

The **AECB** (the Association for Environment Conscious Building) and its sister organisation the **Passivhaus Trust**, together with our 1800 members, focus on **building performance, health, comfort and energy efficiency**.

AECB can help:

- **economically deliver both zero-carbon new build and large-scale energy efficiency measures to existing homes, at the lowest cost to UK plc**
- *affordably* decarbonise UK heat – extensive *Energy Efficiency* or ‘Negawatts’ are a compellingly attractive investment
- reduce the energy we use for heat and power, giving the nation far superior returns compared to those from investing in carbon capture and storage, or subsidy for nuclear generation.

UK offers international leadership in responding to the challenge

- “In March 2015, global carbon dioxide concentrations surpassed 400 parts per million for the first month since measurements began”
National Oceanic and Atmospheric Administration, US Dept. of Commerce
- “The UK is a global leader in developing cost-effective policies and innovative technologies so that growth and decarbonisation can now be seen as both sides of the same coin – Paris 2015 is a singular opportunity for generations across the world to share in that future.” *Ms Amber Rudd MP, Parliamentary Under Secretary of State for Climate Change, United Kingdom*

No brainer: invest in the ‘low hanging fruit’ of energy efficiency

The UK’s energy security and economic well-being depend on much more extensive investment in energy efficiency, in all its forms. It is the only bulk energy option that competes with fossil fuels.

- Energy efficiency is virtually carbon-free, and entirely indigenous
- Energy efficiency measures are not just a free lunch, but a lunch that one is paid to eat!

Given the cost-effectiveness of many energy efficiency measures, energy efficiency remains as important an opportunity for energy policy as the discovery of a new series of giant oilfields, but without their global warming impact. We should pursue energy efficiency in all its forms as seriously as geologists have explored the earth’s crust for oil and natural gas deposits.

A wide portfolio of energy efficiency measures are available that would cost the UK less than 3p per kWh electricity saved; i.e. they would equate to selling consumers electricity for less than 3p/kWh. Most consumers already pay 8–13p/kWh for their electricity.

*This is covered in more detail in **Less is More: Energy Security after Oil** (<http://www.aecb.net/wp-content/plugins/aecb-publication-library/librarian.php?id=7653&file=9296>)*

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Improved appearance following deep retrofit with external insulation

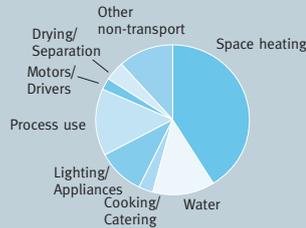


Cut dwellings' heat demand by at least 50% through insulation, draught proofing, better ventilation and efficient heating systems

how important is heat?

To understand what benefits sustainable heat can give us, we need to understand what role heat plays in our economy. Two key facts highlight this:

- Heat dominates UK energy use – outside of the transport sector it accounts for 76 per cent of all the energy we use. Three times as much as electricity. Even allowing for transport, more than half of the total energy that we use is for heating purposes.¹
- Heat has a huge contribution to emissions - just under a third of all UK carbon dioxide emissions came from heat in 2004.²



UK energy consumption by end use, excluding transport (2003)³

Source: <http://www.green-alliance.org.uk/resources/A%20manifesto%20for%20sustainable%20heat.pdf>

