

RETROFITTING THE EXISTING BUILDINGS TO OVERCOME THE TRIPLE CHALLENGE OF CLIMATE, ENERGY AND SUSTAINABILITY



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Three great challenges are upon us, the need to adapt to and mitigate against future climate change, to reduce energy consumption to help maintain national security, and to consume resources in a manner that is sustainable in the long term. In each case about half the problem (45% of our carbon emissions) is associated with energy and resource within existing buildings, and a third (27%) of the problem concerns our homes. Since 87% of the buildings here now will still be present and form about 70% of the building stock in 2050, we will see off or succumb to the three challenges by what we do, or fail to do, with existing buildings, and especially our homes. Since the urban buildings dominate, it will be the

response of our towns, cities and metropolitan areas that will be decisive in winning or losing the battle.

THE TWO PERIODS 1990-2005 AND 2005- 2020:

Over the period 1990-2005, the carbon emissions from domestic buildings dropped by a net 4% from 154MtCO₂e (e = equivalent) to 147MtCO₂e. This reduction came, in the main, from steady progress in measures to improve the thermal envelope in houses. Taking a basket of interventions, ie installing 3" or more of loft insulation, double glazing more than 60% of the windows by area, draught-proofing over 60% of rooms by volume, and installing cavity wall insulation where appropriate: in 1990, about 35% of all houses already had this standard of insulation and were capturing the energy savings benefits, and this figure rose to about 65% by 2005. The reduction in CO₂ emissions might have been 10% or more without countervailing factors: during that time there was a 10% rise in house numbers, a 4% increase in population, and a sharp rise from a very low base of the electricity consumed by electronic appliances for IT and entertainment (eg computers and plasma screens).

At the current rate the basket of measures will be fully installed by 2015, and all the carbon reduction savings exhausted.

When we note that the 2008 Climate Change Bill sets a 26% reduction target for 2022, we can see that the building sector is going to have to work on its existing stock to achieve SIX times the net reduction in carbon emissions in the current 15 year period. We have indicated a limited capacity of the thermal envelope to contribute, unless there is a major R&D project to bring forward new thermal insulation materials and products with new and more effective means of installation. This factor SIX sets the scale of the challenge that faces us for housing, let alone any other part of the national infrastructure – non-domestic buildings, energy supplies, transport etc.

MEASURES TO 2050

There are four ways in principle by which the operation of buildings can contribute their full share of an 80% reduction, and all are needed:

New measures to improve the thermal envelope of buildings – materials, installation processes, controls, etc

Decarbonising the grid and other sources of energy

Improving the energy efficiency of appliances and

Changes in personal attitudes and behaviour concerning profligate energy use and resource consumption (especially water).

Three of these have an engineering focus, and the fourth is a matter of psychology and sociology. Of these only the second is widely accepted in the public debate and measures are being taken in relation to renewable sources of energy, a nuclear rebuilding programme and a renewal of a more efficient grid.

THE BUILDING SECTOR AND THE SCALE OF THE CHALLENGES

Although we see the noble efforts of a few to green their homes at great personal cost in terms of money and time, this has little impact on the problem just described. We have 22M homes, and if we might get at most two chances per household to intervene between now and 2050, we need whole-house interventions (on energy, water, waste and air quality systems) at a rate of the order of 1M a year. This is about 4-5 times the rate at which homes

undergo some form of renovation at present. The advice I have been giving focuses on the scale of that problem, and the place from where we are starting a 40-year journey.

The real problem is that there is no retrofit market. The renovation market, such as it exists, is totally balkanised with small firms or single traders offering limited services. There are many suppliers of different products with no large market leaders. Many players are keen to play a role, but all are looking for clear leadership – none are willing to risk their own businesses on going out alone and ahead on the green agenda while others continue to cut corners on products and services.

