100-102 Arlington Road, 16-18 Delancey Street, London NW1

Environmental Sustainability Overview

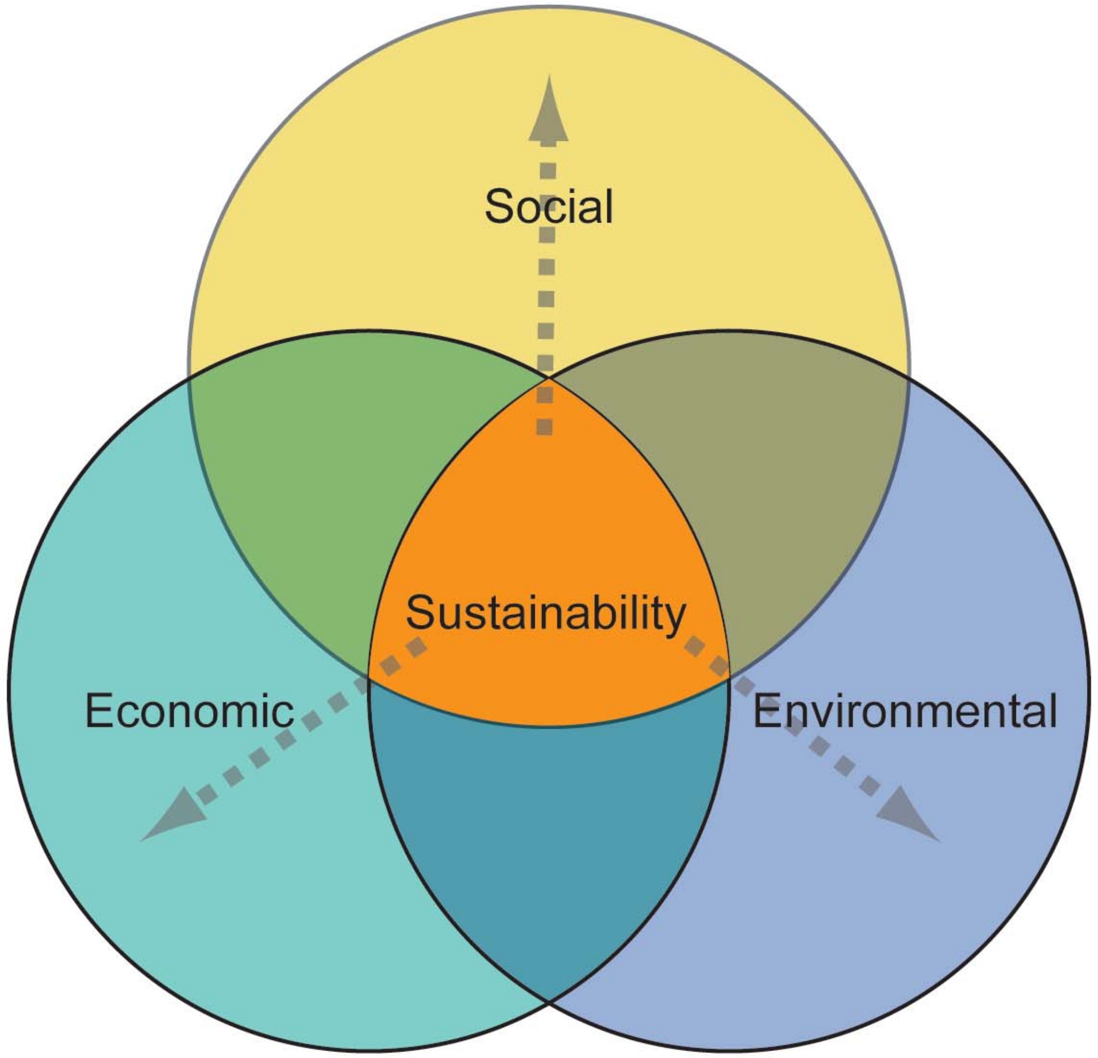
23 August 2006

BATTLE McCARTHY
Consulting Engineers & Landscape Architects

Dog & Duck Yard
Princeton Street
LONDON
WC1R 4BH

t: +44 (0) 20 7440 8282
f: +44 (0) 20 7440 8292

e: admin@battlemccarthy.com
w: www.battlemccarthy.com



"Sustainable design is not just about the environment, important though that is. Sustainability is about considering economic, social and environmental concerns and their interconnections"

