Energy sufficiency: an introduction
Concept paper

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1 Introduction

eceee has commissioned a series of concept papers on the topic of energy sufficiency, based on a recognition that energy efficiency policy alone is not enough to turn around the rising demand for environmentally-costly energy services. The aim of this paper is to promote and assist discussion of energy sufficiency as a concept and offer some suggestions as to how sufficiency policy might be shaped in Europe.

The first call to consider a new policy paradigm of ‘sufficiency in energy services’ in an eceee setting came at the 2003 Summer Study. The authors pointed to a fundamental ‘self-deception’ within the energy policy community: the term ‘efficiency’ (the ratio between an energy service output and an input of delivered or primary energy) was routinely equated with the concepts of ‘sufficiency’ and ‘sustainability’. Sufficiency was not defined in the paper, but it clearly related to boundaries on energy services in order to keep global consumption within acceptable environmental limits while allowing for increasing demand in non-OECD countries: there was an onus on the affluent nations to bring about deep reductions in energy use. The paper also noted that sufficiency is a concept that can be applied beyond a narrow focus on carbon targets: ‘global warming is not the only energy-related environmental problem and ...all forms of energy supply have associated environmental impacts’ (Wilhite and Norgaard, 2003, p.249).

Energy efficiency thus involves improving ratios, achieving greater output for a given input, while energy sufficiency involves recognising and living within absolute environmental limits. Not long after the 2003 ECEE paper, Princen (2005) and Herring (2006) offered similar critiques of energy efficiency as a guiding principle. Princen’s introduction to his book ‘The Logic of Sufficiency’ is worth citing here, to illustrate the implications of moving away from an efficiency frame of reference:

...[there is widespread consensus that] humans are undermining the life-support systems of other species and their own. What we are now doing is not sustainable... We really ought to do something... [But] It’s gloom-and-doom plus platitude... the proposed solutions tend to be more of the same: use resources more efficiently. Recycle more. Form partnerships. Tax the bads, subsidise the goods. Promote spiritual awakening. Adapt... Missing are principles of social organisation consonant with long-term, sustainable resource use. It is from principles that ecologically sensitive patterns of use can emerge. Sufficiency is one such broad principle. (Princen 2005, vii-viii; our emphasis).

The eceee began to take up the challenge of sufficiency. Their response to the 2005 EU Green Paper ‘A European strategy for sustainable, competitive and secure energy’ acknowledges that energy efficiency remains a cost-effective way of improving environmental impact, increasing security, improving competitiveness and providing affordable services. However, it adds that the EU needs to go further than this, looking beyond technical energy efficiency measures and addressing the challenging issue of curbing demand for energy services in a politically acceptable fashion.

Energy efficiency, as noted above, is a measure of the relationship between energy outputs and inputs. So it is possible for a building, vehicle or system to be highly energy-efficient while at the same time being highly energy-consuming. Energy sufficiency is a higher-order concept and energy demands from a ‘sufficient’ building or transport system, by definition, will be low in absolute terms.
It is worth noting that Princen uses the word sufficiency in both positive and negative ways, ‘to mean a sense of “enoughness” and “too muchness”, ... where concern for excess is paramount’ (ibid., p18). This paper addresses both meanings. In doing so, it aims to extend the terms of the sufficiency debate in Europe, where sufficiency has mostly been understood in terms of reducing consumption. We argue that it will not work as an operating principle unless we recognise that sufficiency not only limits damage but supports human and ecological wellbeing.

This paper is a companion to three others that address more specific issues of sufficiency in buildings and products. It offers a deliberately broad framing of the concept of sufficiency and discusses it in relation to similarly broad issues: planetary limits, sustainable development goals, equity, timing and scale. To this end, we have reviewed research literature and incorporated some ideas from recent sufficiency-oriented work on ‘doughnut economics’. The paper focuses mainly on

- energy services and their impact
- infrastructures of demand and supply: the equipment and processes through which energy is converted, transported and made useful
- the European Union.

It does not cover, for example, sustainable land use or the circular economy although both relate to energy sufficiency. The needs, wants and responsibilities of individuals are starting points for some of our arguments. So while parts of this paper are relevant to all uses and aspects of energy systems, many of the examples relate to individuals and households rather than organisations.

The paper begins by setting out the background of global agreements on climate change and sustainable development, and introducing the ‘doughnut’ model of sustainability (Section 2). Then a definition of energy sufficiency is proposed, illustrated and discussed in relation to other definitions and related concepts (Section 3). The long-running debate about whether wants can be distinguished from needs is core the idea of sufficiency, and is set out in some detail (Section 4). There follows a discussion of trends and issues in Europe which impact on sufficiency (Section 5). Finally we explore how policy could respond to sufficiency and make suggestions for change (Section 6). The paper closes with a summary and conclusions (Section 7).

2 Global change and sustainable development

The Paris Agreement and Sustainable Development Goals

Before focusing on what sufficiency means for energy services, systems and policy, we first look at the bigger picture of global change and governance. The European Union has a record of progressive action and leadership on climate change, yet has struggled to meet Kyoto goals and shown large differences in response between member states (Parker and Karlsson, 2010). In the wake of the Paris Agreement of December 2015, with its basis in Intended Nationally Determined Contributions, there is an immense global challenge to contain temperature and sea level rise, and also an immense challenge to each nation to determine how its people are going to live not only within planetary but regional and local limits.¹

Only three months before the Paris Agreement, world leaders adopted the ‘sustainable development goals’ (SDGs) – a set of goals to end poverty, protect the planet, and ensure prosperity for all. There are 17 SDGs with 169 associated targets which are ‘integrated and indivisible’, to be achieved over 15 years. The UN resolution states that ‘We are setting out a supremely ambitious and transformational vision’ ...‘Never before have world leaders

¹ Whether the nation state is the best unit of analysis is of course arguable, but we concentrate on this for simplicity’s sake.
pledged common action and endeavour across such a broad and universal policy agenda’ (UN General Assembly 2015, Articles 7 and 18).

Governments are expected to take ownership and establish national frameworks for the achievement of all 17 SDGs\(^2\). Those most immediately relevant to energy policy are:

7. Ensure access to affordable, reliable, sustainable and modern energy for all.

8. Decent work and economic growth

11. Make cities and human settlements inclusive, safe, resilient and sustainable.

12. Ensure sustainable consumption and production patterns.

13. Take urgent action to combat climate change and its impacts.

16. Peace, justice and strong institutions.

Goal 7 thus deals directly with energy (though without specific reference to services). The term ‘modern energy’ currently refers to electricity, clean fuels and technologies for cooking (IEA and World Bank, 2017). Goal 11 includes the built environment and transport systems, each of which constitute huge infrastructures of energy demand with the ability to shape and lock in patterns of consumption over long periods (Unruh, 2002; van Vliet et al., 2012). Goal 13 is self-explanatory. Goal 16 is included because of the political and procedural challenges of incorporating sufficiency into policy. Without strong and trusted legal frameworks and institutions, these challenges are likely to be insurmountable.

The most problematic SDG in relation to sufficiency is probably Goal 8. There is a mass of research and commentary on whether economic growth can be compatible with respecting planetary limits – whether ‘green growth’ is possible or desirable. There is not room to review it here, only to comment that it is reasonable to doubt whether there can be economic growth, as measured by the usual metrics of GDP etc, consistent with ecological sustainability (Jackson, 2011).

The SDGs as a whole are open to criticism on several fronts, including the voluntary nature of the commitments, the lack of accountability for achieving them, and arbitrary metrics. For example, Holden et al. (2017) describe the goals as ‘vague, weak and meaningless’, the result of a process that has been far too wide-ranging to produce useful outcomes.\(^3\) The point of including them in this discussion is that the SDGs represent current international consensus on development, just as the Paris Agreement comes from a consensus on climate action. Imperfect as they are, these two agreements offer points of reference for policymakers and raise challenging questions for all signatories about ‘enoughness’. How is it possible to judge when enough basic human needs are being met and ecosystems are healthy and resilient enough? Can economies that rely on creating ‘new wants’ be turned around so that their primary purpose is to meet needs within environmental limits? In order to answer these questions, we need to draw upon knowledge from many directions and from different traditions, including some types of knowledge that do not sit easily with others; this calls for fresh and integrative thinking. A recent example is the development of a ‘Doughnut’\(^5\) framework showing social and planetary boundaries and also showing where we stand in relation to specific boundaries.

**The ‘Sustainable Development Doughnut’**

The doughnut diagram developed for Oxfam (a development NGO) in 2012 by Kate Raworth (Figure 1) identifies a ‘safe and just space for humanity’ that lies between a ‘social foundation’ where basic needs are met, and an ‘environmental ceiling’. It thus combines


\(^3\) The alternative proposed by Holden and colleagues rests on three ‘moral imperatives’ that also appear general and hard to translate into specific action: satisfying human needs, ensuring social equity and respecting environmental limits. These three principles arguably have the advantage of being more focussed on process than on targets, and less complex than the SDGs; the whole debate illustrates the difficulty of putting large-scale, long-term aspirations into practice and measuring progress.

\(^4\) For example, traditional ecological knowledge and classical economic theory.

\(^5\) A ring-shaped fried cake.
and maps concepts from both the Paris Agreement and the SDGs. It also goes beyond the Paris Agreement in taking into account a range of planetary boundaries, not just the limit set by what is considered a ‘safe’ amount of climate change. The doughnut model is also based around the concept of universal human needs for a variety of goods, services and freedoms (water, income, education, resilience, voice, jobs, energy, social equity, gender equality, health, food), in line with the approach taken in setting the Sustainable Development Goals, and with Doyal and Gough’s (1991) theory of human need.

Having tested out her ideas in many different contexts around the world, Raworth has developed new approaches to economic thinking to help deliver the safe and just space for humanity envisaged in the doughnut (Raworth 2017).

**Figure 1. The Raworth/Oxfam sustainable development doughnut**

The doughnut offers a powerful visual representation of Sustainable Development goals, including climate goals, in aggregate. It also incorporates the two principal characteristics of sufficiency as discussed above: the idea of absolute limits (sufficiency as a restraint) and of minimum requirements (sufficiency as satisfaction, or ‘enough’). The accompanying text in Raworth’s 2017 book provides a critique of mainstream economic thinking and a programme for transforming it into a discipline more capable of analysing the human condition and planning a better future. It also raises some substantial issues. For example,

- There is a substantive difference between the outer and inner limits of the doughnut. The outer limits are large-scale, defined in quantitative terms, and rely heavily on expert judgement that has to be trusted by policy makers and underpinned by public support. But the inner limits are minimum standards for human welfare in particular contexts, to be determined by some mix of expert and ‘lay’ judgement, using a mix of quantitative metrics and qualitative indicators. The language and processes used for dealing with
each set of limits each will differ and the people who negotiate and evaluate policy will have to take these differences into account.

• There is little guidance on how to distribute available resources within the environmental boundaries of the doughnut; only that the distribution should be ‘just’.

• It is assumed that everyone’s needs can be met within planetary limits, within an implied framework of liberal democracy where everyone has a voice. But some people and organisations stand to lose from a safe and just space and can be expected to resist movements in that direction.

Having set out the challenge of sufficiency in general terms, in the context of international agreements on climate and development, it is time to look at how sufficiency may be usefully defined in relation to energy policy and practice.

3 Defining energy sufficiency

Introducing our definition

We begin with a simple definition:

Sufficiency is an amount of something that is enough for a particular purpose. From the above, we propose this working definition of energy sufficiency:

Energy sufficiency is a state in which people’s basic needs for energy services are met equitably and ecological limits are respected.

We will also be using the term energy sufficiency to refer to an organising principle for achieving that state.

Many of the words and phrases in this definition could be questioned. What are ‘basic needs’? Why ‘energy services’ rather than energy? What do we mean by ‘equitably, and what ‘ecological limits’ do we have in mind? We explore the definition as a whole in more detail below, and set out why the definition refers to energy services, rather than energy. Then there is a brief discussion of how this definition interacts with other sufficiency definitions and the concept of sustainable energy. Following this, there is a longer discussion on the concept of ‘basic needs’, and the question of whether there can be a distinction between needs and wants (Section 4) – as this is fundamental to the idea of sufficiency.

Visualising sufficient energy services

Our definition of sufficiency mentions both ‘ecological limits’ and ‘basic needs’. The ‘safe and just space for humanity’ (as identified in Figure 1) can help us to be more specific about what is involved in achieving what is often referred to as the energy ‘trilemma’: resilience/security, adequate and affordable energy services, and low environmental impact. These are three aims which guide many governments’ energy policy. In Figure 2, our adaptation of the doughnut model, the external environmental limits relate to

• sources of energy for human use and the associated greenhouse gases and pollutants;

• materials used in infrastructures of supply and demand (that is, everything from mines and power stations to pipes, wires, transformers, buildings, vehicles, roads, machine tools, heating systems and electrical appliances);

• land and water used to provide energy services, whether this involves growing biomass, storing water for hydro generation or hosting mines and generating capacity.

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6 http://www.oxfordlearnersdictionaries.com/definition/english/sufficiency
In the inner ring of the energy sufficiency doughnut, the focus is on energy services to meet needs for shelter, health, work, mobility and communication. As noted above, these needs will vary according to local conditions. For example, concepts in health, shelter, mobility and work are being rethought along ‘sufficiency’ lines and tested in different contexts, see van Marken Lichtenbelt et al., 2017; Liddell, 2015; Anable et al., 2012; Coote et al., 2010. A recent eceee paper offers an overview of the potential for ‘non-energy policy’ in fields such as health and employment to shape radical reductions in energy demand (Royston et al., 2017).

**Energy, energy services and sufficiency**

Energy is defined as the *ability to do work*, or to bring about change. We value energy primarily for what it can do. However, energy is not simply a commodity or theoretical concept, it has social, ecological and strategic values (Stern and Aronson, 1984). These values connect with familiar policy areas: social welfare, climate and air quality protection, security and resource management. All are changing, sometimes rapidly. For example, attention is shifting from fuel availability to infrastructures of supply and demand through which renewable energy can be captured, converted, traded and set to work.

In our definition of energy sufficiency we deliberately refer to energy services - the benefits provided by energy, such as cooking, lighting, cooling, IT-based communication, automotive transport and industrial processes. However, the concept of energy services is not straightforward. Three considerations help to illustrate this. First, services have a subjective dimension and will vary according to context: they are valued for specific reasons in specific situations. Second, ambient ‘free’ energy, activities and materials can contribute to delivery of services: staying comfortably warm or cool can be a function of clothing,
activity levels, control over one’s living or work space, and other factors that are often not even considered under the heading of ‘energy’. Third, non-energy initiatives or changes can create or deny access to energy services, as when planners, innovators or natural processes alter the ‘landscape’ and possibilities for action (Geels, 2010; Leighty and Meier, 2011).

A focus on services could offer the best prospect of achieving sufficiency in terms having enough and not using too much. For example, in commercial buildings the most serious policy challenge is probably the spread and normalisation of air-conditioning, hand in hand with the growth in buildings that are uninhabitable without it. There are massive implications for both electricity demand and welfare (Wilhite, 2009; Tuohy et al., 2011). An energy services focus would allow policy to accept more flexible, adaptive definitions of thermal comfort (Arens et al., 2010, Chappells and Shove, 2007) and promote non-mechanical cooling in Europe (with implications for social and working arrangements as well as for building construction), rather than aiming for more efficient air conditioning.

**Moving beyond sufficiency as action or lifestyle choice**

Our definition of energy sufficiency is different from others currently in use. There are many references to sufficiency in the research literature in terms of lifestyle change through informed actions (behaviour changes), typically by people in affluent countries who are trying to reduce their environmental impact (e.g. Schweizer-Ries, 2008; Schmidt and Weigt, 2015). Sufficiency-as-action can be seen as extending the policy options for reducing energy demand, beyond those for improving efficiency.

While useful analyses and insights come from this view of sufficiency, and especially from the research that takes public policy considerations into account (e.g. Thomas et al., 2015), we aim to extend it, for three reasons:

- There is a risk that focussing only on sufficiency in terms of demand reduction takes attention away from the need to ensure *adequate energy services for people who do not yet have them*. That is, sufficiency can be understood in terms of social wellbeing and equity.

- When attention is focused on specific, conscious individual decisions and actions to change lifestyle, there is a danger of missing the *unconscious, routine nature* of many activities associated with energy consumption.

- *Infrastructures of supply and demand*, which greatly influence the possibilities open to individuals, may not receive enough attention if sufficiency is framed primarily in terms of lifestyle choices. Design and construction of the built environment can be crucially important in ‘locking in’ high or low consumption patterns, for example.

This paper therefore considers sufficiency not so much in relation to actions and decisions by individuals – not wishing to duplicate work done elsewhere – but as an *overall state or goal* and as an *organising principle* for policies that may go beyond traditional areas for energy policy.

**Is energy sufficiency different from sustainable energy?**

The definition of energy sufficiency proposed above overlaps to some extent with that used for sustainable development: ‘development that meets the needs of the present without compromising the ability of future generations to meet their own needs’ (World Commission on Environment and Development, 1987). It is similarly based around the idea of meeting human needs within environmental limits. However, the concept of energy sufficiency raises a set of questions which are not normally asked when discussing sustainable energy. These concern the nature and scale of energy services, and how these services are provided.

There is a danger that both ‘sustainability’ and ‘sufficiency’ come to have a motherhood-and-apple-pie quality, as general concepts that no reasonable person could object to. We

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*This may partly be due to gaps between the WCED definition itself and its use in most policy discussions, in ways that can dilute or distort the meaning through overuse and misuse (Giddings et al., 2002; O’Riordan, 2004).*
see ‘sufficiency’ as the more challenging and ambitious term, particularly in challenging ‘sustainable growth’ discourses and mainstream economic thinking. For example, sufficiency calls into question the fitness of both supply and demand infrastructures for particular services (such as thermal comfort or mobility), in particular contexts (such as apartment blocks or isolated villages). It calls for judgements on specific issues of ‘enoughness’ so that, for example, fuel and energy poverty are part of the sufficiency policy landscape (Bouzarovski et al., 2012). And it raises the difficult, unavoidable issue of distinguishing needs from wants.

4 Needs, wants and sufficiency

A long history of debate

Our definition of energy sufficiency is focused on ‘people’s basic needs’ — with the clear implication that needs are a distinct category from wants. Decision-makers inevitably have to face questions about where to draw the line between needs (and an imperative to meet them) and wants: what is essential and what might be desirable. This section explores debates about needs and wants and relates them to sufficiency.

There are complex and long-standing debates as to whether there is a distinction between human needs and wants, and if so, how this can be defined. Some of these debates emerge from philosophical / political / social science traditions, with others arising from the requirements of public policy. For example, policy constantly embodies judgements about how much income is enough for people in different situations. Davis, Hirsch et al. (2015), writing from this applied tradition, summarise the theoretical literature on needs and identify two key areas of debate:

- whether human needs have any universal or objective features;
- what an account of human need should look like, with different approaches to
  - material and non-material necessities
  - absolute and relative norms
  - expert and public/’lay’ judgement about what are necessities.

There is a smaller body of work on needs and wants in relation to energy and energy services (e.g. Darby, 2007; Wilhite and Norgard, 2003). But the same types of debate occur, as energy services can be both material and non-material requirements (e.g. warmth, cooked food, entertainment) and subject to arguments about appropriate standards (absolute versus relative). Below, we consider one particular theory of need, as an example of how needs and wants might be distinguished. Then we look at the counter-argument for there not being a meaningful distinction between needs and wants, and consider how each of these positions interacts with ideas of sufficiency.

A theory of need

Len Doyal and Ian Gough have theorised that human needs are universal and include both material and non-material needs (Doyal and Gough, 1991). This work has recently been developed further (Gough, 2015, 2017). They argue that a sound theory of need provides firm foundations on which to build sustainability targets for public policy. ‘Need’ refers to a particular category of goals which are held to be universalisable (Gough 2015:1195): indoor temperature and air quality conducive to health might be an example. The contrast with ‘wants’ – goals that derive from an individual’s particular preferences – is central to the argument. The universality of need rests on a belief that if needs are not satisfied then serious harm will result: ‘fundamental disablement in the pursuit of one’s vision of the good, whatever that vision is’ (Gough 2015:1196).

Doyal and Gough (1991) identified two basic needs: physical health and autonomy. They then asserted the universal character of eleven ‘intermediate needs’ (or needs satisfiers),
material and non-material. These were: nutritious food and water; protective housing; a non-hazardous work environment; a non-hazardous physical environment; safe birth control and child-bearing; appropriate health care; security in childhood; significant primary relationships; economic security; physical security; appropriate education. However, they recognised that the means of satisfying these needs was culturally variable. This approach of identifying universal needs, which may be met differently in different cultures and at different times, is similar to that which underlies the Sustainable Development Goals.

Gough proposes that this theory of need provides a better basis for understanding and delivering human well-being within environmental limits, than three alternative approaches: welfare economics and preference satisfaction; hedonic psychology and happiness; and the capability approach developed by Sen (1999).

The capability approach

It is worth saying a little about the capability approach here, as it offers a contrast to more individualistic framings of needs and wants and opens up possibilities for thinking about sufficiency. Sen offers a relatively positive outlook on the difficult issue of assessing need, focussing not so much on what people have as on their state of being and what they can do (for example, being adequately fed, mobile and literate); on social arrangements as well as individual capacities (Robeyns 2006).

A capability approach applied to energy service needs could show that, for example, if someone needs to visit a doctor, this need may be met through highly-distributed, accessible medical services, or more centralised services that require high-quality public transport systems or easy access to private vehicles. This arguably offers a broader and more socially-based approach to human wellbeing than an approach based on a list of intermediate needs (Holden et al., op. cit.), and that is why we include it. But the capability framework offers no escape from questions such as how preferences – especially ‘expensive tastes’ – are generated and addressed. Which capabilities are most worthy of attention? And at what level of aggregation should they be considered – the capable individual, neighbourhood or city, for example? (ibid.)

Needs and wants – who decides? An empirical example

There has been little debate about whether experts or public judgement should define energy or energy service needs. In areas where absolute needs have been agreed and adopted into various policies and standards, these have typically been set by experts, e.g. Public Health England’s guidance for minimum indoor temperatures in winter (PHE, 2014).

The literature indicates that, despite arguments against the existence of objective human needs, everyday language suggests that laypeople instinctively feel that they do exist and can be identified (Davis et al., 2015). The Minimum Income Standard (MIS) these authors have been instrumental in developing seeks to cut through much previous debate about what can legitimately be considered a ‘need’ within a society, by asking the members of that society to make a collective judgement about what to include. It enables and records public discussion that produces not just lists of agreed necessities but a set of rationales that tell us why certain items are included and others are not (ibid., p.17). Such discussions could themselves be seen as part of a process of creating and maintaining a sufficiency-based society.

The Joseph Rowntree Foundation has sponsored research on the incomes that people need in order to reach a minimum, socially acceptable standard of living in the UK today (Davis, Hill et al. 2016, Padley and Hirsch 2017). This Minimum Income Standard (MIS) is calculated by specifying ‘baskets’ of goods and services required by different types of household in order to meet these needs and to participate in society. The minimum is defined as follows, based on consultation with groups of citizens:
A minimum standard of living in the UK today includes, but is more than just, food, clothes and shelter. It is about having what you need in order to have the opportunities and choices necessary to participate in society. (Padley and Hirsch 2017:3)

The original research for the MIS was carried out in 2007 and the findings were presented in 2008, using April 2008 prices. Every July, new MIS figures are published in the UK reflecting not only inflation but changes in the list of minimum needs that are based on new primary research every two years. This process ensures that the MIS is continuously updated to reflect social and economic change, although the overall pattern of minimum household requirements has remained relatively stable since 2008 (Davis, Hill et al. 2016).

The researchers note: ‘...a minimum is about more than survival alone. However, it covers needs, not wants; necessities, not luxuries – items that the public think people need in order to be part of society’ (Padley and Hirsch 2017:4). The social aspect of this definition is noteworthy, bearing some relation to the ‘capability’ approach to wellbeing and the need to function as a social being.

The assessment of minimum standards for household energy use in the MIS relies heavily on expert rather than lay judgement; the standard of energy services used in the modelling is not explicitly stated and was not opened up for discussion by researchers or the research participants during the process of drawing up the standard. However, the process is explained to some extent: the MIS case study takes energy use to be a function of dwelling size and assumes that typical housing will have gas central heating with a radiator in each room. A fuel expert calculates energy requirements for cooking, lighting, heating etc. based on typical room dimensions and insulation levels for the kinds of housing relevant for each of a number of household types and sizes (Davis, Hirsch et al. 2015:54).

The MIS is important in showing that it is possible, through careful participatory research, to reach social consensus on what minimum needs are in a given time and place, and that this consensus may be stable, at least over the short to medium term. This offers some prospect of operationalising the concept of sufficiency, as discussed above in relation to the ‘Doughnut’ model of a safe and just space for humanity.

**Needs and wants as indistinguishable**

Energy services, want and need are central to the sufficiency debate, but there are both theoretical and empirical grounds for thinking the distinction between needs and wants is neither meaningful nor helpful. Considering theory first, the basis of welfare economics and preference satisfaction is that individuals are the best judges of their interests or preferences / wants (as noted in Gough, 2015). The principle of consumer sovereignty follows from this: that what is produced and consumed should be determined by individuals’ private consumption and work preferences. Therefore there can be no valid distinction between wants and needs. This approach fits with mainstream political thinking in many parts of the world and with the neoclassical economic paradigm. There is, however, a significant omission in that publicly-provided or free goods such as fresh air, cycle lanes or street lights are not covered adequately by preference satisfaction theory.

Sen’s capability approach to human welfare also does not distinguish between needs and wants, although it does take public goods into account more fully. This proposes that individuals with more internal ‘capacities’ (e.g., education, mental health, physical strength) have more capabilities (more available choices, more freedom) and can fulfil more of their needs. There is no upper limit on many of these capacities, though: at some point wants may again merge into needs and the environmental costs of meeting them become unsustainable.

Wilhite (2016) makes a strong case for a low carbon transition, without invoking arguments about needs and wants. He lays out a theory of habit, arguing that it can provide a conceptual frame that acknowledges deeply held collective and individual dispositions for high energy consumption and provide insights into how low carbon policy can engage with high energy habits. This theory suggests more infrastructurally-oriented policies for reducing carbon emissions that would, for example, reduce working hours and change the nature of work; make collective transport more convenient and reasonably-priced; reduce
the size of homes; increase the sharing of living spaces and products; and reduce the
dependency of food systems on refrigeration.

Empirical data demonstrate how there has been constant renegotiation of what may be
considered as basic needs, usually in the direction of increased consumption of energy and
other resources (Wilhite and Lutzenhiser, 1997). This process is continuing. For example,
average living space per person (and the energy needed to service it) continues to increase
in most developed countries, and the use of refrigeration, cooling and other energy services
is increasing rapidly in developing countries (Wilhite, 2016). What was once an expensive
service, only accessible to the most privileged people, can become cheap and commonplace
within a few decades or less. The supply of energy services such as refrigeration, automotive
transport and air-conditioning has become so entrenched in many parts of the world,
transforming want into need and start-up company into multinational giant, that we not
only see massive environmental impact but also complex systems of provision held in place
by law, custom and physical infrastructure. These are not easily dismantled.

Moving beyond the needs/wants controversy

Whether or not a school of thought holds that needs can be distinguished from wants, there
is agreement that human wants/needs are met in ways that vary over time and between
cultures. Work on the Minimum Income Standard shows a workable method for
distinguishing needs and wants at national level, and that consensus can be reached on this
and updated to take account of social change. For the ten years over which this definition
has been reviewed in the UK, perceived needs did not increase significantly and some
decreased. However this has been a period of low economic growth and ‘austerity’ (low
investment in public services), and over longer time scales we might expect the minimum
needs identified to increase.

Policy responses to high levels of consumption can sidestep a ‘needs and wants’ framing,
focussing more single-mindedly on environmental goals and the achievement of these in
ways that are socially just. Yet in practice, debate and negotiation about environmental
goals almost inevitably raise questions of equity, needs and wants. The early arrival of
‘grandfathering’ as a contentious issue in the Kyoto negotiations illustrates this. Even if, in
principle, it is not necessary to think in terms of needs and wants, they are hard to avoid in
politics. Disagreements on this issue are certainly worth considering further. However, they
need not stand in the way of action to take European consumption patterns in a new
direction. While recognising the needs/wants debate is complex and unresolved, we take
the position that distinguishing needs and wants by social consensus has been shown to be
possible; such consensus can be a useful input to policy. Therefore we continue to use the
definition of sufficiency outlined earlier and offer some thoughts on how it can be put into
practice.

5 From concept to implementation: some
energy sufficiency issues for Europe

Sufficiency may be seen as both positive (the satisfying good life, the common good,
flourishing ecosystems etc.) and negative (limits that must not be exceeded) (Darby, 2007;
Parag and Fawcett, 2014; Princen, 2006). When putting it into practice, it is necessary to
address fundamental questions about what a basic need may be and what energy services
have to be sufficient for? Going into a little more detail, other questions arise such as

  • How much do we need to take into account regional or local ecosystem conditions along
with planetary limits to growth?

  • How do needs for energy services/consumption differ in different parts of the world, and
what does that mean in terms of equity?

  • At what scale(s) is sufficiency most effectively addressed – neighbourhood, city region,
nation, continent, all of these? Do the answers vary according to whether we are talking
about built environment, supply infrastructures, social norms or appliance standards?
• What timescales does sufficiency operate on? Some energy-consuming activities are more time-sensitive than others; flexibility is increasingly important in the operation of electricity systems, in particular.

• How might sufficiency policy address the dynamism and uncertainties of product and system development?

The challenge of putting the concept into practice can therefore be framed in many ways, depending on policy priorities and context. We can only begin to outline the considerations here but offer some reflections on scale, timing, demography, equity and technological development.

**Scale**

Of the environmental limits identified in Figure 2, the ‘climate change’ limit is global. Carbon and other GHG emissions limits are generally set on a national basis: this has been the approach of all international UN negotiations on climate change. Yet context and scale influence the impact of emissions: for example, particulate carbon from burning ‘dirty’ fuel will have a different impact from carbon dioxide gas released during the making of cement, greenhouse gases emitted at high altitudes from planes will have a different impact from those emitted at ground level (Jardine, 2005), and pollution from vehicle fumes has greater impact in urban than in rural areas (Brand and Hunt, 2018). Emissions can be experienced locally as pollution, in addition to contributing to climate change globally, and will then affect health and wellbeing – on the inside of the doughnut – as well as moving humanity close to planetary limits.

Scale clearly matters when it comes to governing energy systems (Goldthau, 2014) and the principle of subsidiarity in EU governance is relevant here (e.g., Collier, 2007). Within the EU, air quality standards have been set across all Member States but national, regional and local authorities need to develop their own air quality plans and act at different scales in order to meet these uniform standards. For example, the Austrian energy regions, also known as Climate and Energy Model Regions, are ‘organizations who envision energy self-sufficiency by using regional energy sources and by building a decentralized energy infrastructure’. Launched ‘bottom up’ by local people, the regions are small in size, undertaking a range of actions from advice to householders and businesses to investment in low-carbon transport infrastructure such as cycle lanes. The energy regions are expected to deliver a range of social, economic and environmental benefits (such as those in the inner ring of the doughnut), to municipalities, businesses and residents (Fritz 2017).

**Timing**

Practitioners, researchers and policy makers pay increasing attention to when energy is used – seasonally, weekly, diurnally, or even (for electricity) from minute to minute and second to second. Space heating and cooling are only required at certain times of year and a supply that is sufficient in summer may not be sufficient in winter, or vice versa; electricity demand fluctuates through the day and the week, not always predictably; distributed generation and new end-uses such as heat pumps and electric vehicles pose major challenges for system management on different timescales. Networks are sized to deal with peak demand and ‘sharp’ peaks mean a lot of underused capacity: shifting usage away from peak times can be very valuable at system level (Pudjianto et al., 2014) but may reduce energy service levels at times (Bozarovski and Petrëva, 2015). As renewables are integrated into electricity networks, a combination of demand, storage and supply need to be flexible and sufficient for agreed energy services at particular times and in particular places, as well as being sufficient to enable the whole system to operate effectively.

‘Time of use’ is a growing consideration, then, and so is ‘use of time’: the pace of human activity. Here ‘non-energy energy policy’ has potential, for example in relation to working hours, school holidays, public holidays and daylight saving (Darby, 2007; Walker, 2014; Royston et al., 2017).
Demography

The challenge of meeting peoples’ basic needs within ecological limits depends not only what we define as needs and limits, but also on the number of people. Within the EU, our population continues to grow, but the growth is both fairly slow and unevenly distributed. For example, while the population of the EU-28 as a whole increased during 2016, that of 10 Member States declined (Eurostat 2017a). Population growth, or decline, and the factors which cause it (particularly migration) are of considerable political concern, and unlikely to be addressed through the lens of energy sufficiency.

However, average household size is also related to energy use, and this may be an area where policy development could be considered. Smaller households require more energy to deliver energy services per person than larger households (Boardman, Fawcett et al. 1997), so a trend to smaller households also increases aggregate energy requirements, other things being equal. In Europe the number of households is rising more quickly than the number of people, as average household size continues its long term decline. Average EU household size was 2.3 in 2015, varying from 1.8 in Sweden to 2.8 in Croatia and Slovakia (Eurostat 2016). The energy implications of this trend could indicate a need for policies to encourage living arrangements with more resource-sharing and easy access to community-based services (e.g. mixed-use neighbourhoods, distributed health facilities).

Equity

Energy sufficiency requires us to consider equity. At a minimum, our definition requires that everyone has access to a socially-agreed minimum set of energy services. Further, we might want to expand this to claim that access to energy services should be equitable. We are not offering a precise definition of ‘equitably’ for use in our formulation of sufficiency, primarily because this is a huge topic. Discussions about equity take place against a background of growing income and wealth inequalities in the developed world (Freeland 2012, Dorling 2015). In 2015, a population-weighted average of national figures for each of the 28 EU Member States shows that the 20% of the EU population with the highest equivalised disposable income received 5.2 times as much income as the 20% with the lowest (Eurostat, 2017b).

Greater public concern about inequity and fuel/energy poverty, if translated into political action, could assist in enabling more people to meet their basic energy service needs and in increasing equity (note that the first of these can be met without the second). There is some prospect that inequality and fairness will become more important policy issues as carbon-based energy supply declines, as required by the Paris Agreement (UNFCCC 2015); also some evidence that people are increasingly concerned about inequality in general terms. For example, the idea of a basic income (periodic cash payments available to all, unconditionally) is gaining traction across the political spectrum, e.g. in Belgium, Finland and the Netherlands. A comparable approach to reducing the risk of fuel poverty would involve investing in the building stock so that all housing would be of sufficient quality to allow those on low incomes to experience adequate thermal comfort (Boardman 2010, 2012). This too establishes an agreed minimum for everyone.

Technological development

Technology is obviously very significant in terms of both energy services and ecological impact. Much new technology in the EU is ICT-enabled. As noted above, energy policy is increasingly concerned with system flexibility. ICT began ‘smarterning’ electricity systems at high-voltage level decades ago and is now being used more widely to improve demand flexibility via direct load control or demand response. This raises many issues relating to demand-side infrastructure, customer-technology interactions, tariffs, privacy, security and regulation (Darby and McKenna, 2012). There is room here only to make a few cautionary points about smart technologies in relation to energy sufficiency:

9 https://www.theguardian.com/world/2016/jun/02/state-handouts-for-all-europe-set-to-pilot-universal-basic-incomes
• much of the research and marketing literature about the impact of smart technology on energy use is based on optimistic assumptions about real-life outcomes. Ecological impacts are rarely addressed in ‘smart’ designs and there are strikingly few published evaluative studies (Ahvenniemi et al., 2017; Darby, 2018);

• the term ‘smart’ covers a wide range of socio-technical configurations and functions. It is therefore hard to generalise about it and important to try to understand why a particular ‘smart solution’ might be used or proposed for a particular purpose;

• connected appliances mean increased standby consumption; this will mean substantial extra load if the Internet of Things grows as anticipated (Kyburz, 2016);

• smart technologies, though often introduced with an aim of reducing or eliminating ‘human error’, are used by and for humans. Qualitative and quantitative outcomes can emerge far from what designers and policymakers intend, in domestic or commercial settings (Nyborg and Røpke, 2013; Bordass and Leaman, 2013; Hargreaves, Wilson and Hauxwell-Baldwin, 2017).

A questioning approach to claims that smart technology will contribute to energy sufficiency is called for, given these uncertainties.

6 First steps towards policy

In this section we consider a number of ways in which current EU and member state policies on energy and energy efficiency could be oriented towards delivering energy sufficiency.

Developing policy around energy services

By taking a service focus, policy can be expanded to look beyond energy and energy efficiency, to other factors which can influence levels of energy needed to deliver the desired services. For example, a number of concepts are already used to think about buildings and energy, and to set building standards. These include low energy; passive; green; nearly zero energy; net positive; and long life, loose fit buildings. All imply a strong focus on reducing energy use and/or making the most of renewable energy provision and passive design. They also have long-term and structural implications.

In policy terms, developing sufficient energy services this could include

• integrating thinking about systems of service provision and energy supply;

• prioritising the use of ambient, untraded energy services (e.g. passive house design, natural cooling and ventilation);

• valuing and enabling adaptive and non-expert ways of achieving comfort in buildings (e.g. Royston, 2015);

• developing skills and practical know-how for the above (Janda et al., 2014; Burchell et al., 2015).

If sufficiency is going to be a useful idea to bring into building design and maintenance, it needs to offer something distinctive that is not encompassed by existing concepts and standards. Some of the services provided by buildings could be talked about and evaluated in terms of sufficiency, e.g. thermal comfort, hot water, lighting, indoor air quality. Some have legal minimum standards for people to thrive and carry out their work satisfactorily and there is arguably a need to revisit these in order to assess their fitness in different situations (e.g. Energy Performance in Buildings Directive definitions of comfort; the adequacy of EPC as a predictor of consumption), and to accelerate the process where this has already begun. The aim would be to replace them with metrics and indicators that take greater account of social, institutional and activity dimensions of energy use.
Moving from efficiency to demand reduction

Energy sufficiency will require a reduction in energy consumption. Most energy policies, whether originating in member states or at EU level, are efficiency- rather than consumption-focused. However, a number are explicitly set in terms of consumption (Table 1). There have been, and continue to be, debates on whether particular policy instruments, such as product minimum standards and energy labels, could or should be re-focused on consumption.

Table 1. Examples of current energy policies which focus on consumption or efficiency

<table>
<thead>
<tr>
<th>Consumption</th>
<th>Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy or carbon taxation</td>
<td>Minimum standards</td>
</tr>
<tr>
<td>Metering</td>
<td>Energy labels</td>
</tr>
<tr>
<td>National energy reduction targets</td>
<td>Building regulations</td>
</tr>
<tr>
<td>Speed limits</td>
<td>Energy efficiency obligation schemes</td>
</tr>
</tbody>
</table>

It might not be necessary to have consumption-focused policies: energy efficiency policies can deliver reductions in consumption. For example, between 2004 and 2017 gas consumption in UK homes has fallen by 25% and electricity by 15%, despite growing population and household numbers. Prior to that, it had risen fairly steadily since the 1970s (BEIS, 2018). Most of the decrease has been attributed to the increasing energy efficiency of homes and the equipment within them (Palmer and Cooper 2013).

However, other member states are not experiencing the same decrease in energy use, e.g. Denmark (Gram-Hanssen, 2017), despite having strong efficiency policies. Efficiency is unlikely to take us far enough down the road to sufficiency in a future where rapid and sustained carbon reductions are required (Fawcett 2016). More generally, making consumption reduction an overt goal of public policy could be an important move, and targets based on consumption might invoke different economic, psychological and social responses to those based on efficiency.

Focus on products and infrastructure

People and organisations access energy services through technologies, systems of provision and infrastructures. In some cases, needs and wants are supplied by the same technologies. For example, modern heating systems and buildings can deliver a variety of internal temperatures and living or working conditions. In other cases the technologies’ primary function may be to deliver energy services in the ‘wants’ or high consumption class. Examples in temperate countries could include air conditioners, high-flow showers or heated conservatories.

Policy on products, infrastructures and services could deliver systems with lower environmental impact by focussing more on human and ecosystem needs. A rethink of approaches to living and working in hot weather, drawing on vernacular architecture and traditional rhythms of working, is called for and this will mean challenging current building codes, building service standards and a construction and building services industry with an interest in multiplying wants. The aim could be an end to new air conditioning in Europe and the phasing out of existing air conditioning: a tougher prospect than the shift from incandescent to LED lighting, but not impossible. The focus of policy would move from delivering efficient air conditioning to delivering low-environmental-impact (sufficient)

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10 This case has been made for the related idea of introducing personal carbon emissions limits (Parag and Fawcett, 2014)

11 As heat pumps can be operated in reverse, this is unlikely to be fully achievable. But the main aim should be to avoid construction of buildings that are only habitable with some form of air-conditioning, and to convert air-conditioned buildings where possible to mixed-mode or free-running buildings.
thermal comfort. People's need for comfortable living and working spaces can still be met, but in a quite different way. Further examples of an integrated approach to sufficiency through products, infrastructure and services would be investment in cycling and walking infrastructure, or in low-carbon building renovation.

**Policy distinction between needs and wants, lower and higher consumption**

If, as we argue, a sufficiency framing depends on a distinction between energy service needs and wants, then policy can set in place processes by which people can reach some consensus on basic needs. At the same time, it can seek to treat needs and wants differently. Below, we outline two contrasting approaches to promoting sufficiency, by focusing on individuals with high personal energy (service) consumption or by taking social practices as a starting point and working more indirectly to promote change.

**Individuals**

Making a distinction between needs and wants entails moving from abstract concepts to particular descriptions and numbers, and applying these to individuals. Translating Doyal and Gough’s ‘protective housing’ need, or Figure 2’s ‘shelter’ and ‘mobility’ needs, to space per person and energy service standards in housing is likely to be challenging, for example. The boundary between needs and wants could be set in terms of a current socially acceptable minimum (the Minimum Income Standard approach). Another starting point would be to distinguish ‘luxury’ or particularly high personal consumption (discussed in more detail in Fawcett, 2016). Luxury consumption may be important to target in terms of its impact on total carbon emissions – something empirical research could establish. It may also be significant because of its function in increasing general consumption through conspicuous consumption, positional goods, status, identity creation etc. (Kenner, 2015).

To take the example of leisure air travel, where number of flights per person and carbon intensity per journey vary hugely, there is a clear case for considering the distinction between needs, wants and luxury consumption. No air travel is included in basic needs, as defined in UK empirical research (Davis, Hill et al. 2016). However, campaigners wanting to reduce air travel suggest making a distinction between frequent flyers, and other flyers, with one tax free flight per person per year – suggesting this is a basic entitlement (http://afreeride.org). Options such as first class, business class and private flights all emit more carbon emissions per person than standard flights, and are generally considered as being in the luxury category. Thus there are choices to be made about what levels of activity are to be discouraged or banned, especially if all air travel is defined as being in the ‘want’ category. This would also apply on the supply side, and new airports, if judged as supporting only high-carbon wants, would not be built.

A focus on the individual could consider their total personal carbon emissions resulting from energy use. This idea has been explored in ‘personal carbon trading’, an approach for reducing emissions that is usually applied to residential energy use and personal travel (Fawcett and Parag, 2010; Parag and Fawcett, 2014). Individuals are each given an equal carbon allowance, which reduces over time, in line with national carbon reduction goals, and are free to choose which carbon-intensive energy services they use. Although this idea does not rely on a policy distinction between wants and needs, sufficiency is incorporated within it. The personal allowance would be expected to set a strong social norm around acceptable consumption, although people can access additional energy services by buying further allowances.

**Practices**

Practice theory in various forms is becoming influential in social scientific research into energy demand. This offers a model of ‘distributed agency’ that highlights ways in which

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12 This section of the text uses the language of ‘needs’ and ‘wants’, but the discussion could instead be read as being about low- and high-consumption choices, and is relevant for readers who do not consider there to be a distinction between needs and wants.
‘elements’ such as meanings, materials, skills, technologies, rules, skills and knowledge combine to make up everyday social practices (Hampton, 2017). A practice framing highlights ways in which energy is bound up in the broader ‘doings and sayings’ of everyday social life.

Thinking about practices may allow a more detailed understanding of particular energy service needs and wants within homes and organisations, such as comfort or cleanliness, and can open up additional routes to change. Analysis of meanings – of how people understand and communicate different types of energy service – can help inform policy around luxury or high consumption in general, or contribute to a better understanding of a service such as thermal comfort or adequate lighting is, and the different ways in which people achieve it. A focus on skills, rules and competences could contribute to more effective policy on education and the development of individual and collective capability for low-impact living.

**Taking a broad view of sufficiency: ‘non-energy’ policy**

All policies that influence daily practices will have energy impacts, so the scope for sufficiency policy is very wide indeed. Indeed, there is a move towards developing ‘non-energy policy’ that could achieve more radical reduction in energy system impact than is possible through direct approaches. So far there has been little systematic analysis of non-energy policy, and the knowledge that does exist is often not integrated across disciplines and sectors (Cox, Royston et al. 2016). The concepts associated with both non-energy policy and capability are not far apart and it could be fruitful to research them together. As already discussed, making distinctions between needs, wants and luxuries, whether at the level of individuals, services, infrastructure or practices, would be challenging enough. The question of how services are distributed between people and organisations within the ‘sufficiency space’ of the doughnut – what equity is taken to mean – is even more difficult. Some of the broader distributional issues raised by sufficiency are addressed by Benbaji (2006). As energy issues are more of a problem for some people than others, and in different ways, we can expect that policies to address energy sufficiency will be political and controversial: but in order to be effective in meeting both climate and development goals, they will need to address demand reduction as strongly as carbon-free supply (Willis and Eyre, 2010). Such a basis for policy would very different from the perceived neutrality of efficiency policy.¹³

### 7 Summary and conclusions

In this paper we have attempted to define and discuss some of the issues raised by energy sufficiency as a concept and to offer suggestions as to how sufficiency policy might be shaped in Europe, starting from the definition that ‘energy sufficiency is a state in which people’s basic needs for energy services are met equitably and ecological limits are respected.’

The meaning of sufficiency in relation to energy is thus based on quantitative assessments of resource availability and sustainable depletion rates, and on qualitative judgements on acceptable levels of energy service. Sufficiency policies have to recognise and address both.

While recognising the value and role of sufficiency actions and individual lifestyle choices, we used the opportunity offered by eceee and the KR Foundation to look at sufficiency in broad terms, including the concept of capability and the significance of infrastructure and complex socio-technical systems.

The framework of the ‘doughnut’ was used to show how, in an energy-sufficient world, planetary limits would not be breached by providing humans with basic energy services. We have also shown that there are ways in which societies can reach fairly stable consensus on distinguishing between wants and needs, and such consensus can be important in shaping and supporting policy.

¹³ Efficiency policy also embodies political and economic judgements, but these tend to be overlooked.
We pointed to the Paris climate agreement and Sustainable Development Goals as major international commitments supported by the European Union. In theory, these should be compatible; in practice, they may pull policymakers in opposite directions, primarily because the pursuit of economic growth is a feature of the SDGs.

Many authors have already contributed to the debate on sufficiency and some are referenced below. Concepts that we found helpful in the research literature included energy services, capability, social consensus on basic needs, infrastructures of demand and supply, scale and timing. Each could act as the theme for a sufficiency policy brief in its own right.

We suggest the following as some opportunities for developing energy sufficiency-based policy:

- continued analysis of the implications for sufficiency policy of the Paris Agreement (for outer boundaries of the ‘doughnut’) and of SDGs (for the inner ring);
- developing methods for building agreement on minimum standards for energy services;
- revision and rethinking of building standards, including urgent attention to halting and reversing growth in air-conditioning;
- addressing questions of excessive/aspirational consumption and fostering environmentally-healthy social norms;
- developing supportive non-energy policy, e.g. in relation to health and mobility, working hours and skills development for low-impact working and living;
- building sufficiency considerations into smart grid development, recognising efficiency/flexibility trade-offs;
- based on the subsidiarity principle, continuing to promote regional and local sufficiency policies within international/EU framework.

Sufficiency can be used as an organising principle for living within ecological limits. Putting it into practice is a huge task and we have only begun to outline some of the aspects of this, taking a look at some of the main issues that are likely to face policy makers who want to incorporate the idea of sufficiency into workable policy. While recognising that sufficiency will always be contentious, we see it as an important concept to feed into policy at a time when so much is at stake for climate, biosphere and human welfare. It means facing up to the need for substantially different ways of life from those we are used to, which will still have to emerge from existing materials, institutions, ideas and processes. The figure below (Figure 3) illustrates some ways in which we see ‘flowering’ from existing policies and practices; readers may want to fill in the remaining petals with their own ideas.
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