Department for
Business, Energy
& Industrial Strategy

SMART METERING NON-DOMESTIC 'EARLY LEARNING'

Annex 5: Cluster 7 – Higher and lower energy, employee only sites

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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

This is one of seven cluster specific annexes which, together with the main report and the technical report, sets out the findings and conclusions from research designed to provide 'early learning' in relation to the installation and use of smart meters in non-domestic premises[1]. This annex focuses on Cluster 7 - a sample of higher energy consuming, employee only sites.

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 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.

[1] A list of the full set of reports is provided in the appendices; see List of Reports, p.42.

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;

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

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]

A typology of nine clusters was developed before the start of this research and this guided the case study selection. This was based on nine broad clusters of sites which are defined with respect to a number of key characteristics – those most important characteristics

[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.

which help to differentiate the clusters are: public vs. private sector; relative energy intensity; independent vs. multi-site organisation; whether or not customer facing.

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 1.

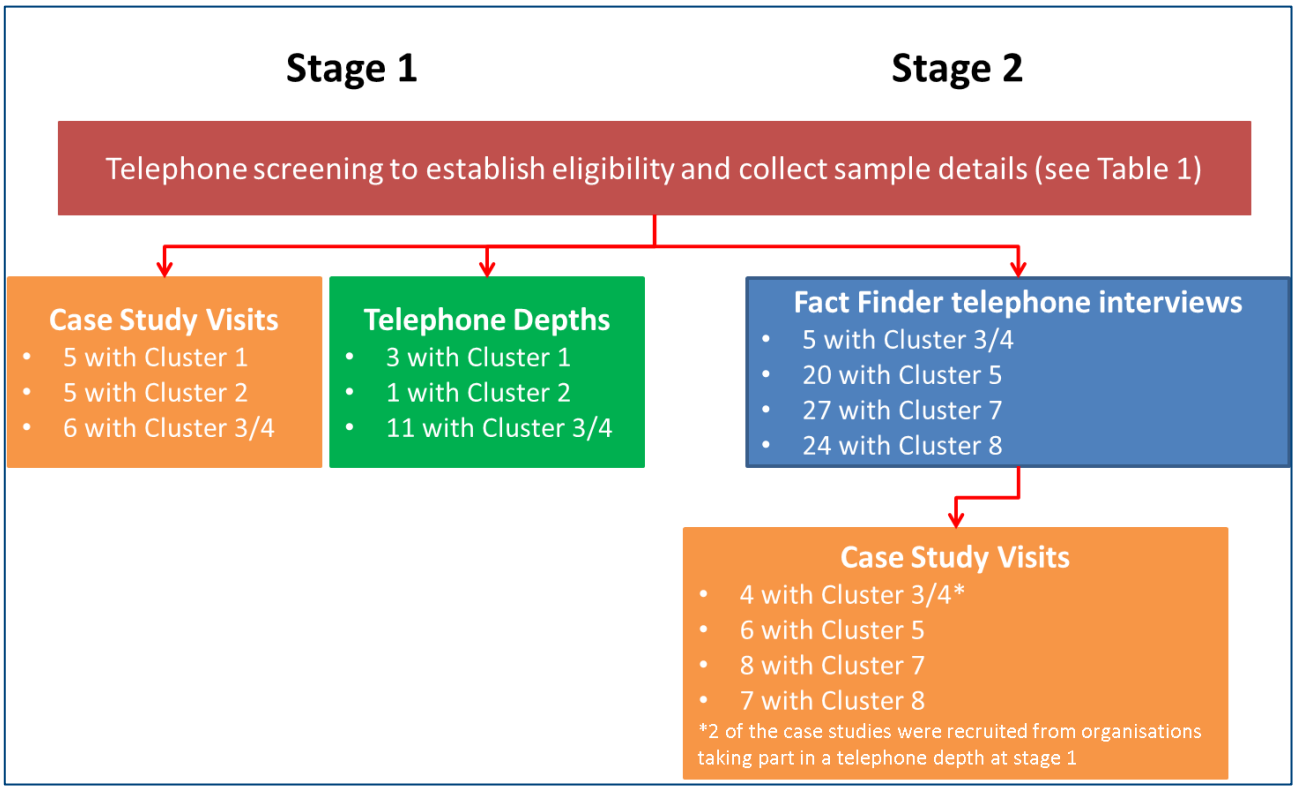

Figure 1: Flow chart of research method

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.

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

Stage 2 comprised:

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

Cluster 7 Sample

Twenty seven energy management decision makers took part in the fact finder interviews. Sixteen internal actors also participated in eight case study visits: twelve energy management decision makers, two implementers of such decisions and two users of energy. Two of the case studies involved telephone interviews with the landlords/managing agents of tenants. Broad quotas were set to ensure the sample included a spread of organisations in terms of business type, energy use, location and tenure. Information was also recorded about the size of the organisation (based on number of employees), the number of sites within each chain, whether responsibility for energy management was focused at the individual sites or head office, how energy bills were paid, the types of energy and meters in use, and the perceived importance of reducing energy consumption. A summary of the sample is provided in Table 1.

Table 1: Sample summary

Total sample: 27, of which, eight were case studies

Region			**Locus of control**		
East	2	(1)	Individual site	27	(8)
E Mids	4	(1)	Head office	-	
London	2	(1)			
N East	2		**Tenure**		
N West	3		Owner occupier	9	(2)

[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

S East	4	(2)	Tenant	18	(6)
S West	2	(1)	**Energy bills**		
W Mids	3		Paid direct	27	(8)
York & Humber	3		Included in rent	-	
Scotland	1	(1)	**Energy types**		
Wales	1	(1)	Electricity	27	(8)
Size of organisation (total employee number)			Gas	7	(4)
Sole trader	-		Other	3	(3)
Micro (<10)	25	(7)	**Type of meter**		
Small (<50)			Smart/advanced electricity	27	(8)
Medium (<250)	1		Smart/advanced gas	6	(2)
Large (250+)	1	(1)	**Importance of reducing energy use**		
Number of sites			High	18	(5)
Single	22	(7)	Medium	6	(3)
Multiple	5	(1)	Low	-	

Most of the information in the table relates to a single case study site. Where an organisation had more than one site, the fact finder interviews focused on a single site which then became the case study site where the participant agreed to take part in this element of the research. For these multiple sites, 'size of organisation', 'number of sites', and 'the importance of reducing energy use', apply to the organisation as a whole. The individual cells of the table show both the overall number of organisations in the cluster 7 sample and, in brackets, the number of these taking part as a case study.

Interpreting the Findings

The findings in this report provide insights into how different cluster 7 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 higher and lower energy consuming, employee only 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 was not designed to be statistically representative of the wider population.

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 and fact finder/depth interviews 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'.

Report Structure

The next chapter (Key characteristics, energy use and the role of potential influencers) provides a summary of the key characteristics of the sample, how energy was being used, and who was influencing its use. This is followed by a consideration the energy efficiency culture found within employee only (non-office) sites, along with the range of energy efficiency measures that had been adopted. The factors that were driving energy efficiency, the potential triggers and the barriers to (greater) efficiency are also set out (Energy Management). The chapter headed Smart Meters summarises the reasons why smart meters had been installed, why some organisations were not using their smart meter data, and the experiences of those that were using their smart meter data. The reactions of non-users to a number of products and services intended to help organisations get the most from their smart meter data are considered, along with possible ways of encouraging greater engagement with smart meter data among non-users. The final chapter sets out the conclusions of the research (Conclusions).

Verbatims are used to illustrate some of the findings and are shown with the cluster number, the type of organisation and the role of the individual providing it (DM: decision maker; I: implementer; U: user; LL: landlord/managing agent; EC: energy consultant)

Key characteristics, energy use and the role of potential influencers

This chapter provides a summary of the key characteristics of the sample, how energy was being used, and who was influencing its use.

The findings provide a description of what was found in the case studies and wider interviews, illustrate the diversity of different behaviours and views, and provide a more in-depth explanation compared to a quantitative survey. This information provides important context for the findings in later chapters which describe energy management activity and associated influences, and experiences of smart meters.

The research was not designed to provide answers to 'how many' type questions and the findings should not be interpreted as indicating the prevalence of such behaviours and opinions within the wider population of non-domestic energy consumers operating from smaller sites. References to the sample refer to the 27 businesses that took part in the fact finder interview. Where findings only relate to one or more of the eight organisations which also took part in a case study, this is indicated in the text.

Nature of Business

Business type

The sample comprised mainly light manufacturing (for example; clothing, furniture, conservatory roof, and agricultural buildings), farming (for example, poultry, dairy) and businesses selling to other businesses (for example, making and supplying electronic testing equipment and lighting) with some focusing on repair and distribution rather than manufacturing (for example, diesel fuel injection repairers).

Business size

25 of the 27 organisations were small or micro businesses with fewer than 50 employees, one was classed as a medium size business (with between 50 and 250 employees) while the other was technically a large business due to the fact that it was the UK operation of a large US company. The UK site however, was a micro business. Most of the organisations were operating from a single site. A small number of organisations operated from more than one site; although energy management might have been systematised across different sites (for example, the poultry farm had three similar outlets) by the same individual, there was no evidence of a 'head office' function.

Business operating hours

With the exception of the farms which were operating seven days a week, most of the businesses in the sample operated Monday to Friday, with occasional Saturday working to meet exceptional demand.

Nature and Management of Buildings

Tenure

In many cases, the sample site was rented. The tenants in the sample were mainly on full insuring and repairing leases (at least for the internal parts) and most were for terms of 10 years or less. A small number reported that they had indefinite or annual rolling leases, while another was on a 30 day notice period. In addition to a business which rented its premises from the owner of the business, another business said that the landlord was a former owner of the business who had since retired.

In all cases, energy supply, bills and the metering arrangements were the responsibility of the tenants[6]. Although none of the businesses reported having common parts[7], a number were paying a service charge to cover costs, such as insurance premiums and repairs.

Condition and management of buildings

Two of the three farms included in the sample said that their buildings were purpose built for their livestock. In a small number of further cases respondents reported that the building was well insulated. Many of the sites involved some combination of workshops (typically, large, high ceilinged spaces) with some office space. Several of the sites had ceiling but not wall insulation and some sites heated the office area but not the workshop. The workshops often had large, floor to ceiling, doors/shutters which were often kept open all day.

Only one of the organisations had a full-time facilities person. In most cases, there was either no active facilities management or this was included as a very small part of the role of a member of staff, usually the business owner.

Very few organisations had automated Building Management Systems (BMS)[8]. This

> We have a small BMS covering our heating and lighting. It's not really necessary due to the small size of the premises, but we manufacture BMS control units so it looks good to our customers if we are using the system. (C7; manufacturer of control panels, DM)

[6] This may not reflect the wider situation. Attempts were made to include in the research some landlords who were managing multi-occupancy sites and where the landlord was responsible for energy bills. In the event, this proved to be very difficult.

[7] All those parts of a property and any associated land which the lessee or occupier has a right to use in common with others.

[8] 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.

included one of the farms, which had recently made a big investment in new livestock facilities, although this had not resulted in reduced energy consumption. Any problems were dealt with by the contractor, who monitored conditions against industry norms to identify any problems. Another business sold BMS control systems so felt that they should use one themselves even though they felt that their premises did not require it.

