Eco-minimalism
getting the priorities right

This article came about as the result of two separate thinkpieces being developed simultaneously by each of the authors. Both of them have a long track record of living and working with green design and technology and are confronted in their daily business with what they have come to see as a number of 'eco-clichés' which can get in the way of good, efficient and truly environmentally sound solutions. This is their plea for some commonsense thinking to precede design and specification decisions that cost time, effort, energy and ultimately reputations if not properly grounded. **Howard Liddell** and **Nick Grant** pique our consciences....

Technology is often applied unthinkingly or inappropriately, and suddenly our patch is awash with it. Albert Einstein said: *"Things should be as simple as possible - but no simpler."*

It is so much easier to sell a product than a process. Never mind the science - let's cut straight to the technology. So as well as having the usual carpetbaggers out with their one-size-fits-all, old products and technologies - re-sprayed green, we also have a new bag of goodies that urgently we should start to question. Not least because those now interested in behaving more sustainably, who we would wish to influence, are daunted and confused in equal measure by the perceived complication of something which, although complex, should remain inherently clear and simple - Ecological Design and Sustainable Construction.

The most ubiquitous sustainability cliché of all is probably the one about solutions being "holistic". It is also probably the most ignored. What's needed is to identify the nature of the problem and undertake effective analysis first, then apply good quality scientific thinking, without pre-empting the solution.

It is not unusual for clients to arrive with off-the-peg technology as a starting point for their brief. Photovoltaics currently lead the field, closely followed by reed-beds and then combined heat and power. It used to be heat pumps. It is not unusual for clients to start their conversations with the suggestion that a heat pump would be a good idea, even before defining what it is that they wish to do. If a heat pump is the answer, what on earth is the question?

The Granada House - Built in 1975 as the focus of a television series "House for the Future" - With 13 programmes @ one technology a week, the house ended up looking like a Christmas tree. The solar roof contributed 2% to the annual energy input - with heat recovery from the cooker outstripping everything else - because the building was superinsulated. (Howard Liddell was a consultant to the programme and worked on the house with the TV team. Architect Don Wilson).

Technical fixes

The most prevalent current eco-clichéd technology is the photovoltaic. As far as we have been able to establish (after some considerable delving and seeking of independent advice) the best available and non partisan estimate of financial payback is 50 years, (does this take into account the pv grants? -ed.) more common are those that run into hundreds. Ah but .... goes the argument ..... once we get bulk demand and a couple of technological breakthroughs the price will come tumbling down. Almost too cheap to meter perhaps ....?

The authors have yet to see a PV roofed building where the potential for more economic demand side measures has been fully tapped. Whilst the sexy PVs sit on the roof, nothing is done about the phantom electrical loads of the cordless phone, hi-fi, cooker clock, wall clock, TV, video, etc. There is, for example, a £5 circuit available that will make the fax machine only come on when the phone rings. One of the authors has saved half the annual output of his experimental PV with this gismo alone.

Then reed-beds - the problem with these glibly recommended treatment solutions

is that they are seen as inherently green, regardless of context. The term 'reed beds' covers a wide range of technologies that can be both economic and ecological in the right situation. However their green image often leads to inappropriate specification where, for example, the public sewer or a subsurface irrigation system might have been better.

What about greywater recycling for WC flushing? Similar water savings can be made by water efficiency measures but without the considerable financial and ecological cost and ongoing maintenance burden. Domestic greywater recycling seems inherently flawed and yet continues to attract funding for research and trials usually at the expense of eco-minimalist alternatives. If you live in a dry climate then direct reuse for irrigation makes sense especially if it can be achieved passively without pumps and filters.

Then there are heat pumps. If the coefficient of performance of a heat pump does not rise above 4:1 (3:1 is more common) whilst the cost of electricity against gas is 5:1 then, until tariffs change, it is neither an economic nor an environmentally beneficial technology in most, current UK circumstances - (they make sense in hydro-powered Norway for example).

Combined heat and power (CHP) is totally scale and context dependent. The most appropriate condition for the exploitation of waste heat from the generation of electricity is where there is a known and constant 24 / 365 demand - as in hospitals or swimming pools. The critical period otherwise is when there is an electrical demand but no equivalent and balanced requirement for the waste heat in summer. Hence it has a value mostly as a base load in a hybrid scheme.

Most turf roofs are actually plastic roofs with turf on top. They usually add significant weight to the roof, which then requires additional structural support (ie more resources than a conventional roof). As with many of the items outlined here we have been known to build them under client insistence, and after long discussions.

Dunning - Straw bale office in Perthshire - with a turf roof at client insistence - conceded when they agreed to grow strawberries on it. Membrane is latex based. (Gaia)

Local materials

What are these - in the city centre? We presume that the logic is that embodied energy is strictly related to travel distance. More often than not the industrial processing of materials is the highest component of embodied impact. Over the building's lifetime, durability, toxicity and efficiency (e.g. energy or water) are likely to be far more important than the usually, relatively minor impact of initial transport distance.

