Buildings

Old v New

The first issue that may confront a Head is - Demolish or Rebuild? Do you really need to construct a new building on the site of an old one, or can the existing one be converted?

Demolishing an existing structure wastes the embodied energy stored in the building's fabric. It is worth considering a conversion, or if demolition is required, the recycling or salvaging of materials such as bricks, wooden panelling and tiles from the previous building. It is also worth considering and making provision where appropriate for any future uses the new building may have and using materials which can be recycled in due course. There is nothing new in this. The reuse of ships' timbers in wooden frame houses or the simple incorporation of old wood and bricks in many a Victorian building is an accepted and welcome element of architectural continuity.

Design and materials

DESIGN

What the building is going to be used for and by whom should always be at the centre of any design. It may sound basic but there are too many examples of projects that have lost sight of the purpose of the project and focused on award winning designs that in practice are not fit for purpose – the RIBA Award winning Business Academy Bexley in South East London, designed by Lord Foster and built for a cost of £31m, now faces a deficit of £859,000 attributed to the spiralling maintenance costs, from the leaking roof, facilities that could not withstand the daily use of over 1000 pupils and a management system that required a qualified engineer to manage.

Whether a new build or a rebuild, putting sustainability as the top of your design criteria will reap dividends in occupation costs and maintenance bills. The Independent school has the advantage of being both developer and occupier and can therefore judge much more objectively the real cost of particular solutions. Insisting both on a building that will require less energy and water in operation and one which is built in an environmentally efficient manner will be commonplace in the lives of today's pupils and learning it early will get them off on the right foot.

From the very first stages, all the parties involved in the project need to understand the importance of sustainability at every stage and to work together to ensure the practical measures are put in place so the overall goal is achieved. Designers, electricians, plumbers and builders, technicians and specialists need to communicate so each area can benefit for the others expertise and experience. Careful project management is crucial.

ORIENTATION

First we have come to relearn the lessons of history by considering the orientation of the building to take into account the likelihood of cooler winds from the north and the warmer exposure to the south. Taking advantage of naturally occurring ventilation came naturally to our forebears until cheap power made us arrogant.

The effects are generally maximised by having quite narrow structures (ranging from 15-18m, window to window) often with a high wall to floor ration and numerous opening vents. Ideally internal spaces are not subdivided,

although where these aspects are not possible, displacement systems that use a high proportion of fresh air and heat recovery are the optimum low-energy alternative. (http://www.building.co.uk/data/cost-model-offices/1030722.article).

Architects are increasingly alive to these old truths but it does no harm to show that the client is aware of their importance. The location of windows to ensure daylight is maximised. Roof lights and sunpipes can be installed to illuminate darker areas. The use of light coloured wall paints will also assist. Shading for south facing windows can be provided by overhanging roofs and plants, which will help minimise glare from the sun. It is surprising how often these issues are ignored by an architect determined to progress a favoured design! Even obvious issues like the positioning of doors to take into account the impact of the weather sometimes take second place to the dictates of design.

Questions to ask

- Has the orientation of the new building maximised the prevailing weather and light conditions for the locality?

WINDOWS

The energy performance of a window is judged by the deducting the heat loss from the solar heat gain. Heat can be lost from a room via the window in a number of ways.

1. Leakage through the gaps between the pane and the sill, between an ill-fitting sill and the wall.
2. Heat transference between the inside and outside facing sides of a single window pane.
3. From the inside pane of double glazing to the external pane of double glazing, through radiation.
4. By convection occurring between the double glazing panes, particularly if the cavity is wide. The spaces can be filled with krypton or argon which improves performance, however long-term integrity may be an issue.
5. Conduction through the window frame. Composite frames are being developed to reduce conductivity, although hardwood frames from a sustainable source are the ideal these often come with a hefty price tag.

It is at this point that a simple piece of technical language will serve to concentrate the mind of the professional who knows that the client is in earnest! The U-value is the way that various window solutions are compared and it is a figure which computes the loss of heat from the room through the window panes. It is expressed in units of W/m2 which means the amount of heat lost in watts (W) per square metre of material. The lower the U-value the better. The difference in typical U-values show how important this measurement can be.

