Sustainable Schools

- Getting it right

Foundation for Learning Environments

Introduction

This discussion paper is intended as a contribution to the ongoing vital debate about sustainability in our schools. Increasingly, we realise that the massive investment in our school buildings has to be a real force for good in pupils' and teachers' lives and for our world.

The BCSE applauds moves from the DfES and across Government to address the issue of sustainability seriously. It is time for political leadership and courage. It is also time we all played our part to reduce our emissions of carbon dioxide - our carbon footprint on the world.

Old certainties, old predictions and old ways of working may not deliver the outcomes we all need. We are going to need more than tick boxes! No one group or sector has all the answers. Getting it right will require co-operation within and across sectors to an unprecedented scale - the BCSE will play its part.

Join us. Ty Goddard, Director, British Council for School Environments.
www.bcse.uk.net

I want to learn more about how we can save energy and our planet. It's us who are going to have to live here.

Pupil, Year 10, School Works online poll respondent.

Sustainability is not about bolt-on, it's about integration. It's like a stick of rock, where sustainability runs throughout the whole thing.

George Martin, Head of Rethinking Construction, Wilmott Dixon Construction.

We want more plants and flowers. We should save energy in school and learn all about it.

Pupil, Year 7, Medlock Primary School.

School design is often driven by a restricted perspective of quality and cost, a one-way briefing process and no proper engagement with those coming into the building.

Adrian Leaman, Usable Buildings Trust.

Value-engineering out things like rainwater recovery should be similar to value engineering-out the school textbooks.

Craig White, Architect.

Surely clients who claim to support sustainable development need to stop asking for five-minute wonder icons that become visual liabilities when the numbness wears off after the first shock of the new.

David Fisk, Co-director of BP Energy.

Written by Roderic Bunn
Edited by Sarah Hill and Ty Goddard

The purpose of this booklet

This booklet will not tell you everything you need to obtain and operate a sustainable school. Instead, it tries to identify features which either helped recently constructed 'sustainable schools' to be more sustainable in use, or which led to difficulties in achieving good performance.

Some people think that sustainability is about adding technical features. Not so. The starting point is to aim to keep things simple, make them usable, and do them well.

In designing, building, and operating a school building, four aspects of performance are particularly important:

- Get the fundamentals right
- Take account of operational, maintenance and management requirements
- Complement the needs and habits of the occupiers
- Design for change and uncertainty

Get the fundamentals right

For example site, location, planning and orientation of the school building, and the materials used to make it. One needs to seek robust, durable but adaptable, low maintenance solutions of good all-round quality which aim to minimise adverse effects on the environment both under construction and in use.

Designers must also aim to maximise the economic use of passive measures, such as natural light, natural ventilation and cooling, insulation, thermal capacity for heat retention and direct solar heating (with shading to avoid overheating) to offset any remaining heating requirements. All these things will minimise the need for additional materials, energy and water when the building is in use.

Take account of operational, maintenance and management requirements

A major problem in many new buildings is that the operational and maintenance demands of the solution have not been appreciated by either the client or the design and building team. For example, schools with entrances which cannot be used because they would need to be permanently staffed - forcing people to use an inconvenient route around the back of the school. Similarly, controls for heating and ventilation that can only be adjusted from a computer in the town hall, so people bake in winter, while ventilation systems keep running unnecessarily in school holidays.

Careful reality checking is required of the solutions proposed, who in practice will provide support, and how much it is likely to cost?

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Complement the needs and habits of the occupiers

Achieving a school that is sustainable in use is a collaborative effort between what the design and building team has provided, how it is managed, and how it fits the needs and priorities of the end-users.

Schools are often constructed with little insight on what the users actually need. Recent examples include open-plan interiors that exemplify the dreams of designers and clients but which turn out to be unsatisfactory learning environments owing to high noise levels. Another major area of under-performance is poor user interfaces for control systems for heating, ventilation and lighting - with frequent outcomes of both poor comfort and wasted energy.

Careful understanding and frequent review of user needs and perceptions is essential, as is attention to detail in the design of user interfaces - even the simplest things like lights switches and opening windows.