Environmental policy and energy audit

Most of the businesses in the sample did not have an environmental policy and, where they did, in some cases the decision-maker did not know what it covered. In at least one case the environmental policy was described as 'off the shelf'. In other cases, it said nothing about energy, with one decision-maker reporting that it was mainly about recycling.

One of the farms did not have a formal environmental policy because they underwent a number of inspections by different bodies, including customers, the Environment Agency, Defra and an animal welfare scheme. Each required information in a different format, so they found it easier to complete the various forms as required.

Most of the businesses had not undertaken an energy audit but where they had, it had mainly resulted in the installation of LED lighting.

Only one business was ISO 14001 registered. This was part of a US company and, in anticipation of head office requirements, they had achieved the standard. Compliance required an annual self-audit and target setting. However, they were conscious not to set overly ambitious targets as this would restrict apparent progress in future years.

Energy Use

Types of energy and meters

All the businesses in the sample had one or more smart/advanced electricity meter[9]. A few organisations also had at least one smart/advanced gas meter, a number had traditional gas meters although quite a few had no gas on site and another did not use it although it was supplied. One organisation had installed renewable energy, another was at an advanced planning stage to do so and a third used a wood burner for heating.

Energy intensity and main uses of energy

In developing the clusters on which this research was based, the assumption was that organisations in this cluster would be energy intensive, taking into account the relative size of different businesses. Energy intensity was gauged by asking if the organisation used any equipment, tools or IT on site, which were considered to be particularly high users of energy. On this basis 15 organisations were rated as high energy users and 12 were rated

[9] 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 (please see Background, p1 for further details).

as lower energy users. However, perceptions of what represents high or low energy intensity were subjective. For example, as the quote illustrates, one of the organisations that described itself as 'low energy intensity' was using a wide range of different equipment, some of which might be considered as 'energy intensive'. Another respondent who rated their energy intensity as low overall was using forklift trucks that were recharged overnight and which he described as 'high users of energy'.

> The office has strip lights, four PC's, a server, a combination printer and one inkjet, a telephone system, fan heaters, a mains 3D printer and a broadband router. Also a kettle, microwave, coffee machine, fridge and water cooler. The electrical workshop has strip lights, electrical test equipment like oscilloscopes, soldering irons, extractor fans and a hot air gun. The mechanical workshop has lathes, a milling machine, a 15kw heater (3 phase), a band saw, grinders, a tool sharpener, pillar drills, a compressor and an AC unit. (C7; designer and manufacturer of vehicle computer control systems; DM)

Table 2 shows the main uses of energy.

Table 2: Main uses of energy

Workshop/farm equipment	compressors, saws/cutters/routers, lathes, welders, forklift trucks, hand tools, extraction, milking machines, environmental control, automatic feeders
Lighting	mainly a mix of LED and fluorescent
Heating	mix of electric and gas hearing; some workshops unheated; 2 also use oil
IT	computers, security systems, phone systems, printers/copiers, servers
Staff Kitchen/canteen	kettle, microwave, fridge, toasters, hand driers, hot water
Renewables	biomass boiler, solar PV, wood burner

Workshop equipment was perceived as the main use, followed by lighting and, in the winter, heating; not all sites had air conditioning and not all sites were heating their workshops. In contrast, a couple of businesses reported that the ambient temperature affected their production process and therefore some heating was required otherwise other costs, including increased production time, were incurred. Where some form of heating was in use, some of the case study visits found that heaters were left on constantly, including when the business was

> The little bathrooms have little heaters which work on a dial which switch themselves on and off. We just have them set to the freeze setting so it doesn't freeze in there. (C7; manufacturer and repairer of agricultural buildings and equipment; DM)

closed; this was to prevent pipes from freezing, or to air work clothes, and/or to ensure the office was warm when workers arrived in the morning. Several of the businesses also left computers on standby 24/7.

Variation in energy consumption

Some organisations felt that there was little variation in their energy use either on a daily or a seasonal basis. Others felt that consumption was seasonal due to higher heating and lighting consumption during winter months. Yet others said it varied according to workloads and/or the extent to which staff were working off site. The poultry farm's consumption was tied to the hens' life cycle.

> The lights, feeders and waterers are on a timer controlled system, there is a cycle of timings depending on the life cycle stage the chickens are at (this does not sync into a 24 hour cycle). The growth cycle lasts 2 months. We have to use the vents mainly in the summer to cool the barns and the biomass boiler in the winter to heat them. This means our summer electricity use is generally higher than the

Energy as a proportion of total operating costs

Most of the decision-makers who were able to estimate the proportion of operating costs accounted for by energy said it was less than 10 per cent. This was classed as 'tiny', 'small' by many of the organisations, and as 'medium' or 'high' by the remainder. Again, this was based on respondents' perceptions which may not always have been accurate; for example, it was estimated at 50 per cent in one fact finder interview, but during the case study visit an interview with the finance manager found that energy actually accounted for four per cent of operating costs.

The highest proportion of operating costs was said by some to be staff and materials.

> **In terms of your operating costs, how much or what proportion goes on your energy bills roughly?...**
>
> … I would say it's a small proportion compared to our wages and everything else. I wouldn't like to guess…
>
> **…So 10% or less?...**
>
> …Yes I would expect. I wouldn't say it was more than that…
>
> **…Okay, so obviously you've got your wages costs which is probably going to be one of your highest things…**
>
> …Yes and also the buying of our steel and everything, that's another, the goods we buy in. (C7; manufacturer and repairer of agricultural buildings and equipment; DM)

Importance attached to reducing energy consumption

Most of the businesses said that reducing

energy consumption was of high importance, with the remainder saying it was of medium importance. Even some of those who estimated energy as a small or tiny part of their operating costs gave a high priority to reducing consumption and to energy efficiency.

> At the moment I've got control because I know where all the battery drills and all the chargers are, so basically I go round [when closing up] and knock lights off and they're in one place. (C7; manufacturer of storage boxes; DM)

Perceived level of control over energy use

Most businesses thought that they had reasonable control over their energy use largely because they were small enough for the decision makers to be able to *"see what was going on"* and/or because *"staff are on board with energy saving".* They also often felt they had done as much as they could to minimise energy use. Moreover, some businesses saw an increase in energy use as an indication that business had increased.

> If we had a blip like that [points to one of the stimulus material charts] I would just say, 'oh, we've got a lot of work in and we're using a lot of machinery, a lot of power'. I look at that as not a bad thing, that's a good thing for work. (C7; sign maker; DM)

The business that reported limited control felt that higher usage levels were a result of the specialist machinery they used. In a similar vein, during the case study visits, some decision-makers felt that they had no choice but to use equipment when it was needed and that this limited their control. It also meant that detailed information on usage was not seen as useful in controlling energy consumption.

Decision Makers and Key Influencers: Internal Actors

An internal actor is anyone employed within the organisation who may influence energy management.

Role of decision maker

The job title of the energy decision maker varied widely across the sample and included owners, partners and directors of the business, various managerial staff (including production, technical, operations, facilities and general managers), those involved on the accounting side (including financial controllers and account managers), those involved in administration (for example, secretary, administrator) and, in the case of one of the farms, herds person. They were all dealing with energy related

> What can you do, a welder uses the amount that a welder uses? You can't turn that down so it's not using so much electricity. A drill is a drill, the only way you can cut down on the price is by the kW per hour being cheaper or not using it as much. Well it's what we do, the welder's got to be going all the time. (C7; manufacturer and repairer of agricultural buildings and equipment; I)

issues as a very small part of their wider role; typically, respondents estimated spending no more than 1-2 per cent of their time on energy management.

In many of the businesses the interviewed decision-maker reported being the sole decision-maker and, in a number of family run businesses, another family member was identified as being involved. In a smaller number of businesses the decision-maker interviewed was an administrator and in most cases had to confirm decisions with the owner(s)/director(s).

Implementers and users

Most of the sites were too small to have energy implementers distinct from the decision-makers. All members of staff were users of energy, although some were more likely to be using higher energy intensive equipment than others (e.g. machine operators).

Energy Management Expertise

Occasionally, the decision maker may have had some expertise in relation to energy management as a consequence of their particular role (e.g. a technical manager) or the nature of the business but to a large degree there was no obvious in-house expertise.

Energy targets

Only the site with ISO 14001 had energy targets and none had rewards for staff compliance or initiatives.

Decision Makers and Key Influencers: External Actors

An external actor is anyone not employed within the organisation who may influence energy management.

Energy supplier

All of the businesses reported that their energy supplier did not provide energy advice.

Energy consultants

A couple of the businesses used an energy broker to identify the best supplier; in one case the consultant also provided energy advice and in the other they did not.

Trade and professional bodies

Very few of the organisations reported belonging to a trade or professional body, and where they did, in most cases, these had not been involved in the provision of energy efficiency advice (for example, the Electrical Contractors Organisation, the Federation of Small Businesses, the Institute of Road and Transport). Only one business, the poultry farm whose owner was a member of the NFU, spoke about receiving advice about energy efficiency.

Landlords

There was no evidence that their landlords were involved in encouraging the tenants in the sample to be energy efficient. The terms of the lease was sometimes perceived to be a disincentive when it came to investing in energy efficiency (see Barriers, p24).

Government

There was only one business in the sample that was classified as large (over 250 employees) because of the size of their US parent; the UK operation was a micro business. As such, Government initiatives, such as Carbon Reduction Commitment (CRC) scheme and Energy Savings Opportunity Scheme (ESOS)[10] were not applicable to any of the sample.

The decision-makers taking part in the case study visits were asked about their perception of government's role in reducing energy consumption. Some knew little about the government's energy policy but some felt that it could be doing more. Another view was that government policy had been *'erratic'* due to recent changes.

> Yeah they [the Government] are encouraging energy efficiency but they could be doing a lot more, especially like the Scandinavian countries and other countries, who are really making it one of their top priorities to make the country energy efficient. But the truth of it

> Somehow they always seem a little bit behind the times, if it's a fair point to say that? You know, they make it too good, it gets carried away from them and then they just put the brakes on it. A bit of an erratic driver. (C7; poultry farm; DM)

Other influencers

Other sources of advice on energy use included: customers, suppliers/equipment manufacturers, trade press, informal cross-sector business networks, industry meetings and, in one case, their ISO 9000 consultant.

> We seem to know quite a lot of people who could be working with different companies and we just our share our knowledge between us. (C7; manufacturer of storage boxes; DM)

> A customer up in [location], they'd started to install LED floodlights and LED lighting and they said their bill diminished a bit so we thought we'd give it a try. (C7; importer and manufacturer of fresh food packaging; DM)

> There will be industry meetings, two to three days a month that we'll attend, not specifically on energy, but of course, you know, any new developments come up and we take subscriptions to quite a lot of the sort of email reports and trade press. (C7; poultry farm; DM)

[10] The CRC Energy Efficiency Scheme is a mandatory reporting and pricing scheme to improve energy efficiency in large public and private organisations. The Energy Savings Opportunity Scheme (ESOS) is a mandatory requirement for all large businesses to undertake regular energy audits.

