional policies and targets on income (in this instance the drive for research income and high impact publications), driven by wider (international and neoliberal) agendas, directly shape the micro-scale working patterns of our participants. This in turn relates to the intensity of individuals' working practices in academic research and the associated energy consumption such intensity requires.

This highlights how designated energy policies such as those targeted at reduced consumption, come into conflict with broader institutional and national non-energy policies as the below quote summarises:

"Science is the main consideration and safety but we do consider energy and try and minimise energy use where possible. We're an Academic Department, we teach students, we undertake research. That's the reason we're here. So the science is our, you know, the day-to-day, that's what we do." (**Senior Manager No. 2)**

Additionally, new modes of workplace governance were also revealed. This was through the use of virtual chat spaces, such as Facebook groups, or specific mobile applications. These were discussed during interviews with some participants and observed in use during the observation days. For one lab group, a mobile application allowed the group to keep track of what other users were doing during the day (see Figure 2). This was favoured as opposed to using email as it offered a real-time way to keep in touch, collectively, 'on the go' in the lab.

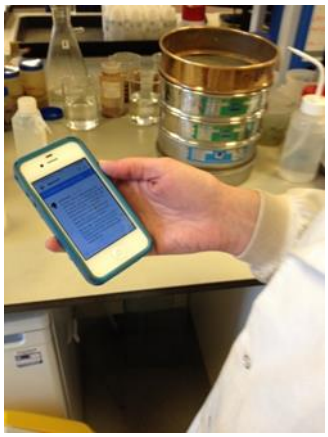

Figure 2. Participant showing phone application used for the research group to share messages of activities, progress etc. while working in the lab.

This observation aligns with the growing body of research exploring the relation of increasing data demand from mobile devices (for instance, data traffic, processing and storage facilities) in relation to energy demand (e.g. see Morley et al., 2018 for a recent exploration and summary). However, much of this research to date focuses on

mobile devices and associated practices in the home, rather than the workplace (Lord et al., 2015, Widdicks et al., 2018). To date, research exploring the use of mobile devices and social media in the workplace is limited. Our research suggests that the use of these devices is additional, rather than replacing existing workplace technology. As Whittle (2015) comments, the use of additional screens for desktop computers is growing as a perceived means of boosting 'productivity', and so the additional use of mobile phones, tablets, and laptops meshes with existing workplace technology and laboratory equipment usage. As well as increasing 'productivity' and 'effectiveness', these new sources of energy consumption are creating additional layers of institutional energy demands that did not previously exist. Furthermore, we saw ways that respondents were using mobile devices to monitor and govern not only their own work activities but also those of others. As such, these devices might add a further, and virtual, space of governmentality in the workplace.

6.2.1 Identity and Governmentality

Our particular case study highlights this theme of governmentality in laboratories located in a department that focuses on environmental research, as well as the way academic researchers build their identities around specific themes, such as 'doing good science'. As introduced in section (3), previous research has looked at the role of identity in environmental action, for example Paterson and Stripple (2010) have written about carbon saving, individual practice and identity. Paterson and Stripple (2010, p.359) suggest that the examples of individualised climate politics that they explored do not entail 'power over', where states, or international treaties, enforce rules over states, companies and individuals, but rather a means of acting through all such subjects. This potentially shapes their behaviour but also their internal rationalities, identities, and what they fundamentally regard as 'normal' behaviour. These forms of carbon conduct mobilise certain subjectivities or identities to encourage individuals to manage their emissions in certain ways (Paterson and Stripple, 2010, p. 342). Given that this is a department of environmental research, it might be expected that those who work there would hold personal environmental values or thoughts on sustainability (e.g. see Paterson and Stripple's (2010)

‘concerned carbon emitter’). Indeed, researcher identity was something that emerged strongly with nearly all participants, as the following quotes from two participants emphasize:

“ So you know I love the science, I love the investigation, it just seems to fit who I am really, I’m naturally inquisitive but quite practical but also, you feel like you’re making a difference as well. Which…for me is very important I think.” (**Postdoctoral Researcher No. 1)**

‘I feel like I know a bit about climate change …I want to try and be green where I can outside of work and I think it does need to translate when I'm in work. And I think culturally it should be something that people are doing across the board basically.’ **(Postdoctoral Researcher No. 2)**

