People, Place and Policy (2022): 16/2, pp. 177-192. DOI: 10.3351/ppp.2022.5254227477

Research article

Digitalisation without detriment: A research agenda for digital inclusion in the future energy system

Joseph Chambers[1], Caitlin Robinson[2*], Matthew Scott[3]
1 Lewisham Council
2 School of Geographical Sciences, University of Bristol
3 National Energy Action

Abstract

It is increasingly recognised that the future energy system will be digitalised, and that end-user engagements with this system will be digitally mediated by smart ICT. The digitalisation of the energy system promises significant benefits, but also risks replicating and entrenching persistent inequalities in the ability of households to access adequate energy services. Focusing on a case study of the United Kingdom, this paper explores the links between energy system digitalisation, digital exclusion, and energy poverty, with the wider aim of sketching out a research agenda for understanding the risks, opportunities, and inequalities latent within the transition to a digitalised energy system. Drawing on a review of relevant literatures, the concept of social relations developed by Hargreaves and Middlemiss (2020), and a thematic analysis of a stakeholder workshop, the paper identifies five areas of focus for further research and analysis: 1) the role of financial exclusion and asset affordability in shaping digital inclusion and exclusion, 2) time and temporality, 3) the role of trust in shaping engagements with digital technologies, 4) language, literacy, and communication, and 5) the uneven impacts of digital exclusion on different social groups. The paper concludes with reflections on the practical challenges and implications of pursuing this agenda.

Keywords: Digitalisation; digital exclusion; energy transition; inequality; social relations.

Introduction

Digital technologies are an essential part of modern life (Walker *et al*., 2016) and play an increasingly important role in household energy access, energy consumption and energy use, especially in relation to electricity (Lovell *et al*., 2017). Over the past decade, the main ways that people access and use energy services have migrated online, a shift which has been positioned as having multiple benefits for consumers (Kloppenburg and Boekelo, 2019). Meanwhile, smart technologies are heralded as offering a greater degree of consumer control over electricity use, costs, and associated carbon emissions (Hillerbrand *et al*., 2021). Increasingly, consumers are also expected to play an active

role in adopting smart technologies to reduce their energy demand, shift their energy consumption away from times of high network constraint or low renewable generation, and even to store electricity at the household scale (Kahma and Matschoss, 2017; Calver and Simcock, 2021). For these reasons, digitalisation is acknowledged as a vital component of achieving a net zero energy system in a range of international contexts.[1]

Yet, while digitalization is often argued to be a path to greater efficiency, higher levels of energy system flexibility, and better outcomes for consumers (e.g., through cheaper energy bills) (BEIS, 2021), it is important not to let a focus on digital solutions detract from deep-seated structural inequalities embedded within the energy system (Connor and Fitch-Roy, 2019). Energy-related inequalities in the home that mean people can't access sufficient energy services to ensure that they are healthy and well – commonly referred to as fuel or energy poverty – are well documented (Ambrose and Marchand, 2017). The adverse consequences of energy inequalities are compounded for the 9 million people in the UK who cannot easily access the internet, or are digitally excluded in other ways (Zheng and Walsham, 2021). As the following sections will discuss in detail, these consumers are more likely to miss out on the cheapest energy deals, and often face digital barriers to accessing key support services in the energy market, such as an inability to easily apply for energy rebates online or access detailed energy usage information (Ofgem, 2019; 2021). In the paper that follows, digital inequality is defined as the gaps that exist between different social groups or societies in digital skills, knowledge or infrastructures (Zheng and Walsham, 2008). Meanwhile, digital inclusion or exclusion refers to the extent to which people can take part in (or not) increasingly digitalised systems (Good Things Foundation, 2021).

As a means of addressing energy poverty, previous research has suggested that digitalisation can lead to an over reliance on technological solutions, distracting from the types of collaboration between multiple social actors and services, as well as systemic change, required (Hansen *et al*., 2020). Furthermore, greater digitalisation creates the need for new and more complex social-technical arrangements in the energy system, generating new forms of inequality and exclusion (Diestelmeier, 2019). Specifically, and as the paper will go on to show, digital developments in the energy sector (e.g., smart metering and grids; electric vehicle deployment; online billing) are likely to benefit some people, but to disadvantage others in new ways (Van Deursen and Mossberger, 2018). For example, Powells and Fell (2019) show how more affluent households are more likely to be able and willing to respond to price signals to shift their electricity consumption to cheaper times of day, and thus more likely to access the financial rewards of doing so, than less affluent households, who are effectively excluded from the benefits of digitally enabled flexibility services. Covid-19 has also intensified digital inequalities in the energy system as people spend more time at home during the day, and are increasingly reliant on the internet for access to essential services (Ambrose *et al.,* 2021). Digital inequalities within the energy system are not solely a UK or even Global North issue. Energy challenges associated with digital inequalities have been identified globally and across a spectrum of energy infrastructures, from more formal network arrangements (e.g., national energy grids) to those comprising relatively informal and decentralised components (Herrero *et al*., 2018; Chambers and Evans, 2021; Sareen *et al*., 2022). Despite their proliferation, digital inequalities and digital exclusion in the energy system are often poorly understood (Hansen *et al*., 2020). Sareen (2021) emphasises a need to evaluate how energy sector digitalisation can become people-centric and inclusive.

Current approaches to understanding energy demand and inequality often overlook the way in which "energy use occurs in places such as homes, workplaces and communities in which complex webs of social relations already exist" (Hargreaves and Middlemiss, 2020: 196). For Middlemiss *et al*. (2019) the relationship between social relations and energy (or energy poverty) is iterative. Positive social relations can enable

access to energy services, but good social relations can also develop as a result of such access. Presenting a framing of social relations for understanding energy demand, Hargreaves and Middlemiss (2020) identify three important types of social relationships: relations of family and friends; relations with communities and agencies (e.g., with landlords; energy advice agencies; energy companies; community energy groups); and relations of identity (e.g., age, race, gender, class, disability). These relations have diverse impacts on energy demand, and are a useful guiding hand when extended to consider how the ability to access adequate energy services is shaped by digital technologies. However, we argue that further attention should be paid to the way in which social relations are mediated and (re)organised by technologies and infrastructures, a focus that is especially important then we think about digital-energy inequalities (Burns, 2015; Hui and Walker, 2018).

