Communicating 'smartness': smart meter installers in UK homes

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Abstract
There is growing interest in 'middle actors' as influences on energy use in the built environment. This paper reports on novel research with four focus groups of meter installers, employed by three major energy suppliers, two in Great Britain and one in Northern Ireland. All the participants have been involved in installing smart meters or semi-smart keypad meters in homes. The Smart Metering Installation Code of Practice requires installers to be trained to communicate to householders the uses of, and potential benefits from, smart metering, along with any health and safety issues. Installers are also required to demonstrate how to use the in-home display that is offered to all customers, and to be able to give basic advice on energy efficiency. The smart meter rollout thus offers an opportunity for a representative of the supplier to go into every customer's home and talk about energy with household members.

Using transcripts from the focus groups, we analyse what the installers have to say about their work in terms of training, support, challenges, rewards, household priorities and concerns, and organisational issues. This material illustrates the social learning that can take place during and around the time of installation, for the utility and the installers themselves, as well as among households and their social networks. It highlights issues for policymakers when planning and evaluating smart metering programmes in terms of customer benefits from demand reduction, particularly those relating to installer training and working arrangements. To set the focus group material in context, the paper draws on findings from the UK Smart Metering Early Learning Project, published in 2015, which included a large-scale household survey.

Context

RESIDENTIAL SMART METERING AND PROSPECTS FOR IMPROVED FEEDBACK

Residential smart metering is part of a process of 'smarting' energy systems by incorporating ICT into the infrastructure at all levels from generation equipment through transmission and distribution networks to individual end uses. While there is no universally agreed definition of a smart energy meter, the term normally covers a meter with two-way communications that measures consumption at regular intervals, typically half-hourly for electricity and hourly for gas. This paves the way for accurate billing based on automated meter reading, easier switching between tariffs and suppliers, and the introduction of time-of-use tariffs. Smart meters can also be designed to measure microgeneration and to communicate with devices in and around the home. Darby (2012a and b) gives overviews of possible applications in relation to EU policy and householder options.

A potential outcome from residential smart metering is improved feedback to householders on their electricity and gas consumption, which can lead to better understanding and to durable reductions in usage. This feedback can be offered through a variety of channels, including informative bills or statements, dedicated in-home displays (IHDs), websites and SMS messaging. The range of savings associated with these modes is quite wide, with the highest figures (10 %+) record-

ed for programmes that involve real-time feedback and/or a combination of modes (see Ehrhardt-Martinez et al., 2010 and VaasaETT 2011 for reviews). The figures for large-scale utility programmes are considerably lower, but trials in Great Britain, Ireland and the Netherlands have shown durable electricity and gas savings of approximately 3 % from a combination of smart metering, improved billing, and IHDs (AECOM 2011; CER 2011; van Elburg 2013). These were achieved with little or no information and advice at the time of installation.

In the long term, user understanding and engagement are arguably crucial to the development of energy systems which reduce consumption and have lower environmental impacts, whether this argument is made from the customer, supplier or system operator perspective (e.g. Stephenson et al., 2010; Honebein, Cammarano and Boice, 2011; Goulden et al., 2014). In order for this engagement to happen, though, there must be interfaces through which customers receive feedback from their meters, are pointed towards ways of interpreting it, and given scope to use the information in making changes in energy use. In this context, real-time feedback may be especially salient, with IHDs in particular offering a variety of support options.

While there is evidence of householders' interest in their IHDs dropping off over periods of up to 15 months (e.g. van Dam et al., 2010), this is increasingly countered by evidence that the impact of continuing feedback is durable and can increase over time (e.g. Ehrhardt-Martinez et al., 2010; VaasaETT 2011; OPower datasets). As with new technologies, new modes of information need some 'domestication' in order to be useful, a process of interpretation and integration into daily life (Nyborg and Røpke 2013). Given what we know about interfaces between people and technology, how explicit and tacit knowledge are developed and passed on, and how habits develop over time (e.g. Verbong, Beemsterboer and Sengers, 2013; Jessoe and Rapson, 2012), even the highest-quality design of billing, websites and IHDs seems unlikely to guarantee effective domestication on its own. Our working hypothesis is that social learning processes are under way, and that the smart meter and IHD are tools in those processes (Buchanan et al. 2014; Grønhøj and Thøgersen 2011; Darby 2006) – part of the story, but not the whole story.

In this paper, we are most concerned with exploring the extent to which customers move beyond simply receiving feedback; we focus on how they interpret, contextualise, and talk about it. Our aim in this paper is to assess whether it is enough for individuals to be supplied with information about their usage, from which they can draw their own conclusions. Or whether it is more beneficial for smart meter installation to be a more explicit process that binds new information from the meter to tacit knowledge about people's own homes, something that can be more effectively achieved through prompting conversation and experimentation, which may more consciously alter a person's "experience-based know-how" (Royston, 2014, p. 148). We are, therefore, exploring the potential of situating smart meter installation inside people's pre-existing frameworks for understanding their patterns of energy use (Catney et al., 2013). Can this be effectively achieved through the agency of one of the 'middle actors' in the development of smart grids: the meter installer, and if so, what is the added value of doing so?