Standard double glazed unit with 20mm air gap has a u value of 2.8 W/m^2.
Standard double glazed unit with 20mm air gap and 1 pane of low e glass has a u-value of 1.8 W/m^2.
A 225mm solid brick wall with 10mm mortar joints has a u-value of 2.0 W/m^2.
A typical cavity wall with no insulation has a u-value of 1.6 W/m^2.

It is important to remember to ask for the U-value of the final assembled window rather than the individual components as it can improve or deteriorate upon assembly. Manufacturers frequently quote the U-value of the central pane rather than the final assembly value which is affected by the frame, fit, and materials.

Solar Gain

It is also possible to have "solar gain" whereby the heat from outside is transferred inside. The G-value is the measurement for how well the glazing stops the heat from transferring into the room. Again the lower the number the lower amount of heat transference; it is expressed as a fraction of the heat that is transferred through the glazing and will be between 0 and 1.

Window films

Window films have improved dramatically in recent times, no longer do they have to be dark, there are now neutral options which keep out over 50% of the solar energy but allow light transfer through windows. Bekaert Specialty Films [http://www.solargard.com] have produced the Solar Gard LX70 window film with maintains the glass' original look but removes over half the heat and over 99% of the ultraviolet light.

Standards and certifications

This is clearly a complex area with many factors impacting performance. Thankfully the British Fenestration Rating Council (http://www.bfrc.org) has developed a system that takes into account the range of factors. The system rates windows on the basis of a nominal energy balance on a scale from A-G. Certification by the Passivhaus Institute ensures that windows are of a very high standard; they will be triple glazed and the u-values will be at least 0.8 W/m^2C for the glazing and the frame.

Glazing

Low-e coated glazing is when the inside facing pane is coated in metal or metal oxide in order that the long wave radiation is reflected back in to the room, retaining the heat, whilst the short wave radiation travels through the pane. Consideration should be given to the impact on room temperatures on sunnier days. The two coating options are: "Hard" which is applied during manufacturing (Pilkington K glass) and "Soft" which is applied after manufacturing (St Gobain Planitherm Total). Although "soft" produces a much lower u-value, it is the less robust option, easily damaged and with a tendency to degrade when exposed to air and moisture.
Developing technologies include vacuum double glazing, warm edge technology where the spacers between the panes are made of non-metallic materials, and lowering the iron content in the pane.

Triple glazing is a significantly more expensive option. Whilst the triple glazed window outperform the double glaze, the cost saving on heating will not recoup the additional capital expenditure. Triple glazing can have the added benefit of significant noise reduction which may be desirable if the building is located in a noisy area. There is greater value in considering this option for a new build or a renovation with the highest specification of insulation. The motivation, cost and benefits would need to be carefully considered when deciding on triple glazing.

Windows – embedded carbon

The Head will be very interested in balancing the cost differential of various window solutions against the savings to be expected in running costs. They will also want to have some idea of the carbon impact of their manufacture. Again the differences are significant enough to need to be taken into account in decision making.

Material	Embedded Energy MJ/m²	Embedded Carbon kg CO²/m²
These figures are a much-shortened and abbreviated adaptation of a survey published by the Sustainable Energy Research Team (SERT) of the University of Bath. The survey, 'Inventory of Carbon & Energy (ICE)' V1.6a, was compiled and written by Prof. Geoff Hammond & Craig Jones, 2008. The full detailed survey, complete with original data, methodology and notes, is available from http://www.bath.ac.uk/mech-eng/sert/embodied/		
Aluminium 2x glazed, argon filled, window	5470	279
PVC 2x glazed, argon filled, window	2310	118
Aluminium clad timber, 2x glazed, argon filled, window	1200	61
Timber 2x glazed, argon filled, window	360	18

Smart glazing

'Smart glazing' materials/ "switchable glass" are useful in windows on the sun side (smart glass or smart windows refers to electrically switchable glass or glazing which changes light transmission properties. Certain types of smart glass can allow users to control the amount of light and heat passing through: by pressing a button, the glass changes from transparent to opaque, partially blocking light while maintaining a clear view of what lies behind the window. Alternatively, glass which is automatically controlled by the external conditions to which a building is exposed is a possibility, reducing solar gain.) However factors of cost and the amount of electricity that is required to run the "smart glass" should be taken into account.

