Better Energy Futures: Developing a framework for addressing fuel poverty[1]

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Contents

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I. Executive Summary

- The project was undertaken as part of a longstanding collaboration between researchers from the Understanding Risk Group at Cardiff University (CU) who work in the Schools of Social Sciences and Psychology, together with colleagues from the Consumer Insights team at the Energy Systems Catapult (ESC). It was funded by the Welsh Government, and forms part of the ESC's Fair Futures programme, providing an initial basis for future work by ESC in developing design solutions for fuel poverty
- Its objective was to draw on social science research concerning people's lived experience of energy use in order to help design fairer, more effective interventions to address fuel poverty. It aimed to do this by producing an enabling framework, to help envision how stakeholders could use research data relating to lived experience to better design innovations that address fuel poverty.
- To do this, it combined qualitative longitudinal research into people's experiences of challenges surrounding energy consumption by CU with a stakeholder workshop convened and led by ESC. The research phase involved interviews with 23 participants in Caerau in South Wales over the course of 12 months
- Analysis of data explored to what extent people's accounts of energy-related challenges reflected other scholars' research findings on the nature of energy vulnerability. In particular, the analysis focused on the extent to which people described experiences of detriment brought about by inadequate access to energy services. The literature suggests that such detriment can be conceived of as a loss of *capabilities*, i.e. the opportunities available to people to achieve a socially valued quality of life. Key questions were to what extent people found themselves vulnerable to such detriment as a result of wider *disabling conditions*, and in what ways the effects of such conditions were influenced by people's own understandings of and responses to their situation.
- The research data indicate that energy vulnerability is characterised by shifts in personal and social circumstances between periods of instability and relative stability. These shifts can arise from various conditions, for example, from predictable or unpredictable financial pressures. Wider social relationships (such as those between tenants and private or social landlords) can also be significant, and can be strongly influenced by the beliefs peoples have about the character of a community. How people deal with shifts from instability to stability and back again is central to whether difficulties increase or decrease. There is significant evidence of people adapting in order to change their circumstances to some degree, particularly in concert with others. There is also evidence that people can adapt by "lowering their sights" which can exacerbate detriment. Experiences with technologies such as smart meters show people feeling scepticism about the extent to which technology alone can help.
- To help understand the influence people's responses to changes in conditions have on energy vulnerability, we have found it useful to engage qualitatively with the concept of *reliability*. That is to say, a persistent theme in participants' accounts of their experiences is the extent to which they feel able to rely on stable expectations regarding income and costs, the material fabric of their housing, on social or private landlords, on others in the community, and so on. Even the experience of 'lowering one's sights' can represent a way of finding something reliable in an otherwise unstable situation. When considering what interventions might be valuable to help address energy vulnerability, it should not be assumed that issues surrounding the cost of energy are necessarily the most important. Instead, they should focus on how interventions can create enabling conditions to help support people's capabilities.
- These could include measures such as
    - designing interventions to reduce or prevent upfront costs falling on households,

- building into interventions active recognition of the complexities of energy users' needs,
- improving housing energy efficiency in ways regulated by appropriate quality control,
- regulating and incentivising private and social landlords in ways that increase householders' capacity to initiate interventions, and
- being aware of and sensitive to what capabilities people are able to exercise, and how their understanding of these capabilities may be influenced by the history of the communities in which they live.

II. The Project

II.i Overview

The project set out to understand how best to design interventions incorporating new technologies intended to help address fuel poverty. To do this, the teams from CU and ESC undertook three main activities. First, to review key literature on the conditions thought to create the propensity for certain households to suffer fuel poverty. Second, to conduct qualitative research in a South Wales community to understand how in depth exploration of people's experiences over the lifecourse can help us understand how the significance of these conditions can change over time. Third, to conduct a workshop with stakeholders to examine how research data can help understand where and how technological innovation can play a role in addressing fuel poverty. Overall, its central concern has been to explore how understanding more about people's lived experience can help shape the development of a low carbon energy system while centrally addressing issues of fairness.

Rather than follow a prescribed model for how to build an effective fuel poverty intervention, the project involved steps that were pre-planned (anticipatory design) while others arose in the course of undertaking the study (emergent design). The project was undertaken as a collaboration between CU and ESC, with each partner taking responsibility for ensuring completion of different aspects of the work. The project has established an initial basis for further concept development led by ESC on designing solutions for fuel poverty.

Section IV "What we learnt" gives a substantive account of findings from the qualitative interviews undertaken and analysed by CU, but also identifies a set of "issues for interventions design" in emergent mode. This reflects how – by actively harnessing the benefits of its dynamic research approach - the CU team built on prior conceptual understandings of what is involved in producing an enabling framework for addressing energy vulnerability.

Workshop activities undertaken with stakeholders were designed by ESC who produced a set of 'user requirements' and reflections on these that were bespoke for the geographical region, a summary of which is set out in section V. After the workshops CU worked with these reflections to construct guidelines for how to design interventions relating to energy vulnerability and fuel poverty (also in section V). A unique combination of data collection and analysis, production of user requirements, and stakeholder-influenced reflections thus underlie the production of these guidelines as an enabling framework.

First, we examine more closely the nature of the problem we set out to tackle.

II.ii Fuel Poverty & Energy Vulnerability

Fuel poverty (as an inability to afford adequate energy services) is a matter of widespread concern in the UK for government, civil society organisations and communities alike. Current levels of fuel poverty in the UK – and ways of measuring it – differ across its constituent nations. In Wales, the official definition of fuel poverty is[i] as a condition where a household spends more than 10% of its income on energy.[ii] Despite differences in definition, it is still recognised by both the devolved administrations and the Westminster government that the cost of energy is a significant social justice issue.

Understanding what measures might work in helping to tackle fuel poverty is challenging. Not only are there different definitions of the condition, but a large body of research suggests that the conditions which give rise to fuel poverty are themselves diverse and often complex. As a result, policy programmes which focus on, for example, providing households with information to help them reduce the amount of energy they use are likely to have little impact. The problem is that households' ability to make significant changes is often limited.