Design for change and uncertainty

Over a building's lifetime, many things will change: student types and numbers, educational theories, technologies, and possibly even redundancy. There could also be growing constraints on energy, water, materials and wastes.

Not all of these changes will be predictable. However, one can test ideas against different scenarios and think of exit strategies. These could all affect the design for adaptability, conversion to another building type, dismantling and re-assembly, or recycling.

Follow-through from design and construction into use is vital, to make sure that the intended features work, that users and management understand them, and that the causes of any persistent problems can be understood.

Improving sustainability requires diligence, a change of culture, and commitment from all stakeholders: staff, parents, children, the local community and the authorities involved. In other words: "This is what we set out to do, this is what we found we were able to do, and this is what we are now doing."

No matter how much money and effort has been poured into its design and construction, a school cannot be assumed to be environmentally friendly simply because certain techniques and technologies have been applied. If key stakeholders have not been properly engaged, if the design has not been realistic about what is appropriate and if the results have not been well-executed, there can be problems. Indeed, performance in use may even be worse than its predecessors, especially in terms of energy consumption.

It follows that for a school to be considered

truly sustainable, its performance must be measured in practice. Its performance needs to be reality-checked and benchmarked against best practice. Where aspects are found wanting, they must be quickly put right.

This booklet explains what school clients and their professional advisors should consider as they embark on their journey to creating a truly sustainable school.

Sustainable Schools

Schools need to be at the forefront of sustainable development for many reasons:

- **Socially**, so that they can be a major asset, not just in the education they provide, but as a wider resource for the community and an example of sustainability principles and practices in action.
- **Economically**, in being long-lasting assets which can both add value directly and indirectly; and which as buildings are easy to use and to adapt, and affordable to operate and maintain.
- **Environmentally**, not just by minimising the adverse impacts of their construction and operation, but in taking positive steps to improve the environment locally, nationally and globally.

The boundaries can be drawn at many levels, not just around the building. For example:

- The school site could be used to enhance biodiversity, to grow food, to collect renewable energy, to collect rainwater and for biological treatment of waste water.
- In the community, the school can source labour, materials, food and operate a green transport plan.

All the sustainability initiatives can provide rich material to support and enhance the curriculum, involving children, teachers and the wider community in developing insights and undertaking practical action.

A really important aspect of a school's environmental performance is the amount of greenhouse gases emitted and solid and liquid wastes generated - during the initial design and construction process, and more importantly after the building work is finished. This occurs both in normal use and in the course of maintenance and alteration.

The carbon dioxide emissions associated with the use of fuel and electricity during day-to-day operation is a fundamental issue. Schools are responsible for 14 percent of UK public sector emissions. The energy, waste and pollution embodied in the construction work and in the procurement of the materials used is also becoming increasingly important - typically accounting for about ten years' environmental impact in operation.

It is becoming clear that emissions of greenhouse gases from the combustion of fossil fuels are having damaging effects on the global climate. Recent scientific insights suggest that large reductions are desirable, in the UK, possibly by up to 90 percent.

The Department for Education and Skills have recently developed a National Framework which introduces eight 'doorways' through which schools may choose to initiate or extend their sustainable activities. It focuses on ways in which sustainable development can be embedded into whole-school management practices and provides practical guidance to help schools operate in a more sustainable way.

Each doorway may be approached individually or as part of a whole school action plan, though many of the doorways are actually interconnected.

The 'doorways' fall into the following categories:

Food & drink

Energy & water

Travel & traffic

Purchasing & waste

Buildings & grounds

Inclusion & participation

Local well-being

Global citizenship

They provide a good starting point when developing a whole school sustainable approach to design and management.
For more information on the DfES 'doorways' visit www.teachernet.gov.uk/sustainableschools

Sustainability through briefing

Sustainability is more about the way in which a local authority or governing body sets out to procure a school building than renewable energy technology.

The best chance of a school design being sustainable in practice comes when a school client and local education authority engages fully in the briefing process and are supported throughout by experts.

