



# **FORGET 'ECOBLING' THE UK NEEDS TO CONSUME LESS ENERGY**

**BY PROFESSOR DOUG KING**

The last two governments have managed to agree on one thing at least: the importance of tackling climate change and addressing future UK energy security. Because of this accord, the UK has actually adopted some extremely worthwhile, but challenging, targets on greenhouse gas abatement and on renewable and low carbon forms of power generation.

**B**y now, everyone should be aware that the UK is committed to reducing carbon dioxide emissions 80% below 1990 levels by 2050. Most people reading this journal will also be aware that carbon dioxide emissions arising from energy consumption in the buildings accounts for around 45% of the total.

Thus, one of the headline policies is that all new buildings should be constructed to zero carbon standards by 2020. However, by the time 2050 comes around new, zero carbon buildings will only account for around 20% of the building stock, the remaining 80% are already in use today. The low carbon refurbishment of some 20 million existing buildings presents an even greater challenge for the construction industry than that of zero carbon new buildings. Further, in order to meet the commitment we will need to deliver over 2,000 low carbon building refurbishments every working day starting today.

Unfortunately, a number of recent

studies of both low carbon housing and low carbon non-domestic buildings have shown that there is still a wide performance gap between the expectations of the construction industry and its clients and the ability to deliver real carbon savings. It is therefore vital that we embark on this journey of decarbonising the built environment with a clear understanding of what it will involve and which approaches deliver the best abatement at the lowest cost. Otherwise, we risk wasting time and money on initiatives that fail to achieve the end goal of reducing the overall amount of carbon dioxide emitted to the atmosphere.

Recently, the conjunction of local planning policies demanding on-site renewable energy generation and the generous financial incentives available for these technologies have created a perverse new market for small scale generation in urban locations. The most common approach now being taken to low and zero carbon housing is to use

an electric heat pump in the winter and then provide the building with sufficient renewable generation to offset the electricity consumed by the heat pump over the course of the whole year. What we are seeing at the putative cutting edge of new housing design will no doubt become the default approach for refurbishment too unless we do something about it.

In some instances, I am even hearing now of low carbon projects that are abandoning super insulation and other passive energy conservation measures in order to pay for the revenue earning technologies. Under the right circumstances an owner can now be paid to generate heat that is wasted in a less well insulated building and paid again to generate renewable electricity to offset the wasted consumption and still qualify as zero carbon.

Subsidies aside, this approach to zero carbon, whether applied to new build or refurbishment, may not actually lead to zero emissions, as

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the assessment of carbon abatement does not take into account the different times at which the generation and the demands occur. The carbon intensity of grid supplied electricity varies depending on the mix of generation required to meet demand. Generally, in the winter the carbon intensity is higher as more fossil fuel generation is brought into the mix to match the demand, whereas during the summer, when building attached renewables will be generating at their peak, the carbon intensity is low anyway.

Taken to the extreme, if we try to address low carbon refurbishment to meet our national targets using a mix of heat pumps and small scale renewable generators then we will simply exacerbate the problems. As more and more renewable generation is added to buildings, the carbon offset available for each individual generator will get lower and lower. On the flip side, a wholesale move to electric heating in the winter, even with the purported efficiency of heat pumps, will require a vast increase in generation capacity. Even if a substantial proportion of this demand can be met from large scale renewables there will still be a

requirement for backup generation to cover the intermittency of the renewable generators.

Then we need to consider the actual performance of heat pumps in practice. Ground source heat pumps provide consistent performance throughout the year, but are expensive and require large areas of land for heat extraction. The performance of the more popular air source heat pumps depends on the external air temperature. The performance figures that are typically used to assess the carbon abatement potential are seasonal averages corresponding to outside air temperatures of 5°C to 7°C. With well designed, well insulated new and refurbished buildings there should be little demand for any space heating at these temperatures. In the future, heat pumps will be required to work mostly at outdoor temperatures below 0°C, when their performance drops rapidly. Thus, the instantaneous electricity demand from heat pumps during the winter could be much higher than anticipated at a time when the grid has higher carbon intensity.

A further problem with adopting small scale renewable heat

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technologies to refurbish British buildings is that we have a history of building homes that leak. The UK's relatively benign climate means that, historically, we never really had to bother with insulation before energy conservation became such an issue, whereas our damp weather quickly leads to mould problems in buildings without good ventilation. Our standards of construction therefore reflect these very real drivers. However, this means that our buildings are generally too expensive to heat continuously, as the heat just escapes. Consequently we have adopted a pattern of intermittent heating following occupancy in homes and non-domestic buildings alike.

Intermittent heating requires a high intensity heat source such as a gas boiler, and a heating system that responds quickly, such as the traditional radiator. Low carbon and renewable heating systems work best when they are configured to deliver low intensity heat continuously to a well insulated, airtight building. To size a heat pump to deliver similar

peak output to a boiler would be prohibitively expensive and lead to significant problems in its operation.

Dealing with the poor state of the fabric of our buildings must be the priority in refurbishment, before we ever start to think of bolt-on technologies. Insulation and airtightness do not have the "EcoBling" attraction of small scale renewable energy, but will require just as much thought and ingenuity if we are to get it right.

When we try to retrofit high levels of insulation and air-tightness to traditionally constructed British buildings we can quickly run into problems with indoor air quality, condensation and even rot within structural timbers, not to mention bronchial health problems relating to mould. Improvements to insulation and airtightness therefore need to go hand in hand with provision for protection against condensation and controlled ventilation with heat recovery. Thus, an apparently simple measure actually introduces a whole family of additional requirements in order to maintain a safe and healthy internal environment. Is a serious mistake therefore to try and skimp on consideration of issues relating to the building fabric in order to pay for the low carbon technologies.

Therefore, when it comes to retrofit, we must not allow ourselves to become distracted by the apparent financial attractiveness of bolt-on renewable energy technologies. It is conceivable that the conjunction of zero carbon buildings, the Feed in Tariff and Renewable Heat Incentive could actually lead to higher emissions overall, whilst not addressing the root of the problem. This is of course an extreme example, but it does highlight



that the approaches we take in order to meet policy goals in the short term may not in fact be the most sustainable approach in the long term.

The problems facing us in dealing with the building fabric issues in our stock of existing buildings will require considerable effort, expense and innovation. Failing to deal with the building fabric issues will result not just in higher than expected emissions, it could exacerbate health problems and other social issues such as fuel poverty. We need to be aware that the directions we are taking now through expedience may not lead us directly to our hoped for destination

and that we may have to change direction several times before we can reach our ultimate goal.

We would be much better off focusing our efforts on building refurbishments that address the fundamental issue of consuming less energy to create comfortable and productive internal environments, rather than continuing to delude ourselves that we can simply bolt expensive technology on top of already failing buildings. That way, the cost to decarbonise our energy supply, the only real way to achieve a low carbon economy, will be reduced in line with the energy we save.

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