Sustainable building Guide

Retro fitting existing buildings

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CORNWALL COUNCIL

Contents

This guide is only available electronically and the information will be updated regularly reflecting the continually improving understanding of sustainable building

Summary

The aim of this guide is to give advice on how to retro-fit existing buildings in a green or sustainable way

This guide has been developed in partnership with the following organisations:

Cornwall Council
Cornwall Sustainable Building Trust (CSBT)

The aim of this guide is to give advice on how to retro-fit existing buildings in a green or sustainable way. The guide is designed to be used by all building occupants and developers from the individual householder to the larger scale developer who might be altering, extending or refurbishing an existing development. The information in this guide can also help towards the submission of a planning application. This guide is only available electronically and the information will be updated regularly reflecting the continually improving understanding of sustainable building. It is anticipated that this guide will be followed by another guide aimed at the development of new buildings.

The guide is divided into the following topic areas:

Design
Energy Conservation
Water Conservation
Water Treatment & Drainage
Materials
Waste
Pollution
Maintenance
Ecology & Biodiversity
Health & Wellbeing
Access, Equality & Diversity
Communities

Each topic is divided into the following sections for clarity of information:

- **Basic design principle** – to outline the design aesthetic for that topic.
- **Sustainability context** – to give a broad overview of the sustainability issues associated with that topic.
- **Practical solutions** – to give advice about what can be done to tackle this topic within an existing building.
- **Historic conservation issues** – to give an overview of the historic conservation issues associated with that topic (as historic conservation is regarded as a cross-cutting theme rather than a separate topic area).
- **Case studies** – any relevant case studies as provided by CSBT.
- **Useful links / references** – a signpost to further information.

Words that are underlined in the text are contained within the glossary at the end of the document.

There is also a Sustainability Checklist which allows you to consider all the topics and this can be submitted in support of a planning application.

Introduction

> If everyone in the world lived as most Europeans do, we would need three planets to support us.

One Planet Living (Bio Regional/WWF, 2004)

Sustainable development can be defined as, **'development which meets the needs of the present without compromising the ability of future generations to meet their own needs.'** Brundtland Report for the World Commission on Environment and Development, 1992.

Cornwall Council defines sustainable construction as; **"The design, construction, maintenance, refurbishment and decommissioning of buildings and other infrastructure that is fit for purpose, resource efficient and will not compromise the health of the environment or the health of building occupants, builders, the general public or future generations."**

Cornwall Council is committed to making Cornwall one of the UK's most sustainable places and helping achieve Cornwall's Green Peninsula status. This guide sets out the Council's requirements in relation to the sustainable management, maintenance and refurbishment of all existing, development within Cornwall.

The environmental impact posed by buildings is perhaps one of the most significant environmental challenges of today. The built environment is responsible for over 50% of global CO_2 emissions, 40% of solid waste generation and 40% of global energy use. The manufacture of construction materials and the demolition of buildings create huge quantities of waste, the majority of which could be reused or recycled. The construction process can also impact on key natural resources through emissions to air, land and water, which can also affect biodiversity. The construction industry has a major impact on our environment and our ability to maintain a sustainable economy. It is clear that we cannot meet our declared environmental objectives without dramatically reducing the impact of buildings and the construction infrastructure; we have to change the way we design and build.

The Government has set a target to reduce total UK carbon dioxide (CO_2) emissions by at least 80% on 1990 levels by 2050 and by at least 26% by 2020. Within this, the Government has already set out its policy that new homes will be zero carbon from 2016, and an ambition that new schools, public sector non-domestic buildings and other non-domestic buildings will be zero carbon from 2016, 2018 and 2019 respectively. The Government's recent Low Carbon Transition Plan details how these targets will be reached but success will be dependent on the extent to which impacts of buildings can be reduced.

2050

1990

The Government target is to reduce CO_2 emissions by **80%** by 2050 from 1990 levels

Design

Time and effort spent researching and prioritising cost effective measures will deliver an easier, more sustainable and durable building

Basic design principle

Any sustainable building project must be well designed. Time and effort spent researching available methods and materials and prioritising cost effective measures will deliver an easier build and a more sustainable and durable building. Whatever their level of involvement, the client should understand and insist on sustainability best practice.

Sustainability context

New homes in the UK are built to a relatively good standard of energy performance, and future targets for "Zero Carbon" homes are motivating forward-looking developers to go beyond current regulations. Individuals are developing high performance, low carbon buildings and taking many varied approaches to sustainability.

> Individuals are developing high performance, low carbon buildings

Much of the housing stock in Cornwall is built before regulations demanded good energy efficiency and some buildings are listed to preserve the character of a historically important area. When a building is listed the options for improving the performance of the building are restricted; innovative approaches are required to increase performance whilst maintaining character. If a building is not listed or within a conservation area, the main consideration is the most appropriate design to achieve sustainability.

Designing for sustainability is necessary to reduce reliance on fossil fuels and develop lifestyles that do not deplete natural resources.

This guide looks at sustainable design and there are many variable and interdependent factors, not least the perceived value of a particular design to consider. The case studies show the diversity of approaches to the challenge of designing for sustainability in Cornwall.

Practical solutions

Be Informed

Because sustainable design is not yet a mainstream practice there are fewer established standards. Knowledge of sustainability issues will inform decisions in critical areas of the project. Even if a designer is employed who specialises in low impact buildings there will still be decisions to be made which will affect overall sustainability.

Much has been written about sustainable design and there are many sources of information on the internet; each topic in this guide has a list of websites which contain relevant information. Government, community and not for profit organisations will provide impartial information, and architects who specialise in sustainability will provide proven sustainable designs.

One of the best ways to promote sustainability is to support sustainable businesses

Insist on Sustainable Design

When renovating, redeveloping or building it is critical to design with consideration for sustainability. Builders and designers, like most people, like what they are familiar with. Unfortunately traditional methods may not be the most sustainable, therefore it is important to take a fresh look at building design.

Key areas to be aware of are:

The **life cycle impact** of all materials used. Is a material renewable or recyclable?

A material, design or technology's energy performance. Is there a more efficient option?

Space heating and hot water consume the majority of energy in a home. Is it possible to reduce demand by insulating, draught proofing and fitting low flow taps and showers?

How a building can make use of natural light. Does the design make efficient use of heat and light from the sun?

Durability of materials and designs. How often will building elements need maintenance or replacement?

Lifetime homes: Is a design suitable for the needs of all potential occupants, or if the needs of the current occupants change?

Long term financial implications of design. Will a higher initial cost result in lower operational costs?

Specify Sustainable materials

When asking for quotes, specify "green" products. Ask contractors about the environmental performance of products or services being offered and score answers as part of the quality evaluation. This will provide an incentive for contractors to offer less environmentally harmful products and services.

Ask contractors about their own environmental management systems and sustainability practices and give preference to those who demonstrate commitment to reducing their impact. One of the best ways to promote sustainability is to support sustainable businesses.

Historic conservation issues

Preserving historic character is also a design issue and the importance of local history and heritage should always be an important consideration. Architectural history is a resource which sustains communities through cultural enrichment, and the Cornish economy by attracting visitors.

Some alterations to improve energy efficiency on historic properties, such as solar panels explain or add to glossary both solar panels and photovoltaics or photovoltaic units, may require planning permission or listed building consent. For guidance on whether such proposals would be acceptable it is always advisable to consult your local Conservation Officer.

Photovoltaics and solar panels with their associated equipment may not be suitable on all historic buildings as they can often be visually imposing. Photovoltaic tiles that replicate conventional roofing slate and recessed solar panels are available, but their suitability should be judged on a case by case basis.

In some circumstances standard equipment can be sited in locations where it is visually unobtrusive such as inner roof slopes, rear elevations, outbuildings, garages and even as stand alone units in gardens. Initial justification for installations should be made to ensure that they will provide benefits to the homeowner and that performance is not impaired through incorrect orientation, slope, shade and maintenance and cleaning difficulties.

Use of hydro power offers the opportunity of enhancing the character of some historic buildings. Reinstating and updating the original power source of old mills and former mill sites could add to their historic appeal and make them self-sustaining. Sensitive site selection and careful design measures are required to minimise the visual impact on the building and the landscape. Where there is a potential hydro resource an Environmental Impact Assessment must consider the most appropriate system to utilise the resource, minimising detrimental effects on the aquatic flora and fauna.

Heat pumps can be used where there is an appropriate resource from air, ground or water. The physical and visual impacts need to be considered in all cases. Installation of ground source **heat pumps** units involves ground disturbance. Before works begin the implications for any archaeology at the site should be assessed. Contact Cornwall Council Historic Environment Service for further advice.

Biomass boilers should be appropriately sized for the property and for the occupants' heating needs. There is a need to sensitively locate components (fuel store, hot water cylinder and flue). In many cases it would be more appropriate to install boilers outside of the main building, perhaps in an existing shed, garage or out-building. A stove system works well in a historic building and can often use an existing chimney (although it may have to be lined).

Repairing rather than replacing windows on refurbishments other than a change of use is preferable and does not have to comply with Part L of the Building Regulations. There is some flexibility with the Building regulations regarding replacement windows. It can sometimes be possible to increase insulation elsewhere to compensate for retention of single glazed windows in listed buildings.

Draught-proofing, secondary glazing and internal timber shutters can all be used to improve the energy and acustic performance of windows in traditional buildings while retaining original character. Historic buildings are often over-ventilated so draught proofing is one of the best and least intrusive ways of improving comfort and reducing heat loss.

Chimneys are visually important on historic buildings and traditionally provided a means of dispersing internal water vapour and reducing condensation. They should be retained and reused if possible, or at least vented with a controllable shutter fitted.

Case study

Fox Park



Scale of development

Small

Type of development

Holiday Cottage

Sustainability features

- Design
- Energy
- Biodiversity
- Water Conservation
- Health & Wellbeing
- Materials
- Maintenance
- Waste
- Pollution

Features

PV roof with 134 Siemens Sunslates providing 1.6 kW installed capacity.

Heating by wood burning stove and solar thermal system.

Materials thoroughly researched and chosen for minimum environmental impact and high performance.

A market gardeners cottage from the 1920s, this building has been re-built as a low impact two bedroom holiday cottage with an extension to the rear. A high degree of comfort and specification has been achieved within solid environmental criteria.

Building Works

The original walls had additional staggered framing added to the outside and the extension was built, also using double staggered framing to reduce cold bridging. To preserve the original character the building is clad with PVC free corrugated steel. Internal finishes are preserved where possible and walls are insulated with 200mm Warmcell insulation. Timber is FSC certified and treated with Probor, a less toxic form of insecticide, and GRP is substituted for lead. The chimney was rebuilt with recycled bricks fixed with lime mortar. Local materials were used where possible, and much of the original materials were reused and recycled on site. The total non-recyclable waste produced by the building works filled just one standard skip.

Energy Efficiency

The roof is insulated with 140mm of Thermapitch foam board the floor has 140mm of Warmcell. Windows are high performance wood-frame double glazed units which are larger than original to increase natural light and solar gain. All joints are taped to increase airtightness.The chimney and internal block wall provide thermal mass, along with a slate floor in the glazed porch. When additional space heating is required, the log stove burns wood recovered from local hedgerows. Electrical demand is kept to a minimum with energy efficient appliances, low energy lighting and solar thermal water heating. Because the cottage is not continuously inhabited the PV roof generates double the required amount of electricity.

Environment

A small orchard planted with local varieties of apple and cherry preserves the historic context of the building. Wherever possible, low impact materials have been used and materials have been recycled and re-used. Due to the clean electricity exported to the grid, this building offsets CO_2 emissions from conventional electrical generation.

See CSBT: **www.csbt.org.uk**

Useful links / references

Researching historic buildings in the British Isles - **www.buildinghistory.org**

BRE - **www.bre.co.uk**

Energy Saving Trust – **www.energysavingtrust.org.uk**

Lifetime Homes - **www.lifetimehomes.org.uk**

Code for Sustainable Homes - **www.bre.co.uk/page.jsp?id=847**

Code for sustainable homes, Communities and Local Government - **www.planningportal.gov.uk/uploads/code_for_sust_homes.pdf**

McEvoy, D, Lindley, S and Handley, J 2006: 'Adaptation and mitigation in urban areas: synergies and conflicts', Proceedings of the Institution of Civil Engineers, Municipal Engineer, 159, 185-191. **www.sed.manchester.ac.uk/research/cure/research/asccue/publications.htm**

RIBA 2007b: Low Carbon Design Tools. London: Royal Institute of British Architects and Commission for Architecture and the Built Environment. **www.uonbi.ac.ke/departments/arch-build-sci/links/RIBA.htm**

Stern review: the economics of climate change, HM Treasury – **www.hm-treasury.gov.uk/Independent_Reviews/independent_reviews_index.cfm**

World Heritage Centre 2007: Climate Change and World Heritage.World Heritage Reports No. 22. Paris: UNESCO **www.unesco.org/en/climatechange**

Yates,T. 2006: Sustainable Refurbishment of Victorian Housing – Guidance, Assessment Method and Case Studies. Watford: Buildings Research Establishment Trust **www.brebookshop.com/details.jsp?id=286929**

Baker, P 2008: In situ U-value measurements in traditional buildings – preliminary results. Published byTechnical Conservation Group, Historic Scotland. **www.historic-scotland.gov.uk/u-value_measurements_traditional_buildings.pdf**

Wheatley, C 2008: Thermal mass in traditional buildings. Integrated Environmental Solutions Limited. **www.historic-scotland.gov.uk/largetext/craig_wheatley_thermal_mass_in_traditional_buildings.pdf**

UK Green Building Council, 2008: Low carbon existing homes **www.ukgbc.org/site/document/download/?document_id=370**

Local Listings

ARCO2
Architect
www.arco2.co.uk
info@arco2.co.uk
ARCO2 House, Boundary Road, Dunmere, Bodmin, Cornwall, PL31 2RX
Tel: 01208 72100

Arco Studios Ltd
Architect
www.arcostudios.net
73 Causewayhead, Penzance
Cornwall, TR18 2SR
Tel: 01736 350999

Atelier 3
Architect
www.atelier3.co.uk
info@atelier3.co.uk
Hamilton House, The Platt, Wadebridge, Cornwall, PL27 7AD
Tel: 01208 895536

Pioneer Environmental Building Co
Design and Build Timber Frame
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Chapel Hill, Porthtowan, Truro
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Ecohouse Ltd
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Purl Design
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Parkes Lees Architects
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Build Art
Design and Build using Natural Materials
www.build-art.co.uk
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RLT Built Environment Ltd
Architect

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Stride Treglown
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Energy conservation

Save energy, reduce CO_2 emissions, save money.

Basic design principle

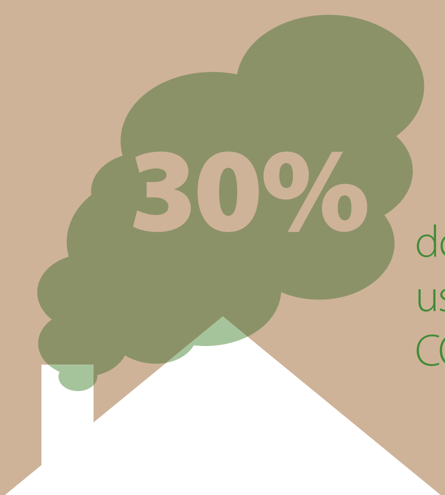
Reduce energy use and CO_2 emissions through changing habits, designing efficient buildings and using renewable energy.

Save energy, reduce CO_2 emissions, save money.

Sustainability context

Modern lifestyles are energy intensive and currently the majority of this energy is provided by fossil fuels. It has been established that CO_2 emissions from fossil fuels is contributing to climate change which is predicted to have potentially devastating effects. Additionally fossil fuels are a finite resource under increasing demand, a situation that will lead to significant price increases unless demand can be reduced to a sustainable level.

In the UK domestic energy use contributes to around 30% of UK CO_2 emissions. Of this, 60% is from space heating and another 20% is from hot water. There is potential for a significant reduction of CO_2 emissions from UK buildings, helping to meet UK, EU and global emissions targets.



domestic energy use share of UK CO_2 emissions

Emissions targets are designed to reduce the effects of climate change on our environment. Reduced energy demand has further benefits including reduced costs to consumers and increased security of supply, where the UK is less reliant on imported fuel.

Practical solutions

Reduction of CO_2 emissions is best achieved by following the energy management hierarchy:

Change behaviour to reduce demand: Actively manage energy consumption. This approach will reduce CO_2 emissions and energy bills at no cost.

