Department for
Business, Energy
& Industrial Strategy

SMART METERING NON-DOMESTIC 'EARLY LEARNING' RESEARCH

Overview Report

November 2017

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The views expressed in this report are those of the authors, not necessarily those of the Department for Business, Energy & Industrial Strategy (nor do they reflect Government policy).

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Introduction

The Government is committed to ensuring that every home and small business in the country is offered a smart meter by the end of 2020. BEIS commissioned this research as part of its work to support a successful smart metering implementation programme, focussing on its value for energy management at smaller non-domestic sites.

The research has provided an analysis of the enablers which will favour the use of smart metering data to improve energy management and efficiency. It also provides learning on how non-domestic organisations can best be supported and encouraged to benefit from the roll-out, in particular by saving energy.

This report sets out an overview of the findings and conclusions from this research. It is supported by eight annexes – six which outline findings specific to different types (clusters) of organisations investigated in the research, a cross-cutting report on landlords and tenants, and a technical report which contains further detail about the research methodology. [1]

Background

Smart Meters are the next generation of gas and electricity meters. They offer a range of intelligent functions and provide consumers with more accurate information, bringing an end to estimated billing. Consumers should have access to near-real time information on

[1] A list of the supporting annexes is provided in the appendix (see List of Reports, p60)

their energy consumption to help them control and manage their energy use, save money and reduce emissions.

The Government mandate technically defines a smart meter as one that is compliant with the Smart Meter Equipment Technical Specification (SMETS) and has a specified range of functions including being able to transmit meter readings to suppliers and receive data remotely. Energy suppliers are required to take all reasonable steps to install smart meters in domestic and smaller non-domestic sites by the end of 2020. The exception to this is in smaller non-domestic sites where advanced meters may remain in place for their lifetime if they were installed before October 2017 for larger suppliers and February 2018 for smaller suppliers.

As a minimum, an advanced meter can store half-hourly electricity and hourly gas data, to which the customer can have timely access and to which the supplier can have remote access. The vast majority of meters installed at sites included in this research were likely to be 'advanced meters' rather than SMETS compliant meters, as at the time the roll-out was still at an early stage and the majority of meters being installed in affected sites were still 'advanced meters'. These meters would have had some, but not all, of the additional functions found in a smart meter that meets the Government's technical specification. For ease of reference, the term 'smart meter' is used to refer to both 'advanced' and SMETS compliant meters in this report unless otherwise specified.

The non-domestic roll-out will cover around two million sites. These sites are very varied; they include private and public sector organisations, and range from small shops to chain stores, from small industrial units to schools.

Aims and Objectives

The aim of this work was to improve the evidence base on how and why smart meter data is or is not being used for energy management in relation to non-domestic sites, as well as the pathways, enablers and barriers to energy saving using such data.

The objectives of the research were specifically to;

i. explore how 'smaller non-domestic sites' use energy and make energy related decisions

ii. understand the ways in which smart meter data is being used for energy management in relation to 'smaller non-domestic sites', as well as the current types of benefits being realised

iii. develop an understanding of the (actual or potential) pathways, enablers and barriers to energy saving in smaller non-domestic sites using smart meter data; and what further action may be required to maximise benefits.

The key research questions to be answered are summarised in Box 7, p50.

Research Framework

BEIS developed a framework to help capture and explain how the non-domestic organisations which are/will be affected by the smart metering mandate manage their use

of energy, including how they use data from smart meters. Initial versions of three key elements of the framework informed this research:

- a typology of smaller, non-domestic sites
- a set of contextual factors that may have an influence on energy management
- a pathway map template to help illustrate how and why an organisation manages its energy in the way it does.

Typology of smaller, non-domestic sites

There will be many factors specific to different organisations which will influence the outcomes of the roll-out, and these are likely to vary by type. For this reason BEIS developed an initial typology for the smart meter non-domestic population using a cluster-based research approach. Whilst there will always be exceptions, if the 'typical' attitudes, drivers and barriers of different business types can be identified, this can help inform a possible framework for structuring approaches to benefits realisation and future policy evaluation activity.

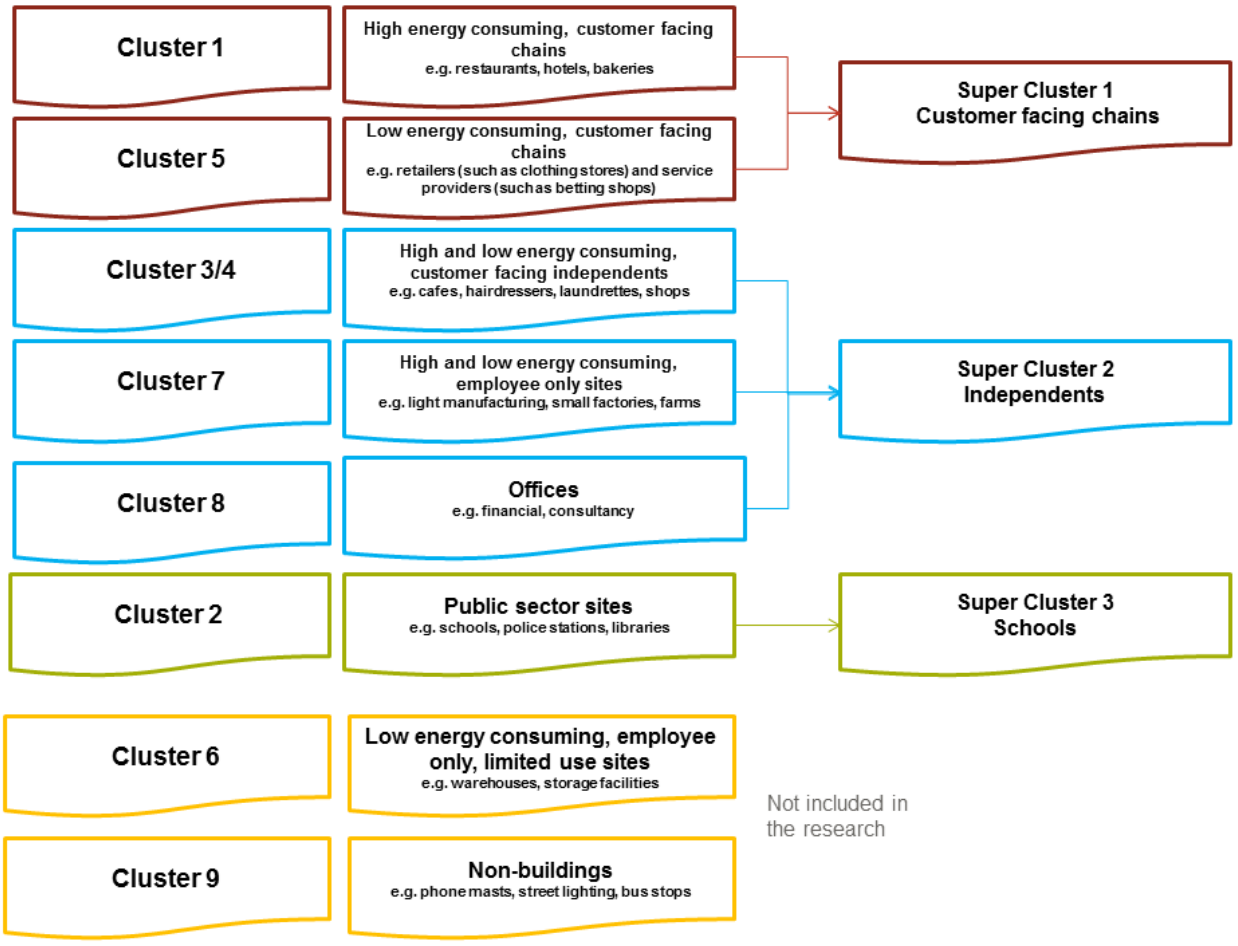
The typology is based on nine broad clusters of sites which are defined with respect to a number of key characteristics – those most important characteristics which help to differentiate the clusters are: public vs. private sector; relative energy intensity; independent vs. multi-site organisation; whether or not customer facing (see Box 6, p.49).

The typology also informed the case study design. Six of the clusters described in the typology were selected for investigation in this research (more detail on case study selection below). The six clusters of organisations were then grouped into three 'super clusters' as the research showed a good degree of commonality between some of the clusters (see Figure 1).

Contextual Factors

Different factors may have a bearing on how an organisation manages its use of energy including whether and how it uses smart meter data. With the help of experts Prof. Elliot Stern and Dr Avril Blamey, and a series of workshops with stakeholders, BEIS identified a number of such factors which have been grouped under six headings as shown in Box 6, p48. These factors informed the lines of enquiry in the topic guides.

Figure 1: The six clusters/three 'super clusters' included in the research



Pathway Map Template

A pathway map template was developed to help summarise the various factors, triggers and barriers that result in an organisation or a group of organisations managing energy in a particular way. The pathway map template informed the research instruments, in particular the questions addressed through the case study research, and is illustrated in Figure 2.

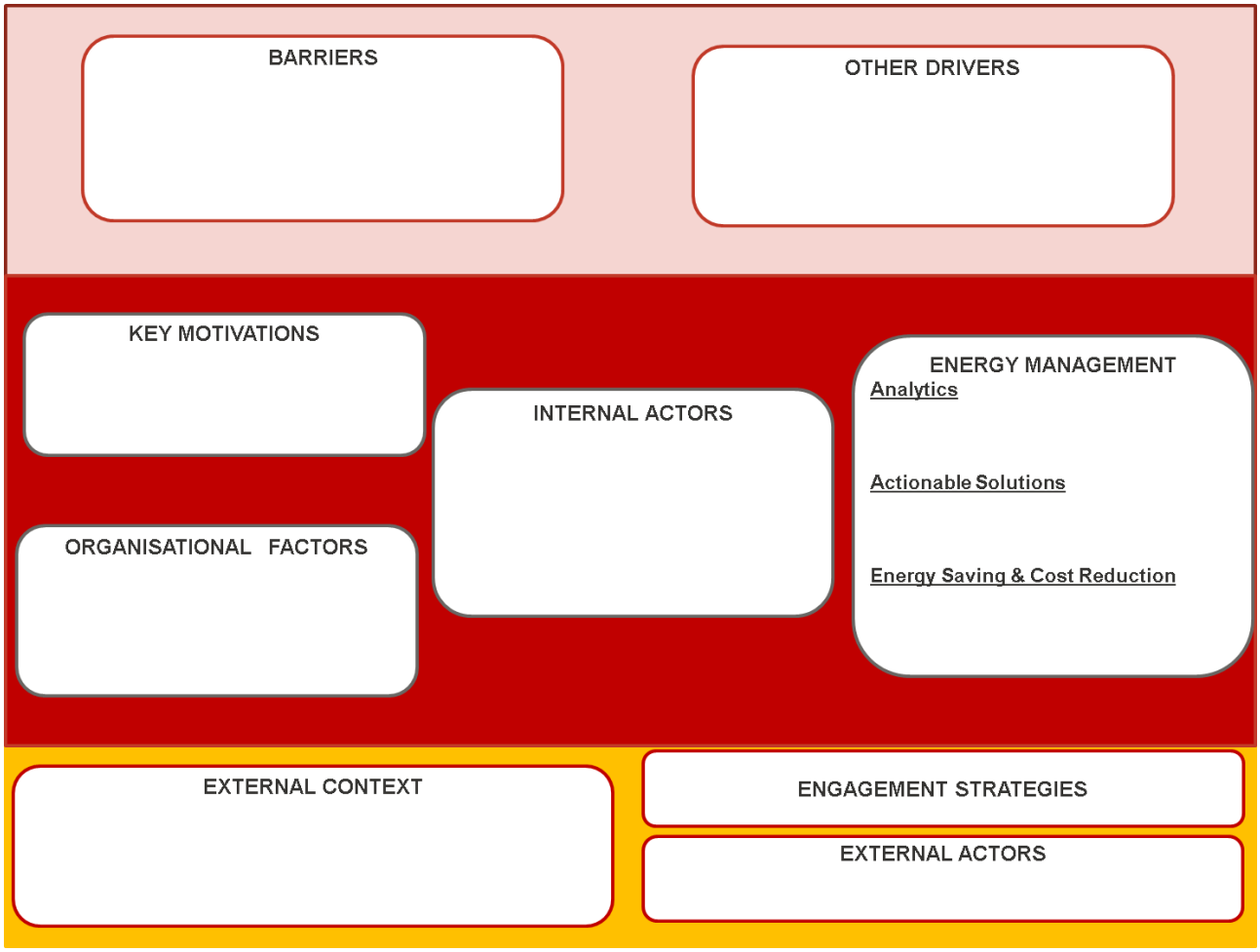
The template contains a number of boxes that group together various factors that are involved in energy management. The four boxes shown within the central red box relate to those things that are internal to the organisation itself and include important organisational factors, the key motivations for trying to manage energy efficiently, the internal actors that have a role in energy management. The fourth box labelled Energy Management summarises how, if at all, the organisations were analysing their energy use, the energy saving actions that had been implemented and the extent to which the organisations had achieved energy savings and reductions in energy costs.

The boxes labelled Other Drivers and Barriers are shown at the top of the map inside a pink box. They include a mix of internal and external factors that influence energy management.

The yellow box at the bottom of the pathway map summarise things that are external to the organisation and is divided into External Actors that played some role in energy management, together with any particular Engagement Strategies that were being

adopted. The External Context box outlines external factors, such as government policies, that were relevant to how the organisations managed energy.

Figure 2: Pathway Map Template



Report Structure

A summary of the research method is set out in the next chapter (Methodology) and this is followed by a summary of the findings on energy actions taken and the common factors influencing energy management (Common Influences on Energy Management). The report then goes on to provide a summary findings for each of the thee 'super clusters': (Customer Facing Chains; Independent Organisations; and Schools). The views of decision makers from organisations that were not currently using their smart meter data are set out in the next chapter (Engaging with Smart Meter Data The final chapter sets out the conclusions of the research (Conclusions).

The findings set out in this Overview Report are supported and underpinned by eight annexes (one on each cluster, a cross-cutting report on landlords and tenants, as well as a technical annex which contains further information about the research methodology).

Methodology

Method[2]

In summary, 107 organisations took part in the research. The research involved 41 case studies of sites, the majority of which had smart meters installed. The aim was to include only organisations that had had smart meters (advanced or SMETS compliant) installed and to provide breadth in terms of geography, organisational size and cluster, tenure, energy use and experiences of using information from advanced or smart meters. There is further detail on sampling below and in the Technical Report.

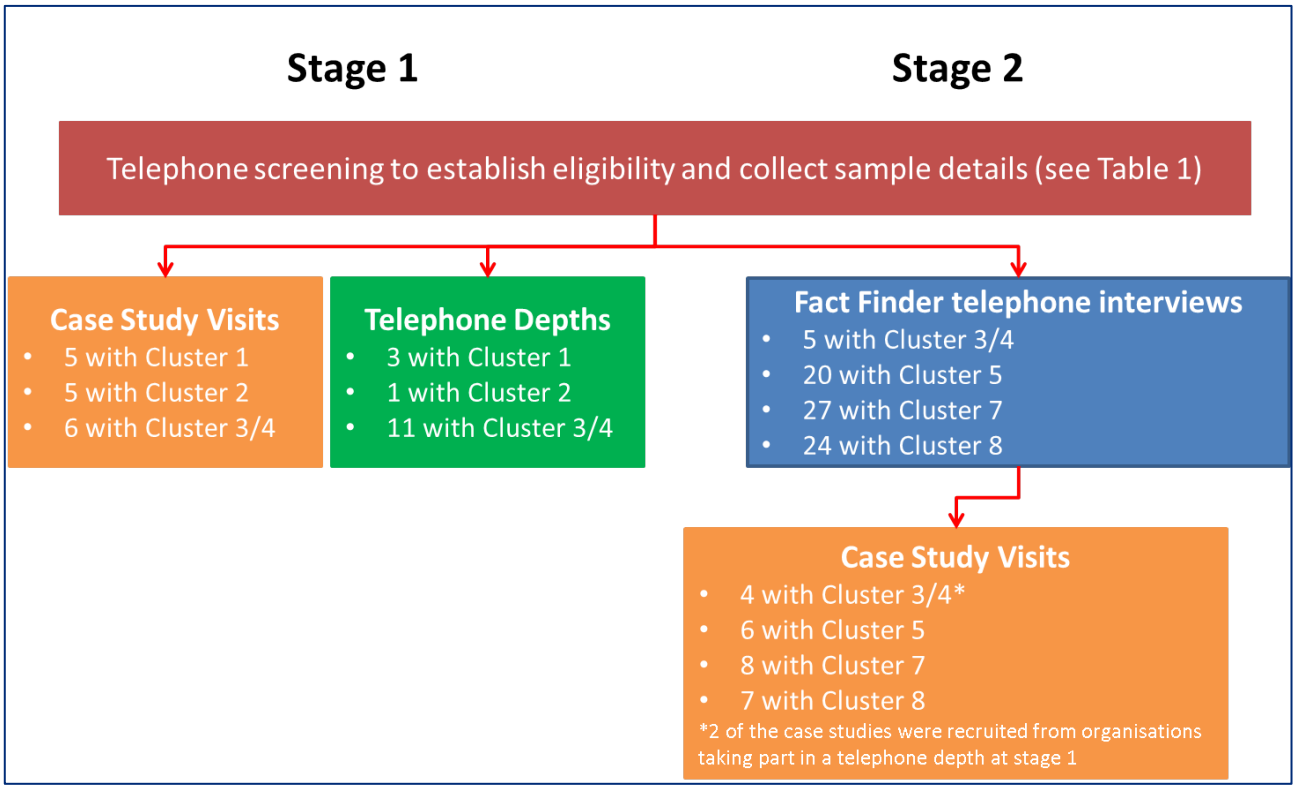
Each case study consisted of a site visit and one or more interviews with key individuals from, or associated with, the organisation to which the site belonged. In addition 91 organisations took part in a telephone interview to add breadth to the findings (25 of these also took part as a case study).[3]

As mentioned previously, a typology of nine clusters was developed before the start of this research and this guided the case study selection. In designing the case studies, some clusters were grouped together where the similarities were greater than the differences (e.g. low and high energy consuming, small customer facing independents). In addition, two clusters (e.g. lower energy consuming, employee only, limited use sites, such as warehouses, and non-buildings, such as phone masts) were excluded entirely based on a combination of assumed low prevalence within the actual non-domestic population and practical considerations about ease of access, given time and budget constraints.

