ROYAL BOROUGH OF
KINGSTON UPON THAMES

SUPPLEMENTARY PLANNING GUIDANCE

SUSTAINABLE CONSTRUCTION

UDP Policies

OL19 STR10 MW3 MW4 MW5 RES3

DIRECTORATE OF ENVIRONMENTAL SERVICES

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CHAPTER 1- INTRODUCTION

About the Guide

Some of the major sustainable development challenges that confront construction include issues that have global as well as local significance, such as resource depletion, protecting bio-diversity and climate change. The process and potential impacts of these are not yet well understood, but the agreement reached at Kyoto and further discussion in Johannesburg has brought a new urgency to address such issues.

This guide has been prepared in response to an acknowledged demand from development professions to have practical information about the key components of sustainable construction development. It is based on a simple concept of ensuring a better quality life for everyone, now and for generations to come.

Sustainable development and sustainable or 'green' construction are often discussed in development circles. The definition of the specific components and more importantly how they can be readily employed in construction today requires greater focus. Recent evolution and growth of the subject has now enabled us to develop a guide that delivers focus, detailing why these new technologies should be integral to every new development and importantly, siting London based examples in the case studies that demonstrate practical and successful execution of sustainable construction principles. Practicality is the essence of the guide with references to useful contacts and web sites throughout.

Kingston – a sustainable future

We are very fortunate to live in an area such as Kingston. But this gives us a responsibility to ensure that we hand future generations a healthy sustainable borough. The aim is to ensure that the borough remains an attractive and vibrant place in which to live and work, and that we treasure and improve the quality of its built and natural environment. In doing so, we must seek to reduce our impacts beyond the borough boundary, and on the global environment as a whole.

Who Should Use the Guide?

This Guide has been formatted to meet the basic needs of all those concerned with planning and building activities within the building/construction industry. The document will be of particular interest to planning and development officers, developers, builders, environmental co-ordinators, as well as manufacturers, housing associations, users/ clients.

How to Use the Guide

The guidance in this document is supplementary to various UDP policies. It is expected that the guidance in this document will be referred to at the relevant stage. In particular all developments should incorporate renewable energy techniques wherever possible. Photovoltaic tiles and solar water heaters, for example, can be used on the roofs of developments to fuel the building's energy demands.

Developers should aim for at least 10% of their development's energy consumption to come from renewable sources. The Council will welcome warmly development proposals that exceed this target.

The Sustainable Construction guide should be referred to as early as possible in the development process. Although the guide is useful throughout the development process the following diagram illustrates the sections most relevant to various stages. When the concept of a development is first discussed the guide should be used to see which of the different elements referred to in the guide can be realistically employed in the new project to enable a reduced overall environmental impact.

The guide was adopted as Supplementary Planning Guidance (SPG) by the Council's Executive Committee on 24th February 2004. Before being adopted as SPG the guide was subject to public consultation and amendments were made to take account of comments received during the process. Details of the consultation undertaken, representations received and the Council's response are given in an accompanying document "Sustainable construction SPG: Statement of Public Consultation" or can be viewed on the Council's website:
http://moderngov.kingston.gov.uk/Data/Executive/20040224/Agenda/$CSustainable%20Construction.doc.pdf

SECTIONS OF THE GUIDE RELEVANT TO STAGE OF CONSTRUCTION

TIME LINE

PREPARATION

- How to use the guide
- Planning Guidance
- National regulations
- Site preparation

Copy of Sustainable Construction SPG - available on line, email or paper.

PRE-APPLICATION

- Contaminated land
- Scope for renewable energy
- Sustainable materials and embodied energy
- Storage & Facilities

Think about relevant issues from SPG appropriate to the site. Discussion with Planning Dept.

PLANNING

- Energy efficient building design
- Orientation, insulation, ventilation
- BREEAM Assessment
- Landscaping
- Water conservation
- Waste Management and Measuring Sustainability

Incorporating the guidance into the scheme proposals.

SITE PREPARATION

- Recycling and reuse
- Construction waste

Pre-planned site matters taking account of conditions and other requirements in the SPG.

CONSTRUCTION

- Pre fabrication
- Water conservation / SUDS
- Construction and demolition waste
- Sustainable Building Materials and Biodiversity

Implementing the planning permission and compliance with Building Regulations.

COMPLETION

Figure 1

CHAPTER 2 – LEGISLATION, GUIDANCE AND LOCAL POLICY

The Changing Environmental Tide

There is growing importance attached to environmental consideration in the development process. Appendix 1 lists some of the changes to national policy over the last 5 years that have a bearing on sustainability and sustainable construction.

The Planning System

The Government published its proposals for reform of the planning system in the Green Paper "Planning: Delivering a Fundamental Change". Following consideration of responses to that consultation paper, key themes for reform were set out in the policy statement *Sustainable Communities: Delivering through Planning*. For further information: http://www.odpm.gov.uk/. The Planning and Compulsory Purchase Act was introduced as a Bill in December 2002 (http://www.parliament.the-stationery-office.co.uk).