POTENTIAL ROLE OF SMART METER INSTALLERS

The paper tests the premise that the meter installer, as a utility representative who is in a position to speak with householders in their homes, is well-placed – in theory, at least – to assist them in learning how to make the most of their new smart meters and any related devices. S/he is also well-placed to reflect on what happens at installation, and on what sort of questions and issues are raised by householders. Yet while there is a huge body of research into the technical challenges of developing smart grid technologies and enabling them to communicate with each other, there is no published research on installers' experiences of introducing smart meters to households, and what potential there might be in the opportunities which installation opens up.

The most common practice worldwide is for installers simply to fit the new meter (which often sits outside the property), and to have little if any interaction with the householder. Their job is likely to be seen as introducing a new piece of technology to the physical infrastructure of a building, rather than introducing technology *along with some of the knowledge required to understand and use it*. In order to find out more about meter installers as potential 'middle actors' in helping householders to understand and manage their energy use more effectively, it is necessary to carry out research in places where there is some policy intent to use smart meters in this way.

POLICY BACKGROUND TO SMART METER INSTALLATION IN GREAT BRITAIN AND NORTHERN IRELAND

In Great Britain (GB) and Northern Ireland (NI), as in the Republic of Ireland and the Netherlands, there have been policy decisions to introduce smart metering on a voluntary basis with an emphasis on customer engagement and understanding. The GB Smart Metering Installation Code of Practice (SMICoP), for example, requires all installers to be trained to

- give guidance on electrical safety and carbon monoxide
- offer each customer an in-home display (IHD) and, if accepted, set it up to meet the needs of the household (for example, with the correct tariff and mode of payment)
- demonstrate how to use the smart metering system 'in a clear and accurate manner … easy to understand, including what information is available … how this can be accessed, and use of the IHD (where provided) … informed by any specific needs' (e.g. visual or hearing impairment, low literacy)
- provide information in a variety of media
- advise on additional sources of help and information
- identify vulnerable customers, report back to the supplier.

However, although the SMICoP has two short sections which focus on customer needs ("Engagement and Customer Awareness" and "Demonstrating the System to the Customer"), the specific needs of a customer are mentioned only in terms of possible vulnerabilities, disability or literacy issues. In this sense, the "customer" is construed in the most generic of terms. There is no specific reference to what customers might already know, either; simply a requirement that communications be

drafted 'in a way that it is reasonable expect that they will be understood' (Ofgem 2013, p. 13).

The two major suppliers who are installing 'Foundation Stage' smart meters in GB have set up training programmes for their engineers that involve a combination of classes and mentoring over up to six months. In focus group, installers from one GB supplier referred to two weeks devoted specifically to 'behavioural training': specifically, how best to communicate with different types of customer.

Northern Ireland installers have also been trained to install smart meters with in-home displays and to pass on knowledge of how to use them, although most of this training took place before the SMICoP was written(Liddell, 2012). The roll-out of semi-smart keypad electricity meters in Northern Ireland, beginning in 2002, was probably the first in which a domestic meter was routinely accompanied by an IHD. The keypad meter arrangement offered a prepayment tariff with a discount of 2.5 % on the standard credit tariff, rather than the usual extra charge. The initial keypad trial, with 200 low-income customers who were also offered in-home energy advice, led to 10 % electricity savings; a later trial with a broader customer base and without the advice found 3 % savings (Owen and Ward, 2007). Roughly 40 % of NI customers now use a keypad meter (Quindi Research, 2014), but few have fully-smart meters.

The keypad meter rollout has differed from the smart meter rollout in three important respects. First, no gas metering was involved. Second, there was no competition in electricity supply in NI until 2010, so much of the initial rollout could be carried out in monopoly conditions, making it easier to operate on an area basis and enrol community-level support to address customer concerns. Finally, the keypads are semi-smart: there is no direct communication with the utility, meters still have to be read manually, and there is no provision for recording microgeneration or for a Home Area Network.

EARLY FINDINGS ON THE SIGNIFICANCE OF SMART METER INSTALLERS IN GB AND NI

As shown in the synthesis report published earlier this year (Darby, Liddell et al., 2015), installers can have a critical role in communicating with customers during an installation, encouraging them to use the IHD in ways that help them to manage their usage, providing energy efficiency advice and indicating where further guidance can be found. Much of this evidence comes from a face-to-face survey (carried out by Ipsos MORI) of 4,016 households, half of whom had smart meters and were selected to be representative of the smart-metered customer base for two GB energy suppliers.[1] The smart meters had been installed between April 2011 and February 2013, and the survey took place between October 2013 and February 2014. The smart-metered interviewees had been living with their new meters for between seven and 32 months, and over two-thirds of the sample had had their smart meter and IHD for between 12 and 24 months. They were asked about self-reported changes to their energy use and energy spend, satisfaction and engagement with their energy supplier, their 'customer journey' before, during and after smart meter installation, level of satisfaction with their smart meter and the installation visit, and the nature and impact of engagement with their IHD.

