EnergyREV

Privacy and data sharing in smart local energy systems: Insights and recommendations

Chris Maidment, Carol Vigurs,
Michael J. Fell and David Shipworth

November 2020

INDUSTRIAL STRATEGY

UK Research and Innovation

Authors

- Chris Maidment
- Carol Vigurs
- Michael J. Fell
- David Shipworth

This report should be referenced as:

Maidment, M., Vigurs, C., Fell, M.J. and Shipworth, D. 2020. Privacy and data sharing in smart local energy systems: Insights and recommendations. EnergyREV, University of Strathclyde Publishing: Glasgow, UK. ISBN 978-1-909522-68-8

Contents

Executive summary

Data are the lifeblood of smart local energy systems (SLES). Such systems can help deliver energy services efficiently by automating complex processes, self-regulating, learning user preferences, and helping inform effective decisions. They cannot do this without data in many different forms, from second-by-second updates on the charge of batteries to the addresses of users' homes. Often, this means that users must actively choose to share such data.

The General Data Protection Regulation puts SLES providers under legal obligations regarding the processing of personal data, including energy data. Equally important, data privacy is a prominent concern for potential SLES users. Get it wrong on the data – even if only in appearance – and trust, participation, and data sharing in the SLES could be seriously damaged.

Because of data privacy concerns around smart technology in general, lots of research has been conducted on the form these concerns take and why they occur. In this report, we review evidence on this topic from the energy field, with the aim of **providing insights for SLES providers on how they can work with users to get the data they need to operate, while respecting and addressing users' privacy concerns**.

The main privacy concern for which we found evidence was that sharing detailed energy use data had the potential to reveal information about home life, and to intrude upon autonomy, choice and control. Many people feel strongly about retaining control over information about themselves, their home life, and ways of living. Setting privacy controls are a part of modern life. People are accustomed to make decisions around sharing data on accepting cookies on websites, and setting privacy controls in social media, ticking boxes to not receive marketing material and so on.

While there has been a lot of research to understand concerns around privacy and data sharing in energy, there has been little publicly available direct testing of what works in appropriately addressing such concerns. Nevertheless, existing studies can still be helpful in creating recommendations where they shed light on the mechanisms that underlie concerns.

Based on these and other identified mechanisms, we derived the following guiding principles for the SLES providers. These are:

- Recognise the mutual benefits of data sharing for smart local energy systems and work with customers as partners
- Involve people in the design of data sharing technologies from the start
- Give people a say on the third parties that they are happy to share data with
- Empower people to set the boundaries around the flow of information about themselves
- Ensure that the purpose and value of the data collected is transparent and fair
- Ensure that everyone that is affected by sharing of data is involved in giving their informed consent
- Recognise that technologies for revealing and monitoring behaviors in the home can be used in unexpected and unwanted ways and anticipate this in service design
- Ensure there are channels of feedback and ongoing communication to continuously improve service delivery

These principles run through and inform the recommendations set out in the remainder of this section.

To address user privacy concerns and maximise (appropriate) data sharing, SLES providers should:

1. Build on existing trust to deliver mutually beneficial outcomes

- Seek to include partners who are viewed as having minimal vested interest and/or relevant expertise. This could include government bodies and energy suppliers, or a data trust to act as an independent intermediary.
- Involve future users early on to help ensure the most appropriate, trusted organisations are brought on board for that locality.
- Don't be afraid to seek to collect and use data where it is of clear benefit to users. An example of this is providing expert guidance, which is likely to be expected where unfamiliar products or services are involved.

2. Ensure people feel in control of both their data and environment

- Make it easy for customers to choose the level of data sharing that they are happy with, and be clear what this means for the kind of benefits or services they can expect to receive.
- Consent to share data should be amendable (with periodic reminders to do so); bounded (stating what the data will be used for) and specific and clear about what data is being shared, and with whom.
- Provide simple processes for customers to express their "red lines", both on what energy providers can control, and the extent to which they can control it (e.g. by time of day, or by appliances).

3. Help people to understand new products and services

- Consider offering customers an option to trial new products or services which require data sharing.

4. Design SLES around user priorities and make these benefits clear

- Use participatory, community/user-centred processes to develop services. This will help ensure they align with users' values and priorities, improving the chances the users will be happy to share their data.
- Ensure that customers can anticipate benefits from data sharing. These could include cost savings, the reliability and fairness of accurate billing and the environmental benefits of more efficient energy use. This could be done by presenting bills that compare energy usage to similar local households.

5. Monitor and use a variety of approaches to actively widen engagement

- Consider engaging with existing local/community groups and networks to identify and proactively target underrepresented groups. Tailor methods to engage directly with all groups of people to ensure that no one is left behind.
- Provide ongoing and proactive communication and support for sustained data sharing for mutual benefit. Consider a range of different means of communication, from personal visits, telephone calls and emails. Make websites easy to access and understand.

6. Consider everyone affected by data sharing when seeking consent to share data

- Reflect the fact that most households consist of more than one person when considering user privacy. Service designers should incorporate the 5 Coercive Control Resistant Design Principles developed by IBM and Refuge, which are based around diversity, privacy/choice, security, combatting gaslighting, and technical ability.

7. Provide clarity on how data will be used and how misuse will be prevented

- Be clear with customers about how their data will be used and how misuse will be prevented.
- This includes not only restricting access to authorised parties, but also limiting data analysis to specific purposes and contexts where consent has been given (and/or policymakers should regulate energy companies to enforce this). It also includes developing clear plans for how data loss will be handled which can be made available to customers on request.

8. Consider leveraging the willingness of users to share data with friends and family where appropriate

- Consider how to enable and encourage peers to support each other towards mutual goals.
- Use accessible and, where possible, trusted technology to help to generate uptake. Promoting this uptake can, in turn, generate further uptake.

Introduction

Data and smart local energy systems

Data are the lifeblood of smart local energy systems (SLES). Such systems can help deliver energy services efficiently by automating complex processes, self-regulating, learning user preferences, and helping inform effective decisions (Ford et al, 2019). They cannot do this without data in many different forms, from second-by-second updates on the charge of batteries to the addresses of users' homes. Often, this means that users must actively choose to share such data.

Much of the data that SLES need to function effectively is personal. That is, it "relates to an identified or identifiable individual". Because of the General Data Protection Regulation (GDPR), SLES operators are legally obliged to pay special attention to how they obtain and use personal data, including around getting user permission (see next section for more on GDPR). Equally important, data privacy is a prominent concern for potential SLES users. Get it wrong on the data – even in appearance – and trust, participation, and data sharing in the SLES could be seriously damaged.