Etcetera

There is a similar discussion to be had on many other off-the-peg, one-size-fits-all eco-technology solutions, and they will all benefit from project specific review. See table below.

Tressour Wood House - House of the Year 1993 - the unheated conservatory was incorporated into the stairwell - mezzanine at the landing. This meant that the temperature regime could vary according to outdoor climate and the sitting area would only be used when comfortable. (Gaia)

Windmill House Skive, Denmark - the house was one of 9 different experimental eco-technology houses built in 1977. The windmill became redundant very soon after commissioning due to excess vibration in the house.

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Technical fix		Side effects
Photovoltaics	-	financial pay back better than 50 years?
Heat pumps. 4:1	-	versus tariffs electricity-gas @ 5:1
(CHP) - combined heat and power	-	context dependent. Hot water in summer?
Conservatory (semi climatic zone)	-	70% have heaters in? Embodied energy?
Small windmills	-	heat churn or storage/battery system?
Active solar collectors	-	longevity v. pay back period?
Condensing boilers	-	cheap ones don't condense. Too Big?
District heating	-	specific to context, layout and form
Reed-beds	-	Issue of context
Grey water recycling	-	expensive, - who looks after it?
Living machines	-	high energy costs, expensive
Turf roofs	-	heavier, plastic DPM, furtive aesthetic
Recycled materials	-	strength, certification, embodied toxicity?
Local materials	-	is it the most appropriate benign material for the job?

This may appear to be a litany of criticism of eco-technology solutions. It is not. All of the above will have some circumstance some time where they have a valid case to make for consideration. But this article is a plea for common sense and rigour to prevail, and for each solution to be the result of clear, efficient and realistic analysis. If it makes sound environmental and economic sense - then use it, but if it is merely an unresearched gimmick and it does not actually save the planet, save money or generally contribute to the environmental agenda, then why do it?

Common sense

Nature is good at conservation - of energy, water and matter. It is an exemplar of passive design and it looks after its own economy not just locally but globally (Lovelock's Gaia principle).

Conservation of energy

Because supply side gets all the media attention (let's face it insulation is not sexy) it is not easy to convince the fans of the latest fashion in energy generation and distribution technology that reducing the demand may be a good place to start. It is a pity that the SAP ratings are inappropriately biased towards bolt on technologies such as condensing boilers which can earn more brownie points than super insulation. Even more significantly they do not yet even tackle structural air tightness in housing. They also take no account of the fact that after a very short time in operation cheap condensing boilers do not condense.

The world out there is full of badly insulated, draughty buildings bristling with eco-gimmicks. In fact there is an interesting problem in the heating system world. If we doubled our insulation, glazed appropriately and tested all our houses for tightness, we end up with a heating requirement for most houses around the 1.5 kW mark. The industry does not make boilers that small.

Conservation of water

Whilst water conservation is not one of the first things that leaps to mind in Manchester or Glasgow for example, the need to consider how we might reduce the demand for the chemical and energy rich filtration of water to drinking standard is an issue which is becoming more pressing. It is easy to achieve cost effective reduction in the amount of potable water we simply flush away. Also simple is the management of surface water so that it does not enter the drainage system (or flood plains) and cause problems at the treatment end. Surely we can incorporate these routinely into designs (e.g. via SUDS- Sustainable Urban Drainage Systems).

Glencoe Floor - the flooring at the Glencoe Visitor Centre is nail-free - designed for easy removal, replacement or reuse by being loose laid and held at the ends by screwed battens. (Gaia)

Conservation of resources

Much is made of recycling and, whilst it is essential to start putting in place more effective ways of doing this, there is a serious limit as to just how much can be delivered, and issues of embodied toxicity need to be addressed just as much as issues of primary toxicity. We do also know that we need to design for future recycling or better, reuse. The use of lime mortar instead of cement enables us to reuse masonry for more than hardcore. The use of screws instead of nails allows us to reuse timber for more than firewood.

Passive design

So much of the ecological agenda can be dealt with by heading problems off at the pass. Many projects end up in solving challenges which are of the client or designer's own making. Mitigation is an option at every stage of the process.

Leslie Court Fairfield, Perth - Fairfield is shortlisted for the World Habitat awards. The Sunscoop on phase 7 is based on permaculture principles. The development includes several passive design items. The whole project was delivered without subsidy at yardstick costs. (Gaia)

For instance: developing an ongoing client relationship from start to hand over and beyond, selecting the right location in the first place, arranging accommodation appropriately on the site, understanding and using topography, landform and landscape, orientating the building to exploit gains and minimise losses, designing the building fabric so it can deal with extremes without having to resort to mechanical systems, selecting materials that are benign to humans and habitat, putting things together in a way which allows them to be disassembled for both maintenance and for ultimate recycling, minimising the usage of resources, energy and water.