Invest in energy efficiency: Energy efficient technologies and buildings will save money and reduce the impact of future price increases. When building or refurbishing consider the cost vs. energy saving performance of potential measures and prioritise the most effective solutions (see Materials section).

Use renewable sources of energy: Offset fossil fuel use by investing in renewable energy technologies. Although there is a significant capital cost there will be ongoing savings supplemented by government incentives and protection from energy price increases as well as CO_2 savings.

Reducing hot water to 60^{0}c saves energy and reduces the risk of scalding

60^{0}c

Reducing demand

In any situation where electricity is used or fuel is burnt for heating or hot water the challenge is to use less. Is the use of energy necessary? If it is, how can it be used most efficiently?

The largest single use of energy in the home is space heating; heating to a lower temperature can achieve significant savings and active management of the central heating system, doing things like switching off radiators in unused rooms, will further reduce energy use. Demand can also be reduced by maximising daylight coming into the building to provide natural heating, closing windows before heat is lost and using curtains to reduce heat loss through glazing.

Heating water is also energy intensive and boilers may be set too high to heat water above the recommended safe minimum of 60°C. Reducing hot water temperature to 60°C saves energy and reduces risk of burns and scalding. Taking shorter, cooler showers and washing laundry at lower temperatures is also an effective way to save energy. Aerating taps, low flow shower heads and well insulated pipes can help to reduce hot water consumption.

Community Energy Plus, Cornwall's local energy advice centre, can provide free 'powerdown' switches. These are plug socket adaptors that switch off the supply to all outlets once the primary demand is switched off. When the main device such as a computer is turned off it will automatically switch off the other plugs supplying power to printers, scanners etc.

To enable better understanding of electricity use, smart meters are available which show real time energy use. Studies have shown that where these are installed, homeowners reduce their energy use through better awareness of how much is being used. It is likely that **smart meters** will be installed throughout the UK by 2020.

Natural insulation should be given preference to reduce environmental impact

Energy efficiency

Appliances

Replacement appliances should be at least A rated, used in energy saving mode and switched off when not in use.

Insulation

Insulation is the most important of all energy conservation measures. For the average house the amount of heat lost through its fabric can be halved through good insulation. As well as the obvious environmental benefit, good insulation leads to increased comfort with less temperature variation.

Natural insulation should be given preference to reduce environmental impact, although if a less environmentally friendly product will perform better it could have a lower life-cycle impact (see Materials section).

Grants for cavity wall and loft insulation are available in many areas. The Energy Saving Trust website has a page that will search for all grants and offers available in any UK postcode.

Windows can be a major source of heat loss. Double or triple glazing should be specified, ideally in high performance timber frames. Other framing material can deliver high performance at lower cost, but with increased environmental impact (see Materials section).

Careful detailing of insulation design to minimise gaps and **cold bridging** is important to achieve maximum benefit.

Airtightness and ventilation

Once air is warmed it is important to keep that heat it in the building. It is critical to achieve good draught-proofing otherwise heat will be lost very quickly. To ensure a high standard a building needs to be designed for **airtightness** and constructed with attention to detail. Doors and windows should have fine tolerances and service penetrations should be grouped together and properly sealed.

Once a high level of **airtightness** is achieved it will be necessary to provide ventilation. Where a ventilation system is installed it is important that it has heat recovery, where up to 90% of the heat is transferred to the fresh incoming air. This type of system is known as mechanical ventilation with heat recovery (MVHR) when the system is powered. Passive systems which rely on the effect of external air movement are also available.

All buildings must have adequate ventilation to maintain a healthy internal environment. This can be achieved by opening windows or installing trickle vents if mechanical ventilation is not installed.

With increasing temperatures due to climate change, keeping cool will become more important and ventilation will need to be designed to enable both the building fabric and occupants to receive fresh air.

Passive solar design

A layout which takes advantage of natural heat and light from the sun while avoiding overheating and uses air movement for ventilation can reduce the need for artificial light, heat, cooling and ventilation.

Passive solar design maximises glazing to the south and minimises it on north facing areas to take advantage of the natural heat and light from the sun, and reduce heat loss through windows which do not provide benefit.

Where possible, use thermally dense material inside the building envelope. **Thermal mass** absorbs heat during warm periods and releases heat when the temperature drops; this allows natural solar gain to be used at night and maintains a more constant temperature. Thermally dense materials include concrete, brick, masonry and water.

The most frequently used rooms, requiring most heating should be on the south side of the dwelling. Rooms used less often or those that will not benefit from sunlight should be on the north part of the building.

Natural light

Natural daylighting is the controlled entry of natural light into a building through windows, skylights, atria, and other building envelope components. A properly designed daylighting system should achieve good daylighting factors by distributing it evenly and by avoiding glare and overheating. Not only does this significantly reduce overall energy consumption, natural light also offers occupants a more pleasant living or working environment.

Manufactured lighting

Low energy lighting should be used. Quality low energy lighting delivers good light and significant energy and maintenance savings. In transitional spaces such as stairs and corridors motion sensitive lighting is an effective way to minimise waste and improve safety.

Landscape

Existing trees and new landscape planting should be taken into account when site planning for passive solar energy. Vegetation and landform can complement passive solar design, reducing heat loss by providing shelter. However, if poorly positioned in relation to buildings tall vegetation will reduce solar gain by overshadowing and obstructing sunlight. Trees that will grow above the shadow line should be deciduous so they allow sunlight to pass through at a low angle in winter and provide beneficial shading in summer.

Cooling and preventing excessive solar gain

With predicted increases in summer temperatures building design will need to ensure there is adequate cooling to prevent uncomfortable internal temperatures. As a first priority, measures such as shutters or **brise-soleil** are simple and effective in preventing excessive solar gain, especially on extensively glazed solar-orientated elevations.

Energy efficient technology

Energy efficient appliances should be chosen where appropriate, in particular energy and water efficient white goods. Appliances providing heat, lighting and other essential services are major consumers of energy; the careful choice of appliances can reduce energy demand and costs significantly.

Environmental control systems for heating, lighting and ventilation should be as simple as possible; buildable, controllable and understandable. Designers or landlords should take steps to ensure that building occupiers are able to operate installed systems effectively by providing a simple user's guide.

Renewable energy

Where possible, use renewable sources of energy to reduce carbon emissions. Financial incentives for domestic and small scale electricity generation are available through the UK Government's **Feed-in Tariff** (FIT) scheme. With the majority of carbon emissions resulting from heating, renewable heat sources should be utilised as the most effective method of emission reduction.

When renewable systems are supplemented by fossil fuels or grid electricity, control systems should always prioritise the renewable technology when it is available.

Wood fuel is becoming more popular after many years of displacement by fossil fuels. Modern wood stoves and boilers are available to burn logs, wood chips and pellets. They are efficient, clean and low maintenance; a chip or pellet boiler with automatic feed from the storage area will only require occasional ash removal. Some models of wood burner are approved for use in Smoke Control Areas.

Solar thermal systems are a tried and tested way of heating water, although an on-demand source of heat will also be required at times when there is insufficient heat from the sun. A well designed system in Cornwall can provide up to 70% of annual hot water demand.

Heat pumps are not strictly renewable unless powered by renewably generated electricity. However they do provide approximately three to four units of heat for every unit of electricity consumed. This ratio is known as the coefficient of performance (COP) and it means that they are much more efficient than an electric fire or an immersion heater. A heat pump transfers diverse heat from one place to concentrated heat in another, typically the ground (Ground Source Heat Pump) or the air (Air Source Heat Pump) and sometimes from water. Heat pumps are most effective when combined with an underfloor heating system. Heat pumps can be slow to respond so they are better suited to buildings with a predictable or steady heat demand. **Contact Community Energy Plus for further information.**

On-site renewable electricity is usually generated by solar photovoltaic systems or small wind turbines. Although wind turbines are cheaper for any given installed capacity they are harder to get planning permission for. They should only be considered where there is a high average wind speed and no obstruction from buildings or other structures which will cause turbulence, resulting in reduced output and reliability. Solar photovoltaic systems only require an un-shaded south facing roof. Where there is a suitable watercourse a micro-hydro system may deliver the most cost effective renewable electricity.

Refer to Cornwall Council's Renewable Energy SPD for further information.

Historic conservation issues

In considering the sustainability of buildings, it is important to remember that existing buildings **embody energy** expended in the manufacture of materials and construction. Demolishing them wastes that embodied energy whilst consuming yet more. Some buildings constructed in the past from traditional materials perform well in terms of energy efficiency if well maintained; these buildings may also add strong local identity and historic character to individual settlements and areas of Cornwall.

Planning needs to seek solutions that combine the unique essence of places with current and future needs. The capacity of traditional buildings to absorb changes that will improve their energy efficiency must be part of the equation.. This is not a simple challenge, but one that requires understanding of sense of place as well as innovative solutions to present and future energy requirements. Cornwall has a long and successful record for innovation: getting the equation right will sustain the Cornishness of our places, a significant driver in the economy of the county and its identity.

The Empty Homes Agency report "New Tricks with Old Bricks" provides useful information on how reusing old buildings can cut carbon emissions. The report concludes that refurbished houses can be just as efficient as new homes. The Sustainable Energy Academy has the "Old Homes – Super Homes" scheme of exemplar refurbishments on its website.

Sensitive and innovative approaches are required to upgrade listed and conservation buildings in Cornwall. These building are usually of solid wall construction and external insulation cannot be used where the character of the building will be altered. The only option is internal insulation which will reduce the internal space and be less effective. Restrictions on material and design of window frames will also lead to expensive custom made frames or the retention of original single glazed windows. Where original windows are retained every effort should be made to ensure a good fit and seal.

Planning regulations restrict the installation of roof mounted renewable energy systems in conservation areas or on listed buildings, contact the planning department of Cornwall Council for current advice.

Some buildings constructed in the past from traditional materials perform well in terms of energy efficiency if well maintained

Improving overall insulation, especially to top floor ceilings is one of the easiest and cheapest means of improving a building's energy efficiency. Relatively thick layers of insulation will not cause problems if they are installed carefully and if the materials are compatible with the performance of older buildings. If you already have some insulation you could simply add to what is already there although care is needed to retain air flow to loft spaces. Insulating internal and external walls could be damaging in some cases and careful detailing will be required. For further advice contact your local conservation officer.

In addition to minimising heat loss there are many other ways to reduce energy consumption in the home:

- Install a more fuel-efficient boiler
- Have heating appliances serviced annually by a licensed technician (CORGI-registered in the case of gas appliances)
- Install heating controls, including thermostatic radiator valves and a boiler timer
- Avoid over-heating, and use thermostats to control room temperature rather than opening windows to let heat out
- Insulate pipework and hot-water cylinders
- Fit photocells or timers to external lights
- Change incandescent lamps to energy-efficient versions

Case study

Hillside Cottage



Scale of development

Small

Type of development

Single dwelling

Sustainability features

- Design
- Energy
- Water conservation
- Water treatment & discharge
- Health and wellbeing
- Materials

Features

Retrofit of high performance materials and technology to an historic building.

Innovative design to maximise performance.

Use of reclaimed and reused materials.

A low energy refurbishment of a cob house c.1800 with subsequent stone and block extensions. Innovative techniques have been utilised to achieve high performance in this difficult to insulate historic building.

Construction and materials

The original stone and cob structure was internally insulated and the block extension cavity insulated. The material selection was varied and innovative including the use of thin film material in window reveals.

Where possible materials from were re-used on site or acquired from a local reclamation yard for re-use in the development.

Energy efficient design and technology

The ground floor is insulated under the slab, along with non insulated internal cob walls, provides thermal mass in the structure. The space heating is delivered by an underfloor system, with heat provided by a Calorex 500 dual temperature heat pump. A wood burner is installed as a secondary source of space heating.

The house is fully double glazed; the conservatory is designed to work as an air-lock to preserve the internal environment and to utilise solar gain. An MVHR system is utilised to retain heat while providing adequate ventilation.

The roofing is insulated with 400mm of Rockwool, preventing heat loss through the ceiling and compensating for the performance restrictions of the wall construction.

Energy savings

The use of energy efficient technology, along with increased insulation has a significant effect upon the heating requirements of the house. When compared to the previous heating requirement of 12kW (at 22 degrees difference), the new figure is reduced by 7kW, resulting in a maximum space heating requirement of just 5kW.

See CSBT: **www.csbt.org.uk**

Case study

Tol-Pedn-Deu

Scale of development

Small

Type of development

Single dwelling

Sustainability features

- Design
- Energy
- Water conservation
- Health and wellbeing
- Maintenance

Features

Orientated for maximum solar gain

Very high levels of insulation and air-tightness

MVHR

Very low energy use

Solar-thermal hot water

Build costs were similar to those for a conventional building of the same size

Award-winning.

Designed by a renewable energy consultant to be his own home, this 'passive-solar' house near Wadebridge has almost no heating requirements and in 2005 won the Regen South West Green Energy Award for Best Home Renewable Energy Instalation.

Construction and materials

Built with readily available 'traditional' materials such as dense concrete block.

Very high levels of insulation: triple skin walls have 300mm Styrofoam (u-value = 0.08W/m2K); roof has 350mm Styrofoam (u-value = 0.07W/m^{2}K)

Windows are triple glazed.

Excellent levels of air-tightness.

Energy efficient design

Space heating is achieved by direct solar gain through a south-facing conservatory and solar roof. The warmed air is circulated through the house by natural convection and under suspended concrete floors with the aid of thermostatically controlled low-energy fans. Heat is absorbed by the dense concrete construction and stored for use when the sun is not shining. A temperature of 21 degrees Celsius is maintained without the need for conventional heating systems. In exceptional weather conditions a portable electric radiator can be brought into use.

Energy saving technology

Ventilation heat losses are minimised through draught-proofing and a Vent-Axia HRE275 MVHR unit.

80% of the property's hot water needs are met by the array of 20 Thermomax evacuated heating tubes.

See CSBT: **www.csbt.org.uk**

Useful links / references

Energy Saving Trust - **www.energysavingtrust.org.uk**

Department of Energy and Climate Change - **www.decc.gov.uk**

Community Energy Plus - **www.cep.org.uk**

Sustainable Energy Academy - **www.sustainable-energyacademy.org.uk**

Low Carbon Buildings Programme - **www.lowcarbonbuildings.org.uk/home**

Renewable Energy Association - **www.r-e-a.net**

Cornwall Council - **www.cornwall.gov.uk**

The Empty Homes Agency: New Tricks with Old Bricks: **www.emptyhomes.com/documents/publications/reports/New%20Tricks%20With%20Old%20Bricks%20-%20final%2012-03-081.pdf**

English Heritage advice for Domestic Energy Assessors **www.helm.org.uk/upload/pdf/EH_Web_Advice_on_DEAs_Dec_07_SE.pdf2.pdf?1247645686**

English Heritage 2005a: Wind Energy and the Historic Environment. London: English Heritage (Product Code 51099) **www.helm.org.uk/upload/pdf/Wind_Energy_%28final%29.pdf?1250844864**

English Heritage 2006a: Biomass Energy and the Historic Environment. London: English Heritage (Product Code 51100) **www.helm.org.uk/upload/pdf/Biomass-Energy.pdf?1247645803**

English Heritage 2007a: Micro Wind Generation and Traditional Buildings. London: English Heritage (Product Code 51366) **www.helm.org.uk/upload/pdf/69945-MicroWind1.pdf?1250844539**

English Heritage forthcoming 2008a: Micro-generation in the Historic Environment. London: English Heritage (Product Code 51391) **http://Microgeneration.pdf?1250844716**

English Heritage 2007c: Energy Conservation in Traditional Buildings. London: English Heritage (Product Code 51367)- good basic guidance with illustrations **www.helm.org.uk/upload/pdf/89410-EnergyConservation1.pdf?1247645803**

English Heritage 2007d: Cutting Down on Carbon: Improving the Energy Efficiency of Historic Buildings. Summary of Government Historic Estates Unit Annual Seminar, Building Research Establishment, Garston, 9 October 2007 **www.helm.org.uk/upload/pdf/BRE-seminar.pdf?1250845158**

English Heritage 2007e: Understanding SAP Ratings for Historic and Traditional Homes: English Heritage Interim Guidance. London: English Heritage **www.helm.org.uk/upload/pdf/SAP_ratings.pdf?1250845118**

Energy Performance Certificates for Historic and Traditional Homes **www.helm.org.uk/upload/pdf/EH_Web_Advice_on_EPCs_Dec_07_SE.pdf2.pdf?1247645803**

2007 Meeting the energy challenge: a White Paper on energy, Department of Trade & Industry **www.dti.gov.uk/energy/whitepaper/page39534.html**