Questions to ask

- What is the final U-value for the window (the lower the better)?
- Which low e-coated glazing is the preferred option?
- Is there a requirement for triple glazing?

Building materials

BRICKS

Factors to consider are: embedded energy from the production process, performance and insulation, durability, life expectancy and the potential for recycling and reuse of building materials.

Fired bricks are made from clay and water and then baked in a kiln. Brick kilns are hugely energy intensive. Other options include flettons, which require up to 75% less energy than the standard, as they contain lignite which provides the extra energy required. The distance and method of transport should also be considered, as well as the effects of quarrying and extraction of the raw materials and the requirement to use cement in assembly. Where possible, lime mortar should be considered as an alternative.

The preferred option, when possible, should be reclaimed bricks, especially if they can be sourced locally. It is always best to ask your builder about locally available suppliers that they may use regularly. Alternatively contact local salvage companies who specialise in bricks (there are more than you would think!) or if it is not possible to find one locally, you can contact a reclaimed brick business that operate nationally ie Reclaimed Bricks (http://www.reclaimedbricks.com) who are based in Manchester. They source their bricks from the North East and distribute nationally. Perforated ordinary clay bricks and flettons are preferable to standard solid clay and stocks due to the lower embedded energy; unfired mud bricks have the least embedded energy but are non load bearing.

Concrete blocks

Concrete blocks were originally made from powered limestone, clay and water. The process evolved to incorporate locally available aggregates such as cinders and blast furnace slag, making breeze and clinker blocks. Concrete blocks were often used for internal walls and subsequently for the interior section in the construction of cavity walls. Their versatility is illustrated by the range of uses they are now employed for throughout buildings, from foundations, to walls to types of flooring.

Type	Ingredients	Negative aspects	Positive aspects	Typical thermal conductivity
Dense aggregate	Cement, sand, aggregates	Impact of aggregate extraction, poor insulation	Durability and strength	0.70 – 1.28 W/mK
Lightweight aggregate	Cement, natural or man-made expanded aggregates(furnace bottom ash, pumice)	Density is proportional to the strength of block	Less strong than dense, better insulation	0.11 - 0.20
Aerated concrete or ‘aircrete’	Cement, lime, sand, aluminium sulphate power and pulverised fuel ash (PFA) and water	Prone to impact damage, more limited application	Perform a dual structural / insulation function, Less embodied energy, Lighter weight	0.11 - 0.20 W/mK

CONCRETE

The creation of cement is a very highly carbon intense process. Its manufacture is responsible for c.5-7% of global carbon dioxide emissions, produced from the heating of the kiln and the treatment of the limestone.

Alternatives are ground granulated blast furnace slag, which can replace up to 50% of the cement in the concrete mix, or pulverised fuel ash, which can replace up to 15% in aggregate blocks and 50% in aerated blocks.

The process of extracting aggregates from land and the seabed as well as their physical removal from the earth are the subject of much debate with respect to coastal erosion and fisheries.

Recycled aggregate can be used to in place of virgin aggregate, in the form of recycled construction and demolition waste. Recycled concrete aggregate is a particular preference due its superior performance, which means it can replace up to 20% of the virgin aggregate in the concrete. Another option are secondary aggregates, by products of other extraction or industrial operations eg china clay waste and blast furnace slags.

Alternatives

Tradical Hemcrete is a building material alternative which can be used in timber, concrete or steel framed buildings. Hemp is the major component to the material so it actually captures CO2 from the atmosphere when growing and stores it in the walls of the building, significantly reducing the CO2 emissions generated for the total build. It is highly insulating and so a thin wall can retain a low U-value. Tradical Hemcrete was used in the construction of the highly innovative Adnams distribution centre in Southwold, Suffolk. The measures taken when designing their new warehouse have meant that neither heating nor cooling are required at any time of the year to maintain the desired ambient temperature for storing their range of products. http://www.limetechnology.co.uk