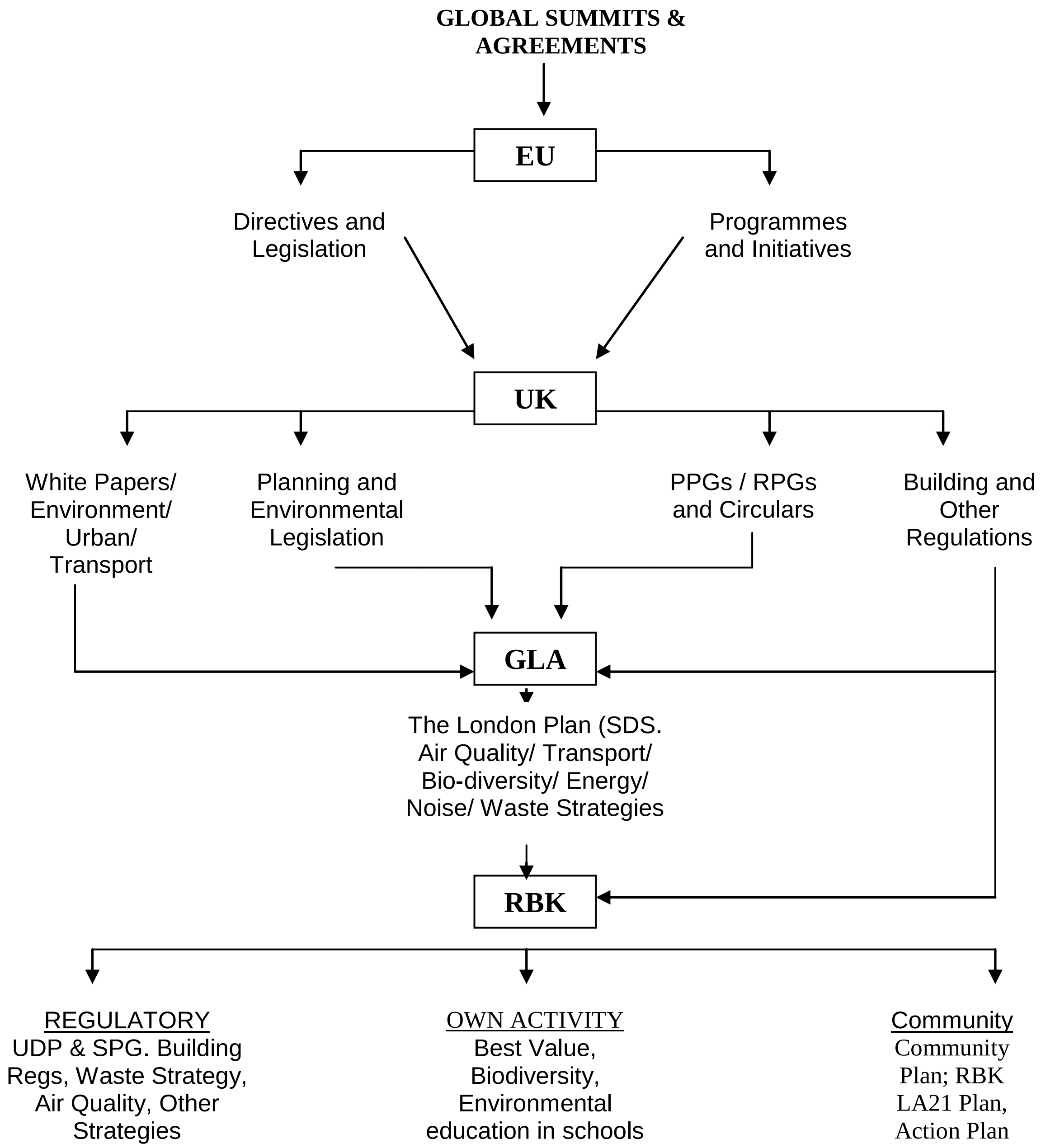
The London Plan

In February 2004 the Mayor of London published the London Plan. This includes policies on sustainable design and construction (Policy 4B.6) including measures to:

- Re-use land and buildings;
- Conserve energy, materials, water and other resources;
- Be bioclimatically designed;
- Reduce the impacts of noise, pollution, flooding and micro-climatic effects;
- Ensure developments are comfortable and secure for users;
- Conserve and enhance the natural environment, particularly in relation to biodiversity.

The policy expects boroughs, where appropriate, to apply the same sustainability principles to assess planning applications. Figure 2 illustrates the various requirements to take account of sustainability in construction.

Figure 2: Requirements for Sustainable Construction



Unitary Development Plan

The Council's Unitary Development Plan (UDP) sets the local policy for promoting sustainable buildings in the borough. Through the First Alteration additional policies have emerged encouraging and requiring sustainable construction:

- **OL19 – Water Conservation and Control** – encourages development to include water conservation measures and run-off attenuation measures such as grey water recycling and Sustainable Drainage Systems.

- **STR10 – Sustainable Energy, Minerals and Waste** – encourages more sustainable methods of mineral transportation, waste disposal and transportation and energy generation.
- **MW3 – Energy Efficiency and Conservation in Developments** – ensures that development has regard to energy efficiency through design, materials, orientation and layout.
- **MW4 – Renewable Energy and Energy Recovery** – encourages renewable energy components, e.g. photovoltaic panels in developments.
- **MW5 – Contaminated and Unstable Land** – requires developers to investigate potential land contamination and to include appropriate remediation measures.
- **RES3 – Determination of Planning Applications** – sets out particularly relevant factors in determining planning applications, including design and layout and sustainability of proposals.

The Guidelines will have the status of **Supplementary Planning Guidance**, and will help to implement the above policies of the adopted UDP and the First Alteration relating to sustainable development. This means that they are a **material consideration** when determining planning applications: they are taken into account when deciding whether or not to grant planning permission. Material considerations are those matters that relate to the use and development of land and are of such relevance that they could lead to:

- A proposal being refused planning permission because of the matter in question.
- A condition being attached to the planning permission with respect to the matter.
- A Section 106 Planning Agreement or planning obligation being required.

Building Regulations

The new Part L Building Regulations (Conservation of Fuel and Power) came into force on 1 April 2002 in England and Wales. The improvements in the regulations have mainly been driven by the threat of climate change and a need to decrease carbon dioxide emissions – a report by the Royal Commission on Environmental Pollution says that the UK needs to decrease emissions of carbon dioxide by 60% by 2050.

On an international level the UK Government has agreed to a Kyoto Protocol target of a 12.5% reduction of greenhouse gases from 1990 levels by 2012 but has gone beyond that with a voluntary target of a 20% reduction of carbon dioxide emissions by 2010. At first this target looked achievable as emissions fell in the late 90s, however most of this was due to the change from coal to gas fired powered stations. This trend has now stabilised and the target is now looking harder to meet.

Part L, which sets out the legal requirements for the conservation of fuel and power in buildings, has been subdivided into Part L1, covering dwellings, and Part L2, covering other types of buildings.

Further information: www.practicalhelp.org.uk or www.odpm.gov.uk/buildingregs

CHAPTER 3 – SITE PREPARATION: CONTAMINATED LAND

Introduction

Our industrial heritage and past lack of environmental consideration has left us with a legacy of contamination land. With the Governments' aim of building 60% of all new developments on 'brownfield' land, it is clear to see the importance of appropriate decontamination techniques.

Traditional techniques for dealing with contaminated land have usually involved either the removal and disposal (dig and dump) of the contaminated soil, or capping of the contaminate with an impervious layer.

Civil engineering solutions still dominate contaminated land remediation in the UK, with process-based techniques accounting for only 20-30% of the work carried out. This preference can be attributed to many factors, but perhaps the most important are the cost of traditional "dig and dump" or encapsulation, when compared to the more advanced forms of remediation. However, the major advantage of using process-based solutions is the removal of risks and the associated liability. The cost difference between these two types of disposal has been significantly reduced as a result of the ever-increasing costs associated with landfilling.