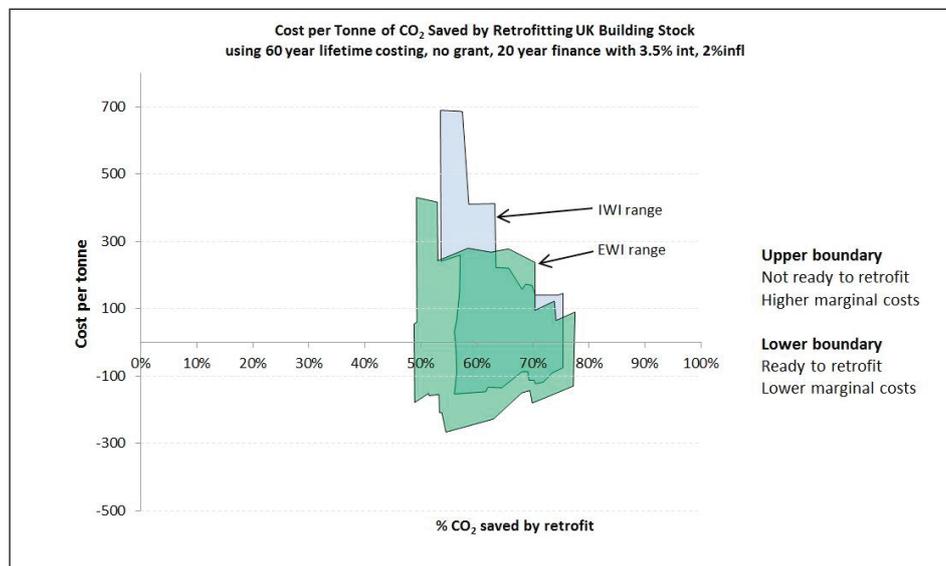
The AECB estimates that through housing retrofit over the next few decades we could economically reduce the amount of gas burnt to heat UK buildings by **at least 50%** – which would mean that we need to invest far less money in the more expensive challenge of decarbonising the UK domestic heat supply.

Cutting homes' heat demand delivers carbon reductions for below £150 per tonne

The AECB CarbonLite Retrofit Programme's financial analysis of implementing effective insulation, draught proofing, ventilation and heating system improvements to the UK dwelling stock suggests carbon mitigation costs are low or negative.



Thermal image after deep retrofit showing reduced heat loss compared to neighbours

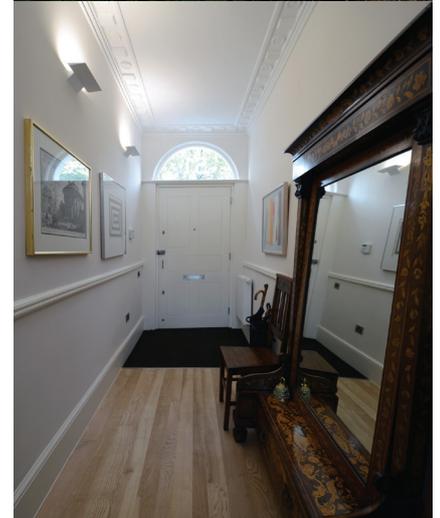


EWI = External Wall Insulation
IWI = Internal Wall Insulation

Carbon mitigation costs resulting from retrofitting a range of UK dwellings at different stages in their maintenance cycles (follows standard lifetime costing as set out in the Treasury Green Book)

- Different colours show alternative insulation strategies, based around internal or external wall insulation (IWI or EWI). Some internally insulated dwellings show far higher carbon costs – these would typically relate to the more difficult types of building e.g. listed or in conservation areas;
- Thousands of whole house retrofit options were modelled in this exercise – the uneconomic combinations of energy efficiency measures have been removed and the remaining cost effective results used to create the regions – or envelopes – shown above;

- Lowest (negative) carbon costs come from retrofitting dwellings at the optimum stage of the repair cycle, so ‘ready to retrofit’ dwellings would be done first and retrofitting dwellings at the least cost-effective point in their repair cycle last;
- Each time a home is renovated or improved without working to a ‘whole house retrofit plan’ the opportunity to incorporate ‘deep’ retrofit measures is missed. Marginal costs for the current or future homeowners increase, and the home becomes increasingly less economically attractive to retrofit, locking it tighter into a poor performance state, and wasting everyone’s money;
- With a whole-house retrofit plan to guide owners’ ongoing investment, the longer term financial performance of the property investment – and as a result that of the UK – can be improved.



Listed building after deep retrofit with internal insulation

What we get from a ‘deep’ retrofit

- Warmer, drier homes as well as very significant reductions in CO₂ emissions – for low and even negative costs per tonne of CO₂ saved;
- At least 50% reduction in space heating cost for all cases – approaching 80% in some cases;
- All dwellings enjoy upgraded ventilation, high quality windows, and fresh decorative finishes (either indoors or outdoors);
- Protection from overheating – crucial to protect occupants from the increasing impact of climate change. Insulation reduces heat getting in as well as out, and ‘deep’ retrofit also includes measures such as solar shading and controlled ventilation.

