National building stocks: addressing energy consumption or decarbonization?

Journal Item

Commentary on 'Climate Change: National Building Stocks'
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This *Special Issue* (Volume 35, Number 4 from last year) was devoted to the potential that the national building stock has in reducing CO2 emissions. As such it contained a wealth of important and recent information on policy measures, technical options and possible scenarios. Undoubtedly there is a large technical potential for reducing energy use, and hence emissions, in our building stock. Also it is possible to construct new buildings with very low or even zero carbon emissions. The key question is how can this technical potential be realised? Through building regulations, economic incentives, or the demolition of the most energy-inefficient of the building stock? Answers depend not only on construction techniques but also on town planning issues and infrastructure decisions.

So building for sustainability, and a low emissions future, involves not only building professionals but also local planners, politicians and the communities that they serve. Whose home will be demolished, whose will be refurbished, where will the new homes be built and what will they look like? At a higher level, the sum of all these local decisions will affect national energy use and carbon emissions. By how much will energy use be reduced: will the technical potential in fact be realised? How much will it cost, and would the money (several hundred of billions of pounds) be better invested in low carbon supply sources (from nuclear power, renewables or even carbon sequestration at power plants)?

If we have faith in energy models that say that the refurbishing of existing homes with insulation measures can deliver massive energy savings by 2050, and have confidence in new technologies such as heat pumps, solar thermal and micro CHP, then we could more than halve carbon emissions in our housing stock by 2050. This is the central message of the *40% House* scenario by Brenda Boardman, and also from the modelling work by Bob Lowe. The belief is that improvements in the energy efficiency of buildings will indeed lead to an absolute reduction in national energy use of buildings. But how far is this belief supported by the historical evidence? Why is it that total energy use in buildings has risen at the same time as there have been massive improvements in energy efficiency? Why do we consume more despite being more efficient?

The central weakness of this *Special Issue* is the neglect of the relationship between energy consumption and energy efficiency. Whilst there are graphs of historic tends in energy efficiency and age structure, there are none on energy consumption. Why is it in the future we can have increased efficiency and reduced consumption, when this has never occurred in the past For instance, in the residential sector of the European Union (the EU-25) over the period 1999 to 2004, total electricity consumption grew by eleven per cent, and gas by fourteen per cent, despite numerous energy efficiency polices at both the EU and national level (Bertoldi and Atanasiu, 2007). The reason, according to many commentators, is that we simply haven't tried hard enough to be energy efficient. While many policies have been introduced, they are often considered too small-scale, under-funded, un-ambitious and ineffectual. If the cause lies in inadequate policies, the solution could be to redouble our efforts - to introduce more regulations, standards and financial support alongside innovative measures such as personal carbon trading or tradable white certificate schemes (e.g. Boardman, 2007). The range of policy instruments is vast and is extensively summarised by Diana Urge-Vorsatz and her colleagues.

However, an equally plausible explanation for the failure to reduce energy consumption is the 'rebound effect'. That is much of the potential energy savings are 'taken back' by consumers in the form of greater consumption. This can be directly in the form of higher standards of energy service, such as higher indoor heating temperatures and longer hours of use. This rebound effect is particularly important in households previously suffering from 'fuel poverty', where heating levels were inadequate (Hong et al, 2007). Or rebound effects can be indirect where the cash savings from energy efficiency are spent on other goods and services (e.g. a holiday abroad or a new service like air-conditioning).

Until very recently there was a complete neglect of rebound effects by policy makers and most energy researchers. But this has changed with the publication of a major report on the rebound effect by the UK Energy Research Centre in late 2007 (Sorrell 2007). Following a comprehensive review of evidence the

UKERC report found that rebound effects are generally *not* negligible and in some cases could exceed unity. Rebound effects, it concluded, need to be taken seriously in any policy appraisal.

The report found that for household heating and household cooling (within the OECD), the direct rebound effect is likely to be less than 30%. Moreover, the direct rebound effect for these energy services is expected to decline in the future as demand saturates and income increases. This suggests that improvements in energy efficiency should achieve 70% or more of the expected reduction in energy consumption for those services - although the existence of indirect effects means that the national reduction in energy consumption will be less. Thus a policy of refurbishing all existing buildings, as advocated by authors in this *Special Issue*, should result in an absolute reduction in building energy use. However the magnitude will depend on economic and energy pricing policies (such as a carbon tax), and whether there can be changes in consumer expenditure away from energy-intensive activities (such as tourism or car travel) towards low-impact activities (home-working or cycling holidays). The extent of the indirect rebound will also depend on urban infrastructure, especially on the location and density of housing, and the provision of public transport, the importance of which is illustrated in the paper by Georg Schiller. Where we live, work, shop and play are crucially important. There is no point in us living in zero-carbon houses if we commute to work many miles a day in gas-guzzling cars! Thus policies on housing, travel and energy have to be joined up to form a sustainable whole; complex issues which are explored in a recent book (Herring & Sorrell 2008).

Save carbon, not energy

However it should always be borne in mind that our primary goal is to reduce carbon emissions rather than energy use. Undoubtedly achieving a 60% cut in emissions would be easier if energy use were reduced but this does to mean that it is essential. It may be technically easier and financially more viable to shift our energy supply systems to low carbon sources, rather than insulate our housing stock. Especially as the electricity industry has a record of substantial and steady progress in decarbonisation, as Bob Lowe points out. With this proven record and under our centralised energy systems, governments may prefer to deal with a few, reliable energy suppliers rather than millions of (unreliable) home-owners who have taken government grants to improve their energy efficiency but failed to cut consumption.

Thus if the building stock is to be part of the carbon solution, rather than a problem, moving to a decentralised energy system, where there is substantial micro-generation is a key strategy. Energy efficiency must be integrated with local generation, they must be considered as partners rather than rivals. And the good news is that those people who are most interested in energy efficiency, are also interested in renewables. Research into the reasons why people adopt or don't adopt energy efficiency measures and low- and zero-carbon (LZC) technologies, reveals that interest in these new LZC technologies increases with the number of efficiency measures installed (Caird et al, 2008). The message seems to be: to sell micro-generation, sell efficiency first.

Now, with consumers' attention focused on their high energy bills, is an excellent time to sell energy efficiency. Also it is an excellent time to retrofit existing properties with the new LZC technologies. However what must not be allowed to blight energy efficiency's bright prospects is talk of demolitions. To associate demolitions with energy efficiency improvements to the housing stock would be a political disaster. As the editorial rightly said 'in most cases comprehensive retrofit is likely to be cheaper, financially and environmentally, than replacement' (p.346). With new house sales at a record low, the last thing policy makers need to talk about is demolishing 80,000 houses a year.

In conclusion the editor of *BRI* is to be complimented in bringing together a range of authors to give their views on ways to reduce carbon emissions in buildings. Buildings have an important role to play in coping with climate change, through good design and high efficiency. However until we can discover how to curb our desires for more comfort and convenience, which has led historically to increased energy consumption, I think it is highly unlikely we will achieve the *40% House* (Skea, 2009). In the future, in 2050, we may (through changes to our energy supply) be a low carbon society, but I doubt we will be a low energy one.

References

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