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Decentralised systems and fuel poverty: Are there any links or risks? ☆

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ABSTRACT

This paper considers the possible links between the development of decentralised or distributed energy systems and the problem of fuel poverty in the UK. The discussion takes on board that decentralised energy systems can take many different forms, in the range of potential technologies that can be used for the local microgeneration of electricity and heat and in the range of ways in which the installation, ownership, operation, networking and maintenance of these technologies can be organised [Walker, G., Cass, N., 2007. Carbon reduction, 'the public' and renewable energy: engaging with sociotechnical configurations. Area 39(4), 458–469; Watson, J., Sauter, R., Bahaj, B., James, A., Myers, L., Wing, R., 2006. Unlocking the Power House: Policy and System Change for Domestic Microgeneration in the UK. SPRU, Brighton]. The focus is on housing and, in particular, on those forms of housing occupied by social groups vulnerable to fuel poverty. Both potential negative links (or risks) and positive links between decentralised generation and fuel poverty are considered. As this is a new area, there is comparatively little literature to draw on and there are significant gaps in knowledge, so some of the discussion is necessarily rather speculative.

1. Fuel poverty and policy

Fuel poverty remains a significant problem across the UK (NEA/EAS, 2007). The groups most at risk are low-income households in 'hard to heat' homes, in particular those with elderly residents. Fuel poverty contributes to ill health, including thousands of excess winter deaths, respiratory problems and psychological ill health (Rudge and Gilchrist, 2005). It has been termed 'a peculiarly British public health scandal and an affront to human rights' (Press, 2003, p. 5). It is both an urban and a rural problem, and remote rural areas without access to the mains gas network present particular problems (Illsley et al., 2007). With significant increases in domestic fuel prices currently taking place, and more expected in the future, the scale of fuel poverty is expected to increase rather than diminish. It is estimated that for every 1% rise in energy prices, 40,000 households become fuel poor, which is defined as meaning that they spend more than 10% of their income to fuel their home (Walker and Cass, 2007).

Policy responses to fuel poverty have primarily focused on providing additional resources for those at risk of fuel poverty to put towards their energy bills, including winter fuel payments, and improving the energy efficiency of homes and heating systems. The latter is demonstrably the more effective and sustainable solution. It has been implemented through a series of grant schemes from the 1970s onwards, which now operate separately in England, Wales, Scotland and Northern Ireland, via the Energy Efficiency Commitment obligation on energy retailers, and through the thermal comfort element of the Decent Homes standards, which is applied to local authority housing. Any contribution to addressing fuel poverty from microgeneration has to be seen as an addition to significantly improving the energy efficiency of the existing and future housing stock.

2. Fuel poverty and distributed generation: potential negative links and risks

2.1. Costs and affordability

Most of the microgeneration technologies that can be installed at domestic dwellings are not cost-effective today without subsidy, and involve significant upfront capital investment. The Microgeneration Strategy (DTI, 2006) estimates the point at which various technologies are likely to become cost-effective. Few are currently in that position (only biomass heating and [1]micro-hydro), and most are expected to take 5–15 years to reach break-even points. There are many uncertainties in such an

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[1] Micro-hydro refers to smaller-scale hydroelectric power installations producing up to 100 kW, usually for individual households, small communities or businesses. Mini-hydro is up to 1000 kW and small hydro up to 10 MW, although these thresholds can be at bit fuzzy.

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analysis, including performance, product lifetimes, future capital costs and changes in the wider energy market, which could push expectations in more positive or more negative directions.

But, regardless of its cost-effectiveness, the need for upfront capital to pay for microgeneration is a major barrier for low-income homeowners. Existing capital subsidy schemes still involve households paying a substantial percentage of the costs involved, at least 70% under the Low Carbon Buildings Programme. There is little research evidence as to who the early adopters of microgeneration technologies are. The little that does exist suggests that they are higher income, professional and managerial groups (Caird and Roy, 2007; Fischer, 2006; Guagnano et al., 1986; SEA/RENUE, 2005). The prospect is therefore of middle classes investing available capital (including the savings of the older grey–greens; Caird and Roy, 2007) and increasingly realising returns as capital costs fall through 'technology learning'. An 18% reduction in costs for every doubling of global capacity is often assumed (Environmental Change Institute, 2005). At the same time the prospect for low-income groups is of continuing dependence on increasingly expensive electricity and gas supplies, making them an 'energy underclass' at continued or increased risk of fuel poverty. Personal carbon allowances, as recently advocated, at first sight appear to provide potential for redistribution between richer and poorer energy consumers (Dresner and Ekins, 2004). But closer inspection reveals a number of problems that could serve to exacerbate fuel poverty (Roberts and Thumim, 2006).

2.2. Complexity

As well as cost, installing local generation involves a range of complexities that need to be understood, tackled and negotiated. They include the energy potential of different technology choices, their economic return, and installation and operation procedures. While these constitute potential barriers for any adopter (Keirstead, 2007; Ofgem, 2006), they are most significant for people without ready access to information resources, with lower educational achievement, suffering from ill health or already living involved everyday lives. Without good advice and information and access to skilled installers (a significant problem: Micropower Council, 2007) there is the danger of systems being fitted that are not appropriate for the building or user and that do not achieve the performance that they are meant to.

2.3. Opportunity

A significant proportion of people on low incomes and at risk of fuel poverty are not homeowners and are therefore dependent on their landlord for the systems through which they access energy. For social housing owned by housing associations and local authorities, this offers potential opportunities (see the section on future prospects). But for those in private rented accommodation there is a fundamental barrier in the way of their instigating microgeneration. The landlord has to decide whether or not to invest. Experience from existing programmes of tackling fuel poverty shows that landlords are not naturally motivated to improve the energy performance of their rental stock, although the energy survey as part of Household Information Packs (HIPs) may help to some degree if selling the property on is part of the landlord's plans. Even if it is, the investment may also be recouped by increasing rents for occupiers, which may only serve to worsen fuel poverty.

2.4. Reliability

For vulnerable groups, reliability of supply is particularly important, and with established networks it is reasonably assured. It is uncertain, as yet, how reliable microgeneration might prove to be when implemented widely and how well installation, maintenance and repair services will perform. Skills in these areas remained underdeveloped (Micropower Council, 2007) and there are cases of pressure selling and poor installation, a problem being addressed by the Renewable Energy Assurance Listed (REAL) scheme (http://www.realassurance.org.uk/introduction). The costs of maintaining systems are an area where hard evidence is particularly lacking (Watson et al., 2006) but could be significant for some technologies. It could be problematic for low-income households to keep technologies operating efficiently, particularly if maintenance costs are a large, infrequent expense.

Some forms of generation are inherently intermittent or variable. For electricity, 'co-provisioning' with supply from and to the grid is expected to be the main mode of implementation, with homes staying on the grid, so that back-up will always be available. With heat systems, the availability of back-up may be an issue, partly because some systems may not be able to cope with the demands of more severe weather conditions (Harrison, 2004). In a novel small-scale biomass district heating network in Wales, low-income householders raised concerns over losing control over 'their boiler' and about how the responsibility for the central boiler and network infrastructure was to be assured. An easy method of reconnecting the existing household boiler into the central heating system had to be guaranteed (Walker et al., 2007).

3. Fuel poverty and distributed generation: potential positive links

3.1. Cheaper energy costs

Once installed, most microgeneration technologies are expected to reduce the size of energy bills. Solar panels reduce the amount of electricity that has to be purchased from the utility company; a ground source heat pump reduces the amount of gas or electricity needed to heat water, etc. If low-income occupants of housing are not having to recoup the cost of capital investment—in other words if it has been paid for by someone else—then this could be a significant mechanism for alleviating fuel poverty, particularly as electricity and gas prices rise. The degree to which these savings can be achieved depends on the local specifics of type of technology, its scale, the profile of demand in comparison to supply, and the extent to which the visibility of the technology and its income-generation potential changes consumption behaviour within the household (Bahaj and James, 2006; Keirstead, 2007). Claims are increasingly being made. For example:

- The DTI Microgeneration Strategy (Department of Trade and Industry, 2006) lists addressing fuel poverty as one of its aims, pointing in particular to the scope for local authorities to take action. It is claimed that 'the installation of ground source heat pumps can allow households to heat the house at a cost lower than the winter fuel payment—meaning that pensioners can effectively get free heating' (p. 9).
- The Micropower Council (2007) claims that microgeneration can contribute to 'fuel poverty relief'.
- A consultation paper on the Energy Efficiency and Microgeneration Bill proposal in Scotland argues that 'by incorporating micro-generation into both existing and new houses then householders could also benefit from cheaper fuel bills, thus helping the Executive meet its fuel poverty objectives' (Boyack, 2005, p. 2).

There are a number of points to be made in evaluating such claims. First, hard evidence on the longer-term performance of *in situ* microgeneration systems is limited. Second, biomass involves the burning of fuel that has to be purchased and prices for woodchip, energy crops, etc. can fluctuate like any other fuel, particularly if demand rises. Third, district heat systems involve the purchase of heat units. A history of expensive and inefficient supply of heat from systems installed in the 1960s still colours expectations. There is no necessary guarantee that they will offer lower prices than other heating methods. Fourth, as noted earlier, maintenance costs over the full lifetime of technologies are uncertain and could become significant in some cases. Finally, assessments by organisations concerned with strategies to address fuel poverty do not suggest that installing microgeneration is cost-effective today when compared to improved insulation or improving the efficiency of heating systems. A recent project, which developed a tool for examining the cost-effectiveness of fuel poverty interventions under different future energy price scenarios, concluded that neither small-scale wind nor solar photovoltaics was cost-effective for addressing fuel poverty. But it did note that 'Under the highest fuel price scenario, the standard package of wall insulation and combi condensing boiler does not take people out of fuel poverty—it will be necessary to install further measures within the next 10 years. For an off gas house, this target cannot be reached without using new technology and renewables' (Smith et al., 2005, p. vii).

3.2. Reliability

Under some circumstances, some microgeneration technologies can provide a continued supply during power cuts and blackouts, and therefore help vulnerable people during these periods.

4. Future prospects and the promotion of positive links

The future prospects for achieving the positive links identified above, and minimising the negative links, rest on the degree to which public, private and community initiatives seek to use distributed generation as part of intervention strategies to address fuel poverty, and how far distributed systems are seen as a productive addition to more fundamental measures to improve the energy efficiency of hard to heat homes. It is highly unlikely that low-income households will be able to realise the cheaper energy potential of microgeneration on their own.

A range of possibilities exist. They are demonstrated in proposed ways forward and in examples of initiatives already under way.

4.1. Company-driven models and ESCOs

While the common assumption is that microgeneration technologies need to be instigated and paid for by householders (a 'plug and play' model), an alternative 'company-driven' model also exists, and has been used overseas (Watson et al., 2006). Under this arrangement a private company pays for, installs and operates the technology. The householder becomes a host who is provided with an energy service package by the energy service company (ESCO). The company effectively has fleets of microgenerators as a substitute for central power generation. In terms of fuel poverty, this model has the major advantage that capital costs are paid for by the company, not by the householder, and the income level of the householder in principle is unimportant. This model is only just beginning to emerge in the UK (e.g. the London ESCO set-up between the Greater London Authority and EDF Energy). A range of barriers stands in its way and how well it would work in practice is uncertain (Watson et al., 2006). There has been some thinking around how the ESCO approach could be used for low-income communities. Kellet (2007) discusses a 'bottom-up' carbon reduction initiative for a deprived community in South Yorkshire, involving energy efficiency and renewable energy resource assessment and proposals to develop a community-based ESCO. Illsley et al. (2007) discuss the potential for biomass heating in Scotland to address fuel poverty problems, through the promotion of 'industrial symbiosis' on a regional scale within the forestry sector and the setting up of ESCOs to develop both community and domestic heating systems.

4.2. Local authority and housing association initiatives

Social housing, housing associations and local authorities can have a key role in funding microgeneration for their low-income tenants. Bahaj and James (2006) report on the installation of photovoltaic technologies on nine social housing units in Havant, Hampshire, through a scheme developed jointly by a housing association and a local authority. After detailed monitoring and analysis of supply and demand they conclude that 'the use of building integrated photovoltaics in social housing developments in the UK can provide a significant contribution towards the annual electricity demand and an overall reduction of the fuel burden' (p. 2135), although their analysis relies in part on assuming that energy demand is altered by the arrival of new technology. Affordable housing provider 'Home' installed solar panels in 18 of the homes it owns and manages in Hexham, Northumberland, to 'help tenants reduce their heating bills in an area where they have to rely on expensive electric storage heaters because there is no gas supply'. It is estimated that this will reduce heating bills by approximately £170 per year (eaga, 2007). National Energy Action (NEA) (2007) details many similar examples focused on 'hard to heat' and 'hard to treat' homes using a range of technologies including air source heat pumps, solar water thermal and microwind.

Some local authorities are developing wider strategies that seek to integrate responses to climate change and fuel poverty. London is a particularly interesting example. The Greater London Authority Climate Change Action Plan and green homes campaign distinguish between different categories of households—those 'able to pay', those in social housing and those with private landlords—with differentiated policies in place for each. It also proposes the development of ESCO arrangements (GLA, 2007). There is particular potential for regeneration initiatives to integrate carbon reduction technologies during area-based refurbishment and rebuild, although such opportunities may not be taken up for a range of reasons (Van der Waals et al., 2003).

4.3. Fuel poverty programmes

Fuel poverty programmes providing targeted grant funding could be key stimuli for the future if they included the installation of microgeneration as standard. This is increasingly being called for despite reservations about its cost-effectiveness. Age Concern has called for such a move in Scotland (Age Concern Scotland, 2007). National Energy Action has been particularly active in taking forward this agenda. Its *Microgeneration Annual Review* (NEA, 2007) argues that air source heat pumps 'have an important role to play in tackling hard to heat homes that are not connected to the gas mains and should be added to the menu of measures that can be funded for fuel poverty work. The grants provided by the Warm Front scheme in England could potentially already be used for microgeneration, in particular for 'hard to treat' homes, through regulatory revisions made in 2002, but this power has not as yet been taken up (NEA/EAS, 2007). The 2008–2011 round of the Energy Efficiency Commitment obligation on energy supply companies is expected to include microgeneration measures, with a priority focus on low-income consumers.

4.4. Zero-carbon homes

The requirement that all new homes are 'zero carbon' by 2016 will apply equally across all income groups and will entail the use of a range of possible local generation technologies. If rigorously applied, this requirement will in the long term become an important mechanism for shifting the energy performance of the UK housing stock. However, the very poorest and those at risk of fuel poverty tend to be in older, worse quality housing that will not be touched by these requirements.

5. Summary

At present, distributed generation is of little significance for the creation or resolution of fuel poverty. While making households more energy efficient has to be the primary way of reducing fuel poverty, microgeneration has future potential to further improve access to affordable energy for low-income households. If a model of development that focuses on households paying for and installing microgeneration technologies is pursued, this potential will not be realised, and low-income households will become even more of an energy 'underclass'. If central and local governments, housing associations and energy suppliers actively take up the potential to provide microgeneration for low-income households in different ways, it could become part of a package of cost-effective measures. However, there are uncertainties over the longer-term energy, economic and social performance of microgeneration technologies. These need to be considered carefully in adopting microgeneration more substantially within fuel poverty programmes.

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