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Developing a relational approach to energy demand: A methodological and conceptual guide

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ABSTRACT

In a recent review of research on the role of social relations in shaping energy demand, authors documented increasing interest in relational approaches to energy [1]. Relational approaches to energy conceive of human behaviour as produced and reproduced by social relations and interactions, placing relationships at the centre of inquiry, as well as understanding these relationships in the context of infrastructure and the built environment. In this paper, we build on a relational approach in new economic sociology, and on our research project about the social relations of energy retrofit, to offer a methodological and conceptual guide to those working on energy demand topics. We detail the ontological and epistemological starting points of our relational approach, and articulate how research can be designed to capture the role of social relations in shaping decision-making on energy, as well as to offer innovative insights for policy-makers and practitioners. We use our experience in a research project on energy retrofit as a case study, reflecting on the practical aspects of this research approach to provide suggestions for research design for those interested in doing similar work. This includes defining key concepts and the way they interact in a conceptual framework for a relational approach to energy. We also offer some conceptually driven research questions as a starting point for energy research projects. We finish by discussing the potential for further application of these ideas in research, policy and practice.

1. Introduction

In this paper we offer a conceptual and methodological guide on how to adopt a relational approach to energy demand problems, in order to support other researchers to ask relational research questions in the energy social sciences. We do this by consolidating our learning from a mixed-methods project, in which we investigated the role of social relations in decision-making for energy renovations and retrofit. Using our empirical work as a starting point, we share what we have learned about how to study social relations and reflect on how this approach can offer both new academic insights in the energy social sciences, and new directions for energy policy.

The project started from the premise that the rational choice model, commonly used as the basis of energy retrofit policy in the UK, fails adequately to explain why and how people decide to engage in making energy efficiency interventions in the home [2–5]. This model has led to

poor policy design and inadequate uptake of energy retrofit measures. A familiar example here is the ‘Green Deal’, which was both based on a logic of rational choice through ‘payback’ on initial investment, and poorly designed, failing to attract the home owners it targeted due to its limited financial appeal and lack of recognition of the broader needs and interests of the household [6].

We propose a relational approach to energy, both as an alternative means of explaining people's decisions, and an alternative theoretical input to energy policy design. This relational approach, building on insights from relational and new economic sociology, conceives of human behaviour as produced and reproduced by social relations and interactions, placing relationships at the centre of inquiry, as well as understanding these relationships in context [7,8]. In this tradition, social relations are seen as central in producing change: shaping the way that resources are distributed, and creating different opportunities and constraints for actors. Authors using relational approaches grounded in

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sociology have developed ways of explaining and studying social and economic phenomena which, while as yet relatively scarcely applied in the energy social sciences [1,9], have the potential to make interesting and useful contributions.

We begin the paper by profiling the use of these ideas in new economic sociology [10–12], as well as showing how relational approaches are applied in energy demand research. We briefly introduce our project on social relations of retrofit, including a vignette about one of our respondents to illustrate these ideas in practice. We then present a conceptual framework for approaching energy relationally. In doing so we articulate and elaborate a number of concepts associated with a relational approach, including ‘relational work’, ‘interactions’ and ‘affiliations’. To put these concepts into practice, we then offer three relational research questions for energy demand research, with suggestions as to how to approach answering each one (including methods and data insights) and examples of how we did so in our retrofit project. We conclude by reflecting on the application of this approach, and the possibilities for future research, policy and practice.

The novelty of this paper is in articulating a relational approach for the energy social sciences, grounded in new economic sociology, which we hope will be of value to colleagues in future work. We also develop existing ideas in new economic sociology in the paper, by applying them in the empirical context of energy demand. Note that we follow Blaikie here in using the word ‘methodology’ in the sense of ‘logics of enquiry, of how new knowledge is generated and justified’ [13], as well as by articulating key concepts, and suggesting how new theories should be generated and tested in a relational approach. As such, this is not intended as a methods primer, although we do comment on how methods and data can be used to implement the approach. Instead we hope that this can be useful as an input to relational research design and theory building.

2. What are ‘social relations’ and ‘relational work’?

In thinking about social relations we draw specifically on the relational and new economic sociology literature, that has a record of addressing relationships between people and the way that these are constituted. Relational sociology understands affiliations (the ‘strong’ or ‘weak’ ties between people) and interactions (the moments in which people come together to negotiate meaning and action) as being generative of society [7,14]. Society is produced and reproduced by interactions between affiliated actors, in dynamic processes which create meaning and identity in people’s lives [7,15]. ‘Social relations’ is the term that we use for these dynamic processes and the resources that they draw upon. Understanding social relations is critical to attempting to explain behaviour and decision-making. Indeed understanding interactions, affiliations and networks, and the resources that underpin these, can help us to explain what is happening in specific social contexts, and to articulate why and how things change [7].

A social relation is not a fixed object, but rather a process of reciprocal interaction which evolves over time [7]. Relations exist in a dynamic web of networks, which form and reform around particular social worlds. Relations also produce and shape distributions of economic and non-economic resources: money, for instance, is negotiated, earmarked and allocated to different purposes in relational ways [8]. This means that the specific distribution of resources in a social world will be shaped by the relations that exist in that world, and the ways in which these are produced and reproduced over time [10,11]. The reproduction (or dissolution) of social relations through interactions means it can be difficult to untangle the role played by different kinds of affiliations: for instance, the everyday links between friends, or the role of class or ethnicity as a more structural set of relationships [15]. When we study social relations, we therefore explore both the mundane interactions and the more structural factors that shape these in everyday life.

‘Relational work’, as devised by Zelizer [16] and elaborated by Tilly [17], concerns how and in what ways social relations shape economic

behaviour. Relational work elucidates the ways in which people create, maintain, solidify, change, and perfect the relationships that exist between them [18]. The worlds of economic action and social relations are thus not separate, nor is one embedded within the other: rather they are constitutive of one another and formed through interaction. As such, other apparently separate elements of social life – emotion, power, identity, organizational context – are brought into any consideration of economic action using the concept of relational work (Bandelj 2012).