To date, evidence from the survey and related research suggests that the first stage of installation in GB (i.e. the Foundation Stage) was largely satisfactory for customers, though with room for improvement (ibid.). Satisfaction with the installer's general competence (e.g. the information they provided during the installation process, and explanations they offered when customers had questions or concerns) was the greatest single predictor of whether a householder would find an IHD easy to use, which in turn affected the likelihood of their making energy savings. While people did not always learn a great deal at installation (there were sometimes reports of 'eyes glazing over', a good installation experience left them willing or even eager to experiment or play with their IHD afterwards. Through this, and sometimes through discussion with others, they were able to discover diverse uses of the IHD (from different screens); in turn, sustained and diverse IHD engagement went on to become the single greatest driver of long-term positive outcomes such as feeling in control, attempting to reduce consumption, and making contact with the utility to explore different deals.

Findings from the Ipsos MORI survey and related research concentrated exclusively on customer experiences, as have most human interface studies to date. By contrast, this paper examines installer experiences, and probes for the impacts these can have on installer teams themselves, as well as on suppliers and householders. It presents and analyses material from four groups of smart meter installers, two in Northern Ireland and two in Great Britain, and augments their comments with relevant findings from the Ipsos MORI customer survey.

Methods

Each focus groups consisted of participants from a single utility. The focus groups offered an efficient and non-threatening platform for data collection, since groups of installers were familiar with one another and hence readily shared ideas, finished one another's sentences, sought consensus, and examined disparate opinions. The focus groups were all recruited by their employers, on the basis of experience in installing residential smart meters. The project had clearance from the University of Oxford research ethics committee. All participants signed a form to consent that the focus groups could be audio-recorded and that anonymised extracts from the summary transcripts might be published, but not before they had had the opportunity to see the transcripts and to offer corrections or protect their privacy if necessary.

The conversation in each focus group was roughly standardised by a topic guide. The topics were chosen by the facilitators, from a combination of their experience in the field and the research literature. They included questions under the headings of:

- **Background**, e.g., 'How long have you been with your organisation? How long have you been installing meters? If you have been doing this for some years, do you think there have been any changes in how customers respond to you

1. The legacy-metered sample were in turn selected to match the smart-metered sample, on the basis of energy supplier, fuel and payment type, energy consumption data, region and social grade profile of the area in which they lived. For more details of the survey, see https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/407543/3_Smart_Metering_Early_Learning_Project_-_Consumer_survey_and_qual_research_-_Main_report_FINAL_CORRECTED.pdf.

when you are working on meters in their homes, over the years? What [work] did you do before meter installation?'

- **Training**, e.g. 'What did your training for smart meter installation involve? Was it just for installers, or for people from other sections of your organisation (such as advice teams)?
- **Installation**, e.g. 'Can you describe your routine when you install a smart meter in someone's home? How easy or difficult is it to get access to homes? How long does an installation take, on average? What's the longest you have ever taken to install a smart meter, and why was that? Roughly how many problems arise from customer needs compared with technical issues? How would you describe the variety of your customers? What do customers find most difficult to understand when you are with them? What sort of questions do they ask about the meter and the IHD? Do you give people any energy efficiency advice as part of your normal routine? When you leave, do you leave any written information behind? If you install a meter in a home where the person or people are on your organisation's vulnerable customer register, is that something you know when you visit with them? If so, do you have a set routine that is different when you are working in their homes?'
- **Closing questions to invite reflection**, e.g. 'What surprises have there been along the way in your experience with smart meters and customers? If you were selecting members of an elite installer group, what personal qualities would you look for? What are the most important challenges those new trainees would face, and what advice would you give them? Can you give us a snapshot of your company's approach to smart metering? Has your role in installing smart meters changed since your company first started installing them? Is being an installer something that has changed your views of energy and energy efficiency?'

GREAT BRITAIN (GB)

The focus groups were recruited by the two major energy suppliers who have been involved in the Foundation Stage of smart meter rollout in Great Britain. This began in March 2011 and is intended to allow the industry to test out systems in advance of the main installation stage. Both gas and electricity meters are being installed, making the GB programme potentially the largest single smart meter installation in the world.

The focus groups were held in November 2013 and were facilitated by the authors. The first group consisted of five installers and their manager, who were installing fully-smart electricity and gas meters with IHDs. The installations were mostly in homes where the householders had expressed an interest in having a smart meter, e.g. by responding to a written or online invitation, though some were routine replacements of an end-of-life traditional meter by a smart meter.

The second focus group consisted of six installers and their manager, also installing fully-smart electricity and gas meters with IHDs. These installations were more likely to be replacements for end-of-life meters.

The team managers in each group took a full part in the focus group conversations, alongside their colleagues. While their participation will have influenced the course of the conversation to some extent, it did not appear to inhibit the other speakers, and their knowledge of organisation and logistics was useful at times.

NORTHERN IRELAND (NI)

The NI focus groups met in Belfast in November/December 2013, and were facilitated by Christine Liddell (Ulster University) and Paul Wallace of National Energy Action (an NGO working to eradicate fuel poverty and promote energy efficiency). These focus groups offered an opportunity to learn from the NI experience with both smart meter and keypad installation, and (given the length of time keypad meters had been available in NI) to indicate the time it takes for utilities to build up a body of knowledge about good practice. Installers in both focus groups had installed several thousand keypad meters since their introduction in 2002.