The local nature of SLES makes this issue more acute. On the one hand, as this report shows, some types of local organisation are likely to be particularly trusted by users, perhaps making data sharing more likely. On the other, there could be more concern about sharing energy data that shows when you are at home or not, with a local body whose office is around the corner. Technically, anonymising data is easier over larger numbers of participants and larger areas. Even a small combination of non-personal data can uniquely identify individuals once local knowledge is taken into account. Harnessing the benefits of trust in local institutions, while mitigating the risk of local identifiability are key to successful data management in SLES.

The aim of this insights report

Because of data privacy concerns around smart technology in general, lots of research has been conducted on the form these concerns take, and why they occur. In this report, we review evidence on this topic from the energy field, with the aim of **providing insights for SLES providers on how they can work with users to get the data they need to operate, while respecting and addressing users' privacy concerns**. By SLES providers, we mean all stakeholders such as companies, community groups, cooperatives, governmental organisations – involved in the design and delivery of SLES.

Throughout this report we will talk of 'appropriate' privacy concern and data sharing. It is not in the interests of users or operators for data to be shared which makes users feel uncomfortable, will not be treated securely and in good faith, or is simply not necessary for SLES operation. However, for the individual and societal benefits of SLES to be realised, some data will need to be shared, and it is therefore important to understand how this can be achieved effectively and respectfully.

It is also important to be clear what this report is not. While we give a brief overview of GDPR, we do not provide legal advice. We also focus on addressing privacy *concerns*, rather than exclusively technical solutions to privacy issues, such as data encryption.

The next section of the report provides an overview of the current privacy landscape in energy, taking in GDPR and some of the main initiatives that have focused on data/privacy issues in recent years. We then present the findings of our review work, highlighting the different kinds of privacy concern that have been found to arise, and the associated barriers and facilitators to data sharing. This is followed by a set of recommendations for how different SLES stakeholders might appropriately address any concerns. Finally, we provide brief details on the studies that were included.

Please note that this work has accompanying material and a technical report [LINK WHEN AVAILABLE] which provides full details on the aims, methods, and findings of our review.

The energy data landscape

General Data Protection Regulation (GDPR)

GDPR is a European Union (EU) data protection regulation which came into force in 2018. Its provisions apply in the United Kingdom (UK).[1] Plentiful guidance is available online about it (and you should consult this for specific detail), but the aim of this section is to provide some basic information about how it might relate to those operating SLES. At the core of GDPR are seven key principles, adapted from ICO guidance:

- Lawfulness, fairness and transparency
- Purpose limitation ("collected for specified, explicit and legitimate purposes")
- Data minimisation ("adequate, relevant and limited to what is necessary")
- Accuracy ("and, where necessary, kept up to date")
- Storage limitation ("permits identification of data subjects for no longer than is necessary")
- Integrity and confidentiality (security)
- Accountability (responsibility for, and ability to demonstrate, compliance)

Responsibilities under GDPR fall on data controllers and data processors. Generally speaking, controllers are the actors who decide to collect data, on the purpose for collection, what data should be collected, from whom, etc. Processors follow instructions from controllers on how data are processed.

1 This will continue to be the case after the end of the implementation period of the UK departure from the EU on 31 December 2020 under retained EU law arrangements (see Gowling WLG, 2020). Note that GDPR is supplemented in some areas by the Data Protection Act 2018.

In a SLES, an example of a data controller might be a local authority which is in charge of the system (they could take this role jointly with other coordinating organisations), while the data processor could be a company that has been contracted to calculate payments to participating prosumers. But given the potentially complex network of relationships between different organisations involved in running a SLES, it will be important for SLES operators to get clarity on their respective roles and responsibilities.

The type of legal basis provided for data processing also has implications for the rights of data subjects. These include things like the right to erase data, or to obtain and re-use data for their own purposes. It is important for data controllers and processors to be clear on when these and other rights apply, so that they can understand the implications for their operating models if they were to be exercised.

GDPR applies to personal data. While obvious categories like names and address fall under this description, certain kinds of energy data, such as smart meter data, may also be considered to do so (Fratini & Pizza, 2018). Organisations need a clear legal basis for processing personal data. Perhaps surprisingly, many of these do not require the explicit consent of the data subject, such as if processing needs to be done to fulfill a legal obligation, or it is in the public interest. For example, local authorities are likely to have wide-ranging abilities to collect data to perform statutory functions. Organisations will likely need to take guidance on whether the uses they have in mind fit public interest or other legal bases.

Obtaining user consent is, however, likely to play an important part in many SLES operations. Firstly, it is often a necessary part of getting access to data in the first place. Secondly, as the evidence provided later in this report will show, getting informed consent for data sharing is an important part of building confidence and trust. GDPR and other data regulation is only part of the picture that SLES operators need to consider. In recent years the roll out of smart meters in the UK has prompted significant attention to the question of energy data privacy. The next sub-section provides a brief overview of the landscape, and some of the key documents, organisations and issues.

Energy data and privacy in the UK

One of the key anticipated forms of data that will underpin SLES operation is smart meter data. Smart meters are currently being offered to every household in the UK. These have the potential to provide fine-grained energy use data – up to every 10 seconds for electricity, and 30 minutes for gas. High profile controversies connected with access to smart meter data (such as in the Netherlands, see Van Aubel and Poll, 2019) meant that substantial planning effort was expended on ensuring the management of smart meter data would be acceptable to householders.

Smart meter data access arrangements are governed by the Smart Energy Code. All smart meter data is explicitly controlled by billpayers, with the data being stored on the meter. Data can be requested by suppliers through an organisation called the Data and Communications Company (DCC) for billing purposes, but only monthly data can be collected unless the billpayer provides their active consent. This was done for privacy reasons, since half-hourly data can be disclosive of things like presence or absence at home. Access to smart meter data through the DCC for other purposes is tightly governed, for similar reasons. Organisations can also access smart meter data over the Internet via a Consumer Access Device in homes – but again, explicit consent is needed.

While most of the accounted-for economic benefits of smart meters are down to things like energy saving through feedback and avoided meter reading visits, this data also has the potential to be used for a wide range of public interest reasons which themselves may have significant value. These include areas such as helping to identify inefficient homes and contributing to health monitoring services.

Box 1: What can you do with smart energy data?

Frequent measurement of energy use can give surprising insights (Greveler et al, 2012) into the lives and preferences of occupants. While an often-cited example is the ability to spot whether or not people are at home, much more subtle insight is also possible. One German study showed how high resolution electricity monitoring data could reveal which television shows people watch, based on screen brightness. Such information could be sold to advertisers. Another use which is being trialled is tracking the progression and status of Alzheimer's disease patients.

In the UK, the organisations Sustainability First and Centre for Sustainable Energy have been carrying out a programme of work to help identify such benefits, and how they might be unlocked in a fair way. This is known as the Smart Meter Energy Data Public Interest Advisory Group (PIAG). One of the key challenges it has highlighted is the way in which repeated requests for consumer consent to use smart meter data for public interest reasons are likely to present high transaction costs both for processors and data subjects. Since consent is required for every new data collection purpose and for every processor, the burden on users to track and manage who has access to their data could quickly mount. One proposed solution is to set up a central data processing platform to manage consent. The PIAG website provides a rich resource of stimulus papers and reports, including one specifically on the topic of sub-national public interest issues.

Box 2: Other sources of energy-relevant data

Smart meter data has received special attention from the perspective of privacy, largely because smart meters are a state-mandated method of data collection that, while being optional, are ultimately expected to apply to the vast majority of UK homes. However, there is potential to draw on other forms of energy-relevant data to assist in the management of SLES. This includes things like smart thermostat settings, and electric vehicle usage and location. Datasets from these devices can be combined with each other, or with other datasets such as the database of Energy Performance Certificates, to yield even more potentially powerful insights for SLES. It is also conceivable that datasets which seem completely unrelated to energy could serve a useful function in SLES.

Data protection by design and by default

The UK's smart meter implementation programme is an example of a 'privacy by design' approach. Under GDPR, this is now referred to as 'data protection by design and by default'. This means that potential data controllers such as SLES operators must consider privacy from the outset in product/service development and bake suitable measures into the design.

Part of this means building technical aspects of the system in such a way that data misuse, breaches, etc. are as near to impossible as can be achieved and that, even if breaches were to occur, the impacts would be minimised. This can include approaches such as anonymisation or pseudonymisation of data; strong forms of encryption; storing and processing data locally on devices rather than centrally; avoiding unnecessary duplication and so on (Engel, 2020).

But such consideration must go well beyond simply technical issues. Thought must be given to how effective service can be achieved with the minimum data possible, at the minimum granularity.

And dealings with users must be open, clear, and transparent. There is also the question of how services which involve delivery of data back to users (such as energy use feedback) might themselves have privacy implications. It is to wider concerns of this nature that our recommendations for SLES operators mainly apply.

Box 3: Privacy and localness

Most of the research we identified in our evidence review focused on privacy and data sharing in the context of (smart) energy in general, without a specific local focus. The 'localness' of SLES is unlikely to completely transform the nature of privacy concerns or the factors which cause or address them. However, it is useful to think about what elements of localness might be relevant to privacy, and factor them into any planned data collection and services. The following is a short list of considerations which may be more or less relevant for different SLES:

- There is a greater chance that people working for local organisations will know or encounter people living locally than living elsewhere in the country or world. This could have implications for what they can infer from, or do with, personal data they are able to access – and possibly for people's willingness to share data.
- There is also a greater chance that data subjects will be known to one another. This could have implications for recognisability from, or impacts due to, any public data sharing, intentional or unintentional.
- In the context of a small local system, individual characteristics are rarer and individual actions play a relatively larger role. This might make anonymisation more difficult or impossible under certain circumstances. For example, while EV ownership might not be a distinguishing characteristic in a country, it could be in a street or neighbourhood.

Recommendations for SLES providers

We carried out an extensive review of the research on privacy and data sharing in energy. For more detail on how the review was conducted, see accompanying report Link ???. We wanted to know if/how people decide to balance any risks of sharing data against potential benefits, and if/how SLES introduced new kinds of privacy concerns because of its "localness".

Because SLES are a relatively new concept, we also looked to research in similar sectors (such as smart homes and Internet of Things) for lessons learned about addressing privacy concerns around data sharing. We were interested in studies that addressed these barriers, and could shed light on the underlying mechanisms at work when people made their decision in favour of sharing data.

What are people's privacy concerns?

Privacy concerns are highly contextual. Different people are concerned about different things, and some privacy concerns were more of a barrier to data sharing than other concerns. Nevertheless, some clear themes emerged, as shown in Figure 1.

We found that the overriding privacy concern was that sharing detailed energy use data had the potential to reveal information about home life and to intrude upon autonomy, choice and control. People feel strongly about retaining control about whether to share or not to share information about themselves, their home life and ways of living. Setting privacy controls are a part of modern life; people are accustomed to make decisions to share data when accepting cookies on websites, setting privacy controls in social media, ticking boxes to not receive marketing material and so on.

Unfortunately, while there has been a lot of research to understand concerns around privacy and data sharing in energy, there has been little publicly available direct testing of what works to appropriately address such concerns. Nevertheless, existing studies can still be helpful in creating recommendations.