In practice, paying greater attention to relational work uncovers, for instance, the role of emotions in economic interactions, the production of trust or repairing of distrust, and the rigidity of inequalities in the distribution of resources. We might also explore where, how and from whom money arrives within a household or organisation, whether as a gift, payment or entitlement [8], and show how the social relations represented by different categories of money play a material role in shaping how it is used. Social relations are negotiated and rendered meaningful by deciding whether the money received should be spent, saved or invested (and to what ends) through a practice Zelizer describes as ‘earmarking’ (ibid.).

Conceding that this may seem abstract to non-sociology readers, let us first consider these ideas in relation to our case study of energy retrofit. Renovations in the home can be paid for by a variety of means: for instance by loans, grants, savings or inheritance. When money is earmarked for renovations a certain amount of relational work has been put in to achieve this. This might be asking relatives to borrow money at favourable rates, applying for a grant, deciding how to spend inheritance or approaching one’s current bank to extend a mortgage. In our empirical work we met numerous people who deemed commercial loans inappropriate for home improvements: this is not the ‘proper way’ (reference redacted). On the other hand, money acquired through inheritance was frequently spent on renovation and retrofit: improving one’s home is a ‘fit’ way to spend such earmarked money. Relational work also takes place at all other steps of the retrofit process: in getting advice on what to do, hiring tradespeople to do the work, getting work done, and checking the quality of the work (reference redacted).

Given the rich insights that relational and new economic sociology provide for a better understanding of behaviour, it is surprising that the approach has not been taken up more widely in other interdisciplinary spaces, including that of energy research. This may be partly because new economic sociology remains at the early stages of conceptual development and exploration and does not offer a clear approach to be applied by others, particularly in an applied social science such as ours [19]. We offer this paper as a first step towards such an approach in the energy social sciences.

3. Operationalising social relations in energy demand research

While the concept of social relations is relatively new in the energy social sciences, a substantial number of existing studies attempt to understand the world of energy demand relationally. For example, Hargreaves and Middlemiss [1] identify three categories of social relations: 1. intimate and care relations; 2. institutional relations and 3. relations of identity. Using these categories, they profile a range of studies which address ‘social relations of energy demand’, including: those concerned with family and friendship relations and their impact on energy consumption (for e.g. [20–22]), community and place relationships (for e.g. with landlords and contractors) and their role in shaping practice (for e.g. [23–25]), and the more ‘macro’ relationships of identity (e.g. class, gender, ethnic identity) which have a bearing on everyday life (for e.g. [26–28]).

A wide range of research within the energy social sciences could potentially complement this relational research. We would argue that it could add depth to any approach which is attempting to explain why change in energy demand happens, in a way which engages with the social world. In the context of home energy retrofit and renovation, for instance, Wilson et al. [5] argue for a ‘situated approach’ that considers

'applied behavioural research' within the broader social context of how and why people renovate their homes. There is also potential for links to the growing literature on care in the energy social sciences. Damgaard et al., for instance, argue for the need to situate responsibility for an energy transition relationally, in order to generate a broader ethics of care [29]. Practice approaches are used widely in retrofit and renovation research [30–33], and their socially rich focus on what energy is used for (e.g. eating, cooking, entertaining), also has the potential to be expanded by relational approaches. Research rooted in practice theory frequently places close attention to how people live with others in their homes, and how they expect to live in future [32,33], both of which are similarly interesting to relational researchers. Adding a relational focus to such work offers a means of connecting the deep interest in habit, infrastructure, routine and everyday life, with people's social lives, through relationships, identity and interactions. The potential here is to deepen understanding of how practices are patterned socially, and how they are shaped through social relations.

We are not the first to notice the potential for a relational approach to practice research. In a special issue of this journal in 2018 [9], considerable attention was paid to the links between practice theory and relations of space and place. This included methodological reflections on how to go about studying relations between practices and their performance in particular places [34], as well as the application of relational ideas about place in an empirical context [35]. While these contributions centre practices or 'activities' in their understanding of relations, they also recognise, after Doreen Massey [36], that places are sets of social relations that intersect at a location. There are interesting parallels with our approach here, perhaps the principle difference being that most of these contributions are rooted in geography. As a result, these authors tend to start with relations in place and infrastructure [37], whereas as sociologists we start with relations between people. There would certainly be merit in bringing these traditions together in future work.

The value of a relational approach here is therefore in explaining 1. how energy-using practices and decision-making around energy in everyday life are shaped by social relations, and 2. how this understanding might help us to answer broader questions associated with the governance of domestic energy. Existing work offers a useful starting point in articulating concepts. To build a methodology for the applied world of energy social science, requires a specific articulation of concepts and more precise instruction as to how these can be operationalised, however. After briefly profiling our research project on the social relations of retrofit, we continue by offering a conceptual framework which more precisely articulates the key concepts in this field and their relationship to each other using energy retrofit as an explanatory example.

4. Our research on energy retrofit: a case study

Our two linked projects brought together an interdisciplinary team of social scientists to better understand the social relations of retrofit. The key research question was 'How do social relations shape decision-making around energy retrofit?', which we raised in response to a widely shared understanding that rational actor explanations for energy retrofit (that people will engage only when it makes sound financial sense) are inadequate, and that more socially nuanced approaches are needed [2–5].

Full methods descriptions are available in other outputs linked to these projects [55–57]. Here we describe the five main activities undertaken in these linked projects to give a sense of the depth of experience that we bring to the ensuing discussion about concepts and methodology, as well as hopefully offering inspiration to others through the breadth of methods used:

1. Interviews with building owners in three case study areas (Glasgow, Leeds, Brighton) about their experiences of home renovation ($n = 38$). Note that our focus here was on home renovation more broadly,

with energy measures as only part of the work done. We chose this approach because there is emerging evidence that households do not distinguish between renovation and retrofit, as both involve often major structural intervention in the home [4,32]. We also chose a sample of the broadly 'able to pay'. We defined this by talking to people who had recently paid for some form of renovation (which had an energy component) and who had not received any government help to do this. Accepting that different tenure types are a significant factor, in the Brighton case we interviewed residential landlords, and in Glasgow (multiple-occupancy buildings) and Leeds (sole-occupancy homes) we interviewed owner-occupiers. We structured interviews around the customer journey: how did you decide to do the work, where did you find the money, who did you hire to work on it, what was the process like, were you happy with the outcomes?