The first focus group took place with two line managers and two installers who had taken part in Northern Ireland's *Smart Meters, Smart People* trial (see Liddell, 2012). As part of the trial, they installed fully-smart electricity meters with home energy displays in 56 homes, mainly low-income customers at risk of fuel poverty. Installation was in 2011.

The second focus group took place shortly afterwards, with two smart meter installers who were taking part in a smart grid trial with 200 homes, along with their line manager.

GATHERING AND PRESENTING THE FOCUS GROUP MATERIAL

All four focus group discussions lasted around two hours and were audio-recorded. Summary transcripts contained the main substance of the conversations and, together with results from NVivo analysis, form the basis for this paper. The themes and issues detailed below derive from the NVivo analysis – that is to say, they emerged primarily from the transcripts rather than from the research literature.

Themes and issues

DEVELOPMENT OF A SMART METERING MARKET

The 'pull' factor of customer demand was thought to be growing, which is significant in the context of a voluntary rollout. The focus groups were carried out a few months after a TV advertising campaign by one of the utilities, highlighting smart metering, and the installers saw these advertisements as having been useful in raising awareness So was word of mouth, as increasing numbers of people now knew someone who had a smart meter. Installers in one of the GB focus groups commented that:

> I've found that from when we first started … the awareness has gone up ten-fold already, but we've still got a 'blank', especially with the elderly customers, they think we are there to just fit in a meter, they don't have any understanding of what they're getting.
>
> … I actually found when they did that 'smart' [TV] advert that overnight people were slightly more aware … I get asked a lot more questions now about how things work, how they can potentially save money, than I did probably a year ago.

> It's natural growth as well, … numerous times … someone would say 'Oh, my brothers had these smart meters installed, if I am just going to put normal meters in … They ask you 'Is that a smart meter you're putting in?' You say No and they're like 'Well, why not?'
>
> Just word of mouth in itself is naturally arousing people's attention.

Given the complexity of the supplier-led GB rollout, though, there may be a need to manage expectations.

PRACTICAL CONSIDERATIONS AT INSTALLATION

Safety was seen as an absolute priority, both in terms of the smart meter installation …

> That's what … I personally think about most of, making sure the customers are safe and that I have done my job properly so that they are not in harm's way at all.

… and in terms of the installation giving an opportunity to check that the home is safe, for example from carbon monoxide or a gas leak:

> Once I saw this black substance around the boiler and I asked if anyone's been ill or had headaches. The man said his daughter had been sick and her bedroom was above that. They were really grateful that you've spotted it.
>
> … we get these old Victorian houses where the pipes go underneath the floorboards and … they've got vents in the house to stop the wood from rotting. So if you've got a gas leak … they could live there 20 or 30 years and not even realise. (GB focus group)

The amount of time allowed for an installation was seen as an important consideration, in that it would affect the possibilities for a conversation between installer and householder. Two-thirds of the householders surveyed by Ipsos MORI who had been present for their smart meter installation recalled that the installer had showed them how their IHD worked. But installers pointed out that they have to prioritise safety and workability, and so the time left for customer explanations and engagement may be squeezed. There were concerns about the extent to which skills could be maintained during a scaled-up roll-out, where the pressure to get meters in place was likely to intensify, and a significant proportion of the work could be contracted out:

> … it's a difficult one – do we ask for a certain technical standard as well as some sort of qualification in dealing with customers? I don't know how you actually do that within the [EU] procurement framework. It's different when you're interviewing staff and you bring them in that way, because you can gauge … how good their 'people skills' are from an interview … whereas whenever you're going out to procure a contractor to install meters in several hundred thousand homes … it's not something that probably naturally comes across during a tendering process, because you're not necessarily talking to all of the individual engineers themselves. (Installer, Northern Ireland focus group)

In this context, installers expressed concern that contract installers are often paid per meter installed, which is a potential limiter on the quality of customer service which could be provided; time pressures are often more sharply felt among installers who are paid for their outcomes rather than for their time.

INSTALLER SKILLS AND TRAINING

As noted above, a well-received installation visit is associated with positive outcomes. It was clear from the installer focus groups that their training had helped in building confidence and ability to communicate. Installers used phrases such as 'very customer-focused', and 'knowing how to adapt to different styles of people'. They took pride in their ability to walk into a wide range of household situations and cope with them constructively.

Both GB companies had training programmes for their smart meter installers, with classes and mentoring over a period of up to six months. The installers in one focus group talked about specific elements of their training in relation to customer engagement:

> There was a lot of behavioural training, isn't it?
>
> Yeah, we had two weeks of that alone …
>
> … It did seem at times excessive compared to the practical side of the job that you needed. I mean, I know it's a big part of the job …
>
> There was some of it that was quite useful in terms of knowing how to adapt to different styles of people and just looking into how different people react and how you can react with them, rather than making a mess of things throughout a conversationoverlap.
>
> … Yeah, we learnt about 'controllers' and things like that.
>
> Reflectors, Creators, Controllers …
>
> I can't remember what the other one was, it was 'green', anyway …
>
> Connector.
>
> It's quite useful when you initially meet a customer and start speaking to them, you … think 'What kind of person am I dealing with here, do they want to absorb all the information I've got to give or do they want it short and sweet and want me to get on and do the job?' … If they are bombarding you with questions you can throw the answers back at them, or if they are a bit more of an analytic person, a bit of a 'controller', they're going to say 'There's your meter, go and fit it now' and stuff like that.

