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Note: not all stories featured on the cover are in this issue!

WELL-BEING - WHAT DOES IT MEAN AND HOW DO WE MEASURE IT?

Well-being is a really hot topic. On the 15th May there was a very interesting workshop on 'Enhancing wellbeing: inclusive, community collaborative approaches to place making' at the University of Dundee. It was very well attended by many with a vested interest in improving people's lives (often at little or no extra cost, it should be added). Attendees included representatives from the NHS, local authorities, NGOs, academics and consultants. Their premise was that people in all walks of life are shifting away from the idea that a flourishing life is primarily connected to material prosperity, to one that positions well-being as a significant goal for personal aspiration and public policy. This shift, it was posited, is being accompanied by a commitment to empower local communities, unlocking social capital and giving individuals a greater voice in the processes of place making that determine the quality and direction of their lives, to provide them with more secure and healthier life styles, safeguard ecological-integrity, promote greater equity and support more resilient places in the low carbon future. High ideals indeed – and I am afraid, to me, rather presented with 20th century thinking. We even got shown the Maslow's Hierarchy of Needs (see Figure 1 below). Needs indeed! Tell that to the people in food bank queues or the 25% of UK home owners in fuel poverty who can't pay their energy bills. I think that the triangle should be inverted to make the most important issue as the meeting of basic needs and drum that home for policy makers.

Alarm bells rang for me. At one end well-being appeared like a great big smoke screen, and on the other end - smoke and mirrors. There were brilliant dedicated people working on the ground in communities to help build better lives saying; 'We want to get communities involved in decision making – but can't afford to run the process'. Then we got the consultants showing the results of well-funded projects to involve citizens in a process that looked like greenwashing to make locally very dubious or unpopular schemes palatable to local communities. For instance, community engagement appeared to be sweetening the bitter pill of the new Aberdeen bypass scheme for some locals – trying to soften the blow of a policy that was fait accompli anyway. Developers have long loved 'sustainability' that allows them to put in a bit of external low energy lighting, a small kiddies' playground and a few swales and ponds to get away with exposed new housing developments on floods plains. We were shown one such scheme in Glasgow. 'Community participation' apparently helped concerned designers put their streets and parks on a site where, with rising sea levels and more intense storms, no buildings - let alone social housing schemes - should be put at all. They did not show a single flood map in all the pretty pictures.

A number of genuine concerns about community participatory processes raised included:

1) The voices heard are of those of small articulate and better off persons, not those of vulnerable and disaffected groups.
2) The whole process can be seen as a 'product' that is bought by a local organisation – with one or several finite meetings. What is needed is a regular process that evaluates the system against its own wish or action lists, to manage rates of progress over time.
3) Such a system needs to be very forward-looking and flexible with aspirations and actions that can evolve over time – essential in a non-linear system.
4) Vested interests of local people or involved organisations can be over-whelming if action plans are based on scenarios where people can trace their own agendas forwards. It would be much better to instigate a local, annually updated vision, based on the aspirations for the community at a further future date, eg. 2030 or 2050 in a backcasting process (icarb.org/2014/06/02/backcasting-summit) and then the milestones can be set and checked against the bigger picture each year.

At the heart of our aspirations for our children is that idea of how can we build a better, safer world for them? Evidence abounds that wealth alone cannot make one happy, but we all know that we all need enough to avoid the distress of real physical needs, So let's put meeting basic needs at the top of our own 'wants' (not 'needs') list. Well-being is a nice word. Its technical definitions include:
Noun: the condition of being contented, (Synonyms: welfare, good, interest, health, benefit, advantage, comfort, happiness, prosperity healthy, or successful) (Collins Dictionary).

Many of you will have read my book, 'Closing the Loop: Benchmarks for Sustainable Buildings', and will have seen in there the numerous metrics and indicator sets for single issues such as health, community, comfort and how they are used by policy makers, designers and planners. But how do you measure well-being? I asked all of the five speakers at the event, 'who used issues of well-being in their work?', and none of them actually measured it! That is not surprising. It is such a complex thing to evaluate as it contains many different determinants and attributes (Figure 2.). For a good introduction to measuring it look at the OECD's guide to measuring well-being (www.oecd.org/statistics/guidelines-on-measuring-subjective-well-being.htm).

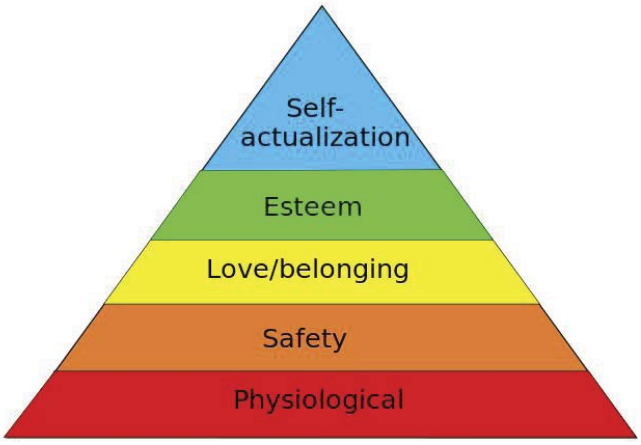

Figure 1. Maslow's Hierarchy of Needs.
http://en.wikipedia.org/wiki/Maslow's_hierarchy_of_needs

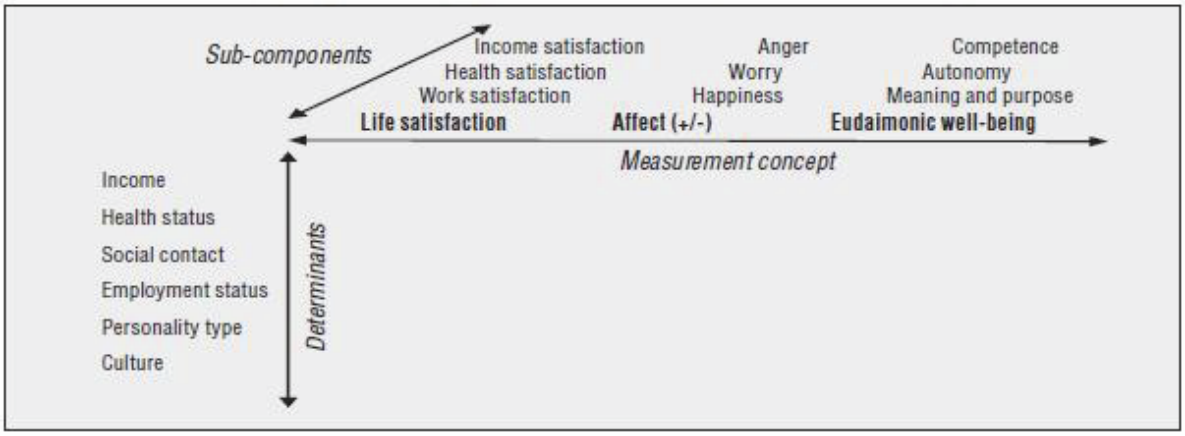

Figure 2. The OECD's simple model of subjective well-being.
www.wikiprogress.org/index.php/Subjective_Well-being

What that publication emphasises is the need for consistency in the structure and wording of such surveys to ensure that results can be usefully compared between different groups. To this end the Scottish Government is preparing its own well-being measures set and I will report back on them in the future. What is sure is that in a changing world the continuing well-being of citizens is vital when the growth paradigm of 20th century economics grinds to a halt and we all have to get used to adjusting to living happily with what we have got – or even less. Welcome to the world of Sufficiency – the challenge is how to ensure that we can all adapt to feeling a sense of well-being within it. The sooner we start to understand how to define and measure it – the better.

Sue Roaf

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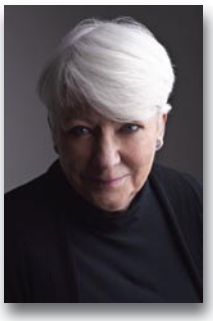

THE CONFUSION IS UNLEASHED

In 2011, the Department of Energy and Climate Change (DECC) published a review of the generation costs of renewable electricity technologies. Onshore wind was one of the cheapest @ £90/MWh, well on par with fossil based power stations or new nuclear. This technology would have looked a good match to DECC's post-election pronouncement to 'keep the lights on and carbon emissions down, whilst saving consumers money on their energy bills'.

Sadly, for the fledgling UK wind turbine industry, the victorious Conservative party declared a 'halt the spread of onshore wind farms', a decision that will most surely put up the average of UK's indigenous clean energy costs. With many insiders predicting that the proposed new 3.2GW nuclear at Hinkley C will either never be built, or spectacularly fail to meet its budget, it rather looks like DECC's contractual energy promises are starting to rest upon a rather paltry 1.4GW undersea inter-connector from Norway due in 2021. I say 'paltry' because we are about to shut 7GW of coal-fired stations whereas the UK demand for electricity averages nearer 36GW. Actually, more like 60GW is needed to guarantee keeping the light on during peak demand. The supply and demand limits are getting unnervingly close to each other.

Cue a National Grid initiative called the Short Term Operating Reserve (STOR). Generally put out to lowest tender, this has funded a series of private sub-50MW mini power stations throughout the country. All well and good, you might think, as these appear to lie at the heart of DECC's desire to keep the lights on. However, many of these mini-power stations have now been revealed as effectively subsidised diesel 'farms'. Albeit for short-term use for a few hours per year, these are not quite in keeping with the stated intentions with CO_2 emissions. Nor is their magnitude sufficient to plug the demand gaps of GW proportions.

Hope is at hand with the recent announcements on home battery energy storage by the USA-based, Tesla Motors, giving an insight into a future scenario. Previously known for their sleek electric cars, they have re-branded their purpose to be global saviours by enhancing the ability to smooth the fluctuations of supply from renewable sources like wind and solar photovoltaics (PV). As useful and appealing as the concept of home-owned energy storage is, it effectively undermines the purpose of having a national grid, plus any accompanying national storage. Early USA adopters, often individualistic in approach, won't worry too much about that, but I doubt the UK can rely on just a few wealthy individuals to provide answers to national problems.

Batteries are not new, but a big international brand getting behind home storage is. Leaving fire safety and the recyclability of battery materials aside, the financial self-interest intended to drive sales in the UK is dubious. This hasn't stopped advance USA orders reaching into a year ahead but battery storage induces a conversion loss that has to be offset by any gain with increasing self-consumption. You also need more equipment than just batteries to automatically interact with the energy sources and domestic appliances. But the real show-stopper is the lifetime of batteries at around 5000 discharge cycles, just around the point where such batteries pay for themselves at current rates. Assuming grid electric does become much more expensive, then the break-even point will shorten but let's not forget when the grid fails, most grid-tied inverters will also switch off for safety. So those seeking full autonomy will find it is not normally viable for more than a few hours, apart from the hardiest of households. Ironically, a mini diesel generating set will provide the desired autonomy far cheaper.

With the new head of DECC vowing to 'unleash a new solar (PV) revolution', this suggests their previous target of 22 GW peak power under optimum conditions is still achievable. With battery storage this will sound appealing to the voters. But electricity represents less than 20% of the UK non-transport energy demand, with heat by far the more significant. This gives the context to the troublesome hydraulic gas fracturing, or so called 'fracking', which was also highlighted in the Tory manifesto. If it's not to be oil or gas for heating the UK urban masses, then there are few other economic choices with current rates. Green builders among you will call foul, but the transition to well-insulated, renewable heated homes remains a tiny niche market compared to the swathes of ageing housing in need of upgrading. The government incentives to improve this have fallen well short. For those who blanket-protest against fossils, we need to hear a detailed alternative scenario of the transition period for heating those houses. Otherwise we'd better get used to gas fracking.

The perverse situation before us, stated recently by the International Monetary Fund, is there will be an expected $5.3tn subsidy for fossil fuels worldwide in 2015. This is greater than the total health spending of all the world's governments. The very same health spending that has to in part deal with atmospheric pollution and climatic disasters caused by burning those fossil fuels. I'd suggest DECC's priorities should be reducing those fossil fuel and nuclear subsidies both nationally and internationally. Then we may well see that the true cost of renewables is capable of standing alone in the market without any subsidies either. Without the layers of administration that surrounds these subsides, resources will be freed for more important duties. Indeed, in a world without fuel subsidies, perhaps we won't need DECC either.

Chris Laughton

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NEWSHOUND - OUR VERY OWN ECO WATCHDOG

In anxious limbo would be a good way to describe the green building news' desk over the last few weeks. The impending election created a kind of paralysis, creating havoc in places, with doubts over future funding, putting projects on hold. Since the result was announced, there has been a lot of speculation, much of it gloomy, but still no certainties. Unlike the situation four years ago, we have had no rhetoric of the 'greenest ever government' variety, and some in the renewable energy industry fear everything could turn brown.

"There is nothing good for green energy about the Tories' election," said Tom Burke, a former director of Friends of the Earth and now chairman of the E3G sustainable development charity.

"We are concerned about the future of onshore wind development, and that there is some suggestion the Conservatives are opposed to decarbonising the electricity supply," said RenewableUK deputy chief executive, Maf Smith, in a statement.

The concern may be warranted, because despite achieving all sorts of clean energy milestones for the UK during his previous term, including a world number 3 ranking in utility scale solar installations, returning Prime Minister, David Cameron, does not appear to be a fan of onshore wind, and did nothing to restrain Eric Pickles, who seemed to delight in refusing permission for wind farms.

Plus Ministers have been intensively lobbied by the fossil fuel industry that money would be better spent on unproven (in the UK) 'fracking' for gas. Cameron is on record for telling an aide to 'get rid of all the green crap' from the party's environmental policy a few years back, while the Tory's current party manifesto does indeed pledge 'to halt the spread of onshore wind farms,' largely on the grounds of appearance.

When it comes to improving Britain's inefficient, existing housing stock, they have not shown any serious commitment, putting relatively limited funding into the unpopular and complicated Green Deal, while pushing large amounts of subsidy towards nuclear power, even though calculations by FOE a while back showed that with subsidy as planned, just one new reactor would cost substantially more than the refurbishment work to people's homes required to save the electricity it would produce.

It's hard to imagine that a second term of Conservative government, without even a little mitigation from the LibDems, could be good for green building, but even taking the above into account, perhaps we shouldn't be too pessimistic. The last Labour administration's plan for new-build 'eco-towns', all designed and built to exacting low carbon standards, is now just a distant memory. Yet, the continued 'austerity' drive, combined with rising prices, is likely to encourage more homeowners to independently undertake energy efficiency works in order to save money, even if they wouldn't describe themselves as 'green'.

The possibilities for eco-refurbishments of older properties seem limited only by the imaginations of the owners. The popularity of such enterprises is demonstrated by the yearly increases in the numbers and distribution of Open Eco Homes' events across the country. Recent additions to the existing gang are 14 properties in York and Lancaster Co-housing's Passivhaus development. Visitors in Lancaster will also get the chance to see the recently completed, linked Halton Lune hydro scheme.

This is currently the biggest community hydro project in England, at Forge Weir just upstream of the green housing, generating electricity with a 100kW hydro-electric turbine. Additionally, the green refurbishment of a nearby mill, plus renewables, have improved the structure to the point where it has been awarded a top 'A' Rating Energy Performance Certificate, almost unheard of for an industrial building of this age, and it is now available as a collection of rentable premises designed for small businesses.

In York, during May, visitors were able to ogle the home of a couple who bought a cheap mid-terrace house in central York and turned it into an energy efficient A-rated property for less than 10% of its value, as well as 13 other varied and inspiring examples of green building, including some new constructions.

North Dorset's second Open Eco Homes' event was also held in May. Here 17 homes were available to view, as well as wildlife gardens, and an electric car charged via PV panels on the house roof. As the owner explained, the car's batteries represented a simple and useful way of storing excess solar energy.

These events, and the skill and knowledge sharing which they facilitate, are the visible face of a growing grassroots movement towards the greening of the existing housing stock, a vital necessity if we are to meet the emissions targets, especially as a large percentage of the existing stock is still likely to be in use by 2050. To help address this problem the AECB's new CarbonLite Retrofit programme, which has been developed over the last few years as part of its Carbonlite initiative, will be launched shortly.

A certain amount of speculation, surrounds the appointment of the new head of the Department of Energy and Climate Change, Amber Rudd, who has taken over from the LibDem's Ed Davey. The Renewable Energy Association (REA) was upbeat about her, with Dr Nina Skorupska saying: "The appointment of Amber Rudd shows a continuing commitment to addressing climate change. (She) has been a champion of renewables and the low-carbon economy in the past year, and her appointment will do much to allay the fears some may have after the general election. We look forward to continue working with her on some of the pressing challenges ahead, ensuring we meet our targets in the most efficient way, laying the foundations for post 2020 and making sure the UK is leading the way in green jobs and cost effective renewables."

It's true that Ms Rudd did make a speech in January at the Carbon Connect Policy for Heat conference in Parliament, which concluded with her saying: "The government... want British examples of the successful delivery of low carbon heating systems on a major scale... this begins to become more and more possible and I look forward to the day when a British city has a heat network to rival Copenhagen. If we are serious about tackling climate change, that's what we need to see happen."

The RHI was also described as a success story so far which could and would be built on.

Friends of the Earth's senior climate change campaigner, Simon Bullock, added: "Amber Rudd has already acknowledged the need to boost renewables and increase investment in energy efficiency – and importantly she recognises the devastating impact that climate change will have without action. Her department now needs to make urgent decisions to get the UK off fossil fuels, not least by phasing out dirty coal, and reducing our energy demand and carbon emissions through major investment in energy efficiency and clean renewable power."

However, other less kind commentators have pointed out that, until recently, she was not especially green. In fact prior to becoming an MP in 2010, Amber Rudd worked in investment banking in the City of London and New York, before moving into venture capital. She then set up a freelance recruitment business and wrote for financial publications.

She also committed some notable howlers during the election campaign, e.g. when asked about her constituents in Hastings, she replied: "You get people who are on benefits, who prefer to be on benefits by the seaside. They're not moving down here to get a job, they're moving down here to have easier access to friends and drugs and drink." And when asked about how gay marriage might have an impact on the General Election, she answered: "When it comes to a general election, I really don't think they'll still be thinking about anal sex," Only time will tell.

The pre-election paralysis effect was well demonstrated by the sad story of a group of 18 pensioners in Lanarkshire who found themselves out in the cold following a bad case of pre-election jitters. The elderly residents were left with no cavity wall insulation for five weeks after a local firm removed the old material and left their homes covered in holes, looking like 'something out of Beirut', after failing to return to finish the job.

One man, who had just had heart surgery, and his wife said their 98-year-old house had been left with numerous gaping holes up to four inches wide on the outside of his house. "It has been a nightmare. Just after the extraction, a cold snap came in and the house was freezing. We had to keep the heating on all day and night."

After weeks of calls to the energy company, the frustrated residents approached their local councillor for help as they feared their homes would be left with no insulation at all. When one of them contacted the firm they told him funding for the second phase of the energy-saving programme had been put on hold, and nothing would be done until after the election because none of the big energy companies, such as British Gas and EON, were signing any contracts under the Coalition's Energy Company Obligation (ECO) scheme until they found out who would be in power and what their plans were going to be.

Indeed, according to DECC's own figures, numbers of installations carried out under both the ECO and the Green Deal hit their lowest level for 20 months in February. Altogether 44,431 energy efficiency improvements were installed in 35,488 homes under the two schemes, the lowest level since June 2013. This compared to a high of 100,206 improvements in March 2014.

The total number of ECO improvements installed amounted to 42,804, compared to a high of 98,872 in March 2014, and through the Green Deal 871 improvements were installed, with a further 756 installed through the Green Deal Home Improvement Fund.

John Alker, of the UK Green Building Council, said: "Sadly it's no surprise that the number of energy efficiency measures and households benefiting from them is at its lowest ebb in a year and half. The policy shambles around ECO and the lukewarm response to the Green Deal have had their impact."

Alker called for a renewed retrofitting push from the new government, adding: "The new government - of whatever colour - needs to dedicate capital funding to pump prime this market."

Pedro Guertler, head of research at the Association for the Conservation of Energy (ACE), agreed the figures were no surprise. He added: "What is needed from the next government is for it to treat home energy efficiency retrofit as the infrastructure investment priority that it is, not a series of here-today, gone-tomorrow programmes. This would mean a long-term policy towards funding and attracting private investment."

When it comes to new constructions, there is some good news. The quality of fabric first solutions to energy efficiency seems to be constantly improving. The latest example of this is that one of the UK's newest green commercial buildings, The Enterprise Centre at the University of East Anglia, has passed its first airtightness tests with an amazingly low score of 0.31 ACH @ 50 Pa - around half the requisite level of air leakage to achieve Passivhaus.

John French, Project Director for The Enterprise Centre, said: "We're delighted with the building's performance in the recent airtightness tests. Passivhaus is really taking off in the region, with highly energy-efficient houses, schools and commercial buildings being built throughout the East of England. The vision for The Enterprise Centre is that it will become a focal point for green construction expertise, housing a variety of business tenants that specialise in this rapidly growing sector."

The NRP Enterprise Centre is targeting two rigorous sustainable built environment standards, BREEAM Outstanding and Passivhaus Certification.

Ben Humphries, from architects Architype, who designed the building, said, "We are delighted that the extensive work that went into the design and detailing of the sealed envelope, and then the meticulous attention by the whole project team during the construction period has paid off. It's a great result to get in an initial air test."

Passivhaus social housing is also spreading, with two prototype homes being built under the auspices of the Isle of Man's Department of Infrastructure, who are keen to encourage more sustainable construction methods on the Island. The performance of the homes, now occupied by specially trained tenants, will be monitored with a view to adapting the design, if necessary, before building more.

Phil Halliwell, an architect involved with project, has delivered presentations and guided tours to MHKs, government officers, fellow professionals and eco housing enthusiasts. He said: 'A significant amount of time and effort has been invested in this project with the aim of testing the benefits of building to the Passivhaus standard in the Island.

It's expected that the additional cost of building and maintaining a Passivhaus will be covered by savings on energy bills over the life of the property. The tenants have been briefed by the contractor on the differences between the Passivhaus and a more traditional construction and are enthusiastic about living in a low energy home.'

Olwyn Pritchard

LEAKY LOOS!

The 1999 Water Regulations (2000 Water Byelaws in Scotland) state that 'all WC flushing cisterns should be provided with a connection for a warning pipe, the outlet of which is to discharge in a prominent position' and that 'an internal overflow discharging into the WC pan shall be deemed to meet the requirements of the Regulations'.

Before 1999 any overflow from a toilet had to terminate in an obvious place and internal overflows were very much not allowed. Whilst this did not guarantee any ballvalve failure would be fixed promptly, building owners definitely had more of an incentive to do so as the damage to the external fabric of the building could be severe. Indeed, back in the 1980's it was common to install overflows to cause an actual nuisance so terminations over front or back doors or into the overflow of a bath were often seen.

Anyway, that has all changed. The tell-tale sign of a wet wall underneath a dripping overflow pipe has now been replaced by a film of water running down the back of a pan, something that is far harder to spot, and, even if noticed, will not be causing any damage, leading to little urgency to repair. And yet a failing ballvalve has the potential to waste significant amounts of water. In a recent trial of smart meters in 4,100 homes in south London, Thames Water found that 5% of homes had a constant stream of water into the WC pan aka a Leaky Loo, and 90% were from failing ballvalves, not, as might be expected, from failing flush valves.

The headline figure used by most water companies for a Leaky Loo is 400 litres of water wasted per day. This is a staggering 146m3 of water a year. 400 litres a day is a 0.28 litres per minute, but my concern is that this figure is too high in the vast majority of cases where a WC is 'leaking'. There is a huge difference in the amount of water wasted by a seeping overflow (12 litres/day compared to a WC filling up and overflowing at a rate of two or more litres/minute (something I have seen from three internal overflows in the last few months) which is 2,880 litres every 24 hours! This has two knock on effects. Headline figures of water saved that bear little resemblance to reality and an over estimation of the amount of water saved by fixing the 'leak' leading to misplaced use of resources.

When flush valves were first installed in the UK (back in 2001) there were quite a few high profile cases where they failed right from the start because site debris had fallen into the cisterns during installation preventing complete closure, but this situation occurs rarely now. The flap type of flush valve are particularly prone to not reseating properly, and I would like to see this type banned for use in the UK. But most flush valves won't fail until after many years of service when the valve washer becomes brittle and starts letting by, at which point it can be replaced. Of course, there is the issue of small bright green tropical frogs that have climbed up the flush pipe from the WC pan into the cistern, who, when the loo is flushed manage to just stop themselves from being swooshed back into the pan, only for the valve to spring down and crush them resulting in a dead frog and a Leaky Loo. Though to be fair that's not really a UK problem!

There are many reasons why a ballvalve starts to let by. As washers age they fail to shut off the incoming flow of water completely. But what is of more concern are ballvalves that are incorrectly adjusted when installed; adjusted properly but the locking nut not tightened; adjusted at some later point to "make the flush more effective"; or a WC connected directly to the incoming mains supply (high pressure) with a ballvalve orifice for a low pressure supply.

Concealed cisterns means it's often less straightforward to diagnose and rectify a Leaky Loo. Luckily there are cisterns that are easy to access. I was in a school recently where the WC I used was actually gushing as opposed to merely leaking. Because it was an internal overflow into the WC pan it wasn't causing a nuisance and presumably hadn't been reported. The school used a staggering 20m^3 of water/pupil/year - a massive overuse of water as a typical primary school uses 3.8m^3/pupil/year. We had assumed the issue was uncontrolled urinals and underground leakage. That proved to be correct but this was obviously adding to it. I fixed the problem there and then (a brand new ballvalve had been installed but not adjusted to cut off at the correct fill level) and calculated that this single failing ballvalve would waste 1,051m^3 a year if I hadn't fixed it - 4.7m^3/pupil/year!

Thames Water are planning to produce a video about Leaky Loos, showing what one is, the various amounts of water (and money) that different flow rates will waste, the causes, and the solutions. This is definitely to be welcomed. The more information out there with correct figures the better. And now you'd better go and check your own WC!

