Motivating energy conservation in organisations: Smart metering and the emergence and diffusion of social norms.

P. Bradley[a]*
S. Fudge[b]
M. Leach[c]

[a] Department for Accounting, Economics and Finance, University of the West of England, Frenchay Campus, Coldharbour Lane, Bristol, BS16 1QY, United Kingdom.

Corresponding author: peter.bradley@uwe.ac.uk, tel: 0044 (0)117 328 3444

[b] Geography, College of Life and Environmental Sciences, University of Exeter, Amory Building, Rennes Drive, Exeter, UK, EX4 4RJ

[c] Centre for Environmental Strategy (D3), Faculty of Engineering and Physical Sciences, University of Surrey, GUILDFORD, GU2 7XH, United Kingdom

Key words: Smart metering, social norms, energy, feedback

1.0   Introduction

Around the world there is strong interest in the use of energy feedback via smart metering technology as an option for businesses to reduce their energy use and mitigate greenhouse gasses (GHGs).   In order to bring about such energy reductions in this way, the feedback provided needs to motivate changes in energy behaviours and practices within organisations. The paper explores the impact of a real life smart metering intervention and its impact on the emergence and

diffusion of energy related social norms and the link between these and energy use. The paper begins by looking at early organization and energy conservation studies (mainly feedback based), before moving on to organizational and social norms studies, and concluding with those most relevant to the current paper. We firstly briefly define what we mean by social norms. Cialdini et al (1991) argue that social norms can be defined as either injunctive (characterised by perception of what most people approve or disapprove) or descriptive (characterised by what most people do). According to this argument, injunctive norms incentivise action by promising social rewards and punishments (informal sanctions) for it (and therefore enjoin behaviour). According to Cialdini et al (1991) these constitute the moral rules of a group. Descriptive norms on the other hand, inform behaviour, and incentivise action, by providing evidence of what is likely to be effective and adaptive steps to take based on what others do (Cialdini et al 1991). The 'focus theory' of Cialdini et al (1991) stipulates that this differentiation of social norms is critical to a full understanding of their influence on human behaviour.

1.1   Organizational energy studies

There are three broad findings from the review of previous organisational studies for this section: firstly, the vast majority (all but one of studies looked at here) rely on self-reporting of energy use when examining individual level energy behaviours. Second, few studies investigate the role of social norms in influencing energy use within organisations. Finally, most studies that do look at social norms and energy (or environmental sustainability related behaviours) tend to only pick up on the role of injunctive (subjective) social norms and not descriptive social norms. However, these studies provide useful background for more detailed exploration of the different norms. This section now provides overview on these studies.

There have been a number of different studies of the use of feedback on energy consumption behaviour. Siero et al (1996) explored the effect of two different types of feedback on energy consumption behaviour within a metallurgical company. Two different groups of employees were given different types of feedback, one received information about their energy conservation and personal performance and were set a conservation goal; the other group received the same but also comparative feedback about the other group. It was notable that more energy was saved when comparative feedback was provided, even half a year after the intervention, and this took place with little change in attitudes or intentions. The study recorded energy wastage around key energy consumption objects, drilling and assembly lines etc. Records were sometimes not based on actual energy data (for feedback). Behaviour change of the groups from the interventions were based on self-reports.

Gustafson and Longland (2008) on the other hand measured whole building electricity consumption on a monthly basis and applied a wide variety of initiatives and interventions with employees in order to encourage energy conservation. Benchmark and end of year surveys provided comparison of employees stated behaviours, environmental perceptions and impacts. However, whilst at the end of the first year the initiative achieved a 5% reduction in electricity consumption, it was difficult to unpick the influences underpinning this change because effects could not be attributed to any one intervention and interventions were not set out in a transparent way.

Another study was carried out by Schwartz et al (2010) who conducted participatory action research studies in an organisation: this included small scale interviews, workshops and smart metering of offices before and after workshops. A larger survey was also conducted. This more

bottom-up approach allowed the study to be reflexive and provide depth of insight on engagement of participants in energy reduction, beyond the impact of just putting the technology in place. Energy use measurement took place at the office level.

Finally, Carrico and Riemer (2011) conducted three intervention studies in a workplace setting. One provided group level feedback, presented monthly to employees via e-mail. The other involved peer educators to disseminate information and encourage reductions in energy use by colleagues, the third involved peer education and feedback. Feedback and energy monitoring was provided at the building level and energy use during the interventions were compared to energy use during the benchmark. Feedback and peer education resulted in reductions in energy use of 7% and 4%, respectively. Surveys were also conducted to provide additional data at the individual level but were not be correlated with individuals energy use. Energy was measured at the building level, but individual energy use estimates were based on self-reports.

1.1.1 Organizational and social norms studies

A number of the studies that investigate energy feedback in organisations point to the potential for normative influence from one's peers in bringing about energy reductions. Cordano and Frieze (2000) look at perceptions of norms for environmental regulation, they focus on descriptive norms of environmental managers, other employees were not included. Also focusing on managers, Flannery and May (2000) investigate the individual and contextual influences shaping the environmental and ethical decision intentions in the US metal finishing industry. They found that magnitude of consequences, a dimension of moral intensity, moderated the relationships between subjective (injunctive) norms and managers' environmental and ethical decision intentions.

Looking more broadly, Ramus and Killmer (2007) provide a conceptual framework to look at prosocial extra role behaviours and relationship to employee motivation. Within their framework, they pick up on the role of social norms within an organisation, as well as outside the organisation on environmental behaviours. They do not however provide any differentiation between injunctive and descriptive norms, or salience of norms and empirical analysis is not conducted.

A useful study by Goldstein et al (2008) undertook two field experiments in the Hospitality sector to investigate the effectiveness of signs (on room doors) asking hotel guests to conduct actions that result in energy conservation (i.e. not requesting towels to be washed every day). They found that messages employing descriptive norms ("the majority of guests reuse their towels") proved more effective than widely used messages that focus on environmental conservation.

Vazquez Brust and Liston-Heyes (2010) present a model that investigates the extent to which environmental behaviour intentions are explained by managers' core values, beliefs and basic assumptions; individual and socio-cognitive frames; contextual factors and principles of governance. In the paper they identify the importance of social norms, but they do not recognise different types of social norms and don't actually look at social norms when applying their model in a regression analysis with survey data. A key limitation of their approach is that they also focus on just managers and not employees.

Papagiannakis and Lioukas (2012) specify and test a model of corporate environmental responsiveness, by adapting a version of the theory of planned behaviour and the value-belief-norm theory. They find that subjective norms (injunctive norms) expressing stakeholder expectations, affect corporate environmental responsiveness.

Ture and Ganesh (2014) review employee-centric sustainability literature in management, pro-environmental areas of psychology and sociology disciplines. Similarly to quite a number of other studies they only pick up on injunctive social norms in their review (subjective norms) and not descriptive norms.

In relation to the study of social norms and energy feedback in organisations, five highly relevant studies for the current intervention were found: Siero et al (1996), Carrico and Riemer (2011), Lo et al (2012), Dixon et al (2014) and Chen and Knight (2014). These most relevant studies are now summarised, focusing primarily on approaches.

In their intervention, Siero et al (2006) measure changes in social norms. They do not however explicitly classify in terms of descriptive and injunctive norms. They define social norms in terms of normative belief and motivation to comply following Ajzen and Fishbein (1980). Social norms about shutting off machines and switching off lights revealed only an effect of the intervention on behavioural beliefs that these habits resulted in energy saving.

In their study, Carrico and Riemer (2011) examined whether their interventions changed the levels of descriptive and injunctive norms around energy services. They found that the intervention increased both. There was however no effect on energy conservation behaviour (which was based on self-reports).

Lo et al (2014) investigate the effect of social norms (descriptive and injunctive) on energy saving behaviours.

The office energy behaviours measured however, were only a select few and based on self-reports not actual energy use.   In the study, perceived norm was a significant predictor of printing intentions and intention to switch off monitors, but not intention to switch off lights.   The study was not an intervention study, but a regression analysis based on survey data.

Dixon et al (2014) undertook a comparative feedback study where individual and collective progress on energy reduction is fed back to participants. The individual level data generated, however is based on self-reports of energy conservation behaviours (building level data is actual not reported). Surveys were conducted before and after the intervention to measure the extent to which the comparative feedback campaign influenced subjective norms as well as self-reported energy behaviours amongst other variables. The measures of injunctive and descriptive norms applied were broadly the same as used in the current study.   Results showed that descriptive norms increased after the intervention. Injunctive norms did not change. No link between changes in norms and changes in energy behaviours was explored.

Chen and Night (2014), as part of their analysis looked at the effect of injunctive norms on energy preserving intentions for 564 employees of 9 state-owned electric power companies. The study came up with their own questions for measuring injunctive norms, what is surprising however, is that some of the questions relate to recycling, reusable materials and protecting the environment which don't seem necessarily salient or directly correspond with energy use. Energy saving intentions were self-reported. The study finds that injunctive norms have a direct, positive and strong effect on energy conservation intentions.