2. Interviews with building owners in Bradford about applications for energy grants ($n = 18$). Our focus here was the process of applying for energy grants, drawing from a sample of those that had done so. Households were sampled due to their location in neighbourhoods where applications for ECO grants were unusually high.
3. Quantitative work at a national scale, and in case study locations to experiment with means of identifying who renovates and retrofits and who does not. We drew on data sets associated with applications for energy grants, the socio-demographic characteristics of neighbourhoods, and their spending patterns on renovation and retrofit [55].
4. A series of institutional interviews with key stakeholders in each study area ($n = 42$). The interview covered customer journeys for energy retrofit, examples of successful projects and inter-institutional relationships that facilitated them, the challenges of delivering retrofit at scale, and potential policy interventions to address these barriers. Interviewees included actors from public, private and third sector active in energy retrofit. The Bradford case study interviews focused on the institutional structures for supporting grant applications.
5. Stakeholder workshops in three case study areas (Glasgow, Leeds, Brighton) to discuss the implications of the results for policy and practice. These included representatives from local authorities, landlords, sectoral advisory bodies, contractors and community groups, in some cases those that we had met in the institutional interviews. We approached this by presenting initial results from institutional interviews, and asking participants to think about how they might approach their work differently in the context of these findings.

We will present the conceptual framework with reference to a vignette from interviews with building owners: the story of Julie, one of the people we met and interviewed about their experience of renovation and retrofit in Otley. We chose Julie because her story was rich, and it allows us to bring to life the concepts most effectively.

Vignette: Julie's story

Julie was a disabled, single woman in her early 60s living in Otley, West Yorkshire that we interviewed in 2021. She responded to an advert in which we asked for people willing to talk about recent renovations on their house which related to energy use. Julie had replaced old double glazed windows (there was condensation between the panes of glass) with new double glazing. She financed the work using a small inheritance, after the recent death of her mum, who she had looked after in her final days. It was important to Julie that she spent this money sensibly, and in a fit tribute to her mum. Other than this inheritance, Julie's main income was through the benefits system, but she had managed to fund the work entirely herself, and she had not thought of applying for government support. In order to find the window fitters, Julie had asked for a recommendation from a friend and neighbour Steve who had recently had windows replaced. The fitters OtleyWin also gave her a lower quote than other companies. Sadly the building work had not been a positive experience. She described a gradual loss of trust in the tradespeople as they failed to finish work, and stopped communicating. She had even got to the point of taking the company to the small claims court – with support from her friend Jill's letter writing skills. She felt particularly strongly that she was treated badly, partly as a result of

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being a woman and being disabled: and she enlisted Steve's help to give the company a 'talking to'. The end result: windows that she could see through, that look smart on the outside, and that keep the house cosy, was very satisfactory. However, she is very reluctant to engage in any further work on her home, partly due to her not having the money to spend, but also because her experience with trades was so negative. (All names changed)

5. A conceptual framework for energy and social relations

Given that this is a new approach to the energy social sciences, we appreciate the need for a clearer characterisation of what we are studying when we study social relations, as well as suggestions as to how to take these ideas to the field to offer insights that can help to shape policy and practice. So far, we have assembled and described some of the key concepts being used to discuss social relations: relational work, affiliations, interactions, earmarking etc. Here we offer a conceptual framework which begins to provide a common language and, by extension, a set of common methodological principles to those motivated to study social relations of energy demand.

In order to conceptualise social relations of energy demand more clearly, we emphasise the distinction made in new economic sociology between **interactions** (the moments in which people come together to work on something, or offer advice), **affiliations** (the existing and potential relationships between people which form the basis of 'strong' and 'weak' ties), and **social relations** themselves (the broader social resources and dynamic processes that form a backdrop to interactions and affiliations). The interaction is the most empirically visible concept: it is easy to see how you might find an interaction, but qualitative questioning can very easily reveal how interactions are built on existing and

new affiliations as well as the resources and processes being drawn on in the social relations concerned. In our vignette, Julie had important interactions with Steve and Jill, and with OtleyWin, with whom she had existing and new affiliations respectively. The affiliation with OtleyWin broke down during the course of the work, and necessitated a new affiliation with the small claims court negotiated by Jill. Julie's gender and disability status were the backdrop to this experience - and an important aspect of the structures that shaped the changing nature of her affiliations and interactions. A further important relational resource was Julie's inheritance of money from her mum, which she spent on double glazing because it seemed an appropriate way to spend this kind of money. This relates to Zelizer's concept of **earmarking**, when money is set aside to spend for different purposes according to its provenance (2017).

In researching retrofit decision-making, we found the concept of **relational work** to be particularly important: the resources committed to the creation, negotiation and formation of social ties [10,16,17]. In the context of energy retrofit, relational work is present in the interactions that people have with family, friends, neighbours, online forums, local and national trades, grant funding bodies, and financial institutions, which may or may not then result in retrofit outcomes. We can see Julie engaging in relational work in a number of ways. First, how she spends her inheritance is deeply relational, and the work here was to find an appropriate way to spend inherited money. There were also relational negotiations as she first chose to employ OtleyWin, and then was supported further by her friends Steve and Jill in bringing them to task. Understanding the extent of relational work being undertaken, and its often exhausting nature, seems to be critical in understanding how social relations shape retrofit outcomes and thus why certain policy interventions succeed or fail.