Cath Hassell

Cath is an expert in sustainable water strategies and low-carbon technologies, formed from a background of 17 years of experience in the conventional plumbing industry and 14 years in environmental building. She set up ech2o consultants ltd in 2004. She is a founder member of the UK Rainwater Harvesting Association, and SWIG (the Sustainable Water Industry Group) and was a director of the AECB for 7 years. Fascinated by how we use water across different age-ranges, cultures and genders, Cath writes a blog - a year of showering variously. She also talks about technological and behaviour-change solutions to water shortages to a wide range of audiences, in the UK and abroad, including 12,000 school pupils and counting.
www.ech2o.co.uk

GRID DEFECTION

With cheap PV and batteries, do we need grids?

With around half of green energy generation in Germany now being in the hands of consumers and local energy co-ops, and the cost of PV falling, some look to a future in which power grids and big utility companies are less important - most people generate their own energy locally. In the USA, there has been much talk of 'grid defection', with consumers going off grid (see 'The Economics of Grid Defection' by Amory Lovins', Rocky Mountain Institute: www.rmi.org/electricity_grid_defection). What has made this more realistic, in some people's view, is not just lower cost PV but also, crucially, the advent of cheaper battery storage, allowing PV-using 'prosumers' to provide their own backup. Tesla's new 7/10kWh, Powerwall batteries are examples.

Off-grid PV and batteries may be getting cheap, and operationally that may be fine for remote US homesteads, but does it really make sense in urban areas or for countries as a whole? Don't grids help us to balance variations in demand and supply in different locations, for a range of renewables at various scales and even internationally, as with supergrids? On its web site Blog, RMI says: 'Grid defection introduces its own set of considerations, including over-sizing systems to account for individual peak demand, rather than more efficiently sharing distributed resources as part of a connected smart grid', and says they will be looking at that soon. Maybe at root what's under discussion here is US individualism v European collectivism! But RMI doesn't take sides. It says 'the future of the grid need not be an either/or between central and distributed generation. It can and should be a network that combines the best of both' (http://tiny.cc/oqcnyx). Well yes, then we could link in wind farms, on-land and offshore, wave and tidal projects, hydro and geothermal, as well as community scale district heating using solar thermal and biomass/biogas.

Then again grid defection will only be as big a deal as expected if PV/storage costs really do continue to fall. An IGov paper from Exeter University, looking at the household level, is quite optimistic. It says: 'Until recently, individual storage units were not seen as a viable option, but prices have fallen rapidly (from $500/kWh in 2013, to $360/kWh in 2014) and financial institution, such as UBS, are predicting further cuts, with prices as low as $100/kWh within 10 years', driven by developments in the electric vehicle field. http://tiny.cc/oscnyx

Even so, for the moment some still see batteries as pricey. In Germany, Wolfram Walter, CEO of Freiburg-based ASD Sonnenspeicher, says that the purchasers of the current generation of batteries are just 'burning money.' He calculates that the per kWh cost of stored power generated from roof-top PV installations is anywhere from twice to five times the market cost of electricity:' lead-acid batteries can't store enough power over their entire life spans to make them worthwhile.' Lithium Ion batteries and other technical developments may change that. But for the present, rather than investing in storage, for most householders, it's cheaper to import power from the grid when needed, and also, under most Feed-in Tariffs, more profitable to sell any excess power to the grid, rather than store it. Longer term, the balance may change to favour domestic storage more. FiTs are likely to be reduced, and, with new battery technology, storage costs will continue to fall. So it might then be that consumers can, at times, export stored power at a profit, and thus help with grid balancing. In simple cost terms, a Citigroup analysis cites $230/kWh as the point where battery storage (e.g. for domestic PV) wins out over fossil generation and says that will be reached by the broader market within 2 to 3 years, and will then likely fall to $100/kWh. The Tesla 10kWh Powerwall retails in the US at $3500- so it's still some way off, and that excludes installation and inverter costs. Also remember that this 10kWh unit won't give you enough power to meet typical home power needs for long periods. To do that, overnight or when the daytime PV input was low, you would have to buy more Powerwall units.

That's all about electricity storage. However, adding yet another dimension, there's also the heat storage option - heat is easier and cheaper to store than electricity. It is true that big stores are best, since, the surface to volume ratio (and hence energy loss) is less than with small stores. But, although less efficient, there are smaller-scale domestic level possibilities, including running PV power into immersion heaters: e.g (www.immersun.co.uk).

For the moment though the jury is still out on domestic scale storage, by whatever means. But it might be relevant and viable soon. However, while a degree of decentralisation seem possible, it seems unlikely that power grids will be eclipsed, given the need to balance a range of variable renewables. At best, the wide adoption of battery storage by domestic consumers might offer a new type of distributed storage capacity, aiding wider grid balancing, but not doing away with the need for grids or, for more generally, more efficient large-scale storage systems. And, in parallel, some see district-heating grids, with large community heat stores, as a much better deal than domestic heating/storage, at least for urban areas. So grids of various sorts will stay with us for a while!

Indeed, a recent study for DECC suggested that, if the planned electrification of UK heating and transport goes ahead (fed mainly from large wind farms, and, if they get their way, nuclear), then that would significantly increase the load on local distribution networks, with heat pumps adding 60% to the cost of network distribution for the low carbon system, EVs 38%, under DECC's 'High' trajectory for low carbon technologies. That said, it also concluded that distributed solar PV and wind had low or no impact on distribution network investment in 2015–30. In fact they offset load growth imposed by the electrification of heating and transport. So you can see why some people think more local energy would be best! http://tiny.cc/2vcnyx

David Elliott

As an academic, researcher and lobbyist, Dave has written extensively about renewable energy and related energy policy issues over the years. His latest book 'Renewables: a review of sustainable energy supply options' is available from the Institute of Physics: http://iopscience.iop.org/book/978-0-750-31040-6 He retired from the Open University some years back, but is still an emeritus professor and continues to produce the long running bimonthly newsletter ,Renew, now free in PDF form from: www.natta-renew.org

GREEN AMBER RUDD

Has Amber Rudd, the new Secretary of State for the Department of Energy and Climate Change, in her first fortnight, put DECC at serious risk of a legal challenge from the wind industry?

In her first interview with the Sunday Times after the election she announced her support and desire to bring into the Queen's speech a legislative change to incentives for onshore windfarms, and that more powers would be passed back to communities to make decisions to accept or reject turbines in their area.

In the same article, Ms Rudd also stated that there would be a strong push to bring in fracked gas approving drilling, even in National Parks, as long as the drilling rig wasn't in the park itself.

In some respects you can understand the Government's dilemma, given the recent announcements in coal power plant capacity reduction with the added closure of Ferrybridge C in West Yorkshire. This will further reduce the grid capacity, which was down to just 4% spare last year.

However, new renewable energy capacity could have been generated from onshore wind, but this seems to have been stopped in its tracks (without any further consultation before the announcement), even though the Government went to the European Commission on the basis of technology neutrality for Contract for Difference (CfD) similar to what it did with Feed-in Tariffs (FiT). It would seem that the Conservative's old slogan; 'vote blue, go green' will now only be true if the contaminated waters from fracking are in fact green. Of course, if you consider nuclear power as green, being lower carbon than coal generated energy, then perhaps in the future (possibly by 2030ish), they will sticking to their word. It should be said that the Government still believes in offshore wind as a good option for renewables and there is potentially good news for PV and reducing energy demand, depending on who you talk to.

There are three particular issues that concern me with the new governments stance.

The first is we have already had incidences of greenhouse gases reaching 400ppm (the tipping point for controlling global warming at 2˚C). This Government is going to be negotiating with countries around the world in the Paris negotiations in December on a new climate change agreement. What credibility will we have, given what we are doing at home?

Closer to home - where is the equity in the Government's approach to a balanced energy mix, if they are happy to push through fracked gas despite all the disruption it will cause for communities (without us even discussing the potential downsides, such as in drought periods, where fracking is taking place, who will get the water needed ...?). The Government is not prepared to put the same emphasis with regards to onshore wind or other technologies. How does that work?

Secondly, given the new policy direction that appears to be controlled by those that vehemently dislike wind turbines, and in particular windfarms, what is the Government going to do to meet our 2020 targets? Or is there nothing to fear if the UK government does not meet these binding targets? My understanding from colleagues is that if the infraction was imposed on the UK Government, then the fine could be equivalent to the cost of actually implementing the required measures to achieve the target (15% of all energy). I would hate to think what that would do to the UK's economy.

Thirdly, will the Government consider the consequences of the potential infraction when negotiating the new relationships and working within the EU? After all, an upset Commission may be inclined to interpret the rule book a lot more strictly for those that it feels are not respecting the partnership of the EU.

While ONS stated in February 2015 that the Government was on target to meet its 2020 targets at 15% of electricity from renewable sources, that is still only 50% of where it needs to be, with only 4.5 years effectively to go. This still does not cover heat or transport, which make up the other parts of ALL energy. 2015 is a reporting year (last reported 2013) for member states to report to the Commission on their progress towards the 2020 targets. It may make for interesting reading, given the direction of travel this Government appears to be taking.

So, are the next five years going to be good for the green agenda in the UK? It would appear that while it is exceptionally early days, depending on your point of view, the answer could be yes or no. Whatever happens, it feels like the next five years could continue to stimulate the growth in low carbon energy or stall it for many years to come.

Gideon Richards

Gideon has a diploma in management studies and an HND in electrical and electronic engineering. He sits on a number of European Standards and the International Committee for Solid Biofuels, Solid Recovered Fuels and Sustainability of Bioenergy. He also chairs the British Standards Institution's PTI/17 mirror committee for TC335 and TC343 and PTI/20 'sustainability for bioenergy' and the Microgeneration Certification Scheme. He runs a consultancy called Consulting With Purpose Ltd and is a director of DC21. He is a trustee of the charity CREATE.
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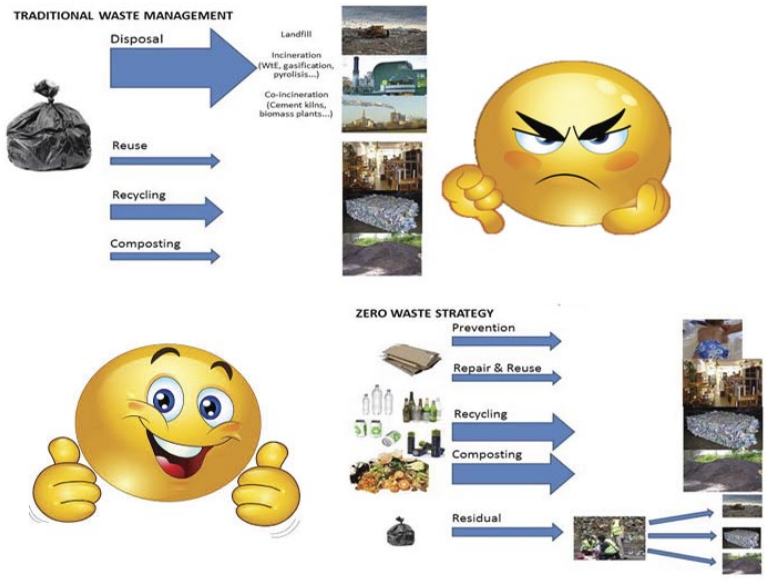
IT WOULD BE A WASTE TO LEAVE EUROPE

With the general election out of the way, the EU referendum is now high on the agenda with debate raging on either side relating to the pros and cons of continuing membership. So, jumping on the band wagon, I thought this could be a good time to look at this from a waste and resources perspective. To be honest, I've focussed more on the pros...

I started my career way back in 1990, working as a waste control inspector in the West Midlands. Essentially this equated to waste management regulation pre Environment Agency days. The Environmental Protection Act had just been introduced with a Duty of Care requirement placed upon all those who produce, manage, transport, treat or dispose of waste to make sure it was managed correctly with minimal risk to human health or the environment. All well and good but in practice there were horrendous acts of pollution occurring on a regular basis throughout business, from small through to large organisations.



Consequently, there were frequent toxic discharges into water courses that wiped out aquatic life in long stretches, leaching of hazardous waste into ground (and then into groundwater/ water courses) and uncontrolled burning of waste materials, causing noxious gaseous emissions. For example, I was called out to an incident involving a battery recycling site which had dumped battery acid over their fence rather than pay for it to be taken away for treatment. This had been going on for years and the pH of the soil was zero. Needless to say, the whole area was devoid of plant life. There were lots more equally awful examples of the complete disregard shown by (mainly) businesses in the four years I worked in that role. The most common excuse I heard was; 'we've always worked in this way and we will go bust if we have to follow all these regulations'. The particular site incident mentioned above, managed to avoid prosecution through installing an onsite treatment plant for the waste acid – which may seem overly lenient through today's lens but was considered a successful enforcement result at the time.

Roll on 20 odd years and these types of incidents are comparatively rare events. Improvements have been largely driven by European Directives that reinforce the fundamental premise of responsibility and accountability of those responsible for waste, including those who manufacture and distribute. This includes Extended Producer Responsibility for end of life vehicles, batteries, tyres, packaging, electrical and electronic equipment etc. Many of these products were routinely dumped in massive quantities throughout the UK. Tyre dumping was particularly problematic as they would usually catch fire at some point and cause significant damage locally, as well as the thick black smoke that could be seen for miles around. Fridge mountains became a common sight with the restrictions on disposal due to the foam containing CFCs and hence no longer having such great scrap value.

It is a testament to how much things have improved that this wild west of waste seems a world away from how most UK businesses act today in terms of waste management. Maybe we would have got to this point anyway through national legislation, but I am confident the rate of improvement would have been much slower without the EU juggernaut driving forward harmonisation of best practice from the likes of Netherlands and Germany across the whole of the EU. Many recent EU member states are currently going through an extremely accelerated improvement process, from almost zero waste enforcement to high levels of resource efficiency.

I've visited less advanced waste economies recently, such as Brazil, which are in denial about the need to enforce Duty of Care to make sure it actually happens. It's a world we definitely don't want to go back to; and with the associated local nuisances of smell, air pollution and pests, I don't think it could become acceptable again in the UK.

So, what are the cons? There are some, though massively outweighed by the benefits in my opinion. The main problem is the requirement to have inherently restrictive legislation to avoid loopholes being created that would be inevitably exploited if it made/ saved money. As a result, the legislation can become a sledgehammer to crack a nut. Inflexibility and complexity often results, and this can have detrimental effect for those who are at the cutting edge of innovation and development of new practices to improve resource use.

Ideally, as waste is redefined as valuable resource, the social norm will act as self-regulation and the EU regulation machine can slow down production. Focus can then be shifted to more proactive work, such as development of the EU Circular Economy Strategy due in late in 2015.

Gilli Hobbs

Gilli is the Strategy Director for the Building Futures Group at BRE. This role includes oversight of research and development relating to resource efficiency, energy efficiency, smart monitoring and measurement, sustainable communities, heating networks and strategies, and lean construction processes and products.
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A new Passivhaus in the Lake District National Park

Following on from the series of articles in previous issues of 'Green Building' (Lancaster Cohousing certified Passivhaus project for 41 houses), Andrew Yeats and Vincent Fierkens from Eco Arc have worked with a local couple to build the first timber frame Passivhaus in the Lake District National Park. It is interesting to review this project and to compare the two types of construction; masonry versus timber, to reach the same Passivhaus end goal.

Tim and Sarah Goffe moved to Staveley in the summer of 2010 when Sarah was appointed to a teaching post at John Ruskin School in Coniston. They had been living in rented accommodation in Staveley village, but had not found anything tempting to buy. When Middlefell, a dilapidated falling down substandard bungalow, became available on the edge of the village, they jumped at the chance to demolish it and start the process of building a Passivhaus. Tim and Sarah are supporters and members of the local Sustainable Energy Network Staveley (SENS) organisation and have friends at the Lancaster Cohousing Passivhaus project 30 miles down the road.

The couple have a long standing interest in sustainable, low energy 'green' buildings, having been frequent visitors to Scandinavia and experienced the 'norm' of the highly insulated comfortable homes there. They were excited by the opportunity to build one of their own. Tim and Sarah were keen to build and live in the most energy efficient house yet to be constructed in the Lake District and work with Eco Arc Architects with our track record of innovation in low energy Passivhaus sustainable housing. It also helped that our office is just 4 miles from the site. In response to the challenges of Climate Change and the depletion of fossil fuel reserves, Tim and Sarah where motivated to demonstrate alternative design and construction solutions that support the shift towards low carbon lifestyles and provide a possible new vernacular model for future affordable housing in the protected National Park. It was equally important to Tim and Sarah not to create a lavish building, but to ensure the design concentrated not only on

energy efficiency and sustainability, but cost-effectiveness.

Having experienced friends struggling through the inevitable delays during long cold winter months building the traditional wide cavity masonry built Lancaster Cohousing Passivhaus project, Tim and Sarah decided, from the outset, that they wanted to go for the efficiency and speed of a part off-site, prefabricated, super insulated timber frame construction to achieve the Passivhaus standard.

Tim and Sarah set the project aims to demonstrate best practice in home energy conservation, renewable energy use, water conservation, waste reduction and home food production.

Principles of design and construction

It was agreed from the outset that the project aims would be achieved through the application of super high levels of insulation, minimizing thermal bridging, excellent airtightness and heat recovery ventilation, natural daylighting, passive solar gain, renewable energy (solar hot water and photovoltaics,) use of recycled materials and recycling of rainwater along with local resourcing of materials and labour.

Passivhaus design standard

The dwelling has been built to the Passivhaus standard, working through PHPP design with Andrew Lundberg of Passivate and with initial M and E designs by Alan Clarke. As most readers will know, this is a successful European ultra-low energy standard for buildings as Passivhaus buildings use only a fraction of the energy for heating (90% less) compared with houses built to the standards required by current UK Building Regulations, and deliver low carbon solutions without needing excessive renewable energy. Where Passivhaus differs from UK Building Regulations and CSH, is the requirement for an absolute minimum level of energy consumption instead of improvement over a more basic specification.

The Passivhaus approach has three main strands:

1. To minimise heat loss – via a compact built form, super insulation and triple glazing.
2. To minimise ventilation heat loss – via airtight construction and heat recovery ventilation.
3. To optimise solar gain for winter heat.

These factors combine to deliver a heating demand that can be met with a minimal heating system (it is recognised that to design a house that needs no heating at all is not economic). As well as very low heating bills, Passivhaus offers comfort and a healthy indoor environment. Attention to detail in design and construction ensures no draughts or cold spots wherever you are in the house. Heat recovery ventilation uses low power fans to provide ample fresh air day and night, warmed to room temperature by a heat exchanger transferring the heat from the exhaust air from kitchen and bathrooms to the incoming air.

Passivhaus is a rigorous energy standard; where energy performance must be demonstrated through the use of the Passivhaus energy modelling software, (PHPP) which is specifically designed to model ultra-low energy buildings. This is backed up by air leakage tests and commissioning records of the heat recovery ventilation. The standard requires a predicted heating demand of 15kWh/m².a over the usable floor area, adapted for the local climate (average energy use for UK housing stock is around 200kWh/m².a and new-build ranges from 50-100kWh/m².a).

We developed the design of the 2 storey house as a compact 10.7m X 7.4m south facing plan. This form has minimised the heat loss from the house and enabled gains to be received from its share of winter and summer sunshine. The Passivate PHPP planning design shows that the house achieves the required targets of space heating demand of: 15kWh/m^2/yr, a heat load of: 10W/m^2 and a primary energy demand of: 112kWh/m^2/yr. We worked hard to develop bespoke cold bridge free junction detail designs and Passivate carried out extensive Psi-Therm 2D modelling of all the key junctions to achieve a resultant calculated cold bridge PSI-value 0.02283W/mK, fRSi-value 0.91.

The Passivhaus standard requires an airtightness of ≤ 0.6 ach (air changes per hour) @ 50Pa (current Building Regulations require 10.0ach @ 50Pa). This high standard ensures draught-free comfort, protects the building fabric from condensation Due to leakage of humid air, and ensures that the efficiency of the heat recovery ventilation is not bypassed by leakage ventilation. The completion air test by Paul Jennings of Aldas confirmed an airtightness result (at 50 Pascal's): 0.58ACH or 0.52m^3/m^2/hr

As a bonus to meeting the Passihaus standard criteria the house achieved an 'as built' EPC A rating and a numerical SAP figure of 104 making it eligible for a Level Six Code for Sustainable Homes rating. Tim and Sarah have now moved in, but are still finishing off certain superficial completion tasks and will monitor actual performance against design criteria over the next twelve months. We will report back in due course to let you know how it performs in reality.

Building fabric

Working with Viking and MBC Timber Frame we developed the low U-value, super-insulated, timber building fabric build ups as set out below.

Ground floor: 20mm reclaimed maple flooring, on 50mm battens with Knauf glass wool insulation between,

on 100mm thick reinforced concrete floor slab, on 300mm Aerofloor EPS insulation, on Viking Passive Slab (PHI certified). U-value: 0.105 W/m²K.

Ground floor walls: 10mm thin coat silicone K render, on 100mm Masterblock recycled aggregate concrete block, on 50mm wide drained cavity, on Pro Clima Solitex WA wind-tight membrane, on 12mm thick Panelvent sheathing board, on MBC 300mm stud twin wall with full-fill Warmcel 500 cellulose insulation, on 12mm OSB with taped joints. The walls are finished internally with 50 x 50 battens to form service void insulated with Knauf glass wool insulation, on 12.5mm Gyproc plasterboard internal lining with plaster skim. Dulux Ecosure emulsion paint. (PHI certified). U-value: 0.112W/m²K.

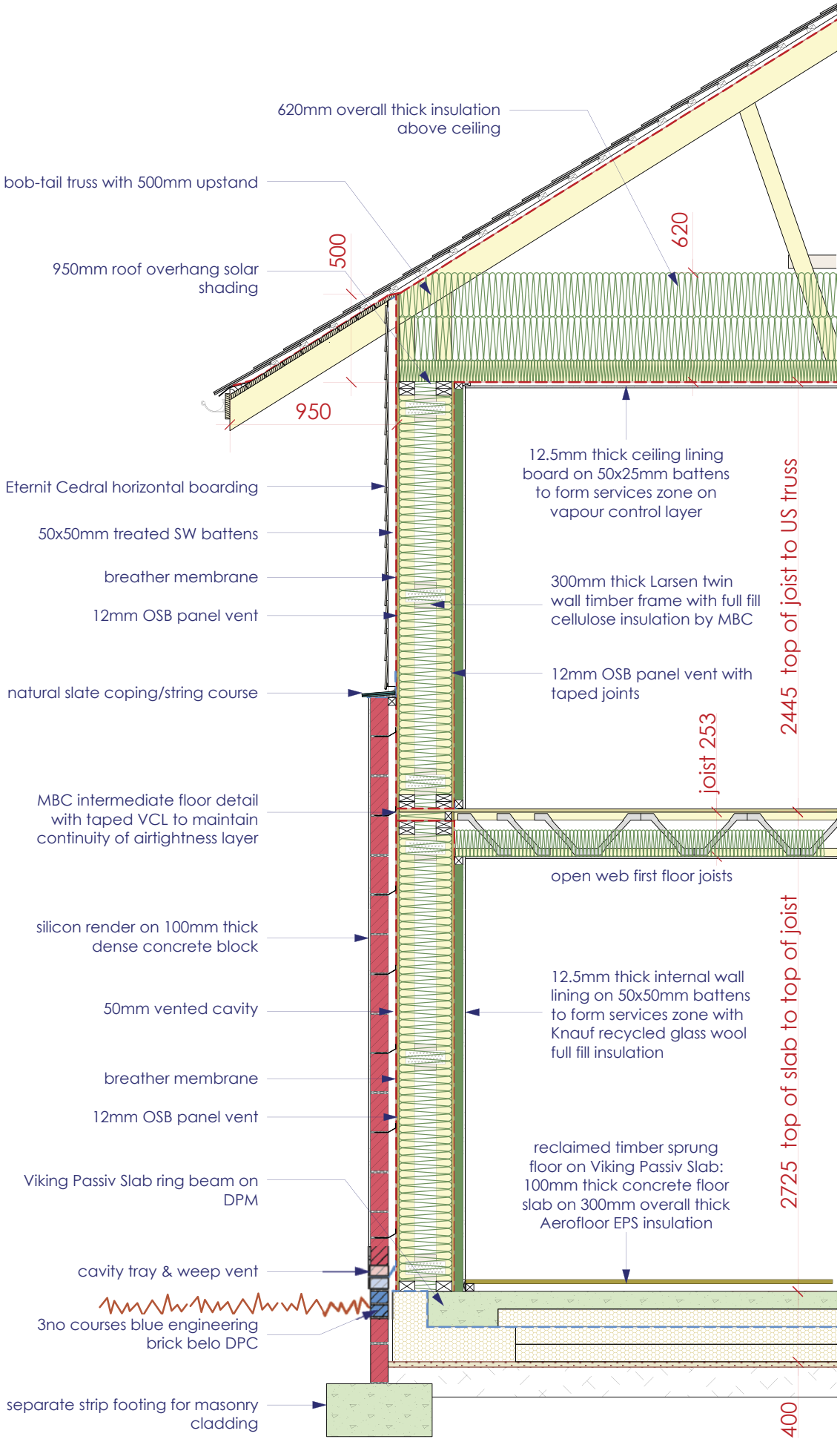
First floor walls: Eternit Cedral weather boarding on, 50 x 50mm vertical battens to form ventilated cavity, on Pro Clima Solitex WA wind-tight membrane, on 12mm Panelvent, on MBC 300mm twin stud timber wall with full fill cellulose insulation, on 12mm OSB with taped joints, The walls are finished internally with 50 x 50 battens to form service void insulated with Knauf glass wool insulation, on 12.5mm Fermacell board with Dulux Ecosure emulsion paint finish. (PHI certified). U-value: 0.110 W/m²K.