Here, ‘*postdoctoral researcher No. 1’* links ‘doing good science’ to their ‘naturally inquisitive’ character, and desire to make a difference, and thus as central to their identity building. In contrast, ‘*postdoctoral researcher No. 2’* discusses their knowledgeability about climate change to being green, both at work and at home. This respondent continued to suggest that this is a cultural expectation, suggesting that others should act as ‘concerned carbon emitters’ and thus highlighting the tensions that can emerge in the workplace when others do not subscribe to the ‘concerned carbon emitter’ identity.

The complexity of the workplace presents competing dynamics, and so while we might expect those working in environmental disciplines to have environmentally informed identities, this was not always the case. For many, we found that the work is ‘about the science’ and this was, for many, the central motivation at ‘work’. There were, nevertheless, multiple layers or drivers underpinning the desire to do ‘good science’: for instance, this could be through their identity as a scientist, environmentalist, teacher, or as being part of a ‘world-class’ environmental department at a ‘world-leading’ university. This observation has important implications when trying to understand *why* people do what they do, or don’t do, and how one’s identity might conflict with shared values around sustainability and individual environmental values

held outside of work. However, it also has implications for how these are shaped by both institutional and national policies and procedures. For instance, in the quote above, *'Postdoctoral researcher No. 2'* discusses their green values and how they try to translate them into the workplace. Figure 3, a diary extract from the same participant, shows how such green values can sometimes create conflict with the day-to-day workings of what it is to be a 'good scientist'. In particular, here they reflect on the frustrations of using disposable plastic during their laboratory work, and the methods they use to try to reduce the waste. However, in trying to save plastic, they increase their use of the dishwashing machine and drying ovens, thus potentially leading to increased electricity consumption.

Photo Diary entry (Feb, 2016) for Postdoctoral Researcher No 2 : '*Here's all the tubes from my extractions. They are disposable but I try to reuse them as much as possible so spend a lot of time washing and drying things – I use the dishwasher and drying cabinet below many times a week when I'm running extractions in the lab. Tubes have to be disposed of if you are centrifuging, as they get warped and weak. The amount of plastic we go through in the lab is frustrating but it is hard to know how this can be changed*.'

Figure 3. Photo diary entry discussing use of plastics and methods used for re-use (Source: *Postdoctoral researcher No. 2)*.

6.2.2 Growth and Productivity

Thinking about reducing energy consumption in the workplace requires people to take their "environmental subjectivity" (Agrawal, 2005) to work, where the imperatives of 'doing good science' and/or being a 'productive employee' may supersede concerns about energy consumption. This may especially be the case as academics and researchers are increasingly under pressure to 'perform' according to the metrics of the Research Excellence Framework (REF)[5] in the UK. It may be that such competing agendas are counterproductive for energy reduction measures. Building on Whittle (2015), we suggest that expecting institutional level energy reduction concerns to be implemented by individual staff is problematic, especially when it competes with concerns about 'productivity' and 'good science' that are the key measures against which the 'effective' employee is assessed for both reputation and promotion purposes.

This desire for growth and productivity also extended to the physical growth of the department, as the following demonstrates:

Interviewer: *"so is there always a rolling programme of projects…on the go in the building?"*
Interviewee: *"Yes, always something, even if it's just a small scale, you know.... So it could be just a refurb of a single office or it could be a suite of laboratories or it could be a new building or it could be, there's always something…"* **(Senior Manager No 2**)

However, departmental growth additionally extended to the number of people working in laboratory spaces, many of whom who were acquired to work on research projects from awarded research grants. For instance, this included the acquisition of new PhD students, postdoctoral researchers, and in some instances visiting researchers from other institutions. For some projects, new instrumentation or 'kit' was also acquired, often with large energy profiles, which would often be used for the

[5] The Research Excellence Framework (commonly known as the REF, https://www.ref.ac.uk/) is a system for assessing the quality of research in the UK. It assesses the 'the quality of outputs (e.g. publications, performances, and exhibitions), their impact beyond academia, and the environment that supports research' (REF, 2018). The results of the REF inform the selective allocation of funding for research in HE institutions.

lifespan of the project and beyond. At the time this research was undertaken, laboratory space was at a premium. Discussions as to what space could be transformed or used for incoming researchers, was mentioned and observed a number of times during the participant observations days.