This occurred at Riverhead Infants School in Sevenoaks with dedicated involvement from its governing body

It is important to do all the careful thinking at the very beginning. It is a false economy to create a superficial brief that can be changed to "the real thing" later in the design process. To act this way is demoralising for the professional team, and can cause huge cost overruns if changes are made late in the day.

The client and users for a school need to express their views clearly on matters such as flexibility of the design and the sustainability measures they are keen to see, along with a strong rationale for those expectations. These can be expressed as must-haves and nice-to-haves, with strong justification to back up the choices.

The brief must be written in jargon-free English, using words that give the design team very strong cues as to what the client really wants from a new school - but without being too prescriptive. There needs to be a holistic approach to briefing. For example as issues around acoustics and natural ventilation can conflict it is important to look at these issues up front

Briefing does not end after the design team has been appointed. It is important to maintain discussions on the detail to ensure there are no false expectations by the client and false assumptions by the design team. At this stage, when ideas are flowering and enthusiasm is at its height, it is quite possible that a school's reach can exceed its grasp. All options should constantly be reality-checked: Can it be afforded, now and in the future? Will a favoured technological solution displace another, simpler method that will have a greater chance of success? Can what is being procured be managed by the caretaker after the experts have left site?

A fundamental reality check is the level of management the school client regards as reasonable. In return, designers should make clear the level of support that the school building and its systems are likely to demand. The two should be equal and co-ordinate.

Ideas Box steps to good briefing

- Be a responsible client: The best sustainable school design comes when the school clients and local education authorities engage fully in the briefing process and are supported throughout by experts.
- Seek as much expert assistance and advice on developing the brief for a sustainable school as possible - if possible identify and use local expertise.
- Schools need to consider how a transformational approach to how they operate their school may impact on sustainability. E.g. Hours of use impacts directly on occupancy - pupil movement impacts on heat loss.
- Take a broad view of design, and take into consideration the life-cycle costs of the school.
- Look at the feasibility of refurbishment and extensions before replacement. The former could be less environmentally damaging than the latter. The virtues of the old school building could be lost forever.
- Remember that the quality of the final school will be directly proportional to the quality of the brief.
- Invest time and effort in selecting a professional design team that is prepared to find out what all stakeholders in the school require.

Case Study: Riverhead Infants School

Riverhead Infants School in Sevenoaks, Kent demonstrates what can be achieved when the local community gets involved in the school's design.

The school's small team of very active governors (who included a land agent, a chartered surveyor and a building services engineer) wrote a very detailed and clear brief for the design competition. The governors also ran the project.

The winning design matched the brief precisely, and the final building was almost exactly as proposed.

Although sustainable design, as a specific requirement, was only of medium importance, the school has many sustainable features. The school is designed to discourage travel to school by car, and walking buses have been initiated whereby a group of volunteer adults walk a specified route, collecting children from chosen stops en route.

The 270-pupil school has been designed to allow future changes in classroom layout. The use of underfloor heating enables the non load-bearing walls to be moved without disrupting heating pipework.

Recycled materials were used where possible, such as crushed recycled glass for bedding paving. The school is covered by a sedum roof which not only helps the school blend into the landscape, but also provides good insulation. External brises soleil reduces solar gain, and steel chains act as rainwater channels for the roof.

Although electricity consumption is double the design estimate - a combination of high use of electric lighting and ICT - the school still comes out better than the top 25 percent of existing primary schools for carbon dioxide emissions.

Lessons learned

- A well-written and extensive brief and an emphasis on simple, robust and flexible architecture can deliver an environmentally-sound school, even without recourse to renewable energy technology.
- An expert design team, backed up by enthusiastic governors and the local community, can drive design in the right direction.
- Including the community in the development of a new school can reduce carbon emissions by a reduction in car use.

Obtaining a sustainable school

When a school or local authority is evaluating tenders for a sustainable school, it needs to look for contractors who can demonstrate an understanding of the life-cycle aspects of the construction process - this will help to ensure that decisions on sustainability are not jeopardised by short term cost implications. The school client should make strenuous efforts to prevent any attempt to cut sustainability features on the grounds of cost, particularly those features that could improve a school's long-term environmental performance.