There had been some selection of installers who were seen as good communicators, prior to training:

> What we do as well is look at the breakdown of people who have been employed during that period, they all fitted into the 'connectors'. And a lot of the customer service side, the majority of people tended to be 'connectors' as opposed to engineers … that was a positive for us.

'Connectors' were seen as good communicators, and the term was used, very appropriately, in relation to both customers and to the staff who were being trained to communicate with them in their homes. The conversation made clear that even (!) en-

gineers can be connectors, and that their training had helped them develop skills in this direction.

There was a degree of overlap in what was taught during training for engineers and call centre staff, and members of each group were shown something of the working conditions and issues facing the other:

> We've got technicians and they will have the training that they need in terms of the customer side … and then we've got Smart … call centres … and we will send all of the people that are on the phones doing the appointments, they go through a two week training course as well. It will be similar in terms of understanding what a smart meter is, the benefits of it, how to sell it over the phone, customer guide …
>
> [Facilitator:] Do the call centre people train along with you?
>
> No, they don't train with us.[2]
>
> We go into the call centres to see what types of calls they're getting.
>
> … That's part of the induction. As part of the 2-week course, everyone who works in a call centre has to go out and see what it's like. (GB focus group)

There were also regular updates on the rollout where it was possible to learn more about company-wide issues:

> We also get called for team briefings every month or so, where you'll sit round and see how things are going in the company and they'll also bring up any issues …
>
> There is always refreshers [additional training courses] and there's plenty of people around if you need help. (GB focus group)

Asked whether they would be involved themselves in training installers for the future, the answer from one GB focus group was

> Yeah, we all have [been]. Now we will need less meter readers but a lot more engineers, because I don't think people realise just how many houses need doing.

These accounts of training arrangements indicate the potential for social learning within the supply organisation through teaching some principles of customer engagement, witnessing the work of colleagues in other parts of the organisation, passing on practical know-how from experience, and discussing issues arising during work.

USING THE IHD

The IHD is recognised in publicity material as the element of a smart meter system that customers are most likely to be interested in. With the technology goes the need to understand and use it effectively, as one NI installer pointed out:

> … there is no point wasting billions of pounds if we don't educate the people in advance … because all you'll do is increase their cost, and they're not going to thank you for that … for putting this meter in and not knowing how to work it and saving them nothing, 'and the electrician wasn't able to tell me'.

A small-scale trial of smart meters with specially-designed displays in Northern Ireland had already demonstrated the value of personal contact, which included a home energy audit and tangible reminders of the visit such as fridge magnets. Although the manual which accompanied the IHD was consulted only occasionally, and none of the 56 trial participants visited the trial's website for further information, customers frequently rang the supplier with queries when the IHD appeared to malfunction, and customers who moved house during the trial all requested relocation of the IHDs (Liddell, 2012).

One GB installer explained how he and his colleagues normally explain the IHD with a combination of written material, a chance for the customer to test out the display, and some personal explanation:

> I think a lot of guys … they'll say, I'm going to come and talk to you about everything I've done at the end [of the installation], when I can explain this more thoroughly … I give [customers] the booklet to explain it at the start so, whilst there's nothing they can do because there's no power, they read the booklet. Then once you've put the power back on, give them the display whilst you're doing the gas [where it is essential to concentrate on safety], and when they come back they say 'Oh, what does this bit do?' because they've already read a little bit about it.

Installers emphasised the importance of the IHD as a teaching aid:

> I get a lot of questions about the energy display. Obviously, we go there and try to encourage people to save energy, and a lot of them would ask, how much is it costing to work? How can you help me save money? That's what everyone wants to know and they want an answer within two minutes … Once you have the monitor, you can act on reducing your bills.

The Foundation Stage survey found that 96 % of smart-metered respondents had plugged their IHD in at some point since the installation visit, and about 60 % still had it plugged in, up to two and a half years later. Moreover, these were not necessarily 'early adopters': the sample were less likely than the general population to agree with the statement that 'I'm the type of person who likes to have the newest gadgets in my home'. (Ipsos MORI 2015). Indeed, for most of the analyses carried out on the survey data, customers being technically-minded played only a modest role in predicting outcomes– much more salient was the customer's interface with the utility provider around the time of installation.

Research and commentary on IHD design note the balance to be struck between immediate appeal, relevance, clarity and ease of use on the one hand, and enough detail to hold the user's interest on the other (Anderson and White 2009; van Elburg 2013). A GB installer commented:

> I agree with the simpleness but … you should also have the option for the complicated, because the novelty does wear off on these meters relatively fast for most of our customers. But … if you're just bored one day yourself and if you're to

2. This was the case for both GB groups.

> pick it up and read through the book and have a mess with it there's something to do with it. If it was too simple, you just look at it, there's nothing to do there …

Even apparently simple 'traffic lights' on a display (for low, medium or high usage) can be problematic, though:

> Problem with the traffic lights on that [design] is … three different modes [cumulative, instant, predictive] … I've been to a customer that's turned off all the heating because she was petrified 'cause the traffic light was on red, but … it was going red because [it predicted that] she'd go over her budget for that day. But she thought, she was told by the engineer that red meant to be using a lot of energy, so she turned everything off.

