1 | Household energy vulnerability as 'assemblage'

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Introduction

In the profile of current energy justice concerns, those focused on households' access to sufficient and affordable energy are perhaps the most well established. In both developed and developing world contexts the well-being that energy services – such as heat, light and mobility – can bring to people's lives has provided the basis for assertions of energy-related rights and for political mobilization against the inequalities in energy access that are implicated in patterns of ill-health, mortality and diminished life-chances (AGECC 2010; Boardman 2010; Wilkinson et al. 2007; Wright 2004). In the UK, for example, and as discussed in the introductory chapter, the language of fuel poverty has provided a powerful framing for recognizing problems of access to affordable energy and for a range of policy interventions intended to address these (Walker and Day 2012; Hills 2012). Such policy, research and political mobilization is less advanced in other European countries, and elsewhere across the developed world, but is emerging and gradually revealing the prevalence, depth and characteristics of household energy problems in different settings (e.g. Healy 2003; Brunner et al. 2012; Buzar 2007; O'Sullivan et al. 2011; Simshauser et al. 2011; Tirado Herrero and Ürge-Vorsatz 2012).

Partly because research and policy attention has emerged in a quite differentiated manner, different languages have been employed to characterize the problem that is at issue, including those of fuel poverty, energy poverty, energy insecurity, energy deprivation and energy precariousness. To some extent these different terms reflect the underlying understanding or framing of the problem. Fuel poverty, for example, is strongly rooted in the UK experience and its primary focus is on affordable warmth; energy poverty tends to be used in relation to access and affordability problems in the developing world which can take on a quite different character; while energy insecurity can imply a concern primarily with the provisioning and price stability of energy supplies to the household. In this chapter we work with the term

'energy vulnerability' with the intention of following a broad and open framing that does not imply a particular emphasis or understanding of cause and effect. As we explain further below, energy vulnerability is a term that for us better captures the variability of circumstances and processes through which problems of access to sufficient and affordable energy are manifest, and one that has the potential to work across many different national and regional settings.

Having proposed this open terminology, we then seek in this chapter to develop a more theoretically informed account than is typical of work in this field. The bulk of existing research is applied and problem oriented, drawing on different disciplinary traditions, but not engaging very substantially with social or critical theory. There are some exceptions. For example, Buzar (2007: 1908) examines household energy deprivation as an 'innately relational phenomenon', drawing together a range of theory on infrastructure, poverty and everyday life to inform his analysis of the 'socio-spatial arrangements' of energy poverty in post-socialist Europe. Powells (2009) uses actor network theory and notions of entanglement and overflow to examine the complex interactions between fuel poverty and energy efficiency policy in the UK. Harrison and Popke (2011), in a rare examination of 'energy poverty' (their term) in the USA, use the notion of 'assemblage' as a way of setting up and analysing their empirical account of rural household energy problems in North Carolina.

Each of these applications of theoretical ideas has connections with the approach we explore in this chapter, but it is the innovative use of assemblage thinking by Harrison and Popke which we particularly seek to take forward. They argue that 'energy poverty' can be seen as 'a particular kind of techno-social assemblage, made up of an array of networked actors and materialities' and that 'a focus on the networked nature of energy poverty ... can help to highlight its historical foundations and multidimensional character' (ibid.: 950). They go some way to substantiate these claims through their empirical work, but, we would argue, take up only some of the potential of 'assemblage thinking'. In particular they do not go as far as they might to draw out the ways in which assemblage embodies particular understandings of agency, emergence and dynamics. Our specific aim is therefore to explore the value of assemblage thinking to the analysis of energy vulnerability, considering both what it can bring to understanding the basis, formation and dynamics of energy vulnerability, and also what it can less satisfactorily account for.