This can be because of the nature of energy needs within the household. For example, households where older people or people with disabilities live may need to spend significantly more on space heating or on powering assistive technologies. Constraints on adaptability can also be because of the material fabric of homes. A lack of adequate insulation or of double glazing can significantly reduce the efficiency of heating systems, for instance. But constraints on households' choices can also come from external conditions. These are often social in nature, such as the relationships between tenants and

private landlords, or the use by utility companies of prepayment meters and higher tariffs for consumers on low incomes.

Together, these conditions can be thought of as *disabling conditions*. They are disabling in the sense that they make it harder for households to avoid spending so much of their income on energy that they then have insufficient income to maintain a decent quality of life, or indeed make it impossible to heat homes adequately at all. The importance of such disabling conditions is underlined by research in Wales which shows that interventions to reduce fuel poverty have had little success in moving households out of this condition.[iii] Such findings are supported by international data.[iv] Income, housing condition, social relationships and how the buying and selling of energy is managed and regulated all make a propensity towards suffering fuel poverty more likely for some households. Households caught up in interlinked disabling conditions can be considered to be experiencing *energy vulnerability* (EV), which increases their chances of suffering fuel poverty, makes them more sensitive to its effects, and can reduce their capacity to deal with it.[v]

A further complicating factor is that measures to address fuel poverty need to happen in ways which also help reduce greenhouse gas emissions and thus assist in mitigating climate change. A transition towards a decarbonised energy system is central to the UK Government's commitments under the Climate Change Act 2008, as well as those undertaken by the UK's devolved administrations. This transition will involve the introduction of new technologies to help end-users manage and better understand their energy use, as well as ways of making energy using appliances and home heating systems more efficient. However, the introduction of new technologies or designs often does not go as planned, as people may interact with them in unintended ways. As a result, there is reason to be careful that new technologies or interventions do not in fact *increase* the likelihood of household energy vulnerability as the energy system is decarbonised.[vi]

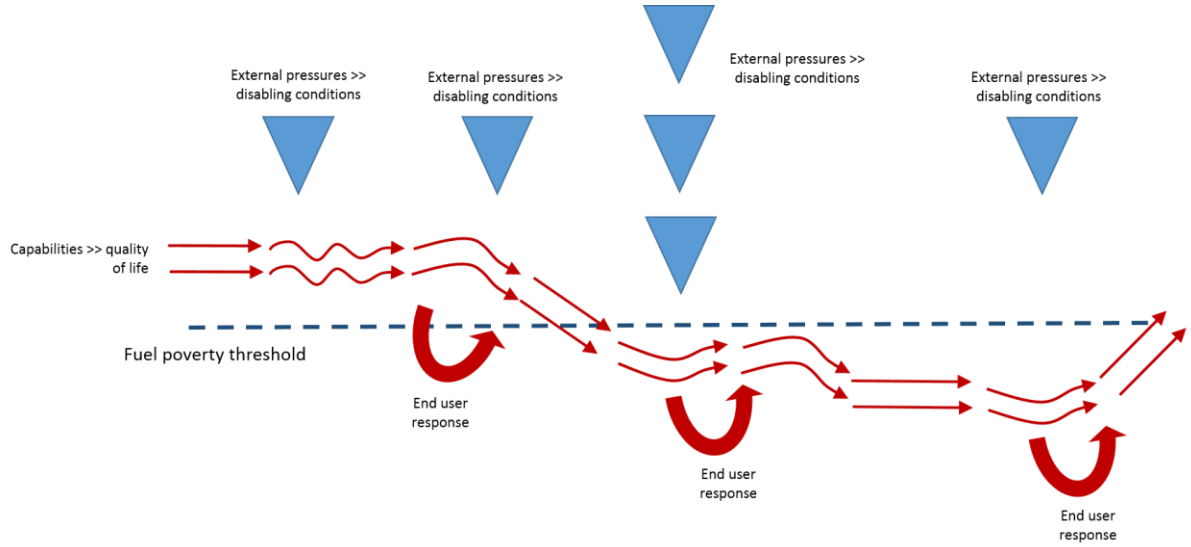

Figure 1: Conceptualising energy vulnerability as a dynamic condition

For all these reasons, designing ways of addressing fuel poverty has to look beyond technologies alone and encompass changes to the social contexts in which they operate. These might include new business models, new forms of regulation for energy markets, the creation of new forms of community ownership and so on. Later we look at how an enabling framework for designing solutions to energy vulnerability and fuel poverty can take account of these aspects of the wider environment in which energy is consumed.

II.iii Researching energy vulnerability

Energy vulnerability underlies fuel poverty. Trying to tackle fuel poverty without addressing its underlying conditions risks leaving the real problem untouched. Understanding how energy vulnerability arises is therefore significant for any attempt to design solutions. In particular, the ways in which the actions households take themselves affect disabling conditions is important. Energy

vulnerability involves exposure to harm, in the sense of members of a household being unable to obtain the energy services (heating, lighting, cooking, communication etc.) necessary to attain a socially-valued quality of life. It also involves a lessening of the capacity of those affected to respond to the threat of harm. Consequently, how household members themselves view their situation, and make sense of what to do about it is important for understanding energy vulnerability as a dynamic condition.[vii] Overall, the disabling conditions which create energy vulnerability do so by undermining the *capabilities* of households, i.e. by removing opportunities from them to act to attain a socially-valued quality of life. Conversely, enabling conditions in the context of energy use would be those which provide opportunities for people to use energy in ways that help them attain such a quality of life.

Together, these considerations justify making greater use of qualitative research to approach energy vulnerability, particularly where this is undertaken *longitudinally*, i.e. by undertaking research activities with the same participants at different points across a given span of time. Interviewing householders enables researchers to avoid relying on assumptions about what energy vulnerability is that may not match people's own experience. Such research methods enable a 'bottom-up' approach that can allow people to articulate their own sense of the energy challenges they face, the effects these may have, and how they themselves have acted to change their situation.