Type of block				**Typical thermal conductivity**
Honeycomb clay (Ziegel)	Inner layer of cavity wall or external load bearing	European - may be unfamiliar to UK layers and additional transport related issues. Not for use with standard steel and concrete lintels. Dimensions not UK modular.	Good insulting properties. Recyclable. Lower embodied energy than concrete blocks	0.10 W/mK
Hemp	Choice of load or non-load bearing	Use of concrete and aluminium contributes to embedded energy	Carbon sequester	0.36 (structural) and 0.11 (thermal) W/mK
Unfired clay	Non-load bearing ; partitions and infill	Uncommon. Non-renewable materials	Low embodied energy. Recyclable and biodegradable	0.21 – 0.95 W/mK
Insulated concrete form (ICF)	Basis of a single skin wall	Use of cement and concrete	Speed of construction. High thermal performance. High percentage of recycled wood waste	0.083 W/mK

Questions to ask

- Which types of bricks / blocks are being used for the construction, and is it possible to reuse existing bricks from the site or local area?
- How can lower carbon embodied alternatives be incorporated?

- How can the amount of cement required be reduced?

INSULATION

Proper insulation is one of the most cost effective ways to reduce energy use. Huge energy savings can be made through the retrofitting of insulation in older properties and the incorporation of high levels of insulation in new buildings.

A variety of insulating materials are available with different levels of insulating efficiency, though it should be noted that some are not environmentally friendly products themselves. Sheep wool insulation is a sustainable resource and has the additional benefit of absorbing moisture, whilst maintaining its thermal performance. It is recommended for use for lofts, rafters, internal wall and inter-floor. The leading UK manufacturer is Black Mountain sheep wool insulation (http://www.blackmountaininsulation.com) who has worked with the schools on new construction projects such as Tobermory School, Isle of Mull (http://www.argyll-bute.gov.uk/content/news/general/3295337) and refurbishment projects, such as for Leven Valley C of E Primary School, Backbarrow, Cumbria. They have worked on a range of projects for historic buildings including upgrading the roof insulation for Caius College, Cambridge University and on an extension for Brasenose College, Oxford University.
They also supply natural hemp insulation, which is recommended for timber framed walls, as the rigid structure prevents slumping. It is particularly suited for period property renovations.

Also be aware that some types are better suited to certain parts (e.g. walls, lofts, cavity walls) of your building than others due to other properties such as rigidity, durability and ease of installation.

The effectiveness of insulation is measured in terms of thermal transmittance, which takes into account thermal conductance and heat transfer. The lower the transmittance the lower the 'U-value', and the more effective the insulation. The U value is measured in watts per square metre per degree Celsius (Kelvin) and is abbreviated as W/m2.k. As a guide, 300mm of glass fibre insulation would achieve a U-value of 0.11.

Types of Insulation	**Cost per M^2**	**Green?**	**Where used?**
Blanket/Batting insulation			
Glass fibre	c.£1.70 for 100mm thickness	Manufacture can create toxic waste, irritant.	Lofts/cavity walls
Sheepswool	c.£7.00 for 100mm thickness	Recyclable and renewable	Lofts/cavity walls
Hemp batting	c.£9.00 for 100mm thickness	Low embodied energy, but often imported to UK. Expensive.	Lofts/cavity walls
Mineral/Rockwool	c.£10.05 for 100mm thickness	Made from recycled steel slag – 100% fire proof	Walls/floors

Types of Insulation	Cost per M^2	Green?	Where used?
Loose fill Insulation			
Recycled newspaper (cellulose)	c. £2.38 for 100mm thickness	Recycled/Recyclable but contains additives	Lofts/cavity walls
Mineral wool	Similar to above	As above	Lofts/cavity walls
Sheet insulation			
Polystyrene board	c.£8.30 for 52mm thickness (to be laid over thin blanket insulation)	Petrochemical derived, can release toxic gas	Floors/cavity wallstd>
Cork/Straw/Wood	Varies, but more expensive than polystyrene	Renewable, cork has very low embodied energy	Cavity walls/floors
Blown Fibre insulation			
Paper/Wool		Recyclable and biodegradable, non-hazardous.	Cavity walls/Sloping roofs
Polystyrene	c. £8.00 for 100mm thickness	Petrochemical derived, non biodegradable, can release toxic gas	Cavity walls/Sloping roofs

Solid wall insulation

Buildings constructed pre-1920s were built without cavities in their external walls. Such buildings can be insulated on the exterior or on the interior facing surfaces. Whilst it is more expensive to clad the exterior surfaces, it may not be practical to insulate the interior surface. A number of factors should be considered – for example whether the building has listed status; the fittings and internal decorative features for the rooms; the size of rooms; and the number of partitions. The Energy Saving Trust (http://www.energysavingtrust.org.uk) are able to give guidance both generally on what insulation would be best suited to your needs as well as their recommendations for sourcing suppliers and fitters.

The point where the walls meet the windows is a critical area of risk for condensation, so ensure that you ask what measures are being taken to prevent condensation. A seal should be fitted as part of the insulating process to prevent the creation of moisture and its build up on a surface where the warm air meets the cold air.

FLOORS

These surfaces are required to be very hard wearing. The ideal would be to have natural fibre or sustainable wood flooring, however this may prove cost prohibitive. If the choice is made for wood flooring, this should be Forest Stewardship Council (FSC) (http://www.fsc-uk.org) certified, confirming that the wood is sourced from responsibly managed forests. All products carrying the FSC label are certified to have been sourced from responsibly managed forests or recycled material, and that they have been tracked and monitored throughout the supply chain. The FSC certify a broad range of products, from printing paper to furniture to sports floors - even sports balls made from FSC certified natural rubber! Information on their product and supplier databases can be found at http://www.fsc-uk.org/products/search.aspx.

When choosing a carpet, consider the following:

- A carpet with a light weight backing will reduce the amount of petroleum required in the process. A backing made of jute would be fully biodegradable.
- If padding is required, ensure it comes from recycled materials.
- During installation, use water-based, low-VOC (Volatile Organic Compound) glues in place of chemical-based glues or tack them down.
- When disposing of the old carpet, consider whether it can be donated or recycled, rather than be sent to landfill. Your carpet supplier may offer this service.

Carpets are now available which made from natural fibres and can be dyed using vegetable dyes. They can also be made from sisal, jute, seagrass and wool and may be options for areas that are not main thoroughfares. Natural linoleum is very hard wearing and requires little maintenance although its linseed smell may not appeal to all.

Another alternative is carpet tiles; these have the advantage of being easy to replace a single tile or section when necessary, rather than the entire carpet. InterfaceFLOR (http://www.interfaceFLOR.co.uk) is a highly reputable manufacturer who took the strategic decision to eliminate any negative impact they have on the environment by 2020. They have reordered their entire business around this promise and have re-engineered large sections of their product offering in order to remove the negative impact, from the production process of creating carpet fibres to the glue that is used to secure the tiles. This organisation makes an interesting case study for students looking to understand how a company can change the way they operate, putting sustainability at the heart of their decision making processes and strategy and operating profitably. A recent product innovation is Tirex, a tough matting made from recycled vehicle tyres, suitable for entrances and walkways, particularly suited to sports clubs and changing rooms as it is a barrier to dirt and moisture and it is resistant to spikes.
Whatever the final decision, it is important to ask about the sourcing of the product and the nature of the adhesives that are used in the instillation.

LAGGING PIPES

It may sound very basic but the further hot water has to travel from its point of origin to its point of requirement, the more energy it requires due to heat loss. Ideally hot water outlets should be as close as possible to where it is heated. However this is not always practical. In instances where distance has to be covered, ensure that the hot water pipes are located above the cold water pipes, that the pipes themselves are as narrow as they can be to meet the volume and speed requirements and that they are lagged / insulated. Cold water pipes should also be insulated to prevent condensation and to ensure the water stays cold – avoiding the need to let the tap run to make sure the water is cold.

Questions to ask

- What are the insulation options in terms of U-value / cost / sustainability?
- What measures are being taken to eliminate condensation and to reduce thermal bridging?
- How do the floor options compare from a sustainability / cost / durability perspectives?