In Fig. 1 we illustrate the key concepts associated with relational

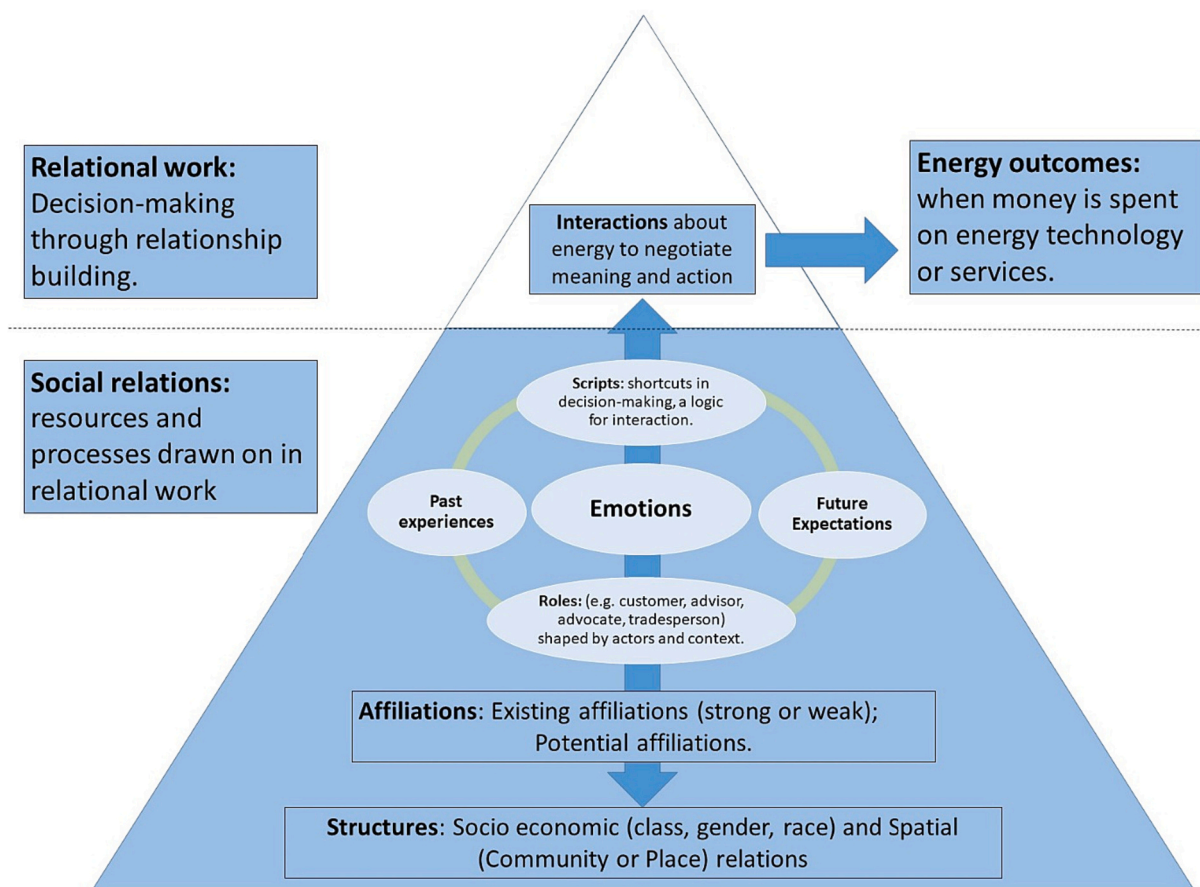


Fig. 1. Relational work for energy demand, and its place in social relations.

work for energy demand, and its basis in social relations. The figure aims to articulate the links between the various concepts we drew on in our work on social relations of energy retrofit. We capture the **relational work** as visible interactions about energy, and **social relations** making up the less visible underlying structure shaping these interactions. Concepts seen on the triangle are those that are principally important in unpacking ‘relational work’ and ‘social relations’: in effect they represent the objects of study which lead us to discuss the former in more detail. So, for example, relational work is approached by studying interactions.

The concepts indicated on the blue part of the triangle are useful in understanding the processes and resources associated with social relations. We have already detailed the importance of existing and potential **affiliations**: they represent a resource drawn on in interactions about energy. At the bottom of the figure, in a broader category called **structure**, we include socio-economic and spatial relations. These link to the relationships of identity articulated by Hargreaves and Middlemiss [1], and make up the more stable social rules and resources that provide a broader shaping effect on affiliations and interactions. We saw this, for instance, in Julie’s impression that her being a woman and disabled meant that OtleyWin did not take her seriously, despite her being the customer. Note that the arrow between structure and interactions goes in two directions: structure can also be shaped by interactions.

In the middle of the triangle we have detailed further resources and processes that shape interactions about energy. Concepts that we have found useful in our own analysis, coming out of the broader literature on relational sociology, include:

- **Past experiences** (working with existing affiliations that you can trust) and **future expectations** (of family life, of home use, of trust in trades, of climate change). Here we saw Julie use Steve’s past positive experience to help her choose OtleyWin. Her future expectations at the end of her project, were that she would be unlikely to change anything in her house again as a result of her negative experiences.
- **Emotions**: We can see that emotional valences from previous encounters, expectations based on the past, and pending obligations all influence how relational work unfolds [19,38]. There are echoes here of work on energy and care, as documented in studies of energy poverty, where we see care practices shaping energy consumption [39,40], and on the ethics of care for the planet and others that shapes a more relational politics of energy [29].
- **Scripts**: shortcuts and ways of approaching interactions that provide a logic for the negotiations with familiar partners. Julie is someone that is clearly very well connected, and has a clear script of enlisting others who she believes to be more proficient at relational work to speak on her behalf. Some interactions are routinised and have clearly defined affiliations, boundaries, and practices. These operate in predictable ways, that follow ‘scripts’. Others are more uncertain and ambivalent and require constant management – relational work – in order to sustain them [19]. Julie clearly did not feel able to fulfil all the relational work required here alone, and asking Steve to support with the OtleyWin relationship, and Jill with the small claims court was part of her script.
- **Roles**: when acting as a neighbour, people draw on different scripts to when acting as a customer or employee. In economic transactions, the role that someone plays shapes their power to influence the outcome. We were partly inspired to use this concept by Butler’s use of the concept of ‘role’ in relation to those offering fuel poverty advice: where she saw experts, allies, antagonists, and peers [41]. In the context of retrofit, this might mean being the uninformed customer in the face of a highly technically aware tradesperson, creating an asymmetry between participants [19]. Julie perceived her gender and disability status as barriers to taking up the ‘dissatisfied customer’ role in our example, patterns that we have seen

elsewhere in our research [56]. This shaped the kinds of relational work she was able to do.

When we apply this conceptual framework to our case study of energy retrofit, we find that it offers a very different lens on retrofit to the usual ways of thinking about this topic. It also has very different implications for policy. The particular value we see here is that when thinking through policy and practice using a relational approach as a lens, we see different challenges and opportunities for change.