Current concern about fuel poverty often focuses on the wider inequalities (in health outcomes, for example) to which it can lead. In addition, it is about how the costs and benefits of participating in the energy system are shared out in ways that tend to improve the lives of some at the expense of others. A qualitative approach to understanding the dynamics through which this inequitable distribution of costs and benefits happens also addresses two other issues. First, research that enables people to speak about their own circumstances goes some way to remedying the lack of opportunities many people experience to represent their own interests. Second, it can allow people to represent their circumstances in their own terms rather than using concepts drawn from elsewhere.

If interventions to address fuel poverty are intended to be more responsive to people's actual experiences of energy vulnerability and how they may change over time, the value of qualitative research may thus be significant.

III What we did

III.i Longitudinal qualitative data collection

Interviewees lived in Caerau, an ex-mining community in the South Wales valleys that scores highly on a number of measures of deprivation.[viii]. Work is currently being undertaken in Caerau as part of Bridgend Council's strategy to decarbonise the energy system in the borough. This project is exploring the potential for a geothermal community district heating scheme, which will use heat taken from floodwater that collects in disused local mineworkings. As part of the scheme, it is likely that energy efficiency improvements will need to be carried out in households that choose to participate. It is also hoped that this scheme will help to reduce fuel bills.[ix]

Caerau Profile (2011 UK Census Data)

Population	6995
No. of households	2966
Economic inactivity (%)	44
Residents with long term limiting illness (%)	36
% of population with no academic or professional qualification	55
Households with no car/van (%)	34
Owner occupiers (%)	76
Private sector rented (%)	11
Social landlords (%)	13

Table 1: Caerau Community Profile

During 2017, 18 interviews were conducted as part of the Flexis project, which is involved in the minewater scheme.[x] These involved 23 participants aged between their early 20s and late 70s. Initial Interviews explored perspectives on the minewater project, everyday energy use and experience of challenges relating to energy.[xi] In 2018 16 second-round interviews with 21 participants were

conducted. At the time of the first interview, four participants lived in social housing, six were privately renting and the remainder owned their own homes.

- Eight participants were retired,
- Ten unemployed
- Five were in employment (a mixture of full-time, part-time and self-employed).

Not being employed can mean individuals spend more time in their homes, which may increase the need for energy consumption.

Using a specific baseline definition of what makes a household more vulnerable to the effects of material deprivation, that is, the dwelling has children, elderly or sick/disabled occupants present,[xii] 18 of the 23 participants in our sample could be described as living in vulnerable households at the time of the first interview. No attempt was made to assess whether the households recruited to the study were in fuel poverty according to official definitions as this would have required detailed assessments of building energy performance and fuel expenditure.

> *"Caerau itself is in the lowest ten percent of postcodes and in the lower groupings for wards and things for most of the deprivation, it comes sixth I think at the moment … within the worst 20% in Wales"*
>
> ('Pamela', 50s, first interview)

III.ii Using design thinking and consumer insight to design new concepts to support vulnerable energy consumers

Following the completion of interviews, extensive data analysis was undertaken and a detailed report shared with ESC. In response to this, the ESC team developed a set of *user requirements* to provide guidance for designing future energy system interventions in ways responsive to the experiences of energy vulnerability presented in our data. They then convened and led a Smart Living Wales workshop in Cardiff in January 2019 with invited stakeholders including representatives of community, social housing and third sector organisations working to address fuel poverty. The aim was to draw on the ESC's experience and expertise in using design thinking to address innovation challenges to explore with stakeholders how to design interventions in ways that are responsive to our findings.

The workshop was organised around an interrelated set of activities designed to allow stakeholders to reflect on the gaps between current interventions, participant experiences, and more responsive future solutions. Following an initial discussion of what life in Caerau might be like if fuel poverty were to be eradicated, ESC facilitators provided a brief introduction to insights from CU research findings, refined into a series of draft requirements. These were then subject to extended discussion in light of the relevant experiences, expertise and professional interests of the stakeholders present. Finally consumer journey mapping and consumer storyboard exercises, addressing specific issues stemming from insights into lived experience in Caerau, together with issues identified by participants and by the Energy Systems Catapult.

IV What we learnt

In this section, we explore how our activities have added to understanding of both the lived experiences of energy vulnerability and of the ways in which transforming the energy system may help address the disabling conditions which create it. This represents a summary of our research. From our data, six main themes emerge as particularly significant to understanding energy vulnerability (see Table 2 below for a summary). These enable us to set energy vulnerability in a *broader* dynamic context – in which how situations change over time emerges as especially important. They also allow us to go *deeper* into how the meaning of people's situation has significant influence on whether they are more likely to suffer detriment from it. Together, these give us a richer sense of how the wider conditions of people's lives may be either *disabling* and create vulnerability, or be *enabling* and thus provide more resources on which people can rely. In many ways, as we detail below, disabling and enabling conditions are not something 'in' households. Instead, they are a feature of the social contexts in which households are located. Further, conditions (such as care responsibilities) which are not in

themselves necessarily disabling can exacerbate disabling conditions. At the same time, these conditions do not absolutely determine whether people suffer energy vulnerability. How people themselves understand and respond to these conditions also shapes their situation.

Issues for intervention design: six themes
1. Instability and unpredictability
E.g. changes in income, unplanned expenditure, health conditions
2. Social relationships
E.g. difficulties with landlords, caring responsibilities, readiness to aid others in the community
3. Multiple meanings of 'budgeting'
Budgeting can be about saving across the year, but is also often about 'just managing' week to week
4. Adapting to changing circumstances
Might mean active improvement to circumstances, but also covers 'lowering one's sights', trading off one value against others
5. Dealing with technology
Experiences of unreliability and/or limited utility of smart meters, contrasted with lived experience of own energy saving practices
6. The importance of place
Local history provides examples of stable and reliable relationships that helped protect against energy vulnerability

Table 2: Issues for intervention design – six themes

1. Instability and unpredictability

A benefit of our longitudinal approach is that it registers change in people's circumstances over time. Our research approach, and specific data arising from it, support other research which suggests that it is too simplistic to treat energy vulnerability as a binary condition in which people are either caught up or not.[xiii] Instead, it points firmly towards the need to understand and represent energy vulnerability as a dynamic condition, experienced as often unpredictable movements between periods of relative stability and instability, marked by slides and shocks and accompanied by anxiety.[xiv] Entering into fuel poverty in such circumstances might be temporary. Poverty may therefore be experienced as transient but a continual threat.