In sum, there were a variety of both direct and indirect policies, at various institutional scales, that had implications for research and teaching laboratories and their energy use. This was through the varying effects of the 'Triad warnings' (direct) but also influenced by the processes and practices of what it is to be a 'good scientist' combined with the pressure imposed at the institutional and national level related to productivity and income. The next section will further unpack these findings and their implications for energy demand (and sustainable campus profiling) in more detail.

7.0 Discussion and Reflections

Olssen and Peters (2005) suggest that the neoliberalisation of HE has introduced a new mode of regulation or governmentality, with clearly defined objectives which take a results-orientated[6] approach (for both the institution and the individual). This in turn replaces, to some extent, the public service efficacy of HE, which is more readily associated with norms and values linked to knowledge generation for the wider good or public interest (ibid). Our empirical data suggests that the neoliberal agenda (centered around this results-orientated culture) is influencing the nature and working patterns of the participants in our study. This goal-orientated approach, largely defined by cost saving and income generation, can be seen to influence participants in a number of ways, which can have significant impacts on energy demand and consumption. On the one hand, neoliberal agendas promote 'productivity' through income generation and doing more science (for publications and prestige), which inevitably leads to more kit, more research, more travel and thus more energy consumption. On the other hand, neoliberal agendas firmly place the responsibility

[6] Such metrics are a key part of the neoliberalisation agenda – see Mountz et al., (2015) who argue that these metric frameworks enroll us as researchers so that "the ambitions of government become a technology of the self" (Davies and Bansel, 2010, p. 9 in Mountz et al., 2015, p. 1242).

for responding to climate change on individuals, for calculating and rectifying emissions (Paterson and Stripple, 2010 p. 359).

These competing demands create tensions for individuals attempting to 'do good science', be a 'good employee' and be a good environmental citizen, and yet do not recognize the limits to workplace reconfiguration available to individual researchers. Further, drawing on recent debates about the value of slow scholarship, and specifically the work of Mountz et al., (2015), we suggest that our findings here echo their arguments about the need to slow down and resist the ever increasing neoliberalisation of the academe, and the associated 'growth' – of publications, grant funding, student numbers, administration, pressure, and, here, energy consumption. We suggest that the ethics of care proposed by Moutz et al., (2015) can be extended to an ethics of care for the environment (through changed working practices, travel practices, etc.) and to each other. However, much like 'care', 'sustainability' may be a concept that is in fact devalued by neoliberalised HEIs and which requires collective political action. Rather than seeing ourselves as calculative individuals, we need space to reframe ourselves collectively to work in ways that are more supportive and caring. In this way, energy reduction activities can be complementary with the wider appetite for challenging the neoliberalising agenda in HE. Given this, HEIs may become more socially just (Mountz et al., (2015: 1238) *and* environmentally just. Slow scholarship and energy reduction may in fact be mutually supportive, and resisting neoliberalism might be one route to a more sustainable and just university.

For instance, the 'Triad warnings' effectively demonstrate the ways in which such an agenda differently influences, and creates tensions, around the actions and practices of laboratory users. This is shown by those who take significant action during the Triad warnings, by temporarily closing laboratory spaces (for both personal values and economic reasons), and those who see the reductions in consumption as important and who "do what they can". Yet the latter rarely prioritise electricity demand above the needs of their work or routine. There are also those who do not see the Triads as something that concerns them and carry on as usual. Being able to do 'good science' was an overriding theme that emerged at both the department and individual level,

and which related to the identity and values at both scales. Thus, we suggest that the *extent* to which the need to achieve this science is now being driven and directed by exogeneous institutional and national (neoliberal) policies based on targets and income, is thus indirectly affecting energy demand.