Inspired by a social relations framing, this paper builds on a review of relevant literature and thematic analysis of a stakeholder workshop to sketch out a future research agenda for improving our understanding of digital inclusion in the energy system. We propose and discuss five themes of importance: financial exclusion and affordability of assets; time and temporality; trust; language, literacy and communication; and social groups.

Thematic analysis of stakeholder workshop

During May 2021, we organised an online workshop "Exploring the challenges and opportunities of the digitalisation of the UK energy system". The event brought together multiple actors working in spaces of digital inclusion and energy in the UK - both practitioners and policymakers. The workshop was split across two sessions: the first featuring reflections from community organisations about their experiences of supporting digitally excluded consumers within the energy market, and the second showcasing new and ongoing research undertaken by relevant policy organisations. Presentations, reflections and discussion involved representatives from a range of organisations working in this area including: Good Things Foundation, National Energy Action, Newcastle University, Citizens Advice, Research Institute for Disabled Consumers and Good Things Foundation community partner organisations. Whilst primarily UK-focused organisations, some insights from policy and practice at the European scale were also provided by Next Energy Consumer to emphasise the wider relevance of the workshop findings internationally.

The workshop was attended by over 90 representatives from policy, practice, and academia, with many actively engaging in the workshop discussion. The event was open and widely advertised, but was not recorded as it was felt that this might restrict participants discussions. Instead, extensive notes were taken by the workshop organisers. Similarly, we did not collect detailed information about attendees, primarily because we intended the workshop to be a space in which different organisations could discuss their views and experiences freely and safely, including anonymously if they desired. However, the workshop was attended by representatives from key organisations working in the energy and digital sectors, specifically housing associations, local authorities, community organisations, energy and digital skills advice organisations, and the energy regulators of Great Britain (Ofgem) and Northern Ireland (the Utility Regulator). To the best of our knowledge, the workshop was not attended by any representatives from national (UK) or devolved (Scotland, Wales, Northern Ireland) government, which limited any possible discussion of the key role of government in addressing the challenges and issues raised by other attendees. In addition to the content and discussions in the workshop itself, the high numbers in attendance from a

range of different sectors emphasized the growing importance of digitalization, digital inequalities, and digital skills to energy system transformation and to energy consumers in general, many of whom have been, or will be, supported by some of the organisations who contributed to the discussions.

As noted earlier, the digitalisation of energy systems is not a phenomenon unique to the UK. Within energy infrastructures across the globe, the integration of Internet of Things and smart technologies, mobile phones and the internet, and many other digital components, have all existed against a backdrop of different levels of digital exclusion. Many governments across the globe identify the need to modernise and update energy infrastructures, whilst simultaneously acknowledging the digital transformation this requires. Digital exclusion is a global challenge and although manifesting differently, cases will often share many of the same causes; a lack of appropriate infrastructure, data and device poverty, socio-psychological challenges and people not having the necessary digital skills (United Nations, 2021). Organisations like Good Things Foundation recognise digital exclusion's universality, applying techniques to address this across different global locations. Therefore, whilst the workshop was held in the UK with organisations that primarily that work there, it's lessons and learnings can resonate globally, whilst simultaneously acknowledging that any output stemming from these would need to be situated within a local context.

Following the workshop, a thematic analysis of the materials was carried out (Terry *et al*., 2017) identifying our five key themes: financial exclusion and assets; time and temporality; trust; language, literacy and communication; and social groups. The five themes overlap and are not intended to be definitive or exhaustive, but rather to act as a starting point for further conversation and research in this area.

Financial exclusion and affordability of assets

Well understood as a central component of energy poverty, affordability and financial exclusion are identified as key underlying drivers of digital exclusion in the energy market. Whilst access to digital technologies has the potential to support households to better manage household budgets effectively or to switch suppliers to access competitive energy prices, in practice the digitalisation of the energy system has generated new structural barriers to low-income households participating in energy markets (Christians Against Poverty, 2021; Hillerbrand *et al*., 2021). Amongst workshop participants there was a perception that the most disadvantaged people are missing out on benefits that the digitalisation of the energy system should be providing them.

For many low-income households, new smart home technologies are often perceived to be non-essential luxuries, despite the potential benefits of digitalisation for managing household bills (Sovacool *et al*., 2021). Workshop participants emphasised that when prioritising different types of poverty, other aspects are likely to take precedence over the digital, including covering the cost of other essential energy services, food, and bills. On the other hand, for some households this results in the prioritisation of an internet connection ahead of other energy services (e.g., hot water), as evidenced amongst young people living in the private rental sector in the UK (Petrova, 2018). Digitalisation can also be a means of reconfiguring the social relations between household members and energy companies, providing a new means for companies to ensure compliance amongst financially disadvantaged households, including the recovery of debt without companies having to go into the home (Ambrosio-Albala *et al*., 2020). As a result, low-income households often perceive new technologies as intrusive (Sovacool *et al*., 2021).

Closely related to financial situation, a lack of assets was recognised as a key driver of digital exclusion, whether as a result of low incomes meaning certain digital infrastructures are unaffordable, or due to wider forms of precarity (Judson *et al*., 2020). Ownership reconfigures the social relations between household members and infrastructures, enabling increased levels of choice and control over energy assets (e.g., domestic solar panels), digital assets (e.g. Home Energy Management Systems or voice assistants), and property (e.g. home ownership) (Powells and Fell, 2019). For example, a lack of internet access is the biggest barrier to households switching supplier (Ambrosio-Albala *et al*., 2020) and is often an issue in temporary accommodation where communal broadband is poor. Lovell *et al.* (2017) also evidence the underuse of digital meters in Australian low-income households that cannot afford to purchase interactive displays.