Governors and head teachers should be involved with the team who will design and build the school from the earliest stages, through commissioning, construction and after handover.

It is very easy for good environmental intentions to fail when there is no professional help after a new school has been handed over. So don't procure what your teachers, caretakers and maintenance staff can't manage within their knowledge, experience and budgets. Go for simple, robust systems, and be wary of complicated technology that

will demand a lot of attention. Keep things simple.

Sustainability through construction

The construction and refurbishment of schools consumes vast amounts of material and generates huge amounts of waste. Evidence gathered from many school case studies reveals that it is practical not only to recycle materials already on the site into the new build, but also to use more recycled materials - and mainstream products with a high recycled content - to reduce the dependency on finite natural resources.

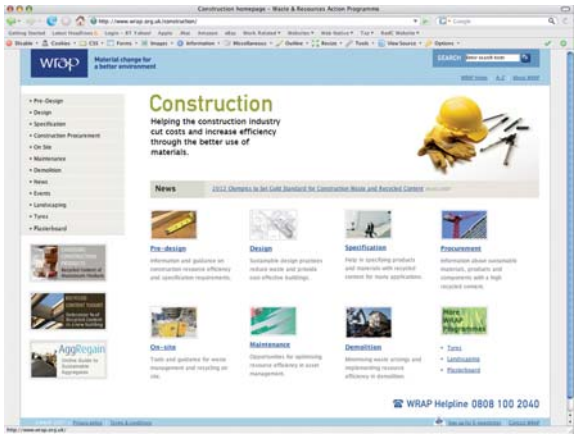
Case studies researched by the Waste and Resources Action Programme (WRAP) demonstrate that it is practical and cost-effective to set a 10 percent benchmark for recycled content in schools, and to require effective waste management on site.

Stakeholders involved in the development of a new school need to take some fundamental steps to improve materials recycling and re-use. At the outset, this involves making a commitment to using recycled materials such as bricks and paving stones a matter of policy.

The school client should also ensure that the construction supply chain is able to deliver

against this requirement, ensuring it is clearly stated in any pre-qualification or tender information. It could include the pre-qualification questions, such as: "Provide details of any experience of the reduction and recycling of construction and demolition waste on site and the implementation of site waste-management plans."

WRAP has extensive resources on the procurement, re-use and recycling of materials in school construction and construction in general, available free of charge from **www.wrap.org.uk/construction and www.aggregain.org.uk.**



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>
> **David Fisk, Co-director of BP Energy**

Ideas Box

- Set clear requirements for a site waste-management plan (in line with DTI guidance- www.dti.gov.uk) and measurable performance on recycled content within the project specification.
- Minimise waste during construction by using reclaimed components and materials.
- Minimise waste during operation: by recovering waste water for irrigation, by recovering all paper and plastics and sending them for recycling, and by specifying teaching materials with recycled content.
- Specify materials and finishes for their health benefits and reduced pollution, such as low-volatility, low toxicity and chlorine-free paints and finishes.
- Select materials in forms that are closest to their natural state, such as sheep wool, recycled newsprint, or even recycled denim - all of which are good alternative forms of insulation.
- Select local materials to avoid the environmental effects of transport.
- Choose products with a higher level of recycled materials used in their production.
- Use long lasting and robust materials, such as linoleum or recycled timber floors rather than synthetic carpets.
- School clients should require their designers and contractors to choose services and products that are subject to independent environmental certification schemes, such as those for timber.
- Ask the design team to consider innovative ways to avoid using new carbon-intensive products when recycled products would be just as effective, such as chains to channel rainwater from roofs rather than plastic down-pipes. Ensure that any solutions will besuitable for use in a school environment.

Sustainability in the curriculum

Head teachers and governing bodies should always consider the opportunities for using school buildings to demonstrate environmental issues in the curriculum. This could include why rainwater is gathered, what it is used for (such as irrigating the football field) and the environmental benefits that it brings.