Unfortunately the sub-contractors on site omitted to install the specified Pro Clima Intello Plus vapour control membrane assuming the 12mm OSB with taped joints would suffice. This goes some way to explain the marginal pass rate at the final airtest, when compared to other subsequent timber frame projects, where we have come to expect a result of 0.2 to 0.3ARC (at 50 Pascal's) as standard.

Roof: bob tail fink truss rafters at 600c/c with 620mm full fill Warmcel insulation, followed underneath by Pro Clima Intello vapour control layer/air tightness barrier, 25 x 50 battens to form a services void, 12.5mm drylining Gyproc board, Dulux Ecosure white emulsion paint finish. (PHI certified). U-value: 0.065 W/m²K. Unfortunately the sub-contractors on site failed to install the specified OSB ceiling board to support the loft insulation, so we had significant sagging of the air tightness membrane between the service battens, which made taping difficult.

Windows: Ecohaus Internorm KF410 triple-glazed aluminium clad windows and doors with ISO glazing spacers (overall U-value: 0.72W/m²K) were supplied and installed with air tight tape seals by Ecohaus to a very good standard. We certainly recommend a similar supply and install package on all our other PH projects to retain a single point of responsibility and high levels of quality assurance.

Passive and active solar design: A large percentage of


620mm overall thick insulation above ceiling
bob-tail truss with 500mm upstand
950mm roof overhang solar shading
500
620
950
12.5mm thick ceiling lining board on 50x25mm battens to form services zone on vapour control layer
Eternit Cedral horizontal boarding
50x50mm treated SW battens
breather membrane
12mm OSB panel vent
300mm thick Larsen twin wall timber frame with full fill cellulose insulation by MBC
natural slate coping/string course
12mm OSB panel vent with taped joints
2445 top of joist to US truss
joist 253
MBC intermediate floor detail with taped VCL to maintain continuity of airtightness layer
open web first floor joists
silicon render on 100mm thick dense concrete block
50mm vented cavity
12.5mm thick internal wall lining on 50x50mm battens to form services zone with Knauf recycled glass wool full fill insulation
breather membrane
12mm OSB panel vent
2725 top of slab to top of joist
Viking Passiv Slab ring beam on DPM
reclaimed timber sprung floor on Viking Passiv Slab: 100mm thick concrete floor slab on 300mm overall thick Aerofloor EPS insulation
cavity tray & weep vent
3no courses blue engineering brick belo DPC
separate strip footing for masonry cladding
400

the high performance solar glazing is orientated due south to the private courtyard back garden to obtain the benefit of passive solar gain to the living spaces. Shading prevents summertime overheating but permits low level winter sun to penetrate to the heart of the house. Windows to the north, east and west elevations, that have less passive solar gain potential and are, in comparison, deliberately kept more traditional in scale and modest in size to reduce heat loss.

Solar hot water: one the largest consumers of energy within any house is the heating of domestic hot water to service the kitchen and bathrooms. As part of the sustainable development, 7.8m^2 consisting of 3 Consolar Plano 27H flat plate integrated solar Panels are located on the south-facing roof of the house and are connected to an Akvatherm 500 litre solar plus thermal store located in the centre of the house, off the landing.

Solar electricity: A 4kWp Solar photovoltaic integrated array, consisting of 16 Hyundai 250W modules are mounted on the south-facing roof of the house to convert sunlight to domestic use electricity and hot water via a Immersun controller unit to transfer excess electric to the Akvaterm solar thermal store.

Low energy appliances: all appliances have been carefully considered to eliminate unnecessary electrical demand and to optimize the efficiency of the essential items (cooker, fridge, low energy LED lighting etc).

MVHR: in the winter months, when the outside air is cold relative to the required inside temperature, a Passive House Institute certified Paul Focus 200 whole house clean air comfort ventilation system is fitted with a 1kW electric supply duct heater, which includes the controller, programmable room thermostat and duct insulation (note: all of the supply ductwork was insulated with 50mm of foil backed fibre glass insulation. (heat recovery rate 91%.) All the duct work was installed by the local Cumbrian plumbing sub-contractor, who had little previous experience and the final installation was commissioned by the suppliers, the Green Building Store. Tim and Sarah have the option to swap the heat exchanger with a 'straight through' module, a standard Paul accessory, which solves the summer over heating problem of the first year of occupancy.

Other measures: presently we spend an enormous amount of energy and money collecting and purifying fresh water to a high standard suitable for drinking. We then use this very inefficiently for purposes that do not require this level of purification. In this proposal, household and garden non-potable water requirements are met by collecting rainwater from the main roof via galvanized steel gutters and downpipes and storing it in water butts and a 3000 litre 'Rainharvester' underground storage tank. Water from underground storage is filtered and used for flushing toilets and the washing machine. The water butts are used for garden irrigation. Mains top-up water is available from the mains system, but due to the relatively high rainfall in Cumbria this has not been required. Efficient low water use dual flush toilets, with a maximum flush of 4 litres and aerated flow restricted taps and shower heads, have been installed.

Scatter rugs over reclaimed maple timber boarded floors, organic non-volatile solvent paints, avoidance of formaldehyde and other toxic equivalents, combined with natural materials along with summer natural ventilation and a winter heat recovery mechanical ventilation system has lead to a healthy internal air quality, which Tim and Sarah are very pleased with.

Kitchen waste and garden debris material is composted until dry and inert and then returned as a valuable non-toxic fertilizer to the food growing areas of the garden and conservatory greenhouse.

Development costs

The overall building spend was £220K, which included for a 72m^2 one and a half story workshop/utility store and a 15m^2 conservatory greenhouse outside the thermal envelop of the 3 bedroom main house. So the actual spend on the Passivhaus thermal envelope was in the region of £1,370m^2, which is exceptionally good value for any one off architect designed house never mind a eco house to the Passivhaus standard. Tim and Sarah will have minimal utility bills for life; in fact at the time of writing they have surplus income after paying bills due to the FIT and RHI tariff payments received.

The high quality/good value for money construction was achieved by Tim and Sarah acting as fully engaged active clients, employing two local Cumbrian builders; Sam Nelson and Jim Crawford on a labour only basis (Sam has done a lot of previous work with Eco Arc before; including building our office and private home, so he was highly trusted from the outset.) The timber frame element was sourced directly from MBC in Ireland at a good price. Sam opened direct trade accounts in the clients' name with several local merchants and most materials were paid for direct to the merchant by Tim and Sarah at the end of each month, along with Sam and Jims labour costs, based on time sheets. Most other sub-contractor trades submitted competitive fixed price quotes which were agreed en-route through the build process. We have used this procurement route many times before, to avoid risk averse over pricing by main contractors who are not familiar with Passivhaus construction and tend to put up tender figures to a super inflated level to cover the un-known risks. Sam had never built a Passivhaus before, and learnt on the job with some gentle tuition from us. He finished this one on time and

on budget without a cross word. Sam has now almost finished his second Passivhaus in Kendal and has agreed to go on and do a third house in Windermere on the same procurement basis, as it seems to be a winning formula for all parties.

Timber vs masonry

We have now finished 45 masonry Passivhauses across five different sites in North England and are currently working on 18 individual timber frame Passivhauses across a similar geographical region. Clearly there are pros and cons for both options, which vary from site to site and client to client, depending upon specific circumstances. Tim and Sarah's house was a steep learning curve down the timber frame route but it was a success. We have now fine-tuned a timber I beam and cellulose system with a local Cumbria based timber frame fabricator, Trevor Lowis of Eden Insulation, and Cumbria based Ecological Building Services, which has allowed us to erect the whole timber frame thermal envelop consisting of all the pre-insulated walls and roof for a four bedroom house in one day, and follow on with installing the triple glazed windows with air tight seals over two further days and deliver consistent air tightness results in the region of 0.11 to 0.2 ARC at 50 Pascal's. In comparison our last wide cavity wall masonry Passivhaus project in Cumbria for two affordable passive houses finished 4 months late due to bad weather delays and struggled to achieve the required 0.6 air tightness results with a wet plaster approach. So from a range of experiences in terms of quality control and time certainty we are leaning towards timber frame as a quality assured route to Passivhaus certification delivery. We are currently working on our first single block work leaf with external wall insulation Passivhaus in Chester so that may put the cat amongst the pigeons and knock timber frame off its perch ?

Conclusion

The Staveley Passivhaus is an appropriate and high quality/ good value development that provides a possible model for the way our new homes may need to operate within a low carbon society and show a route whereby we can live our individual lives in a more sustainable way.

Andrew Yeats and Vincent Fierkens of Eco Arc Architects
(With input text from Alan Clarke on the Passivhaus standard article text)

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Civil and structural engineering: Peter de Lacy Staunton
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Glass wool insulation: Knauf
Quantity surveyors: Bushell Raven
Mechanical contractor: Nick Dent
Electrical contractor: Phillip Townson
Airtightness testing: Paul Jennings
Additional wall insulation: Kingspan
Airtightness products: Siga and Ecological Building Systems
Windows and doors: Ecohaus Internorm
MVHR: Paul via Green Building Store
Solar thermal collectors: Consolar
Solar PV: Lakes Renewables
Thermal store: Akvaterm
Cladding: Marley Eternit
Concrete block: Aggregate Industries

Andrew is the founder of Eco Arc / Ecological Architecture Practice and works as a project architect and lead Passivhaus design consultant. Having designed and over seen the building works of the Lancaster Co-Housing Passivhaus project, with traditional wide cavity construction, he was keen to explore the potential benefits of timber frame Passivhaus construction. Following the success of the featured Staveley project he is now working on 18 individual Passivhaus projects across the north of England and most of them are timber frame.

Vincent is a Netherlands' born architectural designer. Motivated in particular by an interest in the social dimension of the built environment he studied at the Canterbury School of Architecture. Having worked for a number of mainstream practices in the south east for over a decade Vincent gladly accepted the opportunity in 2008 to join EcoArc in Cumbria. He works closely with Andrew Yeats in delivering Eco Arc's wonderful and highly sustainable range of domestic and community-focussed projects, including Lancaster Co-Housing and the numerous Passivhaus projects that have followed since.

The vision and implementation of sustainable buildings

Sustainability is an issue of increasing importance for all of us and the creation and maintainance of sustainable buildings has never been so important to construction industry professionals right across the spectrum. Building owners and occupiers too demand an ever more stringent eco-footprint from the spaces they own, rent or use. Therefore developing property that meets tough scrutiny through standards and certification is paramount. In the article below, specialists from CBRE's Building Consultancy team address some of the most topical issues. Rebecca Pearce, Andrew Smith, Neelum Mohammed, Matt Wilderspin and Simon Brown report..

The road ahead for sustainability in construction

Sustainability in the property industry, and society at large, is more important than ever. Not only are we preparing for the critical UN Climate Change Conference in Paris this December, but long awaited UK legislation is becoming clearer. The recent release of further guidance around the Energy Act 2011 provides clarity on Minimum Energy Efficiency Standards to commence in 2018. The Energy Savings Opportunity Scheme in also full swing with large organisations preparing for the December 2015 deadline.

Such regulatory requirements are reinforcing the need for owners and investors to manage and mitigate risk in their portfolios. The introduction of responsible property management activities is becoming more common, from sustainability due diligence at acquisition stage to detailed audits of existing portfolios. These are a key part of the environmental, social and governance (ESG) risk considerations now widely accepted as an essential part of good fund management.

Furthermore, there is increasing anecdotal evidence of value erosion – the 'brown discount' – where sustainability risk factors have been identified. Whilst we await hard evidence in the UK of enhanced rents and sale prices for more sustainable buildings, there is evidence that investors are paying attention. The 2015 CBRE EMEA Investor Intention Survey revealed that for 70% of respondents sustainability is either 'critical', 'one of the most important criteria', or 'definitely matters' in the asset selection process. We are also seeing regular instances of 'price chipping' for buildings that fall short of standards. This may at first appear to be at odds with recent discussion around occupier sentiment. Some research may even lead one to believe that sustainability is no longer a serious consideration when making property choices. This is far from the truth, and is the result of an increasing sophistication of occupiers around the impacts of the built environment on their business, and potentially of assumptions that energy efficiency is already being addressed by owners.

Results of the 2014 CBRE European Occupier Survey showed a drop in importance for 'sustainability' as a criteria for occupiers when making location decisions. This must, however, be considered in conjunction with other results. The research also revealed that 67% of respondents reported their workplace strategy was primarily driven by the need to attract and retain talent – dislodging cost savings as the key driver. The second most popular reason was the desire to increase employee productivity (46% of respondents, up from 37% last year). The survey also revealed that 65% of companies seek quality office space with excellent transport accessibility and proximity to amenities such as shops, restaurants and gyms. The high correlation between indoor environment quality (e.g. air, lighting, acoustics and thermal comfort) and human performance means that buildings that provide enhanced environments will be in demand.

From these results, and evidence in the market, we can deduce that clever companies are choosing buildings that can provide high air quality, access to natural light and views, facilities to promote physical activity and access to public transport. These features are recognised by the main building certification labels such as BREEAM, LEED, DGNB and HQE as advantageous 'green' features. One could argue that occupiers are not ignoring 'sustainability' but have become more precise in their demands, reflecting the way the building impacts their business performance.

Developers, owners and investors need to consider these evolving needs of occupiers but not at the expense of more commonly reported sustainability measures - operating costs and corporate responsibly reporting are still important factors. The skill for designers and building managers today is to balance the people centric features of a sustainable building with ongoing energy and resource

efficiency through the use of technology and maintenance practices for optimal performance. It is also worth noting that the features that appeal to occupiers in search of increased staff wellbeing and productivity need not be confined to new buildings. By taking a holistic approach to building refurbishment and repositioning one can achieve good environmental performance, regulatory compliance and renewed occupier appeal, creating a truly sustainable asset.

The convergence of human wellbeing and productivity expectations and government legislation around energy efficiency and carbon emissions leads us closer to the point where sustainability in property is synonymous with quality. That is good news for people and the environment.

The cost of green construction

The construction industry, like most business sectors, is continuously improving standards, so a building which only meets the minimum statutory requirements today would be considerably more environmentally friendly than an equivalent building built 10 or 20 years ago.

As statutory minimum standards, best practice and industry standards continue to develop, as well as the continuous introduction of new materials, new construction techniques and new technology, construction will also continue to evolve. It is the speed of this evolution that can affect costs, early adopters investing in new or untested technology, will pay a premium, and this can be a gamble which might or might not pay off.

Reducing the environmental impact of construction and operation of buildings is a large part of this continuous improvement. Almost every part of a new building can be designed and built more sustainably. Optimising energy use, for example, will probably require a better performing building envelope, as well as more sophisticated energy management and monitoring technology.

Recent research shows that the additional cost of achieving a BREEAM rating of Very Good is minimal and the additional cost to upgrade from Very Good to Excellent may be in the region of 2% to 5%. The cost to achieve BREEAM Outstanding, the highest level of performance, can be significantly more. However, this is only targeted by the top 1% of properties and represents the 'exemplar' or 'world class' category in the current market. With BREEAM Very Good being the minimum standard now required by many local planning authorities, what is the motivation and what incentives exist to encourage developers to go beyond this level and pay the additional cost needed to achieve the higher sustainability standards?

The majority of the Government's construction legislation takes the 'stick' approach, setting minimum standards for energy performance and requiring an understanding of carbon reduction measures that reflect the wider global agenda on sustainability and climate change. The direct impact on construction costs can be seen, for example, in the introduction of landfill taxes on the removal and processing of waste in 1996. This is now reflected in

greater attention to recycling and waste avoidance. More demanding Building Regulations have also made it more expensive to build, but at the same time purchasers and occupiers have begun to value sustainability when they make buying choices.

The European Union also takes a similar approach which has a direct impact on construction with initiatives like banning incandescent lights, and R22 refrigerant which was commonly used in air conditioning plant. The European Urban Access Regulations, however, have an indirect impact on construction and sustainability targets as deliveries to sites in central London need to comply with the air pollution targets and low emission zones. To comply with the regulations the whole supply chain needs to keep their vehicles up to date, a cost which will filter down to all end user clients. If vehicles are not compliant with the emission targets it can cost as much as £200 per day to enter low emission zones, which would increase a contractor's preliminary costs.

Windfarms, often located at vastly remote distances from the site of an office complex, may have been installed just to offset the carbon footprint of those buildings.

So, is the carrot approach a more effective way of achieving the wider adoption of sustainable practices in the marketplace? Successive UK Governments have sought to introduce regulations (such as the Climate Change Act), in part to meet international protocols but also to incentivise

innovation and the adoption of green technology. One effective example is the Enhanced Capital Allowance scheme which promotes investment in energy and water efficient equipment and systems. Whilst a limited number of components and products qualified for this favourable tax relief, there is now widespread adoption by end users. Indeed in some instances, there is a considerable benefit associated with selecting these components over non-qualifying assets.

Real change needs everyone involved in the development of buildings to take a longer term view of the benefits that can be achieved over the full life cycle of a building, or a fit out project, looking beyond the initial capital cost. This requires an understanding of the client's capital and operational budgets, and an understanding of how a client depreciates their assets. For example, the decision to install more expensive LED lighting, rather than standard fluorescent lamps, brings benefits from increased energy efficiency, reliability and longer lamp life, and, due to falling costs, can reduce the payback period in refurbishment projects to less than 2 years.

As an industry we need to look at the bigger picture and see the long term benefits of sustainable choices when we make decisions about the way we build, fit-out and refurbish our buildings. As market awareness continues to increase, the cost of going green will provide financial benefits in the future both for the occupier (reduced operating costs improved productivity) and the investor (increase in value). Through a combination of effective legislation, the value placed on corporate social responsibility by businesses and individuals' willingness to look beyond the short term the built environment can help deliver a positive and sustainable change.

The benefits of BREEAM

There are tools available to us to help meet our own aspirational targets and ensure our buildings are properly accredited to approved 'measurable' standards. For instance, the long awaited BREEAM non-domestic refurbishment scheme was published in October 2014. This new tool assesses the environmental impact of refurbishing or fitting out existing commercial buildings.

In order to provide flexibility and accommodate the wide range of projects that might be carried out in existing buildings, the scheme is based on a modular set of criteria which can be selected to match the scope of works being carried out. These criteria include:

1: Fabric and Structure
2: Core Services
3: Local Services
4: Interior Design

This approach allows the BREEAM assessment to reflect the specific aspects of a building that are the respective responsibilities of a developer, the landlord or any tenant, as well as accounting for the varied life expectancy of each component of the building. Interior finishes, for example, are typically replaced on a 5-10 year cycle; the fabric and structure may only be upgraded every 60 years or even longer.

The scope of the project will determine which parts of the scheme can be assessed. The modular basis offers a more sophisticated assessment, focused on what improved performance can be achieved within a defined scope of work. It creates more achievable sustainability goals.

To obtain an accreditation under the scheme, even though the assessment will be based on the relevant parts of the building alone, minimum standards of performance still have to be achieved. The overall BREEAM rating from Pass to Outstanding has not been changed from the new building benchmarks but the environmental ratings of each BREEAM target do differ in each module. This new tool allows landlords and tenants to work together to agree appropriate strategies for setting common sustainability goals. It also opens up the opportunity to consult with employees to understand what they expect from an internal environment that is stimulating and motivating to work in. This approach can also help asset managers focus on maintaining asset value, as well as helping with the preparation of tenant fitting out guides and giving a clear distinction between landlord and tenant responsibility.

This flexible tool enables the stakeholders in any building to influence sustainable performance in a coordinated way. It is a step in the right direction to showcase sustainable performance as a key differentiator in an ever increasing competitive real estate market.

Designing sustainable office space

Over the past 20 years we have seen the trends for 'shell and core' v/s 'Category A' office fit-outs shift one way and then the other. so is the most recent move towards 'shell and core' (or 'shell and floor' including the installation of a raised floor *see boxout*) a returning trend or a shift driven by changing attitudes towards waste and sustainability?

The question being asked then is 'when a landlord installs a raised floor, suspended ceilings and mechanical installations, is this efficient if the tenant then removes or changes them?' When the author first started project managing office fit outs, shell and core was the new trend but we didn't much consider sustainable design. Now we do and sustainability is increasingly important to all of us, owners, developers and occupiers alike. Should we be moving towards a more collaborative, and less wasteful, approach between the landlord and tenant for office fit out? This makes sense not only from a sustainability point of view but from a cost reduction perspective for both landlord and tenant.

When the tenant removes the ceiling to create an open/industrial feel or the 'middle spaces' in the new workplace trends, what happens to the redundant ceiling tiles? Waste isn't just the tiles being thrown away, but the carbon footprint of their manufacture and delivery in the first place. Leaving the landlord's base build as shell and floor reduces this waste, reduces double handling and reduces the carbon footprint of companies, including the contractor, sub-contractors, suppliers and manufacturers. It also allows the tenant's team more flexibility in their office space design; creating a win win situation – flexible design, cost savings and sustainability benefits at no extra cost.

This is all good news, but what happens when the tenant's lease expires and they have to reinstate the premises to an open plan 'Category A' office specification? However, what can be done to reduce the waste of stripping out the previous tenant's fit out to reinstate a ceiling and raised floor that will then be stripped out and changed by the next tenant? We need to find a way to be more sustainable rather than throwing everything in the skip at the end of the lease.

Rather than reinstating, we could look to designing possible re-use of the fit out at the start which would save money for both the landlord and tenant. Designing flexibility and longevity of the fit out components allows the second tenant to reuse the design in full or part. This will require a different way of thinking in the design and specification stages. However, with the change in workspace design trends to create more open plan and collaborative spaces, we could look to recycle key elements of the interior office fit out. Not only will this reduce negative environmental impacts, but it saves money and time! Surely achieving sustainability at low cost is a win win position?

Types of fit-out for commercial office space

Shell and core

Shell-and-core developments include fully finished landlord areas comprising main entrance and reception, lift and stair cores, lobbies and toilets. These areas are not part of the space rented to the tenant. The office floor areas are left as a shell ready for category A fit-out.

Category A fit-out

There is no standard definition for category A fit-out – it can vary between owners/developers but typically, category A is what the developer provides as part of the rentable office space and usually comprises the following: raised floors, floor coverings, suspended ceilings etc.

Category B fit-out

Category B completes the fit-out to the occupier/users' specific requirements. It can typically comprise the following: installation of cellular offices, enhanced finishes , conference/meeting room facilities etc.

A sustainable approach to reinstatement

During a client's exit from a 16,000 square foot trading floor held under a particularly onerous lease in an otherwise occupied building, the client had to spend in the order of £50 per square foot to reinstate new ceilings, LG7 style lights, and carpets, all to the landlord's specification.

Within two years, because the space had remained unoccupied and in the same condition, the landlord stripped out and discarded the ceilings, lights and carpets,

as they didn't match its refurbishment plans for the other floors. What a waste of money, resources, and energy, not to mention considerable disregard of the sustainability agenda.

Every building has a lifecycle and will probably need refurbishment at the end of a lease, but in this case, even though the reinstatement work met the required market standard, it ended up in the skip without ever being used. The financial settlement of dilapidations' liability is often reached and this avoids waste, but there are plenty of occasions where the outcome is financially and environmentally inefficient. Surely reversing this trend would be welcomed by both landlords and tenants as it would reduce costs for both parties by decreasing the need to carry out unnecessary refurbishment.

Maybe it is time that an alternative approach is considered by those drafting heads of terms or leases? For example:

- A covenant giving the landlord an option to demand a reinstatement payment, rather than allowing the tenant to carry out refurbishment works.
- A tenant's option to make a reinstatement payment as part of the licensing of alterations.
- A tenant's option to pay an all-inclusive rent, including the cost of reinstatement of non-structural alterations at the end of the term.
- A landlord's option to require a tenant to reinstate the space to shell and core.

None of these solutions is perfect. At present the principal of reinstatement to a developer's finish is entrenched in UK leasing culture, making it difficult to see this changing quickly. However, to tackle the current unsustainable approach of the reinstatement a new approach needs to be adopted by those drafting heads of terms and leases. This will not only help reduce unnecessary landlord and tenant reinstatement costs but also avoid waste and improve efficiency.

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Rebecca is responsible for driving CBRE's sustainability agenda in the EMEA region. In addition to expanding client sustainability services and overseeing the reduction of CBRE's corporate environmental footprint. Rebecca works internally to raise awareness of sustainability opportunities and innovations. She works closely with senior management and CBRE's US and Asia Pacific sustainability teams to create a global best practice approach and industry leading research to promote sustainable property.

Andrew Smith

Andrew is a Director within CBRE's Building Consultancy and Planning team. Andrew joined CBRE in 2014. Previously at EC Harris, he worked both in the UK and Moscow, with clients including Barclays, BDO Stoy Hawyard, Shire Pharmaceuticals, BAA, Bank of America, Deutsche Bank, Metro Cash and Carry and Kingfisher/Castorama. Andrew has extensive experience in all aspects of commercial and financial management of major fit out projects. He has managed teams of surveyors in many projects from inception through to completion and has developed strong working relationships with many of the UK's leading consultancies.

Neelum Mohammed

Neelum is a Senior Sustainability Consultant within CBRE's Building Consultancy and Planning department. She has strong sustainability expertise and experience in developing achievable solutions that meet and extend clients' aspirations. Neelum works across a wide variety of projects in the UK with a focus on embedding sustainability principles throughout the lifecycle of a development, including the provision of BREEAM consultancy services and the delivery of BREEAM and Code for Sustainable Homes assessments.

Matt Wilderspin

Matt is Head of the Projects Group within CBRE's Building Consultancy division. Matt has a broad spectrum of experience focussed on delivering extra value to clients across a number of sectors, to both occupier and landlord clients, on complex and challenging projects. Matt's primary interests include the provision of strategic and executive project management, working closely with clients providing professional solutions to the clients' needs.