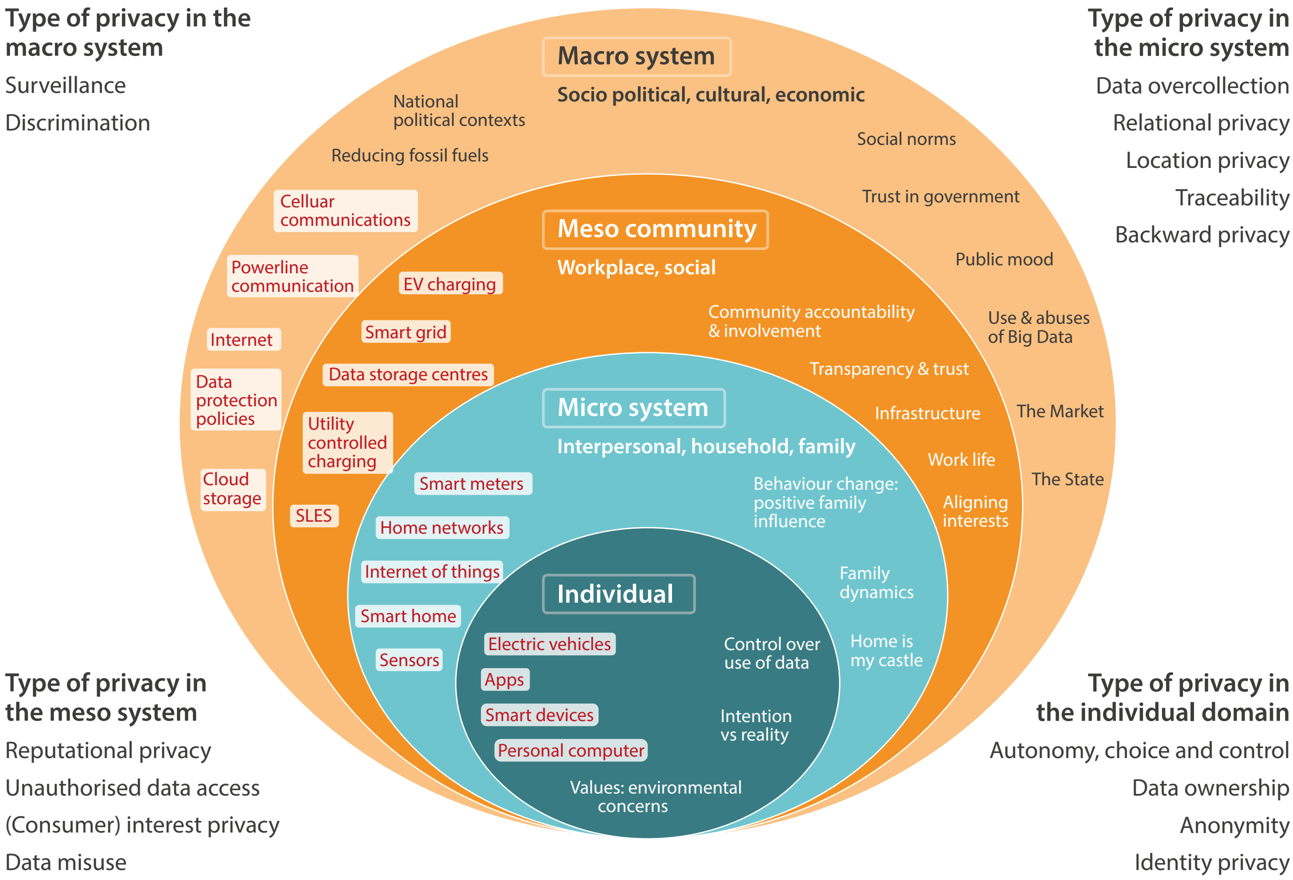

Figure 1: Themes emerging from the review.

Over half of the studies we found described the mechanisms that they thought underpinned decision making around privacy and data sharing. If such a mechanism is shown to be at work, then recommendations can be built around ways to support or interfere with it.

For example, this might include how social norms can act as an important mechanism for deciding to share data, where people look to a general consensus on whether the sharing of data is approved of or not. Other mechanisms were based more around individual decision-making and behaviour, suggesting that people make largely rational decisions based on calculations of the risk to privacy against the perceived benefits of sharing data. Still others tried to reconcile the two perspectives, such as in new kinds of services (like those found in SLES) where social norms are not yet established, and individuals do not often have complete information to make their decisions.

Here, it is argued that people are likely to draw on privacy and data sharing expectations and practices from other more familiar areas.

Based on these and other identified mechanisms, we derived the following eight guiding principles for the smart local energy service providers. They are:

1. Recognise the mutual benefits of data sharing for smart local energy systems and work with customers as partners
2. Involve people in the design of data sharing technologies from the start
3. Give people a say on the third parties that they are happy to share data with
4. Empower people to set the boundaries around the flow of information about themselves
5. Ensure that the purpose and value of the data collected is transparent and fair
6. Ensure that everyone that is affected by the sharing of data is involved in giving their informed consent.
7. Recognise that technologies for revealing and monitoring behaviours in the home can be used in unexpected and unwanted ways and anticipate this in service design.
8. Ensure there are channels of feedback and ongoing communication to continuously improve service delivery

These principles run through and inform the recommendations set out in the remainder of this section.

Recommendation 1

Build on existing trust to deliver mutually beneficial outcomes[2]

- Seek to include partners who are viewed as having minimal vested interest relevant expertise. This could include government bodies and energy suppliers, or a data trust to act as an independent intermediary.
- Involve future users early on to help ensure the most appropriate, trusted organisations are brought on board for that locality.
- Don't be afraid to seek to collect and use data where it is of clear benefit to users. An example of this is providing expert guidance, which is likely to be expected where unfamiliar products or services are involved.

Findings: Our review highlighted the importance of trust in people's decisions about data sharing. Various studies found that trust in government, regulators, and consumer/environmental organisations to handle energy data was relatively high. This was because they were not viewed as having a vested interest in selling something, and were believed to be more likely to follow official standards and procedures. While levels of trust in energy suppliers are often reported to be low, there is evidence that they are trusted to use data to deliver services where their expertise may be relevant.

So what? Many of the SLES that are emerging in the UK already involve the kinds of actors that are likely to be trusted with energy data – for example, the PFER Project LEO in Oxfordshire has partners from local government and energy suppliers, amongst others. Our findings suggest people are not only more inclined to share energy data if these (or other demonstrably trusted) types of organisations are involved, but may actively expect their expert guidance.

2 For each recommendation we include a footnote to indicate which evidence statements they are informed by. A list of evidence statements is available in the online appendix [LINK]. This recommendation is informed by evidence statements C7, C8, C9, S4.

Recommendation 2

Ensure people feel in control of both their data and environment[3]

- Make it easy for customers to choose the level of data sharing that they are happy with, and be clear what this means for the kind of benefits or services they can expect to receive.
- Consent to share data should be:
  - amendable (with periodic reminders to do so),
  - bounded (stating what the data will be used for)
  - and specific and clear about what data is being shared, and with whom.
- Provide simple processes for customers to express their "red lines", both on what energy providers can control, and the extent to which they can control it (e.g. by time of day, or by appliances).

Finding: People often have a principled desire to be in control of their data sharing so that they are able to decide, for instance, which parties could access the data under which circumstances.

They can also be incentivised to trade privacy for cost savings or convenience, but expectations of savings and expected behaviour changes should be clear from the start. For example, the flexibility required to qualify for cheaper tariffs by allowing automatic management of some devices in the home was felt to be too intrusive for some. On the other hand, being able to set some boundaries around the level of flexibility gave participants back a sense of control.

So what? Setting boundaries to control who has access to data shares both control and responsibility for data sharing. Both feeling in control and making life more convenient have value, so relinquishing direct control is done in exchange for value from SLES providers. Handing over control of data and appliances without the ability to override/amend this is likely to increase complaints (and the costs and obligations of addressing these) to SLES providers.

The best user experience design for consent for different kinds of data is likely to vary from context to context. A potentially useful comparison is how different websites treat cookie consents. There are a wide variety of approaches, ranging from simply informing people about the cookies that are necessary to make the service (website) operate, to presenting extensive lists of 'optional' third party advertisers. (For a discussion and extensive list of examples, see this article in Smashing Magazine.)

Box 4: Clear and in control?

