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Conceptualising energy use and energy poverty using a capabilities framework

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HIGHLIGHTS

- We apply the capabilities approach of Amartya Sen and Martha Nussbaum to conceptualising why energy is used and needed.
- We propose a definition of energy poverty based on the capabilities approach.
- We argue that this understanding integrates approaches to energy poverty from global North and South contexts.
- The proposed definition of energy poverty is multi-dimensional.
- This understanding opens new conceptual space for interventions to alleviate energy poverty.

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ABSTRACT

In this article we conceptualise energy use from a capabilities perspective, informed by the work of Amartya Sen, Martha Nussbaum and others following them. Building on this, we suggest a corresponding definition of energy poverty, as understood in the capabilities space. We argue that such an understanding provides a theoretically coherent means of comprehending the relationship between energy and wellbeing, and thus conceptualising energy deprivation, that makes sense across settings including both the global North and South: a coherence which has previously been lacking. At the same time, it has the flexibility to be deployed in a way that is sensitive to local contexts. Understanding energy use in the capabilities space also provides a means for identifying multiple sites of intervention, including some areas that are currently largely overlooked. We argue that this is advantageous for attempts to address energy poverty in the context of climate change and imperatives for the containment of aggregate energy consumption.

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1. Introduction

The specification of what constitutes the basis of a good, sufficient and just life remains enduringly – and maybe necessarily – elusive and contested. Undoubtedly though, most attempts to specify what such a life should involve, explicitly or implicitly include some form of access to energy resources as a necessary underpinning. For some commentators, the whole history of human 'progress' and development has been inextricably bound up with the availability and consumption of energy in more intensive forms and ever greater amounts (White, 1943, Mumford, 1967; Sørensen, 2012). Whilst we are now living in a time where the many downsides of intensive energy resource exploitation are clearly apparent, the positive association between energy consumption and well-being is enduring. Accordingly, across global contexts, the accessibility and affordability of energy for citizens and households is a great concern. Policies, programmes and campaigns position energy consumption as an essential need or right that should be provided for, and the lack of this as a form of deprivation that should be addressed.

Our objective in this paper is not to challenge the positioning of energy consumption as a necessary element of what constitutes a good and sufficient life. We do though want to suggest that a more careful and systematic understanding can be developed of the relationship between energy consumption, energy services and what energy services enable or produce. This is needed, we argue, in order to better recognise how energy and well-being are interconnected, and therefore deepen how notions of energy poverty, energy vulnerability or energy precariousness are understood.

Currently there is a significant disjuncture between approaches

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to conceptualising and monitoring the relationship between energy and wellbeing in different parts of the world, particularly between more developed and less developed regions. Despite sometimes similar terminology such as 'energy poverty' being deployed, these areas of work have tended to progress separately and with little cross referencing (Bouzarovski and Petrova, 2015), which might signify missed opportunities for developing more fundamental understanding. More than that, concerns over energy poverty in more developed regions can be seen as serving to sustain if not increase levels of energy consumption, thereby conflicting with the global need for a reduction in energy use and associated carbon emissions; whilst global objectives for restricting energy consumption can, in parallel, be seen as in conflict with the needs of much of the Global South to extend energy infrastructures and access to energy services (Sen, 2014). A coherent framework allowing comparable analysis across contexts might be valuable in achieving a better understanding of distributions and inequalities across different scales from regional and national to global and thus allow situations and claims in one context to be placed within the context of another. The aim of this paper is to propose such a framework, which we do by using the capabilities perspective pioneered by Amartya Sen and Martha Nussbaum (Sen, 1992, 1993, 1999; Nussbaum, 2000, 2003, 2011). This builds on our previous work (Day and Walker, 2011; Day, 2012; Walker and Day, 2012) where we argued that the capabilities perspective provided an advantageous framework for understanding what energy is for, and thereby to conceive of energy vulnerability. Here we set out a detailed explanation of how this applies and why the capabilities framework provides a comprehensive approach, with potential for both integrating other perspectives and understanding them in relation to each other. Based on this we propose a capabilities-based definition of energy poverty which may be used as the basis for assessing the situations of households across a wide variety of regional contexts.

The discussion that follows moves through a number of stages. We first review different ways in which the relationship between energy consumption and well-being have been framed and articulated within academic analysis, advocacy work and policy measures, moving from global North to global South contexts. We next introduce the capabilities approach of Sen and Nussbaum, which we suggest can provide the core of a framework for conceptualising what energy is needed for. We then think through energy poverty from this perspective and consider the opportunities for interventions that it suggests. We conclude by reviewing the advantages and implications of the capabilities-informed framework that we have proposed. In order to bound the scope of the paper to some degree, and because domestic settings are the main focus of energy poverty and energy and development work worldwide, we develop our argument in relation to forms of energy use taking place in homes, therefore excluding for example transport related energy use and energy use in non-domestic work contexts. Nevertheless, the framework we suggest has the potential to be developed beyond this scope.

