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Demographics, energy and our homes ☆

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ABSTRACT

The projected growth in households in the UK is a key factor in future domestic energy consumption, particularly electricity consumption. While every household needs a home and its heating, lighting and appliances, increasing incomes have historically led to significantly higher appliance ownership, higher expectations of levels of energy service and greater usage. In the past this trend was combined with increasing household numbers to drive growth in domestic electricity demand. Official projections for population growth and household composition indicate significant drivers for future growth in energy demand. Curbing this will require policies to reverse the tendency for energy–efficiency improvements to be overwhelmed by growing numbers of households, more widespread appliance ownership and increased service expectations.

1. Population growth: 25% more households by 2031

Government forecasts published in 2006 anticipate an extra 5.5–6 million households by 2031 (the UK had 24.2 million households in 2006). This expected growth is caused, in roughly equal measure, by growth in the population (through ageing and net immigration) and by the continuing fractionation of families. Fig. 1 shows the trend and projection for England (source ONS, 2007b).

Of these new households, 70%—or some 4 million—are expected to consist of a single person. A quarter will be pensioners. By 2026, 38% of all households are expected to be single person compared to 23% in 1981. Average household size is projected to continue on its downward trend, reducing from 2.41 in 1997 to 2.15 by 2031. Within these households, the number of over-75s is projected to increase by 50% by 2031, and this group will make up 12% of the population by then (CLG, 2006, 2007b; ONS, 2006, 2007).

2. Demographic drivers for domestic energy demand

All of these projected new households will add to total demand for energy services through their heating needs and their lighting and appliance uses. If all other factors stayed constant, domestic energy demand could be expected to grow by 25% by 2031 in line with the growth in household numbers.

Indeed, as Shorrock and Utley (2003) have demonstrated, total domestic energy consumption in the recent past has grown roughly in line with the growth in household numbers. Between 1970 and 2001, domestic energy demand increased by 32%, while household numbers increased by 36%.

However, this simple statement hides a number of different trends. Energy use per household has changed very little in the UK in this period. Since 1970, gains in the thermal efficiency of dwellings and their heating systems have reduced per household heating demand, even as homes have increased in size per person and people have achieved higher internal temperatures. But this improvement in thermal performance (averaging approximately a 1% reduction in SAP rating per annum) has been offset by an increase in demand of over 70% for electricity use in appliances and lighting.

Predicted changes in household composition, heating needs and appliance ownership would suggest that electricity demand growth of only 25% by 2031, in line with the growth in household numbers, may be optimistic without deliberate policies to avoid it.

2.1. Household size

The increasingly rapid reduction in the size of households creates an additional spur to demand growth. Boardman et al. (2005) have calculated that per capita energy consumption is roughly 60% higher for a single-person household than for a two-person household. This is largely due to the lower per capita appliance ownership in larger households as more people share appliances such as refrigerators, freezers and dishwashers, and the lower floor area per person, which reduces heating needs.

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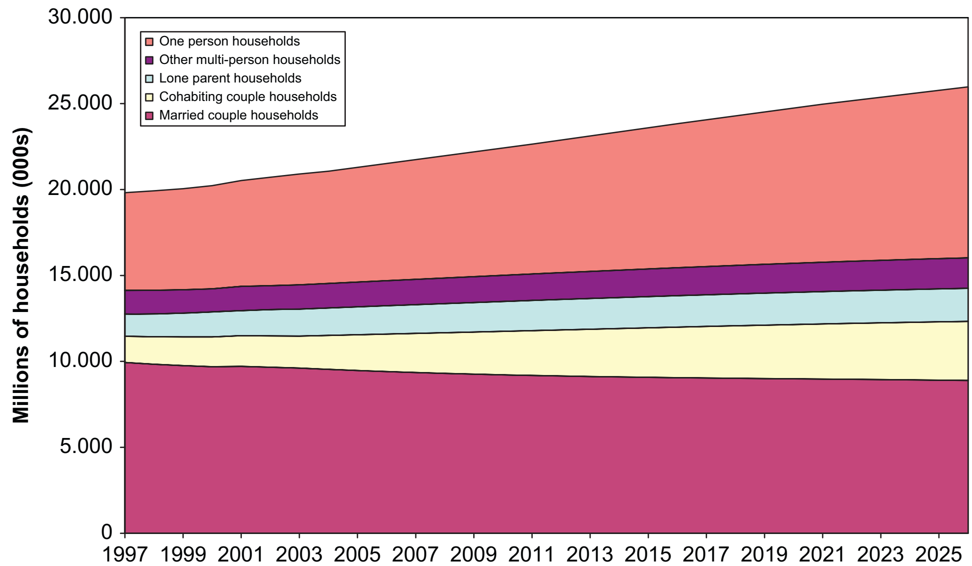

Fig. 1. Projected household composition by type for England 1997–2026.

2.2. *Heating needs for ageing households*

The increasing growth in the number of over-75s and of single-pensioner households will drive health-based needs for winter heating and (with anticipated temperature increases due to climate change) for summer cooling. Age-related needs for longer periods of heating each day and for higher average internal temperatures to maintain healthy conditions could increase heating-related energy consumption requirements by up to 50% for these elderly households compared with a household of working age in a similar property.

These projected changes will tend to shift historical domestic energy consumption trends in an upward direction.

2.3. *Growing appliance ownership*

The Energy Saving Trust (2006) calculates that energy use in domestic appliances (not including lighting) doubled between 1971 and 2002, with a further 12% increase predicted by 2010. This results from an increase in the number of households and significant growth in the ownership of appliances as incomes have increased and appliances have got cheaper in real terms. This study suggests that the number of energy using appliances in the average home has more or less tripled in the last 30 years, from fewer than 20 to nearly 50.

Many of these appliances have improved in efficiency. For example, the energy consumption of the average 140-l refrigerator dropped by 29% between 1990 and 2001. But the growth in the range and ownership of appliances, and in some cases their size, have overwhelmed these gains.

Appliance ownership has also shifted from being dominated by mainly labour-saving devices to entertainment. The ownership and use of consumer electronics is now growing even faster and the Energy Saving Trust (2007) anticipates that DVD players, computers, digital TVs and other home entertainment devices will be responsible for 45% of domestic electricity use by 2020.

2.4. *Other demographic and housing market changes relevant to energy demand*

With house prices rising faster than incomes for more than a decade, there has been a significant reduction in housing affordability (see, for example, NHPAU, 2007). This has fuelled a steady 3% per annum growth in households using private-rented accommodation since 2001, a trend which can be expected to continue.

Historically, the private-rented sector has had a lower thermal performance than other tenures, resulting in part from the split incentive between landlord and tenant to invest in improvements to the building fabric and heating system (see, for example, Table 4.4 in CLG, 2007a). The landlord owns the property but has no direct incentive to invest in measures that reduce the energy bills paid by the tenant. And the tenant has little incentive to invest in a property they do not own and where their tenancy may only be guaranteed for a short period.

There is, therefore, a possibility that a sizeable proportion of the expected new households will have little choice but to live in rented accommodation, and will have little incentive to invest in their accommodation to improve its thermal efficiency.

These anticipated changes, together with income-driven trends towards increasing appliance ownership, create an underlying trend towards increased domestic energy demand, particularly electricity demand. While historical trends are that energy demand has risen at slightly below the growth in household numbers, anticipated future changes may well reverse this trend.

The impact of these anticipated demographic changes on energy demand will depend principally on the speed with which the thermal efficiency of current homes is improved, the actual thermal performance of all new build homes (since some 5.5–6 million new dwellings are going to be needed by 2031 to house the anticipate extra households), and the extent to which improvements in the efficiency of appliances and lighting can be accelerated to outstrip growth in demand.

Historical improvement trends in each of these will not be sufficient to curb demand growth. Additional policy measures will be needed.

3. Implications for future policy on energy use in our homes

In 40% house, Boardman et al. (2005) have examined in detail the potential for improvements in housing stock thermal performance and appliance and lighting efficiency. Their 40% scenario (in which carbon emissions caused by the UK housing stock are reduced to 40% of 1990 levels) includes a major retrofit programme to reduce space heating demand in existing housing to 6300 kWh per building per annum, roughly a third of the current average. They also propose demolishing 14% of the least thermally efficient housing stock and replacing it with new build housing with a space heating demand requirement of no more than 2200 kWh per annum from 2020. Modelled growth in household numbers is largely as anticipated above and is met by new build housing to these standards.

Such programmes and build standards are feasible but will not be delivered by current policy without significant additional effort, particularly on improving the existing housing stock. Boardman et al. (2005) outline a wide-ranging programme of policies to deliver their scenario, including tougher building standards, area-based improvement programmes, energy supplier incentives and personal carbon allowances. Special attention will need to be paid to the increasingly important private-rented sector.

Appliance efficiency and ownership growth present a different sort of challenge. Historically, the Government (principally through the European Union) has established energy–efficiency standards for appliances relatively slowly, with only modest efforts to drive the market to bring forward new technological developments. In addition, such standards are often not applied to new types of appliance until market penetration has reached significant levels, if then. At that stage, the stock of the appliance in question has already been established. It could take many years of turnover before these standards start to have an impact on power consumption. This implies that the regime for appliance energy–efficiency standards needs to be much more responsive and challenging.

Moreover, the standards are currently set on the basis of 'kWh/unit of service'. These have undoubtedly improved efficiency, in that the appliances are providing more service per kilowatt hour. But they may also encourage consumers to trade up to a higher service model which, by virtue of its higher efficiency standards may be as cheap to run, instead of taking the efficiency gains available from replacing like with like.

It may be more appropriate to set future appliance standards on the basis not only of efficiency standards for different sizes of appliance but also of a challenging maximum energy consumption level for any given appliance, irrespective of its size. These could be introduced immediately for any appliance with no current efficiency standards.

Without such a draconian approach, it is difficult to see how the significant potential for appliance efficiency improvements will be realised quickly enough to stop the growth in appliance ownership cancelling out any gains.

This analysis also suggests that, beyond the traditional sphere of energy policy, there would be direct and beneficial energy impacts from government policies which encouraged larger households, helped families to stay together, or persuaded older people to move to smaller, more efficient dwellings or shared accommodation. The carbon and energy impacts of existing and future government policies in these areas should be considered as a key component of policy design and assessment.

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