Various examples from the data point towards these conclusions. Data were primarily coded for reports of difficulties relating to dimensions of energy vulnerability already extensively mapped in the literature (such as financial, housing fabric related, landlord related, and so on), and then analysed further to trace changes in these experiences over time between interviews and how people assessed and responded to their changing circumstances.

Participants saw as particularly disabling external conditions which made it difficult to save money. Respondents describe often facing unexpected expenses, relating to e.g. illness or replacing an appliance. Owner occupiers also described needing to effect repairs, and improvements as household

members needs changed over time. Sometimes this means gradual improvements in insulation and double glazing, even if it means 'buying a window at a time'.

In general, interviewees were very conscious of rising energy costs and indeed the rising cost of living more widely. Energy price regulation is currently heavily market-based albeit with some regulatory oversight and a price cap. This means that energy customers are encouraged to address rising costs by switching suppliers for better deals. However, interviewees pointed out that this can prevent customers on lower or unstable incomes from improving deals, as the act of switching incurs a double charge in the final month of the old contract, as the previous bill period is settled and the first month of the new contract paid for in advance. Utility company practice here acts as a disabling condition. An increased need to spend more for some energy services, heating in particular, is seen as accompanying some long-term illnesses or disabilities, and being associated with being elderly or having children (see 2 below).

> *"It's just general conversation, people just say, "Oh my gosh," you know. It's not just heating. It's, like, food costs as well. Food costs are going up and then, you know, when you've got minimum wage and things like that, just in general, I think, times are getting harder"*
>
> ('Angela', 40s, second interview)

2. Social relationships

> *"Me asking them [social landlord] to do something is always 'no, can't do this, we haven't got enough money for that' … the only time I've been waiting was two years for them to do my wall [issue with damp and mould]. In the end, I said 'I've had enough. You coming out to do my walls, I've had enough, I'm phoning environmental health'"*
>
> ('Amanda', 30s, first interview)

Where owner occupiers report some struggles with repair or improvement costs, social and private rental tenants report other issues. Here, social relationships may act as disabling conditions. Social housing tenants report inconsistent experiences of trying to get repairs carried out, with some housing associations undertaking work promptly or proactively and to a high standard, and others being slow and/or not completing work adequately, resulting in persistent problems in some cases. In the private sector, greater difficulties were reported with repairs or remediation for damp etc., and a lack of willingness to undertake improvements. Relationships with landlords were sometimes difficult or strained as a result.[xv] The impact of such situations is seen as creating disabling conditions which have both financial impacts (e.g. damp conditions requiring more heating) and wider ones, such as effects on health, which may then have further destabilising effects

Within households and their immediate circle, caring responsibilities for others are seen as sometimes making the potentially destabilising impact of other conditions more significant. In particular, the need to keep homes at a stable warm temperature for elderly relatives or young children is seen as a priority in most cases. While heating is generally the single most costly energy service with the wellbeing of others at stake, other services are also seen as important. Some interviewees noted that, particularly where parents are unable to afford to take children on outings for entertainment, watching TV and games consoles are seen as providing important entertainment functions though potentially increasing energy costs. Similar importance is placed on these devices where people suffer mobility problems due to disability or long term illness.

> *"One day, the young lady, single mum [next door neighbour] was saying that she hadn't been down to top up the meter, since she's run out of gas. So I said, well, if you want to borrow some money or something? … I said, well, you can use my gas stove if it's any good to you."*
>
> ('Alec', 60s, first interview)

Beyond the home, care for others is seen as an important feature of community life. The second set of interviews followed the impact of the 'Beast from the East' storm in February-March 2018, which brought cold and snowy conditions, followed by a water shortage caused by burst water mains. Several interviewees reported that they had helped (or seen others help) vulnerable

members of the community. Some of this assistance was energy-related, and either financial (helping others pay for gas in particular, in response to unexpected increases in energy expenditure) or lending people appliances. Some noted that the community was not as close and cohesive as in earlier times (particularly when the coal mines helped provide many of the basic structures of community life and its sense of self-reliance, see point 6), but that helping when people found themselves in difficult circumstances was still a basic feature of life in Caerau, so long as people evidently needed or asked for help. Social networks (including but going beyond family members and neighbours) are also important for sharing information and advice. While energy costs were not reported as being a major feature of conversation, rising prices of goods more generally certainly were (see IV.1 above). Although their image of the community and the roots of its identity had changed, older residents reported, it was still possible to rely on a certain level of assistance in difficult times.

3. Multiple meanings of budgeting

Respondents often talked about needing to budget carefully to manage on a low income. It is important, however, to understand nuances in what is meant by 'budgeting' here. Being able to budget has connotations of achieving control over finances. But to understand the extent to which being able to plan expenditure on energy points to the presence of wider enabling or disabling conditions we need to pay attention to the time period covered by budgeting activity in each case. For some, budgeting means e.g. setting aside money saved during the summer for spending on energy in the winter. For others, it means putting aside money for the longer term and for sudden shocks. For still other households, budgeting implies managing spending week to week.

For week to week spending, some interviewees found prepayment energy meters useful to help with planning. At the same time, prepayment meters increase costs overall across the year, and also add to anxiety. Interviewees reported that these meters make it easier to appreciate how much energy they're using, but that it also makes them aware of how much quicker they incur costs given the higher tariffs associated with prepayment. The multiple meanings of budgeting here point us to another important consideration identified through our qualitative approach. The dynamic nature of energy vulnerability and the ways in which people's own actions affect the extent to which they move into or out of it can be traced in comments made by some interviewees about adapting to changing circumstances.

