Policy and extreme energy consumption

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Paper prepared for DEMAND Centre Conference, Lancaster, 13-15 April 2016

Abstract
Some UK households and individuals use vastly more energy than others. Nationally, reducing personal demand for energy is an important part of meeting the commitment to reduce carbon emissions. However, despite occasional attempts to identify and stigmatise particularly 'excessive' gadgets or activities, energy policy has not been framed around reducing excessive consumption. By bringing empirical evidence about variations in energy consumption together with the history of policy debate on limiting energy use, this paper considers whether concepts such as excessive or luxury consumption can form the basis for policy.

An overview of empirical data, based on existing statistics and surveys, provides context. This shows that energy use in the home and for personal transport varies hugely between households and individuals in the UK, even within the same income decile. A brief historical survey, both in terms of averages and variation across the population, shows changing patterns of consumption, including recent reductions in residential energy demand. The evidence demonstrates that the difference in consumption between low and high energy using households is just over a factor of two, and that household energy consumption rises much less strongly with income, than, say, transport energy use.

The history of UK policy engagement with limiting energy consumption is described, with most attention paid to residential energy use. Case studies of policy proposals to constrain high consumption illustrate how these ideas have been considered. Cases include rising block tariffs, standing charges and energy tariffs, and arguments about the proper basis for EU product energy labels and minimum standards (efficiency versus absolute consumption). These suggestions for policy re-orientation have not been adopted in the UK, where most current residential energy policy is based on efficiency. However, some elements of policy are based on consumption, and these are briefly described.

In the discussion, these different types of evidence are brought together. Policy based on consumption could be designed in a number of different ways. It could focus on individuals and households, or on products and homes, or a combination of both. For households, policy could aim to reduce consumption across the whole population, or focus primarily on high consuming households. There are a number of reasons - from the pragmatic to the principled - for focusing on high consumption, but as yet little understanding of what this might mean in policy terms. Many interesting questions remain as to whether a focus on high consumption should have a place within residential energy policy.

Key words: energy policy, excessive energy use, sufficiency, residential energy, UK

Introduction

Globally, wealth inequality is increasing. In 2015, the top 62 individuals had the same wealth as 3.6 billion people – the poorer half of humanity. This figure is down from 388 individuals as recently as 2010 (Oxfam International 2016). Research focused on the inequality between the top 1% and the remaining 99% shows how this group is increasingly accumulating wealth at the expense of the rest of population (Freeland 2012, Dorling 2015). Beyond these very wealthy individuals, there is also considerable inequality of wealth and of consumption within the remainder of the income spectrum. There is growing concern about the social impacts of inequality, but so far little work on the links between inequality, high consumption of energy and resources, and environmental impacts. Kenner (2015) has begun work in this area, considering the links between inequality and overconsumption, by focusing on the ecological footprint of the richest, but much remains to be done.

Inequality and issues of fairness may become more important in an era of more radical reduction in carbon-based energy consumption, as required by the targets set in the Paris Agreement 2015 (UNFCCC 2015). However, in term of policy making around energy and carbon emissions, little attention has been paid to high personal energy consumption thus far. There are very good reasons for energy policy to have shied away from issues of absolute consumption: it is politically and socially contentious. The question for this paper is whether it is now time to change that approach. And, if so, what might an energy policy which focused more on higher consumers, or higher consuming energy using equipment and homes, look like?

This paper is exploratory in nature, and uses existing data and literature to consider the issues around energy policy and consumption, with particular focus on the residential sector. It explores firstly what high or excessive energy consumption is, with reference to ideas of sufficiency. Then data is presented on changes in energy consumption patterns over recent decades, and links between energy consumption and income. The relationships between energy policy, energy efficiency and energy consumption are discussed, with three options for re-orientating policy from efficiency to consumption described in detail. These issues are brought together in the discussion to consider whether energy consumption, and high or excessive energy consumption in particular, can or should be an element of residential energy policy. The paper concludes with suggestions for issues to be explored further.

What is extreme energy consumption?

This paper is primarily concerned about energy use in the residential sector. One way of understanding energy use, is that is a means of providing energy services, such as warmth, light and clean clothes. Then, the energy efficiency of buildings and energy-using equipment determines how much energy is needed to provide a given level of service. This explanation largely misses out the role of people, society and socio-technical interactions. A more nuanced and complex description of these relationships is given by practice theory (Shove, Pantzar et al. 2012). However, this paper generally uses a simpler framing of energy consumption.

What is considered normal and excessive consumption constantly changes, varies across time and space, across social groups and between individuals (Wilhite and Lutzenhhiser 1997). This is illustrated nicely by information about British expectations around standards of home heating twenty years apart. In a nationally representative survey carried out in 1977, 49% of respondents agreed strongly that “it is not generally necessary to heat bedrooms”(Field and Hedges 1977). By 1996, just 3% of English households did not heat bedrooms at the weekend (DETR 2000).

Closely related to the idea of excess is that of sufficiency. Darby's (2007) review of some of the sufficiency literature shows how sufficiency is both a quantitative and qualitative concept. Where energy services are concerned, it involves setting minimum standards for services as well as for the technology that provides them, as well as maximum permissible environmental impacts. Defining what energy or energy services people 'need' (as opposed to want) is problematic. Dobson (1995) reflects that building a theory of need is notoriously difficult. Owens and Cowell (2002) report that there is an immense literature on the subject of needs versus wants. They found that some authors retained an aversion to distinguishing between wants and needs, while others have perceived a morally significant difference between 'goods of the needs category' and 'goods of the wants category'. Wilhite and Lutzenhhiser (1997) suggest that determining the minimum amount of resources needed for any consumption activity is fraught with both analytical and political pitfalls. They conclude that there is constant renegotiation of what are regarded as basic needs, usually in the direction of increasing consumption of energy and other resources.

There is a long history of debate over meanings of sufficiency, excess and luxury versus necessary consumption, which continues. There is no clear agreement that energy or energy service needs can be distinguished from energy wants. For the purposes of this paper, 'high' or 'extreme' energy consumption is understood as some multiple of average consumption, but a numerical value is not defined.

Patterns of energy consumption

For approximately the past ten years, energy consumption in the UK residential and transport sectors has been falling, despite increasing population and household numbers. Prior to that, it had risen fairly steadily since the 1970s (Figure 1). Most of the fall in the residential sector is due to the increasing efficiency of homes and the energy-using equipment within them (Palmer and Cooper 2013). For cars - which account for the majority of transport energy use - energy use peaked in 2002. Since then vehicle kilometres have remained about static, with decreases in energy use per km (i.e. increases in efficiency) responsible for the reduction in energy use (DECC 2015). These falls in sectoral energy consumption have come at a time when most policy has focussed on efficiency and not on consumption.

The majority of policy savings for energy 2015-2030 are expected to come from the residential and transport sector (DECC 2015).

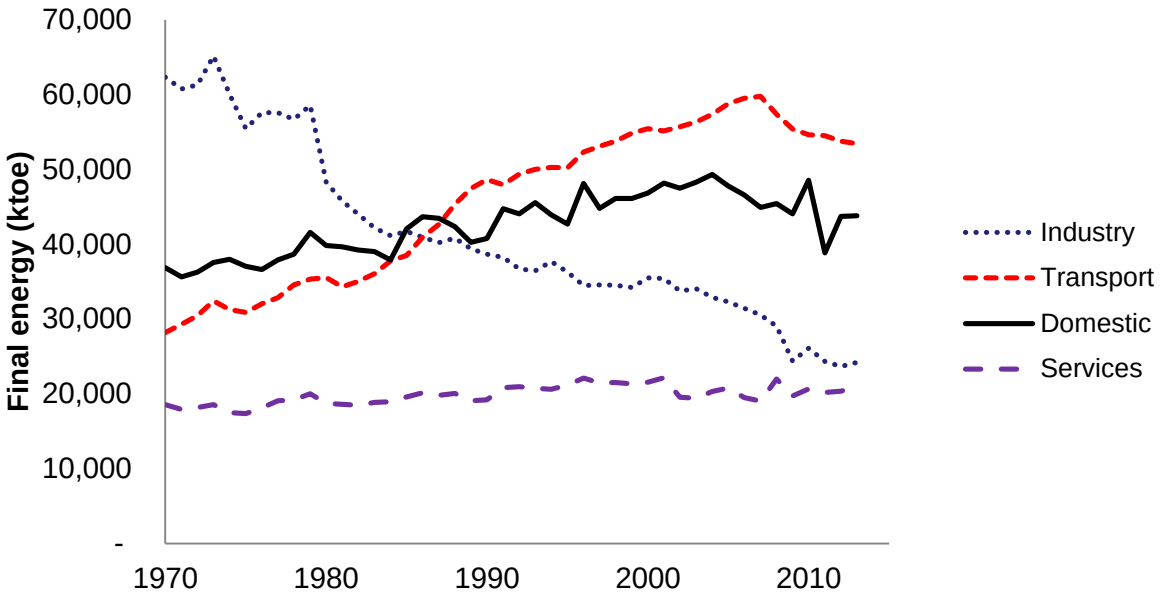

Figure 1: Annual final energy use by sector, UK, 1970 - 2013

Source: DECC 2014a

How has this change in average energy consumption affected the distribution of energy consumption across different households? Ofgem, the energy regulator, publishes 'Typical Domestic Consumption Values' which are industry standard values for the annual domestic gas and electricity used by a typical consumer. Values for 2010, 2013 and 2015 were calculated based on data from the two most recent years available, and are median values (Table 1). The methodology used for 2003 figures is unclear. The 'high', 'medium' and 'low' values are based on data from the top, all and bottom quartiles of consumption per household. Gas figures are temperature corrected (Ofgem 2015).

Table 1: Median household electricity and gas consumption in three bands, UK

Energy source	Consumption band	Median annual consumption (kWh)			
		2003	2010	2013	2015
Gas	Low	10,000	11,000	9000	8,000
	Medium	20,500	16,500	13,500	12,500
	High	28,000	23,000	19,000	18,000
Electricity: Profile Class 1*	Low	1,650	2,100	2,000	2,000
	Medium	3,300	3,300	3,200	3,100
	High	4,600	5,100	4,900	4,600

Source: Ofgem 2010, 2015

*Electricity figures for households not using electricity for heating (who have higher consumption figures).

These figures demonstrate that gas consumption has fallen across all consumption bands. Consumption in high households has fallen more than that in low households, both absolutely and in percentage terms. For electricity, and using the series 2010-2015[1], there have been small percentage reductions in all consumption bands. These data indicate that on average high

[1] The figures for 2003 are somewhat suspect. As DECC themselves reported: "Historically DECC have used mean household consumption levels of 3,300kWh/year for electricity... The exact source for these initial estimates is unclear." (DECC 2014b:52)

consuming households use somewhat over two times the gas and electricity of low consuming households, and this ratio has been roughly stable over time.

Another useful way of looking at energy consumption is to see how it varies with household income. There is no direct data available on this, but household expenditure data can be used as a reasonably good proxy for household energy use and petrol & diesel consumption in cars. It is less good on transport services (largely rail, coach and bus travel) as price is less clearly linked to energy use. Figure 2 shows how average expenditure on each of these varies with income decile. Expenditure on residential energy use rises relatively little with income, that on car transport more strongly (also shown using other data by (Brand, Goodman et al. 2013)), and other travel services most strongly of all. Data on air travel is not included in this graph, but other studies show this to be both highly variable between individuals and strongly linked to income (Brand and Preston 2010).

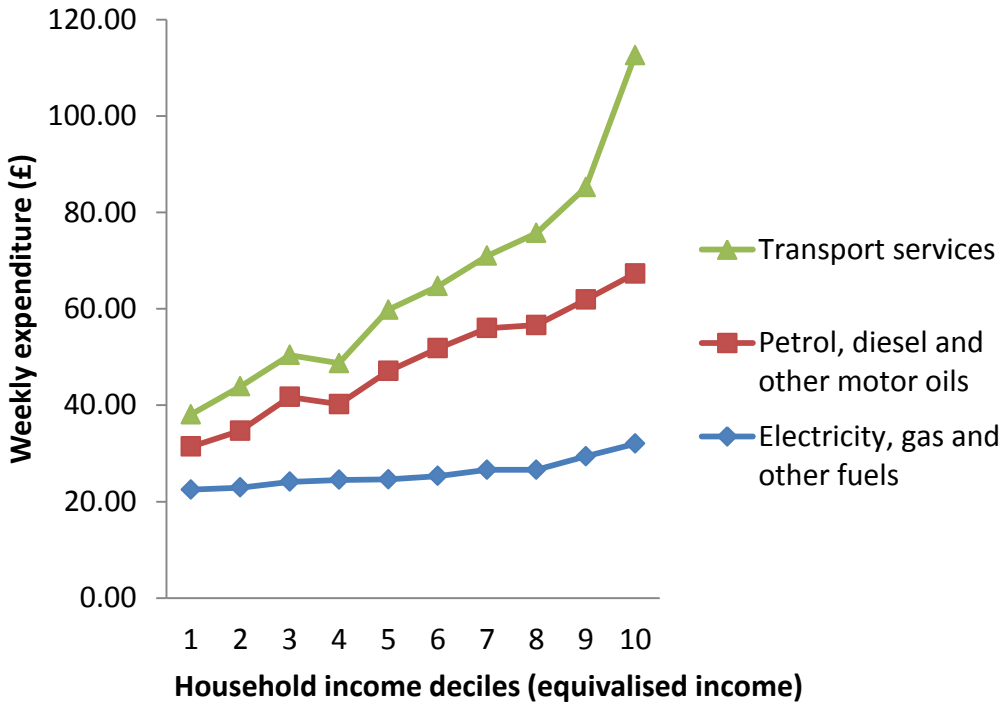

Figure 2: Expenditure on fuel and travel services by equivalised household income decile, UK, 2014

Source: ONS 2015

One interpretation of this data is that most household energy use is for essential rather than luxury services, hence it rises little with income. It also shows the variation of residential energy use with income differs from other energy-intensive forms of consumption.

These figures are just two ways of looking at consumption patterns. They miss the huge variation between individuals and households within income deciles, which are much greater than variations between deciles (Preston, White et al. 2013). A sample of residential energy use carbon emissions from just 32 households showed a ratio of 1:8 between the lowest and highest emitting households (Fawcett 2005). There is every likelihood that a significant percentage of households will have energy consumption several times the average.

Energy policy and consumption

Policy development

Increasing energy efficiency has long been the main approach of demand side energy policy. Energy efficiency can meet several different aims – reducing expenditure on energy, increasing energy security, remedying 'market failures' - and can persist through changes of political control (Mallaburn and Eyre 2013). Policy has focused largely on changing average consumption through delivering energy efficiency to all households, rather than trying to curtail higher than average consumption. To the extent that UK policy has considered differential consumption, attention has been focused on the fuel poor and low income customers – who might be under-consuming energy in relation to their needs, particularly for warmth (Boardman 2010).

For policy makers, there are very good reasons to avoid tackling consumption directly. As Darby (2007) wrote:

> *"Energy services are valued not just for themselves (heat, light) but for the activities and social relationships that they make possible….. It is easy to see why policymakers have shied away from sufficiency in favour of the concept of efficiency which, being a ratio rather than a quantity, can appear more politically neutral".*

However, energy efficiency policies themselves can also attract controversy, with negative media attention being given to the phase out of inefficient light bulbs and vacuum cleaners. The EU Commission has reportedly delayed introducing new efficiency standards for kettles and toasters, for fear of negative media attention in the UK, in the run up to the EU referendum (ECEEE 2016).

Most residential energy policies, whether originating in the UK or the EU, are efficiency rather than consumption focused. However, there are a number of policies which are set in terms of consumption (Table 2).

Table 2: Examples of residential energy policies which focus on consumption or efficiency

Consumption	Efficiency
Taxation	Minimum standards
Smart metering	Energy labels
Article 7 Energy Efficiency Directive	Building regulations
	Energy efficiency obligation
	Product bans

Energy taxation clearly directly affects consumption. Rates of residential energy taxation in the UK are amongst the lowest in the EU (Eurostat 2015) - not surprisingly given the difficult political history of energy taxation (Fawcett 2010a). The introduction of smart meters is linked to energy consumption in the sense that one of the arguments supporting this policy is that smart meters enable people to reduce their energy consumption. Most interestingly, Article 7 of the EU Energy Efficiency Directive requires all member states to reduce annual energy consumption by 1.5% per year 2014-2020, compared with a 2010-12 baseline. Due to exemptions and exclusions, in practice the target is more like 0.75% per year (Ricardo-AEA 2015). Nevertheless this is an absolute consumption target - a target which member states are largely meeting through efficiency measures.

Ideas for focusing policy on consumption

Energy policy throws up periodic debates about the extent to which high or unnecessarily high consumption should be penalised, or discouraged. These debates, in the UK, tend to have focussed on the following topics:

- Pricing structure for electricity and gas, particularly the debate about the role of the standing charge
- Labels on energy using goods– whether they should be based on absolute consumption, or the efficiency of the product, taking into account size and function
- Banning of 'excessive' products

Pricing structures for electricity and gas

In the UK, most tariffs for electricity and gas include standing charges. This is a fixed cost within the energy bill which ensures that all users share the cost of transmission, distribution, metering and billing infrastructure equally and then pay for their consumption separately. Regulatory approaches favour this type of 'cost-reflective' pricing and act against cross-subsidies between groups of customers (Baker and White, 2008).

The lower household consumption, the higher percentage standing charges are of the total bill, and the higher the effective price per kWh. This is illustrated in Figure 3 which shows how the proportion of the bill spent on standing charges reduces as consumption increases. Using the illustrative figures of £100 annual standing charge, and 15p/kWh in Figure 3, the average unit cost is 25p per unit for a household consuming 1000 kWh per year, and 17p/kWh for a household consuming 6,000 kWh/yr.

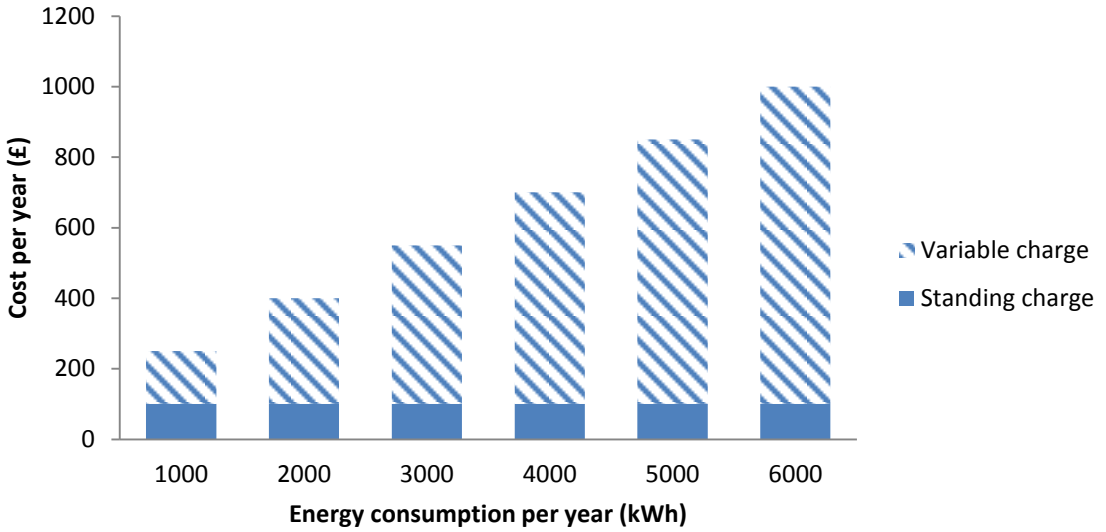

Figure 3: Annual energy bills for different consumption levels, illustrative figures

There have been long-running debates about removing standing charges from energy bills (Warren 2012). However, Ofgem has stated that it does not have the power to compel energy companies to remove standing charges. Currently, energy companies are only allowed to offer tariffs comprising a unit rate (or unit rates for time of use tariffs) and a standing charge, which may be zero (Ofgem 2016). There are a small number of tariffs available with zero standing charge, although these are thought more economical only for people living in their homes for three months or less per year (MSE 2016).

'Rising block' tariffs are one way of reversing this effect of falling prices as consumption increases. This is a tariff whereby prices per kWh increase as consumption increases. Their potential effect in

the UK has been modelled (Thumim, White et al. 2007). Rising block tariffs do exist in a number of countries, for example one of these has been introduced in Spain as part of Article 7 policies (Ricardo-AEA 2015). This is one of several options which might deliver more sustainable tariff structures, in terms of economic, environmental and social objectives (Baker and White 2008). However, none of these is on the policy agenda in the UK at present. Currently, the main focus on tariff development is in time-of-use pricing, due to concerns about peak electricity demand and the integration of renewables into electricity supply. These issues do not link strongly to consumption.

Information labels

The most visible component of EU energy efficiency policy are energy labels, which from their introduction on cold appliances in 1995 have gone on to be applied to most significant household appliances, cars and homes themselves. For homes and appliances, these labels are efficiency labels. For some appliances, particularly cold appliances and washing machines, the efficiency standards are easier to reach in larger models, for technical reasons. As a result, there has been concern that a market shift to higher efficiency might, perversely, lead to higher consumption. For cars, a different approach has been taken in the UK implementation of EU legislation, with labels on energy efficiency and carbon emissions per km being absolute values, rather than related to engine size, vehicle weight or other size characteristics of the car.

For appliances, it appears an efficiency label has generally been effective in supporting reductions in consumption as EU sales data for cold appliances (refrigerators, freezers and fridge-freezers), washing machines and tumble driers illustrates (Michel, Attali et al. 2015). For cold appliances, 2004-2014, the average declared energy consumption has been reduced by 25%, with size increasing by just 3%. Washing machines have become much more efficient, but the impact on energy consumption is less clear. The average declared energy consumption of tumble driers sold decreased both in France (by 28%) and Portugal (38%) between 2004 and 2014 (figures not supplied for EU as a whole). Fortunately the fears of efficiency labels having a perverse effect in terms of consumption have largely been unrealised.

Banning products

Inefficient products have been banned in the UK as a result of national decisions and, more commonly, as part of EU-wide policy. Generally this has led to introduction of more efficient versions of the same technologies, but in the case of lighting has led to the banning of incandescent bulbs (for all but some very specialist uses). The UK is currently planning on banning the sale or rental of the least efficient housing (F and G rated) from 2018 in the private sector. There are very few, if any, cases of products being banned due to energy consumption. There is no upper size of home which can built, supercar which can be designed or fridge-freezer purchased.

Discussion

During the past ten years, energy consumption in the residential sector has fallen significantly, at a time when most policy has promoted energy efficiency. There have been debates about redesigning elements of policy so that it does address consumption - for example by removing standing charges from energy bills, introducing rising block tariffs or by reformulating appliance EU energy labels to be based on consumption rather than efficiency. None of these changes have been made (in the UK) and energy efficiency remains the main policy approach, even for delivering EU-mandated reductions in consumption.

Policies to promote energy efficiency or to reduce consumption are clearly philosophically distinct. However, the recent success of efficiency policy in the residential and personal transport sectors could be thought to make the practical case to moving to consumption policy less clear. We don't

know whether recent falls in consumption are likely to continue into the future, or whether this is an historical anomaly due to a number of important efficiency measures being widely adopted during this period (e.g. condensing boilers, loft and cavity wall insulation, switch to diesel engines). Efficiency policy was also in place during the previous thirty years, during which time energy consumption rose considerably. It would seem unwise to assume that efficiency policies will *necessarily* continue to deliver significant reductions in consumption.

There is still a case to be made for reorienting policy towards lower consumption of energy (which is not the same as lower energy services). Briefly, energy efficiency policies cannot guarantee continued reductions in consumption, particularly if ambitious low carbon targets are to be met in the coming years. 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 efficiency policy[2].

Policies to reduce energy consumption could focus on reducing average consumption of energy, or could specifically target high consumption, and by reducing this, bring down average consumption. High consumption could be defined in terms of household consumption, or the consumption of particular products / homes, or both. Deciding which approach to take would require better understanding than we currently have on the distribution of energy consumption, particularly if we want to avoid penalising vulnerable high consumers (who exist in significant numbers (Preston, White et al. 2013)).

There are a number of reasons why policy makers might want to curb high energy consumption (as opposed to average consumption):

1. it is a significant component of total energy consumption;
2. given its aspirational status, it drives higher consumption in the rest of society;
3. it would be the starting point of reducing average consumption – unless high consumption is restrained, average consumption can't be restrained;
4. it is one component of a wider policy package;
5. it is the right thing to do – the unfairness it embodies is not acceptable.

These are different types of reasons. The first could be investigated quantitatively, as part of a wider investigation into the distributional characteristics of energy consumption. The second fits within the long history of thinking about conspicuous consumption, positional goods, status, identity creation etc. (see Kenner (2015) for more detailed discussion on this). The third and fourth are about how reducing high consumption would fit within the need to reduce total and average consumption. The final argument is a moral argument. The case for focusing policy on consumption in general would not have to include any of these arguments.

This paper has begun to consider the differences between energy policy based on consumption as opposed to energy efficiency. However, there are many unanswered questions about whether a focus on high consumption should have a place within residential energy policy. These include:

- Does unequal use of energy have any impact on the energy security, economy or climate change goals that underlie energy policy?
- Can policy based on energy efficiency target high consumption?
- Which energy policies could tackle high consumption without disadvantaging those on lower incomes / vulnerable households?

[2] This case has been made for the related idea of introducing personal carbon emissions (Fawcett, 2010b, Parag and Fawcett, 2015)

- High consumption can be defined in terms of individuals, households or the things they own and use. Which would be more effective, efficient and equitable?
- Does high consumption refer to the top 10 / 1 / 0.1%?

Conclusions

This paper has begun to consider the differences between residential energy policy based on consumption as opposed to energy efficiency, and the reasons why that change might be required. Recently, energy efficiency policy has delivered considerable savings in energy consumption, and specific policy options for reorienting policy from efficiency to consumption, while debated, have not been taken up. However, there is no guarantee that efficiency can continue to deliver reductions into the future.

Limits to consumption are much harder to agree than limits to (in)efficiency, which involve judgements about technologies and cost, rather than how much is enough. To make progress with exploring consumption limits, a better understanding of patterns of household energy consumption, variability between households, links to income, and the relationship with energy services will be important. Defining over-consuming products may be less difficult, but has generally been avoided to date, with standards, labels and performance requirements being set in terms of efficiency. Most energy policy is set in terms of efficiency, but there are a number of interesting exceptions.

Policy based on consumption could be designed in a number of different ways. It could focus on individuals and households, or on products and homes, or a combination of both. For households, policy could aim to reduce consumption across the whole population, or focus on high consuming households, and thereby reduce average consumption. There are a number of reasons - from the pragmatic to the principled - for focusing on high consumers, but as yet little understanding of what this might mean in policy terms. Many interesting questions remain as to whether a focus on high consumption should have a place within residential energy policy.

Acknowledgements

This research was undertaken as part of the research programme of the UK Energy Research Centre, supported by the UK Research Councils under EPSRC award EP/L024756/1.

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