Energy Management

‘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. This chapter considers the energy efficiency culture found within employee only (non-office) based organisations (Cluster 7) in the sample, along with the range of energy efficiency measures that had been adopted. The factors that were driving energy efficiency and the barriers to (greater) efficiency are also set out.

These issues were addressed in the fact finder interviews on both an unprompted and prompted basis using a list of items derived in part from the context map developed as part of the research framework (see Non-Domestic Smart Metering Early Learning Research reports: Main Report) and partly from the first stage of research. These were explored, as appropriate, in the case study visits. The findings reflect what was reported during the fact finder interviews supplemented from the case study interviews but should be approached with caution as they may not give a full picture of what was being done or why.

Culture of Energy Efficiency

All of the farms and a number of other businesses were family firms and in some cases all the employees were family members. Some of these, as well as some of the other businesses, included colleagues who had worked together for many years, often in another organisation before joining the current business.

In many respects these businesses were very similar to other smaller organisations in the other clusters, where keeping costs and waste to a minimum was a key business principle and part of their corporate culture. However, whereas in the small, customer facing independents in cluster 3/4, for example, the owner was generally integral to the production process or service delivery, in cluster 7, owners were not always involved in day-to-day production (even if that was their professional background) but focused on management and administrative tasks, including sales, marketing and purchasing, as well as overseeing the production process. There was, therefore, a greater distance between these owners and the production teams than in cluster 3/4.

Decision-making about energy was at a local level for all businesses in the sample. Most of them operated from a single site and so naturally in these cases all decisions were taken at site level. There were a small number of businesses in the sample where energy decisions were not made at site level; these were small businesses with no more than three sites. In one case, this was a farm where animal welfare, supplier and other regulations required the same conditions to be maintained at all sites.

Energy Efficiency Measures

> When we noticed six to nine months ago our electricity bill seemed to be extremely excessive we did some basic investigations and we sort of segregated sections off and started putting stuff on and off and tried to work out just basically our meter, 'right, if you left that on for five minutes what was the use?' (C7; manufacturer of storage boxes DM)

Although reducing consumption was important to all the organisations in the sample, in most cases, they were not taking any steps to try and establish how they could do this. An exception was the owner of a manufacturing business who, along with their electrician, had tried to identify how much energy different pieces of equipment used by turning everything off and watching the meter as individual items were turned on; a similar process had been tried by one of the small restaurant owners in cluster 3/4.

During the case study visits and fact finder interviews, decision makers were asked about any energy efficiency measures they had introduced. There was considerable variation across the sample; this ranged from doing nothing at all to a poultry farm that had invested a large amount in purpose-built poultry buildings. Many of the systems were computer controlled and the use of micro-generation meant they were largely self-sufficient in terms of their energy requirements.

Apart from monitoring their bills and occasionally checking to see if there were cheaper suppliers and/or tariffs, participants were often doing very little other than changing (some) of their light fittings and/or bulbs to low energy ones and walking round at night to ensure everything had been switched off. One of the reasons cited by several participants was that they 'knew' what accounted for their energy consumption, it was largely 'common sense' and they had 'little option' but to continue using energy in the same way because their business operations required it.

> Certainly I will go through tariff suppliers; I will ring round see what the best energy supplier can get. (C7; poultry farm; DM)

Nevertheless, across the sample, decision makers described a variety of actions they had taken to try and make their businesses more energy efficient. A number of the actions had been carried out over a period of time (sometimes years) and energy efficiency was often *not* the primary motivation; for example, action had been taken as part of general maintenance or where equipment had broken down. Where improvements were being implemented, they were often being done so gradually, presumably for financial reasons.

The various actions have been grouped into two broad categories: things organisations could change and things they could invest in.

Things that could be changed

- Tariff and/or supplier[11]: a number of respondents reported that they regularly checked that their tariff was competitive although only a very few appeared to be using a broker for this purpose.
- Energy source e.g. switch from electricity to gas: there were no examples of organisations switching energy type.
- The things produced or sold: again, there were no examples of organisations changing any of their products or services in order to reduce energy costs as this was perceived to be a major undertaking (and possibly a risky thing to do).
- Timing; e.g. to take advantage of E7 type tariffs: the poultry farm, which runs on a 24/7 basis was taking advantage of an Economy 7 type tariff; a manufacturer had tried to do this without success.
- Production processes e.g. change the timings of the heating system: the poultry farm had time shifted some of its processes to spread out consumption so it was less likely to need to draw energy from the grid but could rely instead on micro-generated energy. A manufacturer of plastic products had designed and built some of their own equipment which allowed them to operate on a 24/7 basis which they said was more efficient. A manufacturer of electrical testing equipment tried changing the timings of the heating system but staff complained about being cold.

> We have tried turning the machines on at different times of the day to get cheaper rates, but we found it is easier to use our normal production times. (C7; manufacturer of machine tool dies; DM)

> So we've gone a lot more down the line of monitoring and saying well we'll just feed House 1 at 8 o'clock. We'll set the timers so the chickens don't know any difference because it's the same every day for them and then House 2 can feed at 8.30 and House 3 at 9 o'clock, to sort of even it out really so we're not getting the peaks and troughs of consumption. (C7; poultry farm; DM)

> We have designed and built our own energy efficient production machinery, the shift patterns are set so the machinery doesn't have any down time. This avoids the warm up/cool down phase which uses energy, but not productively. (C7; manufacturer of plastic products; DM)

[11] 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).

- Behaviour e.g. incentivise and/or train staff and/or customers to use energy more efficiently: as with many organisations from other clusters, cluster 7 organisations were heavily reliant on staff to use energy efficiently and, just as other organisations reported, this was an on-going challenge. There were no examples of staff being trained or incentivised to save energy. The fact that equipment was manually switched on/off led some respondents to believe that they were in control of their usage. However, this put the onus on staff to switch off machinery and lighting when not in use and some decision-makers and implementers said that they were not sure that staff necessarily complied; several expressed the sentiment that staff were unaware of energy costs, which was a barrier to energy saving behaviour. The case study visits found that a lot of machinery, including lighting and heating, was controlled manually, and was often left on all day even when not being used. It was often the owners or senior managers who had to check manually that equipment had been turned off at the e end of the working day. In a few cases, attempts had been made to automate systems or to provide an easy way of shutting everything off so the organisations were less reliant on their staff. For example, the poultry farm was largely automated and the main task for the staff was to check the sensors were clean, working and logging on to ensure the system was functioning as intended but they could not override the BMS. Another organisation had installed a 'last man out switch'.

> But I think a lot of the staff here, they don't have to pay the bills, they don't care, they're not worried about it. (C7; manufacturer and repairer of agricultural buildings and equipment; DM)

> It's just so much work. I think it's easier just to leave the light on than try and go and turn it off. It's a waste of time like. (C7; manufacturer of storage boxes; DM)

> I usually turn everything off as I'm leaving the production area because I usually lock up at night. (C7; manufacturer of storage boxes; DM)

Things that could be invested in

- New and/or refurbished premises/ improved building installation: as noted above the poultry farm occupied a relatively new purpose built, well insulated building and had installed BMS that monitored and controlled all the systems e.g. ventilation fans, automatic feeders, water pumps, which had resulted in energy savings. A supplier and maintainer of office equipment had carried out major refurbishments in exchange for a reduced rent; this included wall insulation, floating insulated laminate flooring, re-building the front of the building, installing a dropped ceiling with insulation, and double glazing. However, most of the organisations did not report any refurbishment.
- New and/or refurbished equipment: there were a few examples of this including a couple of organisations that had invested in

> We seemed to be using electric drills, so our bills, we seemed to be having lights on all the time where we deemed not needing them, so what we found then we said, 'listen, I think we would be a lot more productive if we went sort of down to air products'. So we changed our air products, yeah, so that obviously reduced our usage of electric. So that brought it straight down, so we put in a brand new air system all the way round the factory. (C7; manufacturer of storage boxes; DM)

a new, more efficient compressor. In one case, they were up-grading their compressor while, in the other, they switched from electric to air powered tools. Some mainly bought second hand items of equipment as they could not afford to invest in new and, as with some organisations in other clusters, energy efficiency often was not the main criterion. For example, since taking over the business from the former owner, a sign maker had slowly replaced all the equipment because what had been left by the previous owner was old and inefficient. The driver was to modernise and speed-up production, not to reduce energy. One of the organisations used a clip-on energy monitor many years before the installation of their smart meter. They replaced all their CRT monitors with flat screens as a result of seeing the amount of energy the old monitors were using.

> We have reduced consumption in the last five years by installing energy efficient equipment and this is monitored [by computer] to ensure the new systems are operating correctly. (C7; poultry farm; DM)

- Improve heating and/or cooling: there were some examples of heating systems being up-graded such as storage heaters being replaced by thermostatically controlled radiators and old boilers being replaced. A furniture manufacturer had installed a wood burner so they could use off-cuts as fuel. A food packaging manufacturer had installed infra-red heaters following an energy audit.

> They told us it is pointless to try to heat the workshop as it is so poorly insulated and it is best to use localised infra-red heaters to heat the specific areas people are working (C7; importer and manufacturer of fresh food packaging; DM)

- Improve lighting systems: the most common action reported by the businesses in the sample was the installation of LED lighting; a number had taken this action or were in the process of doing so and a few others were actively considering it. At least one organisation had been put off by the cost and, in another case, LED lights were deemed unsuitable because they were not waterproof. As with a number of other smaller organisations in other clusters, the changeover was often being implemented on a gradual basis. A few had also installed sensors in certain areas, such as the staff canteen. As well as using less energy, LEDs were recognised by some as having a much longer life which also helped make them cost effective to install.

  In at least one case, they had replaced the low

> We are in the process of switching from fluorescent tubes to LED spotlights. It's about 30% LED now. (C7; manufacturer and distributer of electronic testing equipment and lighting; DM)

> Well things like this [points to overhead LED light], I mean it's on for probably 12 hours a day most of the time, six days a week. That would pay for itself, the actual cost of the bulb would pay for itself in about 18 months probably. Beyond that either, if it took two years, we still haven't got to replace it because they last longer as well, because they last for 20,000 to 50,000 hours. (C7; manufacturer and distributer of electronic testing equipment and lighting; DM)

energy fittings provided by the landlord with fluorescent tubes as the previous fittings (which were high up on the ceiling) provided inadequate lighting.

> The buildings come with these very strange low energy lighting which take a very long time to light up. But they're not necessarily good enough so we've had to put in some of our own strip lighting in places. (C7; manufacturer and

- Micro-generation e.g. solar panels: one organisation had installed renewable energy, another was at an advanced planning stage and a third used a wood burner for heating. The site with renewable energy was a farm that had installed a biomass boiler, solar panels and used an LPG generator for back-up. It was aiming for self-sufficiency in energy, although wood pellets were being bought in for the biomass boiler. The business with advanced plans to install a biomass boiler and solar panels said that ambient temperature was central to the production process because if the temperature was too cold the process took longer and the product was more prone to cracking. The business was currently using oil-burning space heaters, which the biomass boiler was to replace, with solar power intended to replace office heating and other power needs. They hoped to use off-cut wood from the production process (which they currently gave away to local households) to fuel the boiler to reduce their reliance on imported wood pellets. It was also aiming for self-sufficiency in energy. Another benefit of the biomass boiler was that it would be timer controlled as at present the production manager arrived at 4 a.m. to turn on the space heaters so that the workshop was warm enough by 6 a.m. when production began.