Camden Council Principles of Sustainable Design

Introduction

Sustainable Development aims to create solutions that meet environmental, social and economic objectives in a balanced and holistic way.

The Government's strategy 'A Better Quality of Life - A Strategy for Sustainable Development in the UK' May 1999, identifies four objectives:

- Social progress which recognises the needs of everyone;
- Effective protection of the environment;
- Prudent use of natural resources;
- Maintenance of high and stable levels of economic growth and employment

The Concept of Sustainable Buildings

The majority of the existing UK building stock has significant social and environmental impacts. The use of inappropriate materials, the destruction of natural habitats, pollution and the excessive use of energy and water all damage the local and global environment. Reducing the environmental impact of UK buildings is therefore a crucial component of moving towards sustainable development. The concept of sustainable development can be applied to the shell of a building (including its location), or the way we live/work/play in those buildings and our communities. In this chapter we have considered a range of issues which affect primarily the environmental sustainability of the building as highlighted by the relevant legislative and guidance documents. This does not in any way suggest that environmental performance has been considered of greater importance than social and economic issues only that these issues have been covered elsewhere.

Environmental

In environmental terms, housing in the UK contributes around 27 per cent of the total CO_2 emissions associated with energy use - and domestic energy use is projected to rise by 6 per cent by 2010. It is therefore essential to reduce emissions from new and existing homes if we are to mitigate some of the worst effects of climate change.

Furthermore, the construction industry in the UK currently uses around 40 million cubic meters of timber every year, and a high proportion of this is for housing. Meanwhile, natural forest is being lost at a rate of 30 hectares every minute, so it is vital the house building industry demands timber from well managed, independently certified sources if we are to halt and reverse the threats to forests around the world.

Other impacts related to the construction of new homes include quarrying to provide aggregates, the wasteful use of water, and the widespread use of toxic chemicals in materials, which can pose significant health risks to the occupants as well as affecting wildlife. In addition, the way homes and communities are developed determines our lifestyle decisions and our overall ‘ecological footprint’ - the impact we make on the natural world and its resources. For example, by providing easy access to local amenities, public transport, local food links and recycling facilities, residents are easily able to choose the more sustainable option, reduce their ‘ecological footprint’, and in may cases, also improve their quality of life.

Social

In social terms, poor housing has major adverse impacts on the physical and mental health of residents. However, in contrast, sustainable homes and communities off significant health benefits such as warm, well ventilated and healthier indoor environments, with fewer toxic substances and less air pollution from traffic. Well designed communities, incorporating safe pedestrian and cycling facilities, and access to local shops and amenities, may also encourage residents to leave their cars at home and get more exercise.

Economic

In economic terms, experience has shown that developing more sustainable homes does not have to be more expensive than building to current minimum requirements. For example, Gallions EcoPark in Thamesmead achieved EcoHomes “excellent” standard at a close to cost parity compared with their traditional new-build schemes.

Developing Best Practice

The previous criteria highlight the importance of developing sustainable buildings.

A sustainable development will have many benefits for a number of parties.

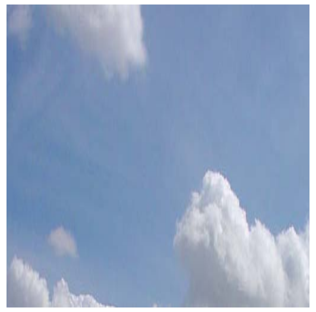
A more sustainable development:
- Reduces impacts on the environment;
- Conserves resources;
- Offers higher standards;
- Makes a significant contribution towards a sustainable economy.