BERR 2007: Draft Strategy for Sustainable Construction: A Consultation Paper London: Department for Business, Enterprise and Regulatory Reform **www.berr.gov.uk/files/file40641.pdf**

Building a greener future, Communities and Local Government **www.communities.gov.uk/publications/planningandbuilding/building-a-greener**

Building Regulations and Historic Buildings - Balancing the needs for energy conservation with those of building conservation: an Interim Guidance Note on the application of Part
www.helm.org.uk/upload/pdf/ign_partl_buildingregs.pdf?1247645803

Cassar, M 2005: Climate Change and the Historic Environment. London: University College London, Centre for Sustainable Heritage
www.helm.org.uk/upload/pdf/Climate-change.pdf?1247645803

Code for sustainable homes, Communities and Local Government
www.planningportal.gov.uk/uploads/code_for_sust_homes.pdf

Baker, P 2008: Improving the Thermal Performance of Traditional Windows. Glasgow Caledonian University, for Historic Scotland.
http://www.historic-scotland.gov.uk/thermal-windows.pdf#xml=http://web1:10700/texis/webinator/pubssearch/pdfhi.txt?pr=publications&prox=page&rorder=500&rprox=500&rdfreq=500&rwfreq=500&rlead=500&rdepth=0&sufs=0&order=r&id=4a89fda47

Mitchell, D 2008: INFORM Guide - Energy Efficiency. Published by Technical Conservation Group, Historic Scotland.
www.historic-scotland.gov.uk/inform_guide_-_energy_efficiency.pdf

Jenkins, D 2008: Energy Modelling in Traditional Scottish Houses (EMITSH) Heriot-Watt University analysis of potential CO_2 savings of building variants. Published by Technical Conservation Group, Historic Scotland.
www.historic-scotland.gov.uk/energy-modelling-scottish-houses.pdf

Technical Conservation Group, Historic Scotland, 2009: Energy Modelling of a Mid 19th Century Villa.
www.historic-scotland.gov.uk/energy-modelling-mid19th-century-villa.pdf

Halliday, S 2009: Indoor Air Quality and Energy Efficiency in Traditional Buildings. Technical Conservation Group, Historic Scotland.
www.historic-scotland.gov.uk/traditional-buildings-air-quality-energy-efficiency.pdf

UK Climate Impacts Programme (UKCIP) **Oxford University Centre for the Environment**
Dyson Perrins Building, South Parks Road
Oxford OX1 3QY
Tel: 01865 285717
www.ukcip.org.uk

Energy Saving Trust
21 Dartmouth Street
London SW1H 9BP
Tel: 020 7222 0101
www.energysavingtrust.org.uk

Historic Environment, Local Management (HELM)
English Heritage
1 Waterhouse Square, 138-142 Holborn
London EC1N 2ST
Tel: 020 7973 3000
www.helm.org.uk

Department for Communities and Local Government
Eland House, Bressenden Place
London SW1E 5DU
Tel: 020 7944 4400
www.communities.gov.uk

English Heritage
1 Waterhouse Square, 138-142 Holborn
London EC1N 2ST
Tel: 020 7973 3000
www.english-heritage.org.uk

Insulation And Draught-Proofing
National Insulation Association
2 Vimy Court, Vimy Road
Leighton Buzzard, Bedfordshire LU7 1FG
Tel: 01525 383313
www.nationalinsulationassociation.org.uk

Local Listings

Community Energy Plus
Energy Efficiency Advice

www.cep.org.uk
enquiries@cep.org.uk

South Crofty House, 1 South Crofty, Tolvaddon Energy Park, Camborne, Cornwall TR14 OHX

Tel: 01209 614 975

Cornwall Council
Green Cornwall Team

Tel: 0300 1234 100
www.cornwall.gov.uk

Cornwall Council
Planning Department

Tel: 0300 1234 100
www.cornwall.gov.uk

South West Air Energy
Pressure Testing

www.sw-airenergy.co.uk
enquiries@sw-airenergy.co.uk

Tel: 01872 275186

Independent Energy
Renewable Energy

www.solarpanelcornwall.com
trenowin@btconnect.com

Trenowin Farm, Ludgvan, PenzanceCornwallTR20 8BL

Tel: 01736 740955

Capture Energy
Renewable Energy

www.capture-energy.co.uk
mail@capture-energy.co.uk

Capture Energy Ltd. Unit C2, Pool Business Park, Dudnance Lane, Pool Cornwall, TR15 3QW

Tel: 01209 716 861

Itsolar
Renewable Energy

www.itsolar.co.uk
info@itsolar.co.uk

Itsolar Ltd, Lee Haven, Feliskirk Lane, Marazion, Cornwall, TR17 0HA

Tel: 01736 710372

Solcentric Ltd
Renewable Energy

www.solcentric.co.uk
Devoran Boatyard, Devoran, Truro, Cornwall, TR3 6PQ

Tel: 01872 865662

Plug Into the Sun
Renewable Energy

www.plugintothesun.co.uk
info@plugintothesun.co.uk

Unit 5E, Long Rock Industrial Estate, Penzance, TR20 8HX

Tel: 0844 800 9512

Natural Generation
Renewable Energy

www.naturalgen.co.uk
info@naturalgen.co.uk

35 Rosemundy, St. Agnes Cornwall, TR5 0UD

Tel: 01872 554144

Water conservation

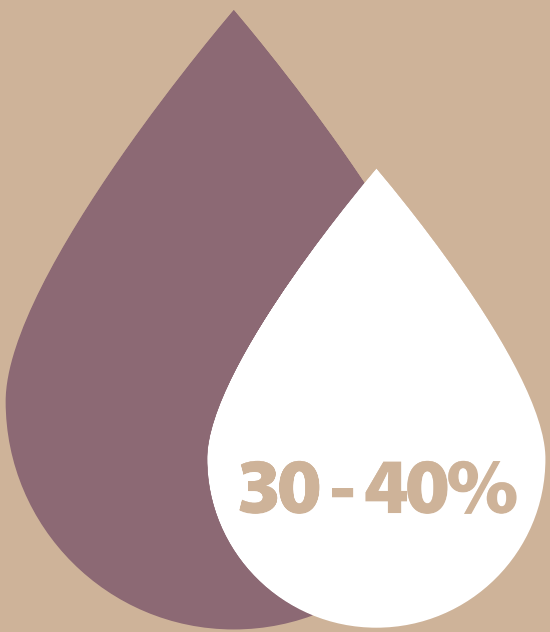
The efficient use of all water resources must be an early consideration in the design

Basic design principle

The efficient use of all water resources must be an early consideration in the design of all building in Cornwall. Development proposals should consider using sustainable water sources and efficient use of all water resources for both internal and external water consumption.

Sustainability context

Water consumption in the South West has grown significantly in recent years. Domestic water consumption in the region equates to an average of 150 litres per person per day. Forthcoming legislation will set a standard of between 120-135 litres per person per day. Homes are being built to achieve standards down to 80 litres per person per day under the Code for Sustainable Homes scheme.



Predicted decrease in summer rainfall overthe next 50 years

The predicted effects of climate change in the South West over the next 50 years include sunnier, warmer, longer summers. Summer rainfall is expected to decrease by 30-40% and more extreme weather patterns are predicted, increasing the frequency of exceptionally 'dry' summers. The effects of climate change are anticipated to account for an additional 1-2% increase in household demand for water and up to 20% increase in demand for other uses, such as agriculture (See Environment Agency Water Resources Strategy). Warmer summers may also lead to a greater demand through increased visitor pressure.

See Met Office Climate Change Guide and South West Climate Change Impacts Partnership 'Warming to the Idea' report for verification of climate change weather patterns and projected demand increase.

Development pressure throughout the county will inevitably result in increasing demand on these water resources. In some areas it may be necessary to restrict existing water abstractions in order to maintain important wildlife habitats. Utilising alternative, more sustainable water sources and using all resources more efficiently is therefore a vital consideration for all development.

There is also a direct link between water use and energy use (and therefore carbon footprint). The Environment Agency have looked across the life-cycle of water supply, household water use and sewage treatment and calculate that for every million litres of water used almost 7 tonnes of carbon dioxide is emitted. Household hot water use is a particularly significant element of this carbon footprint. Spray taps, low flow showers and low volume baths save substantial amounts of hot water and therefore carbon emissions and are fundamental elements of code level 3 homes (see BRE Code for Sustainable Homes).

Practical solutions

As with energy, the first step is to reduce the demand and then to find alternative sources to reduce the use of expensively treated drinking water for uses such as flushing toilets.

Demand can easily be reduced by fitting aerating taps, low flush toilets and water efficient appliances. Collecting and storing rainwater for use in the garden is another easy way to make a difference, as is designing a drought resistant garden. A cheap and simple way to collect water is by using a water butt.

Indigenous planting schemes that include drought tolerant species to reduce the need for watering should be included in any landscaping scheme. Species need to be both tolerant of summer drought and winter damp. Large areas of grass are not advisable, especially on southern aspects. Drought tolerant low ground cover plants should be considered instead. For more information see the 'Gardening in the Global Greenhouse' report on the UKCIP website.

More advanced **rainwater harvesting** systems are available where rainwater is stored and used in non-potable applications such as toilet flushing, laundry, cleaning and garden use. Up to fifty percent of household water demand can be supplied by a **rainwater harvesting** system, giving significant savings if a water meter is installed. A discount is available if rainwater is diverted to a soakaway rather than the sewer, resulting in further savings and environmental protection.

Greywater recycling systems, where basin and shower water is filtered and treated for use in the toilet or garden can give additional water savings. **Greywater** recycling for wc flushing is not commonly used due to additional complexity, energy requirements and health concerns.

Water meters are often fitted for free and can increase awareness of water usage. With a meter it is also possible to save on water bills if consumption is below the estimated average; metered households on average use 12% less water than unmeasured households.

Changing our water use habits can often have a significant effect on water consumption.

For advice and guidance see:

- Conserving Water in Buildings - Environment Agency
- Building and renovation checklists - NetRegs
- Save Water - Energy Savings Trust

Demand can easily be reduced by fitting aerating taps, low flush toilets and water efficient appliances

Historic conservation issues

Reopening and making usable historic wells and village pumps is worth investigating to provide an additional communal water source to towns and villages. Wells and pumps are often an important focal point within settlements.

Many towns in Cornwall have open **leats**, known locally as **kennels**. Running water through these kennels often adds to the ambience and atmosphere of a town or village. Disruption to the flow of water through the kennels could lead to damage of beds and bases through drying up. It is important that water flow is maintained.

Decreasing demand by fitting aerating taps, low flush toilets and water efficient appliances, along with changing behaviour patterns is simple to incorporate.
These changes are unlikely to have any detrimental impact on historic buildings.

Rainwater harvesting can also be particularly useful in maintaining planned historic landscapes and gardens. However, the architectural integrity of some historic buildings could be damaged by the need to provide new and more effective rainwater disposal, harvesting and **greywater** systems and such intervention will require careful consideration. Poorly designed water conservation saving measures could detract from the historic character and fabric of buildings, but well designed measures have the potential to make considerable savings with little or no damage.

Opportunities to recycle rainwater in historic properties should be encouraged, especially on buildings with large roofs. Any required storage tanks and pumps -should be sensitively positioned without damaging any of the original fabric.

Case study

Fairglen



Scale of development

Large – 28 planned dwellings

Type of development

Commercial development

Sustainability features

- Design
- Energy
- Water Conservation
- Water treatment & discharge
- Health & Wellbeing
- Waste
- Pollution
- Community

Features

High thermal mass designs to reduce peaks and troughs in temperature

Over 70% CO_2 saving compared with conventional buildings

Affordable homes

Rainwater harvesting system.

A development in Hayle with 28 dwellings planned in a 1.21 ha area. The buildings meet Code level 4 and would easily achieve level 5 with more renewable generation. An overall carbon saving of 71% over Target Emission Rate means that actual emissions are just 9 tonnes.

Construction and materials

The houses use thermally dense materials to absorb natural heat captured by the south facing conservatory and roof lights. This design aims to reduce the variation in temperature that can occur throughout the day and night. This reduces the energy use; once the space is heated it stays warmer for longer.

The block and beam flooring system is designed and installed by a local company, Cornish Concrete Products. Walls are constructed using aerated block with Kingspan insulation and sustainably sourced softwood outer leaf and timber cladding. The windows and doors are all double glazed and comply with secure by design standards.

Energy efficient design and technology

The houses feature low energy lighting and appliances, ground source heat pumps to provide hot water and mechanical ventilation with heat. All properties except for the affordable dwellings have a 1.4kW solar photovoltaic system.

Waste, water conservation and site ecology

The developer has followed best practice in waste management to minimise the volume of waste produced during construction. The site incorporates 1.3 acres of attenuation ponds to reduce flood risk and provide habitat. Eucalyptus and rosemary is planted to deter mosquitoes.

Each property is fitted with an underground rainwater harvesting system which supplies WCs, laundry and the garden tap.

See CSBT: **www.csbt.org.uk**

Useful links / references

Code for sustainable homes, Communities and Local Government
www.planningportal.gov.uk/uploads/code_for_sust_homes.pdf

Department for energy and climate change -
www.decc.gov.uk

Energy Savings Trust -
www.energysavingtrust.org.uk

Environment Agency -
www.environment-agency.gov.uk

Met Office -
www.metoffice.gov.uk

Netregs -
www.netregs.gov.uk

South West Climate Change Impacts Partnership -
www.oursouthwest.com

South West Water -
www.southwestwater.co.uk

UK Climate Impacts Programme -
www.ukcip.org.uk

Water Efficient Buildings -
www.water-efficient-buildings.org.uk

Waterwise -
www.waterwise.org.uk

Local listings

No current listings

Water treatment and drainage

It is important that location, design and maintenance are fully considered to minimise any impacts on the environment

Basic design principle

This topic covers two areas, the control of rain water and the treatment of waste water. Systems to manage surface water are known as **SUDS** (Sustainable Urban Drainage Systems) though they can be applied in rural or in built up areas. Private treatment of waste water is usually only necessary in isolated rural areas without access to a mains sewer. It is important that location, design and maintenance are fully considered to minimise any impacts on the environment.

Sustainability context

Large roofs and areas of hard landscaping result in excess run-off; exacerbating flooding, pollution and erosion problems, and reducing natural infiltration. Urban flooding has a number of causes, many linked to the nature and location of building developments and associated infrastructure. These causes include the impediment of natural waterways and drains, the increase in diverted run-off and also the increase in impermeable surfaces with reduced ground water recharge. With the predicted effects of climate change including heavier winter rainfall episodes effective flood prevention must be designed into every development.

Where a main sewer is not available, other systems for managing waste water are used. This is often a septic tank with a **leachfield**, which will require periodic removal of untreated solid waste. A leachfield in clay, rock or near a watercourse will be ineffective and sewage may escape into the wider environment without effective treatment.

Private package treatment plants usually require an electricity supply to aerate the sewage, but the resulting effluent is of a higher quality than from a septic tank.

Cesspits are closed systems with no discharge point that require regular emptying by a licensed sewage disposal contractor. They are the least sustainable private system and should be avoided.

The natural breakdown of organic matter requires oxygen. If poorly treated effluent is discharged into a watercourse the available oxygen will be used by micro-organisms and more complex forms of life may not survive.

Practical solutions

Reduction of surface water run-off

Soakaways are subsurface structures into which surface water is drained to allow infiltration into the ground. They may be compact, rubble-filled excavations or hollow precast concrete devices depending on the capacity required.

Filter strips are vegetated areas of gently sloping ground designed to drain water evenly off impermeable areas and filter out silt and other particulates. Landscaping should be designed to maximise this effect.

In paved areas, porous concrete blocks, crushed stone/gravel or porous asphalt can be used to encourage surface water to permeate into the ground. Depending on the ground conditions the water may infiltrate directly into the subsoil or be stored in an underground reservoir (e.g. a crushed stone layer) before slowly soaking into the ground. If necessary, an overflow can keep the surface free of water in all conditions.

Swales are shallow vegetated channels designed to conduct and retain water but may also permit infiltration. **Basins** are dry ponds which provide temporary storage of storm water; reducing peak flows to receiving waters, facilitating the filtration of pollutants and microbial decomposition as well as allowing water infiltration directly into the ground. They can vary in size and therefore can be created as features within the landscaped areas of a site. Swales and basins are often installed as part of a drainage network connecting to a pond or wetland prior to discharge to a natural watercourse.

Ponds and wetlands can be particularly beneficial during heavy rain due to their capacity to hold large amounts of water and therefore reduce flood risk. They are best suited to larger sites where they can be incorporated into landscaping schemes.

A **green roof** will retain significant amounts of rainfall within its substrate. This reduces the flow rate of rainwater from the roof which helps to mitigate flooding and keeps potable water available in the environment through transpiration and evaporation.

Some existing roofs may be converted to insulated green roofs, also improving energy efficiency and biodiversity. A structural engineer should be consulted.

Detailed Information on the design requirements for SUDS is contained in the 'Drainage Guidance for Cornwall Council' document, which can be obtained from Cornwall Council or the Environment Agency.

Private waste water treatment

Treatment occurs in stages, usually two or three to treat the effluent to an acceptable level.

Primary stages are either a septic tank, which separates and stores the solid waste, or a package treatment plant which uses an electrically driven mechanical device to stimulate aerobic microbial activity. The microbial activity breaks down solid matter, reducing its volume and toxicity, and improves the quality of the effluent.

The simplest and most common secondary stage is a **drainage field**, where effluent is discharged into the ground via perforated pipes in trenches of granular material. Microbes in the soil break down the remaining organic matter, and willows or similar damp loving species can be planted to make use of nutrients and absorb excess liquid. The size of a leachfield varies depending on the ability of the ground to absorb water, and in some cases is not viable.

Reed bed systems can also provide secondary treatment. Wastewater filters through sand and gravel in the bed where the organic matter is digested by micro-organisms. Two types exist, vertical flow and horizontal flow, with vertical flow more suited to secondary treatment.

Tertiary treatment can be a leachfield, a reed bed, or a pond where further biological activity and settlement occurs. The number of stages depends on the level of treatment required. Well treated effluent can be discharged to a watercourse, subject to Environment Agency approval.

Composting toilets are an effective and environmentally friendly way of dealing with human waste. Although usually found in remote areas, a modern composting system can be installed in the home, reducing water consumption and decreasing pressure on waste water disposal systems.

Historic conservation issues

Predicted changes in weather patterns are likely to have serious direct impacts on the historic environment. Increased storminess, more intense rainfall and flooding will be damaging to historic landscapes and gardens, historic buildings and archaeology. Therefore it is desirable to mitigate the effects of storm water and run-off. However, within historically sensitive sites works to reduce surface water run-off and private waste water treatment will need to be carefully designed and use materials sympathetic to context.

'The design integrity of some historic buildings and landscapes could be damaged by the need to provide new and more effective rainwater disposal or storage systems or flood protection features' (Cornwall LDF Core Strategy). Discreet provision of irrigation and water storage should be pursued on existing or planned projects in buildings, archaeology and parks and gardens, especially as too much water is being drawn from aquifers and groundwater sources. Additional downpipes should be sensitively located and regular maintenance of gutters and gulleys should be encouraged.

The projected changes in rainfall patterns are likely to give rise to many changes in parks and gardens. Sensitively installed water storage, where possible, may be required to cope with summer droughts while redesigned drainage may also be necessary to cope with heavy autumn and winter rain.

More frequent intense rainfall and flooding will accelerate erosion of historic fabric and archaeological sites making historic buildings difficult to insure. There is a need to monitor and comprehensively record archaeological sites. Sensitive flood prevention measures are needed for historic homes. These could include fitting removable door and window boards, snap-on vent covers or wrap-round skirts, using sandbags, and filing gaps and holes. Raising floors should generally be avoided on listed buildings.

Additional downpipes should be sensitively located and regular maintenance of gutters and gulleys should be encouraged

Run off around historic buildings should be checked to ensure that water is falling adequately away from buildings. Pooling of water will accelerate damp problems. The use of semi permeable surfacing and French drains should be examined. Possible changes in water run-off, following mine engine house shaft capping, should be considered prior to works.

Some adaptive responses to climate change may themselves have an impact on the historic environment. For example 'Hard' coastal defence is seen as untenable on much of the undeveloped coast and has led to a new emphasis on selective managed realignment and 'soft' defences (such as river banks), posing a possible risk to archaeology, buildings and landscapes. Flood protection/ managed retreat plans should be formulated to address archaeological sites, including those below the current low tide level as well as scheduled ancient monuments.

Coastal properties may also be at risk from flooding associated with sea level rise and storm surges. New flood defences, particularly in historic towns, can cause major archaeological damage along historic waterfronts and may impair the character of historic quaysides and waterside buildings and gardens.

Post-flood drying is critical, with buildings and excavated archaeology at great risk from subsidence. Ground heave and subsidence as water recedes were identified as the major issues arising from projected changes in the water table height. Coastal flooding and storm surge were also identified as extremely worrying, at least for sites in high-risk areas. Storm surges are likely to have same effect as overall sea level rise.

The Pitt Report, following the UK 2007 flooding, gives advice and recommendations for simple adaptations to existing buildings to make them more flood resistant.

Water table height and chemistry changes may also provoke problems with maintaining levels of important water features, and with the bore holes and water supplies from wells and springs on which gardens and water features depend. Regular soil analysis and testing will become vital, especially for historic plant collections.

A likely outcome of heavier future rain is a significant increase in fluvial flooding. This is not only directly damaging, but also of concern for erosion. Runoff flooding has been exacerbated by changes in land cover such as the building of roads and hard stands for car parking replacing front gardens.

Case study

Kynance Cove



Scale of development

Small - medium

Type of development

Café and holiday cottages

Sustainability features

- Design
- Energy
- Biodiversity
- Water conservation
- Water treatment & discharge
- Health and wellbeing
- Materials
- Waste
- Pollution
- Community

Features

Full consideration of all design aspects, from water to waste

Traditional design with local knowledge

LPG use in kitchen reduces CO_2 compared with usual fuel supply.

The restored cottage at Kynance Cove is now part holiday homes and part café for visitors to the cove near The Lizard Peninsula. The area is of such natural beauty and environmental significance that the design has been fully informed by local knowledge and tradition.

Building services and utility connections

The existing system of power consisted of a diesel generator with battery backup. In order to provide mains electricity and effective heating the National Trust required a full revision of services to the remote location. They decided to incorporate these in a trench, with installation of an underground LPG tank. This removed the need for overground wires, reducing the impact on the environment and visual disruption.

Energy and water

The design incorporates a turf roof with local plant species, this helps the complex to blend into the surroundings and allows for water collection. All hedging stone was reclaimed from the existing complex which meant no reliance upon transport to the remote location. Retaining walls are constructed of sweet chestnut from local sources.

There is a local spring water supply which is used for flushing toilets within the buildings, the whole site is fitted with low flush cisterns and aerated taps.

The design also has 540 photo-voltaic roof tiles for electricity generation, and solar water heating system for hot water. The guttering is fully recyclable, being galvanised zinc. All insulation is natural and windows double glazed. Low energy lighting and appliances are 'A' rated.

Waste processing

A sequencing batch reactor system monitors the waste levels and adapts for minimum energy use. As well as this, the system can deal with all types of waste from the complex, producing bathing water quality standards.

See CSBT: **www.csbt.org.uk**

Useful links / references

Code for sustainable homes, Communities and Local Government
www.planningportal.gov.uk/uploads/code_for_sust_homes.pdf

Centre for Alternative Technology -
www.cat.org.uk

Construction Industry Research and Information Association -
www.ciria.org.uk

Department for energy and climate change -
www.decc.gov.uk

Environment Agency -
www.environment-agency.gov.uk

Met Office -
www.metoffice.gov.uk

Pitt Report -
www.archive.cabinetoffice.gov.uk/pittreview/thepittreview.html

South West Water -
www.southwestwater.co.uk

UK Climate Impacts Programme -
www.ukcip.org.uk

NetRegs –
www.netregs.gov.uk

Planning Portal –
English Heritage forthcoming 2008c: Rainwater and Greywater Use and Traditional Buildings. London: English Heritage
www.english-heritage.org.uk

English Heritage 2008: Conservation Principles: Policies and Guidance for the Sustainable Management of the Historic Environment. London: English Heritage (Product Code 51393)
www.helm.org.uk/upload/pdf/Conservation_Principles_A4%5B1%5D.pdf?1251185898

Local listings

pdp Green Consulting Ltd

Architects, Stormwater Systems, Environmental Materials Specification

www.pdpgreen.co.uk
enquiries@pdpgreen.co.uk

Office 3, Calenick House, Truro Technology Park, Heron Way, Truro, TR1 2XN

Tel: 01872 265400

Materials

Careful specification of material can greatly enhance the sustainability of a building

Basic design principle

An ideal material will be competitively priced, have excellent performance, low **life-cycle impact**, be sourced locally and be appropriate for its context. Practically, most material selection will involve compromise.

The hierarchy for benign and energy efficient material selection is:

- Renewable
- Local
- Recycled
- Recyclable

Sustainability context

Careful specification of material can greatly enhance the sustainability of a building. The number of factors involved makes finding the most sustainable material difficult, however the principles of a "life-cycle approach" can help to identify which materials are more sustainable.

Embodied energy is incurred from manufacture and transport of materials; most industrial processes are highly energy intensive so generally, the more natural and unprocessed a material is the less embodied energy it has. Locally produced materials reduce embodied energy from transport and sustain local economy.

Industrial processes often involve the use and release of pollutants. Products can leach **VOCs** into the living environment and cause additional pollution when they are disposed of.

Re-used and **recycled** materials require relatively little energy in their production or procurement and avoid environmental impacts linked to extraction and disposal. They can be used in many ways while still producing a new looking building. Consideration should also be given to whether materials are able to be recycled or re-used.

Energy saving performance over the lifespan of the material should be compared with **embodied energy** to get a true picture of the overall energy performance. For example an aluminium or modern steel window frame has high **embodied energy** but will perform well in terms of air-tightness, maintenance and lifespan, and can be recycled.

Wastage of materials is, eventually, a waste of energy. Minimise over-ordering by specifying materials with low lead times and local availability. Excess materials should be re-used or given away for re-use in preference to being thrown away or recycled.

Practical solutions

The Building Research Establishment (BRE) has produced the *Green Guide to Specification* which provides a systematic assessment of the environmental impacts and benefits of many types of building elements. Selecting primarily A-rated materials from this guide gives a straightforward method for specifying more sustainable materials, although this is most relevant in new build situations.

The most sustainable materials are re-used and re-usable. Timber and aggregate from demolition is often re-used and a range of reclaimed materials including timber, slate and stone are available to buy from reclamation yards. See the Cornwall Building Stone and Slate Guide for more information.

Recycled materials follow in the hierarchy of sustainability, requiring some energy in processing and manufacture but not depleting any resource. Recycled aggregate is readily available and it is often possible to specify products which are totally or partially made from recycled material.

Where new materials are required, naturally growing products are renewable and sustainable where the resource is properly managed. Building with plant derived material such as wood and hemp is an excellent way to lock up CO_2. The use of finite resources should be minimised where possible.

Wood from independently certified sustainable forests is a natural resource with low **embodied energy**. Forest Steward Council (FSC) is the most common certification in the UK and ensures that the timber is from a well managed resource that is not contributing to deforestation.

Many processed wood products such as MDF (medium density fibreboard), chipboard and plywood contain chemical adhesives so the use of these should be minimised. Other manufactured products have certain advantages; hardboard is bonded using only temperature and pressure so is relatively benign, **glulam** beams will have lower environmental impact than steel, and manufactured I beams use wood efficiently to provide a fast, light and strong building solution.

Untreated timber can last for many years if it is from a durable species and is correctly detailed. Where treatment is deemed necessary, more natural methods are available. Treated softwood from a DIY store or builder's merchant may have been treated with toxic preservative. However it is worth enquiring as they could have a more benign alternative or decide to stock one.

Basic structure

Timber framed building is commercially competitive and is increasingly seen in new buildings. Timber frames are quick to construct and can be **pre-fabricated**, reducing waste and build time. Modern timber building methods have a design lifespan equivalent to masonry when constructed to **TRADA** specifications.

Materials such as baled straw and hemp-lime are being used in large structures that are now being delivered at costs comparable to those of far more conventional buildings. These materials could in many cases be compatible for extensions to historic structures. Timber is seeing greater use as a structural material, replacing steel and concrete, especially in domestic construction.

Heavy materials such as brick, block and concrete are durable and have the benefit of providing **thermal mass** within the building envelope. Although the **embodied energy** from the manufacture of these materials is largely unavoidable other impacts can be reduced by buying local products containing recycled materials. Using industrial by-products to manufacture materials is an effective way to reduce waste and **embodied energy**. China clay waste is suitable for manufacturing blocks and pulverised fly ash or blast furnace slag can be used to replace some cement in concrete.

Traditional local roofing material has been North Cornish slate from the Delabole area. However this is a finite resource and should be preserved for prestigious heritage buildings.

More severe weather episodes are also influencing the choice of roofing materials. Robust materials and fixing systems will need to resist predicted stronger wind and rain conditions. Where specific appearance doesn't dictate material choice sheeted materials should be considered for durability.

Finishing elements

Timber windows frames which have reduced environmental impacts and lower lifecycle costs should be used in preference to their PVC counterparts. High performance steel and aluminium windows are efficient but less suitable because of their energy intensive manufacture. Double glazing is recommended as the most cost effective way to save carbon, although there are other options for increasing the performance of windows in historic buildings.

Flooring made from natural materials that undergo little manufacturing process has reduced environmental impact and should be specified. Examples include marmoleum, cork, timber and seagrass coverings. Wool carpets and natural floor tiles, such as those made from ceramic and terrazzo also have relatively low environmental impacts.

Natural insulation materials which are approved by BRE (Building Research Establishment) should be specified. These materials have simple manufacturing processes which are less energy intensive than conventional insulation materials. Examples include flax, sheep's wool, recycled newspaper, cork, jute sacking and cellulose. As well as providing effective thermal insulation, natural materials have the ability to breathe and absorb moisture and consequently reduce the risk of condensation and damp. They also have reduced health risk during manufacture and installation and are biodegradable.

Paints that are water or vegetable oil based have less environmental and health impact than mineral oil based paints. It is important to specify micro-porous paints on timber to ensure it can breathe; this prolongs the life of the material by allowing it to maintain correct moisture content.

Historic conservation issues

Existing buildings contain considerable amounts of **embodied energy**, that is, the energy that was used in their materials and construction. Presumption should be in favour of retaining and re-using historic buildings rather than demolishing them. Poor energy efficiency leads to excessive energy consumption, contributing to climate change. Recent BRE research has shown that refurbishment of offices in contrast to new-build is often environmentally better than redevelopment (provided that air-conditioning is not used), and is usually cheaper. Sensitive solutions for the reuse of historic buildings provide vitality, character and good regeneration opportunities.

To preserve local character and historic fabric, many historic Cornish homes require the use of appropriate natural slate and stone, timber windows and breathable paints, renders and mortars. Regular maintenance, repair, sensitive

upgrading and re-use of materials is often more cost effective and more sustainable than wholesale replacement with maintenance free alternatives.

Where new buildings are proposed in historic contexts care should be taken to source sustainable materials that harmonise with their surrounding and respect local character and distinctiveness.

Older buildings function in different ways to modern buildings and need to breathe. Construction is often more porous with soft and permeable materials which respond to air and moisture differently to many of the hard and impermeable materials used in modern buildings.

It is a challenge to make historic buildings energy efficient. Thermal improvements are still possible to older properties but need to be handled sensitively as older buildings with solid walls still need to breathe.

There should be an emphasis on repair as opposed to replacement. Renovating windows rather than replacing them retains the carbon store or invested energy from the original manufacturing process. This provides a vast saving in energy from extracting raw materials through to the processing of these into finished products.

Repairing rather than replacing windows on refurbishments other than 'a change of use' does not have to comply with Part L of the Building Regulations. There is some flexibility with the Building regulations and it is often possible to increase insulation elsewhere to compensate for retention of single glazed windows on listed buildings.

It should be recognised that historic building materials are often of a better quality, more durable than modern replacements and are more cost effective in energy terms. 'Traditional softwood frames have an infinite life if properly maintained, whereas many PVC windows may not last long enough to repay their installation costs from energy savings' (English Heritage – Climate Change and the Historic Environment).

Draughtproofing, secondary glazing and internal timber shutters can all be used to improve the energy and acustic performance of windows in traditional buildings, while retaining original character.

Chimneys are visually important on historic buildings and traditionally provided a means of dispersing internal evaporation and reducing condensation. They should be retained and reused, and incorporate controllable ventilation.

Metal gutters and downpipes can be repaired and reused. They can be made of recycled metals and are much more appropriate for historic buildings than PVC alternatives which are harmful to produce, have a limited lifespan and often end up in landfill.

Photovoltaics and solar panels with their associated equipment may not be suitable on all historic buildings as they can often be visually intrusive. In some circumstances they can be sited in unobtrusive locations such as inner slopes, rear elevations, outbuildings and even at ground level. Initial justification for installations should be made to ensure that they will provide benefits to the homeowner and that performance is not impaired through incorrect orientation, slope, shade and maintenance and cleaning difficulties.

To preserve the local character many Cornish homes and buildings requires the use of slate and stone. The 'Cornish Building Stone and Slate Guide' (2007) provides information on how to source such material. Where the cost of local materials is prohibitive, environmental harm can be minimised by importing shorter distances and researching the environmental policies of the producer. Investigations could be made to reopen local quarries in some cases.

Opportunities to specify traditional materials should be encouraged to stimulate demand for indigenous materials and reduce the carbon footprint of the material supply chain.

It may be possible to use or reuse some natural materials such as slate and stone in certain circumstances. Care should be taken, however, that robbing of other historic buildings is not encouraged.

Limecrete or rammed earth can be appropriate flooring materials for many older buildings. They have lower **embodied energy** than concrete and are vapour permeable.

Natural fibre-based materials such as sheep's wool and hemp fibre are suitable for use as insulation in traditional buildings. These have good thermal insulation properties and do not hinder the movement of moisture. Materials such as fibreglass and mineral wool have a tendency to hold moisture; in older buildings this can increase the risk of damp, timber decay and mould growth.

Vernacular design is dependent upon traditional skills and building techniques and local materials. For example there are various slating styles such as random rag or scantle and areas where local long-straw thatching is found.

The demise of traditional building skills and the pressure of standardisation has resulted in replacement rather than repair- resulting not only in an adverse impact on the historic built environment but also an incessant drain upon finite raw materials and the energy embodied in their manufacture. Local traditional skills training courses are ongoing in the area. Contact your local Conservation Officer for details.

The way people use historic buildings can improve their overall performance. Small changes can have a considerable effect such as altering use patterns, correcting any maintenance backlog (e.g. cleaning windows and light fittings), repairing windows and doors, improving controls (e.g. programmable thermostats, thermostatic radiator valves), upgrading artificial lighting and portable appliances.

Environmentally friendly paints are now available that are also suitable for use on historic buildings. Such paints reduce harmful production toxins, are safe, breathable, prevent trapped moisture in walls, are healthier and have advantages in disposal.

Case study

Trygga

Scale of development

Small

Type of development

Single dwelling

Sustainability features

- Design
- Energy
- Materials
- Maintenance
- Waste
- Pollution
- Community

Features

Straw bale construction with lime render.

Extensive use of reclaimed, recycled and re-used materials.

Adaption of existing building as part of house construction

This five bedroom timber framed straw bale house shows that natural, reclaimed and recycled materials can be used extensively without compromising aesthetic sensibilities. It is let as holiday accommodation during the summer and has been featured in a Cornish lifestyle magazine.

Use of existing building

The site was acquired with a flat roof block built utility building which now forms the core of the house. Initially the local planning department resisted expansion of the existing building's footprint, however these issues were resolved and building control were subsequently very helpful with the straw bale design.

Construction and materials

A significant proportion of the wood used is salvaged and reclaimed, with the balance from local sustainable sources. The straw bale walls are self built with help from friends and family and finished with lime render internally and externally. The exterior render requires an annual lime wash to maintain condition.

The roof is made from recycled tyre tiles. Furniture, fittings and joinery are reclaimed, salvaged, modified and adapted. The bathroom suites are reclaimed and second hand, and paving is reclaimed brick.

Where possible, the house is self built. Along with the resourceful and innovative use of materials this has resulted in a house which cost significantly less than an equivalent new build.

Energy efficiency

Due to the excellent insulation properties of straw bale and low emissivity South facing glazing, space heating is only required for three hours a day in the coldest weather. Low energy lighting is used throughout.

See CSBT: **www.csbt.org.uk**

Useful links / references

BRE Green Guide -
www.thegreenguide.org.uk

Code for sustainable homes, Communities and Local Government
www.planningportal.gov.uk/uploads/code_for_sust_homes.pdf

Constructing Excellence -
www.constructingexcellence.org.uk

Cornish Concrete -
www.cornishconcrete.co.uk

Cornwall Building Stone and Slate Guide
www.cornwall.gov.uk/idoc.ashx?docid=8e16a1e4-0309-4831-90d5-94444fe893ed&version=-1

Devon & Cornwall Master Thatchers Association -
www.devonandcornwallmta.co.uk

Forest Stewardship Council UK
www.fsc-uk.org

Freecycle -
www.uk.freecycle.org

Green Book Live -
www.greenbooklive.com

Re:Source -
www.myresource.org.uk

SalvoWeb -
www.salvo.co.uk

South West Eco-Warehouse -
www.sw-ecowarehouse.co.uk

UK Reclamation Yard Directory -
www.uk-reclamation.co.uk

Waste Resources Action Programme – WRAP -
www.wrap.org.uk

English Heritage 2007c: Energy Conservation in Traditional Buildings. London: English Heritage (Product Code 51367)- good basic guidance with illustrations
www.helm.org.uk/upload/pdf/89410-EnergyConservation1.pdf?1247645803

English Heritage 2007d: Cutting Down on Carbon: Improving the Energy Efficiency of Historic Buildings. Summary of Government Historic Estates Unit Annual Seminar, Building Research Establishment, Garston, 9 October 2007
www.helm.org.uk/upload/pdf/BRE-seminar.pdf?1250845158

Forest Stewardship Council -
www.fsc.org

Building Regulations and Historic Buildings - Balancing the needs for energy conservation with those of building conservation: an Interim Guidance Note on the application of Part L
www.helm.org.uk/upload/pdf/ign_partl_buildingregs.pdf?1247645803

Yates,T. 2006: Sustainable Refurbishment of Victorian Housing – Guidance, Assessment Method and Case Studies. Watford: Buildings Research Establishment Trust
www.brebookshop.com/details.jsp?id=286929

Baker, P 2008: Improving the Thermal Performance of Traditional Windows. Glasgow Caledonian University, for Historic Scotland
www.historic-scotland.gov.uk/thermal-windows.pdf#xml=http://web1:10700/texis/webinator/pubssearch/pdfhi.txt?pr=publications&prox=page&rorder=500&rprox=500&rdfreq=500&rwfreq=500&rlead=500&rdepth=0&sufs=0&order=r&id=4a89fda47

Mitchell, D 2008: INFORM Guide - Energy Efficiency. Published by Technical Conservation Group, Historic Scotland
www.historic-scotland.gov.uk/inform_guide_-_energy_efficiency.pdf

Energy Heritage, A guide to improving energy efficiency in traditional and historic homes, Changeworks:
www.changeworks.org.uk/content.php?linkid=373

Renewable heritage, A guide to microgeneration in traditional and historic homes, Changeworks:
www.changeworks.org.uk/content.php?linkid=424

Ventrolla Green Pack:
www.ventrolla.co.uk/uploaded/Green%20Pack.pdf

Climate Change and the Historic Environment 2005, UCL Centre for Sustainable Heritage:
eprints.ucl.ac.uk/2082/1/2082.pdf

Local listings

Cob in Cornwall

Specialist Skills, Materials

www.cobincornwall.com
info@cobincornwall.com

Manaccan, Helston, Cornwall, TR12 6EN
Tel: 01326 231 773

pdp Green Consulting Ltd

Architects, Stormwater Systems, Environmental Materials Specification

www.pdpgreen.co.uk
enquiries@pdpgreen.co.uk

Office 3, Calenick House, Truro Technology Park, Heron Way, Truro, TR1 2XN

Tel: 01872 265400

Waste

Minimise the impact of waste by choosing materials that are natural and recyclable

Basic design principle

Reduce waste and associated costs by designing, specifying and building in ways that make the best use of materials, and allow maximum recyclability at the end of the building's life.

Minimise the impact of waste by choosing materials that are natural and recyclable, and separating recyclable and re-usable waste on site to prevent it going to landfill.

Provide facilities for segregating material and recycling during occupation of the building.

When demolishing, re-use material on site where possible. Any material which cannot be re-used should be recycled or re-used elsewhere.

National data shows that between 70% and 90% of collected household waste is recyclable or compostable

Sustainability context

Every year the South West produces 12.5 million tonnes of construction and demolition waste.

National data shows that between 70% and 90% of collected household waste is recyclable or compostable. Apart from squandering resources, landfill disposal and incineration creates a range of other environmental problems.

Waste is one of Cornwall's biggest issues. In 2008, Cornwall produced approximately 324,281 tonnes of municipal waste. Of this, 204,557 tonnes (63%) was sent to landfill and only 105,921 tonnes (33%) was recycled or composted.

The introduction of the Landfill Tax has created a significant financial incentive to reuse and recycle materials. It also makes using recycled materials in construction a more attractive financial option. The Aggregates Levy sends a similar message about reducing the unnecessary use of new minerals and supporting the re-use of construction and demolition materials.

Minimisation and effective management of building waste reduces the demand on finite resources. It also helps to minimise the environmental risks and impacts associated with resource extraction, transportation and disposal.

Practical solutions

Prepare a Site Waste Management Plan, forward planning and active management can reduce waste. Planning and monitoring waste management is required for proving the environmental credentials of a project.

Always remember the waste hierarchy: Reduce, Re-use, Recycle. Everything that is produced consumes energy and natural resources, if less is wasted then less will need to be produced. Recycling conserves natural resources but still requires energy to transport and process the material, therefore it is better to re-use where possible.

Provision of space or facilities for the separate collection of recyclable materials, or easy access to recycling facilities, is recommended inside as well as outside the building. For more information about recycling and composting see the Recycle for Cornwall website.

Flexible design is an important concept in that it can lead to the re-use of a building, prolonging its lifespan. Flexible design also reduces the need for major refurbishments. **Prefabricated** components can help minimise waste as the most labour intensive and often most wasteful processes have already been done. Modular or standardised components can also reduce waste at the outset. The design of new roofs could be with purlins instead of trusses to allow for future expansion within the roofspace and avoid the need for additional building.

A waste audit is a tool to assess how waste materials can be sustainably managed through the construction process and subsequent operation/occupation of the development.

For all development proposals, developers should:

- Audit the materials present on a site and assess the extent to which they could be put to use in the new development or in other developments elsewhere.
- Identify any hazardous materials (e.g. asbestos) on site and arrange for containment and disposal by a licensed operator.
- Assess the potential for using reclaimed and recycled materials from elsewhere.
- Consider the life span of all construction materials used, new and recycled, and the ease with which they could be disposed of or used again once the structure reaches the end of its life.

Historic conservation issues

ODPM Select Committee Report 2004 commented that: '**Something like 24% of all waste is generated by demolition and construction. It is simply better in sustainability terms to use and recycle old buildings than to demolish them and to build new ones**'.

Demolition and replacement means not only losing all of the resources embodied in the original building, but also the investment of yet more energy for demolition, the creation and delivery of new construction materials, the building process itself, and the disposal of the resultant waste. English Heritage has commented that '**When our historic buildings stock is needlessly demolished, the stored embodied energy goes to waste, to demolish a Victorian terraced house is to throw away enough embodied energy to drive a car around the world five times'.**

Presumption should always be in favour of converting historical buildings rather than replacing them with new buildings. As well as retaining original fabric it avoids the unnecessary production of new building products. Historic buildings represents a significant past investment of energy and materials as well as in most cases a quality traditional vernacular construction. The regular maintenance and repair to historic buildings and the re-use of materials reduces unnecessary waste.

Sustainability requires us to make the best use of what we already have and reusing old buildings conserves **embodied energy** and in most cases will be a more sustainable option than demolition and new build. All the traditional materials used to build old houses are either recyclable or are a renewable resource.

Environmentally friendly natural paint ranges for exterior and internal use, which allow walls to breathe, are now available. A number of these are bagged as opposed to tinned. This reduces harmful production and has disposal benefits. Leftover paint is classed as hazardous waste.

Useful links / references

Environment Agency -
www.environment-agency.gov.uk

EH Heritage Counts 2004 -
www.heritagelink.org.uk/docs/heritage_dynamo.pdf

Recycle For Cornwall -
www.recycleforcornwall.org.uk

Waste Resources Action Programme -
www.wrap.org.uk

NetRegs -
www.netregs.gov.uk/

EH Guidance: Understanding SAP ratings
www.helm.org.uk/upload/pdf/SAP_ratings.pdf

Local listings

Wardell Armstrong

Environmental Consultants

www.wardell-armstrong.com

Wheal Jane, Baldhu, Truro,
Cornwall, TR3 6EH

Tel: 01872 560738

SITA Cornwall

Waste Management

www.sitacornwall.co.uk

United Mines, United Downs, St. Day,Redruth, Cornwall, TR16 5HU

Tel: 08456 300300

Case study

Mt. Pleasant

Scale of development

Medium

Type of development

Commercial, Eco Park

Sustainability features

- Design
- Energy
- Water conservation
- Water treatment & discharge
- Health and wellbeing
- Materials
- Waste
- Community

Features

Full biomass boiler helps reduce waste and power buildings

Cost of build, approximately £800/m^2

Reclaimed materials used throughout

Mt. Pleasant's six workshop units were completed in July 2004 in Porthtowan near Truro. The project was to offer eco-workshops for local businesses, providing a sustainable base for work in the area. The site incorporates a number of features for energy reduction.

Construction and materials

The existing agricultural building was extended in original block. The structure is a majority rammed earth, with reclaimed timber gables and a lime/sand render. This keeps with the local traditional look, using many local and reclaimed materials. The roof tiles are made from recycled tyre rubber.

The building utilises as much natural lighting as possible and construction materials give a high thermal mass, increasing the efficiency of space heating.

Renewable energy and water saving

The site uses a large biomass boiler, this can have a twofold advantage in that not only does it burn any bio waste, but the site actually generates useful waste from Pioneer fabrication work.

There are solar thermal panels fitted for energy gains and rainwater is harvested for use in the workshops. All light fittings are low energy.

Site considerations

Costs were just £800/m2 for the site development. There was resistance to the extension of the building and many small compromises were made including the use of mezzanine floors instead of a second storey.

Some costs associated with the sustainable technology are; Boiler (Farm 200) was £3,800, Solar Thermal panels were £3,000 and plumbing with storage tank was £8,000.

See CSBT: **www.csbt.org.uk**

Pollution

It is critical to ensure that builders and contractors have sound environmental management practices

Basic design principle

To minimise polluting emissions to water, air and soil and minimise noise and light pollution by remediation of existing on-site pollution and management of potential pollutants during construction and operation.

Sustainability context

The construction process can create noise, dust, water and air pollution which damages the environment and causes nuisance to nearby residents. Post-construction, buildings can continue to affect external air quality and contribute to noise and light pollution. Again, this causes nuisance and, in the case of light pollution, wastes energy through inadequately designed lighting.

Practical solutions

The client is responsible for pollution occurring as a result of construction work. It is therefore critical to ensure that builders and contractors have sound environmental management practices.

On-site Contamination

Residual industrial pollution exists in many areas of Cornwall. In any area with a history of industrial activity the soil should be tested before it is disturbed or removed.

Existing structures may contain asbestos which must be removed and disposed of safely. See the Health and Safety Executive's asbestos web resource.

Minimise construction related pollution

It is in the interests of construction companies to minimise pollution as breaches of regulations can result in significant fines. In most cases complying with codes of practice and adopting best practice should minimise nuisance to neighbours and safeguard the environment. The Considerate Constructor Scheme provides a way of managing construction to minimise pollution and is recommended by Cornwall Council. Noise on construction sites is regulated by Local Authorities under the Control of Pollution Act (COPA) 1974.

Minimise impact on external air quality

Air quality impacts can also be significant. Developers and operators need to assess the emissions that would result from heating, cooling and ventilation plant. In particular they should specify heating plant with low nitrous oxide emissions and cooling systems which do not use ozone depleting or global warming substances.

The environmental impact of a development can extend far beyond the site, especially in relation to traffic movements and related air pollution. Transport impacts should be mitigated through the development of traffic reduction measures and the promotion of more sustainable modes of transport.

Minimise noise and light pollution

Transmission of noise can be a problem between dwellings such as flats and terraced housing. It can also be a problem in other buildings such as open plan offices. Ventilation and heating plant can also produce noise pollution particularly when located on roofs. Buildings located near busy roads, railways or industrial sites may also suffer from high noise levels.

Design of buildings can minimise these problems if attention is given to:

- Adequate sound insulation in floors and walls
- Sound insulation for plant rooms and plant housing
- Double glazing on all aspects exposed to high levels of noise
- Ventilation on aspects exposed to high levels of noise – natural ventilation by opening windows may not be a practical option

Light pollution has emerged as a significant issue in populated areas. Light pollution obscures the night sky, is wasteful of energy and can also be disruptive to both wildlife and those living in and beside any new development. Public safety requires that highways and other public space are illuminated. However, light pollution can be reduced by the use of directional lighting, as can energy costs, without any loss of illumination.

Minimise Internal Air pollution

Many synthetic and processed materials release volatile organic compounds (**VOCs**) which can be detrimental to human health, particularly finishing products such as paints and floor coverings. Specification of natural materials will result in improved internal environment with benefits to the wider environment (see Materials section for more information).

Effective ventilation is necessary to remove stale and polluted air. Where a building is significantly **airtight**, a ventilation system with heat recovery will keep air fresh and regulate humidity while retaining up to 90% of the heat from expelled air.

Minimise Embodied Pollution

Any product or material will have associated environmental impact resulting from its manufacture, transport and storage. Specify local natural materials which are manufactured without toxic chemicals. Also consider potential for pollution at the end of the life of the material. See the Materials section for more information.

Historic conservation issues

PVC windows are often preferred to timber because of their cheaper cost and reduced maintenance. PVC has environmental issues; the manufacturing process is long and produces toxic by-products, it is difficult to recycle so will often end up in landfill where it does not bio degrade and it is hazardous when burnt.

PVC windows alter the character and appearance of a house, gradually discolour and degrade requiring complete replacement if one element fails. Timber windows have comparable thermal characteristics to PVC. Older timber is usually of higher quality to modern timber and can be patch repaired, providing cost benefits and a renewable resource with low embodied energy. Repair retains the original character and appearance and if properly maintained can last for hundreds of years.

English Heritage's Heritage at Risk Register 2009 shows that Local Authorities believe that the top threat to conservation areas is plastic windows and doors. An English Heritage poll of estate agents reveals that 82% think original features add value to a property and 75% think being in a well-kept conservation area enhances house prices.

Useful links / references

Environment Agency -
www.environment-agency.gov.uk

Construction Industry Research and Information Association -
www.ciria.org

HSE Asbestos -
www.hse.gov.uk/asbestos

Ventrolla Green Pack:
www.ventrolla.co.uk/uploaded/Green%20Pack.pdf

Local listings

Wardell Armstrong

Environmental Consultants

www.wardell-armstrong.com

Wheal Jane, Baldhu, Truro, Cornwall, TR3 6EH

Tel: 01872 560738

Case study

Burntwood



Scale of development

Small

Type of development

Detached house

Sustainability features

- Design
- Energy
- Biodiversity
- Water conservation
- Water treatment & discharge
- Health and wellbeing
- Materials
- Maintenance
- Waste
- Community

Features

Carbon neutral living – Energy generated on site equivalent to energy consumed.

Designed for passive performance with sunspace, thermal mass and heat exchange ventilation.

Local wood used extensively in construction, reducing embodied energy

Designed for low impact through choice of materials, energy efficient design and renewable energy technologies.

Passive performance

Designed by Arco2 Architects and built with the help of friends, family and WWOOF volunteers, the building makes good use of natural heating and lighting. A 'sunspace' on the South Corner of the house is a full height glazed facade with stone faced block walls to the interior, this area collects solar heat which can be distributed through the house by a heat-exchange ventilation system. Windows at the top can be opened to dispel excess heat.

Externally insulated concrete slab and block retaining walls provide thermal mass to balance temperature fluctuations. Argon filled double glazing is used throughout.

Low impact materials

Ninety percent Cornish timber, much of which was sourced from an adjoining forest, milled and air dried on site. Douglas Fir post and beam frame with Western Red Cedar roof shingles and cladding boards. Western Red Cedar does not require treatment or painting which reduces pollution and maintenance costs. Sheep's wool insulation provides 225mm in the walls and 300mm in the roof. The wool is reclaimed from carpet manufacturing by-product. An existing building was demolished providing aggregate for the driveway and the kitchen features worktops cut from reclaimed billiard table slate.

Energy

A MORSØ 8kW log stove is fuelled with wood coppiced from the eight acres of woodland which make up the property. Heat is distributed through the building by the ventilation system so radiators are not required.

Roof mounted solar photovoltaic panels with Sunny Boy grid tied inverter have a 4.2 kW installed capacity, generating around 4,000 kWh per year which is approximately equal to the yearly consumption of this three bedroom house.

A roof mounted, 4 m2flat plate solar thermal collector reduces the demand on electricity for hot water heating.

Electricity is also conserved by using energy efficient lighting and appliances, including an induction hob. Ecoballs are used in the washing machine, avoiding pollution caused by detergents and saving water.

See CSBT: **www.csbt.org.uk**

Maintenance

Maintenance of buildings can reduce energy use by ensuring that the building and systems are functioning as they should

Basic design principle

To follow a design hierarchy where the structure performs passively, reducing the need for complicated gadgetry. Keep it simple and understandable to reduce the risk of system breakdown. Where electronic and mechanical systems are unavoidable, clear and simple instructions should be provided for the buildings occupants, in houses this would be referred to as a Home User Guide.

Buildings need to be assessed on their individual merits and decisions taken as to the most appropriate alterations and improvements to make them more efficient and pleasant whilst not over complicating the living conditions of the occupants.

Finishes should be specified which are durable, easily repaired and require minimal routine maintenance.

Sustainability context

Maintenance of buildings can reduce energy use by ensuring that the building and its systems are functioning as they should. However, maintenance and refurbishment uses resources, energy and time so it is imperative to design low maintenance buildings.

Designing a flexible building can extend its lifespan. If a building can be easily extended or modified it is more likely to be adapted for other uses instead of being demolished.

A low maintenance building will reduce the life-cycle impact by reducing demand for materials and extending the life of the building.

Practical solutions

During building maintenance there are always opportunities to reduce environmental impact. Choose low impact, low maintenance high performance materials (see the Materials section for further information).

Repairing rather than replacing has a much lower environmental impact and can preserve the character of a building. Less waste will be created and less material will be used.

When rented or sold each home should have a simple and non-technical user guide that covers information relevant to the occupants on the operation, environmental performance and maintenance of the home. The information should be available in alternative accessible formats. Ideally it should also include tips for sustainable living.

Management during the occupation stage of development will help monitor environmental performance and provide vital feedback information for further improvement.

There should be a commitment to comply with the 'Secure by Design – New Homes', which will include working closely with an Architectural Liaison Officer or Crime Prevention Design Advisor from the local police force.

Historic conservation issues

Good maintenance is vital to preserving the historic character of Cornish buildings. Maintaining and repairing using traditional methods and materials will sustain local knowledge of traditional, low impact building methods.

The way people use historic buildings can improve their overall performance. Small changes can have a considerable effect such as altering use patterns, correcting any maintenance backlog (e.g. cleaning windows and light fittings), repairing windows and doors, making sure that windows open properly, improving controls (e.g. programmable thermostats, thermostatic radiator valves), upgrading artificial lighting and portable appliances. Guidance should be produced by the local authority to encourage property owners to sympathetically improve the performance of their buildings.

To preserve local character and historic fabric, many historic Cornish homes require the use of appropriate natural slate and stone, timber windows and breathable paints, renders and mortars. Regular maintenance, repair, sensitive upgrading and re-use of materials is often more cost effective and more sustainable than wholesale replacement with 'maintenance free' alternatives.

Property owners, professionals, contractors and general public should be made aware of various key issues including:

- Heritage significance and the relevance to this of climate change issues
- The promotion of the sustainable use and reuse of traditional materials including sourcing
- Producing a building log book as part of a conservation plan for each listed property

Useful links / references

SPAB technical advice:
www.spab.org.uk/advice/technical-q-as

A Stitch in Time - Maintaining your property makes good sense and saves money - IHBC/SPAB:
www.ihbc.org.uk/publications/hard_copy/stitch_in_time/SPAB%20PDF%27s%20%28D%29/Stitch%20in%20Time.pdf

Local listings

No current listings.

Case study

Trelowarren

Scale of development

Small

Type of development

18 dwellings plus restaurant

Sustainability features

- Design
- Energy
- Biodiversity
- Water conservation
- Water treatment & discharge
- Health and wellbeing
- Materials
- Waste
- Community
- Access, Equality & Diversity

Features

Full community integration

Locally employed inhabitants

On site bio treatment plant and CHP wood burner

Located on the Western side of the Helford Passage, the Trelowarren estate sits on a 1,000 acre site of agricultural land and woodland. Its 18 individual properties are shared ownership self catering holiday cottages, some restored from older buildings, some purpose built with the development.

Construction and materials

All materials are locally sourced, with the proprietary timber frame helping to reduce thermal bridging significantly. The cladding comprises green oak which requires no painting, this helps to improve the ease of maintenance associated with the development.

The walls contain 300mm thickness Warmcell insulation with U-values exceeding 0.15. The buildings all have good air tightness values to decrease the need for space heating further.

During the construction process, buildings that were not converted were demolished and fully recycled in order to reduce waste.

Energy efficient design and technology

A 300kW wood chip burner provides a source of hot water for the site through coppicing of the forested areas of the site.

Waste water is treated on site through a small bio treatment plant making the community more self-sufficient. The use of aerated taps and low flow appliances reduces the level of water use day-to-day.

Local community

25 people are directly employed at the site, building a local community whilst reducing the need for travel in the area. A further 25 are employed directly by T.E.L Builders – the estate owners.

See CSBT: **www.csbt.org.uk**

Ecology and biodiversity

We rely on many natural products including food, medicines and timber which are provided by biological activity

Basic design principle

To design and construct buildings and landscapes which sustain and promote biodiversity.

Sustainability context

We rely on many natural products including food, medicines and timber which are provided by biological activity. Natural resources like clean water, healthy soil and pollination rely on healthy, functioning ecosystems.

The built environment and its surroundings offer many opportunities to contribute to an increase in the county's biodiversity. Buildings and their surroundings can help to provide suitable habitats supporting a wide range of species that flourish in urban environments.

The built environment and its surroundings offer many opportunities to contribute to an increase in the county's biodiversity

Biodiversity considerations in the planning and design stage should take into account the individual nature of the site. Factors which may be important include the ecological value of the site, how the value can be protected and enhanced and the potential ecological footprint of the building.

Some wildlife species are protected by law. This includes all species of bat, including their roost sites, and it is illegal to damage, destroy or obstruct access to a bat roost. Some bird species, including the barn owl, are also legally protected and it is an offence to intentionally or recklessly take, damage or destroy the nest of any wild bird while that nest is in use or being built (Wildlife & Countryside Act and Countryside & Rights of Way Act).

Badgers and their homes (setts) are protected by law and it is an offence to damage, destroy or obstruct access to a sett. Developers may be required to establish if protected species are present before building work commences and provide mitigation as part of the project.

Habitats associated with buildings can act as bridges within a wider network of connected green spaces, allowing wildlife to develop more freely. The 'greening' of a building can also have other benefits which enhance health and well being.

Embracing sustainable design and construction principles can have far reaching impacts on biodiversity at a local, national and international level, particularly by using timber from certified sustainably managed forests.

Practical solutions

The site should be assessed by a suitably qualified ecologist who can recommend features and design for positive enhancement of ecology and biodiversity. They will also identify any legally protected species present on site and advise on mitigation which can allow work to progress.

Almost all sites will have some existing or potential value as wildlife habitat. Site design and landscaping should seek to preserve or enhance existing habitats, species and features. Cornwall's designated sites of nature conservation importance are detailed in the Cornwall Local Development Framework.

It is usual for new buildings to be airtight and many designs will deal with this by removing or sealing small gaps normally found in older buildings. These gaps give bats and small birds nesting opportunities. Where new design criteria remove these opportunities alternative nest sites can be incorporated as design features in eaves, external walls and garden sheds. Sensitively designed access areas can also be designed into roofs of historic buildings.

Where an existing building is being converted a thorough ecological investigation should be carried out. Flora and fauna may either be using or may have the potential to use the existing building, and steps should be taken in the design of the conversion to accommodate those species.

Installation of nest boxes for birds and bats in suitable locations can provide valuable habitats. Consideration should be given to the landscaping in the vicinity of the nest boxes. Bat bricks with cavities to accommodate bats can be integrated into the fabric of the building. These range from simple bat access bricks to bat roosting units with roughened inside faces to facilitate roosting.

Green roofs provide many benefits to ecology and biodiversity. By replacing the footprint of the building which is lost with a habitat of similar size a net loss may be avoided. The type of habitat provided will depend on the type of green roof installed.

There are three main categories of green roof:

- Intensive - Roof gardens, similar to gardens or parks at ground level, usually constructed over reinforced concrete decks, normally accessible, requiring frequent maintenance.
- Semi-intensive - Vegetated with lawns, grasses and ground covering plants; they require regular maintenance including irrigation. Moderate demands are placed upon the building structure, with occasional access required.
- Extensive - Vegetation normally consists of mosses, succulents, herbs or grasses. They are intended to be self-sustaining and not irrigated, with minimal maintenance requirements. This type is normally not accessible except for basic maintenance and is the least demanding on the building structure.

Green roofs also provide insulation and reduce water runoff, improving the performance of the building.

Planting on façade walls has a number of biodiversity benefits including providing additional wildlife habitat, maintaining cooling in summer and reducing heat loss in winter. Green facades include lichens, mosses, grasses, flowering and climbing plants. A trelliswork that is spaced away from the wall can be used to support non-clinging climbing plants. Native species should be used, with preference to those resistant to predicted climate change.

A sustainable drainage system can be designed and constructed to create a small pond or wetland for wildlife. A pond will provide a valuable habitat for wildlife can be an attractive feature within a development. It should be positioned somewhere sunny and away from trees. The pond should have gently sloping banks to encourage the growth of marginal plants and allow animals safe access.

The creation of "urban habitats" can blur the distinction between urban and rural environment, amplifying the benefits of the green infrastructure network. Urban habitats can bring benefits not only to wildlife but also improve quality of life through contact with nature and green spaces. **Green roofs** can provide a close mosaic of bridging habitats in the urban environment, allowing species to permeate a whole area. In addition, intensive green roofs assist the objective of providing accessible greenspace for urban dwellers, particularly with pressures of increasing density requirements.

See Cornwall Wildlife Trust - Planning Good Practice Guidance for Cornwall: Biodiversity and Geological Conservation.

Historic conservation issues

Proposals for alterations, extensions or conversions to historic buildings and sites need to fully consider the biodiversity issues because the special characteristics of these places often means that they are rich in wildlife.

Works from roof repairs, timber treatment, new lighting to vegetation clearance can all have harmful impacts on biodiversity. Mitigation will need to be carefully planned, timed and designed to minimise any harmful impacts, enhance potential habitats and preserve the character and special historic interest of the site.

The planting and use of locally grown building materials such as thatch, hemp, oak and cedar should be encouraged. This provides a locally available material source that could be used on both modern and historic buildings.

The alteration of agricultural and forestry practices, resulting from changes in crop stock or species viability, could pose a risk to buried archaeological sites, traditional farm buildings and historic landscape.

Increased rainfall could lead to drainage problems in historic parks and gardens. Drainage redesigned to cope with predicted heavier rainfall may prove even more difficult to integrate with historic parks and gardens. The very planting able to cope successfully with dry summer conditions is likely to be at risk from water logged soils in winter. Water logging also destabilises trees making them more susceptible to topple in predicted stronger wind storms.

Changes in soil moisture content could also lead to subsidence and heave affecting buildings and ruins.

Changes in temperature may also require a different range of tree species to deliver shade in drier conditions. Warmer conditions are likely to increase the risks from pests and diseases: particularly for plant collections and structural planting.

Shelter belt re-design may be required for some parks and gardens and historic ruins in order to address uncertainties with future wind conditions. This could have implications for buried archaeology. 'Green carpets' around monuments act as a dust control measure and may require more robust grass species in the future.

Case study

Patreida Barn

Scale of development

Small

Type of development

Single dwelling upgrade

Sustainability features

- Design
- Energy
- Biodiversity
- Water conservation
- Water treatment & discharge
- Materials
- Pollution

Features

Re use of materials (recycled plastic insulation)

Use of gasifying log boiler for effective space heating

Evacuated solar tubes

The upgrade of a property in Callington set in a wooded valley near Dartmoor. The work took place in May 2008 to install a batch boiler, solar thermal tubes and insulation to the house.

Insulation

The property was lacking insulation, and being a traditional building without cavity walls the only practical place to insulate was in the roof. By using a recycled plastic insulation material the depletion of natural resources was avoided.

Installed technology

In order reduce the demand for wood the south facing out-house roof has had 60 solar thermal evacuated tubes fitted for energy collection. A Baxi 30 gasifying log batch boiler was installed in the out-house. This provides both heating and hot water to the house and was installed with a full set of new radiators.

The woodland on the property provides all the fuel required, work associated with gathering fuel is up to one day per week over the year.

Although the installation was more expensive than a fossil fuelled solution, all fuel is free and the owners also enjoy the security and satisfaction of being able to heat their home with self sufficient, zero carbon fuel sources.

Ecology

The land acts as a smallholding with animals living and vegetables growing, to use the land to its maximum potential. Sustainable woodland management techniques are used when gathering fuel for the batch boiler, preserving local ecology and habitat.

See CSBT: **www.csbt.org.uk**

Useful links / references

The Barn Owl Trust -
www.barnowltrust.org.uk

The Bat Conservation Trust -
www.bats.org.uk

The British Trust for Ornithology -
www.bto.org.uk

Cornwall Wildlife Trust -
www.cornwallwildlifetrust.org.uk

The Royal Society for the Protection of Birds -
www.rspb.org.uk

Badgers on site – a guide for developers and planners. Cox, P.R (1993) ISBN 1851631682

Barn Owls on site. English Nature (2002) ISBN 1 85716 6108

Barn Owls. Various free information leaflets produced by the Barn Owl Trust

Bats in houses. Hutson A.M.

Bats in roofs – a guide for surveyors. English Nature

Local listings

Cornwall Environmental Consultants

Ecological Surveys and Consultancy

www.cec.gb.com
enquiries@cec.gb.com

Five Acres, Allet, Truro, TR4 9DJ

Tel: 01872 245510

greenecology

Ecological Surveys and Consultancy

www.green-ecology.co.uk
devon@green-ecology.co.uk

Carrick Business Centre, Commercial Road, Penryn, Cornwall, TR10 8AR

Tel: 01326 389 105

Health and well-being

it is crucial that buildings are healthy and accommodating environments

Basic design principle

Where existing developments have features which are appreciated by the occupants, care should be taken to not lose these features in adaptations as they contribute to the feeling of well-being and general health of the occupants.

Sustainability context

Most people spend a large proportion of their time in buildings. Therefore, it is crucial that buildings are healthy and accommodating environments. Various factors contribute to this; benign non-toxic materials, natural daylight and good ventilation are important. However, it is just as important to ensure feelings of safety, mental well-being and happiness engendered by the building surroundings being safe and secure, warm, well lit, with no dark alleys and where the public realms are overlooked but each dwelling has access to at least some private outdoor space and nature.

Over time the requirements of buildings change. It is important that buildings can be easily adapted to the needs of future users and the demands of future uses. The buildings designed at present will come under increasing pressure in future to accommodate the demands of new uses. Adapting buildings now, to address the likely impacts of climate change, can avoid the costly process of demolition and reconstruction, which can put further pressure on environmental resources.

The health and well being of the occupants today and in the future is clearly important. Whereas fashions will change, the basic needs of having homes which maximise the use of daylight, provide a comfortable private space which is well heated, ventilated and insulated are unlikely to change. In addition, the best utilisation of space around houses is important if predictions for a warmer climate are correct.

Practical solutions

Daylight

Natural light is essential for the health and well-being of any individual. Homes should meet the following standards;

Kitchen to achieve minimum average daylight factor of at least 2%.

Living rooms, dining rooms and studies to achieve a minimum average daylight factor of at least 1.5%.

Kitchens, living rooms, dining rooms and studies to be designed to have a view of the sky.

Sound Insulation

Appropriate soundproofing is essential to reduce noise pollution and to ensure privacy for individuals. It is advised that sound insulation achieves a higher standard than required by Part E of the Building Regulations and this is demonstrated by either using post-completion testing (PCT) or Robust Details (RD).

Private Space

It is important that every residential dwelling has provision of outside space that is at least partially private, and that is accessible to disabled people.

Lifetime Homes

Flexible residential development

Flexible residential design is focussed on accessibility and design features that make houses flexible enough to meet whatever comes along in life: a teenager with a broken leg, a family member with serious illness, or parents carrying in heavy shopping and dealing with a pushchair. Cornwall Council has already prepared Supplementary Planning Guidance concerning "Access for All" which will be relevant in designing flexible future development.

The Part M building regulations provide a baseline for designing for accessibility. "Lifetime homes" features supplement the requirements of building regulations and add to the built-in flexibility that makes homes easy to adapt as peoples' lives change.

Further information on "Lifetime homes" is available at: **www.lifetimehomes.org.uk** which suggests that not only will the occupiers of homes benefit from Lifetime Homes, but so too will tax payers - to the tune of £5.5 billion over sixty years. These savings come from reduced expenditure on adaptations and reduced need to move people to residential care. There could also be further savings in health care and re-housing costs.

Flexible non-residential development

Difficulty in adapting buildings to change often leads to their premature redundancy and subsequent demolition. Even before redundancy, failure or inability to adapt and upgrade buildings can compromise occupant comfort and, in commercial buildings, reduce their productivity.

The pace of change in all walks of life has never been greater. Changing work patterns, new technologies, changing demographics and new legislation are all putting new and different demands on buildings.

To become more sustainable, it is important that buildings are designed to accommodate changing requirements. By doing so, buildings will last longer and greater value will be extracted from the resources (materials) invested in the buildings.

There are four principal areas in which buildings can be made more flexible and/or adaptable:

Structural extension

Internal flexible space

Flexible building services

Flexibility to integrate new technologies

Structural extension

The ability to extend buildings can be important to respond to the changing business needs of the building owner or occupier. Structural systems that can easily be adapted and extended should be specified.

The benefit from Lifetime Homes to the tax payers will be to the tune of £5.5 billion over sixty years

Internal flexible space

It is estimated that British businesses currently spend more than £2 billion per year on moving people or departments around office buildings in response to organisational change. This process is often called churn.

Structural issues that need to be considered to provide flexible internal space include:

The structural design (column spacing, circulation space, stairs etc.)

Building footprint

The building envelope

Flexible building services

In practice, space planning elements may have to be adapted on a much more frequent basis than the building structure and IT is typically obsolescent within three years. In general, long-life building features such as the structure and floor plan should allow as many servicing and layout options as possible to accommodate changes in the building servicing strategy.

Flexibility to integrate new technologies

Advances in new technologies are constant. New developments should considered potential future advances in technology and provide flexibility for delivering power, voice and data. As far as possible, systems should be provided that are controllable and adjustable by the users without burdensome reliance on outside contractors.

Climate change

Predicted climate changes are likely to have a significant impact on the built environment during this century and therefore need to be considered at an early stage in building design.

The key changes, which are likely to be experienced over the coming years are as follows:

Drier summers could cause an increase in subsidence claims in vulnerable areas. Drier summers will also stretch already fragile water resources in the south of England, requiring extra resources to be created or a re-education of demand. (See 'Water' section for advice on water conservation measures). Drier summers will also increase energy demand for air conditioning systems (See 'Energy' section for advice on solar passive design for ventilation). Consideration should be given to features of housing designed for hot climates. For instance, Mediterranean features such as shutters and verandas. However, any design will also need to consider the extremes of predicted winter weather and arrive at a design, which balances these factors.

Changing rain patterns could see an increase in the intensity of rainfall. Driving rain will have major impacts on the suitability of some types of house facings and cavity-fill insulation and give a much higher risk of damp problems, especially in the autumn. Hence water butts need an overflow pipe into the mains drainage system.

Increasing the strength of roof fixings during new build or roof replacement can significantly reduce wind related damage.

Design and orientation of buildings can minimise wind damage, subsidence in clay soils, dampness from rain penetration and weather damage to materials. In most cases, the cost of making the necessary improvements to building stock will be much lower than the potential cost of damage. Hard structures like close boarded fences will cause more turbulence (and risk of damage) than softer enclosures such as hedging and trees.

Building for Life

For more information go to
www.buildingforlife.org

Sick Buildings Syndrome (SBS)

Causes are frequently pinned down to flaws in heating, ventilation and air conditioning systems (indoor air quality). Other causes have been attributed to contaminants produced by out gassing of some types of building materials, volatile organic compounds (VOCs or solvents), moulds, improper exhaust ventilation of ozone, by products of some machinery, light industrial chemicals used within, or fresh air intake location/lack of adequate air filtration.

In Cornwall, Radon (emitted form granite and some building materials) is an issue and you can have your house checked for Radon by the National Radiological Board (NRB).

See the Pollution section.

Historic conservation issues

Climate change will bring unpredictable changes including relative humidity which will have an effect on historic buildings. There will be a need to monitor changes closely and, as it is likely to be a gradual process, hope that remedial measures to vulnerable materials will be sufficient to accommodate them.

Draught proofing existing traditional windows can reduce noise and dust ingress as well as improving thermal and noise performance. Draughts can make people feel cold, which may lead them to turn up the heating and run it for longer.

Up to 90% of the internal surface of a building may be sealed with synthetic, petrochemical-based coverings. Indoor environments can be up to 10 times more polluted than the external environment.

Oil-based paints contain up to 50% solvents; solvents are persistent and can build up in the body causing serious illness. The combination of synthetic paints, chemicals in carpets and furniture, and lack of ventilation is now thought to increase susceptibility to allergies, headaches and other illnesses.

These products can also affect the health of your building. Traditionally constructed walls need to be able to 'breathe'. Modern impervious surface treatments, particularly when applied to external walls, will trap water within the solid wall, preventing natural evaporation. This can lead to damp problems, condensation and mould growth.

Changes in humidity and temperature will affect pests and diseases. This could affect collections and internal furnishings and disturb wetland sites in particular. In terms of overall comfort heating may become less necessary although cooling may become an issue. Intrusive climate control equipment should be resisted with a preference for passive or minimally intrusive methods.

Useful links / references

The Sensory Trust:
www.sensorytrust.org.uk

Building For Life
www.buildingforlife.org

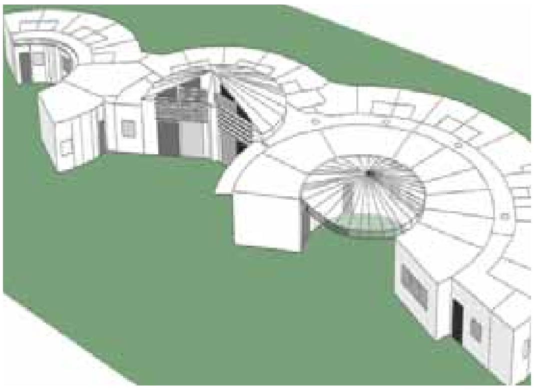
World Health Organisation
www.who.int

Local listings

No listings as yet.

Case study

Boswyn



Scale of development

Medium

Type of development

Residential care facility

Sustainability features

- Design
- Energy
- Biodiversity
- Water Conservation
- Water treatment & discharge
- Health & Wellbeing
- Materials
- Maintenance
- Waste
- Community
- Access, Equality & Diversity

Features

Low Carbon Emissions.

Innovative, low impact design to promote health and wellbeing.

Boswyn, part of Bosence Farm, is a residential detox clinic consisting of 15 en-suite bedrooms, a lounge, dining room, offices and other ancillary rooms. It is situated in a semi rural area on the outskirts of the village of Townshend.

Passive performance

The south facing front windows are fitted with brise-soleil to reduce solar gain and internal temperature in summer.

The walls are timber framed, they are single skin construction with lime render and hemp insulation. The building foundation is a concrete slab for thermal storage of solar gain, allowing heat release in the cooler evening hours.

Low impact design

The building has a Bauder Sedum roof. This is a green roof system, constructed using low maintenance sedum succulents. The plants are grown on a blanket that is harvested like turf. It protects the roof and provides insulation, aesthetic quality and ecological benefits, whilst also slowing water runoff.

Any trees removed from site in construction stages and wasted wood were kept for firewood for the farm.

All soil from before construction stage was saved and reused on site, reducing transport impacts.

Energy

The Building CO2 Emission Rate is 56% better than the Target Emission Rate. This is achieved by using low energy lighting, high levels of insulation, and a Binder wood pellet boiler and a wood burning stove.

Community benefits

Bosence Farm Community provides a range of services to help people maintain recovery from addiction to alcohol and drugs, benefitting the individuals and the wider communities which they live in.

See CSBT: **www.csbt.org.uk**

Access, equality and diversity

Equality is about treating people fairly and ensuring they have equal opportunity. Diversity is about recognising that everyone is different

Basic design principle

Changes to existing developments and the spaces which surround them need to be mindful and inclusive of the varying needs of people within them.

Sustainability context

Equality is about treating people fairly and ensuring they have equal opportunity to access facilities and services. Diversity is about recognising that everyone is different. Equality and Diversity is about creating a culture that recognises and values difference.

Inclusive design integrates equality and diversity in the design process. Inclusively designed buildings and places can be used and enjoyed, regardless of age, ability or circumstance.

Applying an inclusive approach to all stages of planning, design and construction will ensure that developments most closely meet the needs of the people they were designed for. There are legal obligations for employers and service providers to make reasonable adjustments to improve access for disabled people. It is easier to address these issues in the initial concept and design, than to retrofit and incur greater cost.

There are real benefits of delivering inclusive environments, they suit a wider range of people and are therefore a more sustainable investment. The main benefits are:

- User satisfaction - Better quality of experience and working environments leading to positive moral for all users.
- Positive image - Organisations recognised for commitment to improve equality.
- Market Leadership - potential for projects to be recognised as leaders and award winners in this field.
- Cost versus benefit - More effective use of resources and less wastage from temporary measures or "retro-fitting"
- Employment - Greater diversity of people employed, bringing new perspectives and approaches to organisations.
- Legislation - meets legal requirements.

Practical solutions

The following considerations should be made when retro-fitting an existing development. Please note that only some of the following will be relevant depending on scale and type of development.

Site management

- Consideration of site levels and orientation.
- Linking indoors and outdoors through integrating building and landscape design.
- Community consultation by involving local groups such as access groups, resident associations, local interest groups etc.
- Consideration of lone-working through the use of refuges and alarms.
- Make recycling and refuge facilities accessible to all.

Transport

- Links with accessible public transport routes, e.g. car share schemes, community / green transport.
- Pick-up points with high kerbs (for easy access bus pick-up), seating, routes, shelters and toilets.
- Availability of wheelchair and access equipment for loan or hire.
- Clear accessible transitions between buildings and transport hubs, e.g. car parks, train station, car hire and coach park.
- Provision of assisted transport, such as buggies, as support for people with limited stamina and mobility.
- Link with Shopmobility scheme.
- Clear accessible information about the different transport available to the site.

Parking

- Provision of at least 5% of parking bays for use by Blue Badge holders.
- Provision of accessible staff parking.
- Provision of larger spaces for minibuses and other adapted vehicles.
- Provision of additional priority spaces for people with limited mobility who don't have a Blue Badge, e.g. parents with babies and older people.
- Provision of parking layout and signage that minimises the number of choices people need to make and make it easy to identify transport links and help points.
- Secure parking that is clearly visible from the entrance.
- Clearly distinctive parking in terms of name, colour and number.
- Parking spaces with accessible gradients, surfaces, signage, pick-up points for easy access buses, covered waiting areas, help points and toilets.
- Opportunity for drop-off and pick-up by easy-access transport, taxis and private cars near buildings.
- Easy to use ticket and pay machines for people with limited mobility and dexterity.

Arrival

- Clear arrival experience / entrance, transport networks and signage.
- Signage that includes easily recognisable symbols to help people that are unable to read.

Routes

- Ease of access and way finding by minimising the number of changes of level and direction.
- Clearly defined accessible routes throughout different areas for assisting way finding including floor materials, directional lighting, colours, symbols and landmarks.

Changes in level

- Changes in level for access are minimised at every opportunity to improve access for people with limited mobility.
- Consideration of gradients with a slope's length, e.g. sometimes a shorter steeper slope may be preferable over a longer lesser slope.
- Provision of resting platforms on longer slopes.

Lifts

- Accommodation for wheelchair users (including buttons at appropriate heights, flush threshold, and sufficient door width) and visually impaired people (Braille on buttons, audio announcement).
- Reliability of lift operation through a suitable maintenance programme.

Escalators

- Provision of alternative access to some disabled people who can't use escalators.

Steps

- Provision of step design for safe passage and ease of use for greatest range of people, with attention given to dimensions, consistency, resting platforms, handrails, nosings and materials.
- Provision of tactile indicator strips on the approach to steps.
- Opportunities for resting points where longer flights are provided.

Ramps

- Choice of either ramps or steps (as some disabled people prefer steps). Ramps are hard work for many people and their use, particularly their length, should be minimised as far as possible.
- Provision of resting points on longer ramps.

Handrails and balustrades

- Consideration of people of different heights (especially children) either by a second lower handrail or alternative detailing that provides hand grips at different heights.
- Consideration of options for incorporating tactile information on handrails to provide directional information for visually impaired people.

Information and wayfinding

- Clarify of text for accessibility, e.g. text colours and sizes (pictorial symbols and colours help communicate messages, directions and information. Greater consideration of colour, tone, surface textures, landmarks, sound and other design details help people orientate).
- Integration of communication techniques for the visually impaired, e.g. Braille, audio and good colour contrast of features and signage against backgrounds.

Help points

- Help points that are at an appropriate height, within sight of a reception area and other manned station.

Assistance

- Provision of assistance and support from staff.
- Scope of assistance, such as dedicated staff along with a range of technical assistance, such as access guides, pagers, assisted transport, large print and Braille materials, online support etc.

Means of escape / emergency evacuation

- Easy emergency procedure for all groups.
- Panic bolts at an accessible height and easy to use.
- Accessible emergency signage.
- Alarm system with use of visual beacons or individual pagers for people with hearing impairments.
- Clear emergency lighting.

Toilets

- Adequate provision and functionality for a full range of users.
- Door opening strength less than 20N at leading edge for all doors.
- Avoidance of double lobby doors.
- Consideration of height and ease of use of handles, locks, hooks, flushes, machines, washbasins, mirrors, hand driers, taps, urinals etc.
- Accessibility to an alarm from within the toilet.
- Wider cubicles for those of limited mobility.
- Easy access toilets on every floor and at sufficient frequency.
- Floor surfaces are firm, level, non-glare and non-slip.
- Signs are at an appropriate height for all users.

Baby changing

- Provision of a separate baby changing facility that is unisex and accessible to all types of ability.
- Inclusion of private feeding facilities that is accessible to all types of ability.

Showers

- Fully accessible showers with floor drainage to avoid stepped access.
- Consideration of heights of fittings and ease of use of controls.
- Good visual contrast between filaments and backgrounds.

Doors

- Entrances are easy to locate.
- Doors are easy to open by people with limited strength (consider automatic or power assisted opening mechanisms, heights and styles of handles, heights of kick-plates and design of furniture).
- Good visual contrast between door furniture and background, and between doors and surrounds.
- Good visual clarification of any transparent doors or picture windows at adults standing and wheelchair / child height.
- Revolving doors that are wheelchair accessible.
- Consideration of whether a door is really necessary as they can act as a physical barrier.

Materials and finishes

- All accessible surfaces are firm, level, non-slip, non-glare and non-visually distracting.
- Avoidance of loose materials falling onto hard surfaces and causing trip hazards on outdoor access routes.
- Use of different texture and colour to indicate changes of direction, way-finding and sense of place.

Restaurant and café facilities

- Accessibility throughout the whole range of facilities, including circulation space, counter heights, heights of tables, sight lines, facilities for young children, access to toilets, ease of ordering food etc.

Resting points and seating

- Within public spaces, there are seats at least every 50m.
- Resting spaces and seating is accessible to all (wheelchair access, tactile routes for the visually impaired, hearing loop provision for the hearing impaired etc).
- At least 25% of seats meet the needs of elderly people.
- Seating is prioritised in physically demanding areas such as gathering spaces and waiting areas.
- Sheltered seating is provided at transport pick-up points and in waiting areas.

Telephones

- Telephones are at a height accessible by wheelchair users and there are telephones for texting that can be used by people with hearing impairments.

Comfort and health design

- Consideration of environmental comfort levels, such as thermal comfort levels, ventilation, natural daylight and acoustics.
- Maximum use of natural daylight and avoidance of fluctuations in temperature.
- Integrated social spaces to avoid segregating disabled visitors.
- Access to outdoor spaces.
- Free accessible drinking water.
- Outdoor trails that encourage staff to walk and that can also be used by the local community.

Acoustics

- Consideration of acoustics throughout social and work spaces within the site.
- Consideration of positive sound with disruptive ambient noise levels in public spaces and the implications for the visitor and staff comfort, ease of communication and social interaction.
- Provision of hearing loop systems in gathering and meeting spaces.

Lighting

- Avoidance of glare and long shadows.
- Sufficient lighting levels for people with hearing impairments to lip read, and for people with partial sight to see information and features.
- Provision of lighting to help create visual contrast for features like lifts, handrails, path edges etc as a useful guide for people with visual impairments.

Heights

- Attention to height of signs, furniture, desks, fitments and fittings, balustrades, notice boards, and sight lines to help ensure equality of use and experience.

Leaving

- Clearly accessible signage to transport links and other facilities.
- Provision of assisted transport and staff support for older or frail visitors.

Historic conservation issues

Access solutions to historic buildings should be sensitively designed and special care is needed to ensure that the special and valuable features of historic buildings are not damaged where alterations are required.

Case study

Trelander Community Centre

Scale of development

Medium

Type of development

Public Space (Community Centre)

Sustainability features

- Design
- Energy
- Biodiversity
- Health & Wellbeing
- Materials
- Community

Features

High levels of insulation in full building envelope

Green roof helps to increase the area of soil and reduce the impact of heavy rain

Visually promote PV and solar thermal technology through visual meters

A community hall in Trelander, Truro; constructed with high levels of insulation and specially designed roof for maximum solar collection. The hall generates electricity and hot water using photovoltaic and solar thermal technology.

Construction and materials

The entire building is of wood frame construction using local oak for cladding purposes. Insulation levels are high in both the walls, where straw bales are used, and roof, where sheep's wool makes a lightweight and natural alternative. These high levels of insulation allow for reduced space heating requirements, keeping the internal temperature pleasant most of the year without intensive heating; very useful for a large communal building.

Solar collection and reducing lighting requirements

The design utilises a specially angled section of roof to capture maximum solar energy. The building uses both photovoltaic (4.34kW system) and solar thermal collectors for electricity and hot water respectively. The first 6 months of use yielded 2334kWh from the photovoltaic panels, and 703kWh from the solar thermal collectors.

The solar collectors have visual meters to demonstrate their energy generation capability to visitors.

All lighting internally is fitted with low energy specification bulbs to reduce electricity requirements.

Green roofing

The building incorporates a green roof which drains into a soakaway. This helps to reduce the impact of heavy rain to alleviate flooding, removing less soil from the site than would be the case without.

See CSBT: **www.csbt.org.uk**

Useful links / references

Disability Access Provisions for Historic Buildings, Robin Kent:
www.buildingconservation.com/articles/accessbcd98/access.htm

Access to Historic Church Buildings, Robin Kent
www.buildingconservation.com/articles/churchaccess/churchaccess.htm

'**Social Toolkit**' by Sensory Trust:
The Toolkit follows the RIBA stages of work for the Design and Construction Process. The Toolkit links with existing evaluation systems like BREEAM and takes legislative requirements such as the Building Regulations, the Disability

Discrimination Act DDA: and other diversity and equality as a bottom line of provision -
www.sensorytrust.org.uk/projects/reports/social_sustainability_toolkit.html

Sign Design Guide (ISBN 185878 412 3)

CADW – Overcoming the Barriers (ISBN 1 85760 104)

Building Sight (RNIB Publications – (ISBN 1 85878 074)

RIBA Good Loo Guide

Joseph Rowntree '**Meeting Part M and Designing Lifetime Homes**'

Scheme Development Standards – The Housing Corporation

Building Sight (RNIB Publications – ISBN 1 85878 074 8):

Arts Council England – '**Disability access: a good practice guide for the arts**'

Sport England – '**Access for Disabled People**'

Local listings

Stride Treglown

Architects, Access Consultancy

www.stridetreglown.co.uk
alastairwilson@stridetreglown.com

Stride Treglown, 55 Lemon Street, Truro, TR1 2PE

Tel: 01872 241 300

Communities

Reconnecting people with the place they live, and with the communities they share

Basic design principle

To consider the impact of any change to an existing building on the local people within a community and to enhance social cohesion where appropriate.

Sustainability context

Many social issues have at their route a disengagement from society. Reconnecting people with the place they live, and with the communities that share the place is very important.

The following makes us feel like we 'belong':

- National identity to Britain as a nation.
- Collective identity with work colleagues and friends.
- Individual identity with friends, family and hometown.

Practical solutions

An ideal neighbour is someone who:

- Is aware of the situation of other residents.
- Respects the privacy of other residents.
- Is ready to help if needed.

There are four building blocks for thriving communities:

- Social infrastructure and amenities.
- Culture and social life.
- Voice and influence.
- Space to grow.

Communities can work together to improve their shared outdoor and indoor spaces. Community / village halls, green spaces and communal areas are important places for communities to come together. Communities can come together through a variety of ways; Parish Councils, Working Men's Clubs, Village halls, local organisations and groups, e.g. Transition, FairTrade etc.

Historic conservation issues

Retaining and upgrading historic buildings maintains a sense of local pride and identity. Maintaining the communal utility value of historic buildings helps to maintain communities; conversion of historic community buildings should ideally retain communal value.

Where there are established community facilities in historic buildings there is an increased value in building preservation. Local facilities will always be the most accessible and therefore the most sustainable.

Useful links / references

Community creative consultation in the Clay Country, WildWorks project in St Dennis – **www.wildworks.biz/projects/63-clayproject.html**

People and Gardens – use gardening as a medium to promote physical and emotional well-being – **www.peopleandgardens.co.uk**

Sensory Trust – **www.sensorytrust.org.uk**
Tel: **01726 222900**

Eden Project – **www.edenproject.com**
Tel: **01726 811911**

Carnegie UK Trust – **www.carnegieuktrust.org.uk**

Community Land Trusts - **www.communitylandtrusts.org.uk**

Young Foundation – research on what makes people feel they belong – **www.youngfoundation.org**

Community University Partnership Programme (CUPP) – **www.cupp.org.uk**

Transition Communities – **www.transitiontowns.org**

Transition Cornwall was founded in June 2007 as a partnership initiative working to support the communities of Cornwall in addressing two of the greatest challenges of our time: climate change and oil depletion. Its aim is to become a hub that co-ordinates and catalyses the research and ideas of a diverse network of groups, organisations, associates and individuals from the private, public, community and voluntary sector. Transition Cornwall seeks to facilitate positive and pro-active responses to the problems we face, with the ultimate aim of creating a vibrant, resilient, low carbon Cornwall.

Transition Cornwall has specific aims and objectives, which include the support of emerging and existing Transition Initiatives across Cornwall. It has fostered strong, strategic partnerships at the County level, which enable it to access funding streams that can help grow the Transition Movement.

Transition Cornwall grew out of the highly successful Transition Penwith project, and is working closely with the UK-wide Transition Network based in Devon, and the Transition Towns Movement.

Permaculture – **www.permaculture.org.uk**

Permaculture is about creating sustainable human habitats by following nature's patterns. It uses the diversity, stability and resilience of natural ecosystems to provide a framework and guidance for people to develop their own sustainable solutions to the problems facing their world, on a local, national or global scale. It is based on the philosophy of co-operation with nature and caring for the earth and its people.

Permaculture as a design system is based on natural systems. It is about working with nature, not against it - not using natural resources unnecessarily or at a rate at which they cannot be replaced. It also means using outputs from one system as inputs for another (vegetable peelings as compost, for example), and so minimising wastage.

Working together is the key - it takes a lot of strain off the individual. It also is important to be well informed and if you can help others, spread your knowledge in return.

People and Gardens – use gardening as a medium to promote physical and emotional well-being – **www.peopleandgardens.co.uk**

Local listings

No local listings

Case study

Jubilee Wharf

Scale of development

Medium

Type of development

Mixed use

Sustainability features

- Design
- Energy
- Water Conservation
- Water treatment & discharge
- Materials
- Maintenance
- Waste
- Community
- Access, Equality & Diversity

Features

Evacuated tube solar collectors and biomass heating

Excellent location for local public transport

Full building life considerations

This two building development on the waterside in Penryn contains 12 workshops, 6 flats, a nursery, offices, community hall and a cafe. Designed by ZEDfactory, the development is intended to support the local art, craft, health and social industries and bring together the local community.

Construction and materials

The buildings are super-insulated with 300mm wall insulation, double glazing and attention to airtightness detailing. Glulam beams are used extensively, which allow the distinctive curved roof design. Reclaimed and local materials are used where practical and available; eco concrete is used wherever engineering considerations allow.

Energy efficient design and technology

The orientation of the buildings allow for maximum passive solar gain through glazed areas and the residential units all have sunspace areas to collect heat. This feature, along with high insulation means that space heating costs are minimised. The building utilises underfloor heating for increased comfort and efficiency.

Each hot water cylinder is heated by a bank of evacuated tube solar thermal collectors, while additional heat and space heating is provided by a 75 kW Binder wood pellet burner.

ZedCowl venturi effect heat exchange ventilation cowls ventilate the building without the need for electric fans. Four 6 kW Proven wind turbines generate 7,000 kWh of per annum and the site is powered by 100% renewable electricity from the supplier Good Energy.

Extra considerations

The site provides an array of transport options, with bus links to Penryn, Falmouth and beyond being on the doorstep. The site also provides adequate cycle racks to promote green transportation.

See CSBT: **www.csbt.org.uk**

Glossary

Airtightness

Technically, *Air Permeability* and *Air Change Rate*. A fan is fitted to a doorway and the volume of air leaking from the building is measured. Units are m^3*(air)/hr/*m^2*(external walls, ceiling and floor) @ 50 Pa and* m^3*(air)/hr/*m^3*(internal volume)* @ 50 Pa respectively.

Brise Soleil – (breez-soh-ley)

An external sun shade to reduce the effect of bright summer sun, often with louvres to allow winter sunlight into the building.

Cold Bridge

A structural element of a building which is in contact with a cold external face and a warm internal face, or any other non-insulated pathway where heat is lost more quickly.

Drainage Field

A network of perforated pipes in granular material allowing sewage effluent is allowed to soak into the ground. Sometimes referred to as a leachfield.

Embodied energy

An important consideration and part of *life cycle impact* analysis. The amount of energy used to produce and transport a material or product.

Feed-in Tarif

Incentive for small scale renewably generated electricity. A slightly misleading name since a premium is still paid if the electricity is used on site and not fed-in to the grid.

Glulam

Wooden beams which can be made to specification by gluing layers of wood together. A suitable replacement for steel beams with lower environmental impact.

Green Roof

Any roof which has a surface that will support plant growth.

Greywater

Water from basins, bathing and laundry. Can be re-used for toilet flushing.

Heat Pump

Heat pumps work like refrigerators, but in reverse. They transfer heat from the external environment to a hot water cylinder.

Kennel

Local term for an open waterway or leat.

Leat

An open waterway constructed to carry water away from a natural watercourse for industrial or residential use.

Life Cycle Impact

Total environmental impact of a material or product including extraction of raw material, energy used in production and transport, and impact of disposal, re-use or recycling. Potential for saving energy should also be considered.

Photovoltaic

See Solar Panel

Glossary
(continued)

Pre-fabricated
Sections of a building are constructed off site in specialist workshops, minimising waste and maximising efficiency.

Rainwater Harvesting
Retaining water which runs off the roof for use in and around the building.

Recycle
Reprocessing of a material or product.

Re-use
Use a second hand material or product which does not need reprocessing.

Smart Meter
An electricity meter which can display real time consumption and communicate with the electricity supplier.

Soakaway
An area designed to allow rapid permeation of surface water. Also used to describe a *drainage field*.

Solar Panel
Also known as Solar Cell, Solar Thermal or Photovoltaic. A solar panel is a device which is used to convert energy from the sun's rays into electricity. The panels can also be used to heat water (Solar Thermal).

Solar Thermal
See Solar Panel

SUDS – Sustainable Urban Drainage System
Refers to techniques which mitigate flooding and other problems associated with water runoff from large areas of non-permeable surfacing.

Sustainability
"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs" *Bruntland Report 1987.*

Thermal Mass
Dense materials which take a lot of heat to warm up and subsequently are able to release a large amount of heat if the temperature drops. Commonly thermal mass in buildings is provided by block, brick and concrete although it can also be water.

TRADA
The Timber Research and Development Association.

VOC
Volatile Organic Compound. A chemical compound which evaporates at room temperature. Found in many materials used in construction, most significantly in finishing elements such as paint and carpet.

For more information

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www.cornwall.gov.uk/greenbuilding

If you would like this information
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JN26108 Sept 10