ROOFS

Pitched Roofs

Factors to consider are embodied energy from the production process and transport, efficiency of materials (including the structural support required), length of life.
The preference would be for reclaimed slates/tiles, FSC sourced wood shingles, reconstituted slates, UK sourced natural slates, rubber tiles.

Type of material	Length of life	Negative issues	Positive issues	NB
Timber shingles and shakes	30-50 years	Maintenance issues	Low embodied energy (if locally source). No pollution, biodegradable	Cedar or oak. Source as locally as possible Ensure FSC certification
Natural slate	75-100 years	Low reserves in the UK. High percentage of waste during production	Low embodied energy (if locally source). Durable and reusable	Source as locally as possible to avoid high embodied energy
Rubber tiles / slates	Unknown	New product to market	Reusable and recyclable. Recycled material	
Clay tiles	50—70 years	High embodied energy	Reusable. Large reserves. Durable	
Concrete tiles	50-60 years	Heavy, resulting in significant support. Issues around production of concrete	Reusable. Low embodied energy. Large reserves	
Fibre-cement tiles / slates	20-30 years	High toxicity. Issues around production of concrete	Reusable. Low embodied energy. Highly durable	
Coated steel	30 years	High toxicity. Greenhouse gases	Recyclable. High material efficiency	

Type of material	Length of life	Negative issues	Positive issues	NB
Aluminium	100+ years	Very high embodied energy. Powder coated is not recyclable	Durable. High material efficiency	
Lead Sheet	100+ years	High embodied energy. Limited resource	Recyclable. Durable	
Copper sheet	100+ years	Limited resource. Toxic Biproducts. Potential to contaminate rainwater	Recyclable. Durable. High material efficiency	

Questions to ask

- What is the availability locally for reclaimed slates or tiles, FSC sourced wood shingles, reconstituted slates, UK sourced natural slates, rubber tiles?
- What is the builders' experience of using the materials that are locally available?

Flat roofs

For instances when pitched roofs are not suitable. The factors to consider are length of life, maintenance issues, reusability of materials. EPDM or TPO are the preferred materials.

Type of material	Length of Life	Negative issues	Positive issues
TPO (Thermoplastic Polyolefin)	C.25 years	Non-renewable resource	Potentially reusable. Durable
EPDM (Elastomeric membranes)	20+ years	Non-renewable resource. Have been known to shrink	Potentially reusable. Durable
PVC membranes	25+ years	Unrecyclable . Unreusable. Non-renewable resource. High toxicity	High material efficiency
Mastic Asphalt	60 years	Non-renewable resource. Brittle, heavy support required. Chipping for thermal protection. High embodied energy	Recyclable. Seamless and flexible. Potentially durable
Built up felt (laminated with bitumen, covered with asphalt, aggregate or emulsion	15-20 years	Unrecyclable. Unreusable . High embodied energy. Non renewable resource. Low durability	High material efficiency

Bishop Justus Church of England School – 600m2 sedum blanket roof installed in 2006. Image courtesy of Bauder.

Green Roofs

Green roofs use planting on a sub-deck instead of traditional roofing materials. Numerous schools have taken this option citing not only the environmental and cost benefits but also those from incorporating it into lessons; a literally "live" case study. In October 2009, Sharrow School in Sheffield became the first school 'green roof' in England to be given Local Nature Reserve status. This was installed by Living Roofs (http://www.livingroofs.org) who have created green roof solutions for schools across the country.

They can contribute to a sustainable urban drainage system (SUDS) by reducing surface water run-off through evaporation of retained water and plant transpiration. They provide insulation in winter and can significantly reduce the need for air conditioning in summer. The green roof can provide a good sound barrier and actually protect the roof membrane from the elements and significantly increase its length of life. The vegetation also improves the quality of the air by filtering the particles and pollutants in the vicinity.

There are different types of green roof – a sedum blanket, an extensive substrate system which retains more water, intensive systems which are often used for roof gardens and biodiversity roofs. Biodiversity roofs are often created with a specific purpose, such as providing a habitat to a particular breed of bird. They are often made from reclaimed bricks from the site and seeded with local plants. They can also take time to mature and you should be aware that they are not necessarily the most aesthetically pleasing options during the maturation period. Options depend on the loading of the building, the waterproofing and access for maintenance. Bauder [http://www.bauder.co.uk] have a strong track record of new and retrofitting green roofs and undertake all stages of a project, from the manufacturing of materials to the final installation.