The issue with civil engineering techniques is that they either transfer the problem to another location or delay dealing with the problem for a varying length of time. On occasion, due to the level or type of contamination there is no other choice but to remove the contaminate but often the selection of these 'traditional techniques' is the result of time pressures or simply a lack of consideration or understanding of other treatments available

Legislation and Regulation

In April 2000, Part IIA of the Environmental Protection Act (EPA) 1990 came into force, introducing a new regime for the regulation of contaminated land in England. Its main purpose is to provide an improved system for the identification of land that is posing unacceptable risks to health or the environment, and for securing remediation where such risks cannot be controlled by other means. RBK has published "**CONTAMINATED LAND - A GUIDE TO HELP DEVELOPERS MEET PLANNING REQUIREMENTS**" (Oct 2003) which sets out guidance on what may be required when assessing a particular planning application.

It is now more important than ever before to pursue the use of new technologies to provide high value, environmentally progressive, engineering solutions to contamination problems. The following box offers an insight into some of these evolving but proven techniques.

Contaminated Land Remediation Techniques

Bioremediation treats the contamination in situ, obviating the need to excavate and remove large quantities of materials. The technique is based around introducing microbes the soil that eat the contamination over a period of months. It is particularly successful in the treatment of hydrocarbon contamination often found on redundant garage and car breakers sites.

In most cases, bioremediation is not the single answer to a contamination problem, but should be considered as part of an overall reclamation strategy. Bioremediation is more effective in permeable, sandy soils or gravels than it is in heavy clays, where it is difficult to break down the soil structure to one amenable to oxygen transfer and biodegradation activity. Bioremediation needs to be considered as an option as early as possible in the development of a remediation scheme

Bioventing – this can be used to biodegrade contaminants above the water table, in the unsaturated zone. Extra oxygen is supplied through one or several monitoring wells fitted with perforated pipes, to improve conditions for degradation. Contaminant vapours are removed through peripheral boreholes, which promote airflow through the contaminated soil. Nutrients can be added to improve degradation.

Biosparging – this is effective in the saturated zone below the watertable. Air is injected into the saturated zone through boreholes finished with screened wells, where it forms small bubbles in the groundwater, encouraging the dissolution of oxygen and the movement of air towards the surface. As the air rises it picks up the volatile compounds in the groundwater and transfers them to the unsaturated zone.

Injection and recovery (or pump and treat) – this effectively creates the conditions of a bioreactor in the treated medium. Contaminated groundwater is pumped to a treatment tank on the surface where nutrients and oxygen, along with other treatment substances like sulphate and nitrate are added. The partially treated groundwater is pumped back into the contamination zone, where it stimulates microbial activity.

CHAPTER 4 – CONSTRUCTION AND DEMOLITION WASTE RECYCLING

Introduction

Construction and Demolition (C&D) debris consists of the waste generated during construction, renovation, and demolition works. It covers a wide array of materials including concrete, steel, brick, gypsum and timber. C&D debris is a large and complex waste stream. Reducing C&D debris conserves landfill space, reduces the environmental impact of producing new materials, and can reduce overall building project expenses through avoided purchase/disposal costs.

Waste arising from construction and demolition constitutes one of the largest waste streams within the EU and within the UK (30m tonnes per year). A large proportion of this potentially useful material is still being disposed of as landfill.

Current UK Scene and Using Recycled Aggregates

The 1995 Government White Paper, "Making Waste Work", pointed out that some 70 million tonnes of construction waste, including clay and sub-soil, are generated annually. The aim should be to minimise the waste generated and maximise the quantities of material reused and recycled. The White Paper included targets for increasing the use of waste and recycled materials as aggregates from around 30 to 55 million tonnes per year by 2006. Achieving this target will help to save energy and reduce pressures on landfill sites.

We have a choice: we can either satisfy this additional demand by extracting further primary aggregates, or we can follow a more sustainable route and continue to increase our use of recycled and secondary aggregates. This more environmentally friendly option is achievable. The suitability of using recycled and secondary aggregates for a wide range of applications has been well documented. For further details see various websites at the end of this section.

Construction and Demolition Waste Recycling

'London Remade' is a strategic partnership between the business sector, London boroughs and regional government, waste management companies and the not for profit sector. Its principle objective is to develop and promote new markets and secondary industries based on the reprocessing and reuse of London's recycled materials. The programme is supported by Single Regeneration Budget funding from the London Development Agency whose Economic Development Strategy for London acknowledges the role organisations like London Remade have to play delivering sustainable economic growth.

London Remade is active in establishing a range of support services geared specifically to the recycling, reprocessing and manufacturing sectors. This includes the processing of construction demolition waste for reuse in value-added outlets, such as concrete production.

Potential applications

Recycled aggregates can be used in a range of value-added applications. These include (i) concrete aggregate, (ii) in paved roads as aggregate base, aggregate sub-base, and shoulders, (iii) in gravel roads as surfacing, (iv) as base for building foundations, (v) as fill for utility trenches and so on.

Recycled and secondary aggregates are fit for purpose. Cost benefits are achieved where aggregates are cheaper to source than primary aggregates, and costs savings generated as a result of lower disposal costs of site generated wastes. A reduction in transportation costs can also be achieved.

Further information on construction and waste demolition:

www.aggregain.org.uk
www.wrap.org.uk
www.sustainable-development.gov.uk
www.bre.co.uk
www.remade.com

CHAPTER 5 – WATER CONSERVATION AND SUSTAINABLE URBAN DRAINAGE SYSTEMS

Introduction

To help minimise the impact on scarce water resources and to alleviate the increasing environmental problems of flooding and pollution associated with traditional urban drainage systems, it is important to take greater control of water use and disposal and to implement sustainable water conservation and drainage systems.

Water Conservation Measures

Every day a person uses on average 150 litres of water, of this 50 litres is for WC flushing, representing 35% of all household consumption. The following measures can drastically reduce the amount of water we consume:

- The installation of low flow appliances such as supply restrictor valves, low flow showerheads, spray taps and dual flush toilets. There now exists complete washroom control systems for the non-domestic market that regulate water supply, lighting and ventilation, supplying services on demand. Advantages include: minimal additional build/installation cost, up to 40% reduction in water usage for user, an additional selling point for developer.

- Directing all roof run-off via water butts. Advantages include: minimal additional build cost, reduced ‘peak-flow’ surface water run-off and ready supply of water for irrigation purposes.

- Grey water recycling through reusing the water used in washing for toilet flushing. Advantages include: significantly reduced water consumption and additional selling point for developer.

