How to reduce carbon emissions from existing buildings

There are many more priorities in new home design than to achieve 'zero carbon' status, writes Dr David Strong, *and the treatment of the existing building stock is probably more important.*

In 2006 the UK Government declared an ambitious plan to ensure all new homes are zero carbon by 2016. This year (2009) it will announce its intentions for a Code for Sustainable Buildings for non-domestic buildings, so that they too will have to be zero carbon by 2019.

The impact of these plans and the drive towards zero carbon has already had a powerful effect in galvanising the house-building and property development community, and in stimulating innovation. I am not sure that would have happened without such a strong legislative and policy initiative.

However, those of us who are passionate about delivering a genuinely sustainable built environment currently face a real dilemma.

Here's our problem: there is so much more to delivering exemplary built environments than zero carbon. In fact, there is even a danger that a fixation on zero carbon may result in highly perverse outcomes and deliver seriously damaging and unintended consequences in terms of sustainability – with the pursuit of the 'best' becoming the enemy of the good.

Government wants to see all new homes built to the highest level (Level 6) of the Code for Sustainable Homes by 2016. Allowing for the time required to design, specify and fund a development of Code Level 6 new homes by 2016 means house-builders and designers having all the answers to the zero carbon challenge by about 2012 – just three years from now. Housebuilders working in the social housing sector are having to move even faster, producing Code Level 3 or 4 homes already.

The risk is that the single-minded scramble to design and build Level 6 homes gives out the message that this is the most worthy outcome we should aim for. It's not. If we end up with 'zero carbon' homes that rely on unproven or risky technologies, are uneconomic to maintain, are built on flood plains, overheat in summer, have poor acoustic performance, poor indoor air quality or other unintended consequences, then we have created a generation of homes unfit for people. This cannot be called genuine sustainability.

When it comes to cutting carbon emissions from the building stock, a three-pronged approach is necessary. The first priority is de-carbonising the electricity supply grid. The second is all about promoting low and zero carbon new build. And the third requires a coordinated national strategy to radically improve the performance of our existing buildings.

The UK's Renewable Energy Strategy is great news for the first priority – it takes us an exciting next step towards a truly low-carbon UK. The targets for zero carbon new buildings are already going some way towards addressing the second priority.

Inbuilt's 'top 10 tips' for existing stock improvements

The perfect package of improvements to any building, residential or commercial, clearly depends on its age, design, use etc. But Inbuilt has the following advice for anyone who wants simple and cost effective ways to tackle wasted emissions:

1. **Inclusion is mightier than innovation** – existing stock means there are tenants and occupants who must be consulted from the outset. No amount of imposed techno-wizardry will create a sustainable future if the users feel it is imposed.
2. **Look around you and join the carbon dots** – there are great ways to link existing stock with local low and zero carbon new-build developments, which can help make technologies like CHP viable. Local Strategic Partnerships and Regional Development Agencies must play a pivotal role to maximise co-ordination and blending of complementary energy requirements.
3. **Keep your eyes on the horizon** – focusing too much on immediate measures and targets can result in short-term fixes that actually reduce the viability of greater improvements later on. For example, a campaign to install gas condensing boilers during 2008 when a waste heat main is due to be available in 2010 could make later upgrades unlikely for the next 10–15 years.
4. **Together we stand, divided we fall** – true low carbon refurbishment will require both advanced fabric improvements and low/zero carbon technologies. The installation and commissioning of these systems can be disruptive so careful programming of works at street and estate level is key to reduce capital costs and foster a community spirit.
5. **Minimise to maximise** – while bolt-on renewable technologies may be a public statement of eco credentials they should be seen as the final stage in any carbon reduction project. Improving the building fabric to reduce heat loss and air leakage is of primary importance to minimise any fossil fuels used and maximise the financial case for renewables.
6. **There's more to life than walls and boilers** – the way in which a building's immediate environment is treated can have significant energy implications. For example, returning parking areas back to greenery with permeable surfaces and generous cycle stores can provide the incentive for people to reduce car usage. Combine this with building energy monitoring systems that also relay real-time local public transport information and people's carbon literacy will be increased.
7. **Think beyond the immediate solution** – treating improvement techniques in isolation increases the danger of unwanted side effects. An example of this is using insulated dry lining in solid brick walled dwellings to reduce heat loss. The insulation will unfortunately also isolate the thermal mass of the wall, reducing its potential to help minimise summertime overheating if combined with effective shading and night time ventilation.
8. **Remember older buildings are very different animals** – traditional construction techniques and materials rely on vapour permeability to absorb and control humidity levels. Insensitive positioning of modern high performance materials can inadvertently accelerate structural damage.
9. **Money makes the world go round** – without clear financial incentives such as tax rebates, zero interest loans and guaranteed future energy prices, improvement of the existing stock will be perceived by many as Government targetting the hard-pressed individual rather than the more wealthy industrial giants.
10. **Who turned out the light?** – ultimately, real world performance of buildings often differs greatly to modelled predications due to the way people act. Clear and unavoidable real-time information within the building on both carbon emissions and running costs is crucial to make people take action to reduce their consumption.

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Existing building stock

But what about the third part of the package? Sadly, we still do not have a coherent and effective strategy to deal with the huge energy wastage in the existing building stock.

Why does this matter so much? Well, consider that over 70% of the UK's 2050 building stock has already been built. The vast majority of the buildings we will still be using in 20 years' time lack sufficient insulation, heating controls or other measures to save energy – and that puts us among the worst performing countries in Europe.

This issue has been identified time and again as the single most important and potentially effective area where UK carbon emissions could be slashed. To paraphrase Bill Clinton, 'It's the existing stock, stupid.'

The problem with existing buildings is simple; they underperform in relation to current building standards because they were designed and built at a time when sustainability and energy efficiency were not the imperatives that they are today.

And while global warming is a key driver, we must also not forget the more immediate benefits of improved energy efficiency in the existing housing stock – particularly the way it can help us tackle fuel poverty.

Fuel poverty is not easily dealt with because it can be caused by a complex mix of economic and social factors. However, one of the most important contributing factors is the energy inefficiency of the housing stock. Too many vulnerable people still have to spend considerably more than 10% of their disposable income on heat.

A significant and long term programme of improvements to the energy efficiency of the existing stock (supplemented by a programme of appropriate renewable energy installations) will, therefore, deliver considerable social benefits as well as contributing to the Government's carbon emissions reduction target.

There is considerable consensus on what needs to be done, especially now, as a consequence of the EU Energy Performance of Building Directive, we have a fully operational energy rating and certification scheme in place that includes identification of cost-effective energy efficiency measures for all UK buildings.

At the technical level for example, the best improvements for energy inefficient buildings are generally very simple and risk free and are judged on their cost effectiveness and accessibility. These include better insulation (loft, walls, floors, tanks and pipes), draughtproofing, secondary and double glazing, A-rated boilers and appliances, improved heating systems, enhanced control systems and efficient lighting. Some technologies such as solar hot water systems and ground source heat pumps can also help in the right places, and community-wide CHP systems offer the opportunity for highly cost effective improvements on a larger scale.

Case study – Titanic Mill

Lowestwood Mill is a Grade II listed textile mill in Linthwaite, West Yorkshire. Completed in the same year as the launch of the Titanic, the imposing 6-storey, masonry building is known locally as Titanic Mill. Now refurbished, the building has been converted to provide 130 residential apartments on the upper floors and a spa/leisure facility and restaurant on the ground floor and part of the first floor.

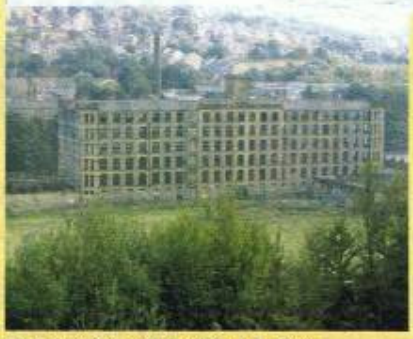
The developer of Titanic Mill, Lowry Renaissance Ltd working in partnership with Energy for Sustainable Development and Kirklees Metropolitan Council, has committed to making the apartments carbon neutral (on a net annual basis) and to minimise carbon emissions from the ground floor spaces.

The project aimed to:

- Reduce energy demand – using high levels of insulation, high specification windows, mechanical ventilation with heat recovery and low energy appliances.
- Produce green energy – Titanic Mill incorporates its own renewable energy generating plant.

The building features a roof mounted, 50 kWp solar photovoltaic system and a biomass-fuelled combined heat and power system, producing 100 kW of electricity and 140 kW of heat energy.

Solar photovoltaic panels, together with a biomass-fuelled CHP system, provide renewable energy on-site



The derelict mill building before conversion started

The phased conversion and occupation plan means that early stages of the project used gas boilers for space and water heating. The gas boilers will eventually provide a support role for the CHP system during peak demand and maintenance periods. The photovoltaic system is estimated to produce approximately 40 MWh per year of electricity (approximately 2% of the total demand).

The site will be connected to the local electricity grid. This will provide an opportunity to export excess electricity from the biomass CHP system and to purchase electricity from an electricity supplier when demand on-site is high or the CHP system is not operating.

An energy service company (ESCo) called Mill Energy Services has been set up to manage the demand and supply of energy at Titanic Mill. The ESCo is a company limited by shares, wholly owned by the building's management company which, in turn, is owned by the residents and the ground floor tenants, that is the end-users of the energy.

Encourage green refurbishment

Similarly, the favoured ways to encourage a green refurbishment and retrofit of existing buildings are already well known. We're talking about a package of measures, mainly regulatory and financial, coupled with effective information campaigns, to act as an incentive to action.

The options include tax changes to encourage more refurbishment, more capital allowances and various tax-neutral rebates associated with stamp duty, council tax, business rates or corporation tax to reward the implementation of improvement measures recommended in an Energy Performance Certificate (EPC) or Display Energy Certificate (DEC).

It's recommended that the next revision of the EU Energy Performance of Buildings Directive should require DECs to be displayed in all commercial buildings such as large supermarkets and hotels, since this will help to stimulate energy efficiency improvements in the service sector.

What is also needed are building regulations which ensure that whenever a building is being extended, or undergoing major refurbishment, the developer should have a mandatory obligation to upgrade the energy efficiency of the existing building.

But whatever the challenges, we must not be distracted from the urgency of reducing carbon emissions from the existing building stock, and of securing investment and planning consents for large scale renewable energy systems. In terms of money invested per tonne of carbon saved, both of these objectives will provide a much greater and faster return than making all new buildings 'zero carbon'. ●

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