1.2   Social norms and the environmental psychology literature

Abrahamse and Steg (2013), from an extensive review of the literature on social influence approaches to encourage resource conservation (including energy), identify that more empirical research linking social influence mechanisms to behaviour change is needed. They found that relatively few field studies have looked at social norms and social comparison as part of effective measures. They also state that emphasis of intervention studies has predominantly focused on looking at whether a social influence approach is successful, not on why it was successful.

Social norms have been systematically researched in the environmental psychology literature. In this literature, analysis tends to focus on examining the effect of social norms on behaviour. There is little work that quantitatively and qualitatively examines the emergence of social norms; a finding in line with Abrahamse and Steg (2013). The main aim of the study upon which this paper is focussed was to investigate and provide empirical evidence on the emergence and diffusion of social norms in relation to energy services from energy feedback provided by smart metering technology, measuring individuals' actual energy use.   We use the 'focus theory of normative conduct' (Cialdini et al 1991) as the starting point to guide this investigation.

2.0   Background on Social Norms

2.1   Theory and empirical evidence in relation to norm emergence within organisations

There are a number of processes that lead to the development of social norms and changes in behaviour, these are as follows: 1.) norm emergence 2.) norm diffusion and 3.) translation into behaviour.   Norm diffusion involves the spread of social norms (injunctive and descriptive). The emergence process and the diffusion processes involve social construction (Lyndhurst 2009) and social comparison (Vishwanath 2006). The social construction and social comparison processes

occur for both descriptive and injunctive norms and are informed from other referent individuals[1]. Social construction is the theory that norms, beliefs and attitudes are constructed through a process of social interaction (Lyndhurst 2009). Burr (1995) identifies the major influence of Berger and Luckmann (1991) on the development of social constructionism, who in turn acknowledge earlier influential work on their thinking, in particular, that of Mead, Marx, Schutz and (as seen in Andrews 2012).

For social comparison, individuals compare with what others do/how they respond to a given situation. With this regard, Snyder & Swann (1978) as seen in Flynn and Chatman (2003). *'Emergent norm formation is an inherently social psychological process. People form impressions of others in their social environments by interpreting information gathered from observation of an interpersonal interaction with the focal individual and similar others'*

2.2   **Translating social norms into actions and behaviour**

A refinement that needs to be applied before the use of normative explanations can be confidently established is whether people's attention is focused on that particular norm in any given situation[2]. This is an important consideration, as whether the norm will influence behaviour, will

---

[1] Goodman and Haisley (2007) identify that there are a number of ways to classify social comparison processes. They identify: initiation, selection of referents and an evaluation process as important.

[2] In the conclusion of their work Cialdini et al (1991), identify that norms can be demonstrated to effect action systematically and powerfully and that individual behaviour is likely to conform to the type of norm that is the present point of focus - even when alternative norms dictate different conduct. Cialdini et al (1991) state that, due to the possible influences of the three different types

depend on whether attention is focused on it, and on its activation.   This is important as social norms motivate and direct action primarily when they are activated (said to be made more salient or otherwise focused upon). Social norms have to be activated to influence behaviour (Cialdini et al 1991).

Rimal and Real (2005) have extended the work of Cialdini et al (1991) to present a theory of normative social behaviour. The theory/model has three variables/parameters that effect the translation of social norms into behaviour. They state that social identity, norm interaction (injunctive norms in their model), and outcome expectations moderate the influence of descriptive norms on behaviour i.e. if you share identity, you are more likely to follow the descriptive norm The theory of social identity was developed by Tajfel (1974), and group identity comes from this. In the current project we restrict our concept and discussion of group identity to the workplace of the relevant department within which the trial was run. The work of Rimal and Real (2005) is a useful extension of the work of Cialdini et al (1991) as these authors start to incorporate influencing factors in their model of translating norms into behaviour. They identify that the translation of a descriptive norm into behaviour is moderated by the existence or injunctive norms relevant to the behaviour, outcome expectations and group identity.   If you believe in and have alignment with outcomes you are more likely to enact the norm into behaviour, and if there are

of norm, one must be careful in specifying the particular type of norm that is being made salient by a given technique or mechanism.

injunctive norms against not doing the action you are more likely to enact the descriptive norm into behaviour; also, if you have share a group identify with others who have and enact the norm you are also more likely to.

2.3   Questions and gaps

Significantly, the focus theory of Cialdini et al 1991 only looks at norm activation and translation into behaviour, it does not look at the emergence and diffusion of social norms. The same can be said of Rimal and Real (2005).   Both Cialdini et al (1991) and Rimal and Real (2005) focus on the translation of norms into behaviour, for example the work of Cialdini et al (1991) typically attempts to invoke a particular norm and then measure behaviour change. Although a useful and valid approach, such research provides no information on the pre-stages of social norm emergence and social norm diffusion. In this study, emergence refers to the arising of norms in participants, which can occur through social interaction (and social learning) and other forms of communication, amongst others. Norm diffusion is used to refer to the extent to which norms (via social interaction /visual observation etc.) become prevalent amongst participants. Rimal and Real (2005) identify group identity and outcome expectations as being important in determining the translation of social norms into behaviour. However, there is little testing of whether group identity and outcome expectations actually effect the emergence of group norms in the first place, this is the focus of the current study.   Additionally, we seek to investigate social construction and

social comparison processes occurring during the study (via interview data) to provide added insight and depth on these processes as they are important to norm emergence and diffusion.

3.0   Methods

3.1   Context and overview

This study was part of a larger project that ran a longitudinal energy feedback intervention in an organisational setting. The intervention was to put in place a smart meter energy feedback system where an energy footprint tool called MyEcoFootprint (MEF) which measures desk based energy use and provides feedback to users (via a web-based interface) was provided to participants.

The participants were from a higher education sector organisation, made up of predominantly lecturers, researchers and students. The department was chosen based on availability and access. The larger project (Murtagh et al 2013) applied an opt-out policy to recruit participants for the project as literature indicated that this was the most effective recruitment policy: participants were provided with smart metering equipment and included in the project unless they identified to the project team that they did not want to participate.

A flow chart for benchmark and intervention periods is provided in Figure 2 showing key timings, it also identifies at what stages surveys and interviews were conducted. Interviews were carried out with the aim of understanding and exploring participants' experience of the intervention; to explore the social context; and to gain insight and depth on social construction and social comparisons occurring during the intervention. The interview approach was believed to be the most suitable method to collect such data, as previous studies such as Schwartz et al (2010) indicate suitability and validity for the context, workshops were considered, but it was felt

that the presence of third parties may inhibit or influence data attained. Surveys were conducted to primarily pick up on factors identified in Rimal and Real (2005) and other relevant information, as identified in section 3.3. Most studies that look to measure social norms in organisational energy study contexts apply the survey approach as seen towards the end of the section 1. Three surveys were deployed to participants (paper and online formats via email) as well as interviews as set out in Figure 1 and further discussed in section 3.3. Interview participants were also requested via email, the response to both surveys and interviews are provided below in section 3.2.
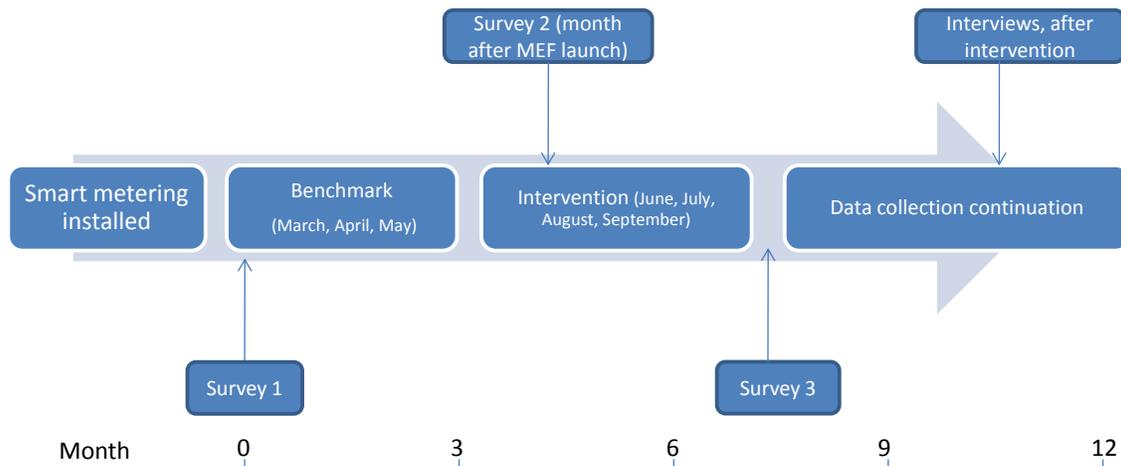

Figure 1: A timeline of activities for the study

The benchmark and the intervention lasted 7 months. Detail on the smart metering deployment is in Murtagher et al (2013), a summary is provided here. Desk based electricity (plug based) and presence data were collected for the benchmark for each participant. After the benchmark data

collection, the MyEcofootprint tool was provided to each participant to provide them with energy

feedback information[3]. The energy feedback information from MEF was available for the four-

month intervention period, energy and presence data was again collected during this time. The

smart metering technology implemented during the study measured energy use and energy use

while present (providing a measure of efficient energy use).

3.2 Response to surveys and interviews

Survey 1 was sent to the 83 intervention participants and received a response of 40 (31 in the

intervention group and that had energy data), survey 2 received a response of 37 out of 83 (19 that

used MEF and filled out the survey) and survey 3 received a response of 29 out of 83 (19 filled

out surveys 1 and 3, of these 17 provided data for all relevant variable tested). The sample was

based on a case study university academic department that was willing to be involved in the study

of those asked in the university. Eight people took part in interviews. The interviews were

conducted with two academics, three researchers, two PhD students and one administrator. All

interview participants were in the intervention group, of the eight, six had used the MEF tool.

3.3 Surveys

A key approach adopted by the study was to apply and measure the change in social norms and

efficient energy use via a longitudinal study[4]. Measurement of desk based energy use was

captured above. To pick up on the processes of social norm emergence and diffusion in relation

---

[3] For more detail on the feedback tool (MEF), please see Muthagher et al (2013).

[4] Social norms in relation to certain energy services were measured in surveys using Likert scale questions.

to energy, the study made use of surveys as well as interviews. Measurement of social norms was conducted via surveys. The surveys allowed quantification and significance testing of the emergence of social norms in relation to energy; but also quantitative testing of relationships between social norm emergence; group identity, outcome expectations and injunctive norms (in line with factors identified as important by Rimal and Real (2005). The questions were informed and developed based on review of previous studies looking at similar issues and through dialogue and discussion with researchers (were previous questions and measures were not available in the literature). For social norms measurement, the authors found robust previous survey questions for these and factors identified above, as outlined in the next paragraph. Quantitative data for a few other variables to understand social construction were also included in survey 1, these questions were constructed in debate and dialogue by the current authors to ensure strong questions. When measuring actual energy behaviours, measuring energy took place at the desk of the occupant, where they received feedback from the smart metering on energy use as well as normative information, this ensured salience to the relevant energy behaviour. Survey 1 was carried out at the beginning of the benchmark. The most important measurement was the benchmark of injunctive and descriptive norms around energy use. Specific questions on these (in Table 1) are adapted from Ohtomo and Hirose's (2007) measure of injunctive and descriptive norms for recycling, which have been shown to be a reliable and valid measures of these concepts. They use a 5 point scale. Questions for collective outcome expectancy are from Carrico (2009) as were questions on group identity. With regards to group identity, these are originally from Mael and Ashforth (1992).

Table 1: Survey 1 questions

Factor	Questions	Answer
Group identity	I am very interested in what others think about the department	7 point likert scale from strongly disagree (1) to strongly agree (7)
	When I talk about the department, I usually say 'we' rather than 'they'	
	When someone praises the department, it feels like a personal compliment	
Outcome expectations	By changing our behaviour, employees and students like me can reduce the department's energy use	
	The department should do more to save energy	
	I am concerned about the amount of energy that the department uses	
	Energy conservation should **not** be a priority for the department now	
Descriptive norms	How many people in your department: turn off office or lab equipment when they are finished using it?	Five point scale: very few (1); 25%, 50%. 75%, Nearly everyone (5)
	How many people in your department: turn off their computers before leaving work for the day?	
	How many people in your department: turn off their monitors before leaving work for the day?	
	How many people in your department: turn off the lights at their desk/office before leaving work?	
Injunctive norms	If the other people in your department saw that a computer was left on when the user was not at work, they would:	Five point scale: Stongly disapprove (1); disapprove somewhat; Neither approve nor disapprove; Approve somewhat; Strongly approve (5)
	If the other people in your department saw that a monitor was left on when the user was not at work, they would:	
	If the other people in your department saw that an individual's lights were left on when he/she was not at work, they would:	
	If the other people in your department saw that office or lab equipment had been left on when it was not in use, they would:	

Survey 2 was designed primarily to measure quantitative variables relevant to social construction and social comparison processes; the questions were developed by the current author in order to deliver information relevant to the current study: the extent of discussion, socialising and communication around MEF and energy use, individual cost and gain and effort required in relation to using MEF and reducing electricity. Feelings of 'duty' and also 'pressure' in relation to using MEF were also measured.

Table 2: Survey 2 questions

Factor	Questions	Answer
Communication and social interaction	I discussed energy use with colleagues	7 point likert scale from strongly disagree to strongly agree
	I discussed MyEcoFootprint with colleagues	
	Such opportunities for discussion encouraged my use of MyEcoFootprint	
	Discussion with colleagues about MyEcoFootprint helped me reduce my energy use	
	I encouraged my colleagues to use MyEcoFootprint	
	I use MyEcoFootprint because my colleagues use it	
	Because I used MyEcoFootprint I now know more colleagues	
	Because I used MyEcoFootprint I now talk to more colleagues	
	Because I used MyEcoFootprint I now know my colleagues better	
Duty	I felt a duty to department managers to use MyEcoFootprint	7 point likert scale from strongly disagree to strongly agree
	I felt a duty to my colleagues to use MyEcoFootprint	
	I felt a duty to the team who developed MyEcoFootprint	
Pressure	I felt pressure from my managers in the department to use MyEcoFootprint	
	I felt pressure from my colleagues to use MyEcoFootprint	
	I felt pressure from the team who developed MyEcoFootprint	

Survey 3 was carried out four months after the intervention period after MEF implementation and measures changes in injunctive and descriptive norms (so used the same questions as survey 1).

3.4   Interviews

Interview participants were recruited based an email request (to) and response (from) the intervention group. Interviews ranged from between just under 1 to 2 hours depending on interviewee. Interviews provided more depth and exploration (via qualitative data) of emergence and diffusion processes, by providing insight and examples of the sorts of social construction and social comparison processes occurring during the intervention.   The questions were developed after reviewing the range of factors that can influence the emergence, diffusion and translation of social norms into behaviour: the review is provided in a working paper (Bradley et al 2014). Again in order to ensure effective questions the current researchers revised and debated the questions and also piloted them. The questions help shed light on the social context in which the intervention took place and the emergence and diffusion of social norms.   The full interview schedule is provided in the working paper for this study, the main questions are provided in Table

8 of this paper. Each interview was designed to be firstly unstructured in order to capture the essentially qualitative nature of this part of the study (Kleining 1998). The second part of the interview was more semi-structured and focused, in order to pick up relevant findings to compare across participants. Based on review of social science research methods, this was felt to be the strongest approach to attain interview data for the current study. In analysing the interview data, all interviews were transcribed and the data was coded and key themes drawn out.

4.0   Results

4.1   Benchmark and Intervention

4.1.1   Descriptive and injunctive norms for energy services in the benchmark period

It was found that both descriptive and injunctive norms were much stronger for practices around lighting and office and lab equipment than for those around computers and monitors. Differences in the mean values around different energy services are provided in Table 3 (key values are highlighted in grey).

Table 3: Descriptive statistics for descriptive and injunctive norms for energy services

	Observations	Index (mean)	Standard deviation	Minimum	Maximum
Descriptive_norm_computers	31	2.5	1.03	1	4
Descriptive_norm_office_or_lab_equipment	31	3.2	1.04	1	5
Descriptive_norm_monitors	31	2.5	1.31	1	5
Descriptive_norm_lights	31	4.1	1.22	1	5
Injunctive_norm_computer	31	2.9	0.67	1	4
Injunctive_norm_office_or_lab_equipment	31	2.5	0.96	1	5
Inj_norm_monitor	31	2.9	0.65	1	4
Inj_nrom_lights	31	2.5	0.93	1	5

Significant difference was found for injunctive and descriptive norms for office and lab equipment and lights, compared to computers, see Bradley et al 2014 for details.).

Some of the reasons for differences between computers and lighting were explored in the interviews, often it emerged that participants could see differences in the attributes of behaviour around particular energy services that would affect norms. A range of factors however, including cultural influences were mentioned. The current study applies a broad definition of culture, following Kapp (2011)[5]. As one participant put it: 'turn the lights off', 'keep off the grass' – you see signs like this everywhere. Yeah, but 'turn off your monitor', 'turn off your computer'....this is very recent. People are not used to that, eh, culture. There is a culture of turning off the light. There is no culture for turning off the computer*".*

---

[5] "the sum total of a complex of institutions and interrelated habitual models of thinking, acting, and feeling (including the corresponding valuations, norms, and interpretations of the world of a particular epoch)-thus comprises the man-made learned and transmitted adaptive tools which form the prerequisites of human life and survival. In order to survive and exist, each individual must learn and master the system of institutionalized behaviour patterns that his group or society transmits to him in the process of enculturation"

4.1.2   Changes in descriptive and injunctive between the benchmark and intervention

There was a significant change (increase) in descriptive norms for computers and monitors going from the benchmark to the intervention period (but not for lighting and office and lab equipment). This is an interesting finding, as these are the very energy services that the energy intervention was set up to explore[6].   Significant change was not observed for injunctive norms. Due to being related samples the observation number (17[7]) is enough to test for significance in changes for this test.