In 2019, the consumer charity Citizens Advice published research on people's views on sharing energy data. It presents many interesting findings. But some are especially relevant to the case of SLES.

- In a survey of over 3000 people, most participants said they would be comfortable sharing data for public benefits, such as identifying vulnerable customers or fighting crime. This was followed by private benefits, such as providing better tariff switching information.
- Services such as general energy savings advice and the opportunity to save money on time-of-use tariffs were attractive trade-offs for sharing data. However, very detailed advice or targeted selling (e.g. of efficient appliances) was off-putting.
- Nine out of ten people thought the ability to opt out of data sharing was important. Removing choices around data sharing would make a third of people less interested in getting a smart meter.

3 Informed by evidence statements I7, I9, I10, I11.

Recommendation 3

Help people to understand new products and services[4]

- Consider offering customers an option to trial new products or services which require data sharing in order to address privacy concerns.

Finding: People who have smart meters are less likely to believe that they collect intrusive data than those who do not. This may be because privacy concerns dissuade people from opting in to smart meter schemes or because privacy concerns are allayed once they know more about them and get to see for themselves. People were also less concerned about smart meters in areas where their use was widespread.

So what? While it is clear from the evidence that privacy concerns can be a barrier to participation, being able to trial unfamiliar products and services may help some people overcome these concerns. As a rule, people were more interested in how products worked than they were about data collection and data sharing. Not knowing how they worked left space for concerns about their intended uses and purposes. Similar effects have been seen in trials of assisted living technology for older people (Tsertsidis 2019), where initial concerns including privacy and ease of use were allayed or even seen as positive characteristics post-implementation, once the users were able to better understand the technologies and the benefits they would bring.

Recommendation 4

Design SLES around user priorities and make these benefits clear[5]

- Use participatory, community/user-centred processes to develop services. This will help ensure they align with users' values and priorities, improving the chances the users will be happy to share their data.
- Ensure that customers can anticipate benefits from data sharing. These could include cost savings, reliability and fairness of accurate billing and the environmental benefits of more efficient energy use. This could be done by presenting bills that compare energy usage to similar local households.

Finding: Some findings suggested that people who were concerned for the environment were more likely to engage in data sharing and were less concerned about privacy and less motivated by price. Such individuals were sometimes described as intrinsically motivated: they saw participating towards the benefit of the environment as its own reward, and also responded to seeing environmental gains, and being seen to "do the right thing".

So what? The motivation for participating in a SLES scheme may be altruistic (supporting vulnerable people, the local economy or the environment) or for personal gain (financial, comfort, health). Uptake can be improved by knowing the specific values and priorities of the scheme's potential users and communicating how SLES will produce outcomes that address these priorities.

4 Informed by evidence statements I2, I7.

5 Informed by evidence statements I1, I8, I13, I15, C1, C3, C4, SC1.

Recommendation 5

Monitor and use a variety of approaches to actively widen engagement[6]

- Consider engaging with existing local/community groups and networks to identify and proactively target under-represented groups. Tailor methods to engage directly with all groups of people to ensure that no one is left behind.
- Provide ongoing and proactive communication and support for sustained data sharing for mutual benefit. Consider a range of different means of communication, from personal visits, telephone calls and emails. Make websites easy to access and understand.

Finding: Certain groups – for example, people on lower incomes, older and younger people, private social housing tenants – were less likely than other groups to be aware of, or included in, decisions about the data sharing choices available. Interventions to save energy and costs savings through changing energy use behaviour were more successful when people were involved in decision making and where there was ongoing support.

So what? Energy efficiency, demand response, and other desirable outcomes are unlikely to be realised and sustained without user buy-in. Unintentional exclusion of certain groups of the population not only reduces the ability of the SLES to achieve these outcomes, but may undermine support for the SLES in general. Achieving equity in distribution of SLES benefits will need proactive effort from service providers in overcoming barriers to access.

Recommendation 6

Consider everyone affected by data sharing when seeking consent to share data[7]

- Reflect the fact that most households consist of more than one person when considering user privacy. Service designers should incorporate the 5 Coercive Control Resistant Design Principles developed by IBM and Refuge (Nuttall et al, 2019). These are:

1. Diversity SLES providers should recognise their diverse user base and have a diverse development team.
2. Privacy and choice SLES providers should work to ensure that all of their users (not just the named "bill payer") can easily make active and informed decisions about their privacy settings.
3. Security and data SLES providers should build secure technology and only collect necessary data. This will limit the risk that the data can be intercepted and/or be used maliciously.
4. Combating Gaslighting Data collection and control over data should disrupt attempts at manipulating someone into doubting their memories and judgement with pertinent, timely notifications and auditing. SLES could consider applying limits to deletion of records of activity (subject to GDPR compliance).
5. Technical ability SLES providers should ensure that the use of the technology is intuitive and can be understood by all who could be affected by it, regardless of their technical confidence.

- Include open channels of communication for customer feedback in the service design. This should aim to quickly identify any unintended effects of new technologies and uses of technology and ensure reflective, continuous service improvement

6 Informed by evidence statements I2, I3, I4, I5, IP2, C14.

7 Informed by evidence statements II3, IP2

Finding: There is evidence that some people are concerned about data on household activities being shared with members of their household and disrupting the relational privacy of family life by shifting the balance of control to the one who could access this data.

So what? Detailed energy use data has the potential to be a vector of control within the household. Detailed energy use data may have unintended consequences. Keeping channels of communication open should ensure that unintended consequences can be mediated and revised quickly.

Recommendation 7

Provide clarity on how data will be used and how misuse will be prevented[8]

- Be clear with customers about how their data will be used and how misuse will be prevented.
- This includes not only restricting access to authorised parties, but also limiting data analysis to specific purposes and contexts where consent has been given. It also includes developing clear plans for how data loss will be handled which can be made available to customers on request.

Finding: Some energy users expressed fears that their data would be misused for financial gain at their expense. Concerns ranged from energy companies identifying behaviours in order to target marketing or alter prices accordingly, to criminals using energy data to determine when homes are empty. These concerns can be context-specific, for example employees might accept a greater level of surveillance by their employers than they would accept in private life.

So what? Uncertainty around how data will be used and protected could lead to reluctance to share data or to participate in services that require data sharing. At the same time, most users will not want to actively engage with a lot of detail on privacy protection. A mixed approach is likely to be best, anticipating areas of concern, with clear summary information available at key decision points and links provided to more detailed information for those who are interested.