Furthermore, target- and income-driven agendas do not only influence the working patterns of laboratory users. The drive for increased research grant money leads to additional people working in those spaces (in order to do the 'work' associated with grants), and an increase in specialized and often energy intensive equipment (purchased by grants), the lifespan (and energy consumption) of which may go on for many years after the grant has finished. This increase in people, intensity of work and specialized equipment, all contribute to an increasing energy consumption profile over multiple timeframes. In some cases, and in our case study example, it can also lead to the building of new facilities such as laboratory spaces. Moreover, observations from the study also exemplified the increasing configuration of mobile or virtual spaces that now factor into the norms and conventions of the working day. This acts to emphasise the 'always on' nature of work that mobile devices bring (Whittle, 2015, Spinney et al., 2012, Lord et al., 2015), especially in relation to a culture that encourages high levels of productivity and responsiveness.

These findings build on Royston's (2016) research that explains in addition to increased investment into facilities to help increase student numbers, the HE sector also has significantly prioritized attracting research funding. Indeed, Royston (2016) reports that the sector has seen an increase of 33% in energy consumption since 1990, which may be unevenly distributed through different types of academic activity. These findings also qualitatively support Wadud's (2019) research that indicated proportionally higher levels of energy demand for research intensive institutions within the HE sector, and start to provide a nuanced understanding of the role policies play in driving this demand.

Another mode of exploration relates to people's practices with relation to energy demand, which aims to challenge the behaviour change rhetoric and encourage

thinking beyond that of individual agency to consider the role of surrounding social, cultural and political norms (Shove and Walker 2014). Given this, understanding the role governance plays in influencing these norms becomes important. The role of governmentality has been used previously in an HE setting, for instance Whittle (2015) explored this in conjunction with the emotional effects of environmental values in the work place and how they are relational. While we don't specifically focus on the emotional or embodied experience of our participants, the role of identity emerged as an important theme, and shapes aspects of governance in relation to laboratory activities.

The Triad example from our case study also aligns with the concept of demand shifting, an often-discussed measure in relation to reduced or low-carbon energy consumption. This concept involves shifting demand practices to better align with energy supply options (for instance shifting demand to better match intermittent renewable energy supplies). This could involve significantly changing some of the current norms and conventions, such as times of cooking, travelling or changing the timing of the working day according to the seasons or weather patterns. In the case of HE, and as the example of the Triads suggests, this might include changing the teaching timetable to hold lab classes and research practices out of 'peak' demand times but during daylight hours for example. Or altering supporting infrastructures such as lighting, or spatially locating large 'energy intensive' machinery that could be supported by their own localized and possibly renewable supplies (and thus not impacting the wider rhythm of electricity consumption, especially as it relates to nationalised supplies) (Bates and Friday, 2017, Powells et al., 2014). However, as the discussion of the Triad warning suggests, these measures are not necessarily simple to implement.

8.0 Conclusions

This research has made a distinctive contribution to debates about invisible energy policy by applying concepts from governmentality to show how different policies and technologies of governance come in to conflict in practice and builds on the growing literature on invisible energy policy in the HE sector. It is the first qualitative study to explore the impacts of invisible energy policy in laboratory spaces and emphasizes the

conflicting priorities and tensions across scales of governance in relation to energy. This is shown through the impacts of invisible energy policies (discussed above) and the intentional energy initiatives put in place (e.g. through the demonstration of the University Triad warning system). It specifically highlights the ways in which governance as well as governmentality are enacted in different ways across different scales of actors. This also enables us to start to understand the micro-politics and practices that are currently played out with respect to energy demand or consumption and the ways in which they become accepted or areas of contestation.

Both research income and high impact publications are key markers of success in HE for both the individual and the Institution, and have become a key and significant driver of individual and institutional activities. This is driven by wider national policies such as HEFCE and UKRI funding decisions, and the discourse that sees universities as part of the neoliberal agenda (Maniates, 2017) and we suggest are also constitutive of the ways that invisible energy policies contribute to increasing energy consumption practices in HEI's. We have shown this by exploring the practices of those working in research and teaching laboratories in our case study, and the influence that invisible energy policies have in shaping the activities and materiality of those in laboratory communities. This propensity was framed around the ability 'to do good science' and empirically supported by the recognition to be competitively publishing and bringing in more research income, thus highlighting the ways that neoliberalised researchers use their freedoms to govern themselves in ways useful for a neoliberalised system .

9.0 Acknowledgements

10.0 References

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