Simon Brown

Simon is a Director in the Building Surveying sector specialising in professional services, in particular dilapidations claims, lease advice, technical due diligence. Simon's key area of expertise lies in dilapidations' consultancy and he provides advanced strategic options for both landlords and tenants in making and defending dilapidations' claims and subsequently negotiating financial settlements or procuring and implementing works. He is experienced in risk management and implementing planned lease exit advice on compliance with conditional break options on behalf of tenants.

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The risks of retrofit

In the first article in this series we saw how improving the energy efficiency of homes, especially those where people live in fuel poverty, can improve the lives and health of the occupants. Part two examined the benefits of deep retrofit, and found it can enable much more robust energy savings, and transform the comfort and appearance of a home. Kate de-Selincourt continues her report and, in this issue, considers the risks involved with retrofit...

It isn't all plain sailing. While the majority of retrofits deliver something between a bit more comfort and a lot more comfort, plus significant energy savings, sometimes things can go wrong.

The underperformance of shallow and/or inept retrofit was touched on in earlier articles, and is certainly a financial hazard – and also makes a subsequent 'proper job' less likely and less affordable – locking in the poor performance. This article, however, is looking at practical hazards that can sometimes arise after retrofit – endangering the health of the building, the occupants, or both.

In the most extreme (and very rare) cases, faulty retrofit has led to the demolition of whole buildings. Less unusual and drastic is for retrofit measures to be reversed, or for additional remediation works to be needed. Damp, condensation and mould are the most usual problems, and many retrofits affected by moisture problems will be underperforming thermally as well. The issues are often interlinked, and a good installation can hopefully avoid both at once.

The 'headline' causes of retrofit problems tend to include:

- Poor (or no) design.
- Unsuitable materials.
- Poor workmanship, design or guidance ignored.

These issues tend to be exacerbated by the prevailing advice, evaluation and funding systems, which are generally based on individual measures, and incentivised on a crude '£/tonne of carbon' basis, derived from a simple RdSAP assumption about the measure in the abstract, rather than in the context of the particular building.

In this article we will look in most detail at how these issues affect one main retrofit measure – insulation of solid walls – as this is the subject of much current investigation. However, many of the same issues about the need for empirical science, the importance of holistic design, attention to detail, and the need to prioritise the building and its occupants, apply to all aspects of retrofit.

Internal wall insulation

Internal insulation of solid walls is pretty widely understood as 'tricky', and guidance is in place, designed to avert the risk of interstitial condensation (where moisture from the interior finds its way to the cold building fabric behind the insulation, where it may condense, and potentially lead to mould or rot).

However, well-intentioned as this advice may be, it is based on quite a limited set of assumptions. This, from an internal wall insulation manufacturer's factsheet, is typical: 'Except in unusual circumstances, such as rising damp or a leaking pipe, the moisture in a wall comes from the inside not the outside.'[1]

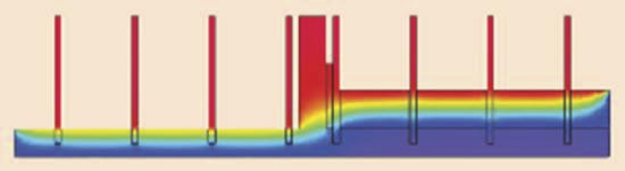
Depending on the construction, location and orientation of the building, however, more moisture may come in to the house from outside than is generated by the occupants. Wind driven rain can affect the entire thickness of solid walls, and this process can, perhaps surprisingly, be exacerbated by sunshine. The mechanism of 'reverse condensation', or solar driven condensation was explained by Matt Smith of NBT at the Retrofit Live event in April 2015:[2]

1. Rain falls on a masonry wall and soaks in to the surface.
2. Sun shines on the wall making the outside of the masonry warm (may be 30-40 degrees), evaporating the water and leading to an increase in vapour pressure (ie, an increased concentration of gaseous water).
3. Some water vapour will immediately return to the atmosphere – the outside of the wall is being dried by the sun. Some water vapour, however, will go the other way and move through the masonry, either through cracks and joints, or even through the solid fabric, depending on how the wall is made. Almost all building materials (even concrete!) are vapour permeable to a degree – and/or, will have holes somewhere.
4. Water vapour reaches the cooler interior of the masonry, away from the sun, where it may condense.
5. The water has to evaporate if the masonry is to dry again; it can go back the way it came (though this may be slow as the sun doesn't shine on the inside of walls). If the internal construction is vapour open, the water can also evaporate into the interior of the building to be removed by the ventilation.

If there is an impermeable vapour control layer (VCL),

Behind the insulation – a colder wall

The diagram demonstrates the modelled temperatures during the heating season of two adjacent external walls, at the intermediate floor level, with, as is usual, the floor joists buried half in the wall. The segment on the left is uninsulated, the one on the right, insulated. The joists in the insulated side have reached a lower temperature than those on the uninsulated side, including where they pass though the insulation layer. Taping a VCL to the joists is sometimes suggested to protect



this cool structure from interstitial condensation – but might it worsen the risk from moisture from outside condensing there and damaging the timber? (See discussion in text of main article). One option that is sometimes deployed is to take the joists out of the masonry and suspend them from joist hangers – quite a big job though! On the Georgian retrofit described on this page, a combination of hygroscopic insulation, injected boron gel, and monitoring, was used as an alternative.

the water vapour from the outside will hit the back of the VCL, where it may well condense – and also on any structural timbers behind the VCL. While some of the vapour will go back the way it came, the VCL will hinder the process of drying out to the interior, Matt Smith warns, and may lead to worse problems with moisture than the VCL has prevented.

Using WUFI, Matt Smith modelled this phenomenon for a variety of locations and wall orientations. He pointed out that the current guidance is based on Scottish measurements where insolation is relatively low (even in summer); "We modelled for other climates, for example Cornwall and London - London has a lot of sun, Cornwall also has strong sunshine and, of course, a lot of driven rain, including on south elevations." So the problem may well be greater than has been generally understood.

To predict this phenomenon with any confidence you need to know the characteristics of the wall itself, and how it behaves in relation to liquid and gaseous water. In fact masonry is very poorly characterised – probably hardly surprising as there are a lot of different wall types, and it isn't just the brick or stone, it is the mortar – and even the bond – which affects both the hygroscopic, and also the thermal behaviour of masonry. It is possible to test some of the moisture characteristics of a wall in situ, if this is likely to be a critical issue in a particular retrofit.

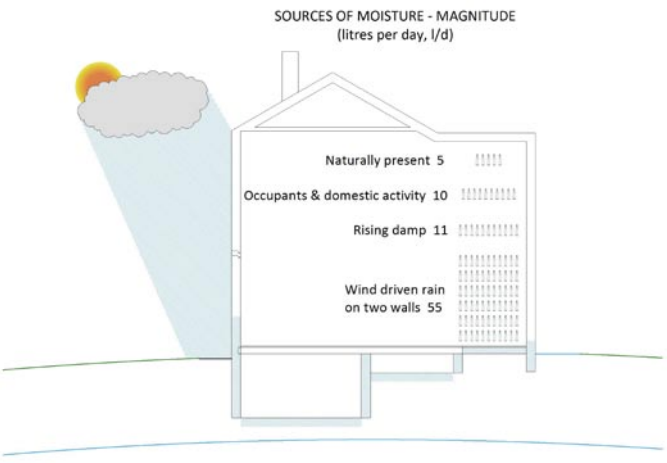
The volumes of water that pass through masonry into the indoors are not insignificant. The team at the AECB, who are creating the new CarbonLite Retrofit course, have estimated that the moisture passing through unprotected masonry may exceed the moisture generated by occupants up to tenfold (see diagram bottom of page). Joseph Little agrees – "The greatest moisture load (in the wall) is often not from the room." This, incidentally, is the reason cavity construction and dpcs began to appear in the 19th century in Britain – to keep some of this moisture out.

This is not just a theoretical risk – net movement of moisture from masonry into the interior has been demonstrated by careful measurements of the moisture in walls. In his talk to Retrofit Live,[3] Harry Paticas of Arboreal Architecture, shared the results of monitoring in the brick walls of a listed Georgian house for which he designed the comprehensive refurbishment. Measures included repointing, airtightness, mechanical extract ventilation, and internal insulation with wood fibre insulation and a moisture-variable vapour check membrane designed to handle interstitial condensation and transfer it back to the surface.

Monitors were installed at a number of points through the thickness of the walls during the refurbishment, and the data (over almost two years) has been analysed by Tim Martel of the AECB CarbonLite team. The analysis shows that moisture moves two ways through the wall, with the dominant direction at the inside being drying into the room, especially in summer, but with some moisture going back from the room into the masonry – then through and out into the outside air – during the winter months.

While the details will vary with every wall construction (and every location and every year) the example here clearly shows moisture passing in to the building from outside, and not just out from in.

Potential moisture loads via rising/ penetrating damp (example based on 9" solid brick wall, no dpc,exposed to wind-driven rain). Courtesy AECB CarbonLite Retrofit.



Keeping water out of the masonry in the first place is an attractive option and various strategies are available.

Well-installed external insulation should certainly keep out the rain (though see below for considerations about rain-proof detailing, and also the possible consequences of applying to already-wet masonry).

Where IWI is being contemplated, this is often because the building owners or the local authority have rejected EWI on aesthetic/conservation grounds. But less conspicuous strategies for keeping masonry dry are also possible. The house above was repointed with a more moisture-repelling, but vapour-open, mix than the old mortar -- this had been in very poor condition and was tracking moisture into the brickwork. However, as the building was listed, that was the extent of measures allowed on the outside.

Architect, Andy Simmonds of Simmonds Mills Architects, has experience of retrofitting a solid walled house which, while ineligible for EWI, has nonetheless been allowed to be treated with 'brick cream', a hydrophobic but vapour open compound which dries see-through. To investigate the effect of the brick cream, half the west facing wall was treated with cream the other half not. Vapour permeable IWI and an intelligent (variable vapour resistant) membrane has been installed, and a dpc was injected.

Moisture levels in the masonry treated with cream fell more rapidly than in the untreated areas, and also faster than the previous example, probably as less 'new' water has been coming in. Drying was once again to both inside and outside but the pattern was very different, with some moisture still passing from the interior to outside but a lot less coming in the other way.

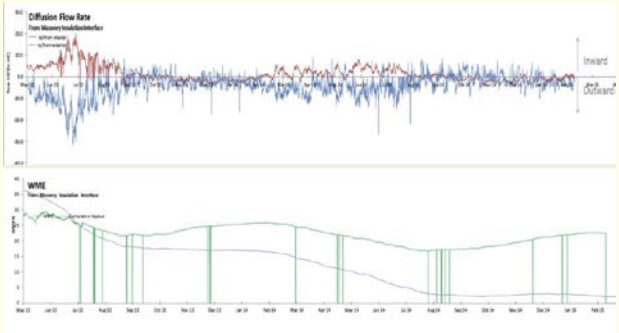
Standards, which standards?

Neil May of the Sustainable Traditional Building Alliance and Joseph Little warn that the standards, the warranties and the rules for funding measures, where moist masonry is an important consideration, are not always consistent with recent research like that seen above. For example, BS 5250, as referred to in Part C of the Building Regulations (Site preparation and resistance to contaminants and moisture) and in many insulation system warranties, takes no account of driving rain; it focuses on interstitial condensation in the heating season and is about vapour. As Neil May explained at Retrofit Live: "Using 5250 leads to recommendation of vapour barrier, yet if you model according to EN 15026, which uses different methodology taking into account orientation and driving rain,[4] you would get the opposite advice."

Knowing that the official advice may be inadequate is obviously worrying for anyone intending to install internal wall insulation, but fortunately this area is subject to active research, and more importantly, the researchers are willing to share their experience. Some new guidance is also due to be issued by DECC, possibly later this year.[5] There are even opportunities for practitioners to monitor their own installations (for example via the AECB arrangements for the purchase of moisture monitors) – both to check the walls are performing as intended, and also to add to the sum of monitored experience.[6]

Diffusion of moisture through the inside and outside face of a brick wall

In the top part of the figure, the red line represents vapour magnitude and direction on the inside of the wall, here it is mostly above the axis, showing vapour is usually moving inwards. The blue line indicates moisture movement at the outside of the wall, and this line is mostly below the axis, which means vapour is being lost to the outside. So, essentially in summer the wall is drying out on both sides (a great deal at the start). There is some minor reversal in winter, when a little moisture moves into the wall from the inside, and leaves from the outside. The net direction of moisture movement on the inner surface however is overwhelmingly in from the wall to the room.



If you look at the net effect of both these lines (the blue line) it shows that it is always going down, or at worst level, which means overall, vapour is only being lost from the masonry, ie the newly refurbished building is drying out.

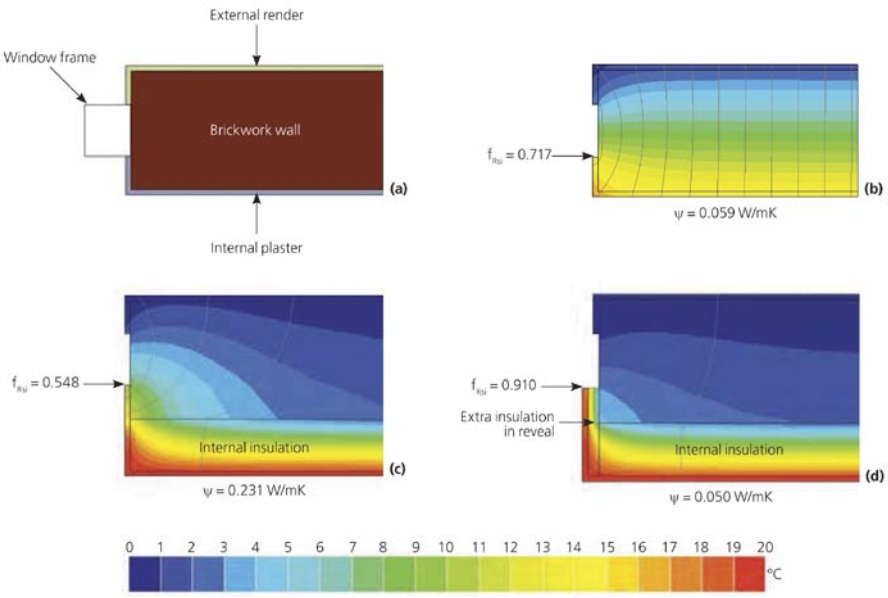
Courtesy of Arboreal Architects and AECB

Thermal bridging

With internal insulation, thought also needs to be given to the risks of thermal bridging. In an internal wall insulation installation, thermal bridging can lead to internal surface temperatures lower than on the uninsulated wall, increasing the risk of condensation.

The 'cold walls' (see boxout above) suggested that joist ends require detailed attention when carrying out IWI. Another fiddly job is insulating the reveals — especially as most standard thicknesses of internal insulation simply won't fit.

As Neil May points out, the (necessarily thinner) insulation on the reveals does not need to be of a super-high performance material to be useful. A reduction in surface condensation risk, and greatly improved thermal



Reducing thermal bridging at junctions when designing and installing solid wall insulation. The thermographic simulations here demonstrate what happens if this job is skimped, however. Image (b) shows the pre-insulation base case for a theoretical solid wall, with a temperature factor of 0.7 at the window/reveal junction. After IWI is applied but with the reveal left uninsulated (c) a colder surface is shown to the room (temperature factor 0.55) – in (d) this is remedied by adding a thin layer of insulation to the reveal.

Caroline Weeks, Tim Ward and Colin King, BRE, 2013

performance can be achieved even with 20mm of normal insulation. May and colleagues at the Sustainable Traditional Building Alliance have calculated that adding 20mm insulation to the reveals might give the same improvement in thermal performance as doubling the thickness on the walls.[7]

Modelling the behaviour of heat is possibly more straightforward than modelling moisture; though as with moisture movement, the thermal behaviour assumptions normally used in modelling, are pretty simplified. BRE Wales has embarked on a major fabric characterisation exercise looking at the thermal performance of all kinds of solid wall constructions, so more guidance may be available in the future.

External wall insulation

External wall insulation poses fewer problems, at least in theory, than does IWI. As Joseph Little of the Building Life consultancy explains: "it makes the wall warmer and leaves its inner (plastered) surface unclad [so] gives the masonry the best chance to dry out."

However, damp and mould problems have been observed in some EWI installations, as Colin King of BRE Wales reports. King has visited numerous EWI installations, mainly carried out under CESP and ECO funding in low income neighbourhoods – and he has not been impressed by what he has seen. Problems for some occupants are apparent: " I have seen condensation mould and decay already in a number of instances."

Three big issues that have stood out to King are: large areas of thermal bridging (eg when the entire top or bottom of a wall is left uninsulated, or a whole window bay); poor detailing or installation that could allow rainwater to track behind insulation, and failure to repair fabric and/or rainwater goods before installation of EWI, that could also allow rainwater into the walls behind the insulation.

"I've seen 2000-odd EWI installations, and probably 20 of them had insulated the reveals and the floor slab. So nearly all of them have massive cold bridging, and they are just waiting for problems." Often the top of EWI is not sheltered by the house eaves, but is instead capped off with a trim sealed to the wall only with a line of mastic. Replacement windowsills may be missing a drip; crude unfinished cut-outs may be left for rainwater goods, service penetrations – or even in one notable installation – a lamp post!

One customer who had EWI fitted privately recounted his experience in the CORE Fellowship submission to the Green Construction Board Solid Wall Insulation consultation earlier this year. He reported that the contractor insisted on stopping short of the ground, the eaves and above any roof-wall junctions; his assessment was that these thermal bridges cost 40% of the suggested performance. On top of this, "damp appeared in various locations some months afterwards, eventually traced to rainwater running off adjoining tiled area where they had cut short a gutter to install the EWI."

The installers did not have a good strategy for dealing with this service entry, and there is a very large thermal bridge at the porch.
Courtesy of NDM Heath Ltd

If water is tracking into masonry and it is wetter than before, but uninsulated owing to large thermal bridges, the worse U-value of wet masonry may make internal surface temperatures lower than they were before. Or the moisture may simply be soaking right through - in which case a warm wet wall could grow mould even faster than a cold wet one anyway.

Finally, as with a range of energy retrofit measures, the fabric infiltration rate may have been reduced, intentionally or unintentionally, and this may, in some cases, be exposing the ineffectiveness of the ventilation (be it trickle vents, extract fans or simply window opening by occupants). Once again, this could lead to increased humidity indoors and therefore increased condensation and mould growth, (see the paragraphs on draughts and ventilation next page).

The way so many installations have been financed is likely to be a large factor in these problems, many believe. Architect, Nick Heath, was commissioned by English Heritage to evaluate three large-scale EWI programmes in traditional terraced housing in the north of England – many of the same installations visited by King. As he explains: “The way the jobs are funded and procured makes it almost impossible to do EWI properly; the many fine words of guidance may as well not be there. There is no time to deal with the fancy bits on the building, so you see massive thermal bridging – the sole measure of its success is numbers completed by the deadline . And there is never enough money for ventilation.”

The choice of contractor is generally dictated by the lowest price; referring to the inadequacy of the subsidies, Nick Heath pointed out that; “to do EWI properly may cost more like £15,000, not £5,000”. Quality control is limited to say the least: PAS 2030 permits installers to certify their own workmanship: “I have a bee in my bonnet about self-certification,” BRE's King says, “No-one is going to fill in their own self-cert form saying they mucked up the job.”

Although it is not well studied, one plausible cause of damp problems in these homes was that the walls were already damp when EWI was installed, Nick Heath suggested. A complete absence of finance for 'pre-remediation' in CESP and ECO budgets, to make the underlying fabric sound and dry, will not have helped, neither will the common situation of only having access to funding if the works can be completed in a really short timetable (often just a few months), making it more or less impossible even to survey the properties, never mind to put in place necessary repairs.

Similarly, 'carbon' oriented funding, though often (as with CESP and ECO) targeted towards people in fuel poverty (so therefore, unlikely to lead to major carbon savings) tends to be scored and reimbursed purely on a '£/theoretical tonne' basis. Once again, measures that could improve the lives of the occupants just as much, such as gutter repairs and upgraded ventilation, are excluded.

Even the apparently tried and tested insulation of cavity walls is not foolproof. In fact a Cavity Wall Insulation Victims Alliance has been established, to campaign for help for people whose CWI has gone wrong.

The worst problems appear to have been in the wetter west of the UK, in areas which may not have been suitable for CWI. This may have been the problem in some social housing in South Wales, where Newport City Homes are reported as having investigated damp reports by residents, and having found the cause to be cavity wall failure; “To remedy these issues we took the decision to remove all cavity fill.”[8]

Location, location

Driving rain is liable to make an uninsulated house damper and, therefore, colder. Unfortunately it also makes any insulation a riskier proposition.

Longstanding government advice in Part C states that; “When the cavity of an existing house is being filled, special attention should be given to the condition of the external leaf of the wall, eg its state of repair and type of pointing... The suitability of a wall for installing insulation into the cavity should be determined either with reference to the map [of exposure to wind and rain] and the associated table of following the calculation or assessment procedure in current British or CEN standards."

As a note on the Kingspan website put it: “Cavity wall insulation may not be suitable in properties which are exposed to severe risk from the amount of wind driven rain. Basically, in this situation, any damp or rain that penetrates the outer layer of bricks may be carried across the cavity by the insulation, through to the inner layer of bricks/blocks, and appearing as damp on the inner wall.”[9] Clearly, this advice has not always been heeded – as the RH map (green) published by the Cavity Insulation Guarantee Agency indicates.

As with cavity wall insulation, so with internal wall insulation – the higher the exposure, the more careful the design and modelling need to be, and the stronger is the case for protecting the masonry as well, if possible (though this cannot be relied on as an alternative to proper design: brick creams are not entirely easy to apply – a bit like sun cream, it isn’t always easy to see you’ve missed a bit till it’s too late).

External insulation is likely to be the safest bet in an exposed location, but detailing to stop the rain getting behind the insulation is critical. As well as reducing the risks

of horrible internal damp problems, getting and keeping the masonry dry will even, in itself, keep the occupants warmer. The U-value of natural stone may increase by more than 50% when the same material becomes wet.[10] Similar findings have been reported in brick walls, by the manufacturers of a water-repellent brick coating.[11]

Climate change is thought to be likely to increase the incidence of driving rain. Over the coming 50 years rainfall is expected to increase in most of the UK, and wind speeds are generally increasing too.[12]

In his report, Design for Future Climate, architect Bill Gething warns: "It is a mistake to assume that familiar materials will continue to behave in exactly the same ways in a changing climate. Designers will need to have a thorough understanding of the fundamental principles of materials' behaviour and building physics so as to predict behaviour under different climate conditions."

Brickwork is not an impervious barrier; 'Its weather resistance relies on a dynamic process of wetting and drying.' In today's climate it may not become sufficiently saturated to allow significant quantities of water to penetrate far enough to cause problems, however, this may not be the case if winter rainfall and wind speeds increase.

'Routine maintenance/replacement is an obvious opportunity to upgrade to higher standards, and there may also be opportunities to improve weather tightness as part of works to upgrade a building's thermal performance (in response to the mitigation agenda). For example, adding external wall insulation protected by a rain screen could provide a higher standard of weather resistance than the original wall.'[13]

Draughts and ventilation – not the same thing!

Although the effect of retrofit on airtightness can be unpredictable, if uncontrolled infiltration is reduced in a dwelling that already has inadequate ventilation, air quality may suffer. This does not mean that leaving fabric leaky is a 'solution' to the risks of poor air quality and condensation. Fabric infiltration is often conflated with ventilation, but this is unhelpful and leads to some unnecessarily pessimistic attitudes.

You will sometimes hear it suggested that 'a balance needs to be struck' between reducing heat loss for GHG reduction policies, and the need for a healthy air change rate. In these kind of statements, infiltration and ventilation tend to be conflated – as if draughts were an essential aspect of ventilation. This may even lead to the suggestion that fabric should be insulated while being left leaky – despite the fact that this would seriously limit the energy and comfort improvements.

This mindset seems to imply pessimistically, that only by enduring draughts, can you have an adequate fresh air supply – in other words, you can't have both comfort and health. Thinking like this could be unhelpful and even dangerous:

- It may put people off making buildings warm and airtight, by implying this may be incompatible with health – even though it doesn't have to be.
- It implies that unretrofitted, leaky buildings can be assumed to be well ventilated, and so have adequate air quality – when often they do not, and their ventilation should not be left unimproved.

The often-cited trade-off is a false one. Ventilation can work well without any fabric infiltration, and once effective ventilation is in place, improving the fabric airtightness is unproblematic and indeed desirable, and will lead to increasing comfort, energy efficiency – and possibly even to more effective ventilation (because there is more control over air paths). Reducing infiltration also reduces exfiltration – the leakage of warm, possibly moist air through into colder parts of the fabric, where condensation may then occur.

Thus, for example, in the deep retrofit of the listed building described above, architect Harry Paticas specified continuous mechanical extract ventilation (MEV), and undertook extensive draught proofing to increase airtightness to 1.8ach@50Pa, in order to limit heat loss; "We monitored the air quality, and after careful commissioning the relative humidity went down to around 50%; the house is now very comfortable and the clients are very happy." A good ventilation system running in an efficient, airtight fabric does not lead to big energy costs. In the example above, total energy use is pretty well on target for AECB silver, at 40kWh/m^2.a. for heating and 120kWh/m^2.a primary energy. It is sometimes possible to install MVHR in a deep retrofit, offering even more comfortable and controllable ventilation, and with filtered air as well. If the airtightness of the dwelling can be reduced below about 3ach @50Pa, the MVHR can even save energy.

By contrast, even in leaky homes, infiltration plus 'natural ventilation' fails to deliver reliably good air flow and IAQ. In one study of naturally ventilated homes, with airtightness ranging from 5 to 20 ach @50Pa, winter air exchange rates ranged from higher than the recommended 0.4 or 0.5 air changes per hour, right down to a stuffy 0.2 ach. However, the ventilation rate was not closely related to levels of airtightness, but much more to occupant behaviour (mainly window opening).[14]

King is adamant that upgraded ventilation should become an integral part of any funding programme for energy retrofits: "Ventilation has to become a Green Deal

and Eco measure. And we have to test it is working as designed."[15]

There is sometimes concern that increasing the thermal performance will lead to the risk of overheating as heat is 'trapped'. In fact insulation (particularly in the roof, but also EWI) can protect against overheating. It is, however, always important to ensure there is effective and safe ventilation – both background ventilation, and the opportunity for 'purge' ventilation, usually via opening windows on two sides of the building.