> So we've made the massive investments, but now effectively we've got free energy for 20 years. So it's like a set figure. If energy prices did double or triple it's not going to massively impact upon us. (C7; poultry farm DM)

Key Motivations

The term **key motivations** is used to refer to the key internal motivating factors behind an organisation's energy efficiency efforts. . **Other drivers** is used to refer to any other influence on energy management activity. **Barriers** refers to anything that could make it difficult for an organisation to become (more) energy efficient. **External factors**[12] could also have an impact on approaches to energy management. The relationship between these various forces in cluster 7 are summarised in the pathway summary map (**Figure 2**, p35).

[12] A number of external factors, such as climate change, energy prices, company reputation, etc. were relevant to how an organisation manages its energy. In some cases, these factors motivated organisations to become more energy efficient (e.g. compliance with government policy initiatives) or were a trigger (e.g. increases in energy prices) but they could also be a barrier (e.g. planning restrictions).

- **Reducing costs** was a driver for all the businesses in cluster 7 and for some this was related to **ensuring that their prices were competitive**. This did not seem to be a result of systematically monitoring market prices, although in some cases prices were set by customers, for example, in the case of some of the farms. One of the farms felt that the significant energy efficiency measures in which they had invested did not provide a competitive edge but that they would have lost market share if they had not made them.

> To keep our core costs down, to keep our costs down to be competitive, very competitive in the industry. So if we can keep costs down energy wise, as we pass these on to our customers, but also, in effect, our company gains. (C7; manufacturer of storage boxes; DM)

- In a similar way, participants often spoke about the importance of **trying to do one's bit in terms of CO_2 emissions and climate change**, and **to be seen by customers as a responsible organisation**. These two drivers typically went hand in hand i.e. trying to do one's bit for climate change is one signifier of a responsible organisation. There were some exceptions: a small number of decision makers agreed that they wanted to reduce CO_2 emissions but did not state that they wanted to be seen as a responsible organisation. Conversely, a couple of other businesses agreed that they wanted to be seen as responsible organisations but did not agree that they wanted to be seen as 'doing their bit for climate change'. The case study visits revealed that attitudes towards climate change for the business were often determined by the owner's personal beliefs and attitudes. There was also a sense from the case study visits that claiming to want to reduce CO_2 emissions and to be seen as a responsible business were seen as the 'right' answer, as the quote above acknowledges. Moreover, as previously noted, most organisations in the sample did not have an environmental policy and, where they did, decision makers were unclear about what it contained (see Environmental policy and energy audit, p10). In other words, it was sometimes difficult to see a clear link between statements of intent and how energy was being managed.

> Everybody wants to tick the green boxes and nobody wants to be seen as a polluter. (C7; poultry farm; DM)

> I've always been, you know, 'let's save the planet and whatever'. I like my car to be energy efficient; I like my lights to be energy efficient. (C7; manufacturer and distributer of electronic testing equipment and lighting; DM)

- A number of businesses reported that they experienced **supply chain pressure** to be energy efficient and this prevalence is somewhat unique to this cluster. For example, a decision maker commented that they were selling into a mass market and they "do what they can to impress buyers".

> We are weak in the sense of it is a commodity product. We are selling into a mass market and you are sort of doing what you can to impress those customers. [ ] But if you'd not done it, you would have had a competitive disadvantage. (C7; poultry farm; DM)

Another spoke about working to a very unusual business model; essentially they sold products to their US parent company, who then marketed and sold them on. However, the parent company will only take the products if the UK arm can undercut the competition by at least 10 per cent. If they could do this and still make a profit, they could put that into R&D to develop further products. This meant they needed to keep their cost base as low as possible. Another manufacturer was a member of a procurement intermediary for the utility sector which holds data on suppliers for buyers to monitor compliance. A possible reason why supply chain pressure was more relevant to this cluster was the organisations were selling to other businesses rather than directly to the public.

Other Drivers

Although across the sample, various other drivers were identified by at least one organisation there were only two that applied to a reasonably large number of organisations in the sample (see **Figure 2**, p35). Both were commonly found across all the clusters covered by the research and, as such, they were not unique to cluster 7.

Most frequently mentioned drivers

- The trigger for action that applied to the highest number of sampled businesses was a **rise in energy prices**, although this was not universal and energy prices had fallen in the months leading up to this stage of fieldwork.
- The other important trigger for this cluster was the **purchase of new equipment;** equipment suppliers were sometimes a source of information on energy consumption for this cluster. However, as noted above, some organisations bought reconditioned equipment and, for others, energy efficiency was not the primary driver in the equipment purchase decisions.

> Occasionally we do buy refurbished or second hand equipment, particularly on the big equipment that we've got…
>
> **…And is that for cost reasons, it's more cost effective?...**
>
> …It's what we can afford basically. We're only a small business and some of the big machines cost a lot of money. (C7; manufacturer and repairer of agricultural buildings and equipment; DM)

> **When you were buying it [new equipment] did you look at relative energy use?...**
>
> …No we didn't. No, it was more of getting the right machine to do the job, rather than looking at its energy efficiency. (C7; sign maker; DM)

Less frequently mentioned drivers

The following drivers were all mentioned by a relatively small number of organisations. The first of these appeared to apply more to at least some cluster 7 organisations compared to organisations in the sample from other clusters; in other words, it may be a characteristic of this cluster (or at least some of the organisations within it).

- **Suggestions from employees**: for example, the organisation that was accredited to ISO 14001 employed a retired quality control engineer on a part-time basis to advise them on their certification and how they might look to make further energy savings. Although only mentioned by a number of organisations in the sample, nevertheless this trigger seemed to apply more to cluster 7 organisations compared to organisations in other clusters. One possible explanation is that staff sometimes were involved in more specialist production processes and there was a suggestion that owners and senior managers were sometimes less hands-on; in these circumstances, staff may be better placed to identify ways to save energy.
- **In response to customers/employees/competitors:** as previously noted, organisations in this cluster were more likely to be affected by supply chain pressure. An organisation had switched to LEDs after seeing the savings a customer had achieved.

> A customer up in [location] started to install LED floodlights and LED lighting and they said their bill diminished a bit so we thought we'd give it a try. (C7; importer and manufacturer of fresh food packaging; DM)

- **In response to third party recommendations:** the recommendations of friends who were local tradespeople were sometimes a trigger for action**.**
- **When moving/refurbishing premises:** as noted above, some organisations had invested in energy efficiency improvements when moving or refurbishing their premises.
- **In response to an energy audit:** for example, the poultry farm had paid the National Farmers Union to undertake an energy audit as part of completely refurbishing the animal sheds. This had resulted in the business aiming for self-sufficiency in energy production through biomass and solar panels with an LPG powered generator for back-up.
- **To take advantage of funding opportunities:** for example, to benefit from the FIT and/or RHI.

Barriers

The main barriers to energy efficiency in the cluster 7 organisations in the sample are summarised below (see also **Figure 2**, p35). None of the barriers were unique to this cluster but were found in most other organisations in the sample, especially smaller organisations that were not using their smart meter data. While there were relatively few 'triggers', there were a large number of potential barriers.

- **Staff compliance:** there was reliance on staff to switch off tools, lights and heaters when not in use but, as discussed above, some scepticism that staff always complied.

  One implementer, when asked about staff behaviour, commented that there was no incentive for staff to comply with energy saving measures, while a user commented that it was largely a waste of time turning things off.

> It doesn't matter how many times I say 'turn it off, turn it off'. It doesn't necessarily happen. [ ] It would go in one ear and out the other. (C7; manufacturer and repairer of agricultural buildings and equipment; DM)

> It doesn't give them [production staff] much incentive to get up in the morning knowing they've got to put more clothes on when they get here than when they've come out of the house. (C7; manufacturer of storage boxes; I)

- **Condition of buildings:** many of the organisations occupied buildings which posed challenges in terms of effective energy management and while some attempts had been made to address these, for many it was an on-going and unresolved challenge. Workshop areas were very problematic from a heating perspective irrespective of when they were built. They were relatively large areas, often with high ceilings and no insulation and some suffered from the problem of full height doors being open much of the day for deliveries and despatch. In several instances, no attempt was made to heat workshops because of these difficulties. One of the businesses reported providing staff with fleeces and another that staff needed to wear more clothes in the workshops than outside. Installing insulation was seen as a major undertaking that would be disruptive to production as well as expensive.

- **Buildings leased, not owned:** the fact that the premises were leased and not owned, and the term of the lease (such as the requirement to return a building in the same state it was in at the start of the lease), acted as disincentives in terms of a business investing in energy efficiency measures. The managing agent of one of the case study organisations confirmed that energy management was entirely left to individual tenants. He recognised that the typical length of a lease (in this case, three years) was a disincentive.

> It is only really sensible to invest in energy saving measures such as LED lighting at the start of a lease, as you need to make sure there is enough time for it to pay for itself. (C7; manufacturer of plastic products; DM)

> I think at the end of the day the electricity or the cost is going to be down to the tenants paying for it in those areas. I mean, if the tenant wants to install panels, then we would look favourably at it, if it's what they want to do to save themselves money. When it goes then either you'd have to build it in as part of the lease, whether we hang on to the panels or whether they just get referred to as a landlord improvement if you like, or whether they get taken away by the tenants and re-installed elsewhere, in which case he's got to make good what he's left behind. (C7; manufacturer and repairer of agricultural buildings and equipment; L)

Landlords were not reported to be providing advice or to be taking measures to improve insulation. They may also have been based some distance away and had limited contact with their tenants.

A tenant business that considered installing solar panels reported that the landlord refused permission because of the appearance of the building. Another business reported that their landlord, the local authority, had not undertaken repairs that were needed and which they were obliged to do under the terms of the lease, due to a shortage of funds.

- **Energy costs too small/ ROI not worthwhile or takes too long:** two of the most frequently mentioned barriers were the perception that energy costs were not high enough to make it worthwhile investing in energy efficiency; the returns on any such investment, therefore, would not be worth having or would take too long to materialise. Even where energy costs were perceived to be high, the inhibiting factor was the perceived cost of the investment and the length of the payback period. In weighing up any ROI, participants took into account how long they were planning on running the business and/or remaining in the property. This presented a further barrier for some who were planning on retiring within the next few years or so.

> My top priority is finding work for us to do. Energy is secondary as it is not a big cost for us. (C7; sign maker DM)

- **Lack of funds/funding**: this was a constraining factor for many of the businesses within the sample and it may go some way to explain why they had not undertaken more energy efficiency measures and why those things they had done, were often being done gradually. Some businesses had considered installing LED lighting but were put off by the current cost.

> At the moment you know my credit is absolutely rubbish and I wouldn't get a loan anyway. I can't even re-mortgage my house. (C7; manufacturer and distributer of electronic testing equipment and lighting; DM)

- **Lack of information, time and expertise:** given that the decision makers were responsible for all aspects of managing and running their businesses, it was not surprising that they lacked information about, and expertise in, energy efficiency as well as the time to acquire these.
- **Lack of reliable information about energy use** and **lack of awareness of smart meter data/ability to access it/know how to use it** compounded the situation (see Non-users of Smart Meter Data, p29).
- **Perceived lack of control over energy use/limited scope to reduce consumption**: although only one decision maker said they lacked control over their energy consumption (see Perceived level of control over energy use, p13), many felt there was limited scope to reduce their consumption. This was often because they felt they needed to use the energy they used in order to run the business.
- **Scepticism about achievable savings:** this was often linked to respondents' inherent distrust of external expertise (see below).