> *"[with a prepayment meter] you've got to go up the shop to put £10 on when you're starting to tick down, you know, it's the fact of, 'I've used that much already!' and you know, you see it go quicker and especially with the charges on the meters […] "*
>
> ('Jessica', 20s, first interview)

As some interviewees point out, prepayment can give a feeling of being in control, and a feeling that may be valued as a source of some pride. But beyond managing week-to-week, the higher tariffs associated with them can contribute to reducing financial resilience in the face of surprise events: 'all you need is for it to, to have a sudden bitter, freezing snap and then all your maths is out' ('Jenna', 30s, first interview). In such cases, it might be possible to say that people are being 'self-reliant'. But at the same time, all they have to rely on is skill – real skill – in managing what are still meagre financial resources that themselves provide an unreliable support against unpredictable circumstances. Week-to-week budgeting is an achievement of stability, but one which does not escape wider instability.

4. Adapting to changing circumstances

In general, people are reluctant to identify themselves as vulnerable, preferring to talk about being adaptable in often challenging circumstances. But differences are evident in how people present the actions they have taken, over time, to cope with restricted incomes, inefficient homes, or difficult family circumstances. Being able to renovate a property, for example, is presented as a way of adapting which increases respondents' sense of control over their situation. As noted above, such opportunities are often constrained by e.g. social relationships between landlords and tenants, the costs associated with switching energy suppliers, or the extra costs which come with health conditions and being elderly.

In these and similar instances, respondents might refer to themselves as adaptable in the sense of *struggling on*.

The longitudinal approach we took makes it possible to appreciate how some respondents' maintained a sense of being in control of their energy expenditure and their lives more generally by "lowering their sights". It is thus important to pay close attention to how people describe their ways of managing their situation. Talk of either budgeting or of adapting can mean quite different things, referring to practices that in some cases demonstrate an ability to actively adapt to difficult circumstances and maintain a higher standard of living, and in others refer to a situation in which someone just about gets by - but in ways that do not alleviate and may even make it more likely a household will experience energy vulnerability.

> *"[Utility companies] tell you the cheapest way to do it is to keep it on low. You can't do that, they're charging you a fortune on low. You've got to judge it: it's going to be warm this afternoon, so we'll put it on for an hour in the morning, put it on for an hour in the evening, until this fire warms up, and that's how you've got to judge it."*
>
> ('Terry', 60s, first interview)

Active adaptation involves changing how and how much energy is used in the house, but in ways which often engage sceptically with official advice, as in the case of e.g. elderly people being advised to keep heating on lower settings throughout the day to provide adequate heating. The main motivation for scepticism here is a perception that advice is being offered by utility companies, who are motivated primarily by profits. As such, one's own experience and that of family, friends and neighbours is often seen as a more reliable guide to how to better use energy. What is deemed adequate heating varies widely with householders' own circumstances, with vulnerabilities associated with health conditions and caring responsibilities often requiring significant adjustments to participants' sense of what adequacy might mean.

> *"Sometimes we struggle, but we've got a way of managing. We know, for example, we're running low on a bit of money and we needed some bread or whatever, then we come [to the food bank]. […] I suppose when you know you can manage your money and manage the way that you pay your bills and what you're left with… prioritising I suppose you can say"*
>
> ('Jessica', 20s, second interview)

Being adaptable can, as some interviewees point out, also mean dealing from time to time with multiple difficulties that come with combinations of insecure incomes and unexpected events. In such situations, adapting is described as struggling on, even to the point of prioritising either spending on energy services or other forms of expenditure. Here, as in the example of budgeting, people can be found describing how they are capable of maintaining a kind of stability amidst wider instability. But descriptions of this balancing act are often two-sided. On the one hand, they may speak (as Jessica does here) of finding a way of managing, indicating a sense of achievement and being able to rely on one's own abilities in the last instance. On the other, Jessica also speaks of trade-offs, of "prioritising, I suppose you can say". The suggestion is that something of a desired quality of life has to be given up, and one's sights need to be lowered. So while a sense of capability remains in the experience of struggling on, the capabilities needed to achieve a desired quality of life are absent. Awareness of having to trade off quality of life in order to keep struggling on may itself be experienced as detrimental.[xvi]

5. Dealing with technology

The introduction of (first generation) smart meters in the UK has generally been accompanied by promotional materials suggesting that these devices will provide information that will help people save money, although there is concern regarding the extent of such benefits and whether all end-users will be able to realise them.[xvii] Other domestic devices and technologies badged as 'smart' (such as heating controls, televisions, home assistants, door locks and domestic lighting) are typically associated with convenience rather than energy efficiency and saving money. Experience with smart meters is widespread among the sample, with a few using other technologies. Several interviewees expressed

some enthusiasm about the functions smart technology might provide, particularly those with long term health issues, but when it came to the contribution smart meters could make to saving money on energy, there was a significant amount of scepticism.[xviii]

Some described incidents where smart meters seemed to have proven themselves unreliable, in contrast with their own knowledge regarding their energy use. Others saw the kinds of information they provided as being of relatively little use to people on low or unstable incomes. People facing these challenges described already having adapted to difficult circumstances by reducing energy use as much as possible, sometimes to the point of struggling with difficult choices (as in Jessica's quotation above). Once again, experiences of dynamically changing circumstances play a role, this time in shaping people's views on the value of technological solutions to energy issues. Whether new technologies might be relied upon to enhance people's ability to achieve a valued quality of life is an open question, but participants often feel there is much scope for doubt.