2. Energy and well-being in the UK and other more developed regions

The general relationship between energy use and well-being has long been articulated, permeating for example the period of electricity grid expansion in more economically advanced countries during the first half of the 20th Century (Hughes, 1993; Nye, 1999; Harrison, 2013). However, beginning in the UK in the 1980s, concerns about the detrimental impacts of the under-consumption of energy gathered momentum, expressed through the language of 'fuel poverty', and garnering policy, civil society campaigning and research attention. In the UK, this agenda has always been dominated by concerns about the affordability of *heating* specifically, linked with anxieties about the public health effects of cold homes. Annual 'excess winter deaths' statistics for the UK show every year a peak in the number of deaths during winter months that run to the tens of thousands (Office for National Statistics, 2014). This peak is far larger than many countries with colder climates, a fact which is generally attributed to the poor energy efficiency of the UK housing stock, making houses expensive to heat. Following the influential work of Boardman (1991) and after much activist campaigning, a definition of fuel poverty was established in UK policy in 2001 as a household needing to spend more than 10% of their income to achieve a satisfactory heating regime, (as well as other energy services – although this addendum is often overlooked in much of the discourse around fuel poverty: Simcock and Walker, 2015). This was revised in 2013 in England to a new 'low incomes high costs' definition, whereby to be classified as fuel poor, a household must have a relatively energy inefficient home, and stand to be left in relative income poverty as a result of paying fuel bills assuming they heat their home to the recommended regime (Hills, 2011). Policy to combat fuel poverty in the UK has accordingly focused to some extent on relieving affordability, through a limited number of direct payments to older person and some low income households specifically to help with winter heating,[1] and to a greater extent on improving the energy efficiency of people's homes.[2] The detrimental outcomes of living in fuel poverty are implicit rather than explicit in official formulations, but the logic of the discourse points to both poor health and reduced income to meet other needs.

The UK's framing of 'fuel poverty' has been influential and is reflected in research and policy on energy and wellbeing in other developed economies. Researchers in New Zealand have also focused on housing energy efficiency and the affordability of heating, linking this with a similar problem to the UK of excess winter deaths and hospitalisations (Howden-Chapman et al., 2012; Viggers et al., 2013; O'Sullivan et al., 2012). In Europe, fuel poverty has been researched using the EU survey data on households' ability to heat the home, occurrence of damp and mould, and energy bill arrears (e.g. Healy and Clinch, 2002; Thomson and Snell, 2013). Other research in post-soviet Europe has also concentrated on the affordability of heating services, linking problems with poor quality housing (Buzar, 2007; Tirado Herrero and Ürge-Vorsatz, 2012; Petrova et al., 2013); as has post-crisis research in Greece (Santamouris et al., 2013). In terms of official framings, Ireland, with similar climatic and housing issues to the UK, has defined fuel poverty as 'the inability to afford adequate warmth in a home, or the inability to achieve adequate warmth because of the energy inefficiency of the home' (Office for Social Inclusion, 2007 p67) and again, concerns centre on the health effects of cold and damp housing (Healy and Clinch, 2004; McAvoy, 2007). France's policy definition defines 'energy precariousness' as a person encountering 'particular difficulties in their accommodation in accessing the necessary energy supply to satisfy basic needs, due to inadequacy of financial resources or of housing conditions' (De Quero and Lapostolet, 2009 p16, translated). Although less directly focused on heating, this reproduces a similar understanding, and research in France has also focused on dwelling and heating efficiency and affordability (Dubois, 2012).

A minority of European research concerned with energy affordability has looked beyond heating as the energy service of

[1] E.g. the Winter Fuel Payment, Warm Home Discount and the Cold Weather Payment https://www.gov.uk/browse/benefits/heating.

[2] Currently via the Green Deal and the Energy Company Obligation programmes https://www.gov.uk/energy-grants-calculator.

concern: Brunner et al. (2012) in Vienna, Austria examined low income households' rationing of both heating and lighting, as well as their coping with energy bills in a more general sense; Santamouris et al. (2007) acknowledged air conditioning for summer cooling as a significant energy demand in Greece although they remained more focused on heating. Cooling alongside heating was also addressed by Harrison and Popke (2011) in a rare use of the term 'energy poverty' in US research, examining poorer households' struggle to maintain thermal comfort in the climate of North Carolina as an outcome of an assemblage of housing and infrastructural materialities alongside socio-economic conditions. In US policy and practice, weatherisation programmes provide the closest analogy to fuel poverty policy, the language and purpose focused on weather and property interactions, but in terms of both warmth and keeping cool (Office of Energy Efficiency and Renewable Energy, undated). The notion of fuel poverty or energy vulnerability being configured by an assemblage of material, socio-economic and political conditions was also developed in our previous work (Day and Walker, 2013) and recently in Bouzarovski and Petrova's (2015) wider European research. Such expanded notions of fuel or energy poverty in Europe/US/Australasian contexts however are rare, and currently underdeveloped.

Within the global North discourse, there is some recognition that energy needs vary from household to household, or that being in fuel poverty has larger potential impacts on some people than others. English policy for example categorises some households as 'vulnerable' with respect to fuel poverty: such households are those with at least one member who is elderly, disabled or very young. In Scotland, a 2 °C higher living room temperature is prescribed for 'elderly and infirm' households (Scottish Executive, 2002); across the UK a 'winter fuel payment' is paid to older households (Gov.uk, 2015). Research and campaigning has also sought for greater recognition of the specific needs and vulnerabilities of particular groups including the disabled (Snell et al., 2014) and the terminally ill (Macmillan Cancer Support, 2009); again largely with respect to heating but also hot water for washing.

The dominant discourse around energy and well-being in the global North is therefore repeatedly focused on thermal comfort, mainly warmth through heating as an essential service, with other energy uses being acknowledged, but little discussed. It is an *affordability* and *service* based understanding of energy poverty, with a narrow view of the essential services. Regarding impacts of fuel/energy poverty, concerns about excess mortality and poor health dominate, with other impacts rather under-explored. That individuals' needs might differ is weakly acknowledged in some policy, but again largely with respect to heating. Despite the language of fuel *poverty*, there is little conceptual linkage with wider understandings of poverty and how that is manifest. However, there is a rather different set of understandings in work relating to energy needs and wellbeing in the global South, to which we now turn.