- **Distrust of advisors and reluctance to pay for advice:** one of the barriers to effective energy management was not knowing how to go about finding a service provider and concerns that even if they did find one, they would end up paying for advice which either related to actions they had already considered and rejected, or actions that would be costly to implement.
- **Planning restrictions:** planning issues appeared to be less of an issue for this cluster compared to some of the other clusters possibly because industrial units are located away from the public gaze and not on the high street or in listed buildings.

Smart Meters

There was almost no awareness of the availability of smart meter data amongst the sample of cluster 7 organisations. Moreover, most decision makers did not feel that detailed usage information would help them to be significantly more energy efficient and there was almost no willingness to pay for such information.

Motivation for Installing

All of the businesses had smart or advanced electricity meters although a number did not know whether their meter was smart or advanced. Indeed, some only realised that they had a smart/advanced meter when contacted to take part in the research. A number of organisations also had smart/advanced gas meters.

> I wasn't aware there was a benefit from it. I thought it was so they could read it. I'm serious, that's what they told me. I said, 'why have we got a smart meter?' and they said, 'so we can read the meter without coming here'. (C7; manufacturer and distributer of electronic testing equipment and lighting; DM)

In many cases the business had a smart meter because the supplier had insisted or offered to install one. A small number were already *in situ* and only a couple of organisations had requested them. The case studies found that for most businesses there were only two perceived benefits; remote readings and accurate bills.

One of the case study visits involved an organisation that had requested smart meters. They were part of a US corporation that was only willing to pay for energy supplied and would not accept estimated bills. They were told by their supplier that the only way they could have accurate bills was to have a smart meter. Another organisation reported that when they installed solar panels they were required to have a smart meter to monitor the exports and imports to and from the Grid.

Installation Experience

For most businesses who understood little or nothing about smart meters, the experience of installation went smoothly. However, some had experienced problems when switching supplier as a new smart meter had to be installed because the new supplier could not read

the old meter[13]. In one particular case, it seemed that the old meter was sold on without the SIM card being replaced/updated and the business was receiving bills for a block of flats. It took over a year to resolve the issue.

Some businesses still had the meters read on site because either the meter was broken or the supplier did not believe the remote readings.

The fact finder interviews did not specifically record whether information was provided about the smart meter functions by the supplier/installer. However, only one case study reported receiving information, this was a leaflet that came in the post but which had not been read by the time of the case study visit.

Non-users of Smart Meter Data

Respondents were monitoring their energy consumption using the cost of their bills rather than the kWh. A couple of businesses claimed to be using their smart meter data, although neither was interacting with the data in the way that some businesses in other clusters were doing.

In one case the smart meter had been installed when a biomass boiler and solar panels were installed. Each month the business received printed graphs of energy use broken down into half-hour intervals for the period covered by the bill. On the basis of this information, the decision-maker had identified that conducting an operation across the whole plant at the same time meant that the business was drawing power from the National Grid, but if the operation was staggered across the plant the solar panels generated sufficient power not to require this (see 'Things that could be changed', p18 for further details). Time shifting the operation resulted in a financial saving.

In the other case, the business had identified a malfunctioning radiator as the result of receiving a very high bill. This was identified from just looking at the bill but the decision-maker was convinced that without the accurate bill which resulted from the smart meter, the problem would have taken longer to come to light.

> There's bound to be certain things that maybe we should just be charging a wee bit more for because of power usage. And we have an argument against somebody saying, 'oh, you're charging too much'. [I'd] say, 'well look, this is what power costs'. (C7; importer and manufacturer of fresh food packaging; DM)

During the course of a case study visit, another decision maker said that more accurate data could help them charge customers more accurately for work.

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

One of the two businesses that had requested a smart meter was aware that they should be able to access their data but the supplier's web portal was not working and, in the end, they gave up trying; they were the exception.

> We are meant to be able to access the [energy provider] online portal, but it didn't work when I tried. I couldn't compare the different meters we have directly and couldn't work out how to access the data. It was a long time ago so I can't remember the details. I haven't tried since. (C7; manufacturer of plastic products; DM)

Most organisations that took part in a case study visit were unaware that any data could be accessed, never mind how to access it, interpret it and use it to take action. In some cases, this was not considered a problem because they felt that their operation was too small and already tightly controlled in terms of energy use and/or the perception that the business was already using energy as efficiently as possible. It is worth noting that these were barriers not just to using smart meter data but also to becoming more energy efficient.

Getting the information to the right person within a business could also be a barrier to its use. In one of the larger businesses, the finance manager received the paperwork and said that only overall day and night readings would be of interest, whereas the production manager claimed that he would be interested in seeing some of the more nuanced data on usage by time of day and for different areas of production.

> No I don't think so, not for our business not really, not in here. Everything is too open, too small and you can see what you should and shouldn't be doing I think, do you know what I mean, because of the way we are? (C7; office equipment maintenance and supply; DM)

Smart meters only record energy drawn from the Grid, so for those that are self-generating, this information would become less useful as they became self-sufficient. Moreover, for the few organisations that had it, BMS was said to make smart meter data less relevant.

> We can't make it come down any more, so what's the point in looking at it [smart meter data] sort of thing? (C7; office equipment maintenance and supply; DM)

Reactions to Products and Services

During the course of the case study visits, respondents were taken through some examples of energy saving measures and smart meter data analysis and asked for their reactions. It was not possible to cover all the material with all the participants and in some cases respondents looked through the information presented and picked-up on topics that resonated with them.

> Yeah it [the visual device] would be good. What people are is they are ignorant of what sort of use a business runs. If they could see for themselves what a company uses electrical, maybe they'd be a bit more inclined to turn things off after them. (C7; manufacturer of storage boxes; DM)

> I think if it was there, it would be a lot easier. You don't have to log in and passwords. (C7; manufacturer of storage boxes; DM)

Methods of accessing data

Respondents were shown Information on how smart meter data could be accessed (see Figure 3, p40). Access via a PC was the preferred method although mobile workers wanted access via their mobile phone. However, finding time to look at the data and the need to log on was a barrier for some. It was occasionally thought that a visual display could be useful for staff to understand usage, might be easier to use and removed the barrier of logging on.

> When you first get it [smart meter data] you look at it about six times a day and then periodically it gets less and less and less until you are just looking for the emails coming through that's effectively a warning email to say this has gone wrong. It becomes less interesting once you've learned those initial trends. It becomes more of a bore and there's nothing there much on a day to

Critical window

There was an expectation among some non-users that smart meter data was something one might look at when the service was first available, that this might result in some changes in how energy was being used, after which, one might only look at the information periodically. This had been the case with the organisation that had used smart meter billing information in relation to their micro-generation. It had also been the case with another organisation where the decision maker had used a clip-on energy monitor prior to having a smart meter installed. He felt that this had provided useful information at that time but it was not needed on an on-going basis.

Expressing savings as a monetary value

A number of respondents thought that information about energy savings should be expressed in monetary terms and not, for example, kWh or CO_2 equivalents.

Added value services

> It would be nice to know, but I can't see it's going to be any advantage. (C7; manufacturer and distributer of electronic testing equipment and lighting; DM)

It was difficult to get some respondents to engage with the examples of the analysis that could be obtained from smart meter data. At a general level, decision-makers found the charts interesting but did not see how they could help them. Some decision-makers were slightly defensive in their reactions to the stimulus material in that they wanted to be seen as already efficient and knowledgeable about their energy use.

Respondents were shown some examples of **pattern recognition** software that can be used to identify opportunities for saving energy (see, for example, Figures 3-5, pp41-42).

Information about energy use outside of working hours was said to be irrelevant by some as they only had essential equipment such as fridges running outside working hours. Others felt that this could be useful to ensure all equipment was turned off.

> Might be handy in the evenings. I could use it to check if everything's been switched off so in the evening we're not paying anything at all. (C7; manufacturer and repairer of agricultural buildings and equipment; I)

In a similar vein, information about use of energy during normal operating hours held some interest but respondents often felt that they knew this information already and/or felt they had no control over what equipment needed to be in use during the day. Plotting energy use against outside temperature was felt to be more relevant to office premises as many workshops were not being heated, and ensuring settings have been adjusted in accordance with BST was thought to be obvious.

> I would assume this bump would be when they [staff] got using, not that we are using power tools for any length of time, but I would assume that they were using stuff in the workshop. I can't stop them using it. (C7; manufacturer and distributer of electronic testing equipment and lighting; I)

Reaction to the idea of being able to generate profiles for diferent types of equipment using **device disaggregation** (see Figure 7, p42) was more positive as this provided more tangible information about specific items of equipment which might enable specific actions and could possibly help to encourage staff to be more energy conscious.

> If they knew how much it cost to leave various items of equipment on overnight – perhaps using device disaggregation – and this can be expressed in simple pound shillings and pence – this might encourage [staff] to become more energy conscious. (C7.17; I)

Although it was acknowledged that engaging staff with energy savings was important, 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 8, p43).

Methods of engagement

There were mixed responses to the suggested methods of encouraging businesses to engage with energy efficiency and their smart meters through the use of mentors, local networking and case studies (see, for example, Figure 10, p44). Although having access to an energy saving mentor was well received by some, others did not want outsiders in their business. There was more support if the mentors were government backed. In contrast, energy suppliers were often not thought to be helpful when it came to supporting energy conservation.

> Probably just information on how other businesses have done it, I think. If you're doing that online, yes, but if you're all having to meet… There's probably forums and sites where you can go and do that kind of thing anyway, I would have thought. I think for somebody to come in, you almost think there's not enough here for

Some decision makers were already informally networking but others were fairly isolated and time was a barrier to attending meetings. The idea of case studies was considered useful but many felt these would need to be based on very similar types of businesses for them to be deemed relevant.

> It's got to be somewhere using similar equipment or the amount of equipment we use. I think you've got to look like for like, it'll give you a good idea of where you'd save. It would be no good if it were a different company doing something totally different. (C7.17; DM)

Willingness to pay for added value services

While businesses within this cluster seemed to have a lot in common with other smaller organisations in other clusters, they seemed to be more willing to pay for services if the payback was greater than the cost over a relatively short time period. This may be because they were used to investing in more substantial equipment than some of the businesses in these other clusters. Having said this, some businesses were sceptical that the financial benefit would be greater than the cost.

> £25 would be nice. £50 I think, £1 a week, no that wouldn't be too bad either [referring to the cost of the value added service on the proviso it was going to achieve savings]. (C7; manufacturer of storage boxes; DM)

> We're a small company, there're only five of us and would the cost of it outweigh what we weren't using or were using? Because that's the most important thing, what the bottom line is. (C7.17; I)

One decision-maker suggested a month's free trial of the data but most decision-makers felt that looking at the data and making changes was a one-off activity, not an on-going exercise.