The gas and electricity meters can also be used to show schoolchildren what effects the heating and lighting systems have in causing carbon dioxide emissions. Where possible the effects should be expressed in forms that the children are able to visualise.

It can pay to engage the help of the school children and their parents in setting the environmental criteria for a sustainable school. School children are more focused on environmental matters than their predecessors; their enthusiasm and clear thinking can be a great asset when developing a sustainability strategy.

Sustainable technologies such as photovoltaics (roof panels which convert energy from sunlight into electricity) and wind turbines can be funded by grants and government incentive schemes. They can be useful as teaching aids, but should not be purchased purely for this reason as they are often expensive and difficult to maintain.

Ideas Box

- Protect or enhance bio-diversity by landscaping the school grounds to encourage wildlife, and introduce plants that support indigenous flora and fauna.
- Create learning opportunities about sustainability, enabling pupils to understand their environment by making the school's energy, water and waste flows available in a ways that children of all ages can understand.
- The use of sustainable materials, such as recycled newspaper for insulation or reclaimed bricks, can be exposed or made visible so that the schoolchildren can understand how the school was built.
- Energy and water meters can be put on display in such a way that they can be used by pupils to monitor consumption.

Ideas Box

Steps to sustainable design

- Invest time and effort in selecting a professional design team that is prepared to research the needs of all stakeholders.
- Select a supply chain that understands how to partner, rather than selecting purely on design flair and willingness to innovate - The Royal Institute of Chartered Surveyors can help advise on this.
- Ensure there is enough time and money in the budget to cover all the sustainability measures – and money afterwards to manage and maintain them.
- Create a specification appropriate to the scale of the project, and not too complicated that strains cost and management expertise.
- Insist on controls that are not too complicated for the prevailing management expertise, and with local controls that are well labelled, well matched to the task, and intuitive for teaching staff and schoolchildren to use.
- Ensure the design is fully integrated, and that there are no technologies such as wind turbines and solar panels that are bolted-on when they should be integrated within the total scheme.
- Insist on post-handover support that can fine-tune and calibrate the systems to the needs of the school's occupants.

Sustainability through technology

Avoiding greenwash - Sustainable technology is often difficult for non-specialists to manage. Systems such as photovoltaics, wind turbines and wood-chip boilers are often thought to automatically endow a school with sustainability credentials. This is not always the case, as these systems can present a greater technical challenge to the construction team and a greater burden on the school's management team than might be anticipated. They may also require constant maintenance attention, or demand a level of understanding by the school caretaker or local authority that is assumed at the design stage but not available in reality.

Design choices with proven performance are always better, and are often passive measures rather than active technologies, such as higher levels of insulation and airtightness, well engineered openable windows, high thermal mass, and good daylighting strategies. Well-engineered and thoughtfully designed solar and glare control measures can reduce the need for environmentally-damaging electric lighting.

DfES case studies show that rainwater recovery is largely a "fit and forget" technology, which requires modest facilities management once it's commissioned. It also has an educational value.

If a school only has enough expertise to manage basic gas and electricity consumption, then it's odds-on that there's little chance of measuring the contribution from the more complicated energy technology. In the absence of proper energy monitoring and targeting, it will not be possible to understand the true energy performance of these ostensibly sustainable features. The money spent on such systems could have been better spent on higher insulation, better controls, or used to fund better energy management.

Renewable energy technology should only be used where there is a strong justification for its use. This does not include ready availability of grant-aided funding, or fortuitous local expertise in supply and installation. These things only cover initial capital purchase and fitting - they do not cover on-going management and maintenance of the technology. What may promise to be fit and forget can turn into fit and manage - and a nightmare for the school staff who want to concentrate on the things that really matter: teaching children. Schools are places of learning, not showcases of architectural and engineering ingenuity. Where renewable energy technology is used it is important to ensure that it also serves as a learning tool for pupils in encouraging them to think about bold solutions to 'zero carbon'.

Schools should attempt to reduce energy requirements before buying technology. It should become a matter of course that equipment is turned off when not in use and that lights are not automatically turned on when natural lighting levels are adequate.