Summarily, it is likely that without broader steps to tackle financial exclusion and asset (un)affordability, the benefits of energy system digitalisation will disproportionately favour those with higher incomes who have the economic privilege to access, and use, digital technologies. However, more research is needed to understand precisely how this may occur, especially with regards to the intersection of digital exclusion and energy poverty with broader forms of poverty, deprivation, and societal inequalities.

Time and temporality

The ability to synchronise activities in time is increasingly valued in digitalised energy systems, especially the flexible use of cheaper electricity at times of high renewable generation or low network constraint (Blue *et al*., 2020). It is widely recognised that the increasing integration of intermittent sources of power (especially variable wind output) into the energy system will require greater flexibility at both a network and household level (Lund *et al*., 2015; Grünewald and Diakonova, 2018). At times of low generation or high network constraint, households will be signalled and incentivised to move electricity consumption to different times of the day (Curtis *et al*., 2018). The ability of networks and energy companies to signal the appropriate times at which electricity should be used will be digitally mediated, and the responsiveness of households to these signals will depend on social relations that are inflected by digital skills and capacities.

Researchers, including Hargreaves and Middlemiss (2020), have noted the possible injustices associated as households with lower "flexibility capital" may not have the ability to shift their electricity use compared to relatively affluent household, therefore missing out on the financial benefits associated (Calver and Simcock, 2021; Powells and Fell, 2019). Less discussed is how this kind of flexibility will be shaped by social relations of trust and responsiveness between households and networks that will be fundamentally digitally mediated (e.g., Hargreaves *et al*., 2013). Price signals are likely to be communicated through in-home displays, smartphone apps, or energy consuming devices, such as smart dishwashers (e.g., Frontier Economics and Sustainability First, 2012; Powells *et al*., 2014). The way that these signals are responded to (or not responded to) will depend not only on whether households can afford and access these technologies but on their ability and willingness to recognise the signal, understand accurately what they are being asked to do, and programme appliances to turn on or off at the necessary times. Not only will the ability to shift consumption activities in time be shaped by digital inequalities, but these inequalities will intersect with wider relations of (mis)trust and digital skills.

The stakeholder workshop also highlighted that social relations with energy suppliers in particular can be defined by forms of waiting, anticipation, and frustration that vary between different digital technologies. Ash (2013: 20) argues that technical objects (such as telephones, smartphones, and websites) "actively produce spatio-temporal

atmospheres, which shape the humans who are immersed in these atmospheres." The Covid-19 pandemic has underlined just how much technical objects can shape the form and content of relations between households and energy suppliers. For example, households without internet access attempting to contact their energy supplier by telephone quickly found themselves in seemingly endless loops of automated messages imploring them to access the information they required online (National Energy Action, 2020). The energy regulator Ofgem (2021: 23) noted that during the initial UK lockdown, a third of energy suppliers "kept customers waiting for more than ten minutes on average before their calls were answered", and that "consumer group intel suggested that in some cases it has taken months for customers to reach their supplier." Workshop participants testified that the prolonged experience of waiting often ended with households being cut off when the automated attendant declared their call a non-emergency without any warning, or with people simply hanging up the phone in despair. For some households with internet access but lacking some of the confidence and skills to use it properly, interactions with chatbots on supplier websites generated parallel atmospheres of uncertainty, confusion, and impatience (National Energy Action, 2020).

These examples indicate how digital exclusion shapes the form of social relations with energy suppliers in ways that can create damaging experiences of time, producing real and potentially serious forms of injustice and disadvantage in the energy market. The digital production of relations defined by delay, anticipation, and frustration with energy suppliers can have harmful implications if a household requires urgent support. Furthermore, if households cannot shift their electricity consumption in time because of digital exclusion they will simply miss out on the financial incentives of doing so, incentives that will be hoovered up by digitally engaged and typically more affluent households.

Trust

Efforts to better understand the causes, realities and consequences of digital exclusion have identified trust as a key component of social relations. This was emphasised strongly by workshop participants and is a prominent theme in extant academic literature on digital inclusion. For someone to be digitally included, it often requires them to be able to trust (to a reasonable extent) that the technologies, actors, and supporting infrastructure they rely on will carry out their specific role and not cause distress or disruption to the people using them (Hunsaker and Hargittai, 2018; Harvey *et al*., 2021; Cuijpers and Koops, 2013). In addition, digital inclusion often requires using and navigating an array of platforms (e.g., Facebook, Uber), platforms that require people to have a certain level of trust in what they do, how they work, and that they provide appropriate information and don't operate nefariously (Trentham *et al.,* 2015; Etzioni, 2019; Fan and Zhang, 2021). As the Covid-19 pandemic has highlighted, people need to be able to trust platforms to give them appropriate and honest news and information (Sounderajah *et al*., 2021; Ahmed *et al*., 2020), and if they are digitally excluded, they are placed at a significant disadvantage in being able to do so (Ramsetty and Adams, 2020).

As a social relation that influences digital inclusion or exclusion, trust is not just confined to the relationship between people and technology. For the multitude of projects that aim to tackle digital exclusion across communities, relations of trust between the institutions delivering these and the people participating is crucial. When facing challenges, communities will often seek help from trusted local institutions as a first port of call as opposed to larger, non-local organisations. In addition, trusted local organisations are identified as some of the most effective forms of institutions to deliver

digital inclusion programmes due to their embedded relationships within their area (Strover *et al*., 2020). Those facing digital exclusion also experience other forms of exclusion. Further to financial exclusion previously discussed, people with disabilities, refugees, and migrants are excluded from society in multifarious ways, and often have pre-existing relationships with local organisations, connections that many digital inclusion programmes have built on (Stone, 2021). Vulnerable groups can be sceptical of formal and larger governmental institutions, further reinforcing the reliance on, and close relationships with, smaller and local organisations (Harvey *et al*., 2021). People who face digital exclusion frequently turn to friends and family to carry out online tasks on their behalf (Richardson, 2018), echoing Hargreaves and Middlemiss' (2020) identification of these relationships as crucial to shaping energy demand. Such trusted connections can provide the support that people need to navigate sensitive information (e.g., online banking or health information).