Less fuel burnt to heat UK dwellings – while making occupants more comfortable

We now know how to successfully overhaul and improve poorly performing building fabric, ventilation and heating systems of older dwellings in a way that reliably delivers the hoped-for energy savings whilst increasing comfort and preventing or managing damp related problems.

Delivering this successfully at scale is of course – like all infrastructure projects – a challenge, but importantly is also a huge economic and health-related opportunity for the UK.

It is a challenge because we are talking about people’s homes, and because to transform our outdated stock into homes that are truly efficient, comfortable and healthy, we will be bringing to bear the best science, engineering and skills that the UK has to offer.

If however we turn our back on science, and on craft quality, we will be throwing our money away.

It is an incredible opportunity because, done well, countless thousands of dwellings that not only waste energy, but also damage their occupants’ health and even their employment prospects, can become warm, comfortable, healthier low-carbon homes.

‘Free benefits’ and the economics of large scale retrofit as a public infrastructure investment

The costs to the UK of saving CO₂ in this way are low or negative, even without the suite of ‘free’ co-benefits that come with retrofit – even where buildings are retrofitted at an uneconomical point in their maintenance cycles. If these co-benefits were ascribed a financial value the carbon costs would reduce even further. However in the AECB’s very conservative financial and energy analysis we have not included co-benefit value so in our scenario these ‘benefits come for free’.

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Transforming the housing stock so it becomes efficient, comfortable and healthy releases these numerous benefits:

- under our legal obligation to cut carbon, housing retrofit is better value for money than many of the options currently being pursued, with much available well below a cost of £150/tonne (see graphic above);
- reducing energy imports will improve the balance of payments;
- fuel poverty is tackled at source, without the need for recurring subsidies;
- improved physical, mental and social health will cut NHS costs, and is expected to improve education and employment prospects. The NHS in Oldham has recorded significant reductions in hospital admissions, following local investment in home energy efficiency (findings due to be published in summer 2015).



Typical semi-detached houses after deep retrofit with external insulation

Invest in the retrofit knowledge economy for robust results

We now know what can go wrong as a result of badly designed and executed energy efficiency retrofit – a predictable combination of under-performance and occasional moisture-related problems.

Retrofit pioneers have now recognised many of the performance and moisture-related problems that arise from poorly designed and executed ‘improvement’ work, and have proved through exemplar monitored projects that adequately ‘moisture-robust’ energy efficiency retrofit is achievable.

Home improvement programmes to date have scratched the surface of the problem, but failed to mobilise the full potential value of energy efficiency investment because:

- half-hearted and piecemeal improvements enabled little more than a small rise in temperatures for occupants, with few if any fuel savings;
- poorly conceived and executed installations purchased for cheapness rather than value, led to faulty, ineffective installations which wasted the public’s money.

To guarantee real as opposed to paper savings we need to harness the knowledge and experience we have available, build on that, and incorporate the guidance into a robust quality framework.

Pump-prime the market to release private investment

Energy infrastructure is a long-term investment that looks for reliable returns over decades. Energy efficiency offers the UK shorter returns than many other low-carbon infrastructure investments, and with distinct advantages:

- individual household capital and/or borrowing can be mobilised as there are individual household benefits as well as national and global benefits;
- the investment is dispersed across thousands of locally-owned SMEs, showing relatively higher employment rates and revenue returns than seen with comparable investment in multinational corporates;
- there are numerous co-benefits (including comfort, health, resilience to energy price rises and supply constraints, improved value of housing stock);
- these co-benefits are shared by private investors and by the state.

Fuel poverty is tackled at source, without the need for recurring subsidies

By offering competitive loan finance and the backing of a robust, soundly-evidenced retrofit methodology, property owners and households get the opportunity to invest in their own health, well-being and comfort, and increase the value, performance and longevity of their properties.