Box 5: Why it doesn't pay to read privacy policies (or obfuscation by design)

Most people would probably not be interested in being compensated a penny or two to trade privacy for their personal data. But they might think differently if they considered the time it would take if they actually read all the relevant privacy statements for each website they visited just once a year. Authors of a study on estimating actual costs of reading privacy policies in time and dollar values ask: What would that time be worth? The study calculated that the total time to read privacy policies would amount to around 76 working days per person, or a national (US) costs of working hours lost of $781 billion. If privacy policies incur too high an opportunity costs compared to the perceived risk, then people will not read them, and lack the information they need to make informed choices (McDonald and Crano, 2018). A more recent review of the usability of privacy policies on websites against GDPR regulation find there is still much to do to make privacy policies accessible and usable (Renaud and Shepherd, 2018). Other studies claim this is not by accident, but by design, baffling the website users with manipulation of their cognitive biases (Waldman, 2020).

8 Informed by evidence statements C7, C10, C11, C12, C13.

Recommendation 8

Consider leveraging the willingness of users to share data with friends and family where appropriate[9]

- Consider how to enable and encourage peers to support each other towards mutual goals.
- Use accessible and, where possible, trusted technology to help to generate uptake. Promoting this uptake can, in turn, generate further uptake.

Findings. People tend to be willing to share certain energy data with family, friends and neighbours through common, popular platforms. This is known as horizontal data sharing (compared to vertical data sharing, such as with companies or authorities). Doing so can foster a supportive environment where individuals learn and get recognition from their peers and feel part of a collective good. But there is also the danger that requiring people to monitor their peers may create ill feeling and resistance.

So what? While sharing data horizontally rather than vertically to generate local accountability may be attractive, it can produce unwanted impacts on community relations. Users may feel more comfortable sharing certain data with 'faceless' companies than people they have a relationship with. Ongoing community buy-in would be important to ensure that participation in a local scheme produces only the desired impacts. For example, Homeowners Associations – groups of local residents who set byelaws and procure shared services for property maintenance – are common in the USA and can prove to be an asset to their neighbourhoods. Long term commitment is needed from these residents though, along with good communication and transparency to ensure that they continue to reflect the views and priorities of their community and avoid becoming a resented authority.

Box 6: Sharing data closer to home

Much of the discussion around privacy and data sharing focuses on how companies or other organisations might use the data they collect. But it is important to remember that adopting smart devices may mean usage data can be shared amongst household members and, potentially, the wider community. This carries both threats and opportunities.

There is growing evidence of the role smart devices could have in enabling new forms of potentially coercive control within households. One of the studies we drew on included the example of a woman whose husband monitored her electricity use at home from his work (Snow et al, 2014): "...he monitors it all on his thing (computer) and it drives her insane! So she thinks it's dreadful, she feels violated all the time". We recommend that SLES providers follow specific guidelines to reduce this risk.

But there are also reasons why SLES might consider a level of horizontal data sharing. Another study we looked at found that public rather than private sharing of energy data led to reduced energy use in a university hall of residence (Koliou et al, 2016). Data were shared in a way that allowed people to compare usage with peers, without being disclosive of identity. Used correctly, this kind of sharing could be a useful tool for engagement and action in SLES.

9 Informed by evidence statements C1, C2, C3, C4, C5, C7, C8, C9.

Closing remarks

In this report, we have drawn on existing research to suggest ways that those setting up and running SLES could maximise the chance that their users are comfortable with appropriately sharing energy-relevant data. Cutting through our recommendations are principles reflecting transparency and fairness in realising the value of data, participation, control, and consent – and ultimately respect. These principles are all well aligned with wider work on SLES emerging across EnergyREV and elsewhere.

Achieving effective inclusion and informed consent for data sharing is likely to require active outreach from SLES providers in a variety of ways to understand and meet people's preferences and abilities. Ongoing education and support will likely also be needed to ensure that privacy concerns are adequately addressed, and the benefits of sharing data are realistic and realised. SLES providers are likely to be well-positioned to deliver on these requirements by building on existing local trust, social/community networks, and a recognition of the importance of delivering public benefits.

Box 7: Opportunities for coordination

There are opportunities for cost efficiencies and quality improvements by encouraging shared responses to some of the recommendations above. Indeed, a Prospering From the Energy Revolution portfolio review of SLES concepts asks "What collective investments in tools and data would reduce cost, risks and delays (e.g. in consumer and social research)?". We see a role for innovation funding and coordination to support:

- Development and/or testing of high quality, adaptable, and interoperable SLES-relevant data sharing user interface platforms.
- Data trusts which could act as an independent data-holding third party, to bolster user trust.
- Development and dissemination of successful approaches to user participation around data sharing.

Developing sector-wide common data standards that support both SLES interoperability and scalability, as well as appropriate data collection and protection could have sector-wide benefits and reduce barriers to entry.

Further reading

The following sources produced as part of the Prospering from the Energy Revolution programme have relevance to privacy and data sharing:

- The EnergyREV Policy and Regulatory Landscape Review Series Working Paper 2: Digital energy platforms, includes consideration of data and privacy implications of such platforms.
- The EnergyREV report The energy revolution: cyber physical advances and opportunities for smart local energy systems includes consideration of how privacy and security fit into a SLES system architecture.
- The Modernising Energy Data Applications funded through PFER. A programme aimed at maximising value from energy data, including user considerations.

The following resources provide useful additional background and guidance relevant to privacy and data sharing.

- Information Commissioner's Office Guide to the General Data Protection Regulation (GDPR).
- Energy Data Taskforce: A Strategy for a Modern Digitalised Energy System. A general report on how energy data can help unlock decarbonization and decentralization.
- Smart Meter Energy Data Public Interest Advisory Group (PIAG). Exploring how smart meter data can be help further public policy goals and the energy transition, and considering how Government and other organisations might access data for public interest purposes while safeguarding consumers' interests.
- Regen Local Energy Data Innovation project and report on problems in local energy systems that energy-related data applications could help solve.
- European Group on Ethics in Science and New Technologies (EGE). An independent, multi-disciplinary body which advises on all aspects of European Commission policies where ethical, societal and fundamental rights issues intersect with the development of science and new technologies.
- The Usable Privacy Policy Project. A project that supports research policy and practice towards effective web privacy notice and choice.

The recommendations in this report are drawn from a rapid realist review of privacy concerns in the energy sector. Full details of the rapid realist review methods are in appendix 4 and a full list of how the evidence statements were combined into recommendations are in appendix 6 which can be found in [LINK TO SEPARATE DOC].

References

Engel, D. 2020. Enhancing privacy in smart energy systems. e & i Elektrotechnik und Informationstechnik, 137: 33–37.