6. Putting concepts into practice

In order to help people to translate these concepts into practice, we structure the following section around key questions that will shape research design, methods and data choice, in order to capture the role of social relations in an energy demand problem. For each key question, we discuss how one might go about answering it, and which methods and data types are appropriate.

6.1. What are the interactions that may lead to an energy outcome?

This is rather an obvious question, and in some ways it merely articulates the particular topic of interest. In our retrofit project we found the concept of interaction to be a useful way in to the project: the interaction is something that can be easily understood by research participants. As a result, we centred the retrofit process in our interviews with building owners, talking through the series of interactions people had to undertake in completing a renovation project. In our work in Bradford we discussed the grant application process, and the interactions involved in that. We could have structured interviews around affiliations, but we felt this would foreground the more structural aspects of social relations, which could be more challenging for participants to reflect on.

How do we study interactions? From a qualitative perspective this is fairly straightforward: we can uncover the process of a project by talking to people about how things happened, and then asking about the interactions that took place during that process. Interactions can be at a range of scales, and happen across scales, and between all the different actors involved (e.g. inside the household, between households, between households and contractors or between these actors and government). The process in which interactions happen is often well understood and recognised (following a ‘script’), and in our project people found this relatively easy to talk about. In the context of energy, interactions are likely to connect to money being spent in some way: studies might start with where money is being spent, and map the interactions associated with that in conversation with key players. Note that this is useful at a number of scales: interactions are present when building owners, institutional actors and national government spend money.

There are existing data sets that can be of use in understanding the energy interaction, but quantitative data tends to document outcomes rather than interactions. For instance, there are records of people applying for energy grants [42], which evidence the outcome of a series of energy retrofit interactions. In other energy contexts, we might see switching energy suppliers as an outcome, and uses of energy switching sites as an interaction [43,44]. In our project we have also looked at expenditure on DIY as evidence of potential for energy outcomes [45], and by extension, linked to interactions on energy.

6.2. Who are the actors, and what are the affiliations?

Given Crossley’s (2011) contention that social relations are patterned differently for different contexts and actors, identifying actors and affiliations in the particular part of society in question, or indeed for the specific actors concerned, is important. In our social relations of retrofit project, we developed a process of identifying actors and describing

affiliations which we adapted in the different phases of research. Note that we apply these ideas to interviewees representing their households (in our work ‘building owners’), to stakeholders representing their organisations, and (through quantitative work) to communities or places and the patterns of behaviour apparent within them. The unit of analysis here is therefore rather flexible, and concepts in Fig. 1 could be applied to a range of units. In the context of our retrofit project, it became clear very quickly that affiliations between actors had a distinct character in Glasgow, Brighton and Leeds, and therefore that it was useful to bring together the sets of relations in each household and for each stakeholder to get a sense of the whole experience in each city.

More practically speaking, in order to understand building owners and their affiliations, we began with the categories that Hargreaves and Middlemiss derived in their review on this topic: relations of intimacy, relations of service provision and activism, and relations of identity [1]. Operationalising these in qualitative interviews helped us to understand who people are affiliated with and what those affiliations mean to them. In practice this involved stepping back and forward between energy interactions and actors and affiliations, asking questions such as ‘who did you go to for advice?’ and ‘did anyone help with the finance?’. We uncovered relationships of identity and place indirectly in talking through experiences of the process of retrofit. This approach is similar to a qualitative social network analysis approach, which aims to map the quality of affiliations between actors [46–48].

We also wanted to know about affiliations that are not present. To uncover these we can ask people about their affiliations to the types of retrofit actor that we might expect them to need to interact with (a form of theoretical comparison [49]). We could also ask actors about affiliations that existed in one of the other cases we were working on (Glasgow, Brighton, Leeds). Sometimes a lack of affiliations is revealed by talking through a project: when people talk about not knowing where to go to get advice or help, or being unaware that grant schemes were available to provide financing. It can also become clear in a qualitative interaction with someone that they are relatively isolated and that can become a prompt for a discussion on what that means about their ability to engage in interactions towards an energy outcome.

In interviews with institutional stakeholders, we were concerned with understanding the affiliations of actors that are engaged in delivering retrofit. More simply put: we wanted to know who people work with and what they do together. This can begin in a relatively simple way, using similar techniques that we outlined for building owners. Links at the institutional level might be between organisations, or between individuals within organisations. For instance, in our retrofit project we found very strong ties between trusted individuals in different institutions being at the heart of successful retrofit project delivery. This was certainly the case in Leeds, where the head of retrofit at Leeds City Council and the sustainability lead of a local contracting partner both talked about their strong working relationship, and how this had shaped the success of their projects.

We also need to draw on the wider set of concepts outlined in our framework to understand how affiliations are organised and, in turn, how they shape interactions. Institutional affiliations are often shaped by expectations and past experiences within those institutions and for particular individuals: a particular partnership might be prioritised because the partner is seen as trustworthy and good to work with. People play particular roles within institutions, which also might determine which kinds of affiliations are considered desirable. Similarly, there may be institutional scripts which shape the ways in which people tend to interact. Affiliations can also be organised by broader social rules: for instance, local authorities are constrained by the rules set by central government on how to fund retrofit (e.g. through loans or partnering with private sector finance). We hope that the concepts in the framework will provide a useful start for those attempting to understand what affiliations exist, and how they are shaping outcomes.

We engaged with both building owners and institutions active in retrofit in our research, and we found some gaps between the social

relations associated with each of these. Considering how social relations of actors are positioned in relation to other actors and groups of actors is in itself useful. For instance, in our building owner interviews we frequently found people who had not heard of some of the prominent institutional actors associated with retrofit in the locality. Julie, that we described in our vignette above, did not think of approaching the local retrofit group Otley Energy [50] as she was planning her work, for instance. Further, some of the local authority interviewees in England expressed frustration at the gap between the work going on at local level and the national governance of retrofit. We also identified a gap between people working on energy retrofit and people working on renovation, despite these activities sharing many of the same practices, materials and properties. Furthermore, in the case of cross-organisation collaboration, there is often an intertwining of competitive and non-competitive practices that need to be negotiated through relational work in order to build trust while at the same time hedging a position in order to protect an organisation's future interests.