Sustainability and local authorities

There is currently no specific advice to schools or local authorities on the best way to procure a sustainable school. In addition there is no standard way to develop a brief for a school design and this leads to varied quality.

The competitive tendering process for work under Building Schools for the Future leaves little room for rigorous briefing in the early stages of contract. A partnering approach with design and construction firms can generate better commercial conditions for producing a sustainable school, than the competitive, lowest price approach that can militate against value-added design and construction.

The process of procuring a school differs however among local authorities and this can have an impact on the extent to which school communities are involved in briefing and design. The level of sustainable expertise also varies greatly.

Schools and local authorities should:

- Not assume that sustainability technologies will perform as suppliers' predict. Ultimately, performance will be determined by the way the school is run, and peoples' understanding of how to operate the systems.
- Carry out occupant surveys of existing teaching accommodation to identify how the teachers and staff use their spaces, and in what ways they want to maintain control over their environment. Use survey methods for which robust benchmarks are available, such as those championed by the Usable Buildings Trust. (www.usablebuildings.co.uk).
- Local authorities should solicit the opinions of teachers and staff on the practicality of design options.

Sustainability: energy efficiency

In many ostensibly sustainable schools studied for the Department for Education and Skills (DfES), gas and electricity consumption is both higher than the designers expect, and often much higher than DfES benchmarks. In general, gas consumption is higher because heating systems seem to run for longer. This is particularly true of extended schools, where a community would use a school during evenings and weekends.

Electricity consumption is often greater than best practice targets, and often higher than design targets. Partly this is due to systems defaulting to on, such as lighting (particularly of out-of-hours use), but a lack of control over electronic whiteboards, projectors and computers is also a major contributor. Catering equipment like fridge freezers left on unnecessarily during holiday periods will also cancel out efforts at running a school sustainably.

With the development of the use of ICT in schools and other electrical equipment it is not unusual for new schools to use much more electricity than historic good practice benchmarks - a problem that needs to be tackled vigorously in the next generation of school buildings if they are to be sustainable.

Designers of sustainable schools should set meaningful energy targets and always take account of the likely hours of occupation - including potential changes such as additional extended schools services.

Ideas Box

- Reducing a school's carbon dioxide emissions requires realistic energy targets to be set during the design (see info on BREEAM). They should be regularly reality-checked and remain high on the list of priorities .
- The design team should not burden the school with excessive energy management tasks, All energy reducing measures should be supported by simple methods of assessment, with clear choices.
- Energy controls must be clearly explained at the design stage to enable schools to put in place the appropriate management expertise.
- A school can pay twice for water: once for it to be delivered, and again for waste water to be taken away when it could be used for irrigation.

Sustainability through good controls

Controls in schools - from the humble light switch to computer-based management systems - ultimately determine whether the energy-hungry heating, ventilation and lighting systems runs as the designers intend. This is because they are the critical interface between mechanical and electrical systems and the teachers and pupils.

Occupants like buildings that can respond to them, and which have usable controls and interfaces. The best schools are those that are designed to be largely self-managing and which possess plenty of opportunity for users to alleviate their discomfort, such as by simply opening a window, or by flicking a switch that is well labelled and which gives instant response on what it's controlling.

Designers and local authorities often extol the virtues of controlling schools using computerised systems - perhaps remotely from the local authority head office. This can work well, but demands a level of attention and vigilance that is often not available when needed. The technology may be poorly calibrated to the way teachers want to use their classrooms. For example, if school staff are unable to switch off heating systems when they want to, but have to ring someone 50 miles away, then systems are more likely to simply stay on - and the windows opened to release the heat. This will not be energy-efficient, but it will be easy to manage with the minimum of complaints. Part L of the building regulations shows that absence detection, particularly on lighting systems is one of the easiest ways to save energy and this is something worth exploring.

Teaching and administrative staff should be asked by designers what they need in terms of controls, and the degree to which they want manual controls to override automatic systems. If this is not included in the design of the controls system, the controls may be difficult to understand and operate, and end up being abused or fall into disuse.

More attention to usable controls at the design stage can show great dividends in terms of a well-controlled school and satisfied occupants.

Sustainability and ICT

Some forms of information and communications technology (ICT) will have a major effect on a school's energy consumption (with the exception of devices relying on Extra Low Voltage (ELV) systems). Personal computers are increasingly common in all schools, including infants and primary schools. Along with other devices such as projectors and electronic whiteboards, this equipment can be responsible for significant energy consumption, particularly if it is left running when not needed.

A school's design strategy needs to take into account the required information and communication (ICT) needs at an early stage. This requires conversations and agreement with teaching staff. A sustainable ICT strategy is one that balances teaching needs with energy consumption, not one where the ICT ends up being tacked-on after occupation.

The original reasons for the application of distribution technology needs to be recorded in the school's operating principles so that a good design, arrived at in discussion with the client, does not changed after the school is occupied.

Ideas Box

To reduce energy consumption from ICT, schools should:

- Separate the metering of energy used for the basics such as heating and lighting from other energy usage, such as ICT and security systems.
- Undertake analysis that shows the energy consumed by ICT, and show how consumption will be affected by ICT left switched on.
- Run the school to ensure that energy intensive technology is switched off when it isn't needed.
- Ensure ICT is not introduced ad-hoc after occupation.
- Ensure all ICT is placed in accessible locations, so that it is secure, controllable, well-ventilated and not compromised by daylight glare, so that teachers default to blinds-down, lights-on.
- Consider the use of more energy efficient 'Thin Client' technology. This is a network that relies on a central server for processing.

Project evaluation tools

A sustainable school should be able to maintain good environmental performance throughout its life. Unfortunately, it is very easy for good environmental intentions to break down when there is no professional help after a new school has been handed over.

New schools rarely work perfectly on day one, but if the architects, engineers and contractors aren't around to help with fault-finding and fine-tuning, then the school staff are unlikely to resolve all the questions they have about how to run the school.

This is not the same as snagging defects, such as poorly hung doors, windows that won't close properly, or damage to paintwork. Schools often have complex control systems for lighting and ventilation - possibly under the control of software. Any shortcomings or modifications will be very difficult for the school to sort out if the design team have been disbanded.

Designers themselves can benefit from understanding the performance of the school they have designed. So rather than invest in technology such as photovoltaics (which may not show a return on investment for 20 years or more), the money could be better spent negotiating some post-occupancy aftercare and fine-tuning of the school. This way the school's sustainability will be low energy, not sustained high energy consumption and unhappy occupants.

It is now a condition of schools capital funding that both new build and refurbishment projects achieve no less than a 'very good' rating under the Building Research Establishment's Environmental Assessment Method (BREEAM) for schools.

BREEAM helps schools and LEAs to set environmental targets for new and refurbished school buildings. It also serves as a tool for designers who want to demonstrate the environmental performance of their designs. However it can only be effective as a measurement/ benchmarking tool if there is support for teachers and designers in their initial development of a sustainable strategy.

BREEAM should not be just a tick box exercise but should be used to support the delivery of a realistic and sustainable school design and management strategy. It is very easy for good environmental intentions to fail when there is no professional help after a new school has been handed over.

Essential rules

- There is a need for independent trusts, local authorities, the DfES, school boards of governors and contractors to realise that follow through-and feedback are not optional, but should be essential and routine elements of school procurement.
- Ensure that there will be an expectation of feedback and post-occupancy evaluation written into contracts at the beginning of procurement processes, and apportion money to fund it.
- Client and design teams should use a sound platform of design assessment techniques and adopt project evaluation benchmarks.
- Apportion money in the budget for a soft-landing after initial occupancy, involving fine-tuning and optimisation for a sustained low energy performance. The standard default of school operation must be one that meets design expectations.

Case Study: Bradley Stoke Community School

Bradley Stoke Community School is a 9000 m2, mechanically ventilated secondary school for 950 pupils, Contractor Kier Western reduced the environmental damage caused by the development by applying environmentally-friendly methods of waste disposal. He arranged for the local plasterboard manufacturer to gather and recycle waste plasterboard, constructed a sealed washdown pit for concrete delivery vehicles to prevent contamination of the soil, and saved 3000 m2 of concrete by opting for large concrete pad foundations rather than concrete pile foundations. The latter made a massive difference to the school's embodied energy and the amount of waste generated during construction.

Recycled stone was also used for the hardcore, much of which was sourced locally and crushed on site. Again this reduced the number of traffic movements for importing stone to site, reducing the school's embodied energy even further.

The school's proximity to local roads persuaded the designers to put noise reduction ahead of natural ventilation. This meant sealed rather than openable windows, and a mechanical ventilation system.

In naturally ventilated buildings, heat in winter is lost through the windows that are open for natural ventilation. As a kilowatt hour unit of gas incurs fewer carbon dioxide emissions compared with a unit of electricity, mechanically ventilated buildings need to be very efficient in terms of fan power in order to offset the carbon dioxide generated by the mechanical systems. Recovering waste heat from the extract air in winter can be used preheat the incoming air, and reduce the need for gas-fired space heating. However, no specific energy targets were set for the school.

In use, the school is using less gas than schools considered to be achieving good practice, but more electricity. At the time of the energy survey (summer 2006) the school was only occupied by 185 pupils out of a design maximum of 950. Both gas and electricity consumption are likely to rise, especially in winter when all classrooms will be occupied.

The mechanical ventilation system is partly responsible for high energy use, and the noise generated by the system is not far off that generated by the road. All parts of the school are mechanically ventilated - even those furthest away from the road.

Lessons learned

- Reductions in a new school's embodied energy can often be achieved through thoughtful methods of construction.
- Road noise affecting one elevation is not necessarily a justification for adopting mechanical ventilation throughout.
- A headteacher and architect who are enthusiastic about sustainability can make a huge difference in reducing a school's environmental impact.

Ideas Box

Design evaluation and feedback tools

A variety of design and project feedback tools available to help schools and their construction teams produce a sustainable school. They provide a systematic way of extracting needs and wants from clients in a form that designers can act upon.

Design Quality Indicators for Schools

A version of the Design Quality Indicators (DQI) system developed by the Construction Industry Council specifically for schools

www.dqi.org.uk/schools/

BREEAM Schools

A schools version of the established design environmental rating scheme: BREEAM.

www.breeam.org

Building Use Studies (BUS) occupant survey method and reporting method

An empirical analysis method available under licence that generates feedback data from occupants on building performance. Results can be benchmarked against a rolling database of school buildings.

www.usablebuildings.co.uk

School Building Assessment Method

A guide for new school buildings consisting of a survey and discussion tools to aid understanding of how school buildings work

http://www4.ncsu.edu/unity/users/s/sanoff/www/schooldesign/assessment.html

For more information go to:

BREEAM for Schools: www.breeam.org/schools.html

www.teachernet.gov.uk/management/resourcesfinanceandbuilding

British Council for School Environments: www.bcse.uk.net

Usable Building Trust: www.usablebuildings.co.uk

www.teachernet.gov.uk/sustainableschools

Local Authority Sustainable Construction Network: www.wellbuilt.org.uk/lascn/

Partnership for Schools: www.p4s.org.uk

The Sustainable Development Commission: www.sd-commission.org.uk

DfES – Schools for the Future 'Design of Sustainable Schools - Case Studies' available from The Stationery Office, www.tso.co.uk

Royal Institute of Chartered Surveyors - www.rics.org

About the BCSE

The British Council for School Environments (BCSE) is a membership organisation made up of local authorities, schools, construction companies, architects and others involved in, and concerned about, the design and build process in the education sector.

It acts as a forum for exchange, dialogue and advocacy for anyone interested in learning environments; from educators to policy makers; users to designers; managers to constructors.

To join the BCSE

Visit our website - www.bcse.uk.net or contact Beth Gladstone on beth@bcse.uk.net, 020 7785 6286

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British Council for School Environments Founding Members:

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BCSE Foundation for Learning Environments

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