Observations such as these show how installer experience can be harnessed to improve outcomes for customers.

In terms of IHD use, two broad styles of interaction were noted among the Ipsos MORI survey respondents. Some householders developed an 'information-driven' approach to using their IHD: that is, their main interest was in learning how much electricity specific appliances used, and which caused the most dramatic spikes in demand. They would not necessarily look beyond the screen that showed electricity consumption in real time. Others were described as taking a 'monitoring' approach, using the IHD to monitor day-do-day energy use and the state of things in the home more generally. Many of them had moved on to this mode of interaction after first being 'information driven'. People in this second group might describe using the IHD to check that everything was switched off before leaving the house or going to bed, using the budgeting function on the IHD, monitoring their usage over time or using the IHD as a talking-point to encourage other household members to reduce their gas or electricity use. Respondents with a predominantly 'information-driven' approach to the IHD were more likely to have stopped using it after an initial learning period, whereas those who used more diverse functions were more likely to continue to use the IHD, and might even increase their use over time.

Whether differences in the length and diversity of engagement with the IHD were related to differences in energy consumption remains unknown, but merits scrutiny. The survey did find, however, that 'monitoring' customers were more likely to believe that their smart meter and IHD had helped them learn which appliances use most electricity, and that it had encouraged them to change some energy-related behaviour. Among respondents who said that they felt in control of their gas usage, the 'monitors' were almost twice as likely to say that this had been helped by the smart meter installation as the 'information-driven'.[3]

PRIOR KNOWLEDGE AND THE INFORMATION ENVIRONMENT

As already noted, customers have differing levels of knowledge about energy and metering when their smart meters are installed. While a majority of survey respondents said they had heard of smart meters before they were contacted about receiving one, only 14 % of those who were aware they had a smart meter felt that they knew 'a great deal' or 'a fair amount' already. It seems that there is still plenty of scope for developing knowledge and know-how ahead of installation. This was borne out in the focus groups:

> … the typical thing we hear from customers – 'How does it work?' People are excited to see what happens. They don't really know much about it and physically want to know what is happening and what it's displaying. (Installer, GB focus group)

Some knowledge prior to using the IHD, even if it is gained during installation, gives householders a vocabulary with which they can discuss the new meter with the installer, as noted in one of the GB focus groups:

> … I'd say if you've done the job, most people just stand there and listen and don't ask you any questions … you know that they're not understanding a word that you say unless you can get them to interact with you, which is why this YouTube channel now is good, so they can watch that. DVD is the best option, I think, because while you're changing the gas meter they could be watching the DVD and then ask you any questions once it's finished to save time. Not everyone has internet access.

The experience of installing both semi-smart keypad meters and fully smart meters in Northern Ireland also demonstrated the usefulness of preparing customers before the installation began:

> I think there has to be a certain amount of learning before the installer even hits the door. You could use television programmes … community groups, you could use a lot of training before we actually start the roll-out and then the installer just gives them the quick refresher. (Installer, NI focus group)

This comment is borne out by the survey results, in which householders who had already attained prior knowledge of smart meters were more likely to recall the information given to them during the installation. Possibly, this is a result of householders being less prone to information overload (or 'eyes glazing over') when the installer is explaining the meter and IHD. This lends support for the role of the central supplier-funded body 'Smart Energy GB', and for the involvement of local organisations in preparing people for rollout and, potentially, for related efficiency programmes.

MEETING CUSTOMER CONCERNS: ADVICE DURING AND AFTER INSTALLATION

The installers reported largely positive customer responses to smart metering. This is not surprising, given the voluntary nature of the rollout and the overall state of public opinion up to that point – broadly though not strongly positive.[4] However,

> Recently, there was a customer who was convinced there was a camera in the meter watching him.

3. For a detailed analysis, see Chapter 5 of Ipsos MORI (2015).

4. E.g. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/237234/quantitative_research_into_public_awareness_attitudes_and_experience_of_smart_meters_wave_3.pdf.

> There's a lot of bad press with smart meters in other countries. America, Austria … With some people you do get this conspiracy theory …
>
> [F:] About what proportion of households would have those concerns?
>
> A very, very small percentage, much less than 1 %.
>
> You can easily turn these people around. You can explain that they're not like the pre-payment meters and you can make sure they know what smart metering actually is.
>
> … Once you explain to them what the meter does, what the purpose is, the in-house display and everything else they'll benefit from it quite happily. (GB focus group)

Installers identified two factors that particularly affected their approach to Foundation Stage installation – customer interest, and (a recurring theme throughout the focus group discussions) the time available for conversation:

> … three different types of customers with regards to their engagement … you've got the ones that … know more about it than you and it gets embarrassing because the … questions they're gonna ask you, go right over your head. So you just let them speak. And then you've got people who are interested in but not very good with technology, and you've got the ones who are really interested in technology but have no engagement, no time free. You put it down to three groups of engagement – and you get the phobic ones, who don't want to talk to you. (Installer, GB focus group)

While installers' training helps to develop their communication skills, giving advice in a new situation can still be a challenge, given the time available. Installations can take from under 30 minutes for an electricity smart meter to four hours or even more for a difficult dual-fuel installation. But the average time spent with a customer on a normal work day was said to be one-and-a-half to two hours, which normally allows time for a conversation about the meter and display.