There is a further structural problem that needs fixing. In recent years, much public and some private money has been committed to R&D towards solving the problems of energy inefficiency, climate change and sustainability. Funding agencies can be assured of a route to market of successful R&D in nuclear rebuild, renewable energy, and carbon capture and storage. Someone bidding to research on new external cladding materials cannot get the support from big players that do not exist, and that person is at a disadvantage. Indeed there are some novel technologies sitting on the shelf for want of a clear order for ten thousand pieces that would justify the tooling up for manufacture.

The new building sector is better off, with demanding targets of zero carbon new buildings by 2016 and 2018. The new materials and products are likely to be closely coupled to new methods of construction that will not be applicable to retrofitting the existing buildings, which are constrained by older

methods of construction and designed in an era of cheaper energy.

MY ADVICE

The core of the advice I have been giving colleagues within CLG (with responsibility for planning and buildings regulations and codes) and across Whitehall emphasises the scale of the problem, and it has five elements, three on engineering systems, and one each on attitudes and planning.

1. If the higher and further education sector were tasked (or better volunteered) to help lead the national attack on these challenges, they could start by getting their own estates to the 2050 standards by 2035 to show the rest of us the way. Campuses have buildings that are proxies for private dwellings, public buildings, offices and factories. Some of the brightest minds in engineering and psychology are on campus, and if they cannot succeed at their place of work, who else can we expect to succeed? Let's inspire the students, who are the leaders of tomorrow, to participate. The skilled personnel needed for the transformation of existing buildings can be recruited and trained within the FE and HE sectors. The scale is big enough to engage the building sector in bringing new products and services to market. Knowledge exchange is a core skill of academics, and they can be articulate advocates of what works and critics of what fails in the journey towards a new national built infrastructure. Many universities are doing experiments at present, but they are not to the scale needed to impact the whole country, but would like to be in that position.

2. Public procurement could be used to create and drive a UK retrofit market by working together and specifying

aggressive improvements in the performance of future thermal materials, products, and installation processes, and better and more efficient appliances. The model is the California legislature which drove the market for the reduction in vehicle emissions from the 1980s. Between them, the health, education, defence, social housing and local government sectors spend in the order of £10B pa on renovation: they could use their combined muscle to help pull through the new products and services that are needed, at the required scale. In ten years the individual home owner would find only superior products on the market and at competitive prices, with possible reductions on household insurance if retrofit improvements are carried out by approved installers.

3. Central Government ambitions for the nation are actually delivered at a local level within local authorities. Few universities, companies, local authorities or other bodies that espouse their green credentials have any vision that extends beyond 2015. I would like to see model trajectories developed at the local authority level that will tell us how Cambridge, Bristol, Manchester and London are going to work in each of the eight five-year periods from 2010 to 2050 to meet the 2050 targets and the interim targets. There is no need to rush at everything indiscriminately. Some model trajectories, engineering equivalents of the economic arguments of Stern would add immensely to the quality of policy formation and action plans.

4. Over the last four decades, public attitudes and behaviour have changed with respect to wearing seatbelts in cars, not drinking and driving and not

smoking in public confined spaces. We have to reach a position where the profligate use of any forms of energy is considered deeply antisocial, and personal behaviour tends to exploit any technology interventions rather than circumvent them. A commonly accepted redefinition of comfort at home and at work is an essential first ingredient.

5. The planning system will need to evolve so that it becomes an enabler, and not a barrier to meeting the targets of the Climate Change Bill. For example, with 15% of buildings in the South West being either listed or in conservation areas, wherein most current methods of saving energy (solar panels on roofs, double glazing, external cladding etc) are not allowed, we can admit defeat now if there is no change to planning.

CONCLUSION

I know of no previous era in history where a global problem, or in our case now a set of global problems, have come to the fore with a timeline of 3-4 decades for making serious inroads. If we soon see a six-fold increase in the rate of improvement of the energy consumption of buildings in the current 15 years to 2020, compared with the period 1990-2005 above, we may continue with the heightened sense of urgency. If not, the cries for a Manhattan style project, or the move by non-democratic bodies to launch geo-engineering projects, will gather force.

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