3. Approaches to energy needs and energy poverty in the global South

The energy situation in much of the global South is of course very different from that in the North. Billions of people especially in rural areas lack access to clean and reliable energy, instead depending on solid fuels such as biomass and coal, frequently obtainable in relatively small amounts, for basic needs such as cooking. This situation, typically termed 'energy poverty', is closely connected in research, policy and advocacy literatures with a range of adverse outcomes. Burning biomass or low grade fuels creates high levels of indoor air pollution, which affects the health women and children especially (Bruce et al., 2000; WHO, 2004; UNDP, 2005a); gathering fuel is time consuming and again often done by women and (female) children, restricting time for income generating work and education; and a lack of energy restricts labour productivity. As such, access to affordable clean energy has been identified as crucial to realisation of many of the Millennium Development Goals (WHO, 2004, 2010; Modi et al., 2005; UNDP, 2005b). The services that clean, reliable energy allows including lighting, mechanical power, communications and transport, facilitate productivity and in addition, cleaner fuels improve health, and removing the necessity to collect firewood and waste allows women to do alternative things and children to go to school (Modi et al., 2005). Underpinning the idea of energy poverty in the Global South then, is a much more comprehensive understanding of the ways in which energy and energy services are connected to socio-economic development, wellbeing and quality of life.

There have been various moves to measure energy poverty, which take varying approaches. Many focus on the actuality of *access* to 'modern' or 'conventional' energy sources. 'Modern' fuels may include charcoal, kerosene, LPG, and biofuels, as well as electricity, which are more efficient, reliable and cleaner than traditional biomass fuels of wood and animal waste (UNDP, 2005a), although grid electricity and natural gas are often seen as the optimum. The idea of the 'energy ladder' is sometimes used to denote a spectrum of fuel cleanliness, moving 'up' the ladder being linked with increasing level of household prosperity (Hosier and Dowd 1987; UNDP, 2005b). The access approach assumes that with modern fuels comes a better level of services with fewer adverse impacts (Mirza and Szirmai, 2010) and so access is taken as an indicator of better outcomes in a more general sense. Nevertheless the focus on access alone is recognised as simplistic.

An alternative approach has been to focus on the *total amount of energy* that households are able to routinely consume and researchers have attempted to define minimum acceptable levels against which actual consumption can be measured, based on a set of goods and services. The threshold level varies: the UN AGECC (2010:p9) proposes 1200 kW h per person per year as a starting target for development programmes; Modi et al. (2005:9) define minimum need in 'the poorest countries' as 50 kgoe per person per year for just cooking and lighting which equates to only 58.15 kW h. Mirza and Szirmai (2010) cite a recommendation that a threshold should be set at the level which supports reaching a level of 0.8 on the Human Development Index and calculate that for their study area of rural Pakistan, this would be 8140.6 kW h per capita per year. This latter approach is based around an idea of broad-based human development (represented by the HDI) and is related to the capabilities framework which we discuss below. However the above approaches take a highly standardised approach to needs, assigning the same level per capita.

More recently, a few researchers and organisations have started to approach the diagnosis of energy sufficiency/energy poverty from the basis of the energy *services* accessed or achieved, which would be in line with the recognition discussed above that a range of energy services are crucial for eliminating poverty and realising the millennium development goals (Modi et al. 2005; UNDP, 2005b). This approach to energy poverty does not make any assumptions about the amount of energy or fuel needed to produce the energy services, but rather looks at what is actually usefully delivered to households. Which services are considered essential differs a little between researchers and organisations, as does the method of measurement and calculation of energy poverty rates. Nussbaumer et al. (2012) compose an indicator of Multi-dimensional Energy Poverty (MEP) based on the indicators of a household using modern cooking fuel, having access to electricity for lighting, having a fridge, having a TV/radio (for entertainment and education), and having a phone (for communication). They

acknowledge the importance of space heating and cooling, other appliances such as water heaters and washing machines, and mechanical power, but these are not included in their indicator as they argue that data availability constraints in many countries would make this unworkable, and their aim is to develop an indicator that can be used to compare countries. The NGO Practical Action similarly developed an indicator of Total Energy Access, which measures households against prescribed minimum service standards for lighting, cooking and water heating, space heating, space and food cooling and ICTs (Practical Action, 2012). They also stipulate that the household should not spend more than 30 min per day per household collecting fuel (see also Mirza and Szirmai (2010) for conceptualising inconvenience and time costs as part of energy poverty).

These energy service orientated measures are probably the most comprehensive approaches for defining and measuring energy poverty to date, across contexts. In being multi-dimensional, they recognise that energy is needed for achieving a range of outcomes related in different ways to well-being. They also potentially provide a means of assessing at a household level where the service gaps are and what the priorities for action should be, recognising that these will vary among households, communities and regions. They connect with a multi-dimensional model of poverty and development, and in this sense are more nuanced than the 'access' and 'total energy' approaches.

These are advantages not just in terms of understanding energy poverty in less developed regions, but also, we argue, in comparison to the current approaches in the global North that we reviewed in the previous section. As such, work in the UK, Europe and more developed world settings concerned with energy needs and energy poverty may benefit from thinking along similar lines to these multi-dimensional concepts. This is an argument also being recently made by others: Bouzarovski and Petrova (2015) have argued for an energy needs and services based approach to understanding energy vulnerability that overcomes apparent boundaries between fuel poverty and energy poverty. However, transposing ideas of energy need across different contexts is clearly problematic. If an approach to understanding energy needs and energy poverty is to have very wide applicability, it cannot be linked to a fixed notion of necessary energy sources, amounts or even services, but rather must relate to a more general set of outcomes. Capability theory we contend offers a useful framework to do this.

References to capability theory and/or the ideas of capabilities and functionings have been made to a limited degree in previous work on energy poverty and energy vulnerability (Day and Walker, 2011; Walker and Day, 2012; Nussbaumer et al., 2012; Bouzarovski and Petrova, 2015) but without significant or systematic development; It is also indirectly an influence where the Human Development Index is referred to (e.g. Mirza and Szirmai, 2010). The strongest use of capability theory in connection with energy needs is made by Sovacool et al. (2014), where it is deployed, along with other conceptual resources, to build an argument as to why access to energy should be understood as a matter of justice. However their argument remains rather abstract, and in the territory of global justice. Our intention here is to put forward a more specific set of proposals as to how and why energy poverty can be defined in capabilities terms. We first explain the key elements of capability theory, before we move on to applying this to conceptualise and define energy poverty at the individual and household level.

4. Capability theory

Capability theory (sometimes also referred to as a perspective, approach or framework) was first developed by Amartya Sen and Martha Nussbaum, to some extent working together but latterly more independently (Sen, 1992, 1999; Sen and Nussbaum, 1993; Nussbaum, 2000, 2011). It is an approach to conceptualising the purpose and aims of economic development. Both Sen and Nussbaum were dissatisfied with development approaches that focused purely on material wealth, and which generally measured success in terms of increase in household incomes or in aggregate GDP. They argued that the aggregate measure is unsatisfactory as it does not take account of wealth distribution or the position of the poorest, whilst both GDP and household income as measures of progress disregard many factors that are crucial in quality of life. Instead, Sen and Nussbaum argue that the focus of social and economic development should be on wider human flourishing, and on what people can achieve and do.

The capability approach they propose as an alternative uses two linked concepts: functionings and capabilities, which relate to individuals. Functionings are defined as 'beings and doings' (Sen, 1992 p40) – they can include states such as being in good health, and activities such as undertaking paid work. Capabilities are the actual or real opportunities to realise given functionings, whether one chooses to at any particular time or not. Because both theorists (Sen especially) put a high value on freedom to choose, they believe that capabilities should be the object of concern rather than functionings, because a focus on functionings – what a person actually does in their day to day life – would dictate a particular way of living. Promoting capabilities maximises opportunities, but leaves the individual free to decide what kind of life they value. Their proposition then is that development programmes should be aiming to increase the capabilities of individuals, and should be evaluated in these terms.

Poverty or underdevelopment is therefore conceptualised as capability deprivation (Sen, 1993; Alkire, 2007) – the lack of capability to achieve crucial and valued functionings such as being in good health, engaging in education or in paid work, maintaining meaningful relationships. Because a range of capabilities is acknowledged, the capability approach can be seen as a multi-dimensional approach to poverty. Other multidimensional approaches such as the basic needs school also grew out of critiques of the GDP based development models (e.g. Stewart, 1985; Doyal and Gough, 1991), but the capability approach is distinct in its attempt to encompass wider human flourishing.

Inequalities, it follows, should also be evaluated in the capability space, by focusing on the capabilities that individuals have rather than on their income or other 'primary goods' as a Rawlsian perspective would (Rawls, 2009). Sen puts forward an important argument as to why this is the case: he reasons that individuals cannot convert income to outcomes at the same rate, for reasons which include i) personal differences to do with e.g. age, gender, disability, illness; ii) environmental diversities such as climatic conditions, pollution; iii) variations in social conditions, e.g. crime, social networks; iv) differences in community requirements e.g. social norms and ways of behaving; and v) distribution within the family (Sen, 1999, see also Nussbaum, 2000). Incomes therefore cannot be taken as a reliable proxy for outcomes, and to Sen, it is these outcomes that should be the object of concern, therefore they should be the direct focus. Sen also argues that capabilities are a better focus than utility outcome measures such as happiness or satisfaction. Although usefully bringing in a subjective perspective, utility is too influenced by expectations: people very badly off to start with may be made a lot happier by very little material gain, whilst the better off would expect more for the same rise in happiness (the problem of adaptive preferences: see Nussbaum, 2000, 2011).

In trying to implement a capability orientated approach in any domain, the key question quickly arises of what capabilities we should be concerned about. Not all capabilities are equally as

important for quality of life and well-being (Sen, 1993; Nussbaum, 2000). A lot of debate has centred on the issue of what the valued capabilities should be, and whether and how these can be defined, and here Sen and Nussbaum diverge in their approaches. Nussbaum (2000, 2003), with a background in philosophy, has drawn on various philosophical work including Aristotle and Marx to propose a list of central capabilities,[3] essential for human dignity, which she argues all governments should seek to ensure for their citizens. In doing so, she has been criticised as unreflexively modernist as well as ethnocentric in values (Kapur, 2001; Menon, 2002); however she maintains that the list was meant to be open to debate and customisation. Her items are indeed highly abstract and general and would need contextual specification (Olson and Sayer, 2009).

Sen on the other hand has always refused to define an essential capability set, and argues instead that societies should decide through deliberative processes what entitlements are appropriate to that context. This has the benefit of ensuring that necessary value judgements are made explicitly and openly (see Sen, 1999; Alkire, 2002, 2007); it is also more flexible in allowing contextual variation in what is considered to be needed. For Sen, the deliberation is a crucial aspect, as it is through this that 'the emergence of shared values and commitments' (1999 p253) is possible. However, this approach has been criticised as too unwieldy to be realistically usable as an alternative to using measures such as income or primary goods (Rawls, 1999). Concerns have also been raised as to whether such deliberation could be really inclusive, and not merely uphold the interests of the already powerful (Dean, 2009). This is a concern which applies to deliberative and participatory processes more widely (e.g. Young, 1990; Cooke and Kothari, 2001) and it has also been pointed out that such deliberation does not preclude misguided or immoral functionings being agreed upon (Stewart, 2005). The debates about how to select and specify capabilities continue, therefore, but beyond Sen, who remains vague on methodological specifics, useful work has been developed to guide the implementation of a capability approach with strong deliberative aspects (Frediani, 2006; Biggieri et al., 2006; Alkire, 2007), whilst others have combined a more Nussbaum-style theoretically informed *a priori* list specification with some aspect of discussion or deliberation (Robeyns, 2003; Burchardt and Vizard, 2011). Another key methodological debate concerns how, and to what extent, capabilities can be measured (given that they are possibilities that may not be actualised), rather than functionings, which are what people can be seen to be doing. Again the various methods proposed take different approaches, with more quantitative ones tending to find functionings more practical to measure, or attempting a combination of functionings and capabilities (Comin, 2008; Anand et al., 2009; Burchardt and Vizard, 2011).

Arguably the biggest impact of the capabilities approach has been in the development of the UN's Human Development Index (UNDP, not dated), which uses the three dimensions of income, education and life expectancy to compile a comparative index of the degree of development of societies around the world. It is though only a partial mobilisation of the theory, designed pragmatically to capture the most basic dimensions while working with data available in most countries. Another notable (partial) application of the approach is by the UK's Equality and Human Rights Commission, who monitor and measure equality through a capability-based framework (Equality and Human Rights Commission, 2015). Academics and practitioners have variously discussed or advocated capability based approaches in numerous social and welfare policy fields, including higher education, public mental health, hazard impact analysis, and disability support (e.g. Burchardt, 2004; Walker, 2005; Hopper, 2007; Gardoni and Murphy, 2009). We now move on to discussing how the capability approach can be applied to domestic energy consumption.

5. Thinking about energy usage in the capability space

It is a well rehearsed argument now that energy demand is not for energy per se, but for the services energy use can provide such as lighting, cooking, heating and cooling (Sovacool et al., 2014; Wilhite et al., 2000). Indeed, some of the approaches to energy poverty discussed earlier, such as Nussbaumer et al.'s MEP index and Practical Action's TEA measure, are explicitly orientated to this. Our proposition is that this line of reasoning should be taken a step further, and that consumption of energy services should be understood as linked to the quest for certain capabilities. To use Nussbaum's terms (Nussbaum, 2000), energy is a material prerequisite to achieving valued capabilities (see also Sovacool et al., 2014).

In expanding this point we find it useful to think of capabilities in different levels or classes. Smith and Seward (2009) make a useful distinction between what they call 'basic' and 'secondary' capabilities. Basic capabilities are those that Nussbaum (and Sen in the examples he provides) define in broad and generic forms and that they see as most fundamental or substantial, for example 'bodily health' and 'bodily integrity' to take two from Nussbaum's list of ten central capabilities. Secondary capabilities are more 'concrete' and 'specific' (Smith and Seward, 2009) and are seen as component parts of materialising one or more basic capabilities. In this sense, secondary capabilities can be positioned as precursors to basic ones. These secondary capabilities are important, Smith and Seward argue, because 'the secondary level gets to the heart of where most research and learning about capability resides' (p229) and it is at a secondary level where theorisation is necessary to identify the mechanisms through which capabilities are 'actualised'.

Thinking about this distinction with our interest in energy consumption and energy services, whilst a basic capability might be being in good health, various secondary capabilities would be needed to underpin this, including being able to keep adequately warm or cool, and being able to acquire and cook nutritious meals, which would require energy services of heating, cooling and cooking.[4] Taking another basic capability such as having social respect, this might require, among other things, being able to wash oneself and ones clothes, which are likely to require the energy service of hot water, as well as potentially the power for a shower and/or washing machine if these technologies are implicated in context.

So, to summarise, we see an individual or household's ultimate concern as basic capabilities (or functionings when they are being enacted), which require secondary capabilities, which sometimes require energy services. Energy services of course require an

[3] These are explained under the broad headings of: life; bodily health; bodily integrity; senses, imagination and thought; emotions; practical reason; affiliation; relating to other species; play; and control over one's political and material environment (Nussbaum, 2000 p78–80).

[4] This addition of the secondary functioning/capability category also helps to make a clearer separation between energy services and functionings, which we think has previously been sometimes rather blurred. Practical Action's TEA which takes a services approach has heating and cooling on their list of essential services that a household should have, but they acknowledge that these are not necessary in all contexts. In practice, they assess the household's ability to control their thermal comfort, which is better understood as a capability rather than a service, and which clearly is the important issue rather than the service per se. They have a similar situation with food cooling, where it is actually the ability to lengthen the lifespan of food (a capability) that is the concern, rather than having a designated amount of refrigeration (a service).

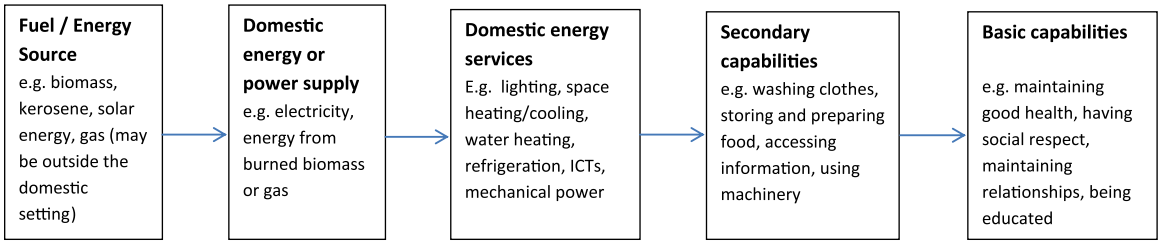

Fig. 1. Conceptualising the relationship between energy, services and outcomes.

energy supply and ultimately a fuel. These elements are depicted in Fig. 1.

The separating out of these elements is key, because it allows us to make the important observation that the relationships between them at each stage are dynamic and context specific, rather than fixed. We already know that the amount of energy needed to achieve a given level of energy service is not constant, but will depend on the energy efficiency of systems, technologies and/or buildings (depending on the energy service concerned). This is well understood, and energy efficiency is given a lot of attention in interventions to improve household energy security. However, the other dynamic relationships further to the right of our diagram are less well discussed.

In considering the relationship between services and secondary capabilities we can return to the insights of Sen that we discussed earlier, and echo the arguments he made regarding why the relationship between income and capabilities is not a constant (i.e. that some people need more income than others to reach the same level of capability). Transposing this to think about energy services in place of income, we can consider that the amount of energy service needed for an individual or household to be able to secure a good level of secondary capabilities will depend on household size, specific individuals' needs and circumstances – e.g. are they older, disabled, very young, or ill – and on the local environment, e.g. climate which is particularly significant for key energy services. We would add to this that what a specific household needs will also depend on the availability of energy services in alternative locations such as at community centres (more appropriate for some services than others of course).

The relationship between secondary and basic capabilities is also variable across time and place. For example, in the UK it is now commonplace to take a warm shower at least once a day, but this practice has only become really established in the last 3 decades. Where a weekly bath would have once seemed normal, the frequency of bodily washing needed in order to be free of stigma and shame is now much greater, with implications for hot water demand (see Shove, 2003). This will be the case with many other secondary capabilities, depending on custom, tradition, and shared conventions.

We can work through the diagram using the example of heating, because as we discussed above, that is most commonly focused on in European fuel poverty concepts. Our ultimate goal is to have households in good health, and not dying prematurely in winter. We would read this as a basic capability, positioned on the right of our figure. At the other end (left on the figure) we have an energy supply to any given household, the availability of which may be variable in itself. The energy supply is needed to provide the energy service of heating, but the amount of energy needed will depend on the heating system efficiency and the ability of the dwelling structure to retain heat. The service of heating is needed to keep the household in thermal comfort – a secondary capability. However the amount of heating needed will depend on the climate, weather, physical state and wellness of the household members. It will also depend on the amount of time they spend at home compared to alternative venues outside the home where they may also find warmth. Thermal comfort underpins the basic capability of staying alive and in good health; the ambient temperature needed for good health though may arguably be affected by social context – certainly prescriptions on this vary across time and space (WHO, 1990; Brager and de Dear, 2001; Shove, 2003; Public Health England, 2014). Thermal comfort at home may also be necessary for other basic capabilities, for example undertaking paid employment, if working at home is involved in generating household income.

6. Capabilities and defining energy poverty

Following on from this position on how we should think about energy use and energy needs, we suggest that energy poverty can be positioned as:

> *an inability to realise essential capabilities as a direct or indirect result of insufficient access to affordable, reliable and safe energy services, and taking into account available reasonable alternative means of realising these capabilities.*

Compared to most current definitions of energy poverty from Europe, this conceptualisation has at its centre a much clearer acknowledgement that energy is needed to support a range of capabilities, including but not limited to health. It is more multidimensional, and closer to some of the approaches used in global South contexts, which recognise energy as necessary for work, education, participation in social life, and communication as well. It acknowledges that safety (being not dangerous or harmful to health) and reliability are important criteria for energy services to be considered adequate,[5] as well as their being within the budgetary means of the household. We understand access broadly, so for an energy service to be considered sufficiently accessible, it and the energy source that underpin it must be available without undue time investment, and their use must be feasible given available knowledge, skills, beliefs and material arrangements.[6]

The definition recognises the central role of energy services but deliberately does not mention any specific services. Energy services are an inevitable link between energy supply and capabilities: however, leaving services unspecified in nature and amount allows the link between services and capabilities to be dynamic, as explained above, and gives the required flexibility to allow the definition to work in different cultural and climatic contexts.

Crucially, our definition also allows for alternative routes to realising capabilities to be considered, that might not require an

[5] It is often better to consider the safety of the service rather than the cleanliness of the fuel, because the combination of fuel, appliance and usage determines the cleanliness or safety, rather than the fuel alone, as with different forms of biomass-burning hearths and stoves for example.

[6] So for example a fuel or service should not be considered accessible to a household or individual if it is available but they do not have the skill or equipment to use it, or its use is against cultural or religious beliefs.

energy service at a household level – the last phrase of the definition emphasises this. So for example, rather than assuming that good health, requiring thermal comfort, would in most climates necessitate some form of space heating or cooling within the home, it gives conceptual space to possibilities to support health and thermal comfort by other means, for example adjusting the design of dwellings, adjusting clothing codes, heating or cooling public and community spaces, etc. It therefore has the advantage of not locking in assumptions about required energy services, or about where they should be accessed and delivered (most other definitions assume services should be provided at the household level). We feel that this is particularly valuable in being able to consider how to address energy poverty in the context of the need for global carbon emissions reduction, in that it opens up possibilities for more flexible and creative solutions.

Inevitably, a major consideration in implementing this definition would be deciding which capabilities should be supported. Energy and energy services might contribute to any number of capabilities, for example being able to provide and consume meals, being able to iron clothes, and being able to keep tropical fish, but not all would necessarily be considered essential. If energy poverty is to be defined by identifying a lack of essential capabilities, then we need to distinguish between capabilities which are understood as essential and those which are not. It is also possible that threshold levels might need to be decided for some basic and secondary capabilities.

Referring back to capability frameworks discussed earlier, we see two potential approaches to this. One is to work from a prescribed list of capabilities that is drawn up from theoretical underpinnings. Nussbaum's list of core capabilities could offer a starting point for example (see Anand et al., 2009), but further specification would be needed especially with respect to energy-relevant secondary capabilities that would be seen as essential to underpin the basic, core ones. Here, one potential approach is for an authoritative body within any given context to draw up a list of (energy relevant) essential capabilities based on theory and evidence, much as current standards for thermal comfort have been already in the UK. An alternative approach would be to deploy more inclusive and structured deliberative processes involving lay members of the public, as recommended by Sen. We are well aware that such processes are not straightforward, cheap, or quick to undertake, but there are precedents and much guidance which could be drawn upon (as noted above). Related 'consensual' approaches to defining poverty have been demonstrated, for example in the Minimum Income Standards work in the UK (Bradshaw et al., 2008; Davis et al., 2014) where extensive focus group work is used to decide upon the goods and services considered to be essential to a minimum acceptable standard of living; this is not based on a capabilities approach but does draw on a multi-dimensional model of poverty.

The definition of energy poverty we have proposed is meant to be sensitive to local circumstances, and adaptable. It is probably less suited to the measuring and monitoring of energy poverty at a large scale, such as at national levels, and we are not proposing here that it should, for example, replace the official definitions used for modelling and monitoring fuel poverty in the UK. Much work would need to be done on agreeing the 'essential' capabilities to be included and on how to measure or assess them, before a large scale measurement program could be implemented and it is beyond the scope of this paper to propose such a method. Our definition would include lack of affordability of fuel as a reason for having insufficient energy services, but we have not specified what 'affordability' means. Rather, we think that it is an approach that could most easily lend itself well to the assessment of specific households, and smaller scale intervention programmes, in contrast to some other definitions designed for larger scale monitoring.[7] Doing so would assess the different ways in which an individual or household – either could be the focus[8] – was compromised in their ability to participate fully and flourish in the societal context in which they live, on account of an energy service deficit. The capabilities approach more generally has been accused of being only operational in a counterfactual sense, i.e. to identify compromised capabilities rather than opportunities to build them (Smith and Seward, 2009), but the counterfactual application actually works well for identifying energy poverty according to our definition. Nevertheless, we also believe that thinking through energy need and energy poverty from a capabilities perspective does identify areas for positive intervention, which we discuss next.

7. Interventions against energy poverty

Different definitions of energy poverty draw on different understandings of its causes, and thereby point to different sites of intervention. We consider our approach to be usefully integrative, covering the territory of others but more systematically and comprehensively identifying the scope for intervention. If we think about other approaches to defining energy poverty that we reviewed earlier, we can consider the interventions that they point to and locate these on our diagram (see Fig. 2). Approaches that focus on energy poverty as lack of access to modern energy, which are mostly concerned with the global South and less developed economies, are focusing towards the left of the diagram and on interventions that relate to energy supply infrastructure (which may be at different scales) and on imparting the knowledge and skills to enable people to use cleaner sources of fuel. Affordability approaches would also be concentrating on the area to the left, although with a different kind of intervention, to do with prices of fuel, energy connection and energy supply, or with incomes more generally in order to ease affordability. Approaches to energy poverty that highlight energy inefficient buildings and infrastructures as a cause, such as the UK approach, are highlighting and seeking to intervene in the space between energy supply and energy service, because increased efficiency would give a greater amount of service for the same level of supply; efficiency is also relevant in the conversion of raw fuel to energy supply and service, wherever that may take place – sometimes in the home, as in biomass burning, but sometimes before reaching the home. Approaches to energy poverty that focus on access to energy services bring into view the middle of the diagram as well as the left, and would likely be interested in interventions in provision, affordability and efficiency, as appropriate to the context in order to produce better service outcomes.

Our approach would justify intervening in all areas mentioned above, but because we consider what services are for, rather than seeing provision of a specific level of services as the goal, we bring into view some further potential points of intervention. These are towards the right of the diagram, in the spaces between services and capabilities, and between secondary and basic capabilities. Regarding the relationship between services and capabilities, we have already argued that this will be affected by individuals' characteristics and circumstances – for example disabled people or young children may need more heating for various reasons, in order to be in thermal comfort and good health. This is a matter of

[7] For example the two UK definitions cannot be readily applied at household level due to the complex energy efficiency modelling needed to calculate 'necessary' spend.

[8] The capabilities approach was deliberately developed to focus on individuals, because individuals differ in their ability to realise capabilities with the same resources and thus variation can occur even within households (Nussbaum, 2000).

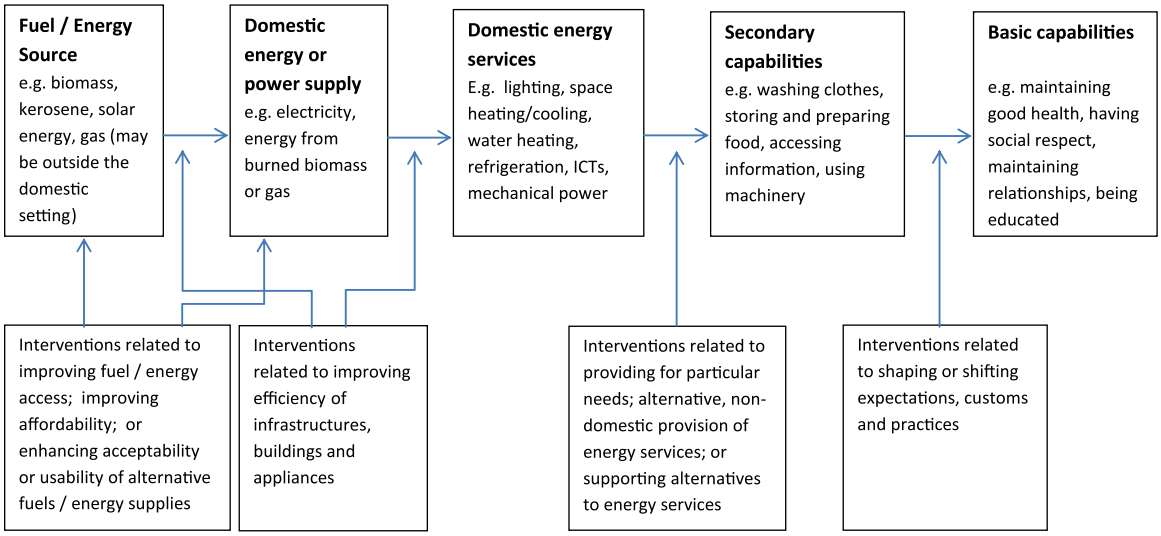

Fig. 2. Positioning of interventions related to energy poverty alleviation.

recognising differential needs; something that is done to some extent in, for example, UK policy with certain income supplements for older people especially, but many approaches to energy poverty/fuel poverty assume a standard fixed relationship between services and outcomes. More attention could be paid to this area therefore, and the capabilities approach gives us a theoretical justification to do so. In this area there is also the possibility of alternative ways of providing services. In order to reach a certain functioning, it may not be requisite that the service is always provided in individual households. The community scale might at times come more into play, for example in the case of IT provision, or as has happened in the case of opening community buildings for people to keep warm/cool. Community solutions, following sharing principles (McLaren and Agyeman, 2015) may be less obvious and less immediately popular than more individualised ones, but it is important to remember that they could be a way of maintaining essential capabilities/functionings and that they can be a crucial back-up when individual household resources fail. The other side of this coin is that individuals or households who are less socially integrated may be in a more precarious position if their energy is constrained than those with stronger social networks. Other ways of providing alternatives may be about substituting for energy services – for example, more clothing instead of more heating; building shading instead of air conditioning.

The highlighting of the contingent relationships between services/secondary capabilities and basic capabilities allows us to see the effect of evolving social norms in constituting energy demand and, therefore, relative energy deprivation. Energy poverty can involve not being able to engage in accepted social practices. This space also can be a place of intervention, for example the 'cool biz' scheme in japan which allowed businessmen to diverge from usual dress protocols for work, reducing the need for air conditioning in summer (Tamura, 2007). Although not a policy to alleviate energy poverty, it does illustrate the possibility of policy interventions around social norms that construct energy demand, and therefore what are perceived as energy needs.

8. Conclusion and Policy Implications

We have put forward in this paper a case for conceptualising domestic energy consumption through a capabilities framework, informed by the work of Amartya Sen, Martha Nussbaum and others, and have suggested a corresponding definition of energy poverty, in capabilities terms. We believe that this has a number of advantages. First, it usefully provides conceptual coherence across contexts, whether regional or global, whilst having the flexibility to be contextually specified. Second, as a definition of energy poverty it has a stronger theoretical basis than many current definitions, linking it with wider notions of poverty, needs and under-development. Third, it brings to attention a wide range of ways in which energy is instrumentally important for wellbeing and quality of life, and therefore, recognises a diversity of impacts of energy poverty. This is an advantage over current European and other developed region perspectives, in particular, which have a narrow focus on energy for thermal comfort and health, while it affirms the multi-dimensional approach from much of the work on the Global South. Fourth, it can lend itself to locally assessing individuals and households in terms of their energy poverty or vulnerability, which some other definitions, notably the UK definition, cannot – although the flip side of this is that it may be hard to implement at large scales. The diagnosis could be quite different for different individuals or households, pointing to different possible interventions, which although adding complexity may be more effective than blanket solutions, and not necessarily more expensive. Fifth, taking capabilities as the end point of concern, rather than energy supply or energy services, opens up additional conceptual space for designing interventions, perhaps by working on the accepted relationship between services and capabilities, or secondary and basic capabilities, or by looking for alternative means to support capabilities, that do not necessitate a specific energy service at household level. As such, the approach may be particularly useful for thinking about reducing energy poverty in the context of climate change mitigation and carbon reduction, whereby there is a wider imperative to contain overall energy production and consumption.

Undoubtedly, the implementation of such an approach for assessing energy poverty would pose methodological challenges especially around defining the capabilities to be deemed essential, both basic and secondary. It has not been within the scope of this paper to specify exact methods but rather, we have discussed broad approaches, and point to other established work on operationalising capabilities approaches for various ends, that offers useful resources for the further development of such an approach in energy related work (e.g. Robeyns, 2003; Alkire, 2007; Anand et al., 2009; Burchardt and Vizard, 2011). Further work could experiment with developing more specific frameworks for assessing energy poverty through our proposed definition, at different

scales. We would be particularly interested to see the utilisation of deliberative elements, as this is most in keeping with the fundamental ethos of the capabilities approach. Other work on fuel poverty and energy poverty, even if not embracing a full capabilities framework, might usefully reflect on how the situations of those in energy poverty might relate to notions of compromised capabilities, and thereby connect with a number of wider approaches to poverty and deprivation. Overall, we can see much scope for the further development and application of a capabilities approach to understanding energy use and energy poverty in the context of global climate change mitigation.

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