Conclusions

Summary of Key Findings

Summary pathway map

A summary pathway map was developed for cluster 7 to provide an overview of the factors and contexts that underpinned how these types of businesses were managing their energy (see Figure 1). The map needs interpreting with care as it is based on a small number of organisations.

The map displays 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 that were relevant to how the organisations managed energy.

Factors that were common to all or most of the 6 clusters are shown in [square brackets] as they do not appear to differentiate between clusters. All other factors appear to discriminate between at least some of the clusters.

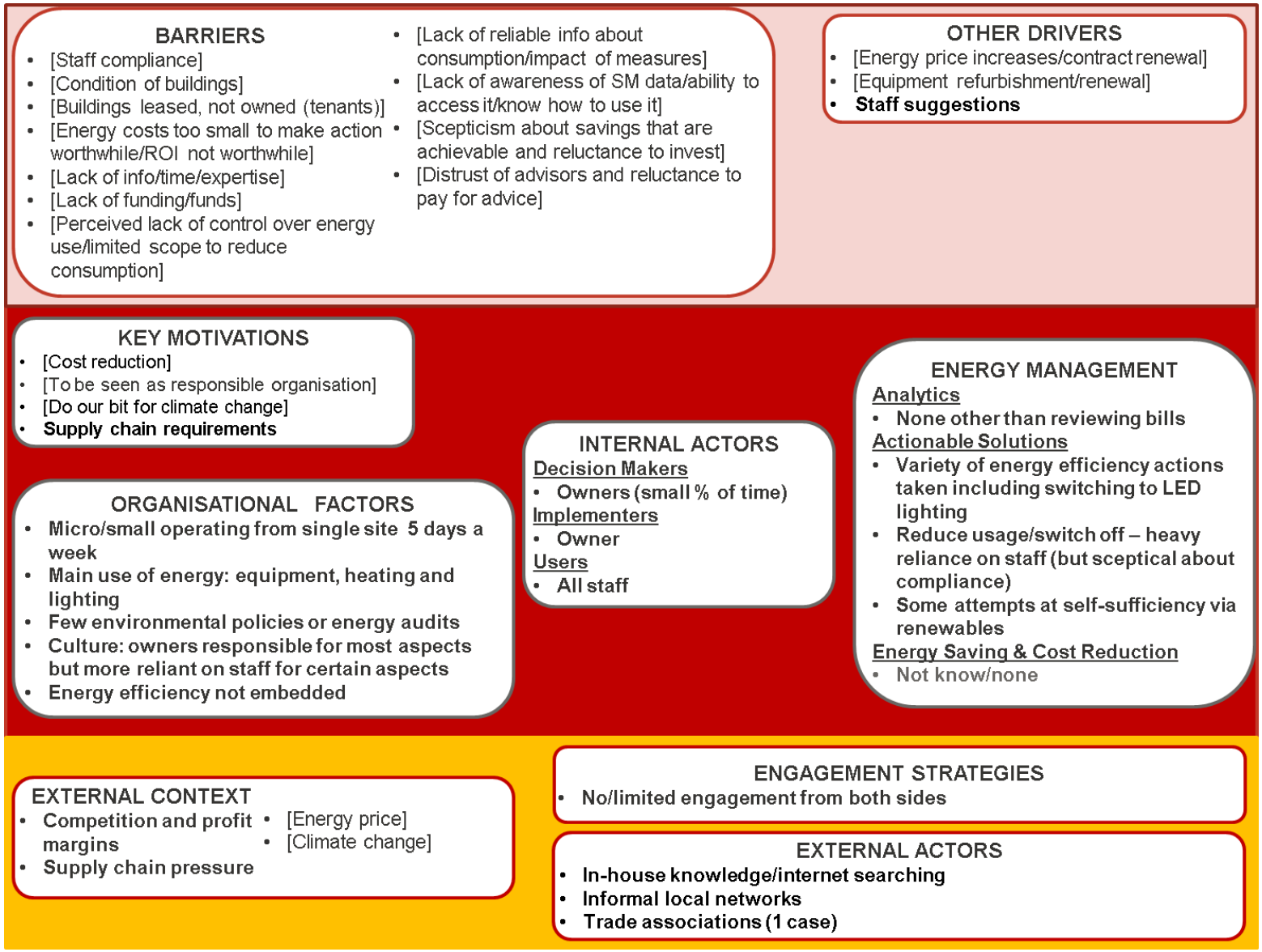

Figure 2: Summary pathway map for cluster

Cluster specific findings on energy use, management and associated influences

In many respects these businesses were very similar to other smaller organisations in the other clusters, where keeping costs and waste to a minimum was a key business principle and part of their corporate culture. However, whereas in the small, customer facing independents in cluster 3/4, for example, the owner was generally integral to the production process or service delivery, in cluster 7, owners were not always involved in day-to-day production but focused on management and administrative tasks, including sales, marketing and purchasing, as well as overseeing the production process. There was, therefore, a greater distance between these owners and the production teams. Nevertheless, in keeping with most other small businesses taking part in the research, decision makers in cluster 7 typically demonstrated little interest in, or engagement with, energy use. There was a lack of any proactive, on-going energy management; instead the businesses reacted to events.

There were very few factors influencing energy management that only applied to cluster 7 as most of them were also characteristic of other, smaller organisations. **The things that applied in particular to cluster 7 are summarised below**.

Most were operating from a single site five days a week; a notable exception was the farms which were using energy 24/7. Workshop/farm equipment was the main use of energy.

There was some (limited) use of renewable energy sources and attempts to become energy self-sufficient.

The decision makers were often the business owners but they were sometimes somewhat removed from the day-to-day production side of the business compared to, for example, the small independent businesses in cluster 3/4. This may underpin the finding that staff suggestions were more likely to trigger energy efficiency actions in this cluster, in that production staff may be more integral to the range of more specialist processes and procedures involved in these types of businesses.

In contrast to many other organisations from other clusters, most businesses thought that they had reasonable control over their energy use largely because they were small enough for the decision makers to be able to “see what was going on”. Moreover, some businesses saw an increase in energy use as an indication that business had increased. The business that reported limited control felt that higher usage levels were a result of the specialist machinery they used. It also meant that detailed information on usage was not seen as useful in controlling energy consumption.

There was evidence to suggest that competition and profit margins and supply chain pressure were more important for these organisations. This may be because they were largely selling to other businesses rather then directly to the public.

Organisations in this cluster may possibly be less affected by planning restrictions compared to other clusters. This may reflect location as they were not based ‘on the high street’.

Other factors influencing energy management in cluster 7 organisations were common to many small organisations across all the clusters covered in the research. These are summarised below.

The owners were responsible for all aspects of running the business and adopted a 'hands on' approach; this meant they had little time to devote to, or interest in, energy management. Energy efficiency was not embedded within the organisational culture. For example, most did not have environmental policies and had not had an energy audit.

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

Although reducing energy consumption was considered a priority, in reality this 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; lack of funds/funding was a particular barrier.

Although some 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 were often reliant on the advice of family, friends, and local tradespeople.

Smart meters

The only benefits of smart meters that people were aware of were accurate bills and remote reading.

With one exception, smart meter data was not being accessed or used. This was mainly due to lack of awareness that the data was available, how it was accessed, and how it could be used to manage consumption. In one case, the organisation knew they should be able to access the data but had been unable to do so because the energy provider's web portal was not working. With this one exception, there was no evidence that energy suppliers or meter installers had attempted to engage customers with the benefits of smart meter technology other than the fact they provide accurate meter readings remotely.

When shown what information was available and how it could be accessed, some of the businesses expressed interest in being able to do so, feeling it could help them better manage their consumption. However, there was little appetite for 'value added services' especially if these attracted a cost.

Research Implications

The importance of size and energy intensity

25 of the 27 organisations in the sample were classed as 'small', 'micro' or 'sole trader' and this had an impact on their approach to energy management; for example, they often

lacked the resource and expertise that was found in some of the larger organisations in clusters 1 and 5, and they shared many characteristics with small, independent retailers (clusters 3 and 4).

Although cluster 7 was originally defined as high energy consuming and/or energy intensive organisations, the findings suggest that the cluster probably contains a spread of higher and lower energy intensive operations. There was no clear picture in terms of the extent to which energy intensity (as defined by the organisations themselves) was influencing energy management

Engaging organisations in using smart meter data

Although a couple of businesses in the cluster 7 sample claimed to be using their smart meter data, neither was interacting with the data in the way that some businesses in other clusters were doing. The other organisations in the sample were not using the data to help manage their energy. The key learnings from the research about how to engage these organisations, as well as those organisations that have not yet had smart meters installed, are summarised below.

Decision makers need to be aware that they can access smart meter data. Given the perception of many that there was limited scope to make energy savings (for example, some decision makers felt there was little value in monitoring the power used by their workshop equipment), it will be a challenge to persuade them to take the time to log onto a web portal to review their energy consumption. Additionally, some decision makers perceived smart meter data to be a ‘one-off’ that may prompt action but that once action had been taken, information was no longer needed. They did not see it as something to regularly monitor. The findings suggest that some form of ‘exception reporting’, such as an email pointing out unexpected overnight consumption, could be an effective way of engaging this audience.

There was also little engagement outside the business with networks or sources of information and there was limited engagement with staff on the details of energy use. However, customers of businesses in this sector appeared to be more likely to exert pressure to manage energy efficiently compared with other clusters.

Triggers to action were energy price increases, the renewal of equipment and competitive pressure, often manifested as pressure from customers on pricing. These findings suggest that these businesses will respond to triggers relating to costs and that they can be engaged by suppliers of energy/smart meters at the point of meter installation, and by equipment suppliers. Where they exist, trade bodies and trade press can have impact, but not all businesses are engaged in such networks or even in local networks.

A culture of self-reliance means that these organisations might use a bank of information on trusted websites, including government and trade associations, such as case studies tailored to their particular type of business. Energy suppliers were not seen as impartial sources of information but they could provide more information on usage with bills and ‘exception reporting’ in place of regular monitoring by businesses.

The findings also suggest that these businesses will need considerable (free) support to use and interpret smart meter data and to understand the actions that can be taken.