It is possible to access quantitative data that detail the socio-demographic profile, behaviour or beliefs of particular sets of actors, which can tell us something about the actors and affiliations involved in an energy problem. In energy research, we are often trying to bring more technical data (e.g. housing type and quality) together with data about people (e.g. socio-economic background or spending habits) in particular places (e.g. neighbourhood classification types, climate zones). In our project we were able to use spatially referenced quantitative data and approaches to think about what types of actor engaged in particular energy interactions (e.g. who applies for energy grants? Who engages in retrofit?). This allowed us to access more structural socio-economic affiliations: membership of particular social groups, and their access to resources. We also looked to map these more structural affiliations spatially: looking to understand how these are patterned in different places. If spatially referenced data is used, it is possible to overlay data collected at different geographies (i.e. postcodes, vs census output areas) and then to combine these datasets together to build a rich picture of neighbourhoods.

Bringing in quantitative approaches therefore allow us to think about the more structural patterning of affiliations across space, and in relation to socio-economic categories. This is brought to life in our work on ‘who applies for energy grants’, where we found that Asian ethnicity households, on low-incomes, living in terraced housing were much more likely to apply for energy grants than many other social groups, including their white counterparts (white, low income, terraced housing) [55]. This resulted in a spatial and social patterning of retrofit, shaped by the affiliations, structural and lived, between people in particular areas of the country (where there are more Asian households, and where there is more terraced housing).

6.3. What relational work is happening and how is it shaping energy outcomes?

One of the key tasks in taking a relational approach to energy studies is to find the relational work that is happening and to understand how it shapes outcomes. Given that this concept is a means of explaining how energy outcomes come about as a result of affiliations, we look for relational work by qualitative means. Research aims to capture the quality of affiliations here: to understand levels of trust or distrust between actors. We are also interested in how this quality comes about: the work that it takes to create and maintain affiliations.

In practical terms, we approach this by being alert to relational work, both in qualitative interactions and in qualitative analysis. In the context of retrofit this often means being alert to accounts of affiliations, and the levels of confidence people have in them. This allows us to probe deeper to find out how these affiliations gained the qualities they have. For instance, we ask directly how the strong relationship between a local authority actor and a private sector building contractor came about, and what it meant to the retrofit work that is done by actors. Intriguingly,

relational work was often readily discussed by building owners as we talked through the retrofit process. As soon as we asked ‘how did you find someone to do the work?’ people launched into accounts of the building of affiliations with an unknown tradesperson, to either negative or positive conclusions. These are accounts of relational work. Note that in retrofit, and likely in many energy contexts, relational work happens at multiple scales, and between scales (household, institutions, policy). We need to be alert to this in data collection and analysis.

Once relational work is the topic of discussion, we can use concepts in our framework above to identify patterns in this work. For instance, we look to find out who is actively engaging in relational work around retrofit. Here we observed people acting in different roles: some actors are trying to do retrofit; others are trying to facilitate retrofit: in effect facilitating or smoothing the relational work for others. The latter are typically local authorities or NGOs. The concept of ‘role’ is quite helpful, both to identify the type of relational work undertaken, but also to lay bare the absence of relational work. For example, when no one takes such a facilitating role, this can leave building owners in a position where all the relational work is left to them and they may be less likely to undertake retrofit. These are not wholly new observations in this area, indeed the body of work on ‘intermediaries’ and the role they play in low energy buildings is particularly relevant here [51–53].

The centrality of relational work as a topic of conversation in many of our qualitative interactions is reassuring: it suggests that taking a relational approach allows us to access an important factor in the failure or success of retrofit. It also suggests a different role for policy: the support and facilitation of relational work for retrofit.

7. Future research and application

In this paper we offer an invitation to others working in the energy social sciences to consider taking a relational approach, inspired by new economic sociology. We do this because we think this approach could be valuable more broadly across the energy social sciences. Indeed, we argue that a relational approach could lend itself to replication in a number of different energy demand research fields. We have thus framed our ‘relational approach to energy’ for an interdisciplinary audience as a means of understanding how interactions about energy (between affiliated actors, and enabled by relational work) lead to energy outcomes. Bringing theories and concepts from new economic sociology into the study of energy retrofit has been a highly productive journey for us, which is leading to new insights about energy decision-making, and, in turn, the ability to make novel recommendations for policy and practice. Framing energy in relational terms, and asking the relational research questions that we ask here, leads to different insights into how people spend money on energy, and by extension, how socially desirable energy outcomes might be achieved. We hope to have added to the call from Hargreaves and Middlemiss (2020) for a relationally driven energy demand research, by articulating a possible approach to this.

Understanding how results from relational research can be applied in practice, and how they might shape policy, is vital for future research to fill a key knowledge gap with respect to retrofit, as well as other energy problems. In this paper we have principally focused on introducing conceptual ideas and methodological principles. However, in interactions with policy-makers and practitioners in the course of our project on renovation and retrofit we have realised that approaching this energy problem relationally leads to different opportunities for intervention. Our research partners in policy and practice are keen to use this thinking to help to design more effective interventions in this field [57]. A relational approach leads to a different way of understanding the policy problem, and so different kinds of policy design and recommendations. In the face of energy problems that are both urgent and wicked, relational approaches can add to the set of tools that policy-makers and practitioners have to address these.

For instance, seen through a relational lens, the policy problem might be an absence of actors (due to institutional failure), an absence of

affiliations, or an unwillingness to engage in relational work. If policy supports relational work more effectively, and recognises where interactions for energy outcomes are already happening, they have more potential to achieve change. A relational approach suggests that interventions cannot enjoy success with a ‘one-size fits all’ offer, and instead need to engage with place-based stakeholders to leverage local networks reducing the relational work involved for people, making retrofit a feasible and attractive outcome. Policy designed to respond to such problems, would be policy that facilitates and smooths relational work: finding and taking advantage of existing affiliations of trust, or providing funding to reduce relational work within particular places where affiliations are limited.

We finish by using our vignette as an example of where policy and practice can hope to produce change. Julie's experience was characterised by distress at the breakdown of trust in the tradespeople she employed. This could have been alleviated had she found her way to one of the existing support mechanisms in place either locally (through the community group Otley Energy [50] which could have advised her on choice of product and trades), or further afield (through the support group ‘Her Own Space’ [54], a women only Facebook group where women exchange support and advice on dealing with trades in the process of renovation and retrofit). These groups are not always recognised as key actors in the practice of retrofit, and are frequently reliant on unstable financial support. They also rely on a very public presence in the community to ensure that people realise that they exist. Julie was unaware of both of these groups.