Ford, R., Maidment, C., Fell, M., Vigurs, C., and Morris, M. 2019. A framework for understanding and conceptualising smart local energy systems. EnergyREV, Strathclyde, UK. University of Strathclyde Publishing, UK. ISBN: 978-1-909522-57-2

Fratini, A. and Pizza, G. 2018. Data protection and smart meters: the GDPR and the 'winter package' of EU clean energy law. EU Law Analysis.

Greveler, U., Glösekötter, P., Justus, B. and Loehr, D. (2012). Multimedia content identification through smart meter power usage profiles. International Conference on Information and Knowledge Engineering (IKE).

Koliou, E., Friege, J., Hakvoort, R.A. and Herder, P.M. 2016. Energetic communities for community energy: A review of key issues and trends shaping integrated community energy systems. *Renewable and Sustainable Energy Reviews*, **56**. doi: 10.1016/j.rser.2015.11.080

McDonald, A.M. and Crano, L.F. 2008. The Cost of Reading Privacy Policies. *Journal of Law and Policy for the Information Society*, **4** (3): 543–568.

Nuttall, L., Evans, J., Franklin, M. and Burne James, S. 2019. Coercive control resistant design: the key to safer technology. New York: IBM.

Renaud, K. and Shepherd, L.A. 2018. How to Make Privacy Policies both GDPR-Compliant and Usable. IEEE CyberSA 2018 Proceedings. doi: 10.1109/CyberSA.2018.8551442

Snow, S., Radke, K., Vyas, D. and Brereton, M. 2014. Privacy in the new era of visible and sharable energy-use information. In: Loke, L, Leong, T, O'Hara, K, Wadley, G, & Robertson, T (Eds.) Proceedings of the 26th Australian Computer-Human Interaction Conference on Designing Futures: the Future of Design. Association for Computing Machinery, United States of America, pp. 342–351.

Van Aubel, P , and Poll, E. 2019. S30. Smart metering in the Netherlands: What, how, and why. International *Journal of Electrical Power & Energy Systems*, **109**: 719–725.

Waldman, A.E. 2020. Cognitive biases, dark patterns, and the 'privacy paradox'. *Current opinion in Psychology*, **31**: 105–109.

Appendix 1: Included studies

Bailey, J. and Axsen, J. 2015. **S1**. Anticipating PEV buyers' acceptance of utility controlled charging. *Transportation Research Part a-Policy and Practice*, **82**: 29-46.

Begier, B. 2014. **S2**. Effective cooperation with energy consumers: An example of an ethical approach to introduce an innovative solution. *Journal of Information, and Communication & Ethics in Societ*y, **12**(2): 107-121.

BEIS, 2018. **S3**. Smart Metering Implementation Programme: Review of the Data Access and Privacy Framework. pp.40.

Choe, E.K., Conslvo, S., Jung, J., Harrison, B., Patel, S.N., Kientz, J.A. 2012. **S4**. Investigating Receptiveness to Sensing and Inference in the Home Using Sensor Proxies. In: Proceedings of the 2012 Association for Computing Machinery International Conference on Ubiquitous Computing. pp. 61–70. doi: 10.1145/2370216.2370226

Citizens Advice Bureau, 2019. **S5**. Clear and in control: Energy consumers' views on data sharing and smart devices.

Da Silva, P.G., Karnouskos, S. and Ilic D . 2012. **S6**. A survey towards understanding residential prosumers in smart grid neighbourhoods. In: 2012 3rd IEEE PES Innovative Smart Grid Technologies Conference Europe. doi: 10.1109/ISGTEurope.2012.6465864

Delmas, M.A. and Lessem, N. 2014. **S7**. Saving power to conserve your reputation? The effectiveness of private versus public information. *Journal of environmental economics and management*, **67**(3): 353.

Fell, M.J., Shipworth, D., Huebner, G.M. and Elwell, C.A. 2015. **S8**. Knowing me, knowing you: the role of trust, locus of control and privacy concern in acceptance of domestic electricity demand-side response. In: eceee 2015 Summer Study on energy efficiency. pp. 2153–2163.

Giordano, V., Gangale, F., Fulli, G. and Jiméne, M.S. 2011. **S9**. Smart grid projects in Europe: lessons learned and current developments.

Guerreiro, S., Batel, S., Lima, M.L. and Moreira, S. 2015. **S10**. Making energy visible: sociopsychological aspects associated with the use of smart meters. *Energy Efficiency*, **8**(6): 1149–1167.

Hansen, M. and Hauge, B. 2017. **S11**. Scripting, control, and privacy in domestic smart grid technologies: Insights from a Danish pilot study. *Energy Research & Social Science*, **25**: 112–123.

Hess, D.J. 2014. **S12**. Smart meters and public acceptance: comparative analysis and governance implications. *Health, Risk & Society*, **16** (3): 243–258. doi: 10.1080/13698575.2014.911821

Hmielowski, J.D., Boyd, A.D., Harvey, G. and Joo, J. 2019. **S13**. The social dimensions of smart meters in the United States: Demographics, privacy, and technology readiness. *Energy Research & Social Science*, **55**: 189–197.

Hoenkamp, R.A. and Huitema, G.B. 2012. **S14**. Good standards for smart meters. In: 2012 9th International Conference on the European Energy Market, Florence, 2012, pp. 1–6. doi: 10.1109/EEM.2012.6254820.

Horne, C., Darras, B., Bean, E., Srivastava, A. and Frickel, S. 2015. **S15**. Privacy, technology, and norms: the case of Smart Meters. *Social Science Research*, **51**: 64–76.

Huang, C. and Sankar, L. 2016. **S16**. Incentive mechanisms for privacy-sensitive electricity consumers with alternative energy sources. 2016 Annual Conference on Information Science and Systems (CISS), Princeton, NJ, 2016, pp. 175–180. doi: 10.1109/CISS.2016.7460497.

Jakobi, T., Ogonowski, C., Castelli, N., Stevens, G. and Wulf V. 2017. **S17**. The catch(es) with smart home – experiences of a living lab field study. In: Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems. doi: 10.1145/3025453.3025799

Jakobi, T., Patil, S., Randall, D., Stevens, G. and Wulf, V. 2019. **S18**. It is about what they could do with the data: a user perspective on privacy in smart metering. *Acm Transactions on Computer-Human Interaction*, **26**(1).

Kapade, N. 2017. **S19**. Credit based system for fair data sharing in smart grid. 2017 International Conference on Computer Communication and Informatics (ICCCI), Coimbatore, 2017, pp. 1–5, doi: 10.1109/ICCCI.2017.8117689.