Table 4: Descriptive statistics comparison for the benchmark and intervention period

	Observations	Mean (Index)	Minimum	Maximum
Descriptive_norm_computer_(Benchmark)	17	2.3	1	4
Descriptive_norm__monitor_(Benchmark)	17	2.4	1	5
Descriptive_norm_computer_(Intervention)	17	2.8	1	5
Descriptive_norm__monitor_(Intervention)	17	3.1	2	5
Injunctive_norm__computer_(Benchmark)	17	3.1	2	4
Injunctive_norm_monitor_(Benchmark)	17	2.9	2	4
Injunctive_norm_computer_(Intervention)	17	2.6	1	4
Injunctive_norm_monitor_(Intervention)	17	2.8	1	4

Table 5: Significance of changes in injunctive and descriptive norms

---

[6] The results align with energy feedback which was desk based (computers and monitors and other desk based items).

[7] We did not have data for the particular variable for one of the 18 participants.

	Significance Des_office_lab_(Int) - Des_office_lab_(Bench)	Significance Des_computer_(Int) - Des_computer_(Bench)	Significance Des_monitor_(Int) - Des_monitor_(Bench)	Significance Des_lights_(Int) - Des_lights_(Bench)
The median difference between the benchmark and intervention	0.688	0.048	0.04	0.417
	Significance Inj_office_lab_(Int) - Inj_office_lab_(Bench)	Significance Inj_computer_(Int) - Inj_computer_(Bench)	Significance Inj_monitor_(Int) - Inj_monitor_(Bench)	Significance Inj_lights_(Int) - Inj_lights_(Bench)
The median difference between the benchmark and intervention	0.346	0.07	0.45	0.717
Related-Samples Wilcoxon Signed Ranks Test				

The two cells highlighted in grey are significant because they are less than 0.05 (applying a 95% confidence interval). Given the significance of changes in descriptive norms, next the relationship between descriptive norms and energy use was tested.

4.1.3   Testing the relationship between descriptive norms and efficient energy use

A cross tabulation and chi-squared test was run to observe whether there was a significant relationship between descriptive norms for computers[8] and energy efficiency ratios (energy use while present/overall energy use). In order to test this, the descriptive norms category data was put into one of two groups group low descriptive norms (*LOW*): (score 1 to 2.9) and moderate to high descriptive norms (*MODERATE TO HIGH*): score 3 to 5). Results from cross tabulation with the energy efficiency ratio are provided in Table 6 below.   It was possible to conduct this for the 25 participants that had both filled out survey 3 and that had energy data.

Table 6: Cross tabulation of descriptive norms (computers) against energy efficiency

---

[8] This was chosen as opposed to monitors as computers use significantly more energy than do monitors.

Des_norm_computers				Energy efficiency ratio					
				0.00	0.10	0.20	0.30	0.4	Total
			Count	7	4	0	0	1	12
	LOW		Expected Count	3.4	4.8	1	1	1.9	12
			Std. Residual	2	-0.4	-1	-1	-0.7	
			Count	0	6	2	2	3	13
	MODERATE TO HIGH		Expected Count	3.6	5.2	1	1	2.1	13
			Std. Residual	-1.9	0.4	0.9	0.9	0.6	
Total			Count	7	10	2	2	4	25
			Expected Count	7	10	2	2	4	25

It was apparent that those with moderate to high scores for descriptive norms for computers (at which the intervention primarily targeted), tended to have higher values for energy efficiency (meaning they are more energy efficient). The significance of this finding is identified in Table 7.

Table 7: Significance of the cross tabulations provided in Table 6

	Value	df	Asymp. Sig. (2-sided)	Exact Sig (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	a	4	0.015	0.005		
Likelihood Ratio	16.7	4	0.002	0.004		
Fisher's Exact Test	11.9			0.005		
Linear-by-Linear Association	b	1	0.009	0.005	0.002	0.000
No. of Valid Cases	25					

9 cells (90%) have expected count less than 5. The minimum expected count is .96. The standardized statistic is 2.623.

The fisher's exact test is an appropriate test statistic to use when the sample size is lower as it is here (but still high enough to robustly test significance). It can be seen that the fisher's exact test provided a value for exact significance (2 sided) at 0.005 which is highly significant, as 0.05 is the threshold for testing significance (applying a 95% confidence interval).

4.1.4   Group identity, group outcome expectations, and descriptive norm changes

As identified in section 2, Rimal and Real (2005) identify group identity and outcome expectations as being important in determining the translation of social norms into behaviour. However, there is little testing of whether group identity and outcome expectations actually effect the emergence of group norms in the first place, this is the focus of the current study.   From testing with a chi-squared test, for the benchmark, group identity was found to have a significant relationship with descriptive norms for computers (those with higher group identity tended to have higher descriptive norms around computers). For monitors a significant link was not found. This result can only be said to be indicative and not conclusive however, as although the fisher exact test is designed for small sample sizes, sensitivity testing revealed that the result is somewhat unstable due to the particular sample size (17), see full details and results in Bradley et al (2014).

Collective outcome expectancy

The relationship between collective outcome expectancy and descriptive norms was investigated. Significance of a relationship was not proven in the benchmark or the intervention period see full results and details in Bradley et al (2014).

Norm interaction

Although the significance of changes in injunctive norms could not be proven, the mean index scores indicate a strengthening of these norms (lower score) from the benchmark to the intervention. It was perhaps not surprising that change was not significant as the emergence and diffusion of injunctive norms tend to follow sometime after descriptive norms.

4.1.5   Social context around MEF and energy use

Survey data also presented quantitative evidence of social construction and social comparison in relation to use of MEF and energy use. Interestingly this showed roughly an even split between participants that discussed MEF with colleagues and those that did not as can be seen in Bradley et al (2014).

For at least 6 of the participants, such discussion encouraged their use of feedback.   In this way, social interaction played a role in incentivising and motivating people to use the feedback tool.

4.2   **Social Construction, Social Comparison and Social Norms**

In this section the main findings relevant to the social construction and social comparisons and the development of social norms are presented. Findings are developed below under key themes which emerged: views and attitudes (and others views and feelings); social distance and interaction; and referents proximity and location.   A summary table of responses for the full range of questions is provided below. In general attitudes, and experience were generally positive for participants 1, 4, 5 and 8; participants 2, 3, 6 and 7 seemed to share a somewhat less positive experience.

Table 8: Summary table

25

QUESTION	1 (researcher)	Participant 2 (PhD student)	Participant 3 (admin)	Participant 4 (researcher)	5 (academic)	Participant 6 (PhD student)	Participant 7 (academic)	Participant 8 (researcher) - emailing answers
1. What were your experiences of the beginning of the project?	Technology implementation went smoothly	Concern - I don't see any gain from turning off my computer etc.	A negative perception of how the project was introduced and early experience of being told off. Problem with acessing MEF.	Not very clear experiences as I used MEF from time to time, sometimes I would click and look. Forgot/ignored from time to time, becomes part of the screen.	Good, but was not aware of a comparison with the average	Having these devices next to you at the beginning might be abit uncomfortable, we don't know exactly what they are there for. But afterwards, once we understand that they are not recording discussion, you don't care about it.	I have not installed MEF or used MEF, so have not experienced much.	*I wanted know the project and the technology used in it.*
2. What kinds of things encouraged you to use MEF?	Good to see facts and compare.	At the beginning, curious to see my energy behaviour.	I did look at a couple of times, but it did not tell me how I could do anything about it.	I liked monitoring my usage	When my computer brings up the screen and the emails.	Did not use MEF	na	I was interested in the project and I wanted to consider my next research referring to this project.
3. Were you aware of the feelings and opinions of others in the department of the project?		I don't know, but my guess is that they are thinking the same	The academics thought it was very important.	No - can say that he was more interested than office mates.	Noticed some discussion, more the reaction when people were getting access to their online information. Interpretation from some was that I have to turn my computer off all the time.	In the office that we were like...five or six students having these devices, some were more concerned about privacy and what's that for, eh, but I haven't talked to them to learn more about that	Have not heard much, but think it has just become a part of things. I don't think people were very enthusiastic about it, and I have not seen much concern about it. Later discussion signals there may	No, I wasn't. Because I hadn't had a discussion about it. Second answer provided: As I hadn't heard
4. How did people feel about participating?	There was a postive attitude.	I don't think there are people resentful to participate	Some early discussion arround lack of choice in participating.	Yea, some people might have some privacy concerns.	not asked.	States that there wasn't any self motivation about doing something with participating, he indicates that it was mainly department led.	Initially, there was not much enthusiasm. After some time, people were willing.	It was not bad.
5. Were there any reasons why you might have felt uncomfortable by not participating in the MEF project?	Felt comfortable with.	No, I don't think	Yes. You would have felt like you were not really helping.	Would have felt bad for environmental reasons.	Could not see a problem as was not dealing with personal information.	If there was surveillance, i.e. When you come to the office and leave and reducing pay/salary. This was not the case. If I would have perhaps, had to annaounce in public. But if I had to just sign, perhaps I might not be that uncomfortable.	No	No, there weren't
6. Were you aware of others viewpoints on taking part/not taking part in using MEF?	Common agreement at least in my office, taking part.	Yes some, but just from a general point of view. They simply don't care in my opinion.	Did not directly answer	Just a feeling, that some had privacy concerns. I think some people just said..."okay just install it I don't mind" but they were not really interested.	Did not know of anyone refusing to take part, or joking/procrastinating, but it may happen.	Yes some.	No	No
7. What was your view about taking part in using MEF?	Positive	Could not see any gain from.	Early discussion signals that they wanted to take part.	Positive	Positive	He did not use MEF, but was a participant in the project.	Did not take part	I was interested in the project itself and how the sensors worked
8. Were there situations or circumstances where you were able to discuss the project with others?	No (yes for the other project)	Yes	Not really	Might have been, maybe lunch breaks	yes	The specific project, I don't think so.	No	No
9. Did you have such discussions often? What did you discuss?	na	rarely	n.a.	Now and again. Perhaps about the reason the project is run. Perhaps about confidentiality, privacy, are we being tracked or not? How successfull it will be in reducing energy use. Speculated about how it may effect wellbeing of the centre.	Often enough	Quite irrregular. Discussion was about potential applications and how we can use sensors to get information and smart-cities, smart offices etc.	na	No
10. Were such discussions before	na	After	n.a.	After	After, once you start seing	not asked.	na	na

QUESTION	1 (researcher)	Participant 2 (PhD student)	Participant 3 (admin)	Participant 4 (researcher)	5 (academic)	Participant 6 (PhD student)	Participant 7 (academic)	Participant 8 (researcher) - emailing answers
11. Did such discussions encourage/discourage your MEF use	na	I don't think they changed my ideas	n.a.	No	Yeah, it certainly did'nt discourage me.	na	na	
12. In what ways was the project a shared experience do you think?	Because I know some colleagues also using - common	Individual	I suppose the department involvment, if there is some sort of campus wide, or	Maybe. On a scale of 1 - 100, I would say 20/25	Shared in the sense of other research projects that im linked too.	It could be a shared experience, if when results are published, whether people in the same office have similar results,	Maybe, everyone working to reduce energy, could be seen as shared.	I don't think the project was shared with participants
13. Was this experience positive or negative?	positive		Fairly positive, I guess.	Can't say positive or negative.	Positive	Neutral	Did not directly answer	It was positive. To reduce our electricity is very important for the environment
14. In what ways was this not a shared experience?	You can see a comparison performer, but you don't know whos in your group.		Early discussions identified some issues.	Some discussion but not long lasting	I don't think so really, as I'm some one who gets out and about and talks to alot of people.	It was not, because each individual has his own information and they did not interact with each other.	Not a shared exepreience in that not enough face to face meetings, only emails which people delete.	I hadn't any discussion about it with other people
15. Do other people in CCSR use MEF that you are aware of? Do they tend to be lecturers, researchers or students?	Definately everybody in my office, researchers.	No	I don't know.	I just know about my room mates. Researchers.	Aware of one or two others that actively use it. Probably the others I would expect use it, or atleast every so often, but may not take furthur. Certainly the ones he knows that use are academics.	I am not aware, but I guess there will be.		Yes, researchers
16. What about your office colleagues use?	" "	na	na	" "	I have my own office.	No I don't know. Probably, they don't.		They seemed to check their electricity usage on their computer screens
17. Of those using MEF, why do you think they used MEF?	I'm not aware, we have not discussed.	na	I don't know why they would, I suppose its because their interested in ecology/saving energy/ the reseach aspect.	Probabaly because it is being installed, rather than them choosing to use it.	I think its because they are keen to know how the project is working and what exactly it's doing.	They would use it if it was related to their research.		I think they were asked to use MEF
18. Who do you tend to 'hang out' with within your department when you have time to catch up?	My corridor (and a few on the ground floor)	Mainly researchers (particularly one he works with). Other	Admin	Researchers	Academics	Office mates and a couple of others from CCSR	All of them.	Persons in the same room
19. Do such colleagues feel a strong connection with CCSR?	did not ask	I don't know.	Not necessarily, no.	Yes, at least the ones I know.	Yes	Yeas, some of them. Students, not so much, because they are hear just a few years and see as a way to a job. Others like fellows and lecturers, feel more close.	CHECK Friendlier in a previous department.	I think so
20. How do you feel about your role in CCSR?	Positive		Okay, don't get much input or influence into anything thats going on.	Does not directly address, but later states he feels comfortable and likes.	See's his role as important	My role as a student is to produce a research programme and papers. I find it an interesting place to also make friends and work and a community.	CHECK	As a visitor, I had'nt felt that I had some role in CCSR
21. How would you best describe the culture in CCSR?		Sociable place	Can be abit isolating. Pressure from the REF and focus on income	Work orientated, people are tolerant of each other and respect. People are reasonable. Well organised.	VeRy international, fragmented, because of how we are positioned and size, and pressure. Very focused with what we have got to do.	International, e.g. Asia etc. and the culture is abit different from European and the western world. There is a different approach in cultures about things, for like privacy.	It works like an enterprise	There are many projects and people work hard
22. Is there a team atmosphere in the group?		Not really, with the people you directly work with, maybe there is. Not a team in the sense that you don't know everyone.	Not really	Within individual projects, yes - who you are working with.	Not entirely, a bit short on, because were large probably.	Yes, but whether its a happy team or not, Im not sure.		Yes

Before interview findings are presented, measured changes in descriptive norms for participants are presented (results from survey).

Table 9: Change in descriptive and injunctive norms (benchmark to intervention) for participants 1 to 8.

Interview participant	Change in descriptive norms	Change in injunctive norms
Interview participant 1 (researcher)	Increase (apart from office and lab equipment)	Increase (all categories)
Interview participant 2 (PhD student)	No data (but view informed from interview)	
Interview participant 3 (Admin)	All increased by 1	No change in injunctive norms (Neutral)
Interview participant 4 (researcher)	Increase for lights, others remain the same	Decrease for lab equipment and lights
Interview participant 5 (academic)	Increase all categories	Increase all categories
Interview participant 6 (PhD student)	Increase for 2 of the 4 decrease for 1 of 4	Increase for 1 of the 4, decrease for 1 of the 4
Interview participant 7 (acadmic)	No data - but did not use MEF	
Interview participant 8 (researcher)	Increase for 3 of the 4 categories	Decrease for 2 increase for 1

Changes in Table 9 show that participant 1, 3, 5 and 8 primarily experienced increases in descriptive and injunctive norms. This was based on comparing relevant score for questions before and after the intervention. Results for descriptive norms for other participants were mixed.

4.2.1   Views and attitudes

Views towards the project at the start and participation

From the top 2 questions in table 8 ('What were your experiences of the beginning of the project?'; 'What kinds of things encouraged you to use MEF?') it can be seen that participants 1 (researcher), 5 (academic), 8 (researcher) and 4 (researcher) held fairly positive attitudes towards the project and the MEF tool from the start.   All four participants signalled that they felt comfortable/could not see any problem with taking part/were interested in the project (questions 7 and 5).

Participant 2 (PhD student), had a less positive attitude towards the project and the MEF tool, stating: *'I don't see any gain from turning off my computer etc'.* Participants 2 (PhD student) and 3 (admin) did use MEF but were not that positive about participating. Participant 7 (academic) did not use MEF and had not experienced much. Participant 6 (PhD student) and 7 (academic) did not use MEF. Participant 6 (a PhD student) had an initial experience at the beginning of the project that was somewhat negative:

'Having these devices next to you at the beginning might be a bit uncomfortable, we don't know exactly what they are there for. But afterwards, once we understand that they are not recording discussion, you don't care about it'. [9] The latter comment 'flags up' early concerns from participants around privacy. This project as well as others such as Bolderdijk et al (2013) identify privacy to be a significant issue for businesses attempting to introduce smart metering.

Others views and feelings

With regards to how others felt about participating (question 4), Participant 1 was positive. Participant 3, 2, 5, 7 and 8 were rather more neutral[10].

---

[9] Participant 3 also recalled a negative perception of the start of the project and how it was introduced.

[10] Participant 1 identified that there was a positive attitude. Participant 1 further identified common agreement on taking part in his office (question 6). Participant 5 identified that he did not know of anyone

In terms of feelings and opinions of others in the department towards the project participant 8 identified (question 3) that: '*he had not heard any complaint about it, I don't think they felt bad*'. Interestingly, participant 5 (lecturer) identified that they had noticed some discussion/reaction when people were getting access to online information, and that the general feeling that came out was that they would have to turn off their computers all the time (response to question 3).

Participants 3, 4, and 6 were somewhat more negative. Participant 4 states (question 3): 'Compared to my office mates, I was more interested in it, I think. Because I was taking a look at it and they were not very interested at all, so really, yeah.' Question 17 provided additional information, he stated: 'So they had a positive attitude towards it, but using it was entirely the choice of the Department, as they feel it, I think.' For question 4, he identified that some people might have some privacy concerns.

'I just felt it. People never talked about that. I just thought that, well...I was thinking like what privacy issues could it be, possibly, but eh... perhaps like they might think there is... I don't know, a microphone inside listening to them or... So they are not present there when they are supposed to be and then...'

This shows clearly perceptions of others views that participant 4 had observed. When asked whether aware of the feelings and opinions of others in the department of the project (question 3), participant 6 expressed similar observations:

---

refusing to take part, or joking/procrastinating, but identified that it may happen (question 6). The response from participant 8 to question 4 was: '*It was not bad*'.

'In the office that we were like...five or six students having these devices, some were more concerned about privacy and what's that for, eh, but I haven't talked to them to learn more about that'

These interview data suggest that privacy concerns were an issue for at least some participants. Question 6 and further discussion is quite revealing about perception on how the project was introduced, and views on participating:

'There wasn't any em...like...eh...self em...motivation about doing something with that, so, eh, these were told to us, okay, we will install these device in your office, if you have any problem, then...any concerns talk with us, otherwise they will be there. That's how they introduced it to us' (Participant 6).

This resonates strongly with participant 4's perception from observation of others. When further asked if the introduction was appropriate or could it have been done better, participant 6 stated: *'It could have been done on a voluntary basis. If they didn't have enough volunteers, then they could [employ] non-volunteers'*

Somewhat similar views were reflected by participant 3 (before direct questions), about how the project was introduced and the opt-out policy. This is interesting as it shows how making a policy decision on opt-out versus opt-in can affect, social context and the social construction of attitudes towards the project. Further interview data from participant 3 (non academic) identified that the management's announcement and introduction about the project did not feel particularly

encouraging. This highlights the unknown and influential factor of how well management will

implement such technologies in organisations and industry[11] and the effect that this can have on

perception and the social construction of attitudes and views that emerge in groups, and this can

affect the norms that emerge and the above data also hints towards effects on motivation.

Participants 3 and 7 had fairly neutral responses to question 3[12]. From their review, Bolderdijk et

al (2013) provide light on the underlying roots of privacy concerns in smart metering, and suggest

that employee privacy concerns may be tracked back to a lack of apparent positive personal

consequence. These papers' findings indicate that it also relates to how the project is

implemented and later data suggest that cultural background of participants also influences

privacy concerns.

4.2.2   Social distance and interaction in shaping norm emergence and diffusion

It was clear from question 3 earlier, that participant 5 gleaned information (intentionally or non-

intentionally) about others participation via discussions on such things as technical issues.

---

[11] The introduction made by the management was an unplanned impromptu face to face introduction to the project to participants (beyond that made by electronic communication).

[12] When asked question 3, participant 3 responded: *'The academics thought it was very important.'* Question 6 was not answered directly by participant 3. Participant 7 gave the following account for question 3: '*Have not heard much, but think it has just become a part of things. I don't think people were very enthusiastic about it, and I have not seen much concern about it.'* And question 4: *'Initially, there was not much enthusiasm. After some time, people were willing.'*

Participant 5 was also asked the 'situations or circumstances where he was able to discuss the project with others? (question 8) where he gave the following response: *'you know, corridor chats when you're getting a coffee or doing a fire drill (laughing)'*

This is important as it signals the ability for discussion to provide information on referents outside of one's immediate office environment. In terms of the people that participant 5 interacts with in such discussion, the following is informative: '*people passing do catch me for a quick chat, so I sort of do interact with....usually the academics and senior researchers'*. This referent selection reflects organisational structure, as participant 5 is also an academic.

Participants 2 and 4 also discussed the project (although participant 2 rarely)[13]. With regards to what was discussed, participant 4 states:

'Perhaps about the reasons the project is run. Perhaps about confidentiality, privacy, are we being tracked or not? How successful it will be in reducing energy use. Speculated about how it may affect wellbeing of the centre.'

These concerns have resonance with the literature, that shows that extensive monitoring of employees bears the risk of decreasing employee satisfaction and possible detachment from the process (see review in Bolderdijk et al 2013).

---

[13] Participant 2 (PhD student) and 4 (researcher) tend to 'hang out' with other researchers within their department.

Although participant 4 was generally positive about the project, it was clear that they encountered differing views and concerns relating to confidentiality, privacy and the project, which informed a particular perception of others views. Neither participant 2 or 4 identified that their discussion encouraged their use of MEF (unlike participant 5). It is clear that discussion and social context amongst participants and sub groups on a project like this can have a positive or neutral (even perhaps negative) effect in encouraging engagement and motivation to use the MEF tool. This is in line with quantitative findings from the survey, which showed that for some, discussion encouraged use of MEF but for others it did not. It is clear from discussions of participant 4 (and other participants) that concerns and negative perceptions about the intervention can be shared through discussion (and in this way can be socially constructed) as well as more positive perceptions. In this way attitudes and perceptions as well as norms can be socially constructed within groups. Social distance (taken to be frequency and intensity of social interaction) and interaction affect the emergence and diffusion of descriptive norms because they increase the amount of information available about others views and what they are doing. Gächter and Fehr (1999) state that social distance and familiarity are important to injunctive norms, as repeated interaction is positively correlated with the importance of approval incentives; and repeated interaction is also likely to increase costs from non-compliance.

4.2.3   Proximity, location and referents in shaping norm emergence and diffusion

This section demonstrates the role of proximity and location on referent selection, as well as observational data available for social comparison. From the above section, it would seem that the information that participant 5 gained from discussion was mainly the views of other

academics. Given that participant 5 is in a single office, their main referents for verbal information are therefore other outside academics.

For participant 1 the situation is quite different, as environment, proximity and location play the main role in shaping his perception of others use of MEF. When asked question 15, he stated that definitely everybody in his office used MEF. It is further identified that they are researchers (equivalent in terms of organisational structure). Importantly, information was not communicated verbally (identified from findings for questions 8 and 17), therefore it must have been based on observation. Such observations about others engagement with energy reduction (via MEF) would not be readily available in a single office. Therefore, this highlights a role for environment and proximity and location in determining referents available and observational information (and therefore informing social norms via social comparison). It is also clear that this was the case for participant 8, when asked about his office colleague's use of MEF (question 16) he states: '*they seemed to check their electricity usage on their computer screens.*' This participant tended to 'hang out' with his office colleagues (researchers), so they will have been his main referents. Participant 4 also only knew of his roommates' use of MEF, again indicating the role of proximity and location in determining referents and observational information. Gartel (1982) identify the importance of proximity in relation to awareness of others and social comparison processes, Goodman and Haisley (2007) further discuss. Goldstein et al (2008) identify that: "it is typically beneficial to follow the norms that most closely match one's immediate settings, situations, and circumstances" (p.8 line 34).

Continuing on this theme, when asked do people in the department use MEF that you are aware of? It is interesting to note that for participants 1, 4, 5, and 8 all identified awareness of

participants, and all of these participants show increases in descriptive norms as identified in Table 9. For participants 2, 3, 6 and 7 none of the participants identified knowledge of others using MEF. Following this the norm in these latter participants surroundings (and their 'social context') was to not use MEF, either this, or these participants were generally not interested to know of their referents use of MEF (but this would go against the strong evidence that there was a general shift in social norms from the benchmark to the intervention)[14]. Goodman and Haisley (2007) identify from earlier studies that the perceived relevance of referents determines selection and that relevance and attractiveness of referents is affected by ease of access to the referent and appropriateness of the referent in addressing the person's needs of concern. Individuals will gravitate towards referents that are appropriate and computationally easy to assess.

Culture

Goodman and Haisley (2007) identify culture as playing an important role in social comparison processes. Drawing on Bourdieu's (1984) ideas around the influence of 'cultural capital', they suggest that *background* of workers can be important in determining perception (and therefore also shaping evaluation) in an organisational environment, perceptions can sometimes differ between workers from the culture in which the organisation exists as compared to those from outside cultures. Therefore the international mix is an organisational variable that can influence

---

[14] Of the data that we have for these latter participants, descriptive norms only increase for two of the four energy services (participant...), participant 3 saw a small increase in all norms. The latter participant did use MEF, the former did not.

perceptions within an organisation, probably in many different ways[15]. Field (2002) in his review relating to social norms, expresses surprise that many authors do not explicitly note the importance of culture and history and the current context in restricting the set of norms that are able to arise and that are available to be adopted at any given time. We now look at relevant interview findings and where appropriate, discuss in relation to social construction and social comparison processes.

Question 21 asked: 'how would you best describe the culture in the department?' Participant 4 (researcher) identified the culture as work orientated and that people are tolerant and respectful of others and reasonable, also that the department is well organised. Participant 5 described the culture as very international, but quite fragmented and very focused on what it's got to do. Participant 8 stated: '*There are many projects and people in* the department *work hard*' He further identified that the department works like an enterprise. Participant 2 (PhD student) identified the department as a sociable place. Participant 3 (admin) identified that she felt the department could be a bit isolating, and with pressure from the UK's Research Excellence Framework (a national scheme which assesses the strength of research of each researcher and of their research group as a whole) and a focus on income. Participant 7 (academic) identified that the department works like an enterprise.

Participant 6 (PhD student) identified the following:

_____

[15] The current authors identify that it may effect referent selection and evaluation processes in social comparison.

'the department has researchers from all around the world, eh, mainly, eh, Asia, eh... The culture

is a bit different from Europeans and the Western world. So, there is a ...a different approach in...

cultures about things, for like privacy.'

Interviewer: Okay.

Participant 6:

'So, eh, their…the use of the tool and this project raised more concerns from that…from those

guys than average.'

The interviewee was later asked if they had any idea as to why this is? The interviewee answered

as follows: *'I think it's their culture and I don't know if...it's rights perhaps.'* The interviewer

then asked about specific countries as opposed to Asia and participant 6 identified China, Iran and

Pakistan and such areas. This latter dialogue from participant 6 indicates the influence that an

international culture may have in determining people's attitudes to technologies such as smart

metering. The participants data suggests that this can influence how the intervention is perceived

and social constructed and therefore, the social context and norms (as the literature suggests) that

emerge.

5.0   Discussion

This study set out to explore the role of social norms in energy conservation within organisations.

Social norms around specific office based energy services were measured before and after an

energy intervention to observe changes. Changes in energy for each participant were also

captured. Factors identified in Rimal and Real's (2005) model for determining whether social

norms affect behaviour were explored in the current study, but with regards to norm emergence as opposed to translation into behaviour. Social construction and social comparison processes are important in determining the norms that emerge and diffuse within a group. Interviews were applied to provide insight on the social construction and social comparison processes occurring within the group during the intervention. The main findings from the paper are now discussed.

Descriptive and injunctive norms measured in survey 1 (benchmark), were much stronger for lighting and office and lab equipment than for computers and monitors. Some of the reasons for differences between computers and lighting were explored in the interviews, where often it emerged that participants could see differences in the attributes of behaviour around particular energy services that would affect norms. A range of factors however, including culture were also mentioned.

Change in descriptive and injunctive norms between the benchmark and intervention period were then examined. There was a significant change (increase) in descriptive norms for computers and monitors going from the benchmark to the intervention period (but not for lighting and office and lab equipment). This is an important finding, as these are the very energy services that the energy intervention was focused on. Also, a significant relationship was found between descriptive norms and energy efficiency ratios for participants, after the intervention - those who displayed higher descriptive norms tended to be more efficient in their energy use.

Chi-square tests were then applied to explore the relationship between group identity and descriptive norms and collective outcome expectations and descriptive norms. A significant relationship was found to exist between group identity and descriptive norms for computers

during the benchmark period; further testing is however advised to confirm this as sensitivity testing suggested instability due to low number of observations in the case of this particular result. The preliminary result identifies to companies that group identity is important in determining the emergence of pro-energy conservation norms.

With regards to social construction and social comparison processes occurring during the intervention, roughly an even split was seen between participants that discussed MEF and those that did not (from survey data). It is clear that for at least 6 of the participants, discussion encouraged their use of feedback. The implication for businesses is that social interaction and discussion of such interventions, can incentivise and motivate people to use the feedback tool for some. However, interviews data suggest that in some situations, discussion may discourage use of MEF.

5.1 The role of the physical environment, proximity and location in shaping norm emergence and diffusion

The interviews in this research highlight how the physical environment, proximity and location can affect the referents available and accessibility of observational data as well as the environment of social construction (and resulting social context) within which participants find themselves and therefore the normative information available. This will shape the social norms around energy that emerge and their diffusion. For participants interviewed, available referents (those for which people tended to hang out with or shared a room with) often reflected the position held by the participant (organisational structure) e.g. whether a lecturer, researcher or PhD student etc. and or location. The literature shows that people on the same level (in terms of organisation) provide attractive referents for attaining normative information. The implications

of these findings to businesses are that having multiple occupant offices can increase the amount of referents and observational/comparative data (visual and social interaction) available, and in this way increase the emergence and diffusion of social norms and potentially energy reduction, due to the relationship between strength of energy related descriptive norms and energy efficiency earlier demonstrated.

5.2 **The role of management, policy and culture in shaping social context and norms**

The findings discussed in this paper highlight a deep interaction between technology, social context, norms and policy, this interaction has the potential to affect the success of energy reduction from smart metering.

From the interviews it was clear that both the introduction to the REDUCE intervention as well as policy decisions taken to make the project opt-out as opposed to opt-in influenced the development of attitudes and views for most of those interview participants that had a less positive view/experience of the project. It is interesting to note that of those that had a less positive view/experience (participants 2, 3, 6 and 7), none were aware of their office mates/colleagues' use of MEF. For those that had a more positive view/experience however (participants1, 4, 5 and 8), all were aware of at least some colleagues use of MEF. This is an interesting observation and when taken in conjunction with findings of the impact that managements' implementation and opt-out policy has on the experience of participants, would indicate that, with respect to the development of descriptive norms, policy as well as communication are important factors in smart metering due to influencing social context of participants and social construction and comparison. This has real relevance as it is clear from

our study that there is a significant link between the development of descriptive norms around energy services and actual energy behaviours.

Some of the interview data indicated that cultural background of participants can affect their experience, perception and views and attitudes around privacy and acceptability of the technologies applied and the intervention. Attitudes and views can affect the social context, discussion and norms that emerge. Given such findings and the need for energy interventions and smart metering to have a positive as opposed to negative impact on organisations, the design and implementation of interventions and technologies used should take account of how a particular technology and intervention design may be acceptable/unacceptable as a result of cultural background or mix of participants. Such considerations are highly relevant in the UK which is culturally quite mixed and currently rolling out smart metering to small and medium sized businesses (as well as households) on a large scale, future research should further investigate this issue. One participant identified discussions about how such interventions affect wellbeing within the department, it is important to note this as well as the number of concerns around privacy, as this indicates that such high resolution technology interventions do generate anxieties.

6.0   Conclusions

This research demonstrates the difficulties of getting people to change behaviour in relation to environmental responsibility in relation to energy. Environmental psychology has been good at pinpointing the influence of norms (descriptive and injunctive but less convincing in explaining their emergence). More recent research has considered the significance of social and cultural settings in encouraging and influencing the activation of social norms. As with more recent policies designed to encourage more environmentally responsible behaviour in individuals in

households, energy use in the workplace may become more important for future environmental targets. As the study used as the focus of this paper shows however, institutional settings are a critical factor in developing effective interventions of this kind – particularly the existing organizational structure, which may prioritize social norms which conflict with the intervention which is being implemented.

6.1   Recommendations for practitioners

The implication of the findings of this paper for businesses is that smart metering feedback based interventions can impact social norms and evidence suggests that this impacts efficient energy use within an organisation. Organisations should attempt to foster descriptive norms that encourage energy conservation/efficiency if implementing smart metering. This study found that opt-out policy will increase initial levels of participation, but can reduce motivation to engage with feedback and energy reduction. We recommend that businesses take care when deciding on whether to employ smart metering and involve their employees with any intervention and with how it is introduced, in order to increase acceptability, avoid negative perceptions and social interaction/construction that may hinder motivation to engage with the project.   Decisions on the level of resolution of energy monitoring are a key consideration, as on the one hand they determine the level of feedback that participants receive, but on the other hand, over monitoring of employees behaviour risks decreasing worker satisfaction and performance, as seen in the review by Bolderdijk et al (2013).   Care and consultation is required to come up with the optimum balance here that is acceptable to employees, if smart metering is being considered.

We recommend involving participants in decisions and consultation/workshops to design the intervention and decisions on smart metering as this is likely help increasing acceptability, trust,

reducing privacy concerns and clarify benefits as well as positive personal consequences for participants that should result.

7.0   References

Abrahamse W and L. Steg (2013). 'Social influence approaches to encourage resource conservation: A meta-analysis'. *Global Environmental Change*, 23, pp.1773-1785.

Azar E and C.C. Menassa (2012a). 'Modeling occupant interactions for effective energy reduction strategies in buildings'. Paper presented at the 14th International Conference on Computing in Civil and Building Engineering, Moscow, Russia, 27-29 June 2012.

Azar, E. and Menassa, C. (2012b). 'Agent-Based Modeling of Occupants and Their Impact on Energy Use in Commercial Buildings'. *Journal of Computing in Civil Engineering*, 26(4), 506–518.

Berkowitz, A. D. 2004. 'The social norms approach: Theory, research and annotated bibliography'. Accessed: 22.08.13 Available at:
http://www.alanberkowitz.com/articles/social_norms.pdf

Bolderdijk J., L. Steg and T. Postmes (2013). 'Fostering support for work floor energy conservation policies: Accounting for privacy concerns'. *Journal of Organizational Behavior*, 34 p.195-210.

Bradley P., M. Leach and J. Torriti 2013. 'A review of the costs and benefits of demand response for electricity in the UK'. *Energy Policy, Special Selection: Transition Pathways to a Low Carbon Economy*, 52: 312-327.

Bradley P., S. Fudge and M. Leach 2014. 'The role of social norms in incentivising energy reduction in organisations'. *Economics Working Paper Series* 1404, University of the West of England.

Carrico A.R. 2009. 'Motivating Pro-environmental behaviour: The use of feedback and peer education to promote energy conservation in an organisation setting'. *Dissertation submitted to the Faculty of the Graduate School of Vanderbilt University in partial fulfilment of the requirements for the degree of Doctor in Philosophy in Psychology* . Available at: http://etd.library.vanderbilt.edu/available/etd-07202009-180058/unrestricted/Carrico20May09.pdf Accessed: 04.01.14

Carrico A.R. and M. Riemer. 2011. 'Motivating energy conservation in the workplace: An evaluation of the use of group-level feedback and peer education'. *Journal of Environmental Psychology* 31, Issue 1: 1-13.

Chen ., C. Lin, S. Hsieh, H. Chao, C. Chen, R. Shiu, S. Ye, Y. Deng (2012). 'Persuasive feedback model for inducing energy conservation behaviors of building users based on interaction with a virtual object'. *Energy and Buildings*, 45, pp. 106–115.

Chien-fei Chen and Kyle Knight. 2014. 'Energy at Work: Social Psychological Factors Affecting Energy Conservation Intentions within Chinese Electric Power Companies'. *Energy Research and Social Science*, 4, 23-31.

Cialdini R.B., C. A. Kallgren, R. R. Reno, R. R. 1991. 'A focus theory of normative conduct: a theoretical refinement and re-evaluation of the role of norms in human behavior'. *Advances in experimental social psychology* 24:20, 201–243. San Diego, CA: Academic Press.

Coleman M.J., K.N. Irvine, M. Lemon and L. Shao (2013). 'Promoting behaviour change through personalised energy feedback in offices'. *Building Research and Information*, 41, (6), 637-651.

Cordano, M. and Frieze I.H (2000). 'Pollution reduction preferences in of U.S. environmental managers: Applying Ajzen's theory of planned behaviour'. *Academy of Management Journal*, 43, pp. 627-641.

Dixon G.N., Deline M.B., McComas K., Chambliss L, and M. Hoffmann (2014). 'Using Comparative Feedback to Influence Workplace Energy Conservation: A Case Study of a University Campaign'. *Environment and Behavior*, 1– 27.

Fell D., A Austin, E. Kivinen and C. Wilkins2009.   'The diffusion of environmental behaviours; the role of influential individuals in social networks. Report 1: Key Findings' *A report for the Department for Environment, Food and Rural Affairs.* Brook Lyndhurst. Defra, London

Flannery, B.L., and May, D.R (2000). 'Environmental ethical decision making in the U.S. metal-finishing industry'. *Academy of Management Journal*, 43, 642-662.

Goldstein N.J., R.B. Cialdini. V. Griskevicius. 2008. 'A Room with a Viewpoint: Using Social Norms to Motivate Environmental Conservation in Hotels'. *Journal of Consumer Research* 35: 3, 472-482.

Goodman, P and E. Haisley. 2007. 'Social comparison processes in an organizational context: New directions'. *Organizational Behavior and Human Decision Processes* 102: 1, 109–125.

Gulbinas R., Jain R.K., J.E. Taylor (2014). 'BizWatts: A modular socio-technical energy management system for empowering commercial building occupants to conserve energy'. *Applied Energy*, in press.

Gustafson C. and M. Longland (2008). 'Engaging Employees in Conservation Leadership'. Presented at American Council for an Energy Efficient Economy (ACEEE) Summer Study on Energy Efficiency in Buildings, 17-22 August, Asilomar.

Jackson T. (2006). 'Motivating Sustainable Consumption: A review of evidence on consumer behaviour and behavioural change'. *A report for the Sustainable Development Research Network.* http://hiveideas.com/attachments/044_motivatingscfinal_000.pdf

Kleining (1998), *Das Rezeptive Interview*, Bielefeld: University of Bielefeld.

Kwak J, P.Varakantham, R. Maheswaran, M. Tambe, F. Jazizadeh, G. Kavulya, L. Klein, B. Becerik-Gerber, T. Hayes, W. Wood (2012). 'SAVES: a sustainable multiagent application to conserve building energy considering occupants'. Proceedings of the 11th International Conference on Autonomous Agents and Multiagent Systems - Volume 1, pp. 21-28.

Kwak J., P. Varakantham, R. Maheswaran, Y. Chang, M. Tambe, B. Becerik-Gerber and W. Wood (2014). 'TESLA: an extended study of an energy-saving agent that leverages schedule flexibility'. *Autonomous Agents and Multi-Agent Systems*, 28, (4), pp. 605 – 636.

Lehrer D and J. Vasudev (2011). 'Evaluating a Social Media Application for Sustainability in the Workplace'. Proceedings of the CHI annual conference on Human factors in computing systems. May 7–12, Vancouver, BC, Canada.

Lo S.H., G.Y. Peters., and G.J.P. van Breukelen., and G. Kok (2014). 'Only reasoned action? An interorganizational study of energy-saving behaviors in office buildings'. *Energy efficiency*, (7), pp. 761–775.

Lülfs R., and R. Hahn (2013). 'Corporate Greening beyond Formal Programs, Initiatives, and Systems: A Conceptual Model for Voluntary Pro-environmental Behavior of Employees'. *European Management Reviews*, 10, pp.83-98.

Lülfs R., and R. Hahn (2014). 'Sustainable Behavior in the Business Sphere – A Comprehensive Overview of the Explanatory Power of Psychological Models'. *Organization & Environment*, 27 (1), pp. 43-64.

Murtagh N., M. Nati. W.R. Headley, B. Gatersleben, A. Gluhak. M.A. Imran, and D. Uzzell. (2013). 'Individual energy use and feedback in an office setting: a field trial'. *Energy Policy* 62: 717–728.

Papagiannakis, G., and Lioukas, S (2012). 'Values, attitudes and perceptions of managers as predictors of corporate environmental responsiveness'. *Journal of Environmental Management*, 100, pp. 41-51.

Ramus, C. A., and Killmer, A.B.C (2007). 'Corporate greening through prosocial extrarole behaviours – A conceptual framework for employee motivation'. *Business Strategy and the Environment*, 16, pp. 554-570.

Scherbaum C.A, P.M. Popovichet, S. Finlinson (2008). 'Exploring Individual-Level Factors Related to Employee Energy-Conservation Behaviors at Work'. *Journal of Applied Social Psychology* 38: 3, 818–835.

Schwartz T., M. Betz, L. Ramirez, G. Stevens (2010). 'Sustainable Energy Practices at Work: Understanding the Role of Workers in Energy Conservation'. Proceedings of the Nordic Conference on Human-Computer Interaction, October 16–20, 2010.

Siero F.,W.A.B. Bakker, G.B. Dekker and M.T.C. Vandenburg (1996). 'Changing organizational energy consumption behaviour through comparative feedback'. *Journal of Environmental Psychology* 16: 3, 235–246.

Smith A.M., and O'Sullivan T (2012). 'Environmentally responsible behaviour in the workplace: An internal social marketing approach'. *Journal of Marketing Management*, 28:3-4, 469-493.

Tajfel, H. (1974). 'Social Identity and Intergroup Behaviour'. *Social Science Information*, 13: 65 – 93.

Ture, R.S., and M.P. Ganesh (2014). 'Understanding Pro-environmental Behaviours at Workplace: Proposal of a model'. *Asia-Pacific Journal of Management Research and Innovation* 10, (2), pp.137-145.

Vazquez Brust, D.A., and Liston-Heyes, C (2010). 'Environmental management intentions: An empirical investigation of Argentina's polluting firms'. *Journal of Environmental Management*, 91, pp. 1111-1122.

Vishwanath A (2006). 'The Effect of the Number of Opinion Seekers and Leaders on Technology Attitudes and Choices'. *Human Communication Research*. 32:3, 322–350.

Young, W., Davis M., McNeill I.M., Malhotra B., Russell S., Unsworth K. and C.W. Clegg (2013). 'Changing Behaviour: Successful Environmental Programmes in the Workplace'. *Business Strategy and the Environment* 24 (8). pp. 689-703.

Yun, R, A. Aziz, B. Lasternas, C. Zhang, V. Loftness, P. Scupelli, Y. Mo, J. Zhao, and N. Wilberforce (2014). 'The Design and Evaluation of Intelligent Energy Dashboard for Sustainability in the Workplace'. *Lecture Notes in Computer Science*, Vol. 8519, pp 605-615.