If windows are being replaced, or walls are being made thicker with insulation, it is important to check that window opening is not going to be compromised. Unless carefully specified, tilt and turn windows, in particular, may offer inadequate openings (especially if subject to opening restrictions at higher levels, to prevent accidents).

One special advantage of MVHR in a well-insulated and airtight building is that when it is very hot outside, the ventilation can be run on heat recovery – or 'cool recovery' -- mode during the day, to limit indoor temperature rises. When the temperature falls again at night, the heat exchanger can be bypassed and the windows opened, so the dwelling can then be cooled down ready for the morning. See graph below.

The golden age of building?

There is sometimes an implied assumption that old buildings work well – by design - and modern interventions tend to detract from their performance. Assuming that draughts are an effective mode of ventilation is just one example of this.

Thus we hear that traditional buildings 'breathe' via the fabric, ventilation and draughts to create a 'safe environment' and traditional buildings are designed to, keep dampness levels in the building fabric below problematic levels by evaporation.

Yet a lot of 'traditional' buildings are cold, damp and unhealthy, suffering from various forms of rot and decay – and buildings, especially those of the less prosperous parts of society, always have been.

One common suggestion is that 'breathing' fabric is important in carrying away the moisture loads generated indoors. But it is not clear if this has ever been critical to maintaining low indoor RH. As we saw above, with a 'breathing' fabric moisture movement can be mainly in the other direction with moisture coming in from outside and needing the ventilation air to carry it away.

In the past, if traditional buildings achieved a 'healthy' moisture and ventilation performance, open fireplaces are likely to have played a big role. A constant, vigorous draught (all year round, but especially when the fire was lit), will have removed far more moisture than would ever have passed from inside to outside though a 'breathing' fabric. Now that the open fireplace is generally a thing of the past (decades past, in most dwellings), alternative moisture removal strategies are essential.

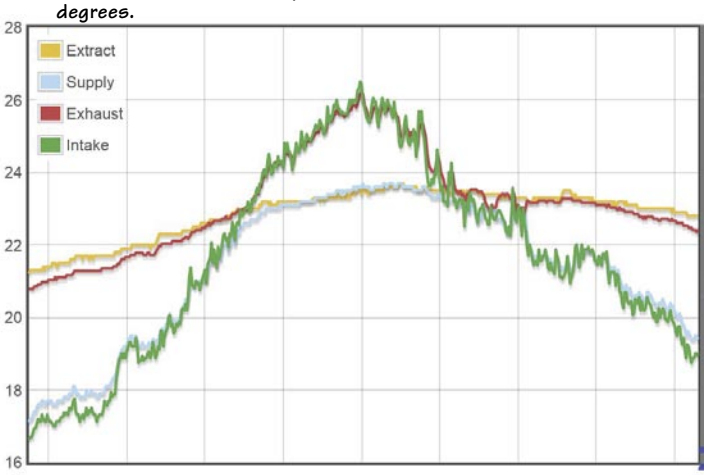
The value of hygroscopic surfaces in buffering hour-to-hour fluctuations in indoor moisture is a different issue – but hygroscopic surfaces can't remove moisture either. Hygroscopicity can also have a role in dealing with dampness that penetrates into the fabric, as we saw above. However, it is often hygroscopic and/or vapour open materials that are letting the moisture in, in the first place. Traditional building materials don't automatically solve all damp problems! Generalisations can be unhelpful.

Pre-remediation

When a retrofit has been designed as a whole-house retrofit by a designer, in a holistic way, it is much more likely that repairs and remediation will be carried out as part and parcel of the retrofit. As we discussed in the previous article, the time for repairs is often the likeliest opportunity for a whole-house retrofit, and makes practical and financial sense a lot of the time.

While not everyone is in a position to strip back the entire fabric to check and replace every last bit of potentially deteriorated timber, there are clearly some basic checks and repairs that should take place. Timbers should be assessed if retrofit is going to change their hygrothermal environment – or simply, render them less accessible. Pointing and rendering should be checked and if necessary, upgraded to be better at shedding liquid water and letting water vapour through. Faulty rainwater goods and poor ground drainage should be tackled in advance – in some situations drying may be faster before retrofit measures

MVHR, airtightness and external wall insulation working together to keep the interior of this stone cottage (yellow line) at a comfortable 23 degrees, while the temperatures outside (green line) climb to 26 degrees.



are installed. While retrofit should always allow continued drying, energy retrofit on its own shouldn't be expected to dry a wet structure and, whatever the other measures proposed, we also saw above any house that is having money spent on it should have the ventilation assessed, and upgraded if necessary.

Heritage and the need for give and take

If the 'tension' between airtightness and health is something of a false dilemma, the conflict between conservation values and energy efficiency can be felt very tangibly. While energy efficiency and good ventilation both benefit the building occupants, heritage issues may, on occasion, set one group's priorities in conflict with another's, with occupants potentially paying the energy bills – or suffering the discomfort - imposed on them by conservationists' priorities.

A comment on a petition about listed buildings[16] read: "I am an owner of a Grade II listed money pit. Our Georgian sash windows are due for replacement. They were replaced in 1975, there is no crown glass, spirals instead of lead weights, 32mm bars ie nothing original at all. We have asked for permission to have double glazed, timber slimline replacements, but, once again double glazing appears to be the most hated invention as far as conservation officers are concerned. The temptation just to put them in and say 'to hell' with conservation officer is massive."

Another added: "After 25 years of living in a Grade II listed building our experience has been that the definition and application of Grade II listing of private residential buildings is: unfair and contravenes human rights; unnecessarily restricting and expensive; subjective and opinionated; arbitrary and inconsistent. Its outcome is environmentally unfriendly, criminalising and counter-productive." It is not just listed buildings where these problems arise. Since the introduction of CESP, a number of pretty humble pre-1919 terraces have been fitted with external insulation, and this too has attracted criticism.

A report in the Architects' Journal began, "Edwardian and Victorian homes in less affluent areas are seen as being at risk of 'aesthetic harm' " because intricate features on terraces were being lost after external wall insulation.[17]

Unfortunately leaving the 'intricate features' uncovered is a very unsatisfactory compromise, as Nick Heath pointed out at Retrofit Live, "The planning department sometimes promotes thermal bridges because they insist the installers leave the features untreated." Leaving the 'intricate features' exposed also introduces weak points where water ingress may occur.

Conservationists sometimes suggest that 'there are lots of other ways of improving energy efficiency'.[18] However, to achieve the kind of deep retrofit that robustly reduces energy consumption, carbon emissions and bills, while increasing comfort, wall insulation is generally necessary. However, when people don't have the luxury of living in one house while retrofitting the next, the disruption incurred from installing internal insulation is almost always unacceptable, and installing IWI to the necessary standard may be more expensive than even well-executed EWI.

Where mass-scale EWI has been carried out on pre 1919 terraces, the reaction from the occupants has tended to be favourable – both about the improved comfort and energy efficiency, and about the appearance.

In some cases, the insulation retrofit has taken place specifically as a regeneration measure, as an alternative to demolition. In these cases, as Nigel Banks of Keepmoat points out, the EWI could itself be seen as a valuable agent of conservation. Buildings, street patterns and, crucially, homes and communities, are all conserved.

BRE's King wonders about the merits of getting hung up on the traditional appearance of homes that are miserable to inhabit: he points out that while there are people who really love traditional working class terraces, "they aren't always the people who live in them".

"If you ask the occupants, they will often tell you their house is horrible, cold and damp". So when people say "we have got to protect the character of these streets" that's not the occupants who can't afford to heat their home. "They like their neighbourhood and community, not the houses," he says.

There is an important question to ask here. Historic buildings hold great charm for many of us, and may have meaning for some who live or work around them. But how much should other people be expected to pay for our delight with their health – and their energy bills? And how much should the planet pay? This seems to be a discussion we need to have.

We know a lot about what not to do ...

Until recently there has been next to no research into the behaviour of moisture, in particular, in solid walls – and even their thermal properties are not well characterised - -

Leaving the decorative band at the top of this wall exposed has created a large thermal bridge, and may increase the risk of rain penetration. Courtesy NDM Heath Ltd

though a number of people are now working on this as we saw above.

Because U-values are affected by moisture content – and also by wind speed, even orientation makes a difference: "A building with four walls will have four U-values," warns King. The right data for a given situation are very hard to find at present, making modelling less reliable that we would like, and meaning larger margins of error have to be built in – which may be costly in terms of materials or performance.

Given some of the poor workmanship described above, it is not entirely surprising that there have been problems following retrofit. Exactly what has gone wrong and why is not always clear though. As King explains in relation to EWI: "We think we understand what is happening in these problem installations from our modelling, but we are also testing this out on site. There is virtually no data out there about what actually happens in insulated walls, it's shocking it has not been measured."

Some of this badly-needed research is now, finally , happening; "Now we are watching the installation we can follow the story right through, from before, then watching exactly what is done, then monitoring afterwards. We have to keep an open mind and follow these installations through, tracking the process."

Meanwhile a number of AECB members are monitoring moisture movement in retrofitted buildings. This research is informing the 'moisture safe' aspects of the forthcoming Carbonlite Retrofit training.

This article has mainly looked at issues with solid wall insulation, but walls are not, of course, the only vulnerable part of a building fabric. Any element can be damaged by careless or inappropriate building works, including those works being carried out with the intention of improving the energy performance.

Floors, and in particular, suspended floors, can be tricky too – no-one wants a cold draughty floor, when they have carefully insulated the roof and walls and replaced the leaky windows – but has the floor, like the walls, been drying into the living space? If the floor is insulated and the joists get cooler, will they be at risk of condensation? And what about rising damp? Some people claim it barely exists, some assert it can be dealt with by 'breathing' constructions allowing the damp to evaporate, others prefer to attempt to stop the damp before it has climbed up the wall.

There is possibly less basic research under way on floors than there is for walls, though there is a notable example at UCL, where researcher, Sofie Pelsmakers, is studying temperature and humidity beneath insulated and uninsulated suspended floors in Victorian buildings, to assess the moisture and mould risks of various approaches.

We aren't standing still

In the light of some of the very poor installations that have taken place, some organisations are also taking steps to avert the errors we do understand. For example in Blackpool , where some of the installations reported on by Nick Heath are located, the city council has commissioned Heath and colleagues to help them develop a decision making tool and installers' code of conduct, to include some quality assurance, to try to improve matters in future. Similarly, the Centre for Sustainable Energy in Bristol has developed retrofit advice for local authorities, being published this summer.

One of the issues with 'bulk buys' of solid wall insulation in particular is that the insulation is sold as a 'system' – with installers often trained and accredited by the manufacturer -- and it is hard to improve the specification within the terms of the system guarantee. However some manufacturers are introducing products that help deal with thermal bridges: for example, low profile insulated components to fit behind rainwater goods, insulated flashings, and so forth.[19]

And at government level, researchers, manufacturers, and representatives of the construction industry and of DECC and DCLG are working together to share understanding of the issues, and to improve practice – no-one wants to be presiding over a disaster, such as was seen with faulty timber-frame designs in the 1970s. The process is already bearing fruit, the Retrofit Live event heard – for example, the moisture guidance for Part C is expected to be updated.

BRE's King reminds us that Ofgem, as the regulator of energy company funding for retrofit (under ECO) also has the power to enforce much higher standards, and he and colleagues are actively lobbying them to do this; 'Yes, we have to be careful, but let's not throw the baby out with the bathwater.'

All the issues above could be worrying for someone who is getting involved in building retrofit. And it isn't always easy to tell whether a particular view (including what you have read here!) is based on sound science, on experience, or on sincerely held but unsubstantiated opinion. It can be confusing when 'experts' appear to disagree.

As we saw above, there are a number of people actively carrying out empirical investigations and trying to learn more, including from some of the more obviously flawed installations; this work is invaluable, as studying real world buildings is the only way to know if the models we use are any good.

The advice from most of those involved in this research seems to be that the most important thing is to go into the process with your eyes open, rather than taking a 'fit and forget' approach. Find out what you can about the potential risks, and take account of them throughout design, installation and post-occupancy use of the building.

Whether it's a one-off retrofit or a community - or estate-wide programme, designer and client should understand there is no certainty. An interested designer will, anyway, want to know how the installation performs over time, and should look for ongoing feedback – even simply informally via aware occupants, or better still by formal monitoring. But do go into it! Carefully designed and monitored retrofits are demonstrating that even in unpromising locations (such as listed buildings suffering from saturated masonry) deep, holistically designed retrofit can transform comfort and energy performance, without causing fabric or health issues.

BRE's Colin King agrees that we should carry on, keep our eyes open, and keep learning; deep retrofit is the right thing to do. Although he has been horrified by many of the EWI installations he has inspected, he comments: "I don't want to colour my views just because I get called out to see bad examples." He has not despaired of retrofit; quite the opposite: "People are living in shabby, old, wet houses. We do definitely need to do something, we just have to be careful."

Go deep

SAP is not a good tool with which to design a retrofit, even though SAP or even RdSAP is the sole criterion on which much retrofit is currently judged and funded. But SAP cannot reveal the true benefits of deep retrofit. As we saw in the second article in this series, it is deep, holistic retrofit that delivers the better value in terms of carbon and running cost savings, once occupant comfort is allowed for.

Deep, holistic retrofit is more likely to consider the whole fabric, to include assessment of fabric condition, of ventilation and airtightness, and to consider all the building elements and those critical junctions between them. When this is done well, the savings in fuel costs and carbon are just one facet of the many benefits that can flow.

Putting people at the centre

As Neil May of the STBA put it at the Retrofit Live event: "People have taken too low a profile in retrofit up to now. It's just been about energy." This is echoed by King: "Retrofit is about creating a better environment for people to live in. We should be measuring improvements in health and wellbeing."

The advantage of putting occupants at the heart of the retrofit is that many of the perceived 'conflicts' or 'trade-offs' disappear. If the goal is to create a healthy home environment, comfortable living temperatures and good ventilation in a sound fabric become the non-negotiable basics. Having set that baseline, you then go on to deliver these basics in the most comfortable and efficient way that ingenuity can devise – but never taking your eye off the occupant. And really, how could you justify doing anything else?

Kate de Selincourt

Refs

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3. Centre of Refurbishment Excellence, April 2015
4. "This standard deals with critical surface humidity and interstitial condensation, and does not cover other aspects of moisture, e.g. ground water, precipitation, built-in moisture and moisture convection ..." and warns that "the much greater risk of condensation occurring" is " as a result of air leakage...as well as the effects of exposure to sunlight, clear night skies, wind and driving rain, particularly in exposed positions". (BS 5250:2011 Code of practice for control of condensation in building)
5. Draft of this guidance can be viewed at: http://stbauk.org/what-we-do/index
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17. http://tiny.cc/trpgzx
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Lammas Eco Village
has reason to celebrate!

In an out-of-the way valley among the rolling countryside of west Wales, a celebration is under way. Lammas, the UK's only fully legal, rural, off grid eco village, has achieved two milestones. One is that their community hub building is now finished and signed off by Building Regulations. The other is that the community has, collectively, at the end of its first 5 years, met the target originally set by the council as part of the conditions for receiving planning permission, of producing 75% of residents' income and household requirements from the land and land based activities. Olwyn Pritchard reports...

Both these achievments have required a huge amount of work and dedication from residents, friends and neighbours and truly deserve to be celebrated. It was June 2007 when a diverse group of people first applied to Pembrokeshire County Council for planning permission to build an eco village, and late 2009 when, on appeal, they finally succeeded in getting it and moving onto their holdings. The land they acquired is on the outskirts of Glandwr, a small rural settlement south of the Preseli Hills. It was previously an unremarkable place, and the fields purchased by the community were exposed, low grade, depleted land, which had been grazed long term by sheep, and provided an income of around £3000 per annum from sales of lamb.

Now, according to the latest figures, produced annually for the council, during 2014, the same 78 acres of land, occupied by 9 households, all cultivating organic smallholdings of between 5 and 7 acres, generated a total income of £93,000. This is made up of the equivalent of £52,000 in food and fuel consumed on site (which would otherwise have had to be bought in), approximately £27,000 of land-based produce sold off site, and around £14,000 generated by such means as produce sales, course fees, training and consultancy.

Melissa Holloway, a member of the community who was kind enough to explain the basics to Green Building added ruefully that although they send in their figures, as agreed, every year, they have never yet had a reply !

Nevertheless, this is still a remarkable testament to the value of a permaculture approach to land management. The productivity of the land, in financial terms, has, within 5 years, increased 30 times, and in addition is now providing homes for 33 people, as opposed to none, as well as a small number of domestic animals and birds. All residential accommodation has to conform to building regulations, to ensure the health and wellbeing of residents, which has at times proved challenging, as the regulations are not designed with low impact structures in mind. Biodiversity has also been increased many times over by planting 10,000 trees, creating additional watercourses, and diversifying habitat through interspersing organically cultivated garden with wild areas.

Tao Wimbush, one of the founding members, said at the beginning; "The project has been designed so that nine smallholdings, while being essentially autonomous, will also fit into an overall permaculture design plan for the whole site. This way we can turn what is considered as poor land into something incredibly productive." And, as Melissa pointed out, the project is still only in its early stages, and a long way from reaching full productivity, so clearly there IS huge potential for such a permaculture approach to be incredibly productive, even on originally poor, leached, acid soils.

Above: Megan Williams and Charlie Hague's roundhouse, built next door to Lammas and has now received retrospective planning permission.

She herself, in common with many of the other residents, takes a 'many strings to the bow' approach to income generation. Her six hives of bees play an important role in fertilising the crops of her own and other's gardens, fruit bushes and trees. In turn, they provide her with honey to sell, and a source of wax for cosmetics and furniture polish. In addition she grows and sells vegetables, salad crops and strawberries, and teaches willow-work and basket making at a centre a few miles away. Her smallholding also produces seed for the 'Real Seeds' company. Other members of the community have businesses selling raw milk (delivered by dog cart), eggs, firewood, garden furniture, hay, cut flowers, and speciality 'wild' plants, much in demand at certain expensive restaurants. Almost everyone is engaged in multiple micro-businesses.

Lammas' application was one of several at the time which led to the adoption by the Welsh Government of the 'One Planet Development' policy (OPD) (TAN6, originally passed in July 2010), which covers the whole of Wales. This ground breaking move means it is now possible to build new homes in the open countryside in Wales provided there is a clear commitment to sustainable living, zero carbon building, and land-based livelihood.

Another resident, Simon Dale, commenting on the policy, said that although this is an improvement over the way things were, it is still a difficult and expensive process, involving paying consultancy fees for work such as full environmental assessments, drawing up business plans, etc. The goal posts have been modified slightly since Lammas was originally set up. The emphasis is now less about income, and more about carbon footprint - households are expected to demonstrate an ecological footprint as low or lower than 2.4gHa/cap (after 5 years), and a minimum 65% of household income must be derived from the land and land based activity. Over and above that residents are free to supplement incomes by other means, so long as that doesn't increase their carbon footprint. Further details can be found on the Lammas website (**www.lammas.org.uk).**

As a successful project, Lammas has proved an inspiration to others, and three other One Planet Developments are currently growing in the neighbourhood. One is the celebrated (or infamous, depending on your point of view) 'Hobbit House', the turf roofed roundhouse built in 2012 by Megan Williams and Charlie Hague, on land owned by a family member adjacent to Lammas.

The couple built the house without consent and have just obtained, with difficulty, retrospective permission, with their final appeal attempt having recently been approved by a Welsh Government planning inspector. Charlie's work is acknowledged to be a beautiful example of a low impact building and has been described as the best example in the UK at present. A campaign on social media recruited 100,000 people to engage with the planning application and sign a petition to support it.

Megan and Charlie have demonstrated that their project meets the OPD criteria. At the hearing inspector Ms Sheffield said that if she allowed the appeal, there would be a number of conditions imposed. They included that the property should 'remain in accordance with the design and management plan' submitted to Pembrokeshire Council, annual figures will have to be submitted, as at Lammas, proving that income is being met by the land, and an agreement will ensure that the home is tied, in perpetuity, to agriculture and horticultural activity, and to the couple.

Two other developments in Glandwr, which proceeded via the official channels, have recently been granted planning consent under the One Planet Development Policy. The Smith family say their aim is 'to create a fully off-grid smallholding using permaculture principals, clever design and minimal technology'. They want to show it is possible to use 1.88Gha or below of the earth's resources and retain a reasonably civilised lifestyle in touch with modern technology. The activities on the 7.5 acre plot will fully sustain the family, both physically and financially, and

Above: an educational course in progress in the newly completed hub building (credit lammas.org).

support more people in the locality.

The other smallholders, Tom Clare and Jacqui Banks, at nearby Pont-y-Gafel, say they aim to establish a five acre smallholding in compliance with the OPD guidelines, build a low impact house (to Passivhaus standards) with ancillary buildings and make the site their primary residence. A small horticultural business will be their primary occupation, comprising a specialist tree (and other plant) nursery, the production of fruit leather for local suppliers and other horticultural produce especially watercress and asparagus for the local market. As well as proving a growing success in terms of people and productivity, the other cause for celebration at Lammas has been the final signing off of the community hub by Building Regulations.

A community building or hub was originally part of the overarching Lammas plan, but rather unexpectedly in 2010 the group won a prize, which resulted in a £350,000 grant from DECC to build a centre for the research, education and promotion of low-impact development. The grant was part of a government initiative in which UK projects were rewarded for pioneering carbon-reduction approaches. Lammas scored highly because it was a carbon positive community – with all buildings zero carbon in both construction and use, energy produced on site by a hydro system, plus other microgeneration, and with travel restrictions in place.

This was something of a double edged sword, as Melissa explained, because the grant came with conditions. The work was to be completed within a limited period of time, and the building had to conform to exacting building regulations, whilst being at the same time low impact, zero carbon and off grid. To build such a large structure to such stringent standards would have been a major undertaking in itself, but it came at a time when the members of the budding community were already stretched by building their own homes, setting up businesses, planting gardens and caring for children. In the end, after a long struggle, with the help of neighbours, (especially Tom Clare and Jacqui Banks) friends, an army of volunteers and the persistence of many, it was finished, and a beautiful, light, airy space it is.

The hub is almost entirely constructed using local materials, which as far as possible are natural and/or recycled. The frame was constructed using locally grown Douglas Fir, in-filled with straw bales, and finished with lime render. More bales provide insulation within the turf covered roof, one single entity curved to cover a terrace and passage connecting gardens at the rear with open space for gatherings to the front. Heating is supplied by a combination of electric underfloor heating, powered by the

Below: the community hub, built with a grant from DECC to promote zero carbon, off grid and Low Impact techniques. To learn more, book a tour, a course or hire the hub as a venue, visit www.lammas.org.uk.

Left: the interior of the hub, with the typical contoured effect created by lime rendered straw bale walls.

hydro system, passive solar gain, and biomass, from the community woodland, via a masonry stove. The building is entirely run on renewables. The Community Hub's main purpose, and the one for which the money was originally intended, will be to provide a centre, and a demonstration project, for the research, education and promotion of low-impact living. This is already being achieved through the provision of hands-on courses, tours, presentations, visitor and volunteer opportunities.

As part of the educational conditions imposed when the government grant was received, the community had to provide regular open days, with tours of the site and talks about permaculture and low impact living. Melisssa said that after the first year, they discovered from studying the visitors' book that over 50% of the visitors came from within 10 miles, and gradually the suspicious, and in some cases hostile, local population came to accept and even appreciate them, an unforeseen but welcome spin-off from the mandatory tour regime. As the project becomes better known, and increasingly successful, numbers of visitors have gone up, and tours are now held once a week. A small charge is made, which is proving to be a useful additional source of income.

The hub also provides a meeting and social space for the Lammas residents as well as facilities for processing their land-based produce (such as drying seeds) and exchanging goods. The building is also intended to provide a focal point for the wider local community, functioning as a hall, seasonal shop (part-time) and seasonal café (part-time). The building is already assisting local land based livelihoods by providing an opportunity for producers in the Glandwr area to sell their goods, in other words, it will act as a depot for a local 'farmers' market'. It is also available for hire as a venue by outside organisations, providing such use does not adversely impact on the Lammas residents.

Olwyn Pritchard

Two of the many different approaches to Low Impact building which can be seen at Lammas. Below is Nigel and Cassandra Lishman and their roundhouse (lammas.org). Above is the 'farmyard' house of Tao and Hoppi Wimbush.

Olwyn was Green Building's news editor, responsible for online news and the quarterly news roundup. She has a long standing interest in low impact structures and 'alternative' land based lifestyles. Olwyn has been involved with the Dyfed Permaculture Farm Trust for almost 20 years, and has an allotment garden there, with an increasingly elaborate shed.

The Green Deal

Somerset Road case study

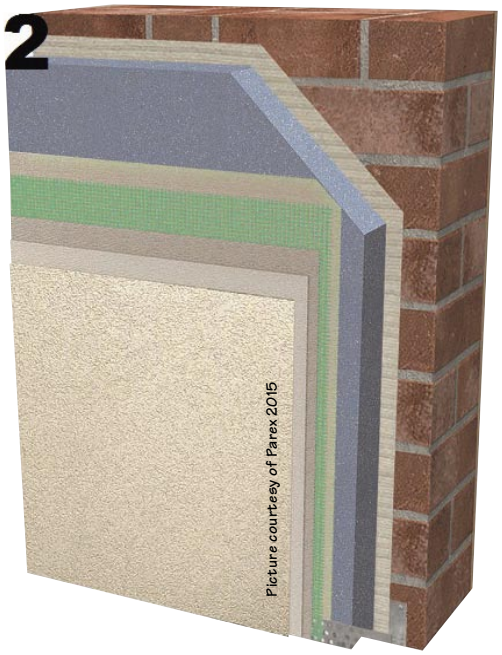
Part 4: System completion

Parts 1 - 3 of the Somerset Road Case Study looked at the intricacies of the Green Deal Home Improvement Fund (GDHIF), pre-installation considerations and system choice. In this, the fourth of the series, the author and building owner, Mike George, discusses the completed installation, highlighting technical points and considerations not previously discussed.