Appendices

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

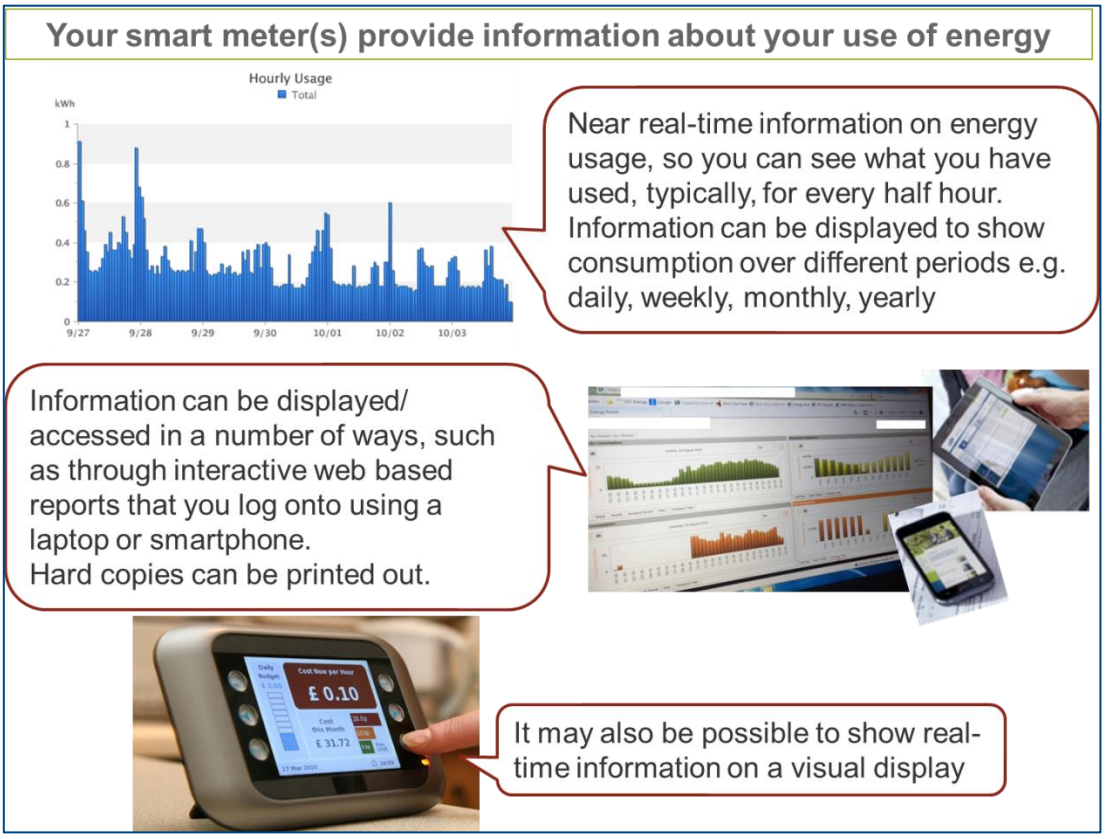

Figure 3: Methods of accessing data

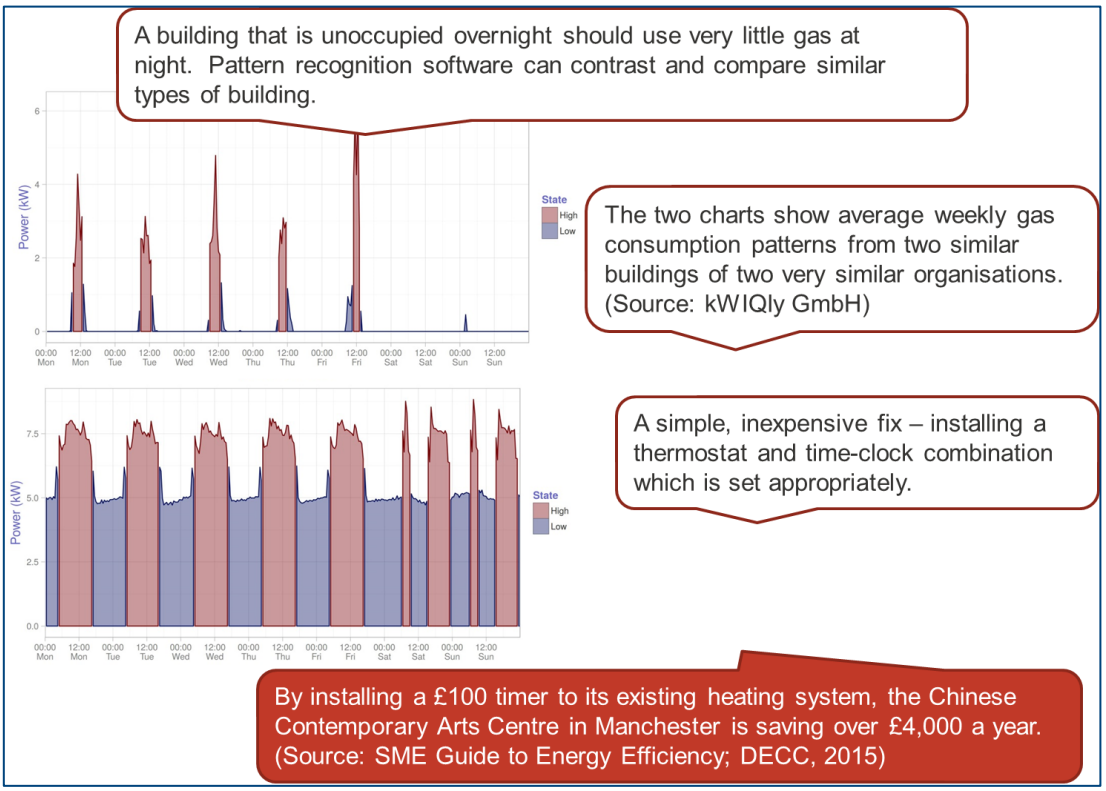

Figure 4: Example of pattern recognition (heating vs. external temperature)

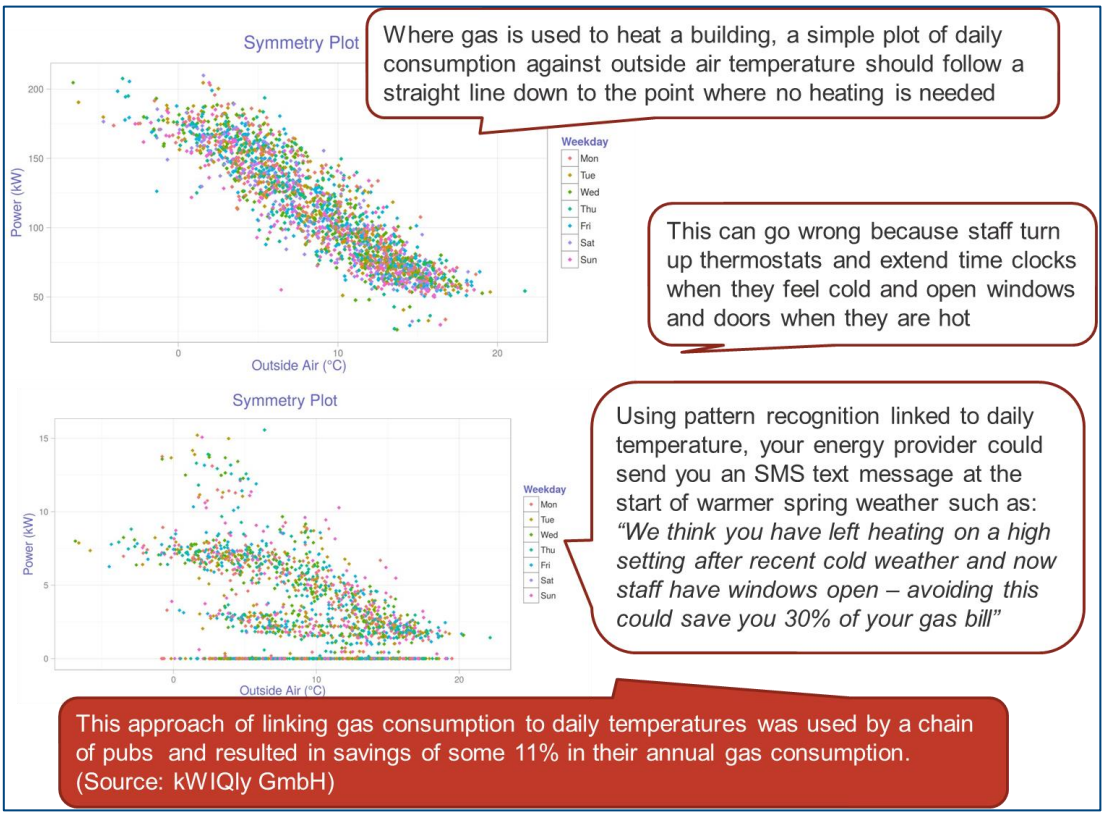

Figure 5: Example of pattern recognition (heating)

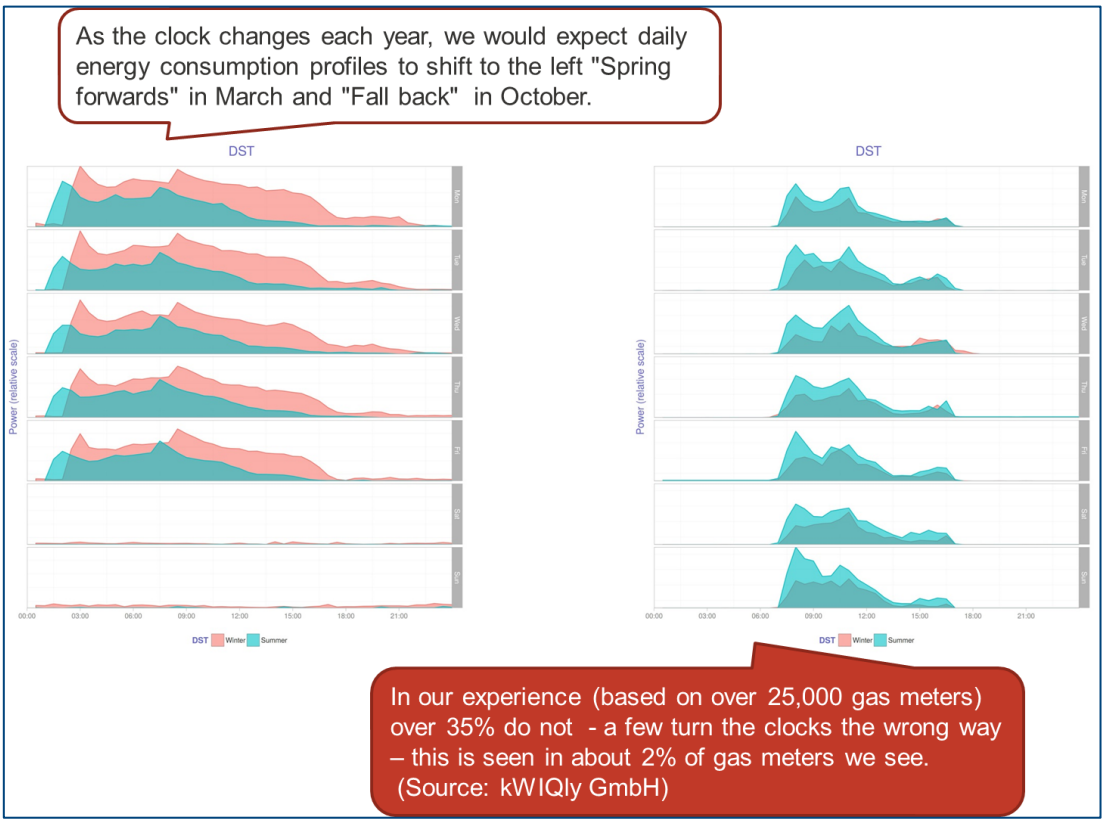

Figure 6: Example of pattern recognition (British Summer Time)