Trust also impacts how users engage with the energy system. Understanding what constitutes trust within a digitalised energy system is somewhat muddied by the concepts' numerous definitional roots. Drawing on Barber (1983) and focusing on infrastructure and energy systems, Rayner (2010) expands the notion of trust to include credibility, confidence in technical competence, recognition of responsibility, meeting expectations, and deference to authorities. In relation to markets, however, trust can be defined as "the willingness to rely on an exchange partner in whom one has confidence" (Moorman *et al*., 1993: 82). Increasingly, digitalised energy infrastructures are inherently tied to markets through their ability to generate new data streams, alter social relations, and provide a clearer understanding of the system as a whole, all of which can influence real-time pricing, profits and costs.

This is important because any efforts to shift towards a low-carbon energy system will require the coordination and sharing of data between households and infrastructure operators (Hannon *et al*., 2013). However, as Grünewald and Resich (2020) note, low levels of trust by households in how energy companies will use, store and share their information frequently results in data not being given up voluntarily by consumers and smart technologies, with the devices capturing much of this data being unplugged, switched off, or discarded altogether. User trust in energy technologies is also tied to other interrelated concepts such as liability, consent and fairness (Rayner, 2010). Whilst people may trust energy technologies, there can be lower levels of trust in the larger-scale actors within the energy system such as energy providers and governments (Cotton *et al*., 2016). Within the UK, for example, energy customers cite the belief large-scale actors don't act in good faith, fail to respond to customers' needs and inadequately adjust operations to respond to climate change as just some reasons as to why they have low levels of trust in them (Cotton *et al*., 2016).

As the digitalisation of the energy system intensifies, it is clear that trust will play a central role in mediating the landscape of inclusion/exclusion and the associated risks and benefits that come with it. Understanding more completely how degrees of (mis)trust in different energy-related actors, technologies, infrastructures, and institutions shape digital inclusion/exclusion is subsequently of considerable importance.

Language, literacy and communication

Language, literacy and communications are also important factors shaping the form and content of social relations, especially in the context of an increasingly digitalised energy system (Michalec *et al*., 2019). Those who are digitally excluded often face a range of language barriers associated with getting online. For migrants and refugees to the UK, two groups vulnerable to digital exclusion, large portions of online tools, digital systems

and learning resources are written in English (Good Things Foundation, 2021c). As workshops participants emphasised, additional language challenges can be seen in the overly technical and complicated vocabulary often associated with getting online and using digital tools (Holgersson and Söderström, 2019), and digitally excluded people may be reluctant to engage with the online world if they are unable to understand the complicated vocabulary it relies on.

As Powell *et al*., (2010) further note, digital exclusion can also be exacerbated if people have limited English literacy (and numeracy) skills (see also Bejaković and Mrnjavac, 2020). To actively engage in the energy system people are often required to be able to understand the language in which documents (e.g., bills) are written, the terms used (energy literacy), and have a grasp of specific was of measuring energy consumption (e.g., through the kilowatt hour (kWh)) (George *et al*., 2011). In the UK, if English isn't someone's first language, it can be difficult to fully engage with the energy system. As technologies and other digital tools bring with them an entirely new vocabulary, their integration within the energy system can further extend the language barriers people face.

Given the aforementioned challenges, effective forms of communications between energy companies and customers are vital within an increasingly digitalised energy system. Being digitally excluded can result in customers being unable to efficiently engage with providers and providers not being able to inform customers of changes, delays or disruption. Large portions of energy companies now use digital forms of communication to engage with their customers (e.g., online billing, chatbot functions and SMS notifications). For the digitally excluded, they may be unable to use these tools and instead will rely on traditional forms of communication (e.g., phone calls and letters). However, we currently lack an understanding of how different methods of communications, and their associated languages and assumptions of digital literacy, will change as the energy system digitalises, as well as how new or renewed forms of digital inequality may be entrenched as these changes occur.

Specific social groups

Finally, academic research has recognised for some time that certain segments of society are more likely to experience digital exclusion than others. As noted previously, digital exclusion is more likely among a range of other groups that may be considered vulnerable, such as older persons and people with a disability (Good Things Foundation, 2021c.). However, relatively little research has explored how social relations shape the extent to which these groups can engage digitally in the energy market. From the point of view of social relations, it is partly the relations of identity that are associated with different vulnerable groups that shape their relations with friends, family, agencies, and communities in ways that exacerbate digital inequalities.

While there are certainly other examples that could be provided, as noted in previous sections, an indicative example is the case of refugees, asylum seekers, and other migrant communities. In focusing on this group, we do not seek to minimise the longstanding harms that come to other social groups due to their exclusion from the energy market, especially those that have been recognised in previous literatures as particularly vulnerable. For instance, in 2017, 790,000 households with a disabled person were spending over £2,500 on energy, compared to an average of £1,214 (Scope, 2018). As was highlighted in our workshop by the Research Institute for Disabled Consumers, the accessibility of energy switching websites and smart home energy technologies is often an additional barrier for people with a disability in their engagement with the energy market that can prevent them from obtaining the energy services they

require at home (see Research Institute for Disabled Consumers, 2021a; 2021b). However, we focus on refugees and asylum seekers in this section for two reasons. Firstly, this was a social group highlighted by our workshop participants as increasingly vulnerable to being digitally excluded from the energy market, but also seldom recognised as being so compared to other groups (see also Butler, 2021). Secondly, in focusing on this group, we seek to point towards the kind of contextual and detailed analysis that we feel is required in our broader research agenda on specific social groups and the ways that they are digitally excluded from the energy market.

Refugees and asylum seekers "face unique and often severe vulnerabilities, struggling to survive on extremely low incomes, having to overcome language barriers, and having to understand new and unfamiliar energy systems" (Butler, 2021: 48). However, for these groups, it is also the exclusionary nature of their relations with other actors that exacerbate their ability to engage with digital services in the energy market. These relations are underpinned by the social and legal categories of refugee, which is associated with forms of suspicion, mistrust, and racism among different organisations that (re)create alienation and digital exclusion (Alam and Imran, 2015; Finlay *et al*., 2021). In other words, it is partly their relations with key agencies, especially government, local councils, landlords, and energy suppliers, that detrimentally shape the ability of refugees to access the energy services that they require online.

