Low Carbon Buildings and the problem of Human Behaviour

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Over the past 18 months the construction industry and the general public in the UK has been overwhelmed with initiatives, legislation and information about low carbon buildings. Prior to this we have had thirty years of legislation and incentives for energy efficiency in buildings, such as Part L in the Building Regulations for the reduction of heating energy, the labelling and regulation of appliances such as washing machines, fridges and dish washers, and grant programmes such as Warm Front for the insulation and upgrading of existing houses. The fact is, however, that as a society we continue to use more energy in houses year on year, and carbon emissions have been reduced in the past mainly by changing the source of fuel (from coal to gas) and not by reducing use. We are now in a position where most of the gains from changing fuel sources have been taken for the foreseeable future (until we have either far more renewables or nuclear power) and carbon emissions are rising again in all human activities in the UK and particularly in building related use.

Now a reasonable response might well be that we are only just beginning to take this problem seriously and that in future legislation and incentives will be better conceived, much greater in scope and consequently far more effective. However it is also possible to argue that much of the legislation and incentives are fundamentally misconceived and will not and cannot have positive outcomes, because they actually make the central problem worse. And the central problem is that of human behaviour and in particular of how we change human behaviour for the better in our society.

The ambitions of Government and the reality of the construction industry

In the UK we now have the most ambitious programme for low carbon buildings in the whole world. This programme is based on the fact that, according to one method of calculation, buildings in the UK are responsible for about 50% of the CO_2 emissions in the UK, the majority of which comes from space heating and hot water. This Government programme includes the Code for Sustainable Homes, the Eco Town programme and many other zero carbon initiatives in schools, offices and elsewhere. The Government proclaims it is leading the world in carbon reduction.

The reality however is that we have increasing energy use and CO_2 emissions from the housing stock. Energy use has gone up steadily by 30% in the last 30 years in spite of a 30% supposed increase in the energy efficiency of buildings and of heating systems. CO_2 emissions dropped due to the change from coal to gas both in heating homes and as fuel for power stations but have risen again since 1996.[1] The reality is also that we have a situation where most new buildings fail to meet even existing standards (where they are actually measured), and that we have a construction industry with very low levels of skills, understanding or interest in building performance, and with adversarial and counter

[1] Carbon emissions from GB housing since 1970. From Shorrock & Utley 2003.

productive site and management practices. As they say in some places, if I was going there, I wouldn't start from here.

Part of the reason for the failure of energy efficiency legislation to make a difference is that the gap between theory and practice is so considerable in the construction sector. It is hard to tell exactly what the gap is because there has been almost no monitoring of buildings (particularly dwellings) over the past 30 years. Where there has been monitoring of buildings we find that actual performance almost never matches the designed performance, and that energy use is often 100% more than predicted and furthermore that it gets worse during the building's life.

The problem of occupant behaviour

In Evidence to the House of Lords Select Committee on Science and Technology: Energy Efficient Buildings by Professors Tadj Oreszczyn and Robert Lowe, the authors make some simple assertions as to why with more energy efficiency we have increasing energy use. The passage is worth quoting in full. They write: "This is because the demand for heat, light and other electricity in dwellings has doubled over the same time period. Whereas the average temperature maintained in dwellings 30 years ago is thought to have been 13°C it is now 18°C and could easily rise to 21°C over the next decade. We increasingly have air conditioning at work and there is already a small market in domestic air conditioning.

"It is now recognised that the theoretical energy savings predicted very rarely materialise as a result of improved comfort and other changes in occupant behaviour. This is often called the "comfort factor" or "take back". Energy economists refer to the phenomenon – which was first recognised by Jevons in the late 19th Century – as the Brookes-Khazzoom effect (Saunders 1992). Estimates of the take-back for improvements to thermal insulation and heating systems have been hard to arrive at with so little monitored data but are thought to be in the region of 50%. However in some cases the proportion taken back may be greater than 100%.

"Energy efficiency can stimulate energy use. We appear to have an almost innate ability to come up with new and novel ways to use energy even if we know it is bad for the planet."

Low carbon buildings in perspective

There is of course no such thing as a low carbon building. There are only buildings and the way they are built and used by humans. This is not a trivial point, as the promotion of low carbon "this" and zero carbon "that" is actually a way of ignoring human behaviour, the interaction of humans with their environments and the forces that enable people to change how they live.

Furthermore many of the issues now covered by buildings legislation are really nothing to do with buildings. For instance, to say that emissions due to the use of many of the appliances in buildings are a building problem is not really true. For example washing machines are connected to clothes and lifestyle not buildings – indeed we all used to wash our clothes by hand or in public laundrettes, and we didn't wash everything after we had worn it only once.

What is essential to and contingent upon the building is the space heating, and to some extent the lighting and the hot water.[2] But even here the type of lifestyle will determine how much energy is used at least as much as the building form. While there is no doubt that certain building forms make it easier or less easy to live at a certain internal temperature, we have to remember that this internal temperature level is not set only by biology but mainly by individual lifestyles within a prevailing culture. For example my 78 year old father, who lives in an unrenovated 1830s peasant brick and flint cottage, hardly heats his house at all and uses the same energy as that set as the lowest energy standard in the world, the Passiv Haus standard, ie 40kWh/m2/ yr. He is of a different generation and culture and has a very active lifestyle. Interestingly in our own unrenovated 1920s council house we use about 240kWh/m2/yr, but there are 6 of us, and so the amount of energy per person is the same. There is no doubt of course that a good thermal shell (good insulation, airtightness etc) here would make a big difference as a high proportion of our fuel bill is space heating (unlike in my father's house). But it is significant to note that levels of occupancy make very considerable differences to per person energy consumption. Levels of occupancy in the UK have been going down steadily for several decades and account for much of the increase in housing energy use.. This is a cultural phenomenon which is just as important in terms of building related emissions as the performance of the building shell or building related appliances.

It should also be pointed out that many of the figures used to emphasise the importance of building emissions misrepresent the real situation and overplay the importance of initiatives to reduce these emissions. Building emissions are not 50% of our total environmental impact, but of the CO_2 emissions from the UK. If we also account for the CO_2 emissions due to UK which are produced outside the UK (such as in foreign manufacture of products consumed in the UK, and international transport related to the UK), then this reduces to around 40%.[3] If we then accept that other green house gas emissions are also need to be accounted for then this reduces to 30%. Finally if we accept that climate change is only about half of our environmental impact, then this reduces to around 15% of our total environmental impact. Of this probably only 80% is actually building related (heating, hot water, lighting), reducing the figure to 12%. This is still a considerable amount, but it reduces the importance of achieving very high standards of building compared to just good building standards by a considerable amount. In my calculation the effect of building new very low or zero carbon buildings in the period to 2050 as opposed to building only to the current building standards (and of course achieving them in reality) would reduce our total environmental impact by less than 3%.

The attempt to give buildings and building construction responsibility for a large proportion of our emissions and for more general human problems than are actually related to buildings is part of our desire to objectify a problem which is actually more to do with us and our lives than we like to admit. The failure to understand the context and causes of environmentally damaging activity in relation to buildings is not just caused by a lack of research but by a desire for technical and legislative solutions which give the appearance of

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[2] Furthermore the energy for appliances is nearly all from electricity and this is best produced elsewhere, because this is much better from an economic and environmental point of view. In this sense the main aim of building related legislation and incentives should be to deal with those issues dealt with by Part L of the building regulations.

[3] See work of the Stockholm Institutute

doing something decisive, and which perhaps allow us to avoid the more intimate questions of how we live and the changes we might need to make.

Laws and targets

Over the past 10 years we have been absolutely inundated with new laws not just in the area of carbon and construction but in virtually every area of society. And while there have been some positive outcomes in closely defined areas (such as the anti-smoking policy or in regard to low energy appliances such as fridges), in virtually every general area (such as health, environment, education, crime) this approach is now seen to be either unproductive or counter-productive.

The worst type of legislation in many areas is that based on targets and timescales. Targets have become a major part of legislation over the past few years and it has been interesting to observe how the setting of targets has changed behaviour in ways that do not always have positive outcomes. The recent House of Commons Committee report on school testing made the very valid point that in many schools teachers are now teaching only for the tests in order to achieve the targets, rather than teaching for education of children. There have been similar reports on the effects of targets in the NHS, transport and elsewhere.

The problem with green taxes, targets and other forms of legislation is that they are often ways of trying to adjust human behaviour without allowing people to learn and to participate in change themselves. The target becomes the end in itself, whereas really the target should be indicator of how things are and how they might change. Targets focus on specifics and, if they have penalties or other consequences, can cut out the wider discussion and understanding of consequences. Similarly green taxes can be viewed as challenges to circumvent. This problem becomes even worse when unrealistically short time scales are set, as in the case of the Code for Sustainable Homes, with its ambition of all new homes being zero carbon by 2016.

The fact is that you cannot ignore or over-rule people in attempts to improve society or human beings' impact on the environment. Carbon emissions are not a technical or legislative problem but a human problem and the sooner we accept this and the consequences the better. This is not to say that we cannot use our technical knowledge and experience to improve our environments, but we will not tackle the basic causes of increasing carbon emissions and overall environmental impact unless we directly address human behaviour.

Damaged people and an addictive culture

As noted above in relation to the construction sector: if I was going there, I wouldn't start from here. This also applies to the more difficult subject of human behaviour and our attempts to change this in relation to environmental impact. If everyone was sane, balanced, and happy then information, legislation and incentives would work well in changing human behaviour. However we live in a society of stressed and damaged people, many physically or mentally ill or disabled, and many more whose priority is caring for these people, often at

huge personal cost.[4] Using less water in a bath or getting the insulation topped up in the loft are not priorities for most of these people.

However there is a worse problem than this, and that is the culture of imbalance or addiction which we live in, and which engulfs all of us. By this I mean our excessive attachment to things or activities which are not necessary and are often bad for us and others. Indeed the real problem we face in making positive changes in human behaviour for the good of the environment is often not lack of information, or lack of good laws and incentives, it is this addictive behaviour, which is a combination of attachment, habit and laziness. We know that we should walk to the shops or school and not drive, but we still drive. We know that we could eat less imported or processed food, but we will just have one more bite. We would like to dig the garden, but only after the TV programme has finished.

One of the most common and most environmentally damaging addictive phenomena is consumerism, by which I mean an excessive attachment to buying, doing and using things which are on the whole unnecessary and do not ultimately make us any happier.[5] This is built into the very structure of our politics, our economies and our daily life and is the cause of massive amounts of waste and wasteful activity.

The problem with consumerism and other forms of addictive behaviour is not only that they have significant environmental consequences, but that they reduce the mental space we have for changing our attitudes and behaviour. This is perhaps the most important factor in encouraging behavioural change. Information, role models and all kinds of incentives are all vital, but if the issue is not one of rational choice, but of imbalanced or addictive behaviour, then restoring balance to lives and breaking addictive patterns requires far more than more TV programmes about green living. It requires a radical re-shaping of our economic and social structures and new relationships between people and sectors of society and between people and nature. We need to find ways of giving people (including children) more time, less hassle, and more meaning and opportunity in their daily lives.[6]

Low carbon buildings and low carbon living

It is my argument that the problem of low carbon buildings is actually a problem of low carbon living and as such is part of a wider problem of our collective and individual values and way of life. The issue of low carbon living cannot be addressed properly without addressing the problems of our culture, which is characterised by imbalance in our selves and in our behaviour, manifested in and influenced by our economy and culture. This imbalance is both a cause (and probably the major cause) of our environmental problem, but it is also that which often prevents us from addressing this problem.

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[4] A recent government report estimated a total of 6 million carers in the UK, many of whom are ill or at risk because of this activity..

[5] See work by the new economics foundation (nef) on well being, or Prof N Layard's book The Science of Happiness. While GDP has risen by 30% since the 1960s, the happiness of people has not risen but stayed about the same, while environmental damage has increased hugely.

[6] Some ideas that might be tried could be restoring Sundays to some kind of special time, introducing 4 day weeks to enable people more time with family and community (as Pooran Desai says, 20% less income, 20% less consumption and 20% more happiness), encouraging people to grow their own food and to cook and eat properly, perhaps through city farms and allotments on a large scale. We need education which is creative, nature based, and which gives meaning and self esteem, not stress and meaningless qualifications.

If this is correct, then the effect of increasing legislation and ever more initiatives about low carbon lifestyles could actually make this situation worse because they close down the space people have in their lives for reflection and creativity, which are the most important preconditions for change. In fact anything that complicates life further, or diverts attention from the need to change our selves and the time and space to do this could be seen to have a negative effect. This applies therefore not only to legislation, but to the promotion of innumerable technical fixes which in themselves are not bad, but which distract us from the main task and enable us to continue in a society without the motivation or means of change.

We should not underestimate the importance or the urgency of this task. Peter Harper recently wrote an article entitled "2012: Will it become the most famous date in history?" in which he states that it is increasingly assumed among climate change scientists that we only have something like 5 years left to make the significant changes required to stop an inevitable global temperature rise of 2°C and the consequent positive feedback mechanisms which will lead to further heating and effective meltdown of our ecological system. He argues that nearly all new technology has far too distant effects, and that actually the only game in town is human behavioural change. However he argues that to give ourselves time to deal with this we need to invest massively in relatively simple carbon sequestration as well.

Personally I believe that we must continue to do all we can, in every sphere, technically and legislatively to buy ourselves time. This includes everything from inventions of new low carbon fuel sources to the minute detailing of building airtightness and thermal bridging. It includes good legislation to stimulate and guide. However none of this should be at the expense of addressing human behaviour issues fully and immediately; on the contrary, all of this should be aligned to assist in this task. We cannot wait till we have more time to tackle this vital issue. We have been waiting too long already. It is the only thing that gives us any chance of meeting the challenges ahead, it is the only thing that makes the technology and the legislation work, and it is also the most humane, safest and fairest course that we can take.

What we can do in the building sector

This is an article about low carbon buildings, so I want finally to return to some specifics, because after all the thinking, we need to do something positive to start making these changes. Addressing changes in human behaviour is not a philosophical exercise only or mainly, but requires engagement. Furthermore the construction sector is a great place to engage, as it is involved in a basic and necessary activity, and has great potential to assist change.

If the premise of this essay is correct, then the aim of a "low carbon building" programme might look and be quite different. It would start with people and learning and not with technologies or targets. It would consider such things as:

- Education of all parts of the construction industry in terms of not only how we build, but how we live in and use buildings and how buildings impact upon our environment in its widest sense. This needs to start in school with the establishment of building as a desirable high status occupation with real opportunity and interest. It needs to continue through proper training and skills programmes.

- Monitoring and assessment of building performance by contractors (and designers) should be a regulatory requirement as an essential part of continuous learning in the industry, and smart metering of buildings should be introduced to enable occupants also to learn how their building works and the effect of human behaviour on building performance and energy use.
- A broader view of value in development and planning terms should be explored, really emphasising social, health, well being and other "soft" values. .
- More co-operative long term working and learning partnerships must be established at all levels in the construction sector so that we move from an adversarial liability driven culture to one of responsibility, trust and mutual benefit. Trust is a key element missing in this sector and needs to be restored urgently.
- Much better site set up with decent facilities, assistance with transport, good food, education rooms and other support mechanisms to enable self respect and high quality work amongst the workforce at all levels.
- A stable legislative framework in terms of regulation, which gives the construction sector the ability to learn and plan for the next 10 years at least.
- An independent and fully funded building research agency and training body to assist in all the above

Of course many of the things which will enable the construction industry to really change its behaviour lie outside the scope of building programmes. However the effect of putting learning and well being at the centre of our building programme would be absolutely immense.

The construction sector in the UK makes up 10% of our total workforce. If even part of this sector was to be lifted up in knowledge and well being, not only would this hugely improve the quality of building in the UK (and reduce environmental impact) but the knock on effects in terms of understanding of buildings and the environment would be considerable. This would affect not only the way that construction workers understand and use their own homes, but would undoubtedly help to affect the seemingly intractable problems of human behaviour right across society in relation to buildings.

Of course these things could be done as well as introducing new legislation and technologies, but very often these are in conflict, because you cannot do everything at once, and furthermore we need to do the important things first. More importantly, we need to ensure that new laws and mechanisms do not actually prevent people from learning and changing, because if we are going to ask the construction sector to transform the buildings of this country and the way we use them, the space and the will to learn and change is where it all starts.

Neil May 24/06/08