Before moving on to examine the origin of assemblage as a concept

and the core ideas it encompasses, we need to say more about how we understand energy vulnerability. Energy vulnerability is for us a situation in which a person or household is unable to achieve sufficient access to affordable and reliable energy services, and as a consequence is in danger of harm to health and/or well-being. This open definition makes no specific judgement about which energy services are significant, what constitutes sufficient access, how harm may be involved or how substantial that harm needs to be. The notion of vulnerability also conveys a sense of potentiality or precariousness rather than necessarily a situation of demonstrable and existing harm. We understand energy vulnerability as having a number of general characteristics:

- First, as much of the existing literature emphasizes, it is multi-dimensional in character and produced through the coming together of social, technological and natural processes.
- Secondly, the exact nature of this coming together for any particular person or household is locally contingent. Hence energy vulnerability is variable in its production and character over space and time.
- Third, energy vulnerability as experienced exhibits different temporal qualities, sometimes constant and unyielding, sometimes far more dynamic and shifting in cyclical or more unpredictable patterns.

In the following discussion these three key characteristics will be reflected on in the light of assemblage theory, drawing on illustrative cases taken from the review work and extended discussions and interactions within the InCluESEV project. In this respect we draw on varied cases and settings from across Europe and North America (which reflects the scope of work in the project), given, as noted earlier, that we are seeking to provide an analytical framework that is open to the international and regional variability of energy vulnerability experiences. We do not in this chapter extend to specific consideration of energy vulnerability in other parts of the world, but suggest in the concluding discussion that an assemblage framework might be readily applicable to a wider global geography of household energy contexts.

Understanding assemblage

The concept of 'assemblage' as it is used by social scientists is normally attributed in its origins to the work of Deleuze and Guattari, and their notion of '*agencement*', which came to be translated as 'assemblage' (Deleuze and Guattari 1987). While some working with

assemblage have attempted to follow Deleuze and Guattari closely, other distinctive versions of the approach have also developed (e.g. De Landa 2006). Also closely related but with distinctive elements is the 'assembling of associations' that is central to Actor Network Theory (Latour 2005; Law 1992; Whatmore 1999).

All of these approaches at their basis view the happening world as coalescing into assemblages, or networks, of heterogeneous entities (sometimes referred to as actants), which include humans, non-human and abstract things. Entities form an assemblage in that they have some kind of relation with each other, such that a kind of collective whole can be discerned. A whole assemblage should be more than the sum of its parts: it is not just a collection of stuff, but a functioning collective, at least for a time. The assemblage, though, need not be self-aware or intentionally formed by any of its members – its function and effect are always emergent and contingent. Although some assemblages may be designed, many are not, and even those that start with a template acquire their own momentum and configuration as they proceed.

The emphasis on the heterogeneity of the constituent entities of assemblages is essential. If we were to take a simple non-energy example and consider a (specific) school classroom as an assemblage, a very simple analysis might reveal it to contain children, a teacher, furniture, building infrastructure involving various material parts, books, clothing, computers and their software, educational theories, curriculum policies, routines, rules, religious beliefs, clocks, artworks, even a cold virus moving from child to child. These and potentially many other entities all shape the 'happening' of that specific classroom.

Viewing things in this way has the effect of decentring the human as the subject. As discussed later, this is an important shift which some social scientists dislike, but which has proved appealing for others, especially geographers, who are centrally concerned with the material world with which humans interact. A core intention for many using assemblage thinking is to make visible the way that non-human (including non-living) entities have a strong role in how situations play out – that is, they are not just props to human endeavours but they assert themselves in significant ways (see especially Bennet 2004, 2010; Callon 1986; Latour 2005).

Another feature of the heterogeneity is that assemblages can also blur spatial and temporal distinctions, bringing together entities that are near with those that are far (Anderson and McFarlane 2011) and entities with different temporal rhythms (Allen 2011). Thus the classroom

example is able to include national government educational policy originating in a capital city and with a lifespan of a few years, alongside the daily rhythm of lesson timings, slowly evolving cultural practices and the rapidly changing weather. The existence of an assemblage needn't be in fully concrete or locational terms, but is rather through its working relations and bonds of influence.

Human and non-human entities can of course be involved in many assemblages at once, so defining an assemblage is not a way of separating or bracketing off parts of the world. Assemblages do not always present themselves neatly. Rather, it is the job of analysis to identify and describe them. Deciding what is and isn't an assemblage, where one begins and ends, is therefore an interpretation to be offered and, potentially, contested. This work of identifying and naming an assemblage and its constituents can imply a rather descriptive orientation, and indeed, this is often a criticism of such approaches. Some uses of an assemblage approach do stay in the realms of the more descriptive, and can be productive in doing so. Those drawing on Deleuze and Guattari in particular, though, are often more keen to emphasize the processual aspects of assemblages forming, unforming and reforming, such that the 'time-space of assemblage is imagined as inherently unstable and infused with movement and change' (Markus and Saka 2006: 102).

Because assemblages are characterized as impermanent, unpredictable and in flux, there are always possibilities for alternatives, and this is also an important aspect of the assemblage approach. Rather than describing just what is, the approach is also concerned with fostering imaginative conceptualizations of what may be, of how the world could be reassembled in different configurations and what difference that might make. However, its essential world view of messiness and contingency would militate against precise predictions of outcomes.

Assemblage has been worked with across diverse disciplinary literatures, usually more as an approach, or an orientation, than as the basis of a coherent theory. It is also applied in fairly diverse ways, which is variously regarded as both an advantage and a weakness (see, e.g., Marcus and Saka 2006; Anderson and McFarlane 2011; McFarlane 2011b; Brenner et al. 2011). To give some examples of the varied phenomena that might be conceived as assemblages, the concept has been applied to, among other things, political support movements (Davies 2012), rock climbing (Barratt 2012), flooding (Walker et al. 2011), environmental justice controversies (Bickerstaff and Agyeman 2009) and church buildings (Edensor 2011).

The approach does attract criticism, including over questions of agency and how assemblages come to be (discussed later), and issues around how the boundaries of assemblages are delimited (Allen 2011). Probably the most trenchant criticism is the perceived blindness of assemblage thinking to the structures and uneven power relations within which actants in an assemblage operate. There is thus an inability fully to explain or understand inequality (Brenner et al. 2011; Madden 2010), including how best to overcome it. However, although some believe that assemblage approaches do signify a full alternative to, and potential replacement of, more structural approaches in critical social and political science (Farías 2009), others advocate the combination of an assemblage perspective with other analytical approaches such as political economy or feminism for a fuller analysis and augmented explanatory power (McFarlane 2011b; Rankin 2011; see also Castree 2002). We will return to these questions later in our discussion.

Assemblage and energy vulnerability

Having introduced the concept of assemblage, its underpinnings and the ways of thinking that it draws on and promotes, we can now turn to applying these ideas to energy vulnerability. As noted in the introduction, the use of an assemblage approach has been mooted in this context before (Harrison and Popke 2011), but the ways in which it can inform and illuminate our understanding and conceptualization of energy vulnerability have not been fully explored. To take this agenda forward, we suggest that there are six fundamental features of assemblage thinking which can provide for a distinctive and productive analysis of the basis, formation and dynamics of energy vulnerability. In working through these we will consider the concept of assemblage in more depth, and draw on examples of varied forms of energy vulnerability.

1 *Networks of entities* Assemblage thinking conceives situations (or phenomena more generally) as being constituted by a network or configuration of human, non-human, material and abstract entities in some kind of relations with each other (as noted earlier, a relational ontology it shares with other theoretical traditions). As already discussed, some who use it particularly value the visibility and status that it gives to material, non-human entities, such as buildings and urban infrastructures, in human lives (Bennet 2004, 2010). For example, McFarlane (2011a), drawing particularly on his own work on informal settlements in Mumbai, argues that attention has to be given to how

material environments are both constituted by poverty, and part of the experience of poverty – as well as sometimes having a role in resistance strategies. Others have also seen value in how assemblage brings status and agency to nature in relational networks, from the molecular scale through to forces of earthquakes and global climatic change (Hinchliffe 2007; Clark 2011).

If we consider this open understanding of networks and entities with respect to energy vulnerability, we can see immediate resonances with the heterogeneity of entities that come together to create energy vulnerability. This dimension of assemblage thinking is what Harrison and Popke (2011: 959) emphasize most strongly in their 'open and relational account' of 'energy poverty as a geographical assemblage of networked materialities'. An energy-vulnerable household contains people by definition. It also involves a material infrastructure with many constituent parts – a building, a heating system, a supply line perhaps, the fuel itself; cooking and lighting devices, other appliances, insulation. The characteristics and condition of these material components are vital to the constitution of energy vulnerability, albeit in hugely diverse ways. How efficient are they? How old are they? How big are they in relation to the spaces and needs they service? Are they even there at all?[1]

So we can see the importance of both the human and material elements – energy vulnerability would not exist without both. Non-human nature in the form of the outdoor climate, involved processes of air movement, temperature, humidity and their relation to the indoors are also essentially implicated, particularly in relation to demands on heating or cooling systems and temperature-related threats to health. We can also add in other, more abstract entities – traditions, conventions, markets, prices, policy priorities – as each is potentially a part of what comes together to produce vulnerability. Some entities may even be assemblages in themselves – a market is by no means a simple entity – but for our purpose of understanding household energy vulnerability as an assemblage, it would be reasonable to consider markets and other complex entities as a single actant.

Assemblage thinking emphasizes that the nature of the assemblage is made in the *interaction* and association of these diverse elements. So, energy vulnerability is not just a matter of the mere juxtaposition or combination of a certain kind of people with a particular kind of building, set of appliances, climatic regime and energy supply and pricing system. It is rather a matter of how these all interact – for example, how specific people expect to inhabit their house, at what

times and in what rooms; how the type of energy supply constrains the appliances that can be used; who makes household financial decisions and how they make choices about their energy supplier and tariff.

Assemblage, then, allows us to be open to, insofar as we can apprehend them, the diverse and varying elements that interact in constituting an energy vulnerability situation. Crucially, the emergence and contingency that are central to assemblage as a process also mean that we do not have to specify a fixed menu of entities involved, or fixed set of relationships between them. While disciplinary silos might often lead us to focus on either the human (for social scientists), material (for engineers and architects) or policy/market aspects (for economists and politicians), with other aspects fading into the background, taking an assemblage approach which insists on a 'principle of generalized symmetry' (Callon 1986; Latour 1993) with respect to human and non-human entities disallows this partial view.

2 *Agency* Developing from the above points, assemblage approaches see agency as distributed between the different entities or actants in the assemblage, not merely lying with the humans involved (although there is some variation across different writers in how this distribution of agency is interpreted). So for example, we might say that a central heating boiler exerts agency in constituting energy vulnerability in a particular situation, perhaps through breaking down, or becoming progressively less efficient as it ages. Pre-payment meters for gas or electricity would be another example of a technical device installed in low-income households (or those with a poor payment record), which disciplines its users to pay for and manage their energy supply in a particular way (OFGEM 2011; O'Sullivan et al. 2011). Bennet (2005) provides a good example of this way of thinking with respect to energy vulnerability in her analysis of the North American blackout of 2003. She shows that while a more conventional analysis might locate the responsibility with human decisions and failings, a convincing alternative case can be made for the agency, and perhaps even the responsibility, being distributed among humans and non-humans.

This blurring of the distinction between human and non-human actants in terms of not just their presence but their agency is essential to the 'symmetrical analysis' referred to above, but thinking in this way is challenging and controversial. Tonkiss (2011), for example, is critical of the status that Bennet seems to give to material objects and argues that human agency is of a different order to that of objects (see also Castree 2002; Kirsch and Mitchell 2004). Fuller, in debate with Latour (Barron

2003), asserts that it is vital to distinguish morally between humans and non-humans. However, it becomes easier to be symmetrical if a distinction is made between agency and conscious intentionality (see Bingham 1996; Whatmore 1999) – so, for example, we can see that a boiler may exercise an effect without it having formulated a plan to do so, similarly a pre-payment meter, or a 'cold snap' in the winter. Latour's response to Fuller (Barron 2003) also indicates that blurring the distinction between human and non-human actors in this way is for the purpose of describing and analysing specific situations, not an all-encompassing world view, and confers the advantage of being able to see the role of the non-human world more clearly.

We shouldn't neglect to think about human agency, however, and this 'distributed agency' analysis presses us to do this as well. Here we can see that in the coming together and functioning of what might be termed an 'energy vulnerability assemblage', humans exert agency in many decisions, preferences, knowledges, practices and ways of interacting with their environment and the material entities around them, such as thermostats, kettles and clothing. This is not to say that the human decisions and choices in such an assemblage are all bad ones or lead directly to energy vulnerability, but they need to be seen as part of the overall situation.

It is also important to note that the assemblage approach, as well as assigning agency to both human and non-human actants, sees the important agency as being that of the assemblage itself – in the interactions, and the totality of these – such effect being referred to as the 'milieu' by Deleuze and Guattari (see Bennet 2005; also Law 1992; Whatmore 1999 on Actor Network Theory). With respect to energy vulnerability, this is clear – the vulnerability which is our ultimate concern is constituted by the overall assemblage; this assemblage goes on to have various, largely negative, effects on the household and its members. There are also ripple effects beyond the household: in the UK context, for example, figures monitoring the number of fuel-poor households galvanize campaigners and cause headaches for governments, and there is significant policy activity around the issue with accompanying financial costs. Further, intervening in energy vulnerability assemblages through their material actants, such as building structures, heating systems and insulation, has become a state-supported industry in many places, including the UK and the USA.

3 *Space and scale* As noted earlier, assemblage analyses are able to transcend Euclidean space and cross scale. Entities/actants within the

assemblage can include people, material and decisions that are both near and far in locational terms and which might generally be seen as operating at different scales – for example, the family, neighbourhood, regional and national governments. All such elements can be traced as part of an assemblage without them being arranged into spatial hierarchies (see Marston et al. 2005 and various responses to that paper for seminal debate on such 'flattening' of scale; also Whatmore and Thorne 1997; Bingham 1996). For energy vulnerability, then, the important criterion for inclusion of entities is not their spatial location, but their relevant relations with other entities within the assemblage that as a whole constitutes energy vulnerability. Thus while conventional analyses of fuel poverty might focus on the local social and material characteristics of the home, a relational account could, for example, draw in distant crises in geopolitical relations that destabilize energy prices and impact on the affordability of gas travelling through extended supply networks and pipelines into the home. The gap between the international framing of 'energy security' and the local framing of 'fuel poverty' is thus traversed through a non-hierarchical account. Similar distant tracings might be made with crop harvests and policies to promote biofuels, and with global climate change and its relations both to energy policies and to locally experienced climatic patterns.

4 *Messiness and variety* Those working with assemblage often argue that a crucial characteristic and advantage is the emphasis on 'messiness', on the contingency of any specific assemblage (Dovey 2011; Simone 2011). What might, through other theoretical lenses, be seen as coherent, similar kinds of force being in operation, can through assemblage analysis be revealed to be heterogeneous, quite diverse situations with internal inconsistencies and idiosyncrasies. For example, McFarlane (2011a) has taken this view with respect to neoliberalism, arguing that it should be seen as a set of place-specific contingent assemblages, rather than a coherent meta-narrative that is cleanly reproduced from one context to another with only slight, functional adaptations. We believe that this is one of the most beneficial insights that assemblage thinking can bring to the analysis of energy vulnerability.

Looking again at the UK, the category of 'fuel poverty' has been extremely powerful and instrumental in bringing to light a real problem and injustice faced by millions of households. However, it has become clear that tackling it effectively requires a fuller and more nuanced understanding than the current prevailing models provide. There are

stereotypes of the 'fuel poor' or 'energy vulnerable' household that commonly circulate. In the UK, it tends to be the older person on a low income living in a home in poor repair, using outdated, inefficient heating systems and appliances. In other climatic and social contexts there may be other abiding images, perhaps, as in southern Europe and the southern states of the USA, more to do with cooling rather than heating. However, certainly in the UK, those working on the ground know that it can be surprisingly hard to find households that actually fit the stereotype so clearly. That's not to say that the elements of the basic model of energy vulnerability are misconceived – incomes, fuel prices and the energy efficiency of buildings and appliances are highly relevant – but the diversity of actual instances of energy vulnerability is never sufficiently acknowledged. Some energy vulnerability may not even fit the definition of 'fuel poverty'. Within the UK, one energy-vulnerable household could be an off-grid couple on low wages in a detached house in a cold part of the country with an old oil-fired heating system; while another might be a single parent in a rented flat in a large city with a broken gas boiler and an unhelpful landlord. In southern Europe it might be an older person with heart problems in a city flat in summer worried about the safety of leaving windows open and trying to keep cool with electric fans ... the possibilities are extensive.

Can these yet be seen as something that is 'the same'? With so much diversity, should we dispense with the idea of a phenomenon called 'energy vulnerability' altogether? We think not, and don't propose to deny any kind of commonality. The direction that all these assemblages move in may be similar, heading the household towards harm of some kind: ill-health, stress, social stigma – again there may be diversity here, but all would be open to being seen as undesirable situations. Furthermore, in all cases energy is something whose circulation is an essential element of the assemblage. The point is, though, that the configuration of elements, or actants, in the assemblage, apart from energy in some form, may be quite different in each case, and this is important because it follows that the points of productive intervention might also be quite different.

5 *Dynamics and flux* Assemblages are not seen as static, but as entities in flux, forming and unforming, with varying degrees of fragility or stability. Some authors feel that the processes of forming and unforming are a more pertinent focus than rather static conceptions of the assemblage itself (Anderson and McFarlane 2011; Farías 2009;

McFarlane 2011a). We see that both aspects are likely to be relevant to studies of energy vulnerability. As discussed above, what the elements are that constitute energy vulnerability in a specific case is an important question, but we would be perhaps even more interested in how they come together, why, and under what circumstances. We can also see through this approach that some energy vulnerability assemblages will be more stable than others. Elements operate at different temporal rhythms – for example, a chronic illness may span years; a period of unemployment several months, but with longer-term impact on debts; a cold winter or a hot summer a matter of weeks; a broken heating system a day or two. The degree of temporal synchronicity of constituent entities is likely to be one factor that influences the lifespan of the assemblage in a particular form (Allen 2011). Stability may also be conferred by the strength of relationships between different elements or actants, and/or the ease with which some elements may be pulled away or substituted. For example, the relation between a household and their fuel of, say, wood biomass may be one of preferential attachment/tradition (which may be strong or weak), necessity (very strong if choice is limited) or comparative affordability (which again may be strong or weak). To give another example, the relationship between a household and their dwelling building may also be strong or weak, depending on tenure, attachment and so on.

A sense of the dynamism of assemblages is thus important in prompting questions about how the elements come together and become entangled – where was the agency?; what was the context?; what might prevent this happening, and how might the elements come apart? Such analysis can help distinguish between more and less intractable forms of energy vulnerability, revealing those which are easiest and hardest to disrupt, and where the best opportunities for disruption are to be found.

6 *Alternatives* For many, the spirit of assemblage thinking is about conceiving alternatives, and in this sense it can be quite optimistic: seeing the state of things as dynamic and somewhat messy rather eschews any sense of inevitability, offering a prospect where there may be many ways of doing things differently. Although it has been criticized for not offering any roadmap for achieving change (Brenner et al. 2011), which indeed in itself it does not, analysing situations in terms of assemblages, by highlighting the heterogeneous elements, the distributed agency and the varying stabilities of bonds and collectives, does bring into view multiple sites and methods of intervention.

However, the dynamic view means that we need also to recognize that interventions may not produce a consistent, stable or predictable impact. The assemblage may be destabilized but the reconfiguration can be unpredictable, and those intervening actants may themselves be changeable, having their own temporal limits. For example, policy is subject to revision and subsidies can be withdrawn or retargeted. Apparatus such as microgeneration equipment can become damaged or obsolete and financial incentives such as feed-in tariffs reduced.

Discussion and concluding comments

In all, we think that using an assemblage approach has much to offer energy vulnerability thinking. Most obviously, the vantage point it affords exposes an array of heterogeneous actors in energy vulnerability situations that more restricted disciplinary outlooks often don't allow us to see. Revealed are people and their actions and decisions, material entities and their properties, other living organisms and their agendas, abstract entities such as traditions, beliefs, practices and policies, non-human nature and its cycles. The entities whose presence and actions get drawn in may be in different spatial locations and unfolding in different temporal rhythms. Tracing the entities involved and the process of their assembling can be illuminating, demonstrating multiple agencies, with actors perhaps unaware of each other, and each acting according to their own logics and having a role of some kind in the situation.

It also shows the great diversity of situations that, in having the potential for negative and unhealthy experiences for the people involved, might be classified as energy vulnerability. We think this is helpful rather than otherwise, as it allows us to have openness to and clearer understanding of what is involved in real situations in context, rather than expecting a fit to a predefined mould. This in turn can both reveal the complexities of working with interventions that typically work with broad characterizations and expectations, and open up better possibilities for change, finding them in in more numerous places.

Rather than endless diversity, though, the assemblage approach may also be able to reveal commonalities, where energy vulnerability assemblages have similar trajectories or where the particular influence of an entity or relationship between specific entities is similarly critical. The assemblage approach, as Allen (2011) argues, can offer a middle way between seeing the world as infinitely differentiated and contingent on the one hand and constantly reproducing consistent structures on the other. However, the commonalities we find may or may not be

the similarities we would expect to see through existing definitions or models of fuel or energy poverty. These existing definitions would lead us to look for energy-inefficient buildings, low incomes, poor access to energy supplies; an assemblage approach may lead us to see, for example, recurring elements of weak social support or liberalized energy markets.

The approach also usefully introduces a sense of dynamism and of situations as evolving. They may evolve at different speeds, however, and in this way we can start to see how some energy vulnerability situations may be fleeting while others are more intractable. Measures of fuel poverty (again most developed in the UK) have traditionally worked with simple 'in' or 'out' categories. A household is either in fuel poverty, and therefore part of the national fuel poverty statistics, or it isn't. A more dynamic understanding would be less absolute, emphasizing that households may be and become more or less energy vulnerable, experiencing harmful impacts to different degrees and over different timescales – maybe seasonally, maybe in response to a particular crisis or sudden shift in household circumstances, energy markets, or geopolitical relations. Recent proposed changes to measuring fuel poverty have attempted to capture some measure of the depth of the problem as experienced across the profile of all fuel-poor households (Hills 2012), but it is clear from those involved in grassroots fuel poverty action that the ongoing messiness and flux of on-the-ground experiences cannot be captured by macro-scale measurements.

The assemblage approach does, though, have its limits, and there are two important things it isn't good at seeing. First, the approach doesn't see things that are absent from the assemblage. Because it tends to trace what entities are involved, how they came together and how the bonds operate, it is not good at accounting for absence or lack, a point noted by McFarlane and Anderson (2011) and by Jacobs (2012). In energy vulnerability situations these absences or lacks may be critical, such as the lack of a back-up system in the event of technological failure or the lack of a household's capacity to cope with debt. Secondly, the approach can tend to overlook the wider context and structures within which entities (actants) operate (Brenner et al. 2011; Castree 2002; Kirsch and Mitchell 2004). Some kinds of context might be accounted for analytically in describing the assemblage itself, especially as the elements don't need to be synchronic, for example housing shortages leading to high rents and tenants' constrained budget for services. But on the whole, the limits on the agency of people in particular tend not to be seen, especially structural power

relations that constrain people's repertoires of action and their ability to influence an assemblage and its trajectory.

For the first problem, we need to be imaginative in thinking about alternatives, which is what assemblage thinking would encourage us to do. So, in looking for intervention points we can think about not just what is in the assemblage that we might want to exclude, or what decisions might be made differently, but also about what else might be brought in to create an assemblage with a different trajectory that would not push the household towards harm. We might want to use comparisons with other, more successful household energy assemblages (while recognizing that 'success' or indeed 'vulnerability' is not inherent to assemblage analysis, but requires external judgement to be exercised); and we no doubt would find it useful to bear in mind some a priori experience that might lead us to be vigilant for particular absences (e.g. insulation, back-up system, social support network) as well as presences (e.g. illness, cold weather). For the second problem we agree with various authors including McFarlane (2011b) and Rankin (2011) (and Castree 2002 regarding Actor Network Theory) that the assemblage approach can be used in conjunction with other theory (such as Marxist, feminist and other structural theory) that provides the conceptual space to address and explain the context within which actants, especially people, operate, and the limits on their agency. Bringing in strands of normative theory would also be important in using assemblage thinking within a wider pursuit of energy justice.

In this respect the assemblage approach per se does not make judgements about which situations are worse, which should be intervened in or what kinds of interventions are more acceptable than others. In that sense, as noted earlier, our use of energy vulnerability does not inherently imply a state of harm which automatically merits attention and potentially intervention. Vulnerability conveys a sense of potential for harm or diminished well-being, a situation in which the realization of 'necessary' energy services is not necessarily or reliably assured. Any household may be more or less vulnerable in this way. A good analysis should offer the basis for thinking through possible interventions and seeing which would be likely to change the trajectory. It should also give a sense of the stability of the assemblage – whether it is likely to move on with a light push, or whether very stable bonds or interactions need to be broken or substantial new elements introduced. However, any other criteria for deciding which potential interventions to enact or which situations to intervene in would need to be established by recourse to other principles, such as justice theory, ethical principles,

societal norms and preferences, political priorities or budgetary constraints. These decisions, though, would necessarily be explicit, as unlike some other framings of energy vulnerability, the approach does not presume any specific remedy ahead of analysis.

As yet, with the exceptions mentioned in the course of this chapter, the assemblage approach has been little applied to the analysis of energy vulnerability, so there is much scope for its development through empirical work. As mentioned at the start, one potential advantage we can see is that the approach can be used in all manner of situations, including those beyond the developed-world contexts that we have largely drawn on in this chapter. Indeed, it would be valuable to have an array of diverse case studies approached in this way for comparison, including situations where vulnerability was less present, each starting without assumptions as to the nature of problems and related responses and looking for dynamics as much as for stabilities. As with research in other domains, such as in the analysis of cities where assemblage has proved quite popular (see McFarlane 2011a; Jacobs 2012; Anderson and McFarlane 2011), we would anticipate variations in how the concept was taken up and applied, theoretically and methodologically. There are certainly challenges to be resolved and limitations to be overcome; we have offered thoughts on some of these but there are no doubt others. However, the essential creativity that is the ethos of the assemblage approach should encourage productive experimentation in future research and potentially in future practice.

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