The property is an Edwardian semi–detached home built around 1912. The front elevation is 105mm engineering brick laid in stretcher bond, backed with approximately 300mm random limestone walling. The lower part of the main gable is of the same construction, though the remaining masonry on the gable and back annex is around 450mm rendered random limestone walling.

The installation, as discussed in Part 3 of this series, is now completed and is insulated as illustrated in the Picture 2 schematic. The finished construction, attaining a U-value of 0.3W/m^{2}K, comprises:

- Approximately 450mm original masonry construction.
- 90mm graphite EPS.
- Parex Maite Monocomposant base coat incorporating 355AVU reinforcing mesh.
- Maite monocomposant slurry coat with sponge finish.
- DPR colour primer.
- DPR optimum fine finish.



Pictures 3-6 show some views of the completed elevations. Aesthetically the result is very pleasing and the chosen finish compliments the existing street scape.

From a technical design standpoint the installed system was researched in some depth with the help of both Parex technical support and the installers on site. As such the result is also very pleasing and in terms of functional performance the internal comfort conditions in the building improved noticeably as soon as the EPS was adhered. An analysis of historical and future energy use is to be undertaken and the results reported in a future publication. Although the main installation was discussed in Part 3 of this series, there were a number of technical details requiring bespoke solutions.

Eaves' extensions

In many properties the addition of EWI is not possible without the finished EWI over-sailing the eaves and/or verges of buildings. There are ancillary solutions available, which are principally various powder coated aluminium sections - exemplars are shown in Pictures 7 & 8. As well as the aesthetics, obvious disadvantages with those shown are the weak silicon sealed junction between aluminium section and fascia board and the adjacent area of wall uninsulated facilitating water to be discharged into the rainwater pipe. Far preferable is the extension of the roof slopes at eaves and/or verges which are relatively simple to design and achieve on site. Unfortunately though, this

operation is time consuming and requires carpenters on site – complicating the 'normal' working routines of the installers who are principally 'wet' tradesmen.

At Somerset Road it was not necessary to extend the verges as the existing soffits were sufficiently wide to allow the insulation system. The eaves, however, were extended in the following way. Firstly the existing fascia and bottom two rows of slates were removed; the existing sarking felt being left uncut. This allowed the roof rafters to be extended by simply fixing new timbers of the same section alongside those existing. Coach bolts or screws should be used to extend rafters, depending upon the sectional size of the timber. A new strip of breather membrane was then fixed over the new area of roof slope and new battens and slates added. Care was taken to incorporate insulation into the 'cold roof' zone and a further advantage to this option is that it is easy to incorporate roof ventilation, in this case with the introduction of over-fascia ventilators.

Cills

Window cills also present a significant problem to overcome. Coming in many materials, shapes and sizes, some solutions are often interesting to say the least. Examples are Pictures 9 & 10, which show prefabricated aluminium 'additions'. In some cases these work very well, and are certainly a reasonable option on the basis of cost.

However, at Somerset Road a bespoke insulated over-sill was proposed, being preferable as the main intention was to eliminate, or at the least diminish, the thermal bridging effect of the existing concrete cills.

Pictures 11 & 12 illustrate the original proposals, the intention being to have these cills prefabricated off-site. However after promising discussion with a local company, unfortunately they were unable to produce the cills. The technology is certainly available, although the thin nature of the EPS section was thought to be too fragile to withstand the manufacturing and on-site fitting. Fortunately, however, the installers had experience of forming bespoke cills and did so at Somerset Road. Pictures 13 &14 show the excellent results.

Window reveals

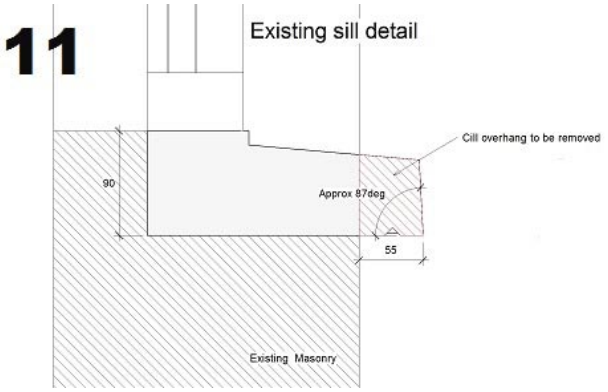
A far more difficult thermal bridging problem to overcome is that of window reveals. In most cases (as at Somerset Road) there is very little scope for insulation to be applied in these areas due to the close proximity of windows. The author's original intention, regarding Somerset Road, was to propose and install a solution which is currently unavailable in the construction industry. Picture 15 shows how such a prefabricated, pre-finished EWI reveal board would work.

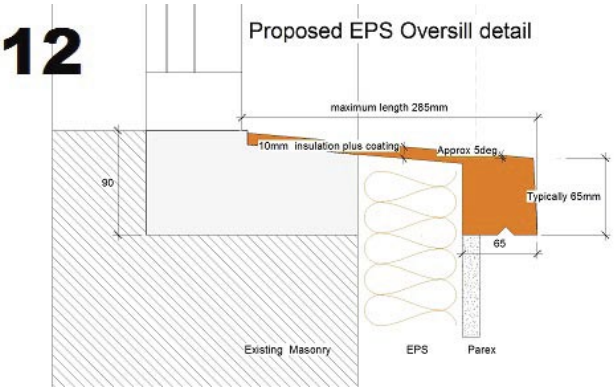
The board would provide significant advantages in that it would not only insulate the reveal but would eliminate awkward areas of rendering and eliminate the need for time consuming quoin beads around windows. However, in order for such a product to be widely taken up in the industry, an acceptance would be needed concerning what is a significant change to the traditional appearance of 'typical' solid walled houses, ie the reveal board wraps around the front face of the rendering giving the effect of ornamental render 'bands'. Unfortunately, time constraints prohibited the progression of this idea during the works. Interested parties should contact the author for more details.

Service pipes penetrating the insulation

Virtually all EWI jobs will require the removal and reinstatement of service pipes, such as boiler flues, soil pipes and other waste pipes. Due to the huge array (sizes) of such pipes, which have been fitted over many years, there are often problems with how to extend them into new locations on or beyond the new finished external surface. Somerset Road was no different and it is unfortunate that while a simple solution should be available, in many cases it is not.

The problem mostly lies with the difference in diameters of solvent weld/push – fit drainage fittings. While reducing fittings are available relative to each brand of pipe, there does not appear to be any fittings which easily convert one brand to another. All that is required is a range of pipes which will enlarge or reduce various branded pipes to a





common solvent weld size pipe. This is important because, in most cases, the join between existing and new pipe is going to remain within the insulation zone. So, unless this joint is solvent weld then there is an inherent difficulty in diagnosing and resolving problems with pipe joints should they begin to leak. Installers should be particularly interested in this as it is they who provide a warranty under GDHIF, which would likely cover such a failure. In addition to this it is often necessary to introduce 'swan neck' style bends into many soil pipes at the base of soil stacks as the alternative of digging underground pipes and re-routing pipe runs is costly and, in some instances, not viable (See Picture 16). A simple range of pipe bends, with screw on access fittings to alleviate blockages should they occur, would solve this problem.

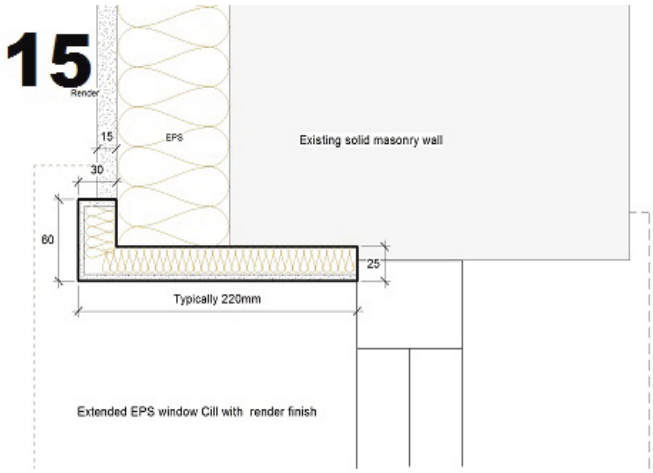
Ventilation

As previously mentioned the continued ventilation to 'cold' roof and floor spaces is critical. Care should be taken at eaves, verges and soffits that any existing vents are not blocked. Sub-ventilated floor spaces are also an area of considerable concern in houses such as Somerset Road as EWI completely changes the dynamics of heat and vapour transfer through boundaries of such spaces. Part 2 of this series discussed the risks of what can happen in such scenarios and it is vital that the ventilation of such spaces remains unhindered.

Re- enablement – fixings

The re-fixing of services and fittings to EWI is problematic. Various methods are available, ranging from plastic/nylon auger type fixings to long stainless steel frame fixings and screws. While the nylon fixings are clearly preferable from a thermal bridging point of view, it is important that they are used before the render reaches a certain curing strength – this was discovered at Somerset Road as it was not possible to use these as the render was too strong for them to auger in to. Research of other early EWI installations has indicated that timber/ply grounds have been inserted in some cases into the insulation zone. In no circumstances should this be done as differential movement of materials will lead to cracking, potential water ingress and timber degradation.

When asked for advice regarding timber grounds, Steven Keitley of Parex Ltd comments: 'In reference to your question, we do not advise using any timber grounds within or hidden behind insulation in EWI schemes. The reason is there are perfectly good fixing solutions without the need to use timber. Timber grounds are poor practice, often poorly fitted, not treated and the adjacent insulation is usually not fitted correctly. In addition they cause different thermal values too!'[1] >>>



Green Deal Home Improvement Fund (GDHIF) update – where are we now?

The consensus in the industry seems to be that the GDHIF has been a shambles from beginning to, what seems to be a premature, end. According to the Independent, the energy efficiency budget is set be significantly reduced as part of the Government's austerity drive, with a proposal that the controversial GDHIF should be mothballed. Amber Rudd, the Climate Change Secretary, told The Independent[2] 'that all Department of Energy and Climate Change (DECC) spending on energy efficiency was being looked at. We're reviewing that whole area.'

Overall, the DECC's £3.3bn annual budget is expected to be cut by around £70m in this financial year and that figure is likely to rise in the autumn spending review - significantly, there is no longer a minister directly responsible for Green Deal.

In terms of personal experience, the funding the author secured for the works at Somerset Road was critical to getting the works done, as without the aid the EWI would not have been possible. There is no doubt that many others now live in warmer, more comfortable and cheaper to heat homes as a result. Unfortunately, however, the funding stream has been open to abuse from the very beginning and it is most likely that this embarrassment to the Government has played a part in bringing the scheme to a premature end.

Summary and concluding remarks

All in all the EWI works at Somerset Road have been carried out to a very high standard. Many technical problems associated with EWI, which are often overlooked or ignored, have been addressed and overcome. However, it has to be recognised that all solid walled houses are unique and there are always going to be compromises which need to be made. Thermal bridging at reveals and cills, in particular, is something which needs to be considered. However, it is not the be all and end all; and in this vein of thought it must be remembered that it is always the first tranche of insulation which has the greatest effect. Even a minimal thickness around reveals will reduce heat loss significantly and help to mitigate surface condensation on the inner reveals. What must be prioritised is consideration of the existing fabric, and a sympathetic design methodology which reflects this.

In the author's view, what is needed is a complete rethink regarding the regulations for insulating all existing homes – it is accepted by all that many are 'hard to treat' (HTT). Why then should this factor not be recognised to the point where stringent U-values are relaxed in some cases? The problem we have with such a rigid regulatory system is the works required to upgrade each and every house to the same standard can vary hugely by house depending upon the level of 'enablement' and 'ancillary' works. There is no doubt that this has driven costs of EWI works up to the level where they are unaffordable for most without financial aid, and, as a result, only a minimal percentage of the existing housing stock have been upgraded to date at a disproportionate cost. In the next part of this series, the author will explore these issues in more detail, and put forward an alternative, more cost effective proposal for insulating HTT homes.

Mike George

Refs

1. Steven Keitely, (2015) Parex General Manager

2. The Independent on Sunday (2015). Available at: http://tiny.cc/alc9zx

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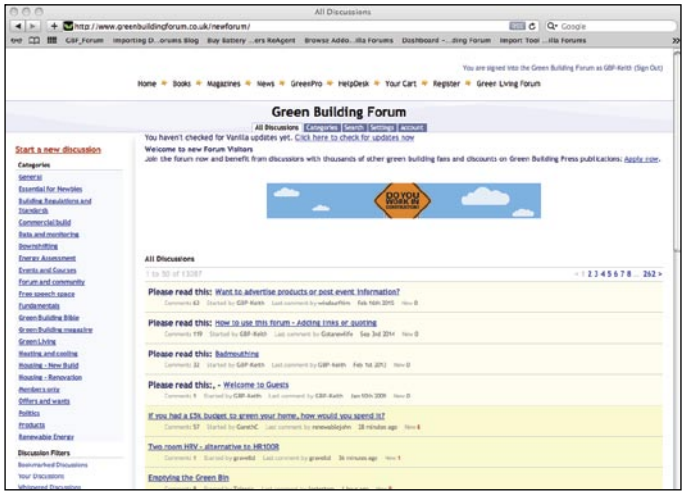
The forum debate

Continuing our look at hot topics from the Green Building Forum at www.greenbuildingforum.co.uk

NOTE: We interpret a mixed discussion of professionals and enthusiasts and we accept no liability for any interpretational errors. This article is offered as an introduction only to the subject but for clarity we recommend that you visit the thread/s, read the discussions yourself and seek any further clarification as necessary.

What heating system is best for a new build in a rural location without gas?

In this forum review we take a look at the ever recurring question that arises when a new home is going to be built outside the reach of mains' gas supplies. Clearly the ecological stance of many Green Building Forum users will be - try to avoid heating using better design, but this is a big ask. As usual, Keith Hall tries to pull the discussion together...



The link to this story is here: http://tiny.cc/062pyx

Guide to help readers: quoted forum usernames are highlighted in red for the first mention of their name to help avoid confusion.

Frank Gibbons brought an interesting subject to the forum recently: Hi everyone, 'I am at the final planning stage of a new build, two storey cottage on Anglesey on a greenfield site. This is a huge learning curve for me. I've never done anything like this before and have no experience or background in the building trade. There is no mains' gas available and I am keen to go down the PV route to generate power. The ground floor of the cottage will be tiled and I am considering electric underfloor heating in the living space, panel heaters in the upstairs bedrooms and underfloor in the bathroom and en-suite. I am also considering electric hot water. I've looked at LPG and oil systems but the low installation costs and all in one energy bill appeals to me. The site is ideal for solar power with no shade and a south facing aspect and I would appreciate any views, suggestions and opinions. Ideally I could do with a website where I could send them the plans and they come back to me with some options and quotes. Any recommendations gratefully received! Thank you for your time. We are planning two wood burners, one in the lounge and one in the kitchen diner, 8kW and 6kW as I will have easy access to lots of logs!'

Barney was first to respond: 'Build it right, and the woodburners, plus an electric immersion for DHW, will be all you need - and the woodburners will be a problem in reality as you can't turn them down enough for a well insulated relatively airtight house. For a more modest level of insulation, I'd go with a bigger than average DHW cylinder to maximise the PV and an air source heat pump into wet UFH downstairs via a reasonable sized thermal store - again to max out the PV panel heaters upstairs. The woodburners can add to the store if you plan the plumbing now. Start off with enough insulation to get your heat demand right down and from there, all electric heating is cheap and efficient - do it well and you can ditch the UFH for panel radiators everywhere. Target say 90% of the year without heating of any kind.'

SteamyTea then chipped in with: 'You need to know what your usage is likely to be, otherwise you are just guessing. An alternative to resistance, that is not too expensive, is an air source heat pump. They have limitations, but if designed and fitted right they work well. You could also look at small simple air to air heat pumps - from about £300.' Barney, I note your comments and it's interesting that I visited an almost identical house designed by the same architect and the people there said exactly the same as you. They fitted LPG central heating but have not had to use it because the woodburners, plus insulation, do such a good job of heating the house. '

Nick Parsons added: 'I have been working with clients on a high-spec new-build. We ultimately omitted the proposed stoves - and the heat-leaking chimneys, because of concerns about heatloss, via the flue, and the cold mass of the stove.' But Ed Davies wanted more information before offering an opinion: 'Roughly how big is this house? What sort of U-values are you planning? Airtightness? Heat-recovery ventilation?'

'If I were you', said Crosbie, 'given a good supply of logs and sun, I'd be looking at log boilers rather than burners, a log stove in the kitchen, and solar thermal panels, plus photovoltaic panels (configured for hybrid on/off-grid operation) to provide energy independence (in a pinch). I'd go for a 1,000-2,000 litre thermal store depending upon

usage. This would supply radiator heating upstairs, and underfloor on the ground only if there was money to spare. I'd also contrive at least one log boiler to be able to heat the thermal store even without electricity.'

Frank Gibbons was pleased with the responses: 'Thank you for all of your replies guys, they have given me lots to look in to. And, in response to Ed Davies, Frank said: the house is a two storey dormer cottage, with a ground floor area of 90m^2. It is in quite an exposed location and will therefore be heavily insulated and airtight. The log boiler sounds interesting.'

Snyggapa joined the discussion: 'I have a 2 storey dormer cottage, but half your footprint (90m^2 over both floors) - we went for an airtight timber frame build, a wood burning stove (room sealed so no need for air intakes), MVHR to control the humidity and electric water heating plus a couple of electric panel heaters. Cheap, simple, reliable, effective. If I had room for more PVs I would get an 'Immersun' type device to heat the water from PVs but we could only fit 6 panels, so not worth the effort.'

Steve Bxman joined with the expected caveat that: 'proper insulation and you will not need any heating, night storage heaters work well on an PV diversion device so spend your money on insulation and stop the wind penetrating the structure.' Then Tony added the point that dormer bungalows are notorious for having bad air leakage so, design in air tightness, set target and measure it before any internal linings go in and watch the contractors like a hawk during construction.

Clearly plenty of good advice was being heaped upon Frank thick and fast and all of it very positive. But there is plenty more where that came from as DarylP noted: 'You are probably getting the message now, but I will risk repetition : build tight, ventilate right. Factor in the necessary insulation to negate the need for central heating, rely on electric backup, solar DHW c/w either biomass/LPG/E7? But now SteamyTea wanted to move on to numbers: 'How much PV can you get on your roof without the dormer windows interfering with it. Have you checked with your local distribution company if you want to put over 4kWp on it?'

Martint wanted to clarify and add more information relating to an earlier point that was made: 'Crosbie mentioned log boilers, but did not mention the RHI (renewable heat incentive), which until recently, would pay 12.2p per kWh of deemed usage over a 7 year period - which may well pay for the cost of the boiler and installation (was talk of reducing this value at the end of the first year). If you go down the PV route, there is also the FIT (Feed-in Tariff). I don't know what would happen if you chose both - presumably a mix. Crosbie then offered a link: **www.stovesonline.co.uk/stoves_with_backboilers.html** Here's a good link to get an overview of log boilers available.' 'Incidentally', he added, 'the benefit is, if you're were going to have a log stove anyway, you might as well put it to good use (and reduce the heat output to the room, whilst still enjoying the stove). Hence, I don't recommend the gasification log boilers (pellet maybe) because they are a lot of work, and you don't put them in your living room.' Just for good measure, here's a section on cooker stoves (with backboilers): **www.stovesonline.co.uk/wood_burning_stoves/Range-cooker-stoves.html** However, it may be that your cottage does not have enough room for a large thermal store (for all the heat you could generate from all the available sources).'

Fostertom decided to ask the question: 'Why not go full Passivhaus standard, now you're considering high insulation/airtightness etc? It's such a good, systematic way to check that everything is designed right, and to deliver assured results.'

Now, maybe slightly overwhelmed, Frank Gibbons came back with: 'Thanks everyone for your help and advice. There are things here that I've never even heard of but I will research every suggestion. At the moment I'm thinking of an electric 'Megaflo' eco hot water system for the house. There will normally be just the two of us there but sometimes we will have guests staying. We are not fitting any baths in the bathrooms but instead will have 2 good showers but I'm not sure what is the best size and make of cylinder. I would appreciate any views on this. I think that the electric hot water will be best because I am planning for our old age and as we get older we may not be as keen to keep cleaning and lighting woodburners!'

Picking up on Frank's most recent point, Peter_in_Hungary added: 'If this is going to be for your old age then make sure that the showers are big enough to get a shower chair in and still have access and movement space. Most shower trays are too small to allow a shower chair + person! Plus full length horizontal handrails on at least 2 sides sooner or later will be needed, just a question of when. Also, if its not too late, have the stairs a bit wider than minimum and straight so that a chair lift is an easy retrofit if/when needed. (Just future proofing). Not much to add on the heating other than to agree with above. For a new build insulation is better use of money than heating systems.'

At this stage commentators are beginning to bring in practical examples from their own projects. For instance: pmusgrove said: 'I went for a utility free house on about the same footprint as yours and it has worked. Masses of insulation, a lot of glass on the south face but next to none on the north and what there is triple glazed. If the sun comes out for any part of the day there is no need for heating at anytime of the year. Cover the roof with thermal solar (8m^2) and PV (4kW peak) and you have more than enough hot water as well. If the sun doesn't come out and for some 'cosiness' in the evenings, a 9kW burner with back boiler works well enough. We do use a couple of 3kW immersions in an 'Akvaterm' tank though when we have weeks without

sun but so far we are producing more electricity than we are using. Downstairs is heated by underfloor from the Akvaterm whilst upstairs is through two towel rails.'

Hairlocks joined the debate at this stage and added: 'You will need a MVHR to keep the condensation down and to comply with building control (I hate trickle vents). I would recommend the 'Woodfire f12' for the wood stove with back boiler. 1kW into room and 10kW, for space heating in a well insulated house. A thermal store also provides main pressure hot water. Our kitchen/diner is the largest room in the house at 27m^2 and the burner still warms it slightly faster than the 750l store.'

Tony chipped back in with: 'The heat loss for my whole house is only 100W above incidentals in October, theoretically rising to max 1.1kW when very cold and windy in January. Never used more them 300W, even when -6^{0}C outside, any wood burner turns my house into a Pizza oven. Have you done a thermal model or heat loss calculation Hairlocks, you must?'

In a prompt reply to this Hairlocks said: 'My SAP calcs say 1.88kW in the cold windy January, but like Tony, if I really burn the wood burner to get the store up to temperature, we need the double door open to the rest of the house. The 1kW from the stove for about 8 hours a day is enough to keep the house warm. When it is about 6^{o}C outside overnight the temp inside the house will drop from 18^{o}C when we go to bed to 16^{o}C in the morning. I would have liked an ESSE range cooker in the kitchen, but after a while during the design phase, I came to terms with the fact the 4kW of heat it would have dumped into the kitchen would have made it unusable, even in the winter.'

Crosbie wanted to tell us of his project experiences too: 'With double-glazing and metre thick stone walls, our 6x6m kitchen/diner only gets too warm in the winter when both the Wamsler 1100 (16+4kW) and the electric oven+hobs are being used at the same time. The Wamsler alone just makes it comfortable, given that its 3 lids and 2 diverters can regulate heat output to the room vs the water.'

Throwing us off on what would seem, at this stage, a bit of a tangent Viking House offered new, seemingly unrelated questions. 'How big will the house be? Do you need to install a septic tank?

Frank Gibbons decided to come back with answers and more clarification: 'Yes it will need a septic tank or treatment plant Viking. And I had a long conversation with the architect today and he agrees with all of your comments. He's really pleased that I'm going down the PV route and he is confident that a combination of underfloor heating on the ground floor, and panels on the first floor, as well as the log burners, will comfortably heat the house. I've started pricing the whole lot up and I'm surprised that it compares very well to the cost of installing oil central heating.'

'You can get a fair estimate of PV yield from here. **http://re.jrc.ec.europa.eu/pvgis/apps4/pvest.php#'** SteamyTea offered. 'Also have a read of this blog: **www.ebuild.co.uk/blog/12/entry-99-in-the-beginning** The blogger, Jeremy, shows what can be done on a difficult site and a relatively low budget.'

To put us out of our misery wondering what a septic tank has to do with home heating Viking House came back at last with; 'That's an awful lot of gadgets you're considering, 2 wood pellet or log stoves, septic tank, large thermal storage tank, PV array 4kWp or more, heat pump and MVHR. For the cost of all that you'd easily get off grid with a TA Digester and avoid all the connection costs and standing charges.' Ah the penny drops. *Ed.*

SteamyTea had reservations about this suggestion: 'Hate to bring it up, but we have not seen any data for these devices you have fitted yet.' BillI did not seem impressed either: 'I doubt that you will ever see any results. It's completely unsuitable for domestic scale use, as the amount of energy available from domestic waste will be tiny. Look at it in food terms; the average energy intake from food is about 2000 calories. Let's say we are only 10% efficient at converting potential energy into useful energy, so about 20,000 calories a day is useable for post consumption digestion. That's about 20Whr per person per day, say 0.1kWhr for a 5 person household. Not many households will live off that amount of electricity. Yes, it's a viable technology if you have the waste output of a few hundred cows or the grass cuttings from a few acres of pasture.'