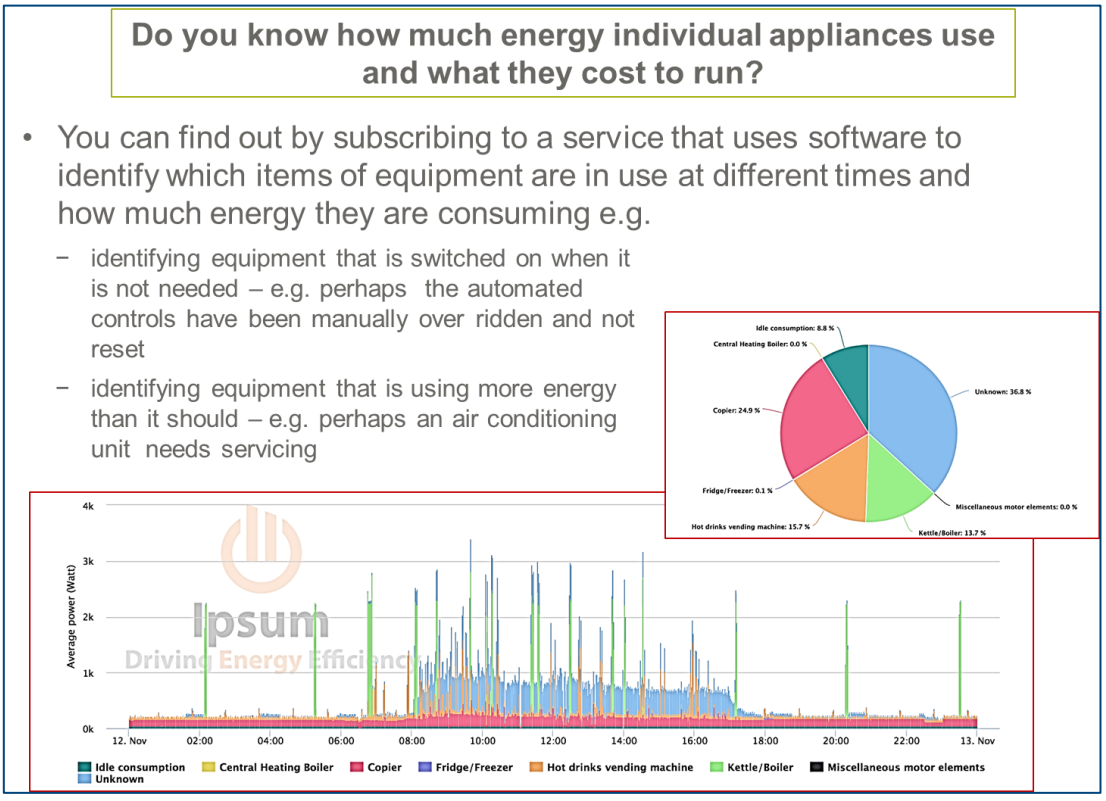

Figure 7: Example of device disaggregation

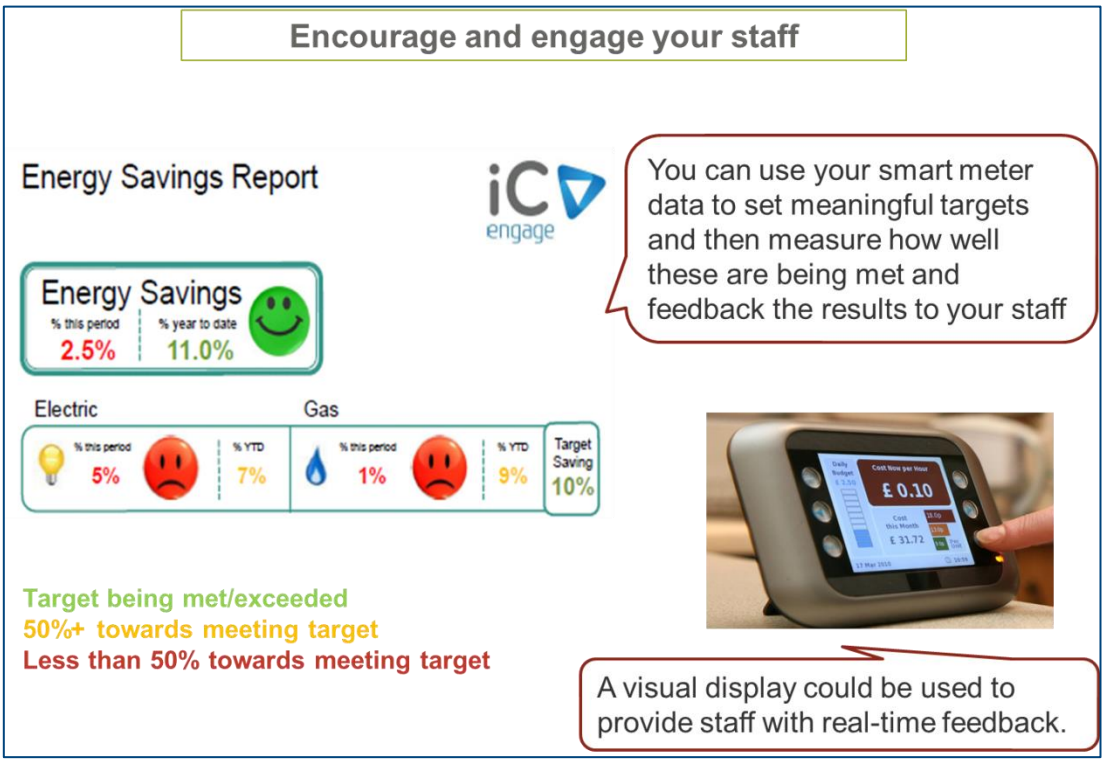

Figure 8: Staff engagement (individual site)

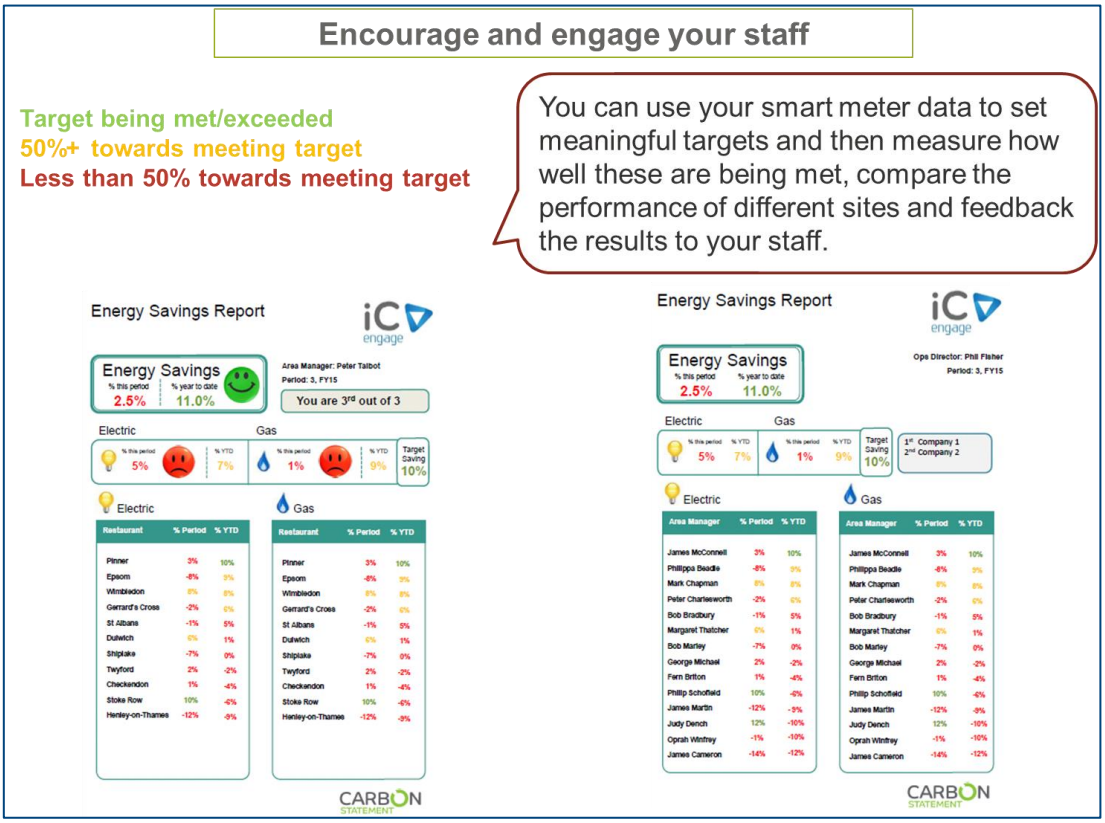

Figure 9: Staff engagement (multi-sites)

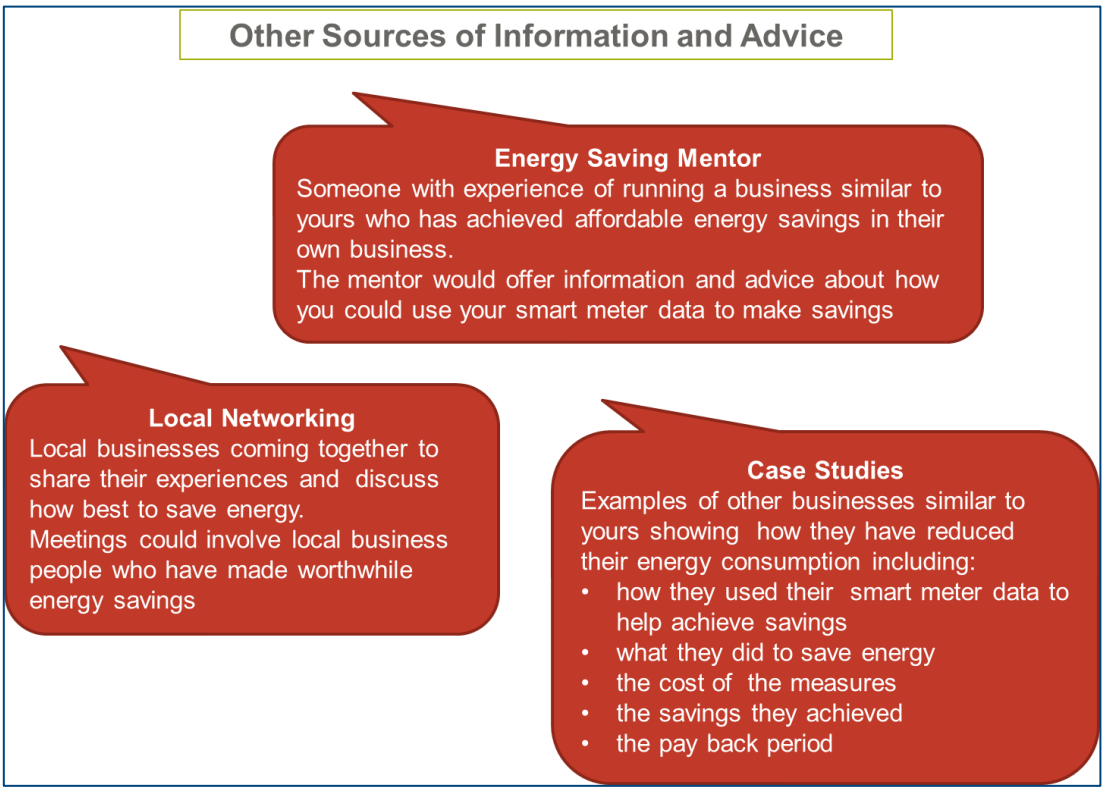

Figure 10: Other sources of information and advice

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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