For occupiers the benefits are:
- Lower bills for gas, electricity and water;
- Greater comfort and satisfaction;
- More convenient houses and neighbourhoods;
- More choice;
- Healthier living environments.

For the Operator:
- Less dissatisfaction and lower management costs;
- Lower maintenance costs;
- It is easier and cheaper to adapt and upgrade stock.

For developers:
- A more favourable public perception aids marketing;
- It is easier to attract funding in a competitive context;
- They demonstrate their sustainability credentials to planning authorities, investors and others.

It is the ambition of this development to become a sustainable building not only to reduce its global impact, although this is a key driver, but also because of the benefits it can provide to the local community and finally the enhanced market value this type of development can bring



1. Low Energy, Low Carbon, Low Resource

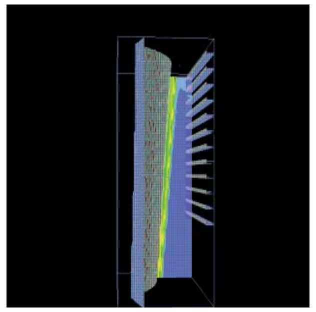
This will be a development that exceeds expectations in energy, carbon and water savings, providing:

- A reduction in conventional energy use
- Reduced carbon emissions
- Reduced water consumption

2. Health and well being

We will appreciate the needs of the occupants and visitors to the site:

- Provide good access to daylight and sunlight in the home specifically to the living spaces i.e. living rooms and kitchens
- Creating landscapes and building forms that protect against the elements and the influences of external pollutants
- Provide enhanced levels of sound control beyond regulations
- Landscaped spaces for people to enjoy all year round



3. A bioclimatic building

A building the harnesses the benfit of the sun and wind

- Living rooms in dwellings that enjoy good access to the sun
- All rooms in dwellings that enjoy good permeability of natural light
- Dwellings sized to allow good natural ventilation

4. Building good practice from the beginning

A development committed to implementing sustainable construction techniques such as:

- Maximising use of recycled materials
- Designing for recyclability and re-use
- Implementing sustainable practices in supply chain management, materials selection and in waste management

5. Green Construction and management

A development that considers its impacts from the beginning and is able to develop to meet changing demands

- On site construction waste management
- Construction pollution mitigation including land, air, water and noise
- Implementation of a Considerate contractors scheme
- Detailed green guide to operation and maintenance for all
- Sustainability workshops for occupiers, designers and constructors

6. Aiming for excellence and innovation

- The team is committed to achieving a EcoHomes 2006 Very Good rating and will work with the Building Research Establishment to achieve this.
- Innovation encouraged in design and supply teams

Building Engineering Objectives

Maximise Human Comfort in terms of:

- Good daylight, views and air quality
- Suitable acoustics and insulation
- Good thermal control
- Suitable humidity control
- Good security and safety provision
- Good personal control

Efficient Planning in terms of:

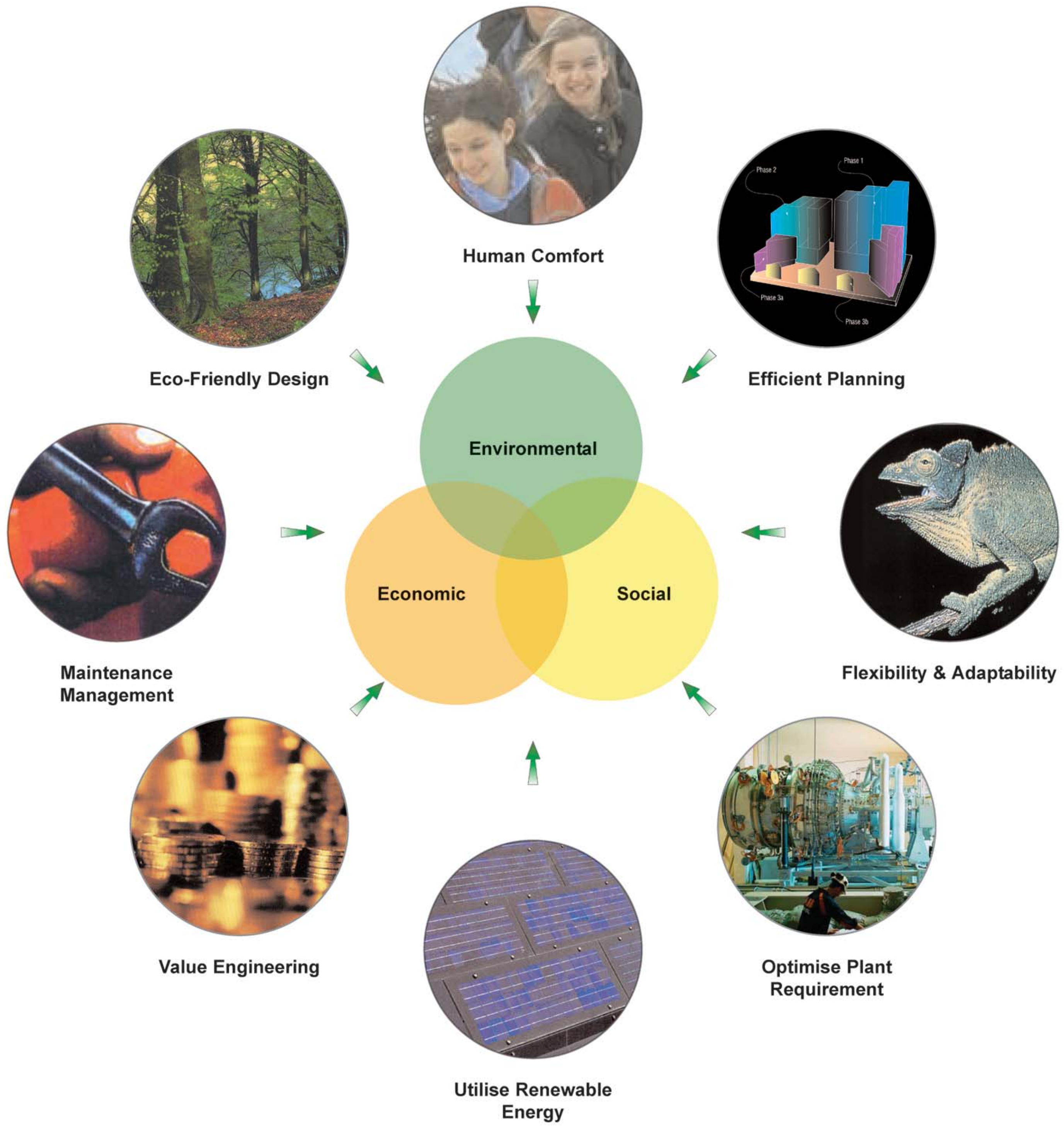
- Good occupant movement flow
- Manageable security
- Ease of adaptability and flexibility
- Responsiveness to occupancy needs

Maximise Flexibility & Adaptability in terms of:

- Simple and modular design to cope with incremental expansion
- Ease of re-routing services for changing functions and layout

Utilise Renewable Energy by:

- Maximising the use of free energies, such as daylight, sun, wind & temperature changes
- High-levels of thermal insulation
- Reliable and suitable control systems
- Efficient building systems and plant



Maximise Usable Space by:

- Minimising area for services
- Maximising structural/service integration
- Removing the necessity for ceiling voids

Create Value Engineering by:

- Reducing the size of mechanical services
- Reducing complexity of services
- Co-ordination of structure and services

Sustