Fuel Poverty Carbon Footprint - Background to Research Project

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Introduction

The Home Energy Conservation Act (1995) placed a duty on local authorities (LAs) to improve household energy efficiency in their area by at least 30% over the 15-year period from 1996 to 2011, and appoint an officer with responsibility for this target. The Warm Homes and Energy Conservation Act (2000) placed further obligation on Government to address fuel poverty, which was devolved to LAs. These two Acts produced a tension in the objectives of those same local authority officers (HECA Officers), as the first obligation addressed energy saving, measured in kWh, whereas fuel poverty measured people brought out of fuel poverty. As LAs could not affect the price of fuel or, generally, incomes other than through information campaigns, they were really left with no option but to address fuel poverty through energy efficiency programmes, thus resources for the one purpose became combined or aligned with the other.

The shift to a focus on climate change mitigation, and carbon saving, has produced a further tension. The Energy Saving Trust switched its focus from energy saving to carbon reduction, and this was followed by the more recent regime for LAs, where Climate Change strategies were developed and implemented in many local authorities, sometimes in harmony or partnership with a regional strategy. The most recent development is for LAs to adopt a series of LAAs, selecting from a menu suggested by central government, which include the three energy related options, energy performance in public buildings, carbon reduction and eradication of fuel poverty. This is a negotiable area, with LA officers being involved in the discussion of the 'best' approaches for their area. The concern of some HECA officers is that focus on climate change mitigation could reduce or remove resources for addressing fuel poverty. The most difficult issue for them to argue on is that of rebound effects, where research has shown that a percentage, often quoted as high as 30%, of energy efficiency gains are wiped out by people using more energy to keep warmer, or switching to other high-energy using products and services, or finding such services affordable and using them when they did not formerly. This means that the value of fuel poverty alleviation programmes in a council with a carbon reduction target is questioned, with no real information available as to how much fuel poverty programmes contribute (if at all) to carbon emissions reduction.

Three issues within this problem require exploration in order to address the arguments satisfactorily;

- Measurement /definition of fuel poverty including actual versus modelled energy use before and after
- Rebound effects and assumptions/modelling
- Carbon footprints and (cost-effective) potential for saving carbon (bangs for bucks)

Measurement and definition of fuel poverty

The original definition of a fuel poor household was "one that needs to spend in excess of 10% of household income on all fuel use in order to maintain a satisfactory heating regime"[1]. However, when the UK Fuel Poverty Strategy was published there was division over the definition of income, as the energy community who had campaigned for the eradication of fuel poverty argued that the definition should consider only disposable income, i.e. after necessary housing costs such as mortgage and rent, and excluding benefit payments because of need, whereas the government wished to include benefits and exclude items such as tax relief on housing costs. Consequently two 'definitions' were used in the Fuel Poverty Strategy. This issue has remained a sticking point, with the Government gradually dropping the use of the wider definition, and campaigners continuing to use it, arguing that disposable income was the critical issue.

[1] DTI (2001) UK Fuel Poverty Strategy

The second issue that has been less widely discussed is the definition of the satisfactory heating regime, and how it affects the way the number of households in fuel poverty is measured. An 'adequate' temperature is assumed to be the World Health Organisation standard of 21˚C in the living area and 18˚C in other habitable rooms. So simply taking a household's fuel bills and seeing whether this is more or less than 10% of their income (by whatever definition) does not necessarily produce a 'correct' result in terms of categorising fuel poverty – it depends on what the household *would need to spend* in order to maintain the standard heating regime.

The consequence of this is that a household that receives measures under a fuel poverty programme may not be spending 10% of their income on fuel before the programme takes place; they may just be heating one room, or none, spending what they can afford from a limited household budget. Afterwards, they may spend the same amount, but be warm throughout the house. Tragically, there are instances when, after receiving central heating systems and insulation measures, some individuals keep the heating off as they don't use all their rooms, and revert to inefficient heating of one or two rooms, as they believe this will be cheaper[2].

The difference between actual and presumed (or modelled) energy use or behaviour has a major bearing on the discussion of rebound effects when considering the fuel poverty issue, but is under-researched.

This difficulty in measuring whether individual households are or were in fuel poverty is one of the particular problems for LA and other fuel poverty programmes, and most resort to proxy indicators, led by the Government's own proxy – people in receipt of a certain 'qualifying' benefits. Most do not then go further in establishing whether people are actually in fuel poverty, even on a simple definition of how much is spent on fuel compared with their income. The issue is thought too sensitive, and smacks of means testing. In addition, there is a widely held view amongst the energy efficiency professionals, as shown at conferences such as EAS when such questions are asked in open forum, that it is better to treat all the houses where there is risk of fuel poverty, because even if the people move out, the next household is likely to have a similar problem as the house itself has a problem. Finally, people move in and out of fuel poverty if their income changes e.g. through unemployment, or through fuel price changes. There are and continue to be efforts made by government and energy companies to address income and prices, but the energy efficiency of the household is the only aspect on which the LA can have direct impact.

Rebound effects

Evaluation of rebound effects have in the main been carried out on a macro-economic basis, i.e. to evaluate or illustrate the 'true' cost to the economy of efficiency programmes. Rebound effects were described as early as 1864: the more efficiently a machine uses energy, the more people use it, and therefore the total energy used increases[3].

Rebound effects can be classified in two main types: direct and indirect. Direct effects are those whereby the increased affordability of an option enable the user to use more at the same price. Indirect effects switch the purchasing power away from the original item (fuel) into something else, which may consume fuel, or may use other resources[4]. Berkhout also identifies second order effects, where the effects of these indirect effects can shift the market, suggesting that potentially large rebound effects can have "severe repercussions on the effectiveness of policy aimed at the penetration of energy efficiency".

In recently published research for the UKERC, Sorrell argues that rebound effects are notoriously hard to estimate, are hotly disputed, and are likely to be less than 30% for household heating, cooling and personal transport[5]. However it is acknowledged that there are gaps in the assessment, an important one of which is the relationship between household income levels and rebound effects.

[2] Pett & Guertler (2004) User Behaviour in Energy Efficient Homes, ACE London
[3] Jevons in Ko et al (1998) Resource rates and efficiency as indicators of regional sustainability. Env. Monitor Assess 51/1-2 571pp
[4] Berkhout et al (2000) Defining the rebound effect. Energy Policy 28 pp425- 432
[5] Sorrell (2007) The Rebound Effect: an assessment of the evidence for economy-wide savings from improved energy efficiency. UKERC, London

One of the few empirical studies that measured household fuel use before and after installation of energy efficiency measures was carried out in Canada in 2000-2[6]. The results gave rise to a classification of three household types, conservers, consumers and the middle, steady type. However, looking at characteristics of these groups, they found that conservers were typically lower income with higher initial bills, consumers (who used much more fuel) generally were higher income groups and had already invested to have more efficient homes in the first place. However they also emphasised the need for local support, and recognised one flaw in their methodology that they did not measure electricity use, which may have influenced the result for 'consumers' as many changed their water heating from electricity to gas.

However, this recognition of lower income groups as conservers is also an issue for green consumption in the UK. Research in the 1990s by the National Consumer Council[7] identified five classifications of consumers whom they termed Affluent Greens, Recyclers, Careful Spenders, Young Greens, and Sceptics. The first and fourth are probably self-explanatory, although Young Greens tend to have relatively low incomes for their age group. Recyclers tended to be older and more affluent, Careful Spenders tend to be middle-income range and older age groups, particularly sparing in their use of gas, electricity and water, and Sceptics tend to be on fairly low incomes and doubt what they can do for the environment. This type of segmentation was echoed by subsequent research sponsored by the Co-operative Bank into ethical consumption[8] although they identified a 5% Global Watchdog group which was as likely to be low-income, or council tenant, as any more affluent indicator. However, this research also identified a large group of people on lower incomes they called the Conscientious Consumers, who are concerned with value for money, product quality and service, plus ethical issues rather than purely environmental. In their 2007 Ethical Consumer Report the Bank highlights the rise of ethical expenditure per household from £366 in 2002 to £665 in 2006, but this still only represents around 5% of total annual expenditure[9].

The problem therefore remains that little is known about what people who receive measures to reduce their fuel costs under a fuel poverty scheme do with the money they save, if any. The assumptions are:

1. they take the benefit in higher standards of warmth throughout the house, i.e. the programme may allow them the standard of comfort defined by the WHO. Calculations of the benefit of the programme assume that they are heating their home to this new standard. They may have a cash surplus, or this may be illusory, i.e. they only spend as much as they can afford anyway.
2. They take this benefit too far i.e. they heat it to a warmer standard than the WHO one. The new cost of fuel allows them to do this within the same level of expenditure as before. This is a cultural issue that brings forward value judgements.
3. They heat their home to a lower, but comfortable temperature (possibly the same temperature as before) and have a cash surplus.
4. They spend the cash surplus on other things that have been carefully budgeted before, including food, clothes, and minor luxuries (small scale entertainment, leisure activities and children's or grandchildren's treats).
5. They spend the cash surplus on major consumer items that they would not have been able to afford before. The most (cynically) cited examples are foreign holidays and plasma TVs.

Research by ACE (op.cit.) analysed the way heating was used by 118 people who had received measures under a housing association energy efficiency scheme. They found that only 23% used their systems in the way that corresponded to policy expectations, whereas 50% used them in a way that seemed reasonable (i.e. efficient) to the researchers given the statements about lifestyle, but did not follow the model used to assess energy use in the home. The remainder did not use the systems effectively and did not get good value for their lifestyle. However only 61% got the results they wanted from their heating systems, many finding them difficult to set to a consistent level of comfort. No assessment was made of possible post-measures purchasing decisions, although numbers of appliances were noted (there were on average 2 TVs per household). In terms of costs, there was no

[6] Parker et al (2005) Who changes consumption following residential energy evaluations? Local Environment Vol. 10, No. 2, 173–187
[7] NCC (1997) Consumers and the Environment: can consumers save the planet? National Consumer Council, London
[8] Cowe & Williams (2000) Who are the ethical consumers? The Co-operative Bank, Manchester
[9] Co-operative Bank (2007) Ethical Consumerism Report 2007

significant shift to paying less even over a period when prices were relatively stable (or falling). More stated they were paying less than those who said 'more', but nearly a quarter were paying much the same. However, most had met or improve their expectations of cost reduction.

Sorrell (op cit) suggests that rebound effects can be managed on a policy basis by a mix of measures. For energy efficiency measures these could include policies such as carbon pricing, labelling, education and advice. There is a reasonably large body of research available on the value of advice, and this tends to show that one to one advice is best, especially combined with education, and that where effort has been put into this area, energy savings persist[10] (see Appendix 1 of Pett & Guertler 2004).

Carbon footprints and (cost-effective) energy saving

One of the policy options gaining ground is the concept of carbon counting (possibly as a precursor to Domestic Tradeable Quotas or Personal Carbon Trading) or carbon footprinting. DTQs have a particularly favourable profile because they have the potential to have low impact on those in fuel poverty[11] (depending on the detail of the application of such a policy). Current carbon footprinting methodologies vary from simplistic to complex, and tend to suffer from different assumptions about the carbon content of (or emissions from) product and services, how to measure them and where to set the boundaries in terms of lifecycle analysis.

One of the simplest ways of determining a carbon footprint is to take direct fuel use for heating and other household use, plus motoring use, and to calculate the carbon emissions based on the carbon content/intensity. This is the basis of the Government's Act On CO2 calculator[12], although to make the web tool user-friendly, various short-cuts and proxies have been introduced, such as the facility to make a simple calculation of the expected emissions if a person using the online tool does not have their fuel bills handy. The person using the tool gets a report on their footprint (i.e. number of tonnes of CO2 emitted) compared with the UK average, and is given a target (a reduction on their existing footprint) to help contribute to reduction in line with the Kyoto targets.

For someone who has their annual fuel bills at hand, this can give an accurate view of their footprint, but there are concerns over the treatment of monthly or quarterly bills at present, and the assumptions based on the type of house and its insulation are woefully inadequate as a measure, albeit user friendly. For example, if someone installed cavity wall insulation between one use and another, that would create a reduction in the footprint, but most other energy efficiency measures, and particularly in hard to heat homes, would show no difference. Yet as a first step the tool is well presented, and the database is open to use by a myriad of applications by different actors through the organisation AMEE[13], with the carbon emissions factors gathered together in one authoritative source, that can be centrally updated as knowledge improves.