Melville, E., Christie, I., Burningham, K., Way, C. and Hampshire, P. 2017. **S20**. The electric commons: A qualitative study of community accountability. *Energy Policy*, **106**: 12.

Moere, A.V., Tomitsch, M., Hoinkis, M., Trefz, E., Johansen, S. and Jones, A. 2011. **S21**. Comparative feedback in the street: exposing residential energy consumption on house façades. In: Campos, P., Graham, N., Jorge, J., Nunes, N., Palanque, P. and Winckler, M. [ed.] *Human-Computer Interaction – Interact 2011*, Pt I: 470–488.

Naus, J., van Vliet, B.J.M. and Hendriksen, A. 2015. **S22**. Households as change agents in a Dutch smart energy transition: On power, privacy and participation. *Energy Research & Social Science*, **9**: 125–136.

Ofgem, 2018. **S23**. Ofgem Consumer First Panel, year 9, wave 3, half-hourly settlement.

Pournaras, E., Nikolic, J., Velasquez, P., Trovati, M., Bessis, N. and Helbing, D. 2016. **S24**. Self-regulatory information sharing in participatory social sensing. *EPJ Data Science*, **5** (14). doi: 10.1140/epjds/s13688-016-0074-4

Sexton, A., Shepherd, E., Duke-Williams, O. and Eveleigh, A. 2018. **S25**. The role and nature of consent in government administrative data. *Big Data & Society*, **5**(2).

Snow, S., Radke, K., Vyas, D. and Brereton, M. 2014. **S26**. Privacy in the new era of visible and sharable energy-use information. In: Loke, L, Leong, T, O'Hara, K, Wadley, G, & Robertson, T (Eds.) Proceedings of the 26th Australian Computer-Human Interaction Conference on Designing Futures: the Future of Design. Association for Computing Machinery, United States of America, pp. 342–351.

Horne, C. and Przepiorka, W. 2019. **S27**. Technology use and norm change in online privacy: experimental evidence from vignette studies. *Information Communication & Society*. doi: 10.1080/1369118X.2019.1684542

Toft, M.B. and Thøgersen, J. 2015. **S28**. Exploring private consumers' willingness to adopt Smart Grid technology. *International Journal of Consumer Studies*, **39** (6): 648–660.

Valor, C., Escudero, C., Labajo, V. and Cossent, R. 2019. **S29**. Effective design of domestic energy efficiency displays: A proposed architecture based on empirical evidence. *Renewable & Sustainable Energy Reviews*, **114**: 11.

Van Aubel, P. and Poll, E. 2019. **S30**. Smart metering in the Netherlands: What, how, and why. *International Journal of Electrical Power & Energy Systems*, **109**: 719–725.

Vermont Trasco LLC. (2014). **S31**. Customer participation in the Smart Grid – lessons learned. US Department of Energy, pp. 22.

Walter, J. and Abendroth, B. 2018. **S32**. Losing a private sphere? A glance on the user perspective on privacy in connected cars. In: Advanced Microsystems for Automotive Applications 2017: Smart Systems Transforming the Automobile. pp.237–247.

Winter, J.S. 2015. **S33**. Citizen perspectives on the customization/privacy paradox related to smart meter implementation. *International Journal of Technoethics*, **6** (1): 45-59.

Yao, .Y.X., Basdeo, J.R., Kaushik, S. and Wang, Y. 2019. **S34**. Defending my castle: a co-design study of privacy mechanisms for smart homes. Association for Computing Machinery Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems. doi: 10.1145/3290605.3300428

Appendix 2: Supplemental evidence studies

Barr, S. 2006 Environmental action in the home: investigating the value-action gap. *Geography*, **91**: 43–54

Blake, J. 1999 Overcoming the "value-action gap" in environmental policy: tensions between national policy and local experience. *Local Environment*, **4**: 257–278

Blankenberg, A-K. and Alhusen, H. 2019. On the determinants of pro-environmental behavior: A literature review and guide for the empirical economist. CEGE Discussion Papers, No. 350, University of Göttingen, Center for European, Governance and Economic Development Research (cege), Göttingen.

Flynn, R., Bellaby. P. and Ricci, M. 2009. The 'value-action gap' in public attitudes towards sustainable energy: the case of hydrogen energy. *The Sociological Review*, **57** (2).

Johnson, C.Y., Bowker, J.M. and Cordell, H.K. 2004. Ethnic variation in environmental belief and behavior: An examination of the new ecological paradigm in a social psychological context. *Environment and behavior*, **36** (2):157–186.

Legros, S.B. 2019. Mapping the social-norms literature: an overview of reviews. *Perspectives on Psychological Science*, **15** (1).

McCabe, A., Pojani, D. and Broese van Groenou, A. 2018. The application of renewable energy to social housing: A systematic review. *Energy Policy*, **114**: 549–557. doi: 10.1016/j.enpol.2017.12.031

Mccarthy, l., Ambrose, A. and Pinder, J. 2016. Energy (In) Efficiency: Exploring what tenants expect and endure in the private rented sector in England. Making the case for more research into the tenant's perspective. An evidence review. Project Report. Sheffield, Sheffield Hallam University.

Pavlou, P. 2001. Consumer intentions to adopt electronic commerce – incorporating trust and risk in the technology acceptance model. DIGIT 2001 Proceedings.

Pidgeon, N., Kasperson, R., & Slovic, P. (Eds.). (2003). The social amplification of risk. Cambridge: Cambridge University Press. doi: 10.1017/CBO9780511550461

Renn, O., Burns, W.J., Kasperson, J.X., Kasperson, R.E. and Slovic, P. 1992. The social amplification of risk: theoretical foundations and empirical applications. *Journal of Social Issues*, **48** (4): 137–160.

Thiesse, F. 2007. RFID, privacy and the perception of risk. *Journal of Strategic Information Systems*, **16** (2):214–232.

Zhou, K., Fu, C. and Yang, S. 2016. Big data driven smart energy management: From big data to big insights. *Renewable and Sustainable Energy Reviews*, **56**: 215–225.

Want to know more?

Sign up to receive our newsletter and keep up to date with our research, or get in touch directly by emailing info@energyrev.org.uk

www.energyrev.org.uk

@EnergyREV_UK

info@energyrev.org.uk

About EnergyREV

EnergyREV was established in 2018 (December) under the UK's Industrial Strategy Challenge Fund Prospering from the Energy Revolution programme. It brings together a team of over 50 people across 22 UK universities to help drive forward research and innovation in Smart Local Energy Systems.

ISBN 978-1-909522-68-8

EnergyREV is funded by UK Research and Innovation, grant number EP/S031863/1.