Viking House was not being distracted though and wanted to qualify his suggestion: 'A 150m^2 passive house uses about 50kWh/m^2.annum(15kWh for heating, 15kWh for hot water and 20kWh for electricity) = 7,500kWh/annum. An average family produces about 2kg of waste per day x 365days x 10kWh = 7,300kWh/annum. So its about the same, especially if you add in some lawn and hedge cuttings and bring home your shopping in cardboard boxes: **www.viking-house.co.uk/tad-digester.html'**

Still not impressed, with some aspect of the above comment or link, SteamyTea reached for his calculator: 'So maize silage has the highest energy content and can produce 2.25m^3 per kg according to your link. That is 0.0364MJ/l (energy content of methene) x 2.25m^3/kg (volume of methane produced) x 1000 (convert m^3 to litre)= 81.9MJ or 22.75kWh sawdust is 1.11m^3/kg, so that will be 40.404MJ or 11.2kWh. Now I often make schoolboy errors with my arithmetic, but I think the figures are wrong. But what we really want to see is some real data from your installation in Dorset.' 'Don't get us wrong', said SteamyTea, (seemingly speaking on everyone's behalf), we would all like it to work, but we do question how good it is.' Seeking some further

clarification skyewright said: 'Dry weight or wet?'

'Done this one, think it was dry', replied SteamyTea: **www.greenbuildingforum.co.uk/newforum/comments.php?DiscussionID=12607**

Still unperturbed by the slight 'drubbing' his suggestion was being given, Viking House ploughed on: 'Yes it's dry matter. An average family produces about 2kgs of dry matter waste/day. Here's an update on Derek's Off Grid Passive House in Poole, near Bournmouth. The passive slab is installed and the twin-stud timber frame is erected. 300mm of cellulose insulation is installed in the walls and 400mm in the roof. The airtightness test result was 0.67ACH, but some of the window seals were faulty so we expect a re-test of about 0.4ACH, this isn't that important. The 2 x 4,000L digester tanks arrived at the workshop today, so we'll start plumbing them up and pressure testing them, they'll be shipped to site next week. The 24m^2 Tri Solar PVT roof is in production and should arrive on site in the next few weeks. 4 FreshR HRV units arrived on site yesterday. These reduce the heating demand of a passive house by 65%(10kWh/m^2.annum), vastly reducing the heating demand. The house is 350m^2+ 60m^2 annex and there's an existing 10m x 5m pool in the garden that's normally heated by gas which has been disconnected. The excess heat from the solar PVT and the TA digester will be dumped into the pool. We expect Derek to be able to use the pool for 8 months/annum. There was a old house on site so there's an existing electrical connection Derek wants kept for now. We're confidant he'll be able to disconnect it this time next year.'

He went on: 'One more point about the digester, besides producing 7,300kWh/annum worth of methane in an average house (which can be used for cooking, heating through a gas boiler and generating electricity/heat using a CHP unit), the thermophylic process, using insulated ground tanks, produces 25% more heat than it needs. So the 4,000L tank producing gas at 70 degrees, has a heat exchanger installed in the tank drawing off a constant (4m^3 water x 30 degrees flow/return difference x 1.16kWh x 25%) 30kWh demand. This cooling process improves the efficiency of the digester and excess heat can be diverted to the house and pool. So we're good for heating and hot water throughout the year. The digester tanks can store 1,000kWh's of methane going into the winter and the battery pack stores 50kWh, so we've 400kWh of potential electricity stored coming into the winter. Burning 7,300kWh of methane/annum gives us 213kWh of electricity per month and 350kWh of hot water, so we restrict the electricity usage to 350kWh/month. We're generating 100kWh from solar PV in December and 180kWh in November and January, the pinch month is always going to be December, so no baths! We instructed the client to only install appliances of the highest efficiency, especially the refrigeration.'

Bringing us back to the actual heating discussion, an02ew saw some comparison between his own project and that which Frank is proposing: 'Our self build work well with just 2 wood burners. as you plan one in the lounge and one in the kitchen. However, we up graded to a wood burning oven with backboiler (Pertinger) in the kitchen but as probably mentioned above the important thing is the build fabric, go for passive or as near as you can afford, Very good windows are a must, and design to eliminate all cold bridging and make it as airtight as you can. As I said our home works without any other space heating (wet system) apart from the very coldest weather, (sustained below zero), I place 2 750kW thermostatic electric heater upstairs, the problem isn't so much loss of heat but more a case of not being able to move the heat from the warm areas to the colder ones. We also have a large 80 tube solar thermal array which, from March to October, provides all our DHW - as a family of 5'.

So, in rounding off the thread for the moment, djh wanted to recap and comment on something said earlier in the discussion by Frank: *"I had a long conversation with the architect today and he agrees with all of your comments. He's really pleased that I'm going down the PV route and he is confident that a combination of underfloor heating on the ground floor and panels on the first floor as well as the log burners will comfortably heat the house. I've started pricing the whole lot up and I'm surprised that it compares very well to the cost of installing oil central heating."*

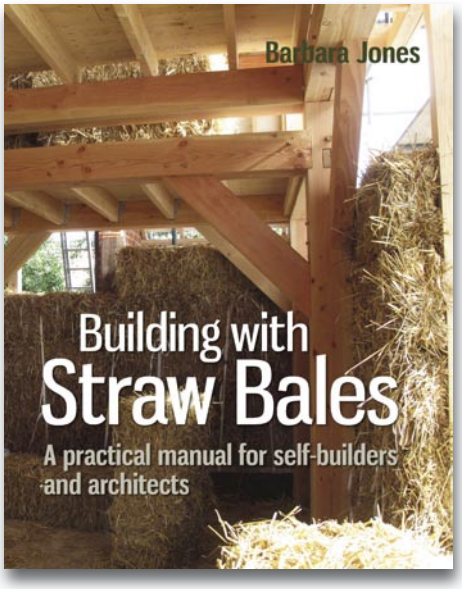
'I'm a bit concerned by the architect's reaction' said djh, '. As Viking House said *"that's an awful lot of gadgets you're considering, 2 wood pellet or log stoves, septic tank, large thermal storage tank, PV array 4kWp or more, heat pump and MVHR".* If your house is well-insulated enough (Passivhaus) then you shouldn't need even one log burner, nor underfloor heating. So it sounds like your architect is happy to spend your money over-specifying, so there's no chance of complaints. At your expense. We still haven't seen any of the calculation results people have asked to see. Has your architect done them? If not why not!

So what do you think? Even though he makes a good point I'm not sure I agree with djh's final summation. Do you? These issues just aren't that black and white. Well you now have the chance to go and join the discussion. The link to this story is here: **http://tiny.cc/062pyx**

Compiled by Keith Hall

In the early 1980s Keith formed his own building business that included general building, renovation and new housing. In 1988 he became concerned about environmental issues and, with his partner Sally, founded the AECB and the Green Building Press. He is now editor of both 'Green Building' magazine and the 'Green Building Bibles'. He has installed renewable energy systems (solar, wind and water) at his own property and been involved in designing, building and renovating numerous sustainable building projects.
keith@greenbuildingpress.co.uk

Building with straw makes so much sense! No other building material stores as much carbon within itself, or provides so much insulation for so little cost, or is so easy to build with. So why aren't there more straw-bale houses? Partly, there is still lack of awareness about this humble building material. Partly, there is fear of something so simple and straightforward. Partly, it's because of lack of affordable land available for people of limited means but with determination and ability. But mostly, there is no profit to be made in the usual way of a business selling a product, because straw-bale building is as much about passion, about empowerment, about belief – a way of life – as it is about construction. Here we run a short extract from 'Building with Straw Bales',



Straw-bale building offers us a radical way to solve many of the issues facing construction with respect to thermal efficiency, carbon footprint production, sustainable materials, durability, air quality and cost. It's far more than just a wall-building technique; it's a completely different approach to the process of building itself. Its background is grass-roots self-build: it is firmly based in that sustainable 'green building' culture that has brought to the construction industry many new and useful ideas about energy efficiency and environmental responsibility.

This method of building is now entering mainstream construction via co-housing projects, designers and architects, and community groups, which see its value in terms of cost-effectiveness, sustainability, ease of installation, air-tightness and energy efficiency. The building method itself is based on a block system, making the designs very easy to adapt from one project to another, and giving great flexibility in its use.

The accessible nature of straw as a construction material means that even those unfamiliar with this building process can participate in it. This opens the door for interest groups to work together on joint projects. Housing associations, co-operatives, and local authorities are ideal managers for self-build straw projects, which are quick to build and which will engender an excitement and motivation that gets the job done. The atmosphere on a straw-bale building site is qualitatively different from that found on the vast majority of other sites; it is woman-friendly, joyful, optimistic and highly motivated. Knowledge and skills are freely shared, and cooperation and teamwork predominate; all these factors have a positive effect on health and safety on site.

Working with straw is unlike working with any other material. It is simple, flexible, imprecise and organic. It will challenge your preconceptions about the nature of building and the correct way of doing things – and not everyone will be able to meet this challenge. The simplicity of straw can be disarming, or alarming. If you need complexity in order to feel secure, this may not be for you. Don't be put off by nursery tales about the big bad wolf – we should be wise enough to realize that the wolf probably worked for the cement manufacturers! And there are thousands of examples of professionally finished buildings – so read on, and make up your own mind.

Straw as a building material excels in terms of its simple installation, affordability, energy efficiency, and the healthy air quality it produces. Straw-bale houses can be built to Passivhaus standards, and a two-bedroomed detached load-bearing straw house can be built by a self-builder for £50,000. Due to the buildings' super-insulation, huge savings in heating costs can be made. Potential savings of up to 75% on long-term running costs can be achieved when compared with a conventional modern house. A typical plastered straw wall has a U-value of 0.11, more than twice as insulating as Building Regulations require. And because straw houses can be built entirely of natural materials, there is no threat from toxic materials, and no harm to allergy sufferers.

The book is aimed at self-builders and architects as well as the construction industry. It is meant to give clear and straightforward information about how to build houses with bales of straw. Since this is a simple and accessible wall-building technique available to almost anyone, it is an ideal self-build manual; it also provides information for mainstream designers and builders to design with straw, and to write specifications for sustainable house building.

Throughout the book the author Barbera Jones will be attempting to encourage you towards the best possible way of doing things with a simple, straightforward and common-sense approach. One of the best features of straw-bale building is the opportunity it provides for creative fun, and the way it enables you to design and build the sort of shape and space you'd really like. It lends

itself very well to curved and circular shapes, and can provide deep window seats, alcoves and niches due to the thickness of the bales. It is flexible and, combined with flexible foundations (not as unusual as you might think), provides excellent buildings to withstand earthquakes. Its forgiving nature means it can be knocked back into shape fairly easily during wall raising, doesn't require absolute precision, and can make rounded as well as angular corners. Partly owing to its great insulation value and partly because of its organic nature, the inside of a straw-bale house feels very different from a brick or a stone one, with a cosy, warm quality to it and a pleasing look to the eye. The beauty of straw (apart from its aesthetic beauty) is that it combines very high insulation properties with great load-bearing ability: it is a material that provides building blocks and insulation all in one.

Different styles and opinions have grown up around the world as bale building has spread. What was suitable in one climate has not proved to be best practice in others, and availability and cost of materials varies from country to country. However, there have been wonderfully imaginative adaptations to conditions. Main design concerns are:

- adequate foundations to deal with moisture and insulation
- airtightness
- maximizing solar gain
- weather protection during construction
- weather protection in general.

By going back to basics, we are able to design more appropriate foundations than became common in the 20th century, which use natural, rather than unnatural, materials and achieve high levels of thermal efficiency. Differences to be found in the UK are also in the predominant use of load-bearing methods and the type of render (lime) used as a weatherproof coating. In Europe we have been able to draw on the rich knowledge of the past, using ideas that have been tried and tested over centuries. In many respects, the requirements of straw-bale buildings are essentially the same as those of traditional cob (earth) or wattle-and-daub buildings. They have high plinth walls, self-draining foundations and large overhangs to the roof – 'a good hat and a good pair of boots', as cob builders used to say. They are also constructed of breathable materials and must not be waterproofed (although they must be weatherproofed). Building with straw encompasses far more than a different wall-building system, however, as the whole building can be constructed of natural materials with very low embodied energy (the energy that was used in making the product) and a negative carbon footprint, all at an affordable price.

Straw is a flexible material and this requires us to work with it somewhat differently from the way we'd work if it were rigid. Accurate measurement and precision is impossible and unnecessary with straw, but working without these aids can be worrying to the novice, and alarming to those already used to building techniques developed in the last century. However, it is very important that you have the right attitude from the outset. You have to develop a feel for the straw. You have to give it time; absorb its flexibility. It is possible to be macho about it – to hurl bales around single-handedly and force them tightly into spaces – but this always has adverse consequences. Rushing the process, and working alone or competitively can mean that an adjoining section of wall is distorted and pushed out of shape – a section that someone else has spent time and care to get right. Straw-bale building is as much a personal learning process as it is about learning a new building technique. More than any other material (together with cob and clay), it is susceptible to your own spirit and that of the team. It is not something to do alone. It requires cooperation, skill-sharing and common sense. Many of the inspirational and artistic features are created in this atmosphere. It is empowering, expanding the world of opportunities for you and making possible what you thought to be impossible!

The atmosphere and environment in which we live is a matter of increasing concern to homeowners and designers alike. There is a growing body of knowledge on the harmful effects of living long-term with modern materials that give off minute but significant amounts of toxins. The more airtight a building is, the more concentrated are the toxins. Living in a straw house protects you from all that. It is a natural, breathable material that has no harmful effects. Hay-fever sufferers are not affected by straw, as it does not contain pollens. Asthmatics also find a straw house a healthier environment in which to live. Combined with a sensible choice of natural plasters and paints, it can positively enhance your quality of life.

When building a straw-bale house, many of the other elements of a conventional building remain. The installation of plumbing, electrics, interior carpentry, joinery and partition walls may be no different from the methods and materials you are used to, though of course they could also be rethought in terms of using natural, locally sourced and recycled materials. This book covers the environmental attributes of straw; how to design an affordable house; the different types of foundation you can build without needing cement; how to build walls with straw and stabilize them; how to protect walls from the weather and make them durable; how straw performs with humidity and how straw-bale buildings can easily meet Building Regulation/Code requirements.

Building with Straw Bales is now available from all good bookshops.
ISBN: 9780857842282 Author: Barbara Jones

AECB local groups

A good way to stay inspired

The AECB has a network of local groups across the UK. These provide a great opportunity to visit some excellent and interesting venues as well as networking with fellow AECB members. The following reports and news of forthcoming events from local group events give a flavour of some of the activities you could get involved with. You will discover that members are keen to share their knowledge and expertise on different aspects of sustainable building.

There is a variety in the types of meeting which are evolving with a diverse expertise to be found. The following feedback from local group events gives a flavour of some of the activities you can get involved with and the various people who are keen to share their knowledge and expertise on different aspects of sustainable building.

Nottingham local group:

Open Homes days 25/26 April 2015 and 3 May 2015

For the last few years, the Nottingham local group and Transition West Bridgford have teamed up to run an Open Homes' event in and around Nottingham for AECB members and the general public.

This year ten homes were involved and over 100 visits took place (with some visitors going to see more than one house). Many of the homes are not particularly big, so a booking system was used to limit the number of visitors at any one time (six to ten visitors was typical) and some homes opened several times over the two weekends in April and May. There were several new projects included this year and it has been great to see visitors from previous years who have completed their own projects and become 'Open Homers' themselves!

At one end of the scale were projects where the Green Deal Home Improvement Fund contributed to the cost of external wall insulation. A couple of projects combined this work with a new extension to achieve varying levels of whole house retrofit. At the other end of the scale were two 'near to passive house' retrofits and a very impressive self build using Porotherm clay blocks and an EWI extension - where the home owner has literally done 95% of the work himself. AECB members Gil Schalom (and architect) and Tina Holt spoke about the projects. Gil gave a technical talk and Tina summarised the performance data for her own home post refurbishment. Gil talked about the elements of the

A West Bridgford homeowner demonstrates his own adaptation to the loft ladder - with draught-proofed hatch below the ladder and an insulated and draught-proofed 'lid' above it.

Below: various homes which took part in the open days.

refurbishment of Tina's house which used EnerPHit as the guide.

The visitors varied greatly in their knowledge of retrofit and their ambitions for their own homes. Those with a professional interest, as well as many 'non-expert' home owners, were interested in the technical information provided. Some home owners clearly have ambitious projects of their own in mind and we hope to see some of them becoming involved in a future events as 'Open Homers' themselves.

Cornwall local group

The Cornwall group has had a mini renaissance with five events since December 2014. Whilst the subject matter has been fascinating, the 'food and drink' theme has also helped maintain healthy attendance figures. Some of the highlights are summarised below.

December: Jubilee Warehouse tour, Penryn

AECB member, Nigel Murray, hosted the Christmas get together. It was at a really interesting retrofit of an industrial building now inhabited by a thriving community of small businesses on an urban waterfront site. Nigel's role as the 'green project manager' was pivotal in achieving high environmental standards amongst a design and construction team with limited specialist knowledge and experience in this area. It's a beautiful building with a real sense of spirit. A time-lapse movie is at: https://www.youtube.com/watch?v=y7zhnTrvL0g

Jubilee Warehouse

In January Stephen Gurney, of Ecological Building Systems, hosted a CPD evening event in the local pub covering airtightness and moisture movement. About twenty attended this event, including a handful of members from Devon. It included a detailed look at the use of Pro Clima's range of construction tapes and published research on moisture and air movement within building fabric.

February : retrofit of cavity blockwork terraced house, Newquay

Chris, from Umbazi builders, invited AECB members over to his own house (part house/part construction site) for a lively debate on how to deal with thermal upgrading of cavity blockwork walls. There was an opportunity have a go with a thermal imaging camera provided by Rachael Simpkins of South West Air Energy. There were discussions on air movement within the cavity, cold bridging at the base of the blockwork walls, maintaining ventilation to sub floor voids (without also ventilating the cavity) and external insulation with wood and cellulose. In Chris's own words, a 'slow burn' project and one that will be well worth re-visiting again in the future.

March: site visit to a low energy 'deep green' conversion of an earth and stone barn.

Grant and Lindi McAlpine have almost finished the work

Gaia wind turbine

to their barn having already completed the wind turbine installation and a timber workshop building on the site. Grant is a 'techie' through and through, so this was a chance to hear the facts and figures of energy consumption and generation, what it's like owning a wind turbine (yes, bits do sometimes fall off), as well as lots of statistics from energy/moisture

Candor Barn Conversion

monitoring for the various wall construction upgrades. The new construction materials used in the project are natural wood/fibre/mineral based, vapour open and compatible with the soft earth and stone masonry. Grant has opted for a very low ventilation strategy relying on the hydroscopic building fabric and openable windows to regulate moisture levels. The group will be following the monitoring of the barn with respect to energy use and moisture (room and embedded sensor readings). The wind turbine is a Gaia 11kW which has produced an average of 30,000kW/annum for the last 3 years. A huge thank you to Grant and Lindi for the fantastic food, draught beer and generous hospitality!

March (the second event in March) was part of a local Warmcel installer's training installing PYC insulation. The lunchtime session focused on Warmcel cellulose fibre insulation at the offices of ARCO2 Architects. PYC is now the UK's distributor for the product following the demise of Excel Industries last year so this was a chance for AECB members to hear answers to those niggling questions on installing blown cellulose, as well as to hear a very reassuring account of the current state of Warmcel in the UK. PYC has been installing Warmcel for over 10 years and now operates through a national network that is trained and supplied directly.

The next event is a chance to get mucky. There will be a mud brick making session and a discussion on designing building envelopes with un-fired earth as an internal component on Friday 17th July at 5.00pm in Truro. Non members are also welcome. Email Cornwall Coordinator Nick Donaldson for more information: nickdonaldson@arco2.co.uk.

For further information on joining the AECB, together with details of member benefits and discounts, please contact Emma Furniss by email emma@aecb.net or join on line at www.aecb.net

Products and Services

A roundup of what is new or changing in the green building products and services arena

Wood energy boiler for seaweed plant

Biomass heating pioneer Wood Energy has extended its reach to the furthest shores of the UK, with the installation of a 999kW Binder wood chip boiler, at a unique Outer Hebridean production plant.

Hitched to a drying mill at the state of the art Uist Asco production facility on North Uist Island, the fully automatic boiler uses timber from the company's own renewable supply to process Knotted Wrack (Ascophyllum nodosum) seaweed, freshly harvested from the shores of the island, into feedstuffs and organic fertilizer for the agricultural sector.

It is estimated that around six million tonnes of wood is wasted by being sent to landfill in the UK each year and that the forestry industry wastes enough biomass annually to heat 1,500,000 homes. But the highly efficient and robust Binder unit - which has a low ash residue and the capability to burn fuel with moisture content of up to 55% (the same as a freshly felled tree) - will allow Asco to make full use of even the very low grade brash and branch wood material recovered from its sustainable forestry operations.

Uist Asco Managing Director Raghnall MacIain explained: "We are unique in the UK because of the low carbon method we use to dry the hand-harvested seaweed. Our plant is the culmination of five years' work and Wood Energy worked closely with us to make sure we got the unit that would best suit our needs. We have our own 720ha of coniferous forest, which my father originally planted over twenty years ago; and last year alone we planted an additional 5,000 trees. This produces over 1,500 tonnes of wood chip for us each year. The Binder is remarkable and can reduce tonnes of wood to mere handfuls of

ash, so we have a low amount of waste; and, because we don't use traditional fossil fuels, we are able to compete on price and quality and operate a carbon neutral system. We are proud to be a totally local, sustainably organic operation."

Wood Energy offers a variety of wood chip, wood pellet and log boiler systems, ranging in size from 9kW to 10MW. Applications are for commercial, industrial, public sector, agricultural and domestic buildings of all sizes and almost all temperature ranges including steam and thermal oil.

The company's in-house installation team has delivered over 100,000kW of medium and large-sized projects across the UK and has the exclusive UK market rights for Binder and Hargassner biomass boilers – both made in Austria and acknowledged for their high quality, controllability, efficiency and longevity. www.woodenergy.com

Ancon awarded BBA approval for the innovative Teplo-L-Tie insulating wall tie

BBA certification for the innovative Teplo-L-Tie basalt-fibre wall tie was officially presented to Ancon Marketing Manager, Annabelle Wilson, by BBA's Head of Client Accounts, Gary Dicker, at the 2015 Ecobuild exhibition in London.

This widely recognised third party approval follows thorough analysis of the Ancon Teplo-L-Tie's independent strength and

durability test data, and robust manufacturing controls.

"BBA product approval provides additional reassurance to users, specifiers, building control, local authorities and insurers as to the quality and suitability of the innovative basalt-fibre TeploTie range, which is outside standard wall tie CE Marking legislation", says Ancon's Annabelle Wilson.

Like the original BBA-approved TeploTie cavity wall tie, launched in 2009, the new Teplo-L-Tie comprises a pultruded basalt fibre body set in a resin matrix. This material, with its thermal conductivity of just 0.7W/mK, minimises heat loss across an insulated wall cavity, which is an essential consideration in low energy construction.

Unique to the new Ancon Teplo-L-Tie, however, is an 'L' shaped stainless steel upstand, mechanically and chemically bonded to one end, which allows it to be securely tied to steel, timber, concrete or masonry using a range of standard fixings. Available to suit cavity widths up to 300mm, it is ideal for today's super-insulated building envelopes, whether new build or refurbishment. www.ancon.co.uk or 0114 275 5224.

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Kingspan sets standard for energy efficiency

Kingspan Insulation is pleased to announce that its manufacturing facility in Pembridge, Herefordshire has now been certified to energy management standard ISO 50001.

This voluntary standard provides organisations with a best practice framework for integrating energy performance improvements into all aspects of their management practices. It complements the existing standards ISO 9001 (Quality Management), ISO 14001 (Environmental) and OHSAS 18001 (Health and Safety) to which the site's fully integrated management system has already been certified.

Kingspan Group voluntarily discloses its environmental performance and carbon emissions via the Carbon Disclosure Project (CDP) and Kingspan Insulation also carries out annual comprehensive reviews of energy usage at the site. Clear improvement plans are identified for the introduction of new staff training, energy reduction measures and renewable energy generation technologies at the site.

The improvements support the firm's ongoing effort to achieve net zero energy, whereby the net energy demand of the facility is matched with renewable energy generated locally around it. Kingspan Group is committed to achieving this goal across all of its site by 2020; Kingspan Insulation is aiming to reach this by 2018

Adrian Pargeter, Head of Marketing and Product Development at Kingspan Insulation commented: "We are delighted to receive this latest certification. The model of continual improvement which the standard requires is central, not only to our energy efficiency policy, but also to our ongoing work developing new, higher performance insulation products."

Kingspan Insulation is set to roll out ISO 50001 across all of its manufacturing sites over the next few years. 01544 387 384 www.kingspaninsulation.co.uk

Kingspan Optim-R achieves BDA certification

The ground-breaking thermal performance of the Kingspan OPTIM-R panel has now been independently verified as it became the first vacuum insulation panel to be granted a BDA Agrément®. The demanding certification ensures the product is fit for purpose and is recognised by professional bodies such as the NHBC and LABC. This can help to fast-track procedures and approvals, saving both time and cost for all involved.

The certificate is issued by BDA Advies, part of the Kiwa Group, an internationally respected institute with over 30 years' experience in testing and inspecting materials for use in the building envelope. Its independent assessors carefully examined and tested all aspects of the Kingspan OPTIM-R panel, from manufacture to installation. Their full findings can be viewed within the document on the Kingspan Insulation website: www.kingspaninsulation.co.uk/certification

With a proven aged design value thermal conductivity of 0.007 W/m·K, the certificate confirms that Kingspan OPTIM-R panel can far out perform the next best insulation product. It also contains installation guidance, R-values and typical details for all Kingspan OPTIM-R system applications.

As a further mark of the rigour and quality of the BDA Agrément® scheme, all results are audited and verified annually. This means, when installed according to Kingspan's guidance, you can have complete confidence that all Kingspan OPTIM-R systems will perform as expected. www.kingspaninsulation.co.uk/optim-r 01544 387 384

'DuoWIN' boiler combines heating with logs and pellets

Windhager has just launched its brand Windhager's new DuoWIN combination biomass boiler.