The research was conducted in two stages; this allowed the methodology to be refined after Stage 1 to reflect lessons learned. The phasing also helped with practical constraints around resourcing and recruitment, for example those clusters that were more difficult to recruit were covered in Stage 2 of the research. The two stages of research are illustrated in Figure 3.

[2] A fuller description of the research methodology can be found in the Technical Report.
[3] A further interview was conducted with an energy consultant employed by a landlord whose portfolio included ports, airports, shopping/retail malls, offices, retail and studios. The interview focused on a site that provided private sector businesses with professional office-based services. The aim had been to arrange a case study visit with one or more of the tenants but this proved impossible within the timeframes of the research.

Figure 3: Flow chart of research method



Stage 1 comprised:

- initial **telephone screening** with decision-makers for an organisation's use of energy to establish their eligibility and collect basic sample details.
- **case studies** with clusters 1, 2 and 3/4. Each case study involved a visit to the case study site during which observations and interviews were carried out with a mix of internal and external actors. Internal actors included decision makers, implementers of energy management decisions, and users of energy. External actors included landlords, managing agents and energy consultants. These interviews lasted between half and two hours.
- 15 telephone **depth interviews** of 1 hour duration were conducted with energy decision makers from additional organisations spread across clusters 1, 2 and 3/4[4]. These interviews were conducted to provide additional information to support the case studies.

Stage 2 comprised:

- initial **telephone screening** with decision-makers.

[4] Cluster 1 – higher energy, customer facing chains; Cluster 2 – schools; Cluster 3/4 – Small, customer facing independents.

- 76 **fact finder interviews** with decision-makers spread across clusters 3/4, 5, 7 and 8[5], including some landlords; this involved a 30-40 minute telephone interview to gather factual information from a wider sample to add breadth to the findings, and to recruit sites for the case study stage.
- **case studies** with clusters 3/4, 5, 7 and 8.

The main difference between Stage 1 and Stage 2 in terms of the method was that Stage 2 began with fact finder interviews designed to gather factual information by telephone in advance of the case study depths, enabling the research team to achieve more focused case study interviews. The fact finders also had the additional benefit of allowing a wider range of organisations to be covered, providing a broader picture of each cluster targeted.

The case study approach enabled an in-depth exploration of how different organisations manage their energy and the various factors that influenced this. It involved the use of semi-structured discussions so that issues could be explored as appropriate.

Sample

Targets were set to achieve a spread of participants within and across each cluster in order to seek a range of views and experiences. Flexibility was permitted due to the difficulty of the difficulty in recruiting some clusters.

A summary of the sample is provided in Table 1. The aims were to include only organisations with smart meters (that is advanced or SMETS compliant) and to get a spread of organisation size, geography and cluster. 107 organisations took part in the research. 16 took part as a case study only; 25 took part as a case study having also taken part in a depth interview, while 66 took part in a depth interview only.

The table displays the total number of organisations taking part in the research broken down by cluster. The number of organisations taking part in a case study is shown in brackets. Most of the information in the table relates to a single case study site ie where an organisation has multiple sites, the research fieldwork took place at one of its sites (the depth and fact finder interviews focused on a single site which then became the case study site where the participant agreed to commit additional time to this more detailed element of the research). The exceptions are ‘size of organisation’, ‘number of sites’,’ and ‘the importance of reducing energy use’, which, in the case of chains and multi-site organisations, apply to the chain/organisation as a whole.

[5] Cluster 3/4 – Small, customer facing independents; Cluster 5 – Lower energy, customer facing chains; Cluster 7 - Higher energy, employee only sites; Cluster 8 - Offices

Table 1: Sample summary							
No of organisations	**Total**	**C1***	**C2**	**C3/4**	**C5**	**C7**	**C8**
	107 (41)	**8 (5)**	**6 (5)**	**22 (10)**	**20 (6)**	**27 (8)**	**24 (7)**
Region							
East	3 (1)	-	-	-	-	2 (1)	1
E Mids	11 (2)	1	-	3 (1)	3	4 (1)	-
London	7 (4)	-	-	2 (1)	1 (1)	2 (1)	2 (1)
N East	5	1	-	-	2	2	-
N West	14 (5)	-	-	2 (1)	2 (1)	3	7 (3)
S East	15 (10)	3 (2)	2 (2)	3 (1)	2 (2)	4 (2)	1 (1)
S West	16 (8)	-	4 (3)	3 (2)	2 (1)	2 (1)	5 (1)
W Mids	9 (1)	-	-	2	2 (1)	3	2
York & Humber	10 (3)	-	-	2 (2)	3	3	2 (1)
Scotland	11 (5)	3 (3)	-	2 (1)	2	1 (1)	3
Wales	6 (2)	-	-	3 (1)	1	1 (1)	1
Size of organisation (total employee number)							
Sole trader	4 (1)	-	-	2	-	-	2 (1)
Micro (<10)	69 (26)	-	-	18 (10)	1 (1)	25 (7)	10 (3)
Small (<50)		2 (2)	1 (1)	2	-		10 (2)
Medium (<250)	13 (7)	-	5 (4)	-	6 (3)	1	1
Large (250+)	21 (7)	6 (3)	-	-	13 (2)	1 (1)	1 (1)
Number of sites							
single	70 (27)		6 (5)	21 (9)		22 (7)	21 (6)
2 or more	9 (3)		-	1 (1)		5 (1)	3 (1)
<100	15 (6)	3 (2)			12 (4)		
>100	13 (5)	5 (3)			8 (2)		

Table 1: Sample summary (cont.)							
No of organisations	**Total**	**C1***	**C2**	**C3/4**	**C5**	**C7**	**C8**
	107 (41)	**8 (5)**	**6 (5)**	**22 (10)**	**20 (6)**	**27 (8)**	**24 (7)**
Locus of control							
Individual site/ Local authority	74 (28)	1 (1)	3 (3)	22 (10)	-	27 (8)	21 (6)
Head office/ Academy	30 (11)	5 (2)	3 (2)	-	19 (6)	-	3 (1)
Franchise	3 (2)	2 (2)	n.a.	-	1	-	-
School type							
Primary	1 (1)		1 (1)				
Nursery/lower/	1 (1)		1 (1)				

middle							
Secondary	4 (3)		4 (3)				
Tenure							
Owner occupier	45 (16)	5 (4)	n.a.	14 (6)	7 (1)	9 (2)	10 (3)
Tenant	55 (20)	2 (1)	n.a.	8 (4)	13 (5)	18 (6)	14 (4)
Energy bills							
Paid direct	106 (39)	8 (5)	5 (4)	22 (10)	20 (6)	27 (8)	24 (6)
Included in rent/paid by LA	4 (3)	-	1 (1)	1 (1)	1 (1)	-	1
Energy types							
Electricity	107 (41)	8 (5)	6 (5)	22 (10)	20 (6)	27 (8)	24 (7)
Gas	68 (26)	6 (3)	6 (5)	17 (9)	7	14 (4)	18 (5)
Other	12 (8)	-	4 (4)	3 (-)	2 (1)	3 (3)	-
Type of meter							
Smart/advanced electricity	101 (38)	7 (4)	6 (5)	22 (10)	16 (5)	27 (8)	23 (6)
Smart/advanced gas	24 (8)	3 (1)	2 (2)	1 (1)	4	6 (2)	8 (2)
Importance of reducing energy use							
High	70 (28)	6 (4)	5 (4)	17 (9)	14 (3)	18 (5)	10 (3)
Medium	29 (12)	2 (1)	-	3 (1)	6 (3)	9 (3)	9 (4)
Low	8 (1)	-	1 (1)	2 (-)	-	-	5

*One respondent taking part in a depth interview did not nominate a specific site as he was not sufficiently familiar with individual sites.

Recruitment

Organisations were sourced in a number of ways: energy supplier lists of non-domestic customers with smart meters; purchased lists (type of meter unknown), some drawn from postcode areas with highest smart meter installation activity; a sample of small businesses approached via an energy broker, who had nominated themselves as 'leading the way' in terms of energy efficiency with smart meters; a sample of landlords and managing agents sourced by DECC; and organisations nominated by DECC contacts as 'leading the way'.

Outline of Interviews

A wide range of issues was covered during the course of the fact finder interviews, telephone depths and case study visits. This included:

- an introduction to the nature of the business and its use of energy, including the different types of energy and energy meters in use, the main uses of energy and an estimate of the proportion of operating costs that were taken up by energy

- a discussion on energy management, including how energy management decisions were taken and who was involved; perceived levels of control of energy use; what impact the nature/size/age/fabric of the building had on energy use and management; whether there were any facilities or building management was undertaken, whether there was an environmental policy (and if so, what it said about use of energy); whether an energy audit had been conducted (and if so, what actions if any had it led to); the priority attached to energy efficiency; reasons why energy efficiency was/was not important (prompted and unprompted); barriers to becoming more energy efficienct (prompted and unprompted); things that had triggered a review of energy efficiency in the past (prompted and unprompted)

- the role of external actors in energy efficiency/management including landlords/ leases; energy suppliers; energy consultants; trade and professional bodies

- any steps taken to reduce energy costs/consumption (prompted and unprompted)

- experiences of smart meters including why they were installed and recall of any information or advice that had been provided

- where an organisation was using its smart meter data: how the data was collected; how it was accessed, by whom, how often; ease of interpreting the data; and what difference it had made to the business

- for those organisations not using their smart meter data: the reasons why they were not doing so; reactions to information about how they could be accessing the data as well as examples of how it could be used to better manage energy consumption.

Copies of the stimulus materials used in the interviews can be found at Stimulus Materials, p51.

Data collection and analysis

During the case study visits and the telephone depth and fact finder interviews, the researchers used topic guides and supporting stimulus materials to ensure that the relevant issues were covered; they also followed up particular points to ensure the point being made was understood, and they may also have explored relevant additional points that were made by the participants. In addition, they used an observational record sheet to observe how energy was being used. Each case study was written up in detail using an analysis template. The answers to the fact finder and depth interview questions were cast into a matrix with the rows as the questions and the columns as the organisations. Findings from both data sets were used to identify the key themes and issues.The views of different actors from the same case studies have been used to ‘triangulate’ the findings from individual case studies. A similar triangulation process was used to compare and contrast the findings both within and between the different clusters.

With a few exceptions, answers were not recorded in the form of tick boxes or head counts since the aim was to explore the range of opinions expressed and actions taken rather

than to ‘measure’ how many participants had expressed a particular view. One reason for this is that people do not always express their answers in black and white terms. Another reason is that it is not possible to explore every issue in every interview. Some issues may only have arisen in certain interviews.

In analysing the data, one of the things that has been looked for is where there is a consensus of opinion or a similar view on an issue and this is expressed using language such as ‘all’, ‘most’, ‘widespread’, ‘widely held’, ‘many people’, etc. However, it is also important to look for the range and variety of opinion that is expressed; these might be opinions offered by just ‘a few’ participants as well as those opinions mentioned by ‘some’ of the sample (i.e. more than a ‘few’ but less than ‘many’). It is also useful to report things that may only be mentioned by one or two people if these seem to offer relevant and insightful observations. This would normally be made clear by stating something along the lines ‘one participant said…’

Use of terms such as ‘most’ or ‘few’, etc., relate only to the sample under consideration and should not be taken to imply ‘most of members in the total population’.

As mentioned, this Overview Report summarised evidence contained in a series of thematic cluster reports, which are annexed. The reader can refer to these annexes for fuller detail on the research findings pertaining to each of the clusters.

This report and all its associated annexes have been quality assured by BEIS analysts, in addition to the BEIS contract manager.

Interpreting the Findings

The findings in this report provide insights into how different organisations in the sample were currently managing their use of energy, the things that get in the way of them being more energy efficient, and some of the ways of trying to overcome these barriers. As such, they are indicative of the broader picture in terms of smaller, non-domestic sites. Nevertheless, care is needed when trying to generalise to the wider population.

This is a qualitative study which means the opinions of a relatively small number of people have been explored in considerable depth. Not only is the sample small, it is not designed to be representative of the full range of organisations that meet the criteria for each cluster. Some organisations were purposively selected to learn from examples of best practice, and although a range of more ‘typical’ organisations were also included in the research, the sample is not designed to be statistically representative of the wider population.

Glossary of Terms

A glossary of key terms is provided in the appendices (Glossary of Terms, p45).

Common Influences on Energy Management

Analysis of the approaches to energy management[6] adopted across the six clusters covered in the research showed that they can be grouped into three 'super' clusters: customer facing chains (clusters 1 and 5), independent organisations (clusters 3/4, 7 and 8) and schools (cluster 2). This chapter summarises the energy efficiency actions taken and the common factors influencing energy management that characterised these super clusters.

Introduction

Analysis of the approaches to energy management across the six clusters revealed examples of the same types of energy efficiency actions being taken across the different clusters; the main difference was in the extent to which they were being carried out. In the same way, many of the barriers and factors that influenced energy management decisions were present in all clusters, even though they appeared to manifest in different ways within different contexts. Having said this, the customer facing chains (clusters 1 and 5) tended to have more in common with each other compared to the independent organisations that made up cluster 3/4, 7 and 8, and the schools (cluster 2) stood out as being different to all other clusters. Therefore, this report has been structured around these three 'super' clusters of organisations.

While these three 'super' clusters provide a useful way of organising the findings, it is worth noting that the size of an organisation (as reflected by the number of employees) and energy intensity also appeared to be associated with approaches to energy management and these cut across both the individual and super clusters. The relationship between size, energy intensity and the propensity to engage with energy management is discussed in greater detail later in the report (see Size, Energy Intensity and Propensity to Engage With Energy Management, p39).

Energy Efficiency Actions

Across the six clusters, a variety of energy efficiency actions had been, or were being, implemented. The main types of actions are summarised below. Examples of the same or

[6] 'Energy management' is used in this report to cover the range of activities that organisations were found to be using to control energy costs, including energy procurement, installation of energy efficiency measures and equipment, control systems and the use of smart meter data to monitor performance.

similar types of energy efficiency actions were found across all the clusters. The main differences between clusters related to the number and range of measures being undertaken.

The majority of organisations in the sample were not using their smart meter data and, as such, this had not driven or influenced energy effiency actions. Nevertheless, for those organisations that were using them, smart meters were having a significant impact on energy management and were allowing them to do things which they would not otherwise be able to. Examples can be found at Users of smart meter data, p23 (Customer facing chains), and Users and Non-users of Smart Meter Data, p33 (Schools).

The extent to which organisations were implementing energy efficiency actions seemed to relate to both organisational size and energy intensity. Thus, the most proactive organisations tended to be the larger customer facing chains, especially the restaurants/pubs with restaurants from cluster 1. The larger lower energy, customer facing chains from cluster 5 were also often proactive but their focus was typically narrower, mainly installing LEDs, reflecting one of their main uses of energy. Some of the smaller, independent restaurants from cluster 3/4 were also trying to find ways of lowering their consumption.

In contrast, many of the small, office based organisations (cluster 8) and the lower energy intensity businesses from cluster 3/4 reported that they were not taking any specific actions to try and improve their energy efficiency. Despite some of the higher energy, employee only organisations (cluster 7) in the sample having relatively energy intensive operations, as a group they were not undertaking a great many energy saving actions.

The schools (cluster 2) were similarly divided between those who were actively aiming to lower their energy consumption and those who were not; the first group typically had implemented a range of actions whereas the latter had done far less.

When discussing energy efficiency actions with research participants, they were asked to distinguish between 'things that could be ***changed'*** eg processes and 'things that could be ***invested in'*** eg new energy efficient equipment or solar panels. In each case, the researchers explored which actions had and had not been taken and the reasons for this.

Things that could be changed

- **Reviewing tariffs/suppliers[7]:** many organisations claimed to do this on a regular basis although smaller organisations were often reluctant to switch due to previous negative experiences.
- **Changing energy type** (e.g. from electricity to gas): although this was often not considered as an option, there were a few examples among organisations preparing food e.g. a pub chain (cluster 1) switched much of its equipment from electricity to gas to take advantage of lower costs while a small restaurant (cluster 3/4) had replaced gas hobs with induction hobs as these only use electricity when a pan is placed on them. One of the schools had switched from electric to gas heated radiators.

[7] Strictly speaking, reviewing tariff and/or supplier is not an energy efficiency action but a cost saving action however it is included here as it was reported to be something many organisations were doing. Indeed, the primary motivation for any energy efficiency was to try and reduce energy costs (see Key Motivations).

- **Changing the things produced or sold**: this was not considered an option by most organisations. There were a few examples among organisations preparing food e.g. two of the chains in cluster 1 had made changes to their menus based, in part, on energy consumption considerations; a small restaurant in cluster 3/4 had substituted beer in cans for draught beer to reduce the cost of cooling.
- **Changing production processes:** this was also not considered an option by many organisations; one of the larger customer facing chains in cluster 1 was experimenting with turning some grills off on less busy days and only using extraction when the grills were in use.
- **Changing behaviour**: this was often the principal, and in many instances the only, action being taken; it typically involved exhorting staff to turn things off or down but it was also acknowledged to be somewhat 'hit and miss'. There were a few instances of staff being trained or incentivised to save energy mainly among some of the larger customer facing chains. The more proactive schools had staff and student engagement programmes in place.

  An alternative approach adopted by some of the larger customer facing chains was to control settings centrally such that staff either could not override them or had to seek permission to do so. One of the schools had automatic cut-offs such that all computers were switched off at the end of the school day. The large office based business in cluster 8 had installed a master off switch at each workstation (but this was not always being used). There were a few other examples of 'last man out switches' being used across the customer facing chains (clusters 1 and 5) as well as some of the employee only sites (cluster 7) and offices (cluster 8).

Things that could be invested in

- **Undertaking an energy-efficient fit-out when opening a new or refurbishing existing premises**: the larger customer facing chains were more likely to have a programme of premises refurbishment while smaller organisations were sometimes undertaking refurbishment work as part of on-going maintenance. In theory, this represented an opportunity for organisations to improve the energy efficiency of their premises. In practice, energy efficiency may or may not be part of the consideration. Cost was often a limiting factor especially for older premises that were considered to be energy inefficient.
- **Purchasing new or refurbished equipment**: this was an opportunity that many organisations in the sample said they took advantage of although, in practice, energy efficiency was often not the main driver for purchasing/refurbishing equipment, if considered at all. Smaller organisations, in particular, were only replacing equipment when it broke down and it was no longer economical to have it repaired. Again, the energy efficiency of replacement equipment was often not a major consideration.
- **Servicing equipment**: many of the larger customer facing chains were having key items of equipment serviced on a regular basis, largely because of the potential impact on the business if equipment broke down, rather than improving its energy efficiency. In contrast, many of the smaller organisations were not having their equipment serviced.
- **Improvements to heating/cooling**: improvements were often motivated by considerations other than energy efficiency, for example, premises that were either too cold or too warm, or because heating/cooling systems needed upgrading/renewing. Some of the larger customer facing chains were using Building Management Systems

to manage heating/cooling automatically but this was often reported as not cost effective for smaller sites. The larger chains were also more likely to be investing in more energy efficient fridges and chillers, as well as more innovative measures such as a restaurant chain that had installed heat recovery systems linked to extraction units and dishwashers.

Some organisations spoke about installing/using heating controls, thermostats and timers. Some of the schools were making sure the settings of their heating systems took account of holiday dates and British Summer Time and were adjusting timers in response to weather forecasts.

- **Improvements to lighting systems**: some organisations were using more energy efficient forms of more traditional lighting; some were using sensors to ensure lights were only used when needed. The main measure here related to switching to LED lights. This was often being done on a gradual basis and many of the individual sites had a mix of lighting systems (incandescent, fluorescent, halogen and LEDs). Although this action was found across all of the clusters, it was something that the customer facing chains in particular were investing in, especially the lower energy, customer facing chains (cluster 5) where lighting was often one of the main uses of energy. Some of them reported achieving significant reductions in consumption of between 20 and 50 per cent by switching to LEDs. In contrast, some of the smaller organisations including customer facing independents, employee only sites and office based organisations (clusters 3/4, 7 and 8 respectively) were yet to be convinced of the benefits of LEDs.
- **Micro-generation**: there were a few instances of organisations investing in micro-generation, often solar panels, mainly among lower energy consuming, customer facing chains and employee only businesses (clusters 5 and 7).

Factors Influencing Energy Management

Many of the factors that influenced energy management were relevant to all or most of the organisations across all six clusters; as such, they were not differentiating factors although they may have been manifest in different ways in different types of organisations. These are summarised below.

External factors

External factors describe pressures that are external to an organisation that might influence energy management. The **price of energy** and **climate change considerations** were relevant to all clusters. **Reputational issues** were said to be relevant in all clusters except for employee only sites (cluster 7); this possibly reflects the fact that these organisations were not customer facing and did not have brands or high profile reputations.

Key motivations

The term **key motivations** is used to refer to the key internal motivating factors behind an organisation's energy efficiency efforts.

In all organisations, the primary motivation for managing energy was to **reduce costs**. For the commercial businesses (clusters 1, 3/4, 5, 7 and 8) this was in order to increase their

profitability. In the case of the schools (cluster 2), any money not spent on energy meant that there was additional budget available for learning.

Being seen as a **responsible organisation** and **'doing our bit for climate change'** tended to be seen as part and parcel of the same thing (the latter being an example of the former). For some of the larger organisations, these drivers may have been carried through into company policy statements while for some of the smaller organisations they reflected the personal values of owners/decision makers. However, it was sometimes difficult to see a clear link between such statements of intent and how energy was being managed. For example, although a number of organisations had an environmental policy, not everyone responsible for energy management knew what it said in relation to energy.

Other drivers

Other drivers is used to refer to any other influence on energy management activity. Three things that could prompt an organisation to review its energy management were found to be relevant across all clusters. These were **energy price increases**, typically when the contract came up for renewal, **equipment needing refurbishment/replacement** and when **refurbishing existing, or moving into new, premises.**

Barriers

Barriers refers to anything that could make it difficult for an organisation to become (more) energy efficient. Three barriers were common to all clusters.

- Although encouraging staff to use energy wisely was one approach to energy management being used by nearly every organisations in the sample, achieving **staff compliance** with energy efficiency behaviours was difficult for everyone.
- The **condition of many of the buildings** that organisations were based in was described as presenting challenges (e.g. poor insulation, high ceilings, single glazing).
- For **tenants**, the fact that their **premises were leased** was a further barrier. For example, the need to get landlord agreement for certain actions, the need to return the building to its previous condition when the lease expired, the difficulty achieving a return on any investment before the lease expired, all made it less likely that a tenant would invest in energy efficiency measures. Several organisations spoke about how they would have liked to have invested in micro-generation but, as tenants, they were deterred from doing so.

A number of further barriers were characteristic of those organisations that were not using their smart meter data to help them manage their energy; again, these were found across most if not all the clusters.

- Nearly all the organisations in the sample and across all the clusters perceived that their **energy only represented a small percentage of their total operating costs** such that any savings were likely to be small and it would be difficult to achieve a worthwhile **Return on the Investment (ROI)**. The only organisations for which this was not perceived to be a barrier were the larger customer facing chains in clusters 2 and 5 and the more proactive schools (cluster 2) who were actively managing their energy consumption using their smart meter data. In the case of the larger chains, it is likely that relatively small savings in energy consumption at a single site could be amplified across their estate thereby resulting in substantial cost reductions.
- Other barriers that mainly characterised organisations that were not using their smart meter data included; **lack of information, time and/or expertise** in relation to energy

management, **perceived lack of control over energy use/limited scope to reduce consumption**, **lack of reliable information on energy consumption and/or the ability to demonstrate the impact of any actions that were taken** and **a lack of awareness of smart meter data/ability to access it/know how to use it.**

Customer Facing Chains

This chapter explores approaches to energy management amongst customer facing chains. Across the combined fact finder interview and case study sample, many of the organisations were using their smart meter data as part of their energy management procedures and key differences between these organisations and those that were not using their smart meter data are outlined.

Context

Clusters 1 and 5 consisted of customer facing chains, the main difference being the energy intensity of their operations. Cluster 1 included restaurants, pubs with restaurants, coffee shops and bakeries with retail outlets that were all using a large number of relatively small but energy intensive items of equipment. In contrast, cluster 5 included a wider range of retailers and service providers and lighting was one of the main uses of energy. Although often associated with relatively low energy consumption, point of sale lighting was important for many of these businesses and the number of light fittings could be considerable. For example, in one average size high street retail outlet, the manager estimated that there were between 200 and 300 fluorescent tubes in use. As retail businesses, the organisations in both clusters were typically operating a 6 or 7 day week; where food was served, they may also have been opening in the evenings.

There was a mix of larger and smaller chains in both clusters 1 and 5. Although there is no definition of ‘large’ and ‘small’, the number of individual sites that made up the chains in the sample ranged from two to several thousand. 15 of the chains had fewer than 100 sites, while 13 had over 100 sites (see Table 1, p9).

There was often a high degree of centralised control and standardisation, both in relation to energy procurement and energy management procedures. Responsibility for energy management ranged from dedicated, full-time energy managers to those who took on this role on a part-time basis. Decisions were typically taken in consultation with other head office staff. The larger chains were also likely to have regional and store managers who were given varying degrees of freedom to manage energy use at the regional/local level. Staff at store level were the main users of energy.

External actors that were reported as playing some role in energy management included energy brokers and, to a lesser extent, energy consultants. There was the occasional mention of the following external actors offering advice and/or support: trade or professional bodies, local authorities, and contractors such as shop fitters or electricians.

Many of the organisations in the sample were classed as 'large' businesses[8] and, as such, were affected by government policies (see below) and a small number were franchises and energy management was influenced by the franchise owners (e.g. specifying equipment that had to be used). Energy suppliers and, in the case of tenants, landlords and managing agents, were not considered to play a role in energy efficiency.

Factors Influencing Energy Management

The same set of **factors** (external factors, key motivations, other drivers, and barriers) that were operating within the other clusters was often found to be relevant to the customer facing chains (see Factors Influencing Energy Management, p16).

Despite differences in energy intensity, approaches to energy management were broadly similar among the high energy consuming (cluster 1) and lower energy consuming (cluster 5) customer facing chains. The main differences were between the larger and smaller organisations taking part in the research. Energy efficiency was strongly influenced by **government policy** (larger chains), by **reputational issues** (especially where there was a 'high street' brand), by **competition and profit margins** (especially for listed companies) and, for franchisees, by **franchise owner requirements** (for example, one of the coffee shop chains reported that they were required to keep all their coffee machines switched on 24 hours a day; the owner did not know why).

Larger customer facing chains

The businesses that were doing the most to manage their consumption were the larger customer facing chains from clusters 1 and 5. This implies that as an organisation grows in size, and as more outlets are opened, the pressure to manage energy more efficiently also grows:

- even where energy represented a relatively small proportion of operating costs, the more outlets there were, the greater the amplification effect. A small reduction in energy costs for a chain of under 50 sites may not amount to very much but the same percentage saving for a chain of hundreds of outlets is much bigger
- as a chain got larger, there was a need for more dedicated, specialist members of staff who only or mainly focused on energy management; in turn, motivated and knowledgeable energy managers helped embed the importance of energy efficiency across the organisation
- dedicated, knowledgeable energy managers, who were more likely to be found in larger organsiations, not only brought an understanding of energy management, they were also better placed to benefit from events such as conferences and trade shows which can spark ideas and provide opportunities for sharing best practice
- larger chains often had a regional tier of management who would also have some responsibility for implementing energy management decisions
- larger chains with dedicated staff were less likely to have difficulty when it came to decision makers having the time needed to explore energy saving opportunities; there

[8] The definition of a large business is based on total number of employees and not the number of sites that make up a chain (although there will be a correlation between the two).

was some suggestion of a difference here between the higher energy intensity chains in cluster 1 and the lower energy intensity chains in cluster 5. Some of the energy decision makers in cluster 5 spoke about the difficulty of working closely with all their outlets due to the small size of their team; some of them were using exception reporting to identify the highest energy consuming sites[9]

- once a chain passes the threshold and is classed as a 'large' employer (>250 employees in total), they meet the criteria of various government policy initiatives, such as the Carbon Reduction Commitment Energy Efficiency Scheme (CRC) and Energy Savings Opportunity Scheme (ESOS) and there was evidence that this was having an impact on energy management within the sample. For example, in cluster 5 there was greater engagement with energy consultants, possibly as a result of ESOS. Decision makers from cluster 5 were also more likely to report that one of the drivers of energy management was to ensure they complied with such regulations[10]
- larger chains are more likely to be listed companies and this seemed to have an impact on energy management within the sample; many of the organisations that were using their smart meter data were listed companies. Listed status can mean additional pressures come into play, for example, one of the restaurant chains spoke about it being easier to attract certain types of investor if they can demonstrate they are an energy efficient organisation
- a potential downside of being a large chain was that the energy decision makers were not necessarily familiar with individual outlets and the extent to which energy management actions had or were being implemented locally.

As noted earlier, the larger chains in the sample, and especially those involved in food preparation, had often implemented a wider range of energy efficiency measures (see Energy Efficiency Actions, p13).

Smaller customer facing chains

There was no obvious 'cut-off' in terms of the number of outlets or employee numbers when it came to drawing a distinction between smaller and larger chains in the sample. The smallest chains ranged from businesses with just two retail outlets up to those with approaching 50 sites, and had more in common with the small, customer facing independents (cluster 3/4) and the smaller employee only sites and organisations occupying offices (clusters 7 and 8) than they did with the larger chains. They lacked any form of head office or a regional structure and the decision makers were either the owners or senior managers who might spend only a small percentage of their time on energy related issues. As small organisations, these businesses were not especially influenced by government policies, although some had plans to grow and were aware that this state of

[9] Exception reporting was not mentioned explicitly by the decision makers from the larger chains in cluster 1 but, as this was not something that was prompted for during the interviews, they may have been adopting this approach without bringing it to the researchers' attention.

[10] This level of engagement with energy consultants was not mentioned by the cluster 1 organisations and, while acknowledging that they had to comply with government regulations, decision makers from cluster 1 often played down the impact of these on their decision making. This might reflect timings; the cluster 1 research was conducted in the summer of 2015 while the cluster 5 research took place in the first quarter of 2016; ESOS came into effect from April 2016. More generally, it may also reflect the fact that cluster 1 organisations had been trying to be energy efficient for a longer period of time because of their greater energy intensity relative to cluster 5 organisations.

affairs might change. The smaller chains tended to have implemented fewer energy efficiency measures (although there were some exceptions).

Differences between the higher energy (cluster 1) and lower energy (cluster 5) customer facing chains

As previously mentioned, the higher energy chains in cluster 1 tended to have implemented a wider range of energy efficiency measures whereas the lower energy chains from cluster 5 were more likely to have focused primarily on converting their lighting to LEDs. Other points of difference already mentioned included the apparent greater use of exception reporting, the increased engagement with energy consultants, and the importance of government regulations as a key motivator among the lower energy consuming chains (cluster 5).

There were a few additional areas of energy management where differences appeared to exist between the two types of organisations. For example, in some of the high energy consuming pubs and restaurants in cluster 1, the managers of individual sites were sometimes said to have responsibility for energy consumption but, other than trying to manage staff behaviour, they appeared to lack any authority or decision making powers in relation to energy management. This was also true to an extent for the cluster 5 organisations although, in a number of cases, site managers had a narrow range of energy management responsibilities. This may reflect the greater energy intensity of the operations in cluster 1 such that leaving ovens or grills on when not in use would have a bigger impact than someone forgetting to turn off lights.

Several of the lower energy consuming customer facing chains (cluster 5) had an ‘open door’ policy which could create challenges in terms of energy efficiency, especially where over-door heaters were used. There were some other factors that were only identified by cluster 5 organisations; however, these may reflect differences in the way the information was collected between stages 1 and 2 of the research, along with differences in sample size, rather than real differences between the two clusters. These included:

- planning restrictions as a barrier, for example, where businesses were located in listed buildings or where local planning requirements ruled out options, such as double glazing[11]
- competitor/stakeholder pressure to be energy efficient (for example, taking steps to be more energy efficient because this was what the competition was doing)
- taking advantage of funding streams, subsidies or award schemes; although these were identified as a trigger by a number of cluster 5 organisations, there was little evidence to show it was an important trigger. For example, only two of the organisations had invested in micro-generation; one of the larger chains spoke about a Carbon Trust accreditation.

[11] This was not raised as a barrier by the cluster 1 organisations; however, it only emerged as a potential barrier during the course of the first stage of research and was not prompted for in the same way it was in stage 2. Given that cluster 1 organisations would be found in very similar locations, it probably applies to both.

Smart Meter Data

Users of smart meter data

With the exception of the schools in cluster 2 (see Schools, p31), all bar one of the other organisations that were using smart meter data to manage their energy (other than for billing purposes) were from clusters 1 and 5. There were some very clear differences in energy management as a result. It is difficult to state for certain but the evidence showed that that these organisations were already actively seeking to manage their energy efficiently and smart meters, and the associated data, were very much a means to this end. There was only one example of an organisation embarking on an energy efficiency journey as a result of having a smart meter installed[12]. Nevertheless, for those organisations that were using them, smart meters were having a significant impact on energy management and were allowing them to do things which they would not otherwise be able to.

The organisations that were using their smart meter data tended to be characterised as follows:

- energy efficiency was embedded within the corporate culture; for example, one of the restaurants in cluster 1 had members of staff in the role of 'energy champions' while another restaurant appointed staff as 'footprint leaders'; best practice ideas were shared across the organisation
- the decision makers were motivated and knowledgeable about energy management, empowered to act, and often supported by a head office team
- users of smart meter data in the sample from the lower energy consuming customer facing chains (cluster 5) were more likely than non-users to have an environmental policy and to have had an energy audit carried out. It is unclear if this was a characteristic of cluster 1 as the information was collected in a different way
- individual outlets were set energy targets and cross-site comparisons were used to identify sites that had higher than expected consumption
- there were fewer barriers to energy management; some barriers were removed as a result of having access to smart meter data; for example, 'lack of reliable information about consumption and/or the impact of energy efficiency measures'
- during the fact finder interviews, the decision makers from the lower energy consuming customer facing chains (cluster 5) spoke about competitor and/or stakeholder pressure being a possible trigger for reducing energy consumption/costs; however, there was little evidence that this was an especially important trigger.

Smart meter data was being proactively used to identify higher/unexpected energy usage so that steps could be taken to establish the cause and actions taken to address these. Staff were not just being encouraged to use energy efficiently, there was more evidence of staff being trained and supported to use energy wisely, and in some higher energy consuming customer facing chains (cluster 1), being incentivised to do so. Other organisations were removing or restricting their staffs' ability to change controls. As part of the energy efficiency culture, these organisations were also looking more widely at

[12] Unfortunately, the journey was short-lived as the energy provider closed their online portal shortly after the organisation started using it.

opportunities to save energy and trialling possible solutions, and smart meter data played an important role in evaluating these. This included looking at the potential of new technologies (e.g. fitting heat exchanges to extraction units and dishwashers and using the recovered heat to supply hot water), adapting existing practices (such as only turning on half the grill on less busy days) and experimenting with menus (e.g. focusing on recipes that used less energy). There was some evidence that the cluster 1 organisations with their higher energy intensive operations were more active in this way.

Non-users of smart meter data

Two of the customer facing chains, one from each cluster, reported that they were unable to access their smart meter data. In one case, a small chain where the accounts were not consolidated (i.e. each site had its own energy account and associated bills), the data had been accessible when the meter was first installed and the owner had been able to take a number of energy saving actions as a result. He was disappointed when the facility was then withdrawn. A larger chain had switched all of its sites to a single supplier and had smart meters installed. This was primarily to allow them to consolidate all their bills but it would also have allowed them to monitor individual sites and identify any excessive consumption. Unfortunately, the supplier was unable to consolidate the various accounts or provide the promised online data access.

As with other organisations in the research sample that were not using their smart meter data, the main reason was they were unaware there was information that could be accessed, how it could be accessed or how to use it[13]. Organisations rarely recalled/did not recall being offered information or advice on the energy saving potential from using smart meter data. However, there were also differences in the organisations' attitudes towards energy efficiency over and beyond this lack of awareness:

- they were often the smaller customer facing chains with less centralised control; although energy efficiency was considered important, it was not given the same priority and was not embedded within the organisational culture
- the decision makers were either owners or senior head office staff who were more likely to have energy management as just one of their roles and for which they may have lacked expertise; for example, non-users in cluster 5 were more likely to say they relied on external organisations for energy efficiency advice
- some made cross-site comparisons based on bills but there was little evidence of sharing best practice in any systematic way
- a wider range of barriers to energy efficiency was apparent including lack of information about how energy was being used and the perception that there were few actions that they could take to reduce consumption
- although these organisations were briefing staff about the use of energy and monitoring their behaviour, there was little evidence of training, engagement or incentivisation
- organisations from the higher consuming customer facing chains (cluster 1) often focused mainly on switching equipment off or down when not in use. For the lower

[13] This should not be interpreted as implying that if they were aware of the smart meter data and how to access it they would be using it. Awareness is a necessary but not necessarily sufficient condition; see, for example, Engaging with Smart Meter Data p36.

consuming customer facing chains (cluster 5), one of the main energy uses was in the form of lighting and a number had switched all/a proportion of their lights to LEDs and had achieved reductions in their energy bills as a result. In contrast, some of the non-users from cluster 1 felt that the quality of LED lighting was not acceptable; this might reflect differences in the desired ambience between a restaurant and a non-food retailer. In this context, it is interesting to note that the users of smart meter data in cluster 1 had found ways of achieving the desired ambience. In other words, the energy efficiency benefits of switching had motivated them to find a solution to the issue.

Independent Organisations

This chapter summarises the approaches to energy management among the independent organisations[14] that took part in the research. The organisations in question included a mix of higher and lower energy intensity operations and the impact of energy intensity is summarised. Most of the organisations in the sample were small or micro businesses and this seemed to be a key determinant in approaches to energy management. Very few were accessing or using their smart meter data and the reasons behind this are outlined.

Context

The organisations in the sample recruited from among small, customer facing independents (clusters 3/4), employee only sites (cluster 7) and organisations based in offices (cluster 8) were predominantly independent organisations operating, in most cases from a single site. While there were differences across the three clusters (see Box 1 for a summary), their attitudes towards energy efficiency were broadly similar and this appears to be a function of the fact that they were mainly micro and small businesses.

Energy management decisions were taken by the owners or, in the case of some office based organisations, directors or administrative staff. While some owners involved other members of their business in the decision making, many of them did not.

There were a small number of multi-site organisations in the sample. Although energy management decisions were taken centrally (i.e. they applied across all sites), there was no ‘head office’ function as such. The only exception was a large office based organisation (cluster 8) which did have a head office function. To date, most of their energy efficiency actions had focused on the head office which had recently undergone a major refurbishment.

The decision makers were generally not energy management specialists and dedicated only a tiny proportion of their time to energy management as they were busy running most other aspects of their business. The same individuals were typically also responsible for implementing their decisions within their organisation. There was some evidence that some of the employee only organisations in cluster 7 were more reliant on their staff for certain aspects of energy use; this may reflect the fact that the owners were not always

[14] The term ‘independent organisation’ is used in this report to refer to any organisation in the sample that was neither a customer facing chain nor a school.

involved in day-to-day production and some of the processes were more specialised, with certain members of staff having specialist knowledge.

External actors, including energy suppliers, brokers and consultants, trade and professional bodies and landlords, were largely said to have little, if any role to play in energy management other than family members, friends and trusted local tradespeople.

Box 1: Sample differences between clusters 3/4, 7 and 8

Cluster 3/4: Small, customer facing independents	Cluster 7: Variable energy consuming employee only sites)	Cluster 8: Offices
Sample included a mix of higher (e.g. restaurants, café, dry cleaner, hotel, hair salon) and lower (e.g. florist, garage repairers, hardware store, optician) energy consuming organisations	Sample included a mix of light manufacturing (e.g. clothing, furniture, agricultural buildings), farming (e.g. poultry, dairy) and business to business (e.g. manufacturer/ supply of electronic testing equipment) organisations	Sample included a mix of creative practices (e.g. design), business services (e.g. accountancy), industry focused consultancies (e.g. quantity surveyor), trading businesses (e.g. imports, wholesale, distribution), and health and beauty focused organisations (e.g. occupational therapy)
Operating hours vary depending on nature of business	Operate five days a week except farms	Mainly operate five days a week with occasional working outside of this, sometimes remotely
Variable energy use; sample included a mix of higher and lower energy intensity operations	Energy intensity varied from 'high' to 'low'. Workshop/farm equipment was the main use of energy; may not heat workshops	Low energy intensity operations
Mix of owner occupiers and tenants	Often tenants	Often tenants rather than owner occupiers and may be on very short rolling leases
No investment in auto-generation	Some (limited in number) use of renewables/self-sufficiency	No investment in auto-generation

Factors Influencing Energy Management

The same set of factors (external factors, key motivations, other drivers, and barriers) was found across all independent organisations and was summarised earlier (see Factors Influencing Energy Management, p16). There were very few factors that applied only or mainly to one or more of the three clusters of independent organisations and those that did are summarised below.

- **Small, customer facing independents (Cluster 3/4):** there were no 'key motivations' that applied, in particular, to this cluster although there was one 'other driver' and one 'barrier' that did apply in particular

  - **Third party recommendations**: as noted above, the recommendations of friends who were local tradespeople were sometimes a trigger for action. In contrast, there was a mistrust of specialist energy advisors
  - **Experiences of energy contracts and switching supplier:** a number of decision makers spoke about how they had switched supplier on previous occasions only to feel their energy costs had increased rather than come down. Many of them therefore took the view they were better off staying with their current provider and trying to negotiate the best rates at contract renewal.

- **Employee only sites (Cluster 7):** in terms of **'key motivations'** some cluster 7 organisations reported that they were subject to **supply chain pressures** in relation to energy management. For example, a manufacturer was a member of a procurement intermediary for the utility sector which holds data on suppliers for buyers to monitor compliance in relation to various issues including energy efficiency. This may reflect the fact that cluster 7 organisations mainly supply other businesses rather than the public. There were no 'other drivers' or 'barriers' that applied, in particular, to this cluster (i.e. the 'other drivers' and 'barriers' were shared with most other organisations in the sample). There was the evidence that cluster 7 organisations were less affected by **planning restrictions**; this may reflect locations of business/light industrial units as well as planning regulations.
- **Offices (Cluster 8:):** there were no 'key motivations', 'other drivers' or 'barriers' that applied, in particular, to this cluster. That is, the 'key motivations', 'other drivers' and 'barriers' that applied were common to most if not all organisations in the sample.

Two other variables played an important role in terms of approaches to energy management within this super cluster, namely energy intensity and size.

Energy intensity

The relationship between the energy intensity of an organisation and its approach to energy efficiency within these clusters was often difficult to determine:

- the office based organisations (cluster 8) in the sample all perceived their energy intensity to be low and this was consistent with the range of equipment they were using and the types of operations they were involved with. As a cluster, with one notable exception, they were the least active in efforts to be energy efficient (the exception was a large organisation that operated from a number of sites and decision making was centralised; as such, they were closer to the cluster 1 and 5 customer facing chains)
- when the clusters were developed, it was assumed that the employee only sites (cluster 7) would be energy intensive, taking into account the relative size of the businesses. However, it became clear during the recruitment process that a number of the organisations that otherwise met the cluster criteria considered their energy intensity to be low and, taking into account the types of equipment and the production processes in use, the cluster appears to cover a range of energy intensive operations from higher to lower; collectively, however, their approach to energy management was much the same as the cluster 8 and cluster 3/4 organisations
- the sample of small, customer facing independent organisations (cluster 3/4) was structured to explore whether organisations meeting the cluster criteria were best considered as a single cluster or whether there were clear differences between the 'higher' (cluster 3) and 'lower' (cluster 4) energy consumers (based on the types of

processes and equipment in use), making two separate clusters. While there was some evidence that the more proactive organisations were the restaurants and cafés which had relatively more energy consuming processes and equipment, this was not the case among some of the other 'higher' energy users, (such as the hotel with restaurant, the convenience stores or the hair salon).

It would therefore appear that there are more similarities than differences between these clusters in terms of energy management approaches and influences; however it may prove easier to engage those organisations that are more energy intensive with the use of smart meter data.

The importance of size

While there was some evidence that the emphasis given to energy efficiency was related to the perceived energy intensity of the operations, the thing these organisations shared in common, and which seemed to be the main reason behind their approach to energy management, was their size (number of employees and/or number of sites). With a few exceptions, the samples consisted of small and micro businesses where the owners were responsible for all aspects of running the business and who adopted a 'hands on' approach. This meant they had little time to devote to, or interest in, energy management.

The organisations from the three clusters were typically operating on low margins and cost reduction was the over-riding driver of any energy management that went on. However, overall there were many more barriers than triggers to energy management.

Although reducing energy consumption was considered a priority, in reality this often did not translate into action, in part because energy was perceived to be a relatively small proportion of their overheads and organisations were reluctant/unable to invest in energy efficiency measures.

Although some business owners claimed that they knew how to be energy efficient, this was often based on a simplistic model of turning equipment down/off. Indeed, many felt they had limited scope to control their energy use because they felt unable to turn items down/off as they were essential to the running of the business.

A lack of in-house expertise, coupled with a reluctance to engage with external 'experts', meant that organisations, and especially the small, customer facing organisations in cluster 3/4, were often reliant on the advice of family, friends, and local tradespeople.

Compared to the customer facing chains in clusters 1 and 5, and the schools in cluster 2, the smaller businesses in clusters 3/4, 7 and 8 tended to share a number of attitudes with domestic consumers (such as their reluctance to switch suppliers).

Non-users of smart meter data

Out of the 73 organisations from clusters 3/4, 7 and 8 taking part in the research, with very few exceptions, smart meter data was not being accessed or used. One small, customer facing independent business (cluster 3/4) that took part in a fact finder interview was using the data but was not willing to take part as a case study. An employee only organisation (cluster 7) had time shifted operations on the basis of static monthly consumption graphs and achieved a financial saving but other than this, they were not accessing or using the data on an on-going basis.

In most cases, non-use of the data was due to lack of awareness that the data was available, how it was accessed, and how it could be used to manage consumption (see footnote 13, p24). There were at least six examples where organisations knew they should be able to access the data but had been unable to do so. In two cases, as far as they were aware, they had not been given any means of accessing it. In three other cases, they were provided with a link to the suppliers' online portal but these had not worked. In the other case, the energy provider had said that they could not provide the data because the smart meter in question had been installed by a different provider[15].

None of the organisations recalled being provided with information or advice from energy suppliers or meter installers regarding the energy management benefits of smart meter technology other than the convenience/billing benefits associated with the fact they provide accurate meter readings remotely.

[15] Once the new Smart Meter Equipment Specification 2 (SMETS2) installations have been rolled out, this difficulty should not arise.

Schools

This chapter summarises the approaches to energy management among the schools (cluster 2)[16] that took part in the research. Those factors that applied, in particular, to the schools are outlined. Three of the six schools in the sample had accessed data from their smart meters but only the two pathfinder[17] schools were using it regularly and proactively as part of their energy management procedures. Key differences between these schools and those that were not using their smart meter data are outlined.

Context

The cluster 2 sample was very small, with just six schools taking part, and therefore even greater care is needed in interpreting the findings.

The sample comprised four secondary schools, one primary school and one nursery, lower and middle school. Three of the schools were academies and three were maintained by the local authority, including the two pathfinders.

Five of the schools were classed as 'medium' size organisations, that is, they employed in total, between 50 and 250 staff. The other school was 'small' because it employed fewer than 50 staff. Pupil numbers ranged between 200 and 1,400. The school settings were varied; a village, small and large towns, and the suburbs of large cities.

Among the schools that took part, day to day energy management decisions which did not involve large sums of money were typically the responsibility of the business manager and, where they existed, the energy manager. The head and the board of governors would be involved in decisions involving larger sums. The Senior Leadership Team was important in securing the commitment of the school to energy efficiency and making any changes in culture that would support energy management. Site managers, teaching staff, students and caretakers who tended to have a greater knowledge of, and responsibility for the plant, such as the boilers and heating systems, also played an important role in the implementation of energy management decisions.

External actors that were reported as playing some role in energy management included local authorities and energy brokers. The pathfinder schools reported that their energy

[16] Although cluster 2 covers public sector sites, the sample consisted of a small number of schools and it is not possible to say with any confidence how representative the schools were of other types of public sector organisation.
[17] Two of the schools had been nominated via DECC contacts as examples of schools that were 'leading the way'; they are referred to in the report as 'pathfinders'.

supplier played some role in energy management. Although most of the schools had been approached by energy consultants, there was little take up of the services on offer. Other potential influencers included organisations involved in buildings work, the Carbon Trust and local community interest companies and social enterprises.

Other characteristics of the sample of schools are summarised in Box 3.

Box 2: Characteristics of the schools in the sample

- Schools were in use not only for the school day during term-time, but there was also some evening, weekend and holiday use, at least for parts of the premises
- The support and prioritisation of energy efficiency by the senior leadership team was critical particularly where decisions involved larger sums
- Expertise in energy management was deemed important and was often lacking within a school; support from the local authority was helpful
- Heating was one of the main uses of energy and boilers represented significant investments. IT equipment, because of the large numbers of items, was also important and could represent a large potential waste of energy when the use was not controlled
- For those schools involved, accreditation to the Eco-schools initiative[18] may have created awareness of environmental issues but it did not always reflect real and sustained commitment to energy management
- The impact of energy management measures was amplified when energy efficiency was incorporated into the culture of a school

Factors Influencing Energy Management

The same set of factors (external factors, key motivations, other drivers, and barriers) that were operating within the other clusters was often found to be relevant to the schools taking part in the research (see Factors Influencing Energy Management, p16). There were a **small number of factors** that applied, in particular, to the schools and these are summarised below.

- **Key motivations:** as with all the other organisations taking part in the research, **cost reduction** was the key driver although, in the case of schools, this was not in order to become more profitable but to enable them to free up budget for learning at a time of severe financial constraints
- **Other drivers:** there were two drivers that applied, in particular to the schools in the sample, namely **reduction of capital budget** and **taking advantage of funding streams.** All of the schools referred to the recent reduction in their capital budget and the need to apply for grants to fund energy efficiency improvements as the cost exceeded their capital budget or there were other improvements that took priority. The

[18] Eco-Schools is an international award programme that guides schools on their sustainable journey, providing a framework to help embed these principles into the heart of school life (source: http://www.eco-schools.org.uk/

availability of financial incentives and indeed, finance generally (such as Salix loans[19]), was an important factor in determining a school's ability to put in place energy efficiency measures involving the refurbishment of buildings, the purchase of new plant or equipment, or the installation of energy management systems or renewable energy technologies.

- **Barriers:** the main barrier that applied, in particular, to the schools in the sample was a **lack of ready funding for energy efficiency measures.** While schools were often able to identify the buildings and plant that were contributing to excessive energy use, the lack of available funds to finance improvements was a major obstacle. It took time to apply for grants and some sources of funding were perceived to lack clarity in terms of potential future costs for which schools were liable.

Users and Non-users of Smart Meter Data

Three of the six schools in the sample were not using their smart meter data; in common with non-users from other clusters, two of these were unaware that smart meter data was available. The third school had only recently had the smart meter installed and although the business manager was aware that the data should be available, her attempts to access it via the supplier's website had been unsuccessful.

The other three schools made use of smart meter data to varying levels. Both pathfinder schools made regular and extensive use of data to guide energy management and engage staff/students. A third school had used data minimally (via a local authority mediated interface) and was sceptical about its value.

The key differences between the schools that were and were not using smart meter data are summarised in Box 4. Again, extreme care is needed in interpreting the findings given the very small numbers of schools in the sample.

[19] Salix is a finance company providing 100% interest-free capital to the public sector to improve their energy efficiency and reduce their carbon emissions.

Box 3: Key differences between schools using and not using smart meter data	
Users of Smart Meter data	**Non-users of Smart Meter data**
Had greater control over buildings, plant and equipment through BMS and someone with understanding of the energy systems on-site. Energy efficiency was embedded throughout the school.	Less control, sometimes due to the lack of/less use of BMS but could also be lower level of understanding of the energy systems on-site. Inconsistent and low-level (if any) attempts at encouraging energy efficiency among staff and students.
Senior leadership team and/or governing body who were interested in energy management, prioritised it in terms of staff time and sent strong signals to reinforce the culture of energy efficiency. Presence of/access to a trusted 'expert' as a key part of the decision-making process.	Senior leadership team and/or governing body who appear disinterested in energy management with consequence that little was done. No easily accessible and trusted 'expert' to make the case for energy efficiency.
Access to expertise, success building on early success in taking advantage of funding opportunities and demonstrating savings.	Not accessing or making full use of expertise, cautious approach to applying for funding, scepticism about possible savings.
Key barrier is funding for further energy efficiency improvements.	Wide range of barriers including lack of prioritisation, interest and time, expertise and funding, perceived lack of control over energy use, scepticism about savings, difficulty identifying where energy is being used and the impact of energy efficiency measures, distrust of advisors.
Reviewed smart meter data regularly to identify unusual patterns of consumption and to evaluate impact of any changes.	Unable to use smart meter data to identify opportunities for energy reduction or to demonstrate impact of any changes; in one school, had access to the data but used it sporadically and did not value it.
Culture of energy efficiency including always questioning whether could be doing more. Embedding energy efficiency in the culture of the schools. Commitment of site staff. Substantial and known cost savings had been achieved. Value put on, and use made of, micro-generation.	No culture of energy efficiency. Lack of remote control over some systems and felt unreasonable to expect site staff to control use by switching off equipment or making small changes to boilers. Low expectations of compliance by staff and students. Inability to identify savings from specific actions.

Engaging with Smart Meter Data

Those organisations that were using their smart meter data to help manage their energy were often taking advantage of services and products from external suppliers. Decision makers from organisations that were not currently using their smart meter data were shown information to illustrate how the data could be accessed and used to help manage energy consumption more effectively. Reactions to this information are summarised in this chapter.

Users of Smart Meter Data

As noted in previous chapters, a number of customer facing chains and schools were using their smart meter data as part of their energy management procedures. They were often taking advantage of a range of services and products from external organisations. These are briefly summarised here.

Accessing smart meter data

Amongst the schools who were using their smart meter data, these data was often being provided by the energy supplier or energy data management service provider, typically via a web portal which provided the option of running/downloading various reports, and which could be accessed via a PC, laptop or other, similar device. The degree of control that organisations had over the design of the data provision varied. One of the chains was using ‘off the shelf’ software to display their data while a pub chain was receiving a daily report detailing every sites’ half hourly consumption data; the report was designed internally and was in HTML5 format which allowed them to access it across a range of devices. One of the local authorities provided all the schools in the county with access to a smart meter data interface and offered training sessions on its use.

Data could be presented in various ways, for example, to compare consumption over different periods or to compare consumption across different sites.

Several of the customer facing chains were sharing the data with the managers of their individual stores (although the extent to which the store managers were using the data varied). In contrast, in at least one chain, data were only accessed by head office staff.

Added value products and services

The extent to which external providers were being used to interpret the data varied. For example, one chain said they employed an in-house analyst to do this. One of the schools was receiving data from external suppliers but was analysing and interpreting it themselves. One of the schools had noticed a spike in energy use over night and had

called in the Property Services from the local authority who adjusted the boiler optimisers and controls.

Some of the schools and customer facing chains were using exception reporting to flag up any unexpected uses of energy. In the case of the schools, this facility was built into their internal control systems while some of the chains were relying on external data monitoring organisations to provide the appropriate alerts and, in some cases, for them to also identify the likely causes and possible solutions. For example, one of the largest chains in the sample had set their BMS bureaux an energy reduction target as a KPI and this included identifying and rectifying instances of excessive consumption.

An energy consultant who took part in a case study visit described how his company converted their clients' smart meter data into charts and graphs for different periods and either left clients to interpret these themselves or provided guidance for those clients who requested it.

One restaurant chain used what they described as a form of device disaggregation to identify energy consumption at the level of individual appliances, using a database that showed the cost of operating each item of equipment based on manufacturer data.

The extent to which data were being used to set targets and provide energy users with feedback to encourage energy savings varied. The two most proactive schools were sharing their data with their students. In one case, the data was being accessed by students for educational purposes and by the STEM Club. Another school was using its data in a simple graphic form to show pupils, for example, how much energy had been saved during 'Switch Off Fortnight'. One of the restaurant chains employed consultants to interpret the data and make it easier for staff to engage with, using a traffic light system and smiley faces.

Non-users of Smart Meter Data

Context

Towards the end of the case study visits, the decision makers from organisations that were not currently using their smart meter data were shown some information to illustrate how smart meter data could be accessed and how it could be used to help manage energy consumption. Where time permitted, some of this information was also shared with decision makers from organisations that were using their smart meter data. The findings are therefore mainly based on the small, customer facing independents (cluster 3/4), the employee only sites (cluster 7), and the office based organisations (cluster 8) taking part in case study visits as none of the case study organisations were using their smart meter data. A small number of organisations from the customer facing chains (clusters 1 and 5) and the schools (cluster 2) also responded to the information. The sample sizes mean it is not possible to draw any conclusions about differences across the clusters, however overall, reactions were broadly similar.

Accessing Smart Meter Data

Decision makers were shown information about the information that was available from their smart meters, and various methods of accessing it (see Figure 6, p51 and Figure 7, p53). The preferred mode of accessing data was on a PC, laptop or tablet although a few also liked the idea of being able to access it from other devices, such as smart phones. The option of being able to print a hard copy of the data was also important to some. A

small number liked the idea of a display that was visible to staff; this very much depended on whether they felt there was any value to be gained by sharing the information.

While there was some interest in seeing their data, it was clear that the information would need to be both free and easy to understand. Having access to smart meter data was, in itself, unlikely to trigger changes in behaviour in many organisations, where they lacked the ability to translate the information into energy efficiency actions. Not everyone was convinced that the data would result in them managing their energy more efficiently, at least in part because they still lacked knowledge about what steps they could take that would be cost effective. Nevertheless, initial reactions suggested that some organisations in the sample could be encouraged to adopt a more proactive approach to energy management. This seemed to apply particularly to the **more energy intensive operations** where the organisations perceived their energy costs to be a higher element of their overheads.

For those organisations that questioned the value of being able to access their smart meter data, the idea of having to log onto a web portal in order to view their energy consumption data was seen as a barrier, mainly because they did not expect to be able to act upon the information. Moreover, the idea of on-going monitoring (i.e. regularly logging on) was not appealing and, unless they were given a reason, it could be something that was carried out once mainly out of curiosity. Even if the smart meter data triggered some immediate energy saving actions, some decision makers felt that once they had taken these actions there would be no need to continue to access and review their data. This implies a **critical window may exist** whereby some organisations engage with their smart meter data when they first have access to it and may be persuaded to take any actions deemed necessary; thereafter, they may not engage any further unless they can see benefits of doing so.

Added Value Products and Services

Decision makers were also shown some information about added value services intended to help organisations get the most from their smart meter data (see Box 8, p52 and Figure 8 to Figure 13, pp54 to 56). **Smaller organisations**, in particular, questioned the relevance of some of the ‘added value’ services that were described to them.

A **power of attorney** service whereby an organisation could be automatically switched to a cheaper tariff when it becomes available was largely rejected. The main reasons for this included; some of the organisations (especially the larger ones) were already working with a broker; a lack of trust and negative experiences of switching in the past (especially among smaller organisations); it would need to result in considerable savings because of the perceived difficulty of switching supplier, and come from a trusted source.

Some of the customer facing chains and the schools in the sample were already comparing individual outlets both with each other and/or with themselves over different periods although not necessarily taking into account variations in temperature; as such, **automated buildings performance evaluation** (a means of comparing a building’s energy performance against itself over time to help identify the extent to which energy is being used efficiently) did not appear to offer them anything new. Those who were not doing this questioned how meaningful it was. The concept of **pattern recognition** (using smart meter information to identify unusual patterns of consumption) generated a similar response. Both of these ideas often seemed irrelevant to small organisations or they thought it was likely to state ‘the obvious’. In contrast, there was some interest across the sample in **device disaggregation** which generates energy consumption profiles for

different types of equipment as it ‘drills down’ to a level that organisations can understand. Some of the **larger chains** had attempted to achieve something similar using sub-metering but had found this both expensive and not very effective; they were keen to know more.

Although it was acknowledged that engaging staff with energy savings was important, for those organisations that were not already doing so, the idea of **setting targets and providing feedback** on the extent to which these were being met was not met with any enthusiasm (see, for example, Figure 12, p56). Reactions to the idea of some form of **exception reporting**, such as an email pointing out unexpected overnight consumption, was seen as an effective way of engaging organisations although to be really effective, it should not just highlight excessive consumption but identify what might be the cause, together with steps that could be taken to address it.

There was little, if any willingness to pay for such added value services unless the savings were guaranteed and were greater than the cost of the service.

Additional methods of engaging with organisations were explored as part of the stage 2 case study visits and included the idea of having access to a **smart meter mentor**, local **networking opportunities** to share experiences and best practice, and using **case studies** to demonstrate how other organisations have reduced their energy consumption (see Figure 14, p57). All of these were of interest to some of the organisations but none of them held wide appeal.

Conclusions

This chapter summarises the implications of the research findings including the factors that influence the propensity of non-domestic organisations to engage with smart meter data. It reflects upon what we have learned about the theoretical framing of the study and sets out the potential for the use of smart meter data within energy management.

Size, Energy Intensity and Propensity to Engage With Energy Management

The cluster approach provided a context for understanding different types of organisations and sites in relation to energy management. The research also revealed that many of the same contextual factors (both enablers and barriers to the use of smart meter data) were found to be relevant across many, if not all the (super) clusters. The potential to engage organisations with smart meter data, appeared to be most closely connected with two factors which cut across the clusters: **size of organisation** and **energy intensity**.

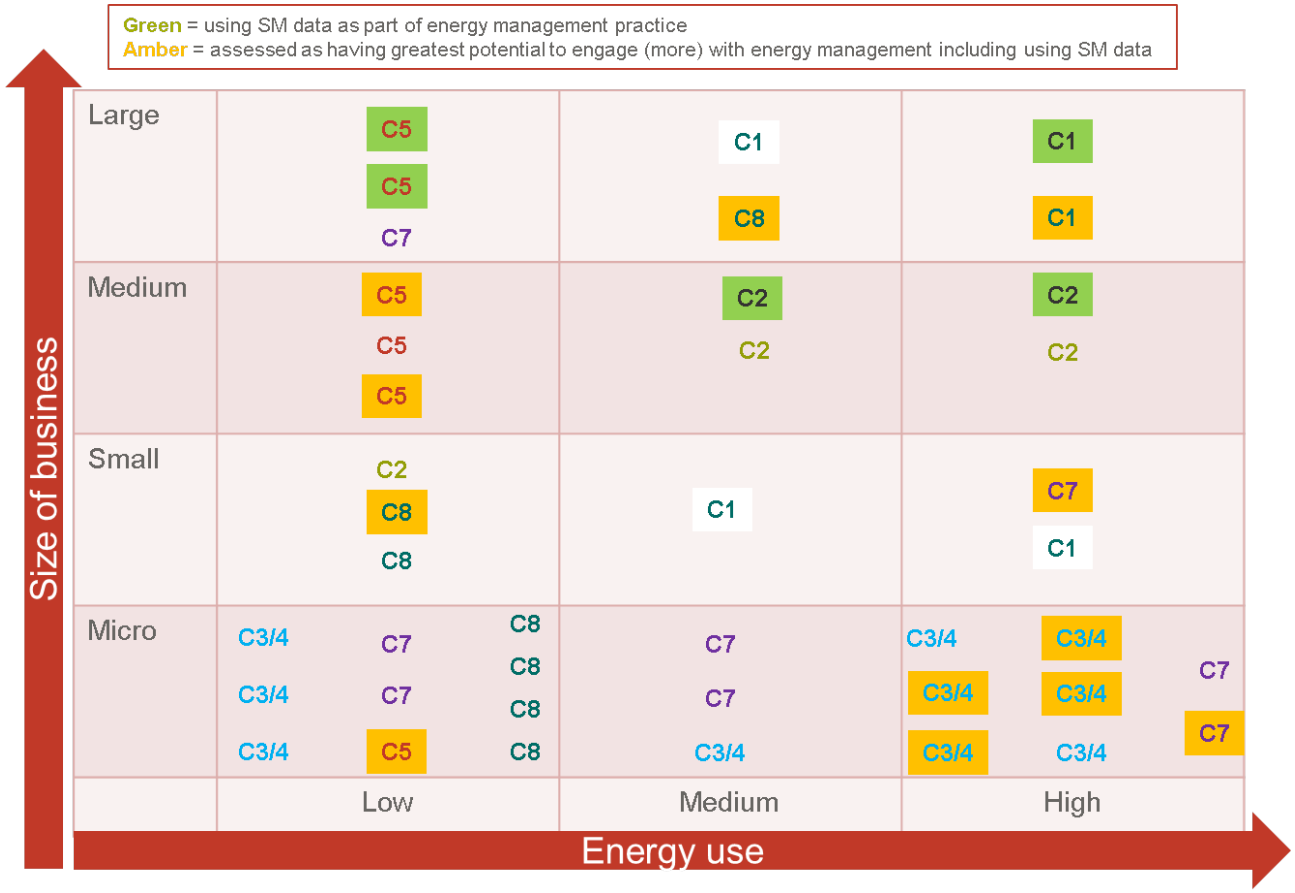
The **larger organisations** in the sample, i.e. those with more employees and chains with larger numbers of outlets, and some of the larger schools, were more likely to engage with energy management and to either be using smart meter data or be more predisposed to do so.

The relationship between **energy intensity** and the propensity to engage with energy efficiency was not so clear cut, in part because of the difficulty in deciding on a threshold for low vs. high energy intensity. Nevertheless, there was an indication that the more energy an organisation used, the more likely they were to engage with energy management.

Forty one organisations took part in a case study visit. A small number were already using their smart meter data as part of their energy management practices. Of the remainder, the researchers identified those that appeared to have the greatest potential to engage (more) with energy management including using their smart meter data. This is illustrated in Figure 4.

The numerical code (C1, C2, etc.) signifies which cluster each organisation belonged to; those shaded green were already proactively managing their energy using their smart meter data. Those shaded yellow were assessed as having the potential to engage with their smart meter data and to use it to manage their energy more effectively. The white shaded organisations were not currently using their smart meter data and were assessed as less likely to do so.

Figure 4: Size, energy use and propensity to engage with energy management



The implications of this are summarised in Figure 5 where the relationship between organisational size and use of energy is simplified into a 2 by 2 matrix.

		ENERGY USE	
		LOW	**HIGH**
SIZE	**LARGE**	**Likely to engage**	**Most likely to engage**
	SMALL	**Least likely to engage**	**Might be persuaded to engage**

Figure 5: Proposed relationship between organisational size, use of energy and propensity to engage with smart meter data

As illustrated in the matrix, the research found that:

- **small organisations with low energy use** may be the least likely to use their smart meter data; particularly for those organisations which perceive that energy is a very small percentage of their costs, that energy consumption is 'visible/obvious' and there is no/little scope to reduce consumption; moreover, they often have no interest in trying to become more energy efficient
- **small organisations with high energy use** might be persuaded to engage with their smart meter data provided this involves minimal call on their time, simple energy

efficiency actions, and reassurance that such measures will be cost effective with a short pay back period

- **large organisations with low energy use** appear likely to engage provided they know which energy efficiency measures to implement and that these will result in worthwhile savings
- **large organisations with high energy use** are the most likely to engage especially those with multiple sites due to the amplification effect; these organisations are more likely to have management skills and resource.

While this indicates that many small, low energy consuming organisations may feel there is little value in engaging with their smart meter data in order to become more energy efficient, it does not mean that they cannot be persuaded to do so. If they are provided with support and information which reflects what they can achieve within their own context, even small organisations using relatively small amounts of energy can benefit from reducing their consumption.

Key Motivations and Other Drivers of engagement with energy management

Any attempt to engage businesses with energy management needs to focus on the main drivers and triggers. These include:

- **Maximising profit/reducing cost:** communications are likely to be more effective if focused on **monetary savings** rather than being expressed in terms of kWh or CO_2 equivalents as this is how organisations think about their energy
- **Minimising the time and effort required to make savings: exception reporting** to flag unexpected uses of energy may be more likely to be effective compared to trying to encourage organisations to review their energy profiles on a regular basis
- **Reputation, climate change, sustainability etc**: larger organisations – especially those with brands – were likely to recognise the corporate value of being seen as a responsible organisation, and **government policies and initiatives** may have an important role to play as a driver of energy management. In smaller organisations, key motivations are likely to reflect the **personal values of the owners/directors** which means messaging that reflects this is more likely to be seen as relevant and 'aimed at me'. There may be lessons that can be learned from the way recycling has been promoted among smaller organisations.

Trigger points represent occasions when businesses may be more receptive to attempts to engage them with energy efficiency. These included lease renewal, premises refurbishment, equipment renewal, energy price rises, and energy contract renewal. Information that linked 'life time energy costs' to energy efficiency ratings may encourage organisations to invest in more energy efficient equipment even if the initial cost is higher if this equates with a lower 'life time' cost.

Barriers to greater engagement with smart meters?

Conversely, the research has identified a range of barriers that, if overcome, would make organisations more likely to engage with their smart meter data as part of energy management. The main types of barrier are summarised below.

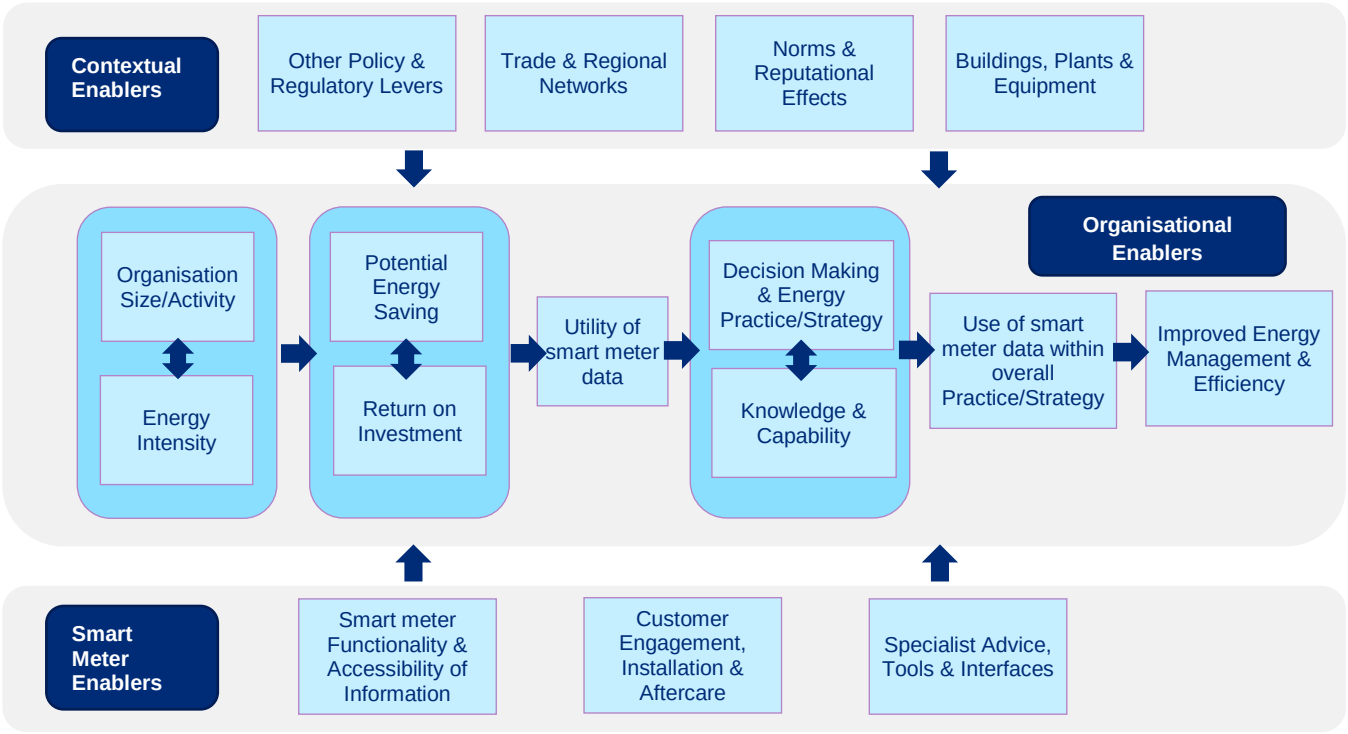
- **Lack of motivation:** the cost of energy represented a small percentage of overall costs.
- **Lack of knowledge:** for example about energy use (during/outside business hours; by different items of equipment) and what savings could be achieved and how to achieve them.
- **Staff Compliance:** most organisations were heavily reliant on staff to manage energy use but end users of energy (e.g. staff) rarely had responsibility for saving energy.
- **Lack of awareness and understanding of smart meters:** including the benefits of smart meters, and how to access and interpret smart meter data.
- **Reluctance to engage with external expertise:** Decision makers often lacked knowledge about where to look for help and lacked the time to find out. They also lacked trust in advisors and the products/services they offered and were reluctant to pay for them.
- **Other barriers:** included the condition of many of the buildings which made energy efficiency difficult, tenants were reluctant to invest in energy efficiency measures while planning restrictions could prevent energy efficient measures (e.g. double glazing in listed buildings) or investment in renewables.

Many of the barriers were the result of a lack of awareness about what was possible, which implies some barriers can be overcome through communication and education.

The Research Framework

This study was designed to have a strong theoretical underpinning to help capture and explain how the heterogeneous non-domestic sector that are/will be affected by the smart metering mandate to manage their use of energy. The research has enabled this theoretical framework to be developed and refined. The role of context – both internal and external to the organisation - have been shown to be important in determining the extent to which organisations actively manage their energy and respond to the opportunities offered by smart metering. Figure 6 illustrates the context into which smart meters are being introduced and the enablers that may promote their use by non-domestic organisations.

Figure 6: The use of smart meters in smaller non-domestic sites: context and enablers



Contextual enablers are factors that influence an organisation's decisions about energy efficiency and smart meter use. Some of these enablers are policy related – including programmes such as ESOS or building regulations; and some are to do with access to professional or regional networks which often have advisory resources. These networks can also reinforce norms and reputations – defining 'industry standards' or good practice. The presence of such enablers may make it more likely an organisation invests time and resource in energy management.

Organisational enablers include characteristics such as organisational size and business activity, energy intensity, existing knowledge and capability, and decision-making practices. The research found that, if an organisation is energy intensive and of a sufficient size, there may be greater *potential* for (and demonstrable value from) energy savings. Organisations with these characteristics may be more likely to access and use information on energy use from smart meters - although the extent of use will depend other enablers such as skills and knowledge available internally and the existence of energy-related management practices and strategies.

Smart meter enablers refer to those features of the roll-out of smart meters that might make it more likely that organisations access, understand and use information about energy use to implement changes in their organisations.

In summary, the research has highlighted the importance of understanding these contextual factors or enablers in work to ensure smart metering can help non-domestic organisations to improve their approaches to energy management and to realise the benefits from smart metering.

Energy Efficiency and the Role of Smart Meter Data

The research showed that smart meter data has the potential to prompt organisations into taking action **provided** they know how to interpret it within the context of their own operations and a cost effective solution is available. There was little evidence of organisations in the research being prompted to embark on an energy efficiency journey as a result of a smart meter installation alone. Furthermore, many of the case study organisations did not recall receiving any information or support from energy providers or meter installers around the potential benefits of smart meter data beyond the fact that they allowed remote accurate readings.

A range of considerations have been shown as relevant to realising the full potential of smart meter data:

- As a minimum, organisations being aware of the data that is available and have a means to access it
- Organisations understanding how to take advantage of their smart meters and the information it provides. In particular, being able to identify how they currently use energy, where energy is being wasted and ways of saving energy and how to measure the impact of any actions they take
- The installation visit, and the period immediately after it, provide an important opportunity for engaging decision makers, particularly if they are themselves present during the actual installation. The research found that organisations, particularly those that are smaller with less capacity to tackle energy management, might benefit from support following the smart meter installation in accessing and interpreting their data. Offering them energy use feedback in different ways that meets their specific needs and interests, for example an energy profile or comparing energy consumption both during and outside normal operating hours, may be beneficial.

Other ideas that reported by respondents included:

- The identification of ‘norms’ (if this is possible) that allow organisations to view their energy consumption relative to other, similar types of organisation/premises e.g. the baseline load for a business of a particular size/type
- Examples of best practice and real life case studies based on different size organisations from different sectors using different amounts of energy showing how they have achieved worthwhile and affordable savings
- Addressing the concerns/preconceptions about energy efficient solutions, in particular the benefits of LED lights.

The research has shown that many organisations need signposting to sources of information and advice. These respondents indicated that things like free/low cost advice delivered by not-for-profit organisations can help counter issues around lack of trust; for example, a number of local authorities promote energy efficiency. According to some of the case studies, potential influencers, such as trade and professional bodies, franchise owners and landlords also have a role to play in encouraging members, franchisees and tenants to become more energy efficient.

In summary, the research highlights the value of raising awareness about what is on offer, tackling identified barriers to accessing and interpreting data and developing appropriate products and services for independent organisations and others, and seeking synergies with broader policies and arrangements affecting energy decision-making.

Appendices

Glossary of Terms

Box 4: Glossary of Terms	
Term	Definition
Advanced meter	
Building Management System (BMS)	A Building Management System is a control system that controls and monitors the building's mechanical and electrical equipment such as ventilation, lighting, power systems, fire systems, and security systems.
CRC Energy Efficiency Scheme (CRC)	The CRC Energy Efficiency Scheme is a mandatory reporting and pricing scheme to improve energy efficiency in large public and private organisations.
Carbon Trust Standard	Carbon Trust awarded certification of an organisation's achievements in taking action on its environmental impact and tackling climate change by managing and reducing greenhouse gas (CO^2e) emissions
Common parts	All those parts of a property and any associated land which the lessee or occupier has a right to use in common with others.
Display Energy Certificate (DEC)	Since 9 July 2015 public buildings in the UK over 250m^2 must display a Display Energy Certificate (DEC). They are based upon actual energy usage of a building and are intended to promote the improvement of the energy performance of buildings.
E7 type tariffs	Economy 7 type tariffs provide cheap off-peak electricity during the night.
Electricity profile class	Load Profile represents the pattern of electricity usage of a segment of supply market customers. A load profile gives the Half-Hourly (Settlement Period) pattern or 'shape' of usage across a day (Settlement Day), and the pattern across the Settlement year, for the average customer of each of the eight profile classes. It is the proportion of demand in each settlement period that is of interest to the Settlement System.
Energy Savings Opportunity Scheme (ESOS)	The Energy Savings Opportunity Scheme (ESOS) is a mandatory requirement for all large businesses to undertake regular energy audits.
Feed In Tariff (FIT)	A Government scheme whereby a premises can apply to get payments from the energy supplier if it generates its own electricity, eg with solar panels or a wind turbine.
Full repairing and insuring leases	A lease which imposes full repairing and insuring obligations on the tenant, relieving the landlord from all liability for the cost of insurance and repairs.
Green lease	A green lease is a standard lease with additional clauses which provide for the management and improvement of the Environmental Performance of a building by both owner and occupier(s).
in-home displays (IHDs)	An In-Home Display, or IHD, is a small electrical device that works

	with a smart meter to provide consumers data about their energy use
ISO 14001	ISO 14000 is a family of standards related to environmental management that help organizations minimize how their operations negatively affect the environment, comply with applicable laws, regulations, and other environmentally oriented requirements, and continually improve in the above.
Large business/ organisation	A business/organisation with over250 employees
Medium size business/ organisation	A business/organisation with 51-250 employees
Memoranda of Understanding (MOU)	A similar arrangement as a green lease that is not legally binding
Micro-business/ organisation	The European Commission defines a micro-business as one which has fewer than ten employees and a turnover or balance sheet total of less than €2 million.
Minimum Energy Performance Standards (MEPS)	The Energy Act 2011 requires Government to introduce regulations to improve the energy efficiency of buildings in the private rented sector no later than April 2018. These are referred to as Minimum Energy Performance Standards (MEPS).
Small business/ organisation	A business/organisation with 10-50 employees
Small or medium-sized enterprise (SME)	A small or medium-sized enterprise, or SME, as defined by the European Commission is a business or company: that has fewer than 250 employees; and has either (a) annual turnover not exceeding €50 million (approximately £40 million) or (b) an annual balance-sheet total not exceeding €43 million (approximately £34 million); and of whose capital or voting rights, 25 per cent or more is not owned by one enterprise, or jointly by several enterprises, that fall outside this definition of an SME.
Smart meter	Smart meters are the next generation of gas and electricity meters and they can offer a range of intelligent functions. Consumers will have near real time information on their energy consumption to help them control and manage their energy use. Smart meters also provide consumers with more accurate information and bring an end to estimated billing. Energy suppliers are required to take all reasonable steps to install SMETS compliant smart meters in domestic and smaller non-domestic sites by the end of 2020.
SMETS compliant	The Government mandate defines a smart meter as one that is compliant with the Smart Meter Equipment Technical Specification (SMETS) and has a specified range of functions including being able to transmit meter readings to suppliers and receive data remotely.
ole trader	In the context of this research, a sole trader is someone who runs a business without any employees

Theoretical Framework

Box 5: Typology of organisations		
Clusters		
Cluster 1:	High energy consuming, customer facing chains	Stage 1
Cluster 2:	Public sector sites	Stage 2 (schools only)
Cluster 3:	High energy consuming, customer facing independents	Stage 1
Cluster 4:	Low energy consuming, customer facing independents	Stage 1
Cluster 5:	Lower energy consuming, customer facing chains	Stage 2
Cluster 6:	Lower energy consuming, employee only, limited use sites	not covered
Cluster 7:	High energy, employee only sites	Stage 2
Cluster 8:	Offices	Stage 2
Cluster 9:	Non-buildings	not covered
Key Characteristics		
Sector:	Private, Public, Voluntary	
Energy usage:	High, Medium, Low	
Site control:	Independent, Franchise, Under central control	
Building occupancy:	Multiple building occupants vs. single building occupant	
On site presence:	Employees only, Customer facing, Limited occupants, No occupants	
Main source of energy use:	Large equipment, small high consuming equipment, heating, lighting	
Size (number of employees):	Large, medium, small or micro-businesses	

It should be noted that the difference between ‘high’ and ‘lower’ energy consumption is based on the type of operation, the processes undertaken and the range of equipment in use and not on any measure of the actual energy consumption. This is because there is no easy or straightforward way of defining ‘high’ or ‘low’ energy consumption. As well as having accurate data on energy consumption, it would be necessary to have accurate data on the size of a site to arrive at a measure of energy intensity. Experience of conducting research in the non-domestic sector found that many organisations will not hold accurate information about their energy consumption and even fewer will have details of the size of the site they occupy.

Box 6: Contextual Factors	
External Context	**Organisational Context**
Technological innovation that has resulted in increased energy use which needs to be managed	Legal arrangements, e.g. building lease, which have an influence on the tenant's ability to mange their energy
Reputational drivers – wanting to be seen as 'green', 'energy efficient'	Energy intensity of operations and premises
Financial incentives or commitments to reduce consumption e.g. environmental awards	Building management incentives and structure e.g. organisational arrangements and/or incentives to reduce consumption
Government policy drivers e.g. CRC Energy Efficiency Scheme (CRC), Climate Change Agreements (CCAs), Climate Change Levy, Energy Savings Opportunity Scheme (ESOS)	Occupancy patterns (one vs. multiple building occupants) and who occupies the building including public access
Competition and profit margins	Basis on which energy leases and/or costs are recovered e.g. where tenant pays energy as part of rent/service charge
Energy price	Process standardisation or Quality Assurance e.g. extent to which energy management systems are standardised
Climate change	Human resources, organisational culture and/or structure e.g. extent to which energy efficiency is systematised
	Active building facilities management
	Budgeting and financial control arrangement
	Operations and premises – types of business and activities taking place, hour of operation, etc; main uses of energy
	Business site composition and control e.g. where energy efficiency is driven by central management
	Size of organisation (large: 250+; medium: 51-249; small: 11-50; micro: <11 employees)

Smart Meter Context	Mediator/Information Provider/Analyst
Price comparison sites which allow organisations to compare different tariffs	Trade association
Display Energy Certificates	Aggregated or collective e.g. retail groupings such as LONDIS or SPAR
Benchmarking e.g. comparing energy efficiency across sites	Equipment supplier
Building performance analysis and data analytics	Site or portfolio energy manager
Sub-metering	Site/portfolio facilities manager
Meter functionality – traditional, advanced or smart	Energy Management service provider e.g. Automated Monitoring and Tracking (aM&T)
Utility engagement strategy	Energy broker
Installation process	Utilities e.g. may provide energy management services
Business Trigger	**Motivation**
Energy contract renewal	Cross site learning
Supply chain access – may need to demonstrate energy efficiency to become a supplier	Motivated facilities manager
Asset renewal e.g. equipment	Public and/or stakeholder feedback – desire to be seen as 'green' is seen as important in terms of customers and/or stakeholders
Lease renewal	Corporate Social Responsibility (CSR)
Refurbishment	Compliance with regulations
New build or start-up	Carbon targets – has set itself carbon targets
	Cost, cost-benefit, payback – where energy is a high percentage of costs, specific actions result in sufficient payback that make investment worthwhile
	Efficiency – wants to be seen as an efficient enterprise

Research Questions

Box 7: Research Questions

- How does the population of smaller non-domestic sites covered by the smart metering mandate use energy and make energy efficiency related decisions? How do these uses and decision-making processes vary according to key characteristics?

- In what ways do different types (i.e. clusters) of smaller non-domestic sites covered by the smart metering mandate interact with;

  - other key influencing actors (e.g. energy suppliers, facilities managers, landlords)?
  - other influences on energy management (e.g. energy prices, reputational and/or corporate social responsibility)?

- How does data from smart meters contribute or have the potential to contribute to improved energy management, energy efficiency and reduced energy consumption in smaller non-domestic sites? What are the barriers to improvements? How does this differ for different types of smaller non-domestic sites?

- Based on an understanding of the support, products and services being (or planned to be) provided to help increase awareness, what is the level of understanding and use of smart meter data within small-non domestic sites? What has been or is likely to be the take-up or response from non-domestic sites?

- What are the implications for maximising the benefits of smart meters (in smaller non-domestic sites)?

Stimulus Materials

Different sets of stimulus materials were used during stage 1 and stage 2.

Stage 1 stimulus material

The following stimulus materials were used with higher energy, customer facing chains (cluster 1), Schools (cluster 2) and a proportion of the small, customer facing independents (cluster 3/4).

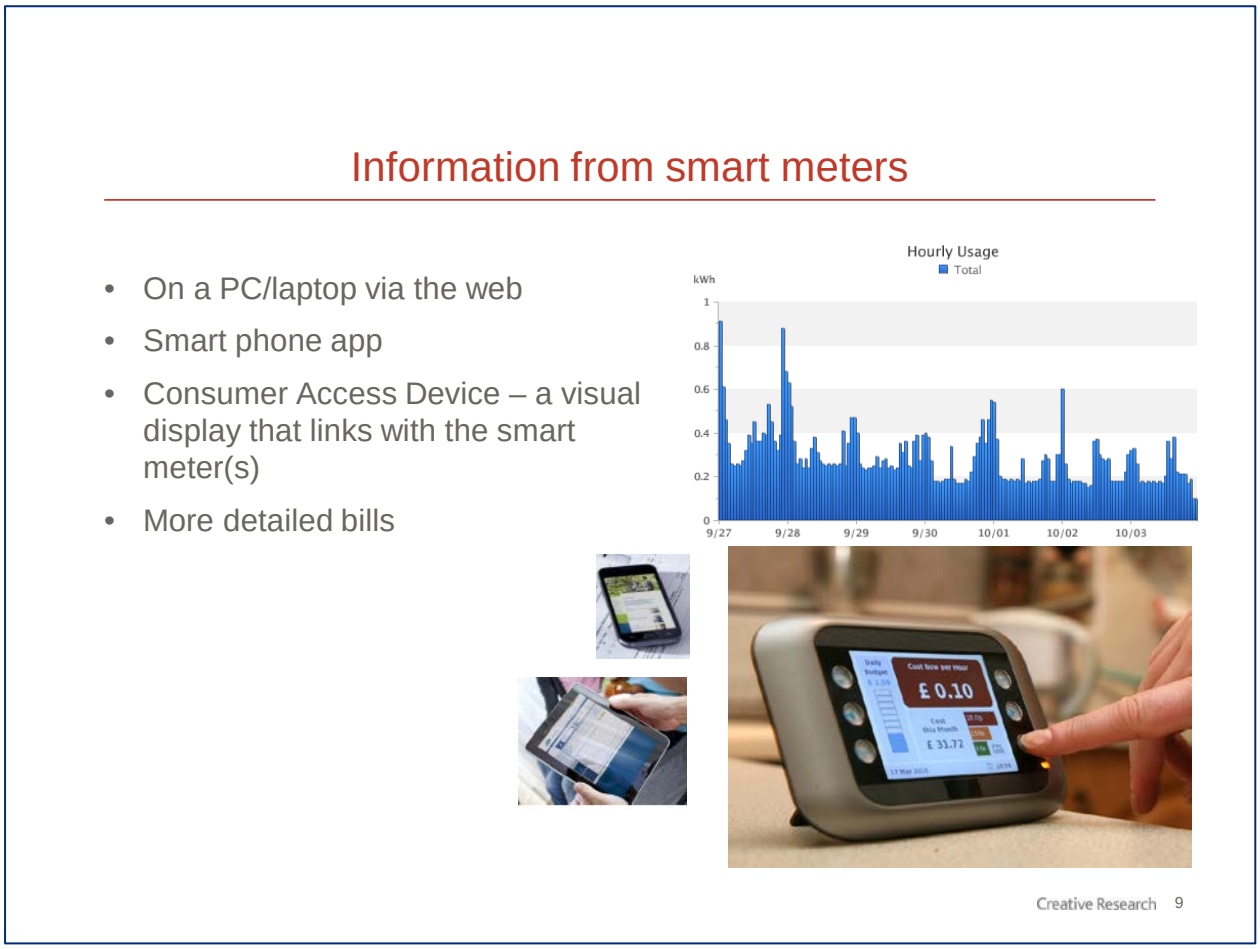


Figure 6: Information from smart meters

Power of Attorney Service
• Cheap Energy Club is an existing ‘power of attorney’ service for domestic energy customers • Subscribers enter data including their current supplier, previous consumption, etc. • They are sent an email automatically once a cheaper deal becomes available • Smart meters means that accurate consumption data could be used
Automated building performance evaluation
• Smart meter data can be used to compare the current energy use of your business premises with the energy use over time, taking into account weather related fluctuations. This can help identify the extent to which energy is being used efficiently • Where this reveals that energy is being used less efficiently, the service could provide ideas and advice on what is causing this as well as suggestions for improvements • By comparing a building’s energy performance against itself overcomes the problems of comparing two different buildings • For example, two hotels, one urban and one rural near to a lake, with a similar building fabric and number of rooms may have a large difference in heating requirements in winter and any benchmarking programme would struggle to account for this
Pattern recognition
• Pattern recognition technology can use smart meter information to identify, for example: • Heating or cooling comes on too soon or switches off too late • Boilers, or other heating components such as heat exchangers, are the wrong size for a building • Building energy management systems have been manually overridden and not re-set • Insights/recommendations can be sent to building managers and occupants; e.g. • “high gas and electricity consumption indicates that heating and cooling systems are working simultaneously” • “your building’s lights are on all night” • “changing your air conditioning filters will pay back in approximately eight months” • “you should change your air-conditioning settings to X today due to the weather forecast”
Device disaggregation
• A range of technologies that allow you to understand the electricity consumption per device. For example, a smart plug that sits between the plug on the appliance and the socket • This could inform you about items of equipment that are using the most energy, as well as those using more energy than they should be, such as an air con unit that needs servicing

Box 8: Products and Services Intended to Help Businesses make Better Use of the Information from Smart Meters

Stage 2 stimulus material

The following stimulus materials were used with a proportion of the small, customer facing independents (cluster 3/4), lower energy consuming, customer facing chains (cluster 5), employee only sites (cluster 7) and organisations occupying offices (cluster 8).

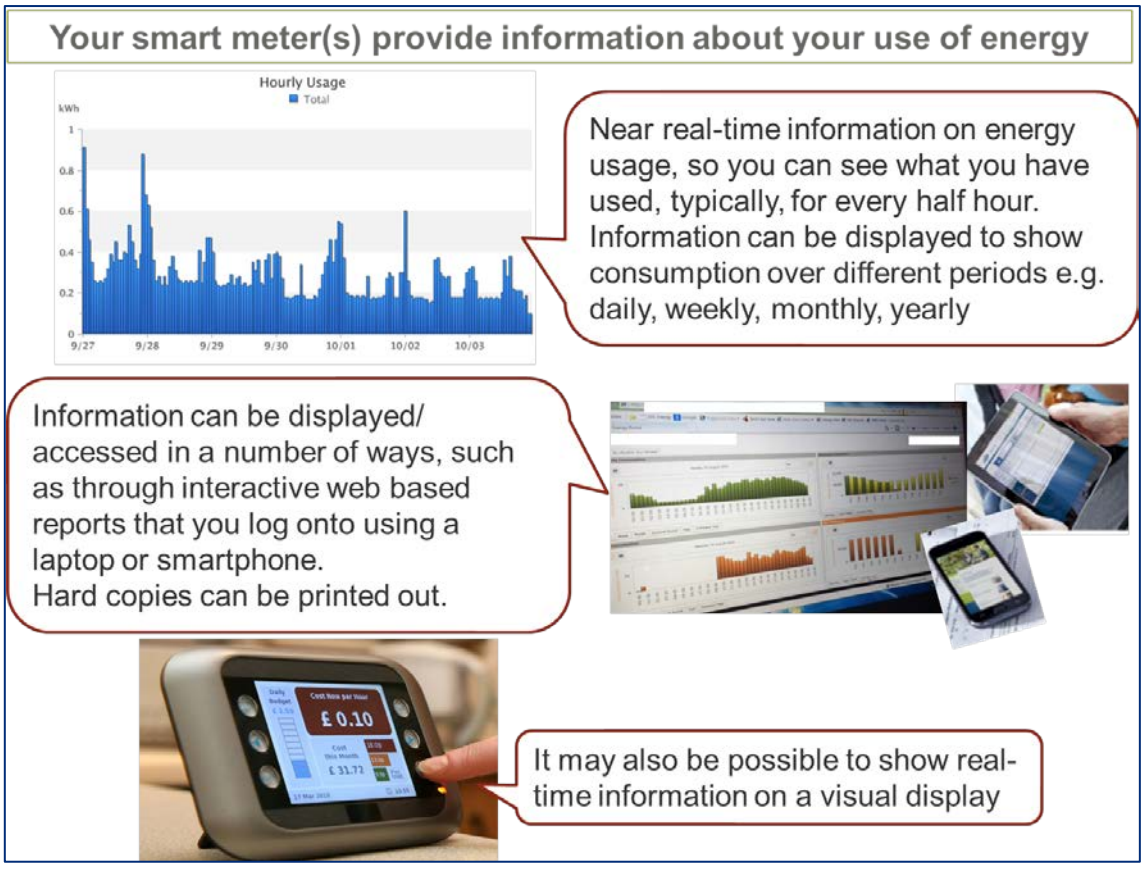


Figure 7: Methods of accessing data

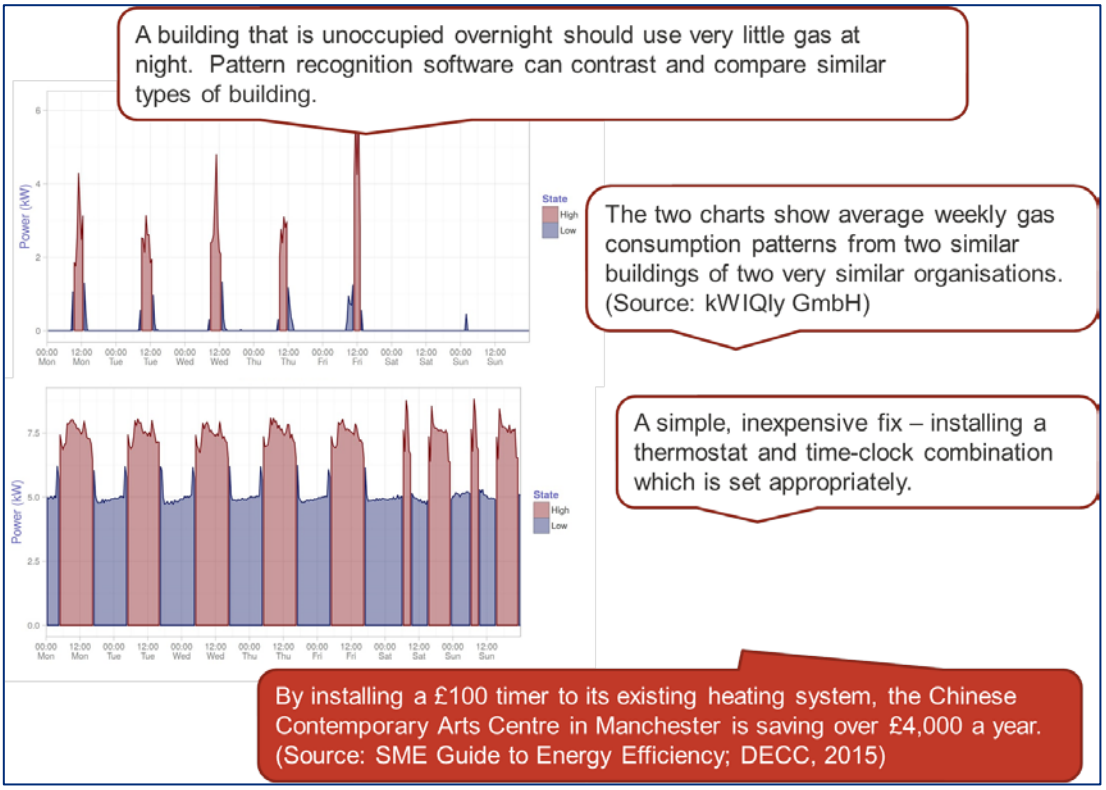


Figure 8: Example of pattern recognition (heating vs. external temperature)

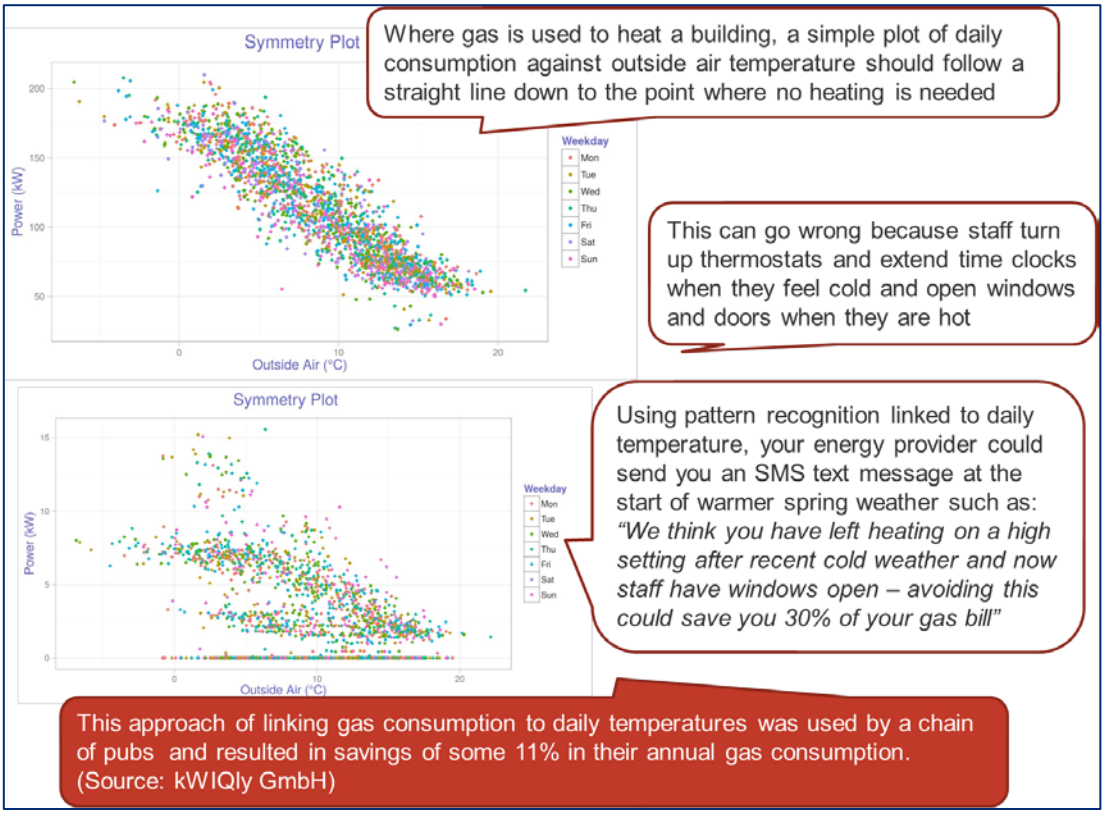


Figure 9: Example of pattern recognition (heating)

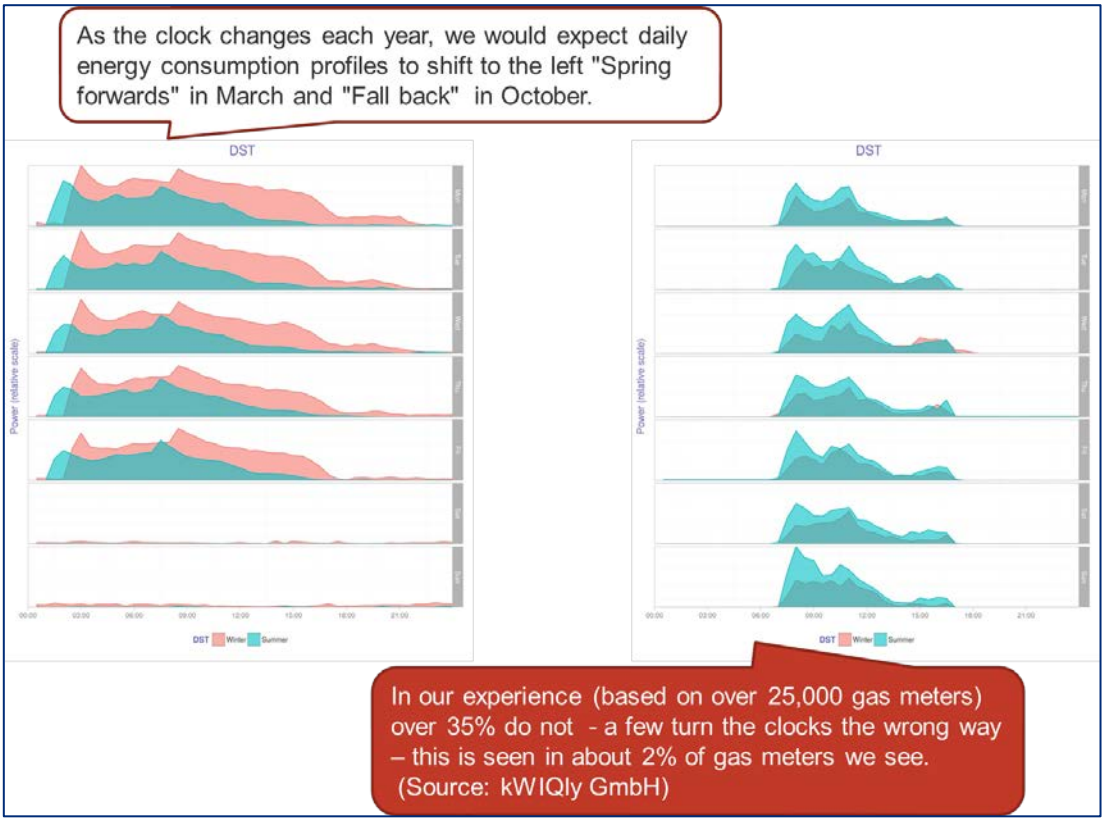


Figure 10: Example of pattern recognition (British Summer Time)

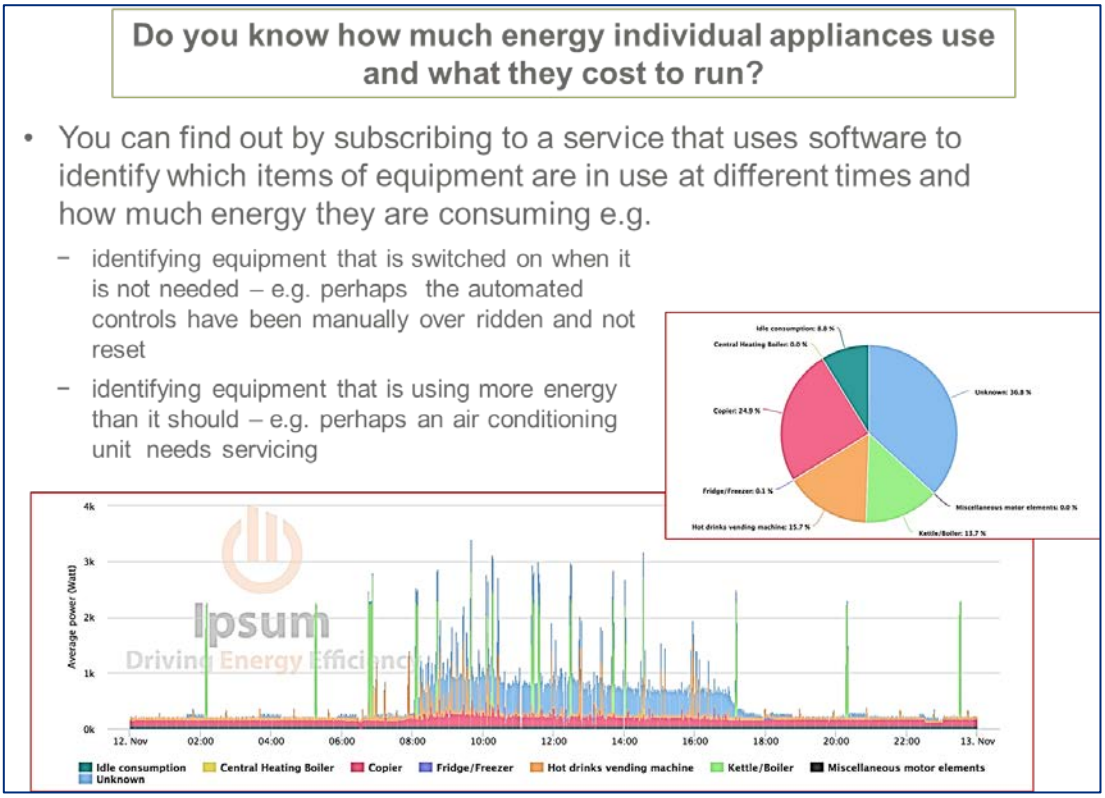


Figure 11: Example of device disaggregation

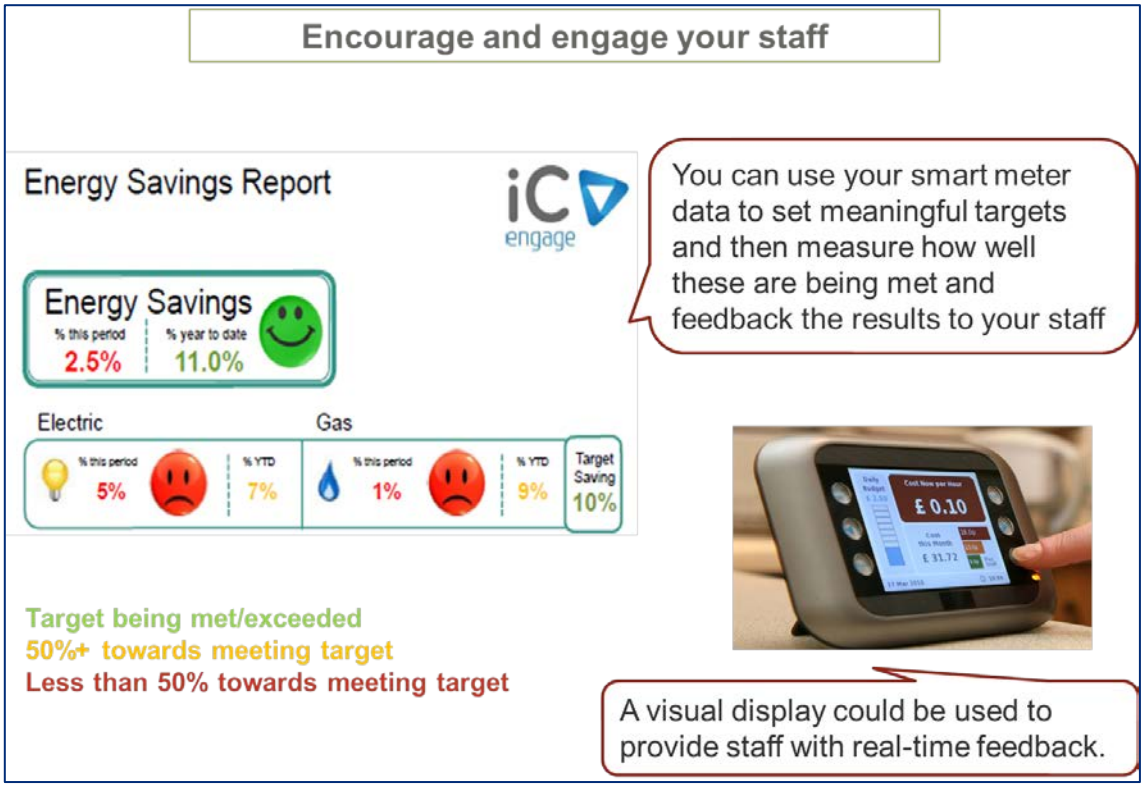


Figure 12: Staff engagement (individual site)

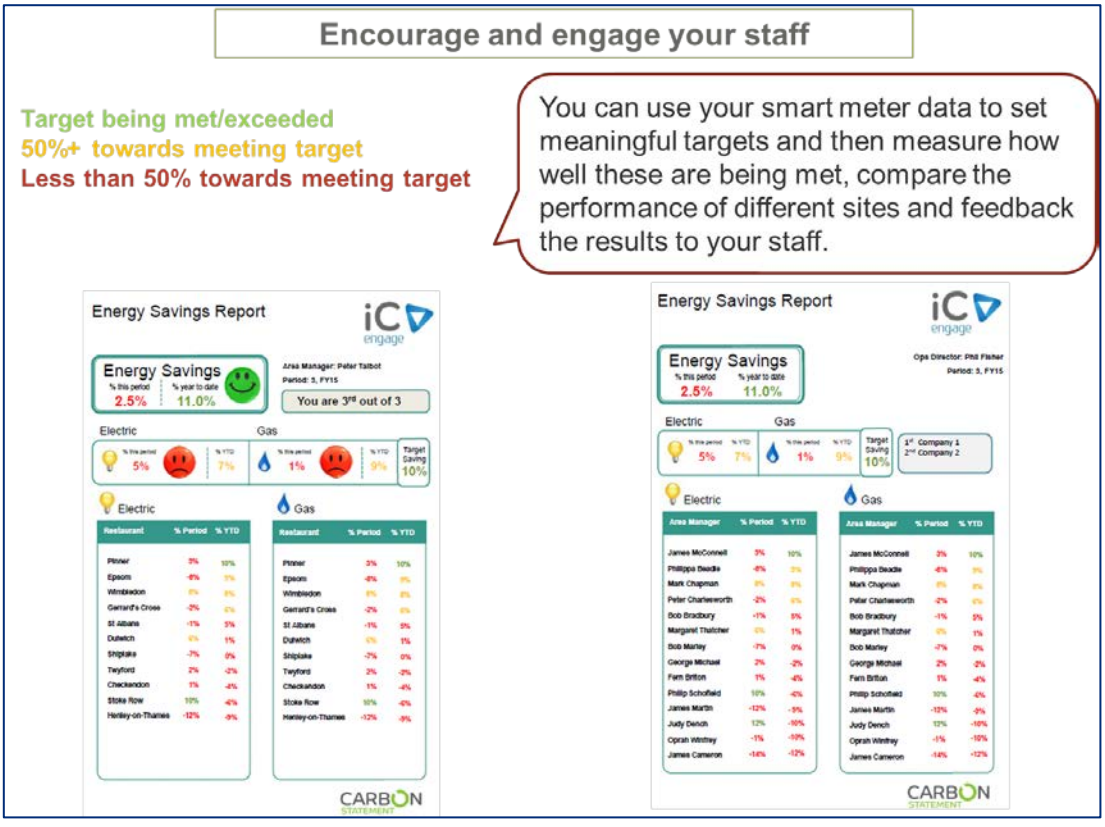


Figure 13: Staff engagement (multi-sites)

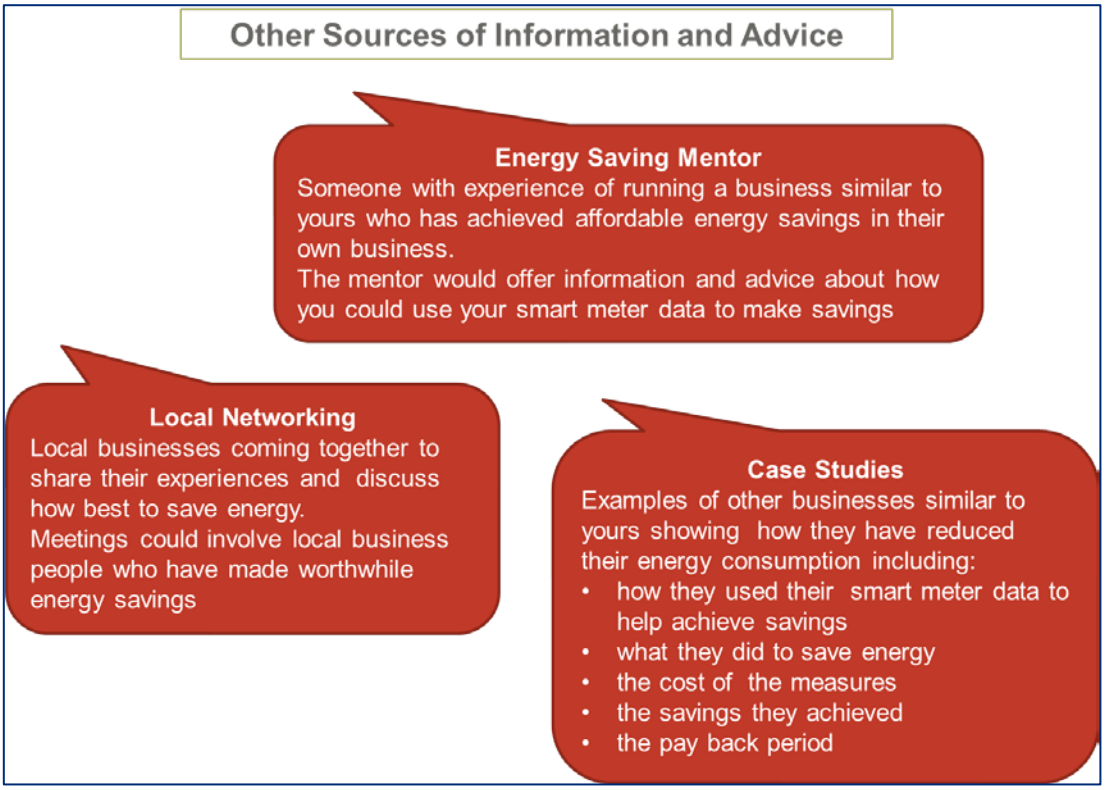


Figure 14: Other sources of information and advice

List of Reports

Non-Domestic Smart Metering Early Learning Research reports:

- Main Report
- Annex 1: Cluster 1 - Higher energy, customer facing chains
- Annex 2: Cluster 2 - Small Public Sector Sites (Schools)
- Annex 3: Cluster 3 & 4 - Small, customer facing independents
- Annex 4: Cluster 5 - Lower energy, customer facing chains
- Annex 5: Cluster 7 - Higher energy, employee only sites
- Annex 6: Cluster 8 – Offices
- Annex 7: Landlords & Tenants
- Technical Report

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