The IHD is often used as the basis for advice:

> Most showers have now about eleven and a half kilowatts. That's three or four kettles every time you get into the shower. You explain to people that when you're there for half an hour, would you put three or four kettles on for half an hour at the time? No … No … That's exactly what you're doing in the shower. So, they even change their habits … they'll spend five minutes in the shower instead half an hour, so they automatically save a fortune by doing that. With these devices [IHDs] you can actually … put the shower on and it'll show how much it's costing you.

One installer emphasised how important it was that customers were able to learn directly from the display and from what was going on in their own home, as opposed to being told disembodied facts – and that he could tailor advice in response to what he saw around him. His comments illustrate the importance of installers being observant and flexible, so that they can personalise the installation experience for customers:

> You can tell them facts and stuff like that and they do appreciate that, but I don't think they take it in as much as … when you're … showing them, when they can see you … When we are in people's houses, you look around when you're doing the job and suss out what they've got … energy efficient light bulbs or whatever, and you can … gauge what sort of level they are … Towards the end when you're … explaining the display you can say to them, I've noticed you've got this or you haven't got this, and you just give them tips and that sort of thing. (Installer, GB focus group)

Gas tends to be sidelined in discussions of smart metering and IHDs, but this was explored in one of the GB focus groups:

> [F:] You're talking very much about electricity … but do you get to talk about gas-related savings?
>
> There are some customers who ask why their neighbours down the road pay £100 less. You try to explain that: 'well, you've got an old Victorian house with high ceilings; the radiators have to work harder to heat those rooms, comparing to the new estate down the road'.
>
> … We ask if they had their loft insulated. A lot of them keep the original windows, so they would be better off with double glazing.
>
> The difference is that with the electric you can actually see how many kilowatts that appliance is costing you. With gas we can't see that and on top of that you don't know how efficient the appliance is either. The appliances could be extremely expensive and you wouldn't even know.
>
> The [display] doesn't know whether you've got cavity wall or loft insulation, it doesn't know … how energy efficient your boiler or how old it is.
>
> The engineer does. So when we're there, we can advise them.
>
> There are leaflets we can leave them about cavity walls.
>
> … Solar saver, boiler care and water pumps.

There are limits to the help that an installer can offer in relation to the 'smart' functions of the IHD. For example, when asked whether they ever set the 'budget' function on the IHD for a customer, the discussion in one GB focus group included the comments that:

> The last thing you want to do is scare the customer. If some people are setting budgets and leaving the alarm system on and it starts going off …
>
> … I went to that job … The budget had been set and the alarm was going off, so [the customer] literally sat there for a few days with no heating on.

At least until factory settings and designs changed, it seemed wise to avoid the budget function.

Advice will be of most value when the customer is receptive and can digest it, and this may not be in a single 'dose' at installation, especially if the customer is in a hurry. Hence the value of reliable advice and information after installation, from call centres and from trusted individuals or organisations.

Installers themselves need some assistance in answering difficult questions or troubleshooting technical problems. The focus group participants pointed out the importance of having accessible support via their phones, and the need for well-

trained call centre staff who knew about the whole process of installation, from booking appointments to fielding customer queries after installation.

VULNERABLE CUSTOMERS

The installers commented that they might or might not know in advance about potential difficulties ahead of them, such as a customer with a hearing or visual impairment. The visit was an opportunity to log information about any special considerations. They had some support for their work with vulnerable customers through the routine specified for Priority Service Register[5] customers:

> … we have a specific vulnerable customer journey. When the appointment's being booked we offer vulnerable customers what we call a smart support coordinator, and then that person in the call centre will follow that customer the full way through the journey so they'll be in touch with that customer or their third party carer once the technicians do the call on the day, and then we'll follow up … They normally phone about an hour after we leave. (Installer, GB focus group)

The experience from both GB and NI pointed to a need for special care in preparing information materials for the elderly, and in training installers to communicate with them. Whilst there were very few customers in the survey who expressed dissatisfaction with the installation process or their smart meter system, those who did were significantly more likely to be over 75 years old. Analysis also indicated that recall of information from installers diminished as the age bands of respondents progressed from youngest to oldest. In general, however, the threshold of 'vulnerability' emerged at 75 years, and not the more customary 'pensionable' age of 65.

Whilst installers had some experience working with customers for whom English was a second language, they reported few difficulties in this respect; in cases where the householder understood very little English, someone else in the household such as a schoolchild was often on hand to help with explanations, and a three-way phone call with a translator was a possibility as a last resort. In other cases, the customer database allowed installers and households to be matched by ethnic group.