Other carbon footprint calculators exist which may take a more detailed view of a person's (or household's) lifestyle, and may or may not use the same emissions data as the AMEE database. The RSA carbon footprint project Carbon Limited[14] was originally independent, but is now linked to AMEE, and aims to test the concept of DTQs through a 'virtual' trading system. Google adopted the same calculator. Erase my Footprint[15] uses a trimmed down version of the calculator and offers to offset emissions through verified schemes. The Penrhos Permaculture holding[16] have a very personal approach to their carbon footprint in which they compare the results from different tools, but also factor in disposal of items like batteries, launderette use and so on. Carbon Footprint Ltd[17] have a more detailed approach to secondary emissions by asking about attitudes to recycling, packaging, etc. to estimate secondary impacts. Finally the Centre for Alternative Technology have an information

[10] Harrigan & Gregory (1994) 'Do Savings from Energy Education Persist?'; ACEEE Summer Study Proceedings 1994:1.65
[11] Ekins & Dresner (2004) Green Taxes and Charges. PSI, London and JRF, York
[12] http://actonco2.direct.gov.uk/index.html
[13] AMEE – Avoiding Mass Extinction Engine, now with the tagline 'The World's Energy Meter'. http://blog.co2.dgen.net/
[14] http://www.rsacarbonlimited.org/
[15] http://erasemyfootprint.com/
[16] http://www.konsk.co.uk/design/energy2.html
[17] http://www.carbonfootprint.com/calculator.aspx

sheet[18] comparing carbon calculators and ecological footprints, and aim to launch their Carbon Gym shortly.

An important feature of these tools, especially in the context of LA carbon reduction, is that they are 'bottom-up', i.e. they take details of energy use and calculate it for the household/individual. Government statistics, including the average UK footprint against which it compares individuals in the Act On CO2 tool, are top-down, taking the estimated carbon emissions from UK households, based on domestic fuel figures from BERR (formerly DTI) and Defra, and dividing them by the number of households/population. The same approach is taken to allocate regional and local emissions, with LA officers currently in the process of determining their local footprint on an overall basis including domestic, industry and the tertiary sector. This creates problems of apportionment when considering top-down versus bottom-up. Just one question to be answered is how should public transport emissions be apportioned? However in terms of local policy decisions it makes sense, if one is trying to reduce the carbon footprint, to address those people with large footprints, where efficiencies are likely to produce larger results. The same issue is at the heart of EST's targeting of energy saving measures and advice.

Carbon footprint reduction versus fuel poverty

Just as Parker et al (op.cit.) described, the greatest reductions in emissions are likely to come from those with most to save. However what Parker et al found is that those with most to save are often not in the highest income brackets. The Ekins & Dresner (op.cit.) also pointed out that some 30% of those in fuel poverty have very high energy bills, and potentially could be badly hit by carbon taxes. So there is a more complex issue for the LA officers to consider when they are negotiating resources for their core energy efficiency programmes. Fuel Poverty is a social issue as much as an environmental issue, and some of those in fuel poverty may have high carbon footprints which can be reduced through either programme, provided that capital (investment) costs can be supported in one addressed to the 'fuel rich'. A number of research reports analyse the demographics of carbon or ecological footprints, such as Barret et al[19], Caird and Roy[20] and Haq et al[21].

What is not clear, because it does not appear in published research so far, is whether people who have received measures under a fuel poverty programme have a smaller carbon footprint than other households, and whether rebound effects lead to spending on other high carbon goods and services. Does addressing fuel poverty negate efforts to reduce the local carbon footprint?

This is the topic that is being addressed by the project Fuel Poverty Carbon Footprint, funded by the Eaga Partnership Charitable Trust and undertaken by Pett Projects. The hypotheses are twofold: that people who have received measures under a fuel poverty programme have lower (or at least, no higher) carbon footprints than others of their demographic groups, and that receipt of measures under a fuel poverty programme does not lead to direct rebound effects of the switching kind to any marked effect. The size of the subject group being interviewed in this survey is too low to prove the hypotheses, but it should provide an indication of whether further study is warranted.

[18] http://www.cat.org.uk/information/info_content.tmpl?sku=info_is_az

[19] Barrett et al (2006) Environmental impacts of UK consumption – exploring links to Wealth, inequality and lifestyle. Paper presented at IABSE Henderson Colloquium, Cambridge, 10-12 July 2006

[20] Caird & Roy (2006) Household Ecological Footprints - Demographics And Sustainability. JEAPM Vol. 8, No. 4 (December 2006) pp. 407–429

[21] Haq et al (2007) Greening the Greys - Climate change and the over 50s. SEI, York