SUSTAINABLE URBAN DRAINAGE SYSTEMS

SuDS is an approach to managing surface water runoff absorption into the ground is as close as possible to the point where the rainfalls. SuDS are being promoted by many organisations (including the Environment Agency and SEPA) and through government guidance (e.g. PPG25 Development and Flood Risk) to encourage their widespread use as an alternative to traditional piped drainage systems and as a means of reducing flooding, reducing pollution, conserving resources and creating habitat.

SuDS are a flexible series of options that allow a designer to select those that best suit the circumstances of a particular development. It is essential that these issues are considered at the earliest point of the design stage. A basic summary of the main components and their advantages over traditional drainage systems are as follows:

- The use of permeable hard and soft surfaces, such as block and sand, gravel, grasscrete etc to aid water absorption.

Advantages: reduced peak flows to watercourses, filtration of pollutants, reduced need for deep drainage excavations, tailored so that construction costs suit the proposed usage and design life and costs are comparable to, <u>or lower than</u>, conventional surfacing and drainage solutions

- Installing Green or Brown Roofs comprising growing medium plus grasses, Sedums etc

Advantages; regulates and reduces water run-off, improved aesthetics, improved insulation values, reduced particulate pollution, improved biodiversity, minimal maintenance, up to 25 year guarantee.

- Infiltration trenches and basins – excavations that have been back-filled with stone to create underground reservoirs that gradually infiltrate into the subsoil

Advantages: costs are comparable to or lower than traditional piped systems, pollution filtration and replenishment of groundwater supplies

- Retention ponds- where large non-permeable hard surfaces are unavoidable, such as substantial road provision.

Advantages – Acts as buffer at peak flow times and can offer wetland habitat creation opportunities and a recreational facility.

Further Information and References:
Sustainable Urban Drainage Systems, 'Conserving Water in Buildings (Fact Sheets)', 'Enhancing the Environment: 20 Case Studies in London'–The Environment Agency – <u>www.environment-agency.gov.uk</u>

Construction Industry Research and Information Assoc. (CIRIA) – <u>www.ciria.org.uk</u>,

CHAPTER 6 – BUILDING TECHNIQUE – PREFABRICATION

Introduction

The arguments in favour of off-site construction have been well known for many years. Quality, health and safety and control handling and storage of materials are obvious advantages but other benefits include greater opportunity for designers to exercise their skills and enormous potential for reducing waste from surplus and damaged materials and a reduced impact on the surrounding environment and residences due to a reduced construction time on site.

The term off-site construction (or manufacturing) covers a wide range of products and solutions. That range from individual building components to entire-factory built structures and building modules.

One of the most popular off-site construction solutions is timber framing, which is used for houses and apartments up to five storeys high and accounts for about of 13% of homes built in the UK. Light gauge steel frames compete in the same market complemented by numerous pre-cast concrete systems.

Also in regular use are modular elements such as fully fitted bathroom or kitchen pods – used in conjunction with traditional construction or timber and steel frames as well as concrete systems. Hotels were the first market to embrace these elements wholeheartedly, but they are now also frequently incorporated into apartment buildings.

Pre-fabrication

Off-site manufacture has also seen the emergence of numerous factory made cladding solutions using everything from traditional bricks to modern composites.

The ultimate example of off-site manufacture is fully volumetric construction, in which buildings are created by fixing together a series of room or apartment modules that have been built, fitted out and finished in a factory environment. Again, the hotel and leisure sector was the first to adopt this technique, but it is equally popular for schools and hospitals and has recently been adopted for the construction of affordable housing, such as the Peabody Trust's critically acclaimed Murray Grove development in east London (see case studies).

CHAPTER 7 – SUSTAINABLE BUILDING MATERIALS

Introduction

Building materials and design, construction techniques, and building operations and maintenance have considerable environmental impacts that can all be minimised.

Sustainable building merges sound environmentally responsible practices to look at the environmental, economic and social effect of a built project as a whole. The entire life cycle of the built environment, including planning, design, construction and maintenance, and demolition, require detailed examination. Careful building design and materials selection can substantially reduce these impacts, and some strategies, such as using renewable and embodied energy in buildings, can actually improve degraded environments. They can also increase the comfort and productivity of building occupants. The Government's target is to make a cut of 20% in UK emissions of greenhouse gases to below 1990 levels by 2010. This is expected to be achieved through a number of measures, including the promotion of energy efficiency in buildings. In this context, the Government has identified the importance of using materials more efficiently to reduce overall energy demand.

Embodied Energy

Embodied energy is the energy needed for extracting raw materials, manufacture, transport, construction, maintenance and repair. The total amount of energy needed can be high, typically accounting for 20% of the building's energy use during a 50-year life cycle, the equivalent of 10 to 20 times the annual energy use. Reducing embodied energy can reduce the overall environmental burden of a building, and provide pointers to reducing capital cost. The range of published figures on embodied energy of commonly used building materials is listed in the table below *(Source: Building Research Establishment- UK, 1994).*

BUILDING MATERIAL	DENSITY Kg/m^3	LOW VALUE Gigajoules/m^3	HIGH VALUE Gigajoules/m^3
Natural Aggregates	1500	0.05	0.93
Cement	1500	6.5	11.7
Bricks	~1700	1.7	16.0
Timber(prepared softwood)	~500	0.26	3.6
Glass	2600	34.0	81.0
Steel (sections)	7800	190.0	460.0
Plaster	~1200	1.3	8.0

In summary, for best practice:

- Keep embodied energy down but without compromising efficiency in use or overall environmental impact.
- Minimise energy in use through high standards of insulation and any other practical means.
- Specify the use of recycled materials, wherever it is technically and economically possible.
- Purchase locally produced materials to minimise transport energy incurred.
- Restrict use of systems with high maintenance requirements of which need frequent replacement.
- Minimise embodied energy costs by including features from the outset rather than retrofitting at a later date.

CHAPTER 8 - ENERGY EFFICIENT BUILDING DESIGN

Introduction

The vast majority of energy we use is derived from the burning of fossil fuels that are not only a fast diminishing finite resource but who's resultant emissions contribute to air pollution on a local scale and climate change on a global scale. In order to address this and meet the commitments of the Kyoto agreement, the Government's Energy White Paper published in February 2003 sets out it's own targets for reducing carbon dioxide by 60% by 2050. For the first time, increasing the energy efficiency of buildings is identified as the cheapest, cleanest and safest way of achieving the government's policy objectives.

An energy efficient dwelling is, in effect 'passive solar' by design, i.e. it minimises household energy needs for the provision of services such as lighting, hot water, space heating in winter and cooling in summer. Passive solar design principles achieve these effects by combining and balancing the effects of building and window design, orientation and shading, insulation, thermal mass and finally ventilation, to create naturally comfortable thermal interiors.

Solar Orientation – making the most of the sun
Buildings should be designed specifically for their site. Design should clearly demonstrate that consideration has been given to solar orientation. In a house the living zones (lounge, dining room and, conservatory) are generally the most heavily used, therefore are located on southern side, for maximum thermal benefit. Bedrooms have different thermal comfort requirements and can be located on the northern or western side of a house as can service areas such as the bathroom, kitchen, laundry and garage.

Thermal mass
The term 'thermal mass' describes the building material's ability to store thermal energy. Using materials with high thermal mass in the floor or walls of a building enables those elements in the structure to:

- absorb heat from the sun during the winter day, and release that heat back into the living spaces at night or during cooler periods, producing more comfortable, even temperatures.
- absorb heat from the building during hot summer days having been cooled down via natural ventilation during the previous cooler evening, i.e., provide 'natural air conditioning' producing more comfortable, even temperatures.

Shading
Shading elements such as eaves or awnings should be designed relative to the aspect of the windows requiring shade, considering the seasonal variations in the angle of the sun for each location and access to views.

Windows and ventilation
Generally, windows need to be designed to provide access to sun in winter, but be shaded from direct sun during summer. Windows let in light, heat and air, and provide access to views. In terms of an energy balance, the critical variables are windows' orientation, shading and size, and the area of glass relative to both the floor area and solid wall area.

Heating
Heating our homes, including the heating of hot water, accounts for the vast majority of energy that is used domestically and represents one of the greatest wastes of energy. Outdated, oversized and inefficient systems do not make the greatest use of energy delivered to them. In considering replacing a heating system there are a number of steps and issues that should be first considered.

Insulation - Lofts and cavity walls. This should be done before putting in a new heating system. A well insulated home will need a smaller heating system. This will mean smaller fuel bills. Consideration should be given to the new range of sustainable insulation materials now on the market including recycled newspaper and sheep's wool.

The Building Research Establishment Environmental Assessment Model (BREEAM)

BREEAM assesses the performance of buildings in the following areas:

- *managemen*t: overall management policy, commissioning site management and procedural issues
- *energy us*e: operational energy and carbon dioxide (CO2) issues
- *health and well-bein*g: indoor and external issues affecting health and well-being
- *pollutio*n: air and water pollution issues
- *transport:* transport-related CO2 and location-related factors
- *land us*e: greenfield and brownfield sites *ecolog*y: ecological value conservation and enhancement
- of the site
- *material*s: environmental implication of building materials, including life-cycle impacts
- *wate*r: consumption and water efficiency

Credits are awarded in each area according to performance. A set of environmental weightings then enables the credits to be added together to produce a single overall score. The building is then rated on a scale of PASS, GOOD, VERY GOOD or EXCELLENT, and a certificate awarded that can be used for promotional purposes. BREEAM covers a range of building types including offices and industrial units. There is special form of BREEAM called EcoHomes for housing. Other building types such as leisure centres and laboratories, can be assessed using a bespoke version of BREEAM.

How can BREEAM be used?

All larger residential schemes in the borough should achieve the Building Research Establishment EcoHomes "excellent" rating.

Clients, planners and development agencies and developers are using BREEAM to specify the sustainability performance of their buildings. For example some local planning authorities are negotiating Section 106 agreements with developers requiring them to design and build to specific BREEAM and EcoHomes ratings on particular developments. This is a means of achieving energy efficiency standards above those specified by the Building Regulations. *Property agents* are using it to promote the environmental credentials and benefits of a building to potential purchasers and tenants. *Design teams* are using it as a tool to improve the performance of their buildings.

http://products.bre.co.uk/breeam/ecohomes.html

Further Information
www.ecoconstruct.com
www.thegreenshop.co.uk
www.greenbuildingstore.co.uk

CHAPTER 9 – RENEWABLE ENERGY AND COMBINED HEAT AND POWER SYSTEMS

Introduction

Renewable energy refers to energy resources that occur naturally and repeatedly in the environmental and can be harnessed for human benefit. Renewable energy sources include solar, wind, hydro, geothermal, tidal and wave energy, and biofuels. These can provide electricity, mechanical power, heat and/ or fuel. Almost any new or existing building can be equipped to draw power from renewable sources using one or more of several emerging technologies that may include:

- **Solar thermal collectors;**
- **Photovoltaic generators;**
- **Wind turbines;**
- **Biofuel consuming equipment;**
- **Geothermal plant;**
- **Landfill Gas;**
- **Sludge Digestion Gas**

The main advantage of using renewable energy is its contribution to limiting the emissions of greenhouse gases (the gases that cause global warming). The main greenhouse gas is carbon dioxide (CO_2), produced principally from the burning of fossil fuels. At present power generation accounts for around one third of CO_2 emissions. Some renewable energy sources (e.g. solar, wind and tidal) produce no CO_2 or gaseous emissions at all. Others, such as the combustion of naturally arising waste materials or energy crops (e.g. fuel from coppiced woodland), emit CO_2 but, since the CO_2 has recently been extracted from the atmosphere, there is no net addition to atmospheric concentrations of greenhouse gases – the carbon dioxide is simply recycled.

The Energy White Paper 2003 proposes that the UK will generate 20% of energy needs via renewables.

Application in an urban environment

Although all of the above types of renewable energy generation can theoretically be used in an urban environment the most viable application in a dense urban environment is solar, as a result of the low visual impact and minimal disturbance to neighbours. In certain industrial locations there may be opportunity to employ other renewable technologies.

Solar

1. Solar Thermal – using the sun's energy to directly heat water or oil.
Solar collectors fall into two categories, the traditional flat plate collector and the more efficient evacuated tube system (delivering hot water even in freezing conditions). You can expect a relatively small inexpensive system (£1200 per dwelling) to meet 50% of annual hot water demand.

These systems are widely used in many countries but are not particularly widespread in the UK (50,000 examples) due to a perception that the weather in the UK is not sunny enough. This not correct, the systems do not require direct sunlight and do work successfully in the UK. They are one of the most cost effective proven systems that can be installed either during construction or after completion.

2. Solar Photovoltaics – using the suns energy to generate electricity via photovoltaic panels. Semi-conductor panels that convert light into electricity. Can be used in the home and exported to the local electricity network. They are best placed facing south at an angle of 45 degrees. Recent developments include panels specifically designed for integration into buildings, such as roof tiles, roof mounted systems, semi-transparent PV panels for atrium/conservatory roof systems and façade systems using large area panels. Integration at a construction stage reduces the cost as the panels replace wall claddings or roofing materials.

Geothermal

A 'Global Perspective Program' has been researching the suitability of the introduction of the technology into London. At present some 400,000 of the geothermal systems exist in USA but only 150 in the UK. Initial assessment of the costing shows short payback periods for the technology and running cost for householders that are lower than gas. The possibly exists for London to utilise one of the cheapest energy system in the UK.

EarthDome has started work on a live demonstration development in Merton of four Eco Flats using the geothermal and thermal mass technology.
www.sustainable-development.gov.uk
www.defra.gov.uk

Combined Heat Power (CHP)

A CHP plant generates heat and power simultaneously in a single process. The basic elements of a CHP plant are a combustion process driving an electrical generator, and heat recovery equipment that uses the heat generated by the combustion process. CHP typically achieves a 35% reduction in primary energy usage compared to a power stations and heat-only boilers solution. CHP can therefore offer economic and environmental savings where there is a suitably balanced demand for both heat and power.

Conventional CHP works best in large mixed use developments where there are a number of energy and heat demands throughout the day that require a consistent supply. It is often necessary to have a significant 24 hour demand (e.g. a swimming pool, or hospital) requirements (e.g. a residential development with gym and swimming pool) CHP systems can provide an economic and efficient energy source.

Micro CHP units for domestic use are relatively new and they are still undergoing commercial development. However they have the potential to offer a 28% reduction in energy use over an average new boiler and a 12% reduction over an efficient condensing boiler by utilising electricity generated within the home and potentially selling it into the supply grid.

For further info on purchasing and installing solar equipment contact:

www.est.org.uk/solar
www.solarcentury.co.uk
www.solartwin.com
www.solarsense.co.uk
www.sunnythings.com

For further info on sourcing renewable energy contact:

www.npower.com
www.communityenergy.org.uk
www.unite-e.co.uk
www.foe.co.uk

CHAPTER 10 - LANDSCAPING

Introduction

The design of landscaping around a building can have a considerable effect on how that building functions and its environmental impact. For example the retention of mature deciduous trees in a landscaping scheme will result in a cooler micro-climate surrounding the built structure during the summer months as a result of increased shading and transpiration. In addition to this trees also act as effective particulate filters and noise dampers as well as providing habitat for wildlife.

Materials

Materials are also an important consideration in landscaping schemes. Is the hard landscaping element of a development using sustainable, reclaimed or recycled materials? Is the surface porous to allow drainage into the sub soil (see Water Conservation Chapter) and are the plants suited to the soil/area or will they need continual irrigation?

Biodiversity

As pressure increases on our open spaces it is vital that landscaping offers some element of habitat creation. Planting indigenous species that provide a home and food source to birds, insects and mammals is vitally important if we are to maintain and enhance wildlife in our urban areas.

Green and Brown Roofs
A 'Green' roof is a roof where the architect has substituted a contemporary roofing material such as tiles, slates or bitumen with a growing medium and vegetation on top of an impermeable membrane. A brown roof is the same concept but with broken substrate replacing the organic growing medium.

'**INTENSIVE'** roofs have deep soil profiles that can grow and support lawns, shrubs and trees. These are more elaborate in design, and are intended for human use and interaction. They will need to be engineered to conform with load requirements. The more realistically applicable system is often the alternative, '**EXTENSIVE**' type that is based on shallower soil profile roofs that are planted with mosses and sedums. These are more often non-access roofs as compared to the 'intensive' type.

Generally, extensive greenroofs can be constructed on roofs with slopes up to 33%, and can be retrofitted onto existing structures with little, or most often, no additional structural support. The average weight of a fully saturated extensive greenroof is 17 pounds per square foot - comparable to the weight of gravel ballast placed on many conventional roofs.

The only universal process that removes carbon dioxide from the atmosphere is photosynthesis. For this reason roof planting on a large scale could play a crucial role in the sustainable development practices of the future.

- The benefits of Green Roofs include:
- Improved rainwater management;
- Improved building thermal performance;
- Reduction in sound transmission;
- Improvement in air quality; reduced in urban heat island effect; provision of habitat for native flora and fauna.

Additional Information and references:

www.erisco-bauder.co.uk/green
www.greenscapeuk.co.uk
www.greenroofs.co.uk
www.kal-zip.de/
www.sustainabilityworks.org

CHAPTER 11 – FACILITIES WITHIN DEVELOPMENTS

Introduction

Recycling facilities should be attractively designed and may be communal. Developments should make allowance for the storage of recycled materials – either within the internal layout of a building, or communally, for example in flatted developments. The requirements of Travel Plans for developments, and requirements on cycle parking should also be taken into account in the design stages.

Storage within developments

Once the development becomes operational, it should offer occupiers the opportunity to reuse and recycle with ease. Where possible (and appropriate to the size of the development), recycling facilities should be provided on site. In residential developments, the preferred form of recovery and recycling would be segregation at source, or as close to source as possible (i.e. within easy walking distance, and by designing access routes to go past waste segregation facilities). Kerbside collections are much more likely to encourage recycling. Expecting people to take their waste to recycling centres is not very attractive to many, and can also generate unnecessary car journeys. Larger housing and mixed-use developments can incorporate central waste segregation (e.g. organic waste, glass, cans, plastics) and recycling facilities. Commercial developments can operate such schemes at the same variety of scales, but care needs to be taken to ensure that contamination of waste does not occur.

Composting is a form of recovery for biologically degradable organic wastes, such as garden and kitchen waste. Compost can help to improve soil structure and enriches the nutrient content of the soil. Householders have an important role to play in composting, which can be encouraged by the provision of composting bins/facilities. By considering this activity in the design phase, it is possible to maximise the degree of activity once the development is inhabited and functioning.

Travel plans

Developers should always consider incorporating bicycle lanes within the their scheme where there will be traffic speeds above 20mph. Where bicycle lanes have been incorporated, cycle parking provision should also be allocated either in communal areas or attached to individual dwellings. It is important that the provision is useable so attention should be given to security features including 'informal surveillance' to discourage would be thieves. Lack of secure storage facilities for cycles inhibits their use as part of commuting or shopping journeys. Commercial developments should include safe and secure cycle parking and shower facilities for their staff. Retail and leisure developments should incorporate safe and convenient cycle parking.

Kingston has developed guidance for developing Travel Plans (further details are available at www.kingston.gov.uk). A new development should illustrate how it aims to work towards achieving more sustainable transport for Kingston by including a Travel Plan with proposals. Travel Plans should specifically address the issues of encouraging walking, cycling, the use of public transport, and car sharing. In preparing Travel Plans, developers should consider opportunities to link up with existing and neighbouring land users to implement a co-ordinated and efficient set of proposals.

CHAPTER 12 - CONCLUSIONS

After referring to this guide, how many of the design recommendations and considerations can be included and implemented within the proposed development you are involved with?

Use the table below to assess how environmentally sustainable your development is

CHAPTER REFERENCE	EXCELLENT	GOOD	AVERAGE	POOR
3. Decontamination Method	On site Bio technology		Capping	Removal from site
4. Aggregate use	Re-use on site demolition waste	Re-use of imported recycled aggregate		Use imported virgin material
5. Water Conservation	Conservation, recycling and SuDS	Two examples of three	One example of three to the left	No examples
6. Prefabrication	Substantial componentry	At least one component		No examples
7. Sustainable Building Materials	Low embodied energy and high thermal performance	Low embodied energy and average thermal performance	Average or high embodied energy and average thermal performance	High embodied energy and average or low thermal performance
8. Energy Efficient Design	Attention to solar orientation, above average insulation and low energy appliances	Attention to two out of three factors.	Attention to one factor	None
9. Renewable Energy	Renewable energy technology employed	Combined Heat and Power employed		Neither
10. Landscaping	Brown installed or Green Roof installed and planted with indigenous species	Green roof installed and planted with non indigenous species	Indigenous landscaping suited to climate and location	Non indigenous planting for aesthetic reasons only
11. Facilities within developments	Attention to storage of recycling facilities (e.g. newspaper recycling), bicycle storage and / or communal recycling storage.	Attention to two out of three factors.		None

GLOSSARY

Accessibility – The ease with which people can travel to any given location by different modes of transport.

Biodiversity – The variety of plants and animals that makes up the natural environment, including species richness, ecosystem complexity, and genetic variation.

Brownfield land – Land and buildings, which have been previously used for development, except for agricultural buildings.

CO2 – Carbon dioxide.

Combined Heat and Power (CHP) – A system that uses the waste heat of electricity production, often from industrial processes, to provide hot water and heating for neighbouring buildings.

Conservation area – A defined area of special architectural or historical interest, the character of which it is desirable to preserve or enhance.

Contaminated land – Soils that contain accumulations of substances that are likely to be harmful to people or to nature.

Density – The floorspace of a building or buildings or some other unit measure in relation to a given area of land.

Embodied energy – The amount of energy used in the extraction, manufacture, transport, assembly and disposal of materials.

Greenhouse gas emissions – Releases of pollutants and gases, such as CO2, into the atmosphere, leading to climate change.

Grey water – Water that may be reused for another use without being fully cleaned first – e.g. for toilet flushing.

Landscape – The character and appearance of land, including its shape, form, ecology, natural features, colours and elements and the way that these combine.

Mixed use – A development that includes a variety of land uses, e.g. housing, offices, shops and community facilities.

Mitigation – Techniques used to reduce the adverse impacts of a development, usually on the environment.

Passive solar design – Using the orientation of a building and its design and materials to maximise natural heat gain from the sun.

Permeable surfaces – Roads, pavements, etc., which can let water filter through them.

Photo voltaic cells – The use of special cells that can generate electricity-using energy from the sun.

Planning obligation (Section 106 agreement) – An agreement between the Local Planning Authority (RB Kingston) and the applicant which requires the provision of e.g. public open space, affordable housing or a commuted payment towards transport improvements, as part of a planning permission. It covers matters that cannot be required by a condition to a planning permission.

Sustainable development – development, which meets the needs of the present without compromising the ability of future generations to meet their own needs.

Sustainable Drainage Systems (SuDS) – Techniques used to control surface water run-off as close to its origin as possible, before it enters a watercourse or groundwater. This involves moving away from traditional piped drainage systems to engineering solutions that mimic natural drainage processes.

APPENDIX 1 LEGISLATION AND GUIDANCE

- **1999 – The UK Sustainability Strategy** – **'*A Better Quality of Life'*** provides the Government's vision for sustainable development.
- **2000 – The Urban White Paper** makes reference in **Section 4 'Looking After The Environment'** to Air Quality, Climate Change and Open Space.
- **2000 – Local Government Act** introduced the power to promote economic, environmental and social well being together with a duty for council's to produce a community strategy to contribute to sustainable development in the UK.
- **2000 – Local Agenda 21 Strategy**. UK Government's national target was for all local authorities to have this in place by 2001 to promote sustainable development
- **2002 – 'Foundations for our Future'** defines DEFRA's Sustainable Development Strategy for the UK.
- **2002 – Planning & Compulsory Purchase Bill** new legislation announced changes to UK planning system including sustainability principles in Planning.
- **2003 – Energy White Paper and Renewables Obligation**– proposing a 20% renewable energy generation by 2020.

Planning Policy Guidance

The PPG's below set out the Government's approach to taking account of sustainable development in planning. A number of these relate directly and indirectly to sustainable construction:

- **1 General Policy and Principles** – Explanation of Sustainable Development and references to other relevant strategies.
- **3 Housing** – References the DETR's 'Planning for Sustainable development: Towards Better Practice' (1998)
- **9 Nature Conservation** – Consideration of biodiversity issues in development including designated sites and protected species.
- **13 Transport** – Travel Plans, alternative fuels and environmental impact assessments.
- **22 Renewable Energy** – Explanation of sources and benefits.
- **23 Planning and Pollution Control** – treatment and development of contaminated land.
- **25 Development and Flood Risk** – sustainable development and the precautionary principle.

APPENDIX 2 – CASE STUDIES

GREENWICH PENINSULA (WWW.GREENWICHPENINSULA.CO.UK)

The Greenwich Peninsula site covered approximately 296 Acres and contained heavy Gasworks waste contamination, including a 30m diameter, 8m circular tar tank which had been capped off temporarily whilst still full. BTEX, cyanide and PAH contamination was also present.

The landowner – Port Greenwich Ltd (British Gas) – undertook the primary statutory remediation of the site to clear target contaminants that would pollute third party land and aquifers. Subsequent remediation was undertaken under the English Partnerships contracts.

Off site disposal was minimised by employing the following methods:

- Soil Vapour Extraction processes;
- Gravel washing;
- Soil Washing; and
- Dry processing.

The remediation, servicing and landscaping works formed the foundation of the site's regeneration and concentrated on protecting the existing environment, including preventing contaminants entering the Thames, and ensuring the safety of future developments.

GALLIONS HOUSING ECO-PARK, THAMESMEAD

Gallions Ecopark is a development of 39 environmentally sustainable affordable homes for rent, and eight flats for sale. They are situated in the Gallions Reach Urban Village, on the southern banks of the Thames in the London Borough of Greenwich.

The goals of Gallions Ecopark are to:

- Develop in Britain the latest European thinking on environmental sustainability.
- Concentrate on practical details of sustainable construction and design, which can be replicated in future housing developments.
- Provide the opportunity to see the selected environmentally sustainable products in a unique Naked House and Visitors' Centre.

These homes are not an expensive one off showpiece for cutting edge technology that has little relevance to social housing. The aim is to build practical, sustainable homes on a realistic budget.

There are five different house types in the scheme. Information will be gathered about what the homes are like to live in, how much they cost to run and how expensive they have been to build in comparison with each other. Ecopark is an experiment to guide us to the best combination of sustainable features for future developments.

The five house types incorporate different combinations of technologies to reduce the consumption of energy. These features include:

- Sunrooms
- Solar collectors for pre-heating domestic water
- Wind pressure controlled natural ventilation air supply
- Under floor heating
- Low temperature heating and individual condensing boilers
- Grey water recycling
- Low flush toilets
- Water saving taps

All of the homes have high insulation levels for walls, roofs and ground floors, and super insulating windows.

PEABODY TRUST'S MURRAY GROVE DEVELOPMENT IN EAST LONDON (WWW.BUILDINGFORLIFE.ORG)

The UK's first multi-storey prefabricated modular residential construction took place in Nov. 1999.

Modules were manufactured in York, brought to London and bolted into place - allowing the Peabody Trust to ensure the development was completed in half the time it would have taken using conventional construction methods. Commissioned by Dickon Robinson

BACKGROUND
The Murray Grove Scheme was developed by Peabody Housing Association using steel framed prefabricated units manufactured by Yorkon at their factory in York.

QUALITY ISSUES
We were told that Peabody had approached York on following disappointment with quality on traditional-build schemes built recently. It was thought that the shortage of traditional skills in the building industry was leading to a lower quality of product. With modular construction, quality was consistent.

COSTS
We heard that the Murray Grove Scheme cost approximately 5% more than if traditionally built, but that the speed of building modular units could be balanced against earlier occupation and thus earlier receipt of rents.

CONSTRUCTION TIME
The Murray Grove development had taken eight months to build three years ago. We were told that technical and operational advances meant that three months could be taken off this time if it were being built today. A similar scheme built by traditional methods was estimated to take thirteen months.

Raines Dairy, Enfield, London, UK
Hoping to build on the success of Murray Grove, Peabody have submitted plans for a second modular scheme. The development would comprise 63 shared-ownership flats and 4,000 square ft of commercial space. Commissioned by Dickon Robinson.

HARLOW PARK, LIVERPOOL (www.**sustainable**homes.co.uk/case_studies/cds2.htm)

33 houses were developed by Harlow Park Housing Co-operative, in partnership with CDS in 1998. All the homes have a low environmental impact because material source sustainability and lifecycle implications were taken into consideration. Features include:

Sustainable sourced prefabricated timber frame construction
High levels of cellulose insulation (recycled newspaper)
Low embodied energy construction
Breathing construction walls
Natural ventilation
Natural paints and pigments
Clad in recycled bricks
Greywater recycling (sponsored by North West Water)
Recycling bins

Water savings are expected to be around 30% whilst heating and lighting use is expected to be reduced by 25%. The average building cost was £54,000. CDS's aim was to include as many green elements as possible within "normal" build costs plus 2.5%.
(Source: Building homes of tomorrow: A combined note of three CIEF seminars, sponsored by the Housing Corporation, exploring sustainability and housing provision).

BEDDINGTON ZERO ENERGY DEVELOPMENT (BEDZED) www.**bedzed**.org.uk/

BedZED, the Beddington Zero Energy Development, is an environmentally-friendly, energy-efficient mix of housing and work space in Beddington, Sutton. BedZED was the first to incorporate up-to-the minute thinking on sustainable development into every aspect of the scheme, from the energy-efficient design to the way the houses are heated.

BedZED will only use energy from renewable sources generated on site. It is the first large-scale 'carbon neutral' community - i.e. the first not to add to the amount of carbon dioxide in the atmosphere. BedZED shows how housing can be built without degrading the environment.

Key BedZED features include:

- Building materials selected from natural, renewable or recycled sources and wherever possible brought from within a 35-mile radius of the site.

- A combined heat and power unit able to produce all the development's heat and electricity from tree waste (which would otherwise go to landfill).
- Energy-efficient design - with the houses facing south to make the most of the heat from the sun, excellent insulation and triple-glazed windows.
- A water strategy that will cut mains consumption by a third - including installing water saving appliances and utilising rain and recycled water.
- A green transport plan which aims to reduce reliance on the car by cutting the need for travel (e.g. through internet shopping links and on-site facilities) and providing alternatives to driving such as a car pool.
- Recycling bins in every home.

PHOTOVOLTAIC PANELS, LADBROKE GROVE (SEE WWW.PV-UK.ORG.UK/NEWS/BRITSOL-11.PDF)

The development near Ladbroke Grove in the London Borough of Westminster, is a £70 million high-tech urban village. The development is to be mixed use and mixed tenure and will feature a number of sustainable attributes including an ecology park and a large landscaped garden, a crèche, children's play areas, and a neighbourhood management service.

The development will also incorporate photovoltaic panels which convert solar power into energy. Peabody Trust was awarded European funding to install the panels - the development will use photovoltaic panels in a mixed use residential and commercial site which will be the largest use of photovoltaic panels in the UK and one of the largest in Europe.

The panels will replace 15000 square metres of conventional cladding materials on roofs and facades. On the sunniest days, the system will generate 200kWp, meeting all the electrical requirements of the site. It is estimated that over the course of a year 10% of the site's electricity will be generated by the panels.

HORNIMAN MUSEUM , LADYWELL (WWW.HORNIMAN.AC.UK)

The Horniman Museum's Centre for Understanding the Environment is a modern, open-plan, glass and timber building - with a living, meadow covered roof. "Passive ventilation" is provided by the columns which run from floor to roof. As air inside the columns is heated it rises out through the roof vents and pulls cool air up from the shaded space under the floor, so no energy-consuming air conditioning is needed to cool the building in summer. In winter, the 10cm-thick layer of soil overhead keeps the building well insulated. A regular autumn mowing regime keeps the grass growing and absorbing carbon dioxide. Less electricity consumed, less greenhouse gas emissions, less contribution to climate change. And in extreme weather the roof acts like a sponge, soaking up excess rain and relieving flood pressure on local drains.