With hybrid technology, DuoWIN combines heating with wood and pellets in one unit. This sophisticated biomass boiler system allows users to either use logs or wood pellets and its intelligent fuel switching detects when the wood gassifier is in burnout and switches to pellet operation, either automatically or at a desired time.

The DuoWIN system is based on two of Windhager's proven biomass boilers, the compact log boiler LogWIN Klassik and the recently launched compact BioWIN 2 wood pellet boiler, and thus takes up only 4.19m² of space.

The new DuoWIN is available as either a comfort or energy optimised variant. The PowerBoost function can meet short-term higher heat demands up to 56kW. With the energy optimised version, the DuoWIN's pellet operation is up to 25% more efficient than conventional combination boilers. Available in four models from 33kW – 56kW output, the DuoWIN has a filling volume of 145 litres for 50cm split logs and 164 litres of wood pellets, the feed for which can be either manual or fully automatic.

Within DuoWIN there are two independent heat exchanger systems which ensure maximum reliability yet with a smaller space requirement of other combination solutions. Both the wood combustion chamber and the stainless steel pellet burner bowl are not wearing parts and are included in Windhager's five year warranty. The DuoWIN's ignition elements ignite silently, are robust and maintenance-free and are also included in the warranty.

One special feature from Windhager is that you can upgrade anytime to DuoWIN if you have Windhager's LogWIN Klassic log boiler as this is 'pellet-ready', meaning that the pellet boiler BioWIN 2 can be added at a later date.

The LogWIN Klassic has a large filling chamber opening for easy access with logs, and has a detachable ash pan for easy removal. The log boiler also features automatic ignition in the DuoWIN meaning that no kindling is required to start the boiler burning.

BioWIN 2, the incorporated wood pellet within DuoWIN, has very long maintenance intervals. Its robust stainless steel burner with LowDust technology burns so cleanly that the

pellet boiler is well below the international emissions standards.
www.windhager.co.uk 01225 892211

Get on board with Norbord

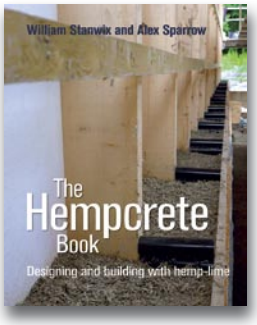
As construction activity increases and builders head to their suppliers for essential materials, Norbord is embarking on a campaign to ensure that customers appreciate the benefits of SterlingOSB. (oriented strand board). Research undertaken for Norbord shows that the job is nearly complete in terms of price. 72% of builders and 84% of merchants know already that SterlingOSB is more cost-effective when compared to plywood. SterlingOSB is lower in cost, but not in quality.

SterlingOSB is ideal for all sorts of roofing, flooring and general building projects. More and more builders are substituting plywood for SterlingOSB; it's more cost-effective,

environmentally-efficient, easy to use, and highly versatile.
www.norbord.co.uk 01786 812 921

The Hempcrete Book:

Designing and building with hemp-lime by Will Stanwix and Alex Sparrow



The Hempcrete Book is the comprehensive, practical new book about building with hempcrete: a natural building material made from the chopped woody stem of the hemp plant (hemp 'shivs') and a lime-based binder. It is a non-loadbearing, sustainable, 'breathable' (vapour-permeable) and insulating material that can be used to form walls, floor slabs, ceilings and roof insulation in both new builds and restoration projects. Hempcrete is also a better than carbon-zero building material. It locks away more carbon dioxide in the lifetime of the building than is used in the production, during transport, and in construction on site.

"Truly comprehensive and enormously helpful. I wish we'd had this guide when building our Hempcrete homes in Swindon", said TV presenter and eco-developer, Kevin McCloud.

Will Stanwix and Alex Sparrow first started working with hempcrete in 2009, when information and guidance on the new material was scarce. As they learned more, becoming industry experts on hempcrete, they decided to write the book that they had needed when they were first starting out: a practical how-to manual providing essential guidance and information, including case studies from finished hempcrete buildings and extensive design notes. It isn't a book just for builders, designers and architects - it is invaluable for the countless professionals who will come across hempcrete during any building project, including planning officials, building regulations officers, building conservation officers and surveyors.

SPECIAL OFFER: Green Books are offering readers of Green Building Magazine 30% off The Hempcrete Book, meaning that you can buy the book now for just £24.50 in paperback, or £35 for the hardback. To redeem this offer simply go to **www.greenbooks.co.uk/hempcrete**, add your books to the cart and then enter voucher code ŒGBMAG15) in the checkout. Offer valid until 14th September 2015.

Ty Mawr design and supply floor to hold tomb of King Richard III

Directors and staff at Ty-Mawr Lime Ltd were delighted to receive a letter from the Dean of Leicester Cathedral recently expressing his thanks for the part Ty-Mawr played in an event of historical and international significance, namely the re-interment of King Richard III.

Ty-Mawr's involvement in this event started in 2014 when it was selected by the architects, van Heyningen & Haward, to design the floor to hold the tomb being prepared for the re-interment of the last Plantagenet King of England. Ty-Mawr's original brief was to undertake the design and the supply of the materials for its innovative Sublime® limecrete flooring system which was subsequently installed in the Cathedral as part of its £2.5m refurbishment works.

In his letter, The Very Reverend David Monteith explained that the eyes of the world witnessed a historic series of events that will never be repeated. He said: "We have received numerous expressions of thanks and good wishes at the Cathedral, and on behalf of the city and county, relating to all aspects of the project, not least the craftsmanship and attention to detail that went into the physical works carried out in the Cathedral to make it all possible."

The floor, which holds Richard III's tomb, is a combination of recycled as well as natural building products for which Ty-Mawr Lime Ltd, based in Brecon, Powys, is renowned throughout the UK.

The floor was carefully excavated by the Limecrete Company, based in Norfolk, who specialise in the installation of Ty-Mawr's floors. After laying a breather membrane, a layer of 100% recycled foamed glass was installed around the newly constructed tomb, compacted ready to receive the underfloor heating pipes, before the limecrete was then finally poured and finished.

Since developing the innovative flooring system in the 1990s, Ty-Mawr has supplied hundreds of churches, cathedrals, cottages, barns and sustainable new build projects right across the UK. Other recent projects include Rochester Cathedral, Coventry Transport Museum, St Georges Cathedral, Southwark, St Alkmunds Church, Duffield, St Peter & St Paul, Great Bowden and St Mary at the Quay, Ipswich.

Nigel Gervis, Technical Director at Ty-Mawr Lime, said; "It is feedback, projects and stories like this that makes what we do very special, from design to delivery! We are delighted to have been involved in such a historically significant

Heating

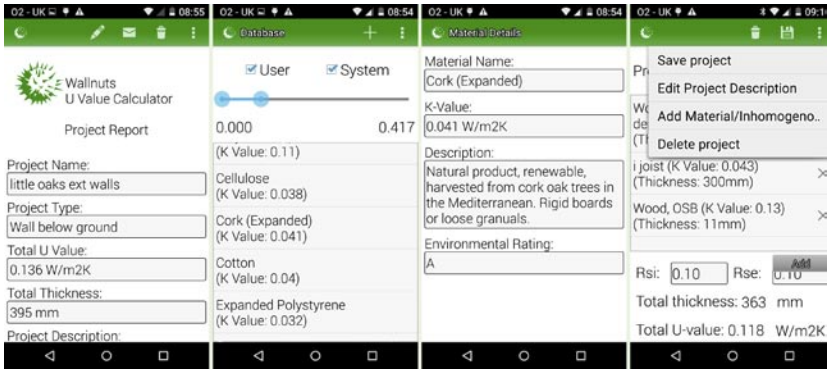
We are going digital from next issue.
Don't miss out, go to:
www.greenbuildingmagazine.co.uk
for more information.

occasion and to be part of the narrative. It also speaks volumes for the floor which can meet all of the modern expectations of a building component in terms of engineering strength and thermal/acoustic performance combined with the 'softer characteristics' demanded by a solid wall building such as breathability and flexibility".

Last year, Sublime®, was awarded the 'Technical Innovation of the Year Award' by Local Authority Building Control (Cymru) and went on to become runner-up in the LABC National Final, alongside the London Shard. www.lime.org.uk or 01874 611350.

Wallnuts' U-value calculator for android devices

Wallnuts has been developed by Conker Conservation Ltd, Chartered Building Surveyors, in collaboration with programmer Kingsley Bickle, to provide a quick but comprehensive U-value calculation for use on site or during preliminary design.



The app contains a wide selection of eco materials such as wool, hemp, cork, earth and chalk, for the discerning green designer. Each material is listed with its associated k value and Conker's eco rating from A to E. The user has the ability to create new materials or inhomogeneous layers and add them to their personal database.

The user can include for 3 levels of gaps to allow for poor workmanship, and change any of the surface resistance (Rse or Rsi) values, although default values in accordance with BRE report BR443 are provided. The app guides the user through the creating of these layers, where the percentage of each is input. There can be multiple materials in each layer.

Projects can be saved, edited and emailed via PDF attachments. The printed PDF lists the project name, project type, date and time of creation, each of the material layers, thickness, k-value, R-value and final U-value.

Walnuts is available online at play.google.com for £4.99. Any feedback from users is welcomed and updates will be offered free of charge. The iPhone version will be released later. 01227 786900 Developed by - Kingsley Bickle-kingsley_bickle@hotmail.com

Eco Angus Boiler sees Somerset Venue profit from a renewable heat solution

Aldwick Court Farm & Vineyard is located at the foot of the Mendip Hills in Somerset. With its stunning views of the surrounding countryside, the farm is an extremely popular venue for weddings, wine tasting tours and other special occasions. Heating across the entire site had previously been provided by expensive and inefficient oil boilers.

It was necessary to provide heating and hot water to multiple areas of the farm including the farmhouse, visitor centre, function and event rooms, offices and a flat in an affordable, eco-friendly and sustainable way.

With Eco Angus' help the team of highly trained installers at Blake Ecotec designed and installed an environmentally friendly, high powered solution capable of providing heating and hot water across the entire site. A purpose built barn was constructed to house the Eco Angus Orlan Super 130kW log gasification boiler, 10,000 litre Akvarterm accumulator tank and the 6 metre high, 300mm NOVA stainless steel flue.

The boiler's 130kW heat output and large loading capacity means it is

capable of burning logs, with a moisture content of 15-20%, up to 100cm in length. The solution works at 91% efficiency and can burn for up to 12 hours continuously. This high efficiency means that, during the summer months, a single weekly load will ensure enough hot water is provided to every building on site.

This solution is not only an eco-friendly and sustainable source of heat but also an incredibly financially rewarding investment. Aldwick Court's new system is compliant with the Non-Domestic Renewable Heat Incentive (RHI) scheme and will receive payments over a 20 year period. They will receive RHI payments of 8.8p per kWh of heat generated by the system, a total of approximately £403,900 in government payments.

The Eco Angus Orlan Super 130kW log boiler solution will also deliver substantial net fuel cost savings of £258,636 across the 20 year scheme. In comparison with fossil fuels, this will save £4,000 in the first year, rising to £26,000 in the final year of the RHI scheme on fuel alone. Add this to the savings made on fuel and the project will gain approximately £662,500 in additional income over 20 years. The RHI payments and the fuel cost savings will see the initial outlay paid off in just over 1 year, before turning a profit for the remaining 19 years of the scheme.

Last, but certainly not least, Aldwick Court's carbon footprint will be reduced. The Renewable Heat Solution will reduce the site's carbon footprint by an incredible 36 tonnes of CO_2 per year, a 90% reduction, www.ecoangus.co.uk

Tadelakt plaster – the revival of an ancient art

Tadelakt is a polished plaster originating from the Mediterranean region of Morocco and means 'to rub' or 'knead' in Arabic. The application of Tadelakt had a practical purpose in a hot, arid climate and records indicate that nomads used it to seal reservoirs for retaining drinking water. Over time its use was extended to plastering hammams, riads and palaces, and today is used as an alternative to tiling in wet rooms, showers and bathrooms or as a stunning feature wall.

The application of Tadelakt, using a wide range of trowels, hand tools and spatulas, allows the plasterer to follow the lines of the substrate closely, hence it can be applied to curved surfaces such as sinks and baths which would typically be difficult to successfully burnish with a trowel alone. The technique for finishing the plaster is unique to Tadelakt. Once the plaster has been applied, the surface is brushed with olive soap and then burnished with a small, hard stone. Stoning the surface compresses the Tadelakt and this, along with the reaction with the lime and olive soap, makes it water repellent whilst achieving a surface shine at the same time. Although skill and patience is required, with the right guidance and practice it is not outside the realms of DIY.

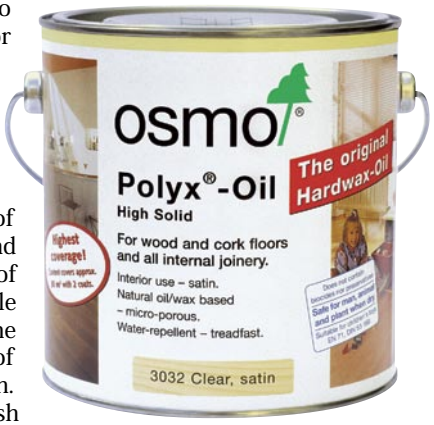
Tadelakt has a beautiful, smooth appearance and is exceptionally tactile. Its versatility means that there are very few limitations in terms of the surfaces and shapes it can be applied to.

Mike Wye & Associates Ltd supply a traditional form of Tadelakt from German suppliers, Kreidezeit, who investigated original forms of the plaster in Morocco and discovered that it was made from an eminently hydraulic limestone found 1.5 metres below ground in the Marrakech Plateau. This lime was added to sand, marble dust and pigments which has been recreated today to make Kreidezeit Tadelakt. www.mikewye.co.uk or 01409 281644.

Premium finish at a sensible price

Polyx Oil from Osmo UK is a premium wood finish guaranteed to keep wooden surfaces in top condition. Ideal for solid engineered or laminate wood floors, it is a high quality, water-repellent and tread-resistant wood finish based on natural ingredients. Available in a matt, clear and satin-matt finishes, the Polyx Oil range offers the highest coverage of any oil on the market - a 2.5 litre can cover approximately 30m² with two coats.

Polyx Oil is also extremely easy to apply. Simply brush on to the wood surface to achieve deep, long-lasting penetration. Another key benefit of this wax-oil is that Polyx Oil has a reduced solvent content. Therefore it is virtually odorless, making Polyx Oil a much healthier (and also more pleasant) wood care product to use. And for anyone suffering from asthma or other breathing problems, an odourless wax oil is much preferred that conventional, solvent-based oil or wax finishes. It also contains no biocides or preservatives.



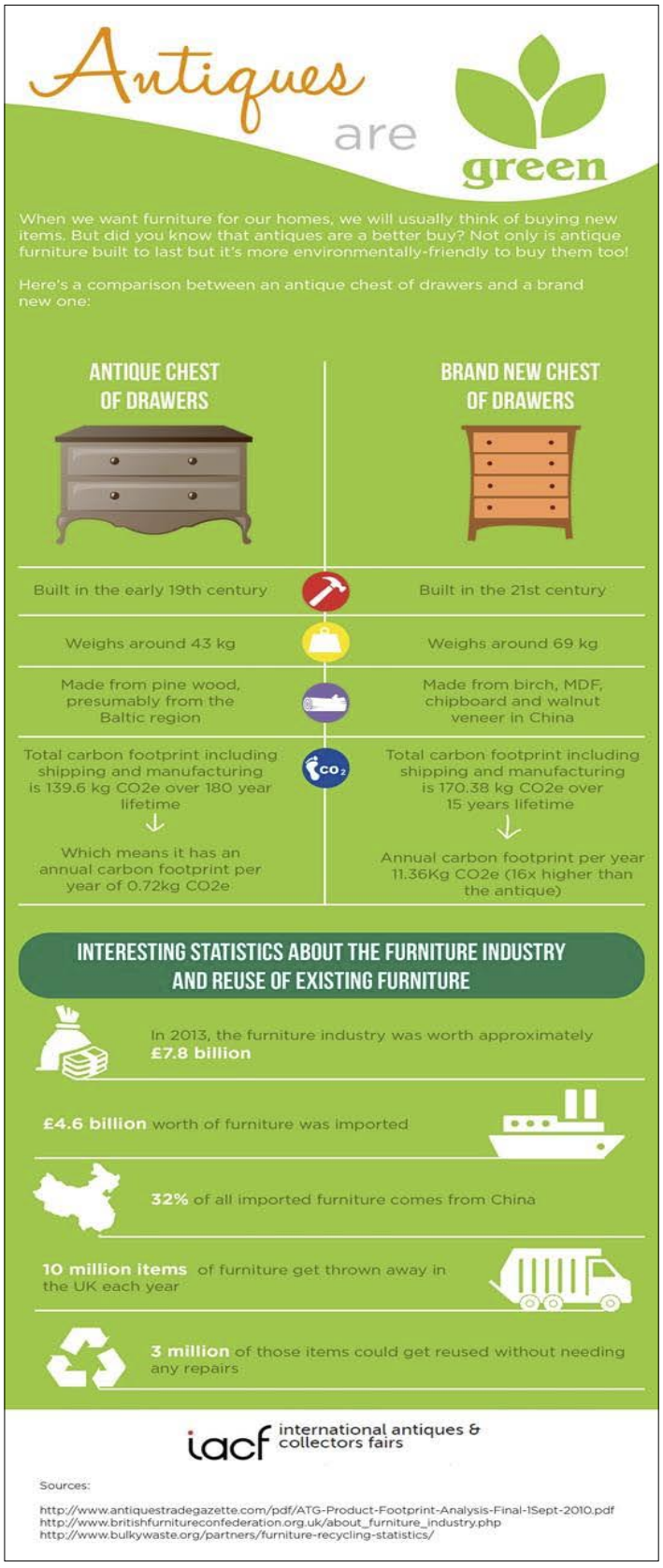
Offering all the professional features of a traditional oil-based finish, Polyx Oil combines the smooth surface of conventional lacquers, and the ease of application of a water-based finish, while managing to eliminate the inherent disadvantages of these other types of finish. Unlike ordinary oil finish products which form a film on the wood, Polyx Oil's natural components penetrate deeply into the wood to create a micro-porous finish. This allows the wood to breathe, moisture to evaporate and ensures a flawless finish both upon application and for many years to come.

After treatment the wood is strengthened from within and retains its elasticity. It becomes water repellent, stain resistant and more hard-wearing, because it meets the wood's natural demands and does not crack, flake, peel or blister. www.osmouk.com or 01296 481220

Antique furniture is greener than the modern day equivalent

International Antiques & Collectors Fairs (IACF) has completed a study to show the difference in the level of emissions between an antique chest of drawers and a 21st century chest of drawers. The study shows antiques are indeed the greener choice when buying furniture for the home.

The study highlights the lower carbon footprint of antiques compared to that of their modern day equivalent. The results compare the greenhouse gas emissions associated with the manufacture and use of an antique chest of drawers to a modern day chest of drawers. The results show the total carbon footprint, including manufacturing and shipping, for an antique chest of drawers is 139.6kg CO_2e over a 180 year lifetime. Comparatively, a modern day chest of drawers has a total carbon footprint of 170.38 kg CO_2e in a 15 year lifetime.



A breakdown of the total results divided by the lifetime of the piece of furniture show that an antique chest of drawers has an annual carbon footprint of 0.72kg CO_2e, compared to 11.36kg CO_2e per year for the brand new check of drawers. Therefore, the new chest of drawers has a carbon footprint 16 times higher than the antique equivalent per year. The antique chest of drawers was made in the 19th century from pine wood and thought to be from the Baltic region, it weighs around 43kg. The modern day chest of drawers was made in China from a combination of birch, MDF, chipboard and walnut veneer, and weighs around 69kg.

Other interesting statistics about the furniture industry which were included in the study show £4.6 billion worth of furniture was imported in 2013. 32% of all imported furniture in the UK comes from China. 10 million items of furniture get thrown away in the UK each year, yet 3 million of those items could get reused without needing any repairs. http://tiny.cc/ynjozx

Kingspan Tek®, a global success

Students at Nottingham Trent University and Nottingham Trent International College (NTIC) are living in new, purpose built surroundings at Global Point, a new 15 storey student residence insulated with the Kingspan TEK® Cladding Panel.

To ensure the accommodation was completed in time for the new academic year, whilst also achieving a high level of thermal performance, the 142 mm thick Kingspan TEK® Cladding Panel was specified for the walls. The structural insulated panel features a highly insulated core sandwiched between two layers of OSB/3. As a result, it can easily achieve U-values of 0.20W/m².K and below, whilst its unique jointing system keeps unnecessary air loss to a minimum.

EnviroSips designed and cut the Kingspan TEK® Cladding Panel to the project's specification at its factory, keeping onsite adjustments

and waste to a minimum. The panels were lifted into the building by crane and then winched from above into place. EnviroSips operatives bolted them directly on to the exterior of the reinforced concrete structural frame from mast climbers and scaffolding. This 'outboard' approach not only maximised internal space, but also reduced thermal bridging with the panels effectively sheathing the frame. The installation of the Kingspan TEK® Cladding Panel was progressed with the frame and a breather membrane was applied to the panel's outer face. The facade was then completed with render and aluminium cladding.

Both the Kingspan TEK® Cladding Panel and Kingspan TEK® Building System panels are now available in 172 mm thickness, delivering a minimum U-value of 0.16 W/m2.K without the need for additional insulation. The manufacturing facility where the panels are produced carries FSC® (FSC®-C109304) and PEFC Chain of Custody certification. As standard, the OSB facing of the Kingspan TEK® Cladding Panel is PEFC certified at 70%. www.kingspantek.co.uk or 01544 387 484

Goodbye to the Green Building magazine paper version

The end of an era but the beginning of a new chapter

Well it's now time to say goodbye from this, the very last edition of our paper version of Green Building magazine. It has been a great privilege to have been its editor since its inception way back in 1990 (yes, we are the longest running eco-building magazine!) and it has been a great honour to be able to present a broad readership with what I hope has been useful and inspiring information. Now I have the task of steering the magazine into its next incarnation as a powerful digital voice for appropriate, well considered eco-building. This is not going to be an easy transition and I think we are being very bold in going forward with this. The potential audience is vast and global but an audience facing many distractions. Regardless of this, I am convinced that this is currently the only future for anyone that is serious about promoting their message.

The message from Green Building magazine is as vital now as it has been since the birth of our very first edition (as Building for a Future magazine) - perhaps even more so. Sadly, only a few of the pressing issues being addressed then have actually been solved - many have worsened, but what seems clear to me is that many of the fundamental, iconic philosophies engendered in the early editions of the magazine are now all but forgotten - only to be found in old archives of ours and similar publications that were born in that decade of destruction but rarely, very rarely found in practice in any live building projects.

On a sadder note, I read recently that we are now entering the third age of extinction - such a gloomy outlook that will make the most fortified of us wilt at the thought.

So have I become just a fossil of the green building movement or are there many more of us out there that still believe in a better way, a simpler way, perhaps even the right way? A way that honours and respects the environment, nurtures the local community and puts little burden on the near, distant and far species and resources that are available to us? Has the message, that I know many of you still want to hear, got to die now with the end of this paper 'totem'? Does it have to be the nail in the coffin of our faith that greener can prevail? I say no to both questions. We can take the message forward - the real message that less is more and the message that 'common' or 'contemporary' can and should be questioned.

I'm determined that it does not end here. Green building and green living have become such an intrinsic aspect of my everyday life that, regardless of my other diverse interests, I cannot, and will not weaken my resolve on this important subject. The world may turn to mush about me but the knowledge that, I for one, have gained in the years behind me are a knowledge that I wish to keep adding to and sharing. Every now and again a lifetime convert joins the green building brigade and never looks back. Looking back is scary, there is only one way and it is forward.

So forward we go - into the unknown - but unshackled and with our 'green building' banner waving proudly. For me it will certainly serve as a beacon, waved with, rather than at the next generation, and waved against an uncertain future where progress and technology always promises better but often fails to deliver much more than novel new ways of consumption.

So, chest beating over let's get down to the nitty-gritty. Our first ever fully digital edition of Green Building magazine, to be called '**GBEzine**' is now in technical development. We will now use the adaptability and connectivity of the latest phone and computer technology as a force for the environment, to spread the accumulated knowledge that Green Building magazine has absorbed much farther than we have ever done to date.

We will be moving into digital over the next couple of months with a very much expanded 'subscription' readership but sadly, (for the time being at least) not with the membership of the AECB on board. So if you're an AECB member then let's not say goodbye, just 'au reviour'. Our new digital subscription rates are now lower than previously so do come and track us down at: **www.greenbuilding.co.uk** or **www.greenbuildingpress.co.uk**

All existing 'direct' subscribers will automatically be transferred to our new digital editions and we will contact you by email regarding renewals, access and delivery when it is up and running. We are also merging the subscriptions with the popular and highly respected 'Green Building Forum' which is a fantastic community where, for the first time, subscribers of both systems will soon benefit from full cross platform accessibility. However, I understand that the Internet is not everyone's cup of tea. If you are an existing subscriber to the magazine and do not want the digital edition, but would prefer a paper copy of an alternative eco-building magazine then send me an email as we will arrange something for you.

Of course I cannot end without saying a very big thanks to you, our readership and to all current and previous contributors and advertisers - there are many hundreds of you. I will be keeping in close touch. I want more, many more contributors, especially if you are a traditionalist 'greenie' with a sustainable heart and a clear head. Email me. Contributors will be better integrated in our new system and we are going to move into the social networks and on to you phones so there's no escaping the re-rise of 'real ' green building.

Keith Hall - Publishing Editor
keith@greenbuildingpress.co..uk
Facebook: http://tiny.cc/o7vs0x

I'll see you on the other side!

Please also refer to the enclosed letter.