> *"[The smart meter] told us that we were using way too much gas but what had actually happened is, it was too far away from the meter so it was making things up. It told us we had gone over our £1.27 - apparently that's what the government reckons we should spend per day on gas."*
>
> ('Jenna', 30s, second interview)

6. The importance of place

People's feelings about the places they inhabit are often complex, but also dynamic, as they reflect histories of positive and negative associations.[xix] They can shed light on how places both constrain and enable people's capabilities to act. Interviewees spoke of Caerau in terms which acknowledged the difficulties living somewhere which had, since the closure of the coal mines in particular, suffered multiple difficulties, some of which (such as certain kinds of long-term illness) were themselves linked to the mining legacy. Cold houses were often seen as a long-standing characteristic of the community, acknowledging the inefficient housing stock. At the same time, lower house prices were an attraction for some residents. Some compared the climate in Caerau unfavourably (if humorously) with nearby towns, with one participant noting that the area is "two overcoats colder than Bridgend" 12 miles away and at a much lower elevation. Others spoke of how they valued landscape and green space. Interviewees generally said they wouldn't want to live anywhere else. Family relationships and social networks, local amenities, histories and landscapes all contribute to people's sense of pride in and attachment to the area.

In addition to this complex historical sense of place in a community where employment from coal mining was once vital, appreciations of community identity also reflect economic history. In particular, the contribution of coal mining was seen as vital. In relation to energy use, several interviewees saw particular significance in the now ended practice of provision of free coal to families with someone employed at a local pit. For a number of interviewees this provided a valued sense of stability, a baseline resource on which households could rely and which reflected a sense of the identity of the community. Households could sell the allowance back to the National Coal Board in exchange for other fuel sources if preferred, or share it with neighbours and others who did not have access to it.

As noted in section IV.2 above, older residents suggested that, compared to the long period in the community's history when coal mining was dominant, the character of Caerau had changed. Whereas in previous times social networks were largely organised around dominant social institutions like mine, church and chapel, the networks that now existed were felt to be more diffuse and harder to see. At the same time, and as the second wave of interviews made clear, such networks still existed through the care for vulnerable (elderly or disabled) residents described by interviewees, and the signs of solidarity evident after events (like the 2018 storms and water shortage) which threatened the well-being of vulnerable people locally.

Interviewees are thus conscious of how the character of Caerau can affect how people use energy in ways that may make energy vulnerability more likely. At the same time, awareness of the community's history provides imagery through which people describe past abundance and having a community one

can still rely on. The shareable free coal provides an interesting comparison with descriptions of instability and struggling on, representing an example of reliable access to energy services rooted in community capabilities. While social networks that provide assistance to vulnerable people continue to be seen as something that can be relied on in the last instance, they are described as less concrete and secure than in previous decades. Help with energy costs now is often still offered, but increasingly people share their own scarce resources. This remains a stark contrast with former times when abundant resources were part of the fundamental character of the community.

What emerges from the research findings (as set out above in section IV – 'what we have learnt') is a picture of energy vulnerability that suggests we should understand it as a condition characterised by transient alternating passages of instability and relative stability. Moving from one to the other is an effect of shifts in disabling conditions that increase households' propensity to suffer fuel poverty, as detailed in section IV above, along with people's own responses to these conditions. Such fluctuations also intensify the sensitivity of a household to any detriment resulting from fuel poverty. In addition, they may decrease the capacity of households to adapt to instability. Our analysis thus yields a somewhat different picture of energy vulnerability to now-dominant definitions from the literature. A further difference lies in how our data highlights the role of how end-users understand their experience and respond to it in affecting whether experiences of energy vulnerability lead to increases or decreases in instability.[xx]

V Developing an enabling framework for addressing energy vulnerability

In this section, we reflect on discussions from the Smart Living Wales workshop in response to the presentation there of CU's research findings and a set of user requirements developed in response to these by the ESC.[xxi] Our findings provide various reasons for being circumspect – though not dismissive

Smart Living Workshops: User Requirements

1. Interventions must avoid mid/high household investment
2. Interventions must account for disability and ageing community
3. Interventions must not be based around high initial outlay to the householder
4. Interventions must maintain attractiveness of community as destination
5. Interventions should enable landlords to act effectively
6. Interventions should require quality control mechanisms to be in place.
7. Interventions should require consumer protection needs to be in place to avoid retaliation from landlordsa
8. Interventions must not rely on self-referral
9. Interventions could harness community-scale awareness of energy saving practices
10. Interventions need to be aware of the existing community conversation about energy
11. Interventions should be considered with transport needs
12. Interventions should consider how potential benefits are communicated
13. Interventions must take account of previous experiences of technology

Table 3: Smart Living workshop: draft user requirements (developed by ESC)

–about the contribution that technological developments can play in addressing fuel poverty while moving towards a decarbonised energy system. Overall, they provide support for the idea of a more holistic *enabling* approach to addressing fuel poverty. This would shift the focus away from helping people pay for energy or simply reducing the amount in kWh they use. What might be appropriate instead would be measures that recognise how end-users value energy services rather than energy in the abstract,[xxii] and how they see difficulties in meeting their energy needs being influenced by disabling conditions.[xxiii] Deciding whether people are subject to the kinds of detrimental reduction in

capabilities associated with energy vulnerability requires an understanding of how they have, over time, come to see themselves as negotiating transient passages of instability and relative stability. It also needs to go one step further, to trace whether people's actual adaptations to their situation have indeed made things better or actually led to further detriment (as in the experience of lowering sights).

V.i Avoid imposing upfront costs: build financial buffers

Central to experiences of instability, as we have seen, are financial shocks, chiefly in the shape of unpredictable additional costs. Interventions designed to reduce fuel poverty should aim to avoid imposing upfront costs on households. Caerau is representative of many communities which have experienced substantial deindustrialisation and the loss of well-paid work over the past 35 years. When budgeting means living week-to-week or month-to-month, any scheme which requires financial outlay from households then risks either being entirely out of reach to them, or creating a spiral of debt. The problem of upfront payment also covers the double billing that can be incurred by switching energy suppliers. Beyond an inability to invest in energy efficient upgrades to the home, workshop participants from the housing sector pointed out that the difficulties householders on restricted incomes may experience in covering unexpected energy related costs can have significant impact on budgeting capacity, particularly where boiler repairs and replacements are concerned. Here, renters may be in a better position, so long as landlords make changes promptly. It was therefore suggested in the workshop that genuinely enabling interventions should prioritise assisting users in building financial resilience for the future. Examples given in the workshop by stakeholders included a mechanism to set aside a proportion of savings made from switching suppliers or efficiency improvements to assist households experiencing financial difficulty. Ring-fencing funds in this way could be done at the level of individual households or for larger communities and customer bases, socialising the risk of financial instability across an aggregated user pool. In addition, the potential role of credit unions in providing additional lending capacity to buffer households against insecurity has been explored in depth.[xxiv]