Discussion

The term 'smart' is used freely in energy circles, usually in relation to technology and novelty. The views presented here shed some light on the question of what happens when people are introduced to a new piece of technology, and give some pointers as to what can happen as the relationships between people and things within the system change: in this case, the relationships between householders, their energy suppliers, and their energy use. This is a live issue, as different possibilities for smart grids are envisaged and developed (e.g. Goulden et al., 2014; Verbong et al., 2013), and we can expect that social factors will continue to play a part in in an iterative process of interpreting and integrating new technologies and practices.

Developing a 'monitoring' approach to smart meter and IHD adoption can be seen as a process of domestication, and one with a social dimension. We might expect the social contexts in which smart meter and IHD engagement takes place to have some impact on how much householders discuss a new technology, and who they talk to. (e.g. Bale et al., 2013, for an account of social networks and technology adoption).Among the Ipsos MORI survey respondents, almost half reported discussing the IHD with others, and three-quarters of these viewed the discussions as positive. This illustrates the potential for passing on messages between people, households and organisations, underscored by the survey finding that those who did participate in discussions about the technology were significantly more likely to have their IHD plugged in at the time they were surveyed, and significantly more likely to be using a range of features on their IHD.

The conversations with smart meter installers fit with findings from a recent large-scale smart metering trial in the Netherlands, where the installer's visit was found to be a key element of the customer experience of smart metering (van Elburg, 2014). The survey finding about differences between customer styles of interacting with an IHD (information-driven or 'monitoring', concentrating on real-time electricity consumption or using a range of features) has important implications for programme support. If supplier explanations and advisory material are focussed primarily on teaching an information-driven approach (e.g. demonstrating the IHD by turning on an electric kettle), many householders may conclude that this is the primary function of the IHD, and not go further to explore other features of their display. This could curtail benefits for them and for the system: it seems that installers have an important opportunity to encourage their customers to experiment with the IHD, either on their own or through discussing it with others. There seems to be a case for developing the installers' Code of Practice (SMICoP) so that it states the importance of seizing this opportunity and also points out the importance of finding out what customers already know and building upon it. In so doing, the Code will be reflecting what is already experienced as good practice.

Conclusions

At a time when there are varied expectations of the impact that smart metering may have on residential energy use, this paper has offered an account of what happens around and during installation, based on material from 'middle actors' – meter installers – whose voices have not yet been heard.

Our findings shine some light on *relational* aspects of technology adoption, and smart metering in particular. They indicate the significance of installers' training and working arrangements, the extent to which they are taking on a new role, and the ways in which they see themselves as part of a wider process of knowledge transfer. This includes teaching and learning within the supply organisation, as call centre staff and installers gain some experience of each others' work.

The focus groups also illustrate the social learning that can take place during and around the time of installation, not just for households, but for a much wider audience through house-

5. The GB energy suppliers' Priority Services Register offers extra free services to people who are of pensionable age, registered disabled, have a hearing or visual impairment, or have long term ill-health.

holds sharing their experiences across wider social networks. Installation appeared to be an opportunity at which curiosity about energy use itself could be mobilised, sometimes initiating new thinking about energy and a better understanding of how it could be saved. What the focus groups also illustrate is how much learning utility companies and the installers can glean from this installation interface. Installers emerge as a hitherto unacknowledged but valuable resource, capable of brokering effectively between suppliers and their customers.

Along with the findings from the GB survey, and from the growing research literature on energy feedback, these results indicate how awareness and knowledge change over time. The paper thus highlights issues for policymakers when planning and evaluating smart metering in terms of customer benefits, particularly energy efficiency and demand reduction.

It seems unwise to jump to conclusions about the impact of smart metering on the basis of a few years' data: the policy, technological and social environments are all evolving, and evidence is still emerging as to who the key players are likely to be. Installers are only one group who are likely to emerge as such. Similarly, while concern about privacy was very rare among the survey respondents (2 % expressed concern) this too could change, and quite rapidly depending on how well data is protected.

What appears evident from the focus groups and supplementary survey results is that installers are a 'cornerstone' for ensuring active public engagement with smart meter technology. A good installer can help ensure that households develop and then sustain an active interest in understanding their energy use, and in deciding whether and how to save energy.

All of the installer focus groups consulted in this study noted the significance of the Foundation Stage of smart meter rollout for their company and their working practices – for example, the efforts made to use smart metering to promote their brand, and the need to recruit new installers. In terms of customer engagement, there was some concern that the Foundation Stage would give way to more pressurised conditions during the main rollout period, so that there would be less time to spend with customers and to talk with them. In this context, suppliers will have decisions to make about how much time should be invested in customer support and service. In terms of supply decarbonisation and likely future needs for demand response, it seems that trimming the time available for installers to engage with customers could be counterproductive: demand response requires a degree of understanding, whether in order to take an active, conscious part in load-shifting, or simply to consent to an automated response. Instead, the more installers can be aware of how valuable their presence is when customers first engage with their smart meter and its IHD, and have time to communicate effectively, the more likely they are to be focused on ensuring that this first encounter leaves their customers empowered to make sense of this new technology.

The communicative role of the installer has been largely overlooked in situations where smart meters are installed without customer interfaces. However, the experience of installers who have been introducing smart metering in conjunction with in-home displays shows how they can be important connectors in more than one sense, helping householders to reframe their understanding of energy use and alter their practices.

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