To say that this is not rocket science is to risk devaluing the extent to which a good understanding of scientific principles can come into play and be effective in making economies and delivering environmentally sound and client friendly solutions. But it does not need rockets.

Materials choice.

In general terms the nearer to natural and the less a material is processed the healthier it is likely to be for both humans and habitat. Embodied energy is not the only thing to consider in a material. Most ecolabel systems cover a number of criteria and these apply through a number of stages in the life cycle of a material (or product). The danger of many systems is that they

reward the easily measurable and ignore the less measurable. This can distort a balanced assessment. For this reason it is as well to seek to establish LCA systems that are as simple as possible ("but no simpler"). We do need something - it could start with a mandatory declaration of contents - as in the food industry, because the UK building products industry is far less open to the real greening of products and has shown a preference to date for the rhetorical greenwashing of what they already produce.

Local economic benefit. If a project is to benefit the local economy then an understanding of that economy and what makes it work is an essential prerequisite. Benefits may come in the form of reinforcing a local activity, growing an existing local activity or creating something completely new. The biggest challenge for a building project is to create something which has a life beyond the construction period.

National economic benefit

Recent work by Gaia in both Norway and the UK is investigating the impact on the CO_2 storage of replacing energy hungry materials with nega-CO_2 materials (ie biomass). Early results of this research indicate that a shift in the construction industry towards increases in wood construction and especially mass wood construction could have a major impact - ie significantly greater than shifting vehicles to more benign fuels. The possibility of locking up CO_2 in buildings is immense and extremely simple - it is merely a materials choice - nothing more nothing less. No bells, no whistles and no need for discounted cash flow calculations in mitigation. It is not the ultimate long term panacea - all materials eventually go back to earth and, in the case of wood then release the CO_2 - but it could buy us up to a 100 years or more, whilst we shift to more benign and less CO_2 generating methods and activities.

Summary

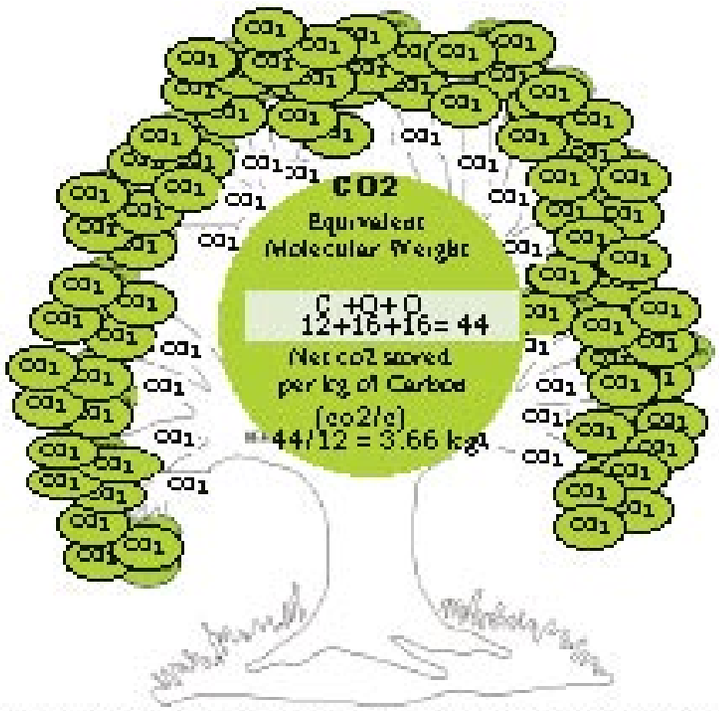
To return to the beginning of this discussion - it is not the fact that the responsibility of delivering sustainable developments and the whole ecological agenda in buildings is "daunting"- it is the fact that it is being made more complicated than it need be. The world is suddenly full of carpet-baggers purveying their eco-goodies and quack doctors with their snake oil remedies, whilst the populace is still insufficiently knowledgeable about the nature of the status quo to be able to resist.

The advice therefore is simple. Trust your common sense, do the straightforward thing first and be wary of strangers bearing gifts.

Much of ecological design lies in the identification and revival of common sense and good practice - albeit it often requires new knowledge and insight to underpin it. It also needs for us to go back and question all the new man-made and often "magical remedy" materials that have rushed into buildings over the past four decades.

Howard Liddell - Gaia Architects
Nick Grant - Elemental Solutions

All photos courtesy of Gaia Architects



The CO2 equivalent of 1 kg wood-fixed Carbon is about 3.6 kg
Seasoned wood is 50% Carbon, therefore about ..
1 .8 kg. of CO2 is bound in 1 kg. of wood product.

CO_2 Tree - Gaia has calculated that the amount of CO_2 stored in a mass timber house (e.g. log or brettstapel) is at least twice that saved by a 40 m^2 photovoltaic roof installation over 25 years.

"In technology reality must take precedence over public relations, because Nature won't be fooled"

Richard Feynmann