Questions to ask

- What are the reasons for having a flat roof rather than a pitched roof?
- Is a green roof feasible in this location?

Waste and Recycling

CLASSROOM WASTE

This is the most clearly identifiable area for pupils and staff to target; it is tangible, understandable and it is right in front of them. Recycling and reuse where possible should be the normal. Classes can have Recycling Champions and there is scope for inter-class competitions to see which class can produce the least waste each week/month. However for the best intentioned initiatives to work, the systems must be easy to use - accessible, comprehensible and close to hand.

GLOBAL ACTION PLAN'S (http://www.globalactionplan.org.uk) waste and recycling audits can be hugely valuable in this. It is essential that the responsibility for the recycling bins is clearly allocated either to the pupils or to the cleaners. Ideally recycling should be embedded into the school cleaning system and supported by in classroom activity and campaigns, to maintain awareness and activity. The school champion for recycling should work closely with the cleaning manager and team to create a workable and simple system, ensuring commitment

and understanding on both sides. Different coloured refuse sacks for the different bins in the classrooms is a simple and effective option and it is worth asking your local council if they provide bins.

KITCHEN WASTE – primarily food and packaging. To ensure effective recycling, the system needs to be simple, convenient, and easy to use. Ensure that sufficient bins are available for the specific types of recycling and that they are easily located. Vegetable peelings, unusable vegetables and egg shells can be composted or used to feed a wormery. Of course, in suitable circumstances, the composter and the wormery can be incorporated into science lessons not least to illustrate the lack of waste in nature, where if waste is not used by its producer, it is used by something, or someone else!

It is essential for the school to build a strong relationship with your local council recycling department so their assistance is maximised in this area. For example, many councils provide a collection service for composting school kitchen waste if you do not have the space or requirement for the end product. You can request site visits to assess what the available options are and it is an opportunity for pupil involvement.

Setting up the arrangements for waste correctly enables it to be measured and monitored, allowing trends to be identified which will assist in the purchasing and disposal procedures. One option is to engage the educational charity GLOBAL ACTION PLAN (http://www.globalactionplan.org.uk) who will come and work with school pupils to do a waste audit, including of kitchen waste, and will help plan for improved recycling facilities. They then return six months later in order to help measure the reductions in waste. Minimising waste is a key part of the process of getting real value out of food and the food chain. Climate change, population trends, and increased wealth will mean that the cost of food will rise, after many years of relative reduction. Systems that ensure sensible procurement of seasonal and unprocessed food, sustainably sourced from ethically responsible companies and then minimise the amount of waste will be increasingly cost effective as food prices rise. These systems should be supported by active campaigns by the Sustainability Committee and pupil groups.

The Marine Stewardship Council.

Where ever possible, food should be seasonal and as unprocessed as possible. Consider purchasing sustainably sourced products such as MSC (Marine Stewardship Council) certified fish and do not be shy in asking your suppliers where the food originates, or whether the coffee is fair-trade. Consider writing a school food policy statement for food and catering services. This will provide a strong foundation from which to develop the sourcing, supplier and procurement policies and processes. It can be done inconjuction with the Caterers' parent company and THE FAIRTRADE FOUNDATION (http://www.fairtrade.org.uk/)can help in devising Fairtrade policies. There is also a Fairtrade School statues for which you can apply. The educational charity PEOPLE AND PLANET (http://peopleandplanet.org/) also provides workshops with pupils on fairtrade issues that can help ensure that the shift to fairtrade it a collective project.

Questions to ask

- Is the waste removal and recycling system been designed for simplicity and convenience for the operators?
- Has a strong relationship been forged with the local council recycling department to ensure the school if receiving all the assistance to which it is entitled?
- Are the School Sustainability Committee and pupil groups campaigning to reduce plate waste?
- Are food suppliers being asked about sustainability certifications and fair-trade options