V.ii Recognise user needs: sensitivity and responsiveness

Changes in people's circumstances that create (often unpredictable) instability can exacerbate the effects of disabling conditions. These are often associated with changes in needs, as in the cases of people with children, the elderly or people with disabilities, as well as those of less traditionally visible groups like ex-forces personnel or care leavers. Stakeholders pointed out how changes in people's circumstances come about at different times and have different durations, a theme which is backed up by other recent research by the CU team.[xxv] Some are highly transient, like temporary disruptions to income, while others – like unemployment – might be longer lasting, and still others (like retirement, or disability) might be permanent shifts in someone's living conditions. Interventions therefore should be sensitive not only to people's needs and how they can create different energy needs (and thus different levels of expenditure) but also to how these needs can change in ways that might be short or long term, predictable or unpredictable.[xxvi]

Stakeholders recognised that, due to their sometimes transient nature, these needs are not always immediately visible to organisations aiming to address fuel poverty, a problem which may be exacerbated if, as noted above in point 4 of section IV, people may be reluctant to identify as vulnerable and self-refer for assistance. A more tailored approach to interventions, designed with the specific needs of households in mind would go some way to addressing these issues.

V.iii Improve housing, enact quality control for interventions

The poor quality of the UK's existing housing stock is already acknowledged in the literatures on fuel poverty and decarbonisation of the UK housing. Indeed, this forms one highly stable background condition contributing to fuel poverty. Damp and poorly insulated buildings not only increase heating costs for those experiencing fuel poverty, they can also contribute to ill health and chronic sickness can render households vulnerable by further increasing energy use and reducing the ability of residents to work. Our research found support for these long-established findings, but also raises questions about the quality and efficacy of some interventions designed to improve the low thermal efficiency of some homes.[xxvii] This issue was also introduced to the stakeholder workshop through stimulus materials provided to participants.

Not only should interventions be tailored to the specific needs of tenants, they should also be tailored to specific buildings to ensure the measures being proposed are suitable and technically workable. Houses are as individual as those who inhabit them. As the UK Energy Research Centre have recently recommended, householders should expect detailed information about the likely impact of modifications to the fabric of their homes, made on the basis of home visits and a detailed assessment of building and inhabitants needs.[xxviii] This information should be clearly communicated to householders in a manner that is appropriate and accessible and which could form the basis for detailed and informed consent to be given prior to interventions taking place. Some mechanism is required to hold developers responsible for lapses in quality and it may be necessary for government to act as a remedy of last resort in instances where problems arise and remedy from the developer cannot be obtained. Work on standardisation in this area is ongoing.[xxix]

V.iv Incentivise landlords, protect tenants

While owner occupiers may be vulnerable due to combinations of unpredictable financial shocks and budgeting constraints, for many interventions tenants have to rely on the engagement and enthusiasm of landlords to authorise modifications to housing. Our research in Caerau again supports findings from the wider literature which indicate that some tenants struggle to persuade landlords to engage with and invest in such schemes. It was pointed out by stakeholders that research also indicates that moving from one property to another is far more frequent within the private rented sector than within social housing. This added instability can make relationships between tenants and landlords even more unstable.

There is evidence to suggest tenants are often reluctant to raise issues such as draft and damp with landlords, for fear of retribution.[xxx] While no substitute for stronger regulation and protections for tenants in the private rented sector, organisations designing interventions to address fuel poverty should pay attention to potential differences in vulnerability stemming from occupancy status and ensure that incentives for uptake are aligned in ways which can motivate landlords, tenants and homeowners. One possibility for improving alignment might be to foster engagement between social landlords engaged in decarbonisation initiatives and private landlords.[xxxi]

V.v Be responsive to local capabilities and expectations

Households in unstable situations and at risk of fuel poverty do not simply await solutions to their problems to be provided from above. They may develop adaptive capabilities to help deal with instability in income and energy use, either within a household or in concert with others in their social network. DIY improvements to the fabric of the home, alterations to energy consuming practices and accepting assistance from neighbours together with wider social networks can represent reliable resources for vulnerable households.[xxxii] Success in improving homes can bring with it a sense of pride and self-efficacy that may be valuable in itself. Interventions therefore need to be sensitive to (and perhaps seek to build on) the forms of agency that people have themselves achieved, both individually and together with others.

By contrast, experiences of 'struggling on' can lead to feelings of distress, anxiety or shame.[xxxiii] These responses to disabling conditions can exacerbate them. People may feel unwilling to access interventions from official agencies – but may accept help from other, known sources. Stakeholders gave the example of council cleaning services which some residents might not accept help from due to a sense of shame. Conversely, cleaning help provided by neighbours might be welcomed. Alternatively, people may adapt to difficult circumstances through a lowering of expectations, and a feeling that under-consumption of energy and choosing between different enabling energy services is an acceptable state of affairs.[xxxiv] The changed sense of self that comes from this 'lowering of one's sights' can itself be harmful to well-being.[xxxv] Interventions therefore should be designed in ways that aim to draw on and bolster forms of capability that people indicate are more reliable.

Finally, while those experiencing energy vulnerability may be reluctant to understand their own lives in such a way, they have little trouble identifying others within their social networks who may be at risk. As pointed out in the user requirements brought to the workshop by ESC for discussion, industry and policy makers should not adopt self-referral as a means of judging entitlement or eligibility for a

particular intervention. However, community knowledge may be a valuable resource in identifying vulnerable households through processes such as neighbour or family level referral.

V.vi Place and history matter

We have found plenty of evidence for questioning the emphasis often expressed in energy saving advice on the responsibility of individuals to take control of their energy use. Energy vulnerability researchers point out how the disabling conditions which give rise to vulnerability are often outside of an individual's or household's control, and also how an emphasis on taking responsibility as a consumer for one's energy expenditure can make the situation worse, as people struggle to cope.