For example, workshop participants relayed examples of poor communal broadband in temporary accommodation and an unwillingness of social or private landlords to provide suitable advice with online energy accounts to refugees. They also described how, after being relocated to new cities, some parents would rely on the English proficiency of their children to try and understand energy bills, being unable to access support from friends or other members of their family. In other words, these relationships of service provision are effectively defined by abandonment (cf. Bouzarovski and Cauvain, 2016), whereby refugees are left to navigate a complex energy market without sufficient support or assistance. This makes it more or less impossible for refugees to access and benefit from any kind of digital engagement. The impacts of this are severe, with one study noting that the result is often that "refugees and asylum seekers can quickly find themselves owing hundreds of pounds to an energy supplier they didn't know they had" (Butler, 2021: 48).

Contrarily, workshop participants underlined that when positive social relations are present or can be developed with trusted mediators, some of the digital exclusion refugees experience in the energy market can be alleviated or even reversed (Lloyd *et al*., 2013). For example, some community organisations presenting at our workshop were explicitly concerned with supporting refugees with free devices and developing digital skills. The cultivation and maintenance of these skills were narrated as being a platform from which refugees could begin to develop the capacities to engage not just with the energy market, but with other aspects of society as well, such as accessing health information or political participation (Alencar, 2020; Kaufman, 2018; Pottie *et al.,* 2020). Importantly, they were also premised on a certain reversal of the social exclusion experienced by refugees, in that the support provided by these charities were described as built on relations of care, mutual aid, and belonging, rather than the relations refugees typically have with energy suppliers and other similar actors. There is evidence that the outcomes of this kind of support are that refugees have increased confidence to control and manage their home energy use independently (Butler, 2021).

While this is a specific example, it begins to show how relations of identity associated with particular vulnerable groups shape the substance of their relations with friends, family, agencies, and communities in ways that contribute to overlapping forms of digital exclusion and inclusion in the energy market. For refugees, their social and legal status predominantly produces social relations of abandonment that leave them unable to

access, let alone beneficially use, digital technologies. For other vulnerable groups, these processes will be different, and exploring how and why could be one of the principal tasks for a research agenda examining digital inequalities in the energy market.

Conclusion

In this paper we have outlined and discussed five key themes relating to digital inclusion in the future energy system that are worthy of further research and analysis. By drawing on the concept of social relations (Hargreaves and Middlemiss, 2020), we evidence how this framework can be useful to evaluate energy-digital inequalities. We also extend the social relations framing proposed to focus on the ways in which social relations are mediated and (re)organised by the technologies and infrastructures that are so central to both energy and digital inequalities.

To conclude, we look forward and sketch out some suggestions for how this agenda can move forwards. While we would not seek to be prescriptive about the research questions and projects that might follow from our analysis, there are at least three areas which we feel could be worthwhile to explore. Common to all of these areas is a need for academic researchers to collaborate with community organisations, industry actors, and policymakers (local and national), and each area speaks to at least one of the five themes we have discussed in previous sections.

Firstly, there is an undoubted need for more research examining the lived experience of digitally excluded households in the energy market, as well as the experiences of those groups of households who are at heightened risk of digital exclusion in engaging with (or not engaging with), accessing (or not accessing), adopting (or rejecting) smart and flexible energy services and products (e.g., smart thermostats, smart meters, time of use tariffs). This research is necessary not just to expand on the themes we have expounded in this paper, but also to begin working towards an understanding of what such households want, and more importantly need, from a digitalised energy system. Chard *et al*. (2021: 5) have noted that the typical development of smart energy services takes place prior to any concerted engagement with low-income and vulnerable energy consumers, with innovation projects tending "to trial existing technologies rather than finding out what consumers want and designing technologies they find appealing and useful." They argue instead that smart energy services and innovation projects should follow best practice, human centred innovation processes that "involves working with consumers to understand the problem space (discovery), co-creating solutions with them (alpha) and trialling at increasing scale (beta), before going live" (Chard *et al*., 2021: 6). We see this as essential; if households at heightened risk of digital exclusion are to benefit at all from the proliferation of smart energy services and the wider digitalisation of the energy system, their multifarious needs and requirements must be "included by design" in their development. For example, what do refugees want and need from the energy market and from energy-related digital technologies? Who do they most trust to support them with it? What communication practices do they value? Asking and answering questions of this nature are essential if the digitalisation of the energy system is to be genuinely inclusive by design to all.

Secondly, we see a need for closer research and evaluation activities with organisations that support digitally excluded households in the energy market. As we have touched on repeatedly throughout the paper, locally embedded, trusted community organisations are often best placed to deliver practical advice and support with digital skills to a variety of different vulnerable groups. However, Butler (2021) has suggested that parallel research and evaluation activities may not automatically take place alongside the delivery of digital skills projects, whether because of lack of resource,

expertise, or funding. Butler (2021) continues that when evaluation activities do take place, they are typically light touch, entailing the distribution of short feedback forms or follow-up surveys to people who have been supported by the project in question. Evaluations undertaken by academics of (for example) energy advice services are often enormously valuable in understanding not only the enablers and barriers to delivering successful community advice and support, but also for comprehending the broader structural inequalities, exclusions, and vulnerabilities that drive people to such services in the first place (Bouzarovski *et al*., 2021). Just as importantly, research and evaluation activities provide evidence of what works for different groups of people. Accordingly, these activities can provide evidence of how households that might face profound difficulties engaging with the digital aspects of the energy market can be best supported to develop the skills, capacities, and confidence to benefit from it in the future, evidence that can be put to work in the development of policy, innovation projects, and regulation in the energy sector.