Given Julie's age, disability status, and low income, her story offers important evidence that people are interested in improving energy efficiency in their homes, even when they have relatively little access to resources. The motivation for Julie was increased comfort, and being able to see through her windows again, improving her quality of life using the inheritance from her mum. A more joined up approach to Julie's experience would involve her being supported through the process of spending her own money, and potentially looking for ways of offering further home improvements through government grants. Such advice could be offered at the point of sale for energy related renovation and retrofit (e.g. double glazing company, DIY stores, building merchants), or through community actors (e.g. Otley Energy). In a context in which government grants are often advertised through a national campaign, and are constrained by complex eligibility criteria and application procedures, we can see why Julie would not have thought to apply. This work suggests a real opportunity for policy: bringing government support to those that need it, through actors and relationships that are already active on energy retrofit and renovations, and that have a trusted presence in place.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Lucie Middlemiss reports financial support was provided by UK Energy Research Centre (ref: EP/S029575/1).

Data availability

Data will be made available on request.

References

- [1] T. Hargreaves, L. Middlemiss, The importance of social relations in shaping energy demand, *Nat. Energy* 5 (2020) 195–201.
- [2] D. Brown, P. Kivimaa, J. Rosenow, M. Martiskainen, Overcoming the systemic challenges of retrofitting residential buildings in the United Kingdom, In: *Transitions in Energy Efficiency and Demand*. Routledge (2018) 110–139.
- [3] A. Karvonen, Towards systemic domestic retrofit: a social practices approach, *Building Research & Information*. 41 (5) (2013 Oct) 563–574.