It may therefore be useful to shift the focus of interventions, in some ways, away from individuals and individual households. Finding ways through interventions to draw on community capabilities can, stakeholders suggested, look for additional resources in the history and heritage of communities, as in the example of the linked Forgotten Landscapes project and the Dragon's Teeth hydropower proposal in Blaenavon.[xxxvi] Our research demonstrated the powerful presence of mining in the imaginations of interviewees as a way of understanding community identity, both in the past (and through drawing contrasts with the past) in the present. The provision of free coal remained for several interviewees with strong links to the area a resonant symbol of stability, abundance and reliability, rooted in community capability (embodied in mining heritage). The complexities of the character of place can contribute significantly to wider conditions of wellbeing.[xxxvii]

In addition, the character of a place can shape how people actively interpret the pros and cons of proposed interventions. As pointed out in ESC's user requirements, as discussed in the workshop, designing interventions needs to be responsive to the history and character of places in order to enhance project benefits by working 'with the grain' of communities.

Developing an enabling framework
1. Avoid imposing upfront costs: build financial buffers
E.g. find ways of pooling financial risk by using proportion of savings from supplier switching or engaging with credit unions
2. Be sensitive and responsive to user needs
End-users can have very different needs, and these may change in ways that might be temporary or more enduring, and affect energy vulnerability. Interventions need to be more carefully tailored.
3. Improve housing, enact quality control for interventions
Better standardisation for interventions is needed, together with closer focus on the 'needs' of individual buildings.
4. Incentivise landlords, protect tenants
Better regulation is needed together with incentives for taking up interventions that are attractive to landlords and tenants as well as homeowners
5. Be responsive to local capabilities and expectations
Understand what people are already doing to address energy issues and how knowledge is shared in communities. Ensure technologies are built into interventions in ways that work with (not against) people's own practices. Don't rely on self-referral to recruit for participation.
6. Make place and history matter

Consider how interventions can build on community history and capabilities, rather than focusing solely on individual households.

Table 4: Developing an enabling framework

VI. Conclusions: Insights for a better energy future

Our research set out to explore how interventions to address fuel poverty need to take into account the role of disabling conditions that create energy vulnerability. It indicates that such interventions need to avoid focusing simply on fixed variables like cost. Alternative suggestions based on our analysis point towards the importance of *enabling* people to act individually and together to shape meaningfully the ways in which energy is used in their communities. To do this successfully, it is important to understand what people feel they can *rely on* in the face of the experiences of instability and unpredictability that our data indicate are central to the dynamic and sometimes elusive condition of energy vulnerability. It also means understanding how relying on certain skills and capabilities can (as in the phenomenon of *lowering one's sights*) help people cope emotionally with uncertainty while also sometimes increasing rather than decreasing energy vulnerability.

In trying to understand how people's lived experience points to disabling conditions that make households more sensitive to difficulties around purchasing energy, we have examined:

- the different ways in which people's efforts to control energy use are affected by financial and social instability,
- the ways in which housing and attempts to improve it can exacerbate these problems,
- the need to ensure that landlords are both properly regulated and incentivised to improve housing conditions,
- and the ways in which the complexities of needs and people's real capabilities to adapt (dependent on social networks and the character of place as well as the characteristics of households) can affect the extent to which they might experience energy vulnerability.

Overall, our approach has shown that qualitative longitudinal methods can help researchers understand how fuel poverty is not a static condition in which people either are or are not caught. Energy vulnerability is dependent on disabling conditions that are sometimes temporary and sometimes more permanent in nature. It is therefore also a dynamic condition. Our approach has also demonstrated that energy vulnerability is not a passive state in which people are trapped. Instead, it is important to realise that the disabling conditions which create energy vulnerability are sensitive to how people experiencing it understand and respond to it. In particular, people's capacity to create at least a *feeling* of stability amidst instability is significant, as is suggested in our interviews by participants talk of 'managing week to week' and 'struggling on' instead of suggesting they may be caught in a condition of vulnerability. Rather than avoiding admissions of vulnerability for fear of stigmatisation, people may point to ways in which they exercise self-reliance precisely because of a need to maintain a sense of resilience, flexibility and stability amidst instability and unpredictability.

If innovations (social as well as technological) are employed as part of interventions to address fuel poverty, those designing interventions should acknowledge in their designs this active role of energy users in trying to manage or escape energy vulnerability. They should also be sensitive to the need to enhance resources on which people can rely in their efforts to deal with their situation. At the same time, interventions should not employ innovation in ways that simply aim to assist people to take responsibility for their energy expenditure. As emerging literature on 'energy precarity' suggests, such measures can simply add to the burdens faced by energy-vulnerable end-users.[xxxviii] Precarity refers to a condition in which people are effectively coerced into being responsible for managing insecurity over which they have little real control. Our analysis complements this literature by suggesting that the resources on which people feel they can best rely tend to be associated with close and also more distant social relationships. These resources can have legal, financial or technological aspects, but may also include the social relationships people rely on, as well as their emotional attachments to aspects of the places in which they live. Addressing energy vulnerability would then mean creating interventions

which enhance people's capabilities to access the energy services necessary to achieve a socially valued quality of life.

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[viii] All names used in this report are pseudonyms with the exception of those of the interviewers.
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[xi] A report on these themes in the research is available online at http://energybiographies.org/wp-content/uploads/2012/09/Minewater-heating-report-web-version.pdf
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[xxvi] See our detailed report at [link], pp. XX
[xxvii] See our detailed report at [link], p. XX.
[xxviii] Greer et al., "Justice in Energy Efficiency: A Focus on Fuel Poor Disabled People and Families."
[xxix] See PAS 2035:2018 Specification for the energy retrofit of domestic buildings, https://standardsdevelopment.bsigroup.com/projects/2017-04146
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[xxxii] See our detailed report at [link] pp. XX
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[xxxiv] See our detailed report at [link], pp. 11-12.
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