Thirdly and finally, we would argue that researchers need to engage with, and critique, the technocentric discourses emanating from government and industry on the digitalisation of the energy system. Influential actors across government and industry tend to argue that digitalisation is synonymous with greater efficiency, higher levels of system flexibility, and better outcomes for consumers. For example, the UK's Energy Digitalisation Strategy, published in July 2021 by the Department for Business, Energy and Industrial Strategy (BEIS), proposes that a digital energy system is essential to decarbonising the energy system at the least cost to consumers while maximising economic growth across multiple sectors of the UK economy. There is a tacit recognition in the strategy that these benefits "must be inclusive and responsive to peoples' variety of needs [...] it is vital these new market services work for everybody – whatever their circumstances" (BEIS, 2021: 19). However, the strategy makes no real attempt to define what digital inclusion actually means or set out precisely how it can be achieved.

Accordingly, the vision and actions that BEIS say they will implement are almost entirely technoeconomic in nature, and concerned primarily with regulatory frameworks, data governance, and institutional design. Correspondingly, although the Energy Digitalisation Strategy is one document, it is arguably representative of an influential strain of policy thinking that sees digitalisation as primarily located within the technical, regulatory, and economic spheres of policymaking. Given the evidence presented in this paper, there is a considerable risk that underlying social, financial, and digital inequalities will be entrenched if the digitalisation of the energy system continues on its current course. We therefore feel it is essential for researchers to continue to critically analyse the prevailing narratives and discourses that are central to what could be termed the digitalisation agenda in the UK (and beyond), emphasizing the importance of social relations and lived experience in the process. Doing so is an important third pillar in a research agenda ultimately pointed at an equitable, just, and digitally inclusive transition to net zero.

Notes

1 In the UK policy context, the importance of digitalisation in the future energy system is recognised via the recent UK *Energy Digitalisation Strategy* (BEIS, 2021). Meanwhile, at a European Union level, digitalisation is a key pillar within the *EU Strategy for Energy System Integration* (European Commission, 2020).

Acknowledgements

The authors would like to thank everyone that thoughtfully engaged with the project workshop that informed the paper, especially the Good Things Foundation. All three authors made an equal contribution to the manuscript and are listed alphabetically. Please note, the views of the author Joe Chambers are their own and exist separately to those of Lewisham Council. Funding for the initial project was provided by the EPSRC Supergen Energy Networks Hub. Caitlin Robinson is supported by a UKRI Future Leaders Fellowship [Grant Number: MR/V021672/1].

*Correspondence address: Caitlin Robinson, School of Geographical Sciences, University of Bristol, United Kingdom. Email: caitlin.robinson@bristol.ac.uk

References

Ahmed, W., Vidal-Alaball, J., Downing, J. and Seguí, F. L. (2020) COVID-19 and the 5G conspiracy theory: social network analysis of Twitter data. *Journal of medical internet research*, 22, 5, e19458.

Alam, K. and Imran, S. (2015) The digital divide and social inclusion among refugee migrants: A case in regional Australia. *Information Technology and People,* 28, 2, 344-365.

Alencar, A. (2020) Mobile communication and refugees: An analytical review of academic literature. *Sociology Compass*, 14, 8, e12802.

Ambrose, A., Baker, W., Sherriff, G. and Chambers, J. (2021) Cold comfort: Covid-19, lockdown and the coping strategies of fuel poor households. *Energy Reports*, 7, 5589-5596.

Ambrose, A. and Marchand, R. (2017) The contemporary landscape of fuel poverty research. *Indoor and Built Environment*, 26, 7, 875-878.

Ambrosio-Albala, P., Middlemiss, L., Owen, A., Hargreaves, T., Emmel, N., Gilbertson, J., Tod, A., Snell, C., Mullen, C., Longhurst, N. and Gillard, R. (2020) From rational to relational: How energy poor households engage with the British retail energy market. *Energy Research & Social Science*, 70, 101765.

Ash, J. (2013) Rethinking affective atmospheres: Technology, perturbation and space times of the non-human, *Geoforum*, 49, 20-28.

Barber, B. (1983) *The logic and limits of trust*. Rutgers University Press, New Brunswick, NJ.

BEIS (Department for Business, Energy and Industrial Strategy) (2021) *Digitalising our energy system for net zero. Strategy and Action Plan 2021*. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1004011/energy-digitalisation-strategy.pdf

Bejaković, P. and Mrnjavac, Ž. (2020) The importance of digital literacy on the labour market. *Employee Relations: The International Journal*.

Blue, S., Shove, E. and Forman, P. (2020) Conceptualising flexibility: Challenging representations of time and society in the energy sector*. *Time and Society*, 29, 4, 923-944.

Bouzarovski, S. and Cauvain, J. (2016) Spaces of exception: governing fuel poverty in England's multiple occupancy housing sector. *Space and Polity,* 20, 3, 310-329.

Bouzarovski, S., Simcock, N., Evans, S. and Crowther, A. (2021) STEP-IN: D2.3 – Data analysis report (Urban Living Lab). Available at: https://www.step-in-project.eu/wp-content/uploads/D2.3-Data-analysis-report-Urban-Living-Lab.pdf

Burns, R. (2015) Rethinking big data in digital humanitarianism: Practices, epistemologies, and social relations. *GeoJournal*, 80, 4, 477-490.

Butler, D. (2021) *Case Study Analysis – UNITED KINGDOM.* HTR Task Users TCP by IEA: London. doi.org/10.47568/3XR117

Calver, P. and Simcock, N. (2021) Demand response and energy justice: A critical overview of ethical risks and opportunities within digital, decentralised, and decarbonised futures. *Energy Policy*, 151, 112198.

Chambers, J. and Evans, J. (2020) Informal urbanism and the Internet of Things: Reliability, trust and the reconfiguration of infrastructure. *Urban Studies*, 57, 14, 2918-2935.

Chard, R., Lipson, M. and Fleck, R. (2021) *How can innovation deliver a smart energy system that works for low income and vulnerable consumers?* https://es.catapult.org.uk/news/can-innovation-make-a-smart-energy-system-work-for-vulnerable-consumers/

Christians Against Poverty (2021) *Digital divide: The persistent and periodic digital exclusion faced by people in financial difficulty, and how we can close the divide.*

Connor, P. and Fitch-Roy, O. (2019) The socio-economic challenges of smart grids. In: A. Taşcıkaraoğlu and O. Erdinç (eds) *Pathways to a Smarter Power System.* Academic Press, pp. 397-413.

Cotton, D., Miller, W., Winter, J., Bailey, I. and Sterling, S. (2016) Knowledge, agency and collective action as barriers to energy-saving behaviour. *Local Environment*, 21, 7, 883-897.

Cuijpers, C., and Koops, B. J. (2013) Smart metering and privacy in Europe: lessons from the Dutch case. In: S. Gutwirth, R.E. Leenes, P. de Hert and Y. Poullet (eds) *European data protection: coming of age*. Springer, Dordrecht, pp. 269-293.

Curtis, M., Torriti, J. and Smith, S.T. (2018) Demand Side Flexibility and Responsiveness: Moving Demand in Time Through Technology. In: A Hui, R Day and G Walker (eds) (2018) *Demanding Energy: Space, Time and Change*. Palgrave Macmillan, pp. 283-312.

Diestelmeier, L. (2019) Changing power: Shifting the role of electricity consumers with blockchain technology–Policy implications for EU electricity law. *Energy Policy*, 128, 189-196.

Etzioni, A. (2019) Cyber trust. *Journal of Business Ethics*, 156, 1, 1-13.

European Commission (2020) *Powering a climate-neutral economy: An EU Strategy for Energy System Integration.* Available at: https://energy.ec.europa.eu/topics/energy-system-integration/digitalisation-energy-sector_en

Fan, Z., and Zhang, N. (2021) *Disconnected citizens in the social media age: unpacking the effects of digital exclusion on satisfaction with democracy in Europe.* Information Technology and People.

Finlay, R., Hopkins, P. and Benwell, M.C. (2021) *"It's like rubbing salt on the wound": the impacts of Covid-19 on asylum seekers and refugees.* Newcastle upon Tyne, UK: Newcastle University.

Frontier Economics and Sustainability First (2012) *Demand Side Response in the domestic sector- a literature review of major trials*. Department of Energy and Climate Change.

George, M., Graham, C. and Lennard, L. (2011) T*oo many hurdles: information and advice barriers in the energy market.* University of Leicester.

Good Things Foundation (2021) *The Digital Divide.* Available at: https://www.goodthingsfoundation.org/the-digital-divide/ [Accessed: 04/10/2022]

Good Things Foundation Australia (2021) *Increasing digital participation of refugees and new migrants.* Online. Available at: https://www.goodthingsfoundation.org.au/news/increasing-digital-participation-of-refugees-and-new-migrants/ [Accessed: 04/10/2022]

Grünewald, P. and Diakonova, M. (2018) Flexibility, dynamism and diversity in energy supply and demand: A critical review. *Energy Research and Social Science,* 38, 58-66.

Grünewald, P. and Reisch, T. (2020) The trust gap: social perceptions of privacy data for energy services in the United Kingdom. *Energy Research and Social Science*, 68, 101534.

Hannon, M. J., Foxon, T. J. and Gale, W. F. (2013) The co-evolutionary relationship between Energy Service Companies and the UK energy system: Implications for a low-carbon transition. *Energy Policy*, 61, 1031-1045.

Hansen, P., Morrison, G. M., Zaman, A. and Liu, X. (2020) Smart technology needs smarter management: Disentangling the dynamics of digitalism in the governance of shared solar energy in Australia. *Energy Research and Social Science*, 60, 101322.

Hargreaves, T. and Middlemiss, L. (2020) The importance of social relations in shaping energy demand. *Nature Energy,* 5, 195-201.

Hargreaves, T., Nye, M. and Burgess, J. (2013) Keeping energy visible? How householders interact with feedback from smart energy monitors in the longer term. *Energy Policy,* 52, 126–134.

Harvey, M., Hastings, D. and Chowdhury, G. (2021) Understanding the costs and challenges of the digital divide through UK council services. *Journal of Information Science.* ISSN 0165-5515.

Herrero, S. T., Nicholls, L. and Strengers, Y. (2018) Smart home technologies in everyday life: do they address key energy challenges in households? *Current Opinion in Environmental Sustainability*, 31, 65-70.

Hillerbrand, R., Milchram, C. and Schippl, J. (2021) Using the Capability Approach as a normative perspective on energy justice: Insights from two case studies on digitalisation in the energy sector. *Journal of Human Development and Capabilities*, 22, 2, 336-359.

Holgersson, J. and Söderström, E. (2019) *Bridging the Gap - Exploring Elderly Citizens' Perceptions of Digital Exclusion*. European Conference on Information Systems (ECIS), Stockholm-Uppsala, Sweden.

Hui, A. and Walker, G. (2018) Concepts and methodologies for a new relational geography of energy demand: Social practices, doing-places and settings. *Energy research & social science,* 36, 21-29.

Hunsaker, A. and Hargittai, E. (2018) A review of Internet use among older adults. *New Media and Society*, 20, 10, 3937-3954.

Judson, E., Soutar, I. and Mitchell, C. (2020) *Governance challenges emerging from energy digitalisation.* University of Exeter: Exeter, UK.

Kahma, N. and Matschoss, K. (2017) The rejection of innovations? Rethinking technology diffusion and the non-use of smart energy services in Finland. *Energy Research and Social Science,* 34, 27-36.

Kaufman, K. (2018) Navigating a new life: Syrian refugees and their smartphones in Vienna. *Information, Communication and Society*, 21, 6, 882-898.

Kloppenburg, S. and Boekelo, M. (2019) Digital platforms and the future of energy provisioning: Promises and perils for the next phase of the energy transition. *Energy Research and Social Science*, 49, 68-73.

Lloyd, A., Kennan, M.A., Thompson, K. and Qayyum, A. (2013) Connecting with new information landscapes: Information literacy practices of refugees. *Journal of Documentation,* 69, 1, 121-144.

Lovell, H., Pullinger, M. and Webb, J. (2017) How do meters mediate? Energy meters, boundary objects and household transitions in Australia and the United Kingdom. *Energy research and social science*, 34, 252-259.

Lund, P.D., Lindgren, J., Mikkola, J. and Salpakari, J. (2015) Review of energy system flexibility measures to enable high levels of variable renewable electricity, *Renewable and Sustainable Energy Reviews*, 45, 785-807.

Michalec, A., Hayes, E., Longhurst, J., and Tudgey, D. (2019) Enhancing the communication potential of smart metering for energy and water. *Utilities Policy*, 56, 33-40.

Middlemiss, L., Ambrosio-Albalá, P., Emmel, N., Gillard, R., Gilbertson, J., Hargreaves, T., Mullen, C., Ryan, T., Snell, C. and Tod, A. (2019) Energy poverty and social relations: A capabilities approach. *Energy research & social science*, 55, 227-235.

Moorman, C., Deshpande, R. and Zaltman, G. (1993) Factors affecting trust in market research relationships. *Journal of marketing*, 57, 1, 81-101.

National Energy Action (2020) *UK Fuel Poverty Monitor 2019-20*. Newcastle upon Tyne, UK: National Energy Action.

Ofgem (2019) *Consumer Vulnerability Strategy*.

Ofgem (2021) *Consumer Protection Report: Autumn 2021.*

Petrova, S. (2018) Encountering energy precarity: Geographies of fuel poverty among young adults in the UK. *Transactions of the Institute of British Geographers*, 43, 1, 17-30.

Pottie, K., Ratnayake, A., Ahmed, R., Veronis, L. and Alghazali, I. (2020) How refugee youth use social media: what does this mean for improving their health and welfare? *Journal of Public Health Policy,* 41, 268-278.

Powell, A., Bryne, A. and Dailey, D. (2010) The essential Internet: Digital exclusion in low-income American communities. *Policy and Internet*, 2, 2, 161-192.

Powells, G., Bulkeley, H., Bell, S. and Judson, E. (2014) Peak electricity demand and the flexibility of everyday life. *Geoforum,* 55, 43-52.

Powells, G. and Fell, M. J. (2019) Flexibility capital and flexibility justice in smart energy systems. *Energy Research and Social Science*, 54, 56-59.

Rayner, S. (2010) Trust and the transformation of energy systems. *Energy Policy*, 38, 6, 2617-2623.

Research Institute for Disabled Consumers (2021a) *Price comparison websites: Summary of survey findings.* Available at: http://www.ridc.org.uk/sites/default/files/uploads/Research%20Reports/Price%20comparison%20websites%20survey%20outputs.pdf

Research Institute for Disabled Consumers (2021b) *Smart Central Heating Control Apps Tested for Accessibility.* Available at: https://www.ridc.org.uk/news/smart-central-heating-control-apps-tested-accessibility

Richardson, J. (2018) A community-level perspective on digitally and socially including older people. In: *Proceedings of the 32nd International BCS Human Computer Interaction Conference*, 32 (pp. 1-4).

Ramsetty, A. and Adams, C. (2020) Impact of the digital divide in the age of COVID-19. *Journal of the American Medical Informatics Association*, 27, 7, 1147-1148.

Sareen, S. (2021) Digitalisation and social inclusion in multi-scalar smart energy transitions. *Energy Research and Social Science*, 81, 102251.

Sareen, S., Waage, M., Smirnova, P., Boakye-Botah, J. and Loe, M. R. (2022) Double energy vulnerability in the Norwegian low-carbon urban transport transition. *People, Place and Policy*. DOI: 10.3351/ppp.2022.3953567323

Scope (2018) *Out in the Cold.* Available at: https://www.scope.org.uk/campaigns/extra-costs/out-in-the-cold/

Sounderajah, V., Clarke, J., Yalamanchili, S., Acharya, A., Markar, S. R., Ashrafian, H. and Darzi, A. (2021) A national survey assessing public readiness for digital health strategies against COVID-19 within the United Kingdom. *Scientific reports*, 11, 1, 1-24.

Sovacool, B. K., Martiskainen, M. and Del Rio, D. D. F. (2021) Knowledge, energy sustainability, and vulnerability in the demographics of smart home technology diffusion. *Energy Policy*, 153, 112196.

Stone, E. (2021) *Digital exclusion & health inequalities.* Sheffield: Good Things Foundation. Available at: https://www.goodthingsfoundation.org/wp-content/uploads/2021/08/Good-Things-Foundation-2021-%E2%80%93-Digital-Exclusion-and-Health-Inequalities-Briefing-Paper.pdf [Accessed: 04/10/2022]

Strover, S., Whitacre, B., Rhinesmith, C. and Schrubbe, A. (2020) The digital inclusion role of rural libraries: social inequalities through space and place. *Media, Culture and Society*, 42, 2, 242-259.

Terry, G., Hayfield, N., Clarke, V. and Braun, V. (2017) Thematic analysis. *The SAGE handbook of qualitative research in psychology*, 2, 17-37.

Trentham, B., Sokoloff, S., Tsang, A. and Neysmith, S. (2015) Social media and senior citizen advocacy: an inclusive tool to resist ageism? *Politics, Groups, and Identities*, 3, 3, 558-571.

United Nations (2021) *Digital Cooperation Roadmap. Online*. Available at: https://www.un.org/en/content/digital-cooperation-roadmap/

Van Deursen, A. J. and Mossberger, K. (2018) Any thing for anyone? A new digital divide in internet-of-things skills. *Policy and internet*, 10, 2, 122-140.

Walker, G., Simcock, N., and Day, R. (2016) Necessary energy uses and a minimum standard of living in the United Kingdom: Energy justice or escalating expectations?. *Energy Research and Social Science*, 18, 129-138.

Zheng, Y. and Walsham, G. (2008) *Inequality of what? Social exclusion in the e-society as capability deprivation*. Information Technology and People.

Zheng, Y. and Walsham, G. (2021) Inequality of what? An intersectional approach to digital inequality under Covid-19. *Information and Organization*, 31, 1, 100341.