- [4] N. Kerr, A. Gouldson, J. Barrett, Holistic narratives of the renovation experience: using Q-methodology to improve understanding of domestic energy retrofits in the United Kingdom, *Energy Res. Soc. Sci.* 42 (2018 Aug) 90–99.
- [5] C. Wilson, L. Crane, G. Chrysochoidis, Why do homeowners renovate energy efficiently? Contrasting perspectives and implications for policy, *Energy Res. Soc. Sci.* 7 (2015 May 1) 12–22.
- [6] J. Rosenow, N. Eyre, A post mortem of the green Deal: austerity, energy efficiency, and failure in British energy policy, *Energy Res. Soc. Sci.* 21 (2016 Nov) 141–144.
- [7] N. Crossley, *Towards Relational Sociology*, Routledge, Abingdon, 2011.
- [8] V. Zelizer, *The Social Meaning of Money*, 2nd edn, Princeton University Press, Princeton, New Jersey, 2017.
- [9] V. Castán Broto, L. Baker, Spatial adventures in energy studies: an introduction to the special issue, *Energy Res. Soc. Sci.* 36 (2018) 1–10.
- [10] N. Bandelj, Relational work and economic sociology, *Polit. Soc.* 40 (2) (2012 Jun 1) 175–201.
- [11] F.F. Wherry, Relational accounting: a cultural approach, *Am. J. Cult. Sociol.* 4 (2) (2016 Jun 1) 131–156.
- [12] V.A. Zelizer, How I became a relational economic sociologist and what does that mean? *Polit. Soc.* 40 (2) (2012) 145–174.
- [13] Norman Blaikie, *Designing Social Research*, Polity Press, Cambridge, 2000.
- [14] N. Crossley, A dependent structure of interdependence: structure and Agency in Relational Perspective - Nick Crossley, 2022, *Sociology* 56 (1) (2022) 166–182.
- [15] I. Burkitt, *Emotions and Social Relations*, Sage, London, 2014.
- [16] V. Zelizer, *The Purchase of Intimacy*, Princeton University Press, Princeton, New Jersey, 2005.
- [17] C. Tilly, *Identities, Boundaries and Social Ties*, Paradigm, New York, NY, 2006.
- [18] A. Garcia, Relational work in economic sociology: a review and extension-García –2014- sociology compass-Wiley online library, *Sociol. Compass* 8 (6) (2014) 639–647.
- [19] N. Bandelj, Relational work in the economy, *Annu. Rev. Sociol.* 46 (1) (2020) 251–272.
- [20] S. Bell, E. Judson, H. Bulkeley, G. Powells, K.A. Capova, D. Lynch, Sociality and electricity in the United Kingdom: the influence of household dynamics on everyday consumption, *Energy Res. Soc. Sci.* 9 (2015 Sep) 98–106.
- [21] K. Burningham, S. Venn, Are lifecycle transitions opportunities for moving to more sustainable consumption? *J. Consum. Cult.* 20 (1) (2017) 102–121.
- [22] L. Nicholls, Y. Strengers, Peak demand and the ‘family peak’ period in Australia: understanding practice (in) flexibility in households with children, *Energy Res. Soc. Sci.* 9 (2015) 116–124.
- [23] A. Ambrose, L. McCarthy, J. Pinder, *Energy (in)Efficiency: What Tenants Expect and Endure in Private Rented Housing*, Sheffield Hallam University, Centre for Regional Economic and Social Research, 2016 (report to the Eaga Charitable Trust).
- [24] M. de Wilde, The sustainable housing question: on the role of interpersonal, impersonal and professional trust in low-carbon retrofit decisions by homeowners, *Energy Res. Soc. Sci.* 51 (2019 May) 138–147.
- [25] A. Owen, G. Mitchell, A. Gouldson, Unseen influence—the role of low carbon retrofit advisers and installers in the adoption and use of domestic energy technology, *Energy Policy* 73 (2014 Oct 1) 169–179.
- [26] M. Anantharaman, Elite and ethical: the defensive distinctions of middle-class bicycling in Bangalore, India. *Journal of Consumer Culture.* 17 (3) (2016) 864–886.
- [27] R. Day, R. Hitchings, ‘Only old ladies would do that’: age stigma and older people’s strategies for dealing with winter cold, *Health Place* 17 (4) (2011) 885–894.
- [28] A.R. Hansen, Sticky energy practices: the impact of childhood and early adulthood experience on later energy consumption practices, *Energy Res. Soc. Sci.* 46 (2018) 125–139.
- [29] C.S. Damgaard, D. McCauley, L. Reid, Towards energy care ethics: exploring ethical implications of relationality within energy systems in transition, *Energy Res. Soc. Sci.* 84 (2022 Feb 1) 102356.
- [30] G. Walker, The dynamics of energy demand: change, rhythm and synchronicity, *Energy Res. Soc. Sci.* 1 (2014 Mar 1) 49–55.
- [31] F. Bartiaux, K. Gram-Hanssen, P. Fonseca, L. Ozoliņa, T.H. Christensen, A practice–theory approach to homeowners’ energy retrofits in four European areas, *Building Research & Information.* 42 (4) (2014 Jul 4) 525–538.
- [32] E.P. Judson, C. Maller, Housing renovations and energy efficiency: insights from homeowners’ practices, *Building Research & Information.* 42 (4) (2014 Jul 4) 501–511.
- [33] C. Maller, R. Horne, T. Dalton, Green renovations: intersections of daily routines, housing aspirations and narratives of environmental sustainability, *Hous. Theory Soc.* 29 (3) (2012 Sep 1) 255–275.
- [34] A. Hui, G. Walker, Concepts and methodologies for a new relational geography of energy demand: social practices, doing-places and settings, *Energy Res. Soc. Sci.* 36 (2018 Feb 1) 21–29.
- [35] E. Roberts, K. Henwood, Exploring the everyday energyscapes of rural dwellers in Wales: putting relational space to work in research on everyday energy use, *Energy Res. Soc. Sci.* 36 (2018 Feb 1) 44–51.
- [36] D. Massey, *Space, Place and Gender*, Polity Press, Cambridge, 1994.
- [37] C. Harrison, J. Popke, “Because you got to have heat”: the networked assemblage of energy poverty in eastern North Carolina, *Ann. Assoc. Am. Geogr.* 101 (4) (2011) 949–961.
- [38] J. Beckert, *Imagined Futures: Fictional Expectations and Capitalist Dynamics*, Harvard University Press, Cambridge, MA, 2016.
- [39] B. Middha, N. Willand, It’s not as easy as ‘heat or eat’ - exploring the intersecting vulnerabilities of energy and food in domestic practices in Australia, *Energy Res. Soc. Sci.* 105 (2023 Nov 1) 103288.
- [40] N. Longhurst, T. Hargreaves, Emotions and fuel poverty: the lived experience of social housing tenants in the United Kingdom. *Energy research and social, Science* (2019) 56.
- [41] D. Butler, *Communicating Energy Vulnerability: An Exploration of Energy Advice within and beyond Formal Settings* [Internet], University of Salford, 2020. Available from: <http://usir.salford.ac.uk/id/eprint/60103/1/PhD%20Thesis%20D%20BUTLER%202020%20FINAL.pdf>.
- [42] UK Government. Find an Energy Certificate [Internet]. 2023 [cited 2023 Aug 2]. Available from: <https://www.gov.uk/find-energy-certificate>.
- [43] BEIS. Quarterly domestic energy switching statistics [Internet]. 2023. Available from: <https://www.gov.uk/government/statistical-data-sets/quarterly-domestic-energy-switching-statistics>.
- [44] Ofgem. Consumer Engagement Survey 2018 [Internet]. 2018. Available from: <https://www.ofgem.gov.uk/publications/consumer-engagement-survey-2018>.
- [45] UK Data Service. Living Costs and Food Survey, 2018–2019, Documentation, Volume F [Internet]. 2021. Available from: <https://beta.ukdataservice.ac.uk/datacatalogue/studies/study?id=8686#!/documentation>.
- [46] E. Bellotti, *Qualitative Networks: Mixed Methods in Sociological Research*, Routledge, 2014.
- [47] G. Edwards, N. Crossley, Measures and meanings: exploring the Ego-net of Helen Kirkpatrick Watts, *Militant Suffragette. Methodological Innovation Online.* 4 (2009) 1–7.
- [48] J. Hamilton, B. Hogan, K. Lucas, R. Mayne, Conversations about conservation? Using social network analysis to understand energy practices, *Energy Res. Soc. Sci.* 49 (2019) 180–191.
- [49] A. Strauss, J. Corbin, *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory*. Second, Sage Publications, Thousand Oaks, 1998.
- [50] Otley Energy. Otley Energy [Internet]. 2023 [cited 2023 Oct 27]. Available from: <https://otleyenergy.co.uk/>.
- [51] P. Kivimaa, S. Hyysalo, W. Boon, L. Klerkx, M. Martiskainen, J. Schot, Passing the baton: how intermediaries advance sustainability transitions in different phases, *Environ. Innov. Soc. Trans.* 31 (2019 Jun 1) 110–125.
- [52] Kivimaa P, Martiskainen M. Innovation, low energy buildings and intermediaries in Europe: systematic case study review. *Energy. Effic.* 2018 Jan 1;11(1):31–51.
- [53] M. Martiskainen, P. Kivimaa, Creating innovative zero carbon homes in the United Kingdom — intermediaries and champions in building projects, *Environ. Innov. Soc. Trans.* 26 (2018 Mar 1) 15–31.
- [54] Coupe E. Her Own Space [Internet]. 2023 [cited 2023 Oct 27]. Available from: <https://www.herownspace.com/>.
- [55] A. Owen, L. Middlemiss, D. Brown, M. Davis, S. Hall, R. Bookbinder, M.C. Brisbois, I. Cairns, M. Hannon, G. Mininni, Who applies for energy grants? *Energy Res. Soc. Sci.* 101 (2023) 103123 <https://doi.org/10.1016/j.erss.2023.103123>.
- [56] E. Bolton, R. Bookbinder, L. Middlemiss, S. Hall, M. Davis, A. Owen, The relational dimensions of renovation: implications for retrofit policy, *Energy Res. Soc. Sci.* 96 (2023) 102916, <https://doi.org/10.1016/j.erss.2022.102916>.
- [57] J. Emden, More than money: moving towards a relational approach to retrofitting, IPPR, <https://www.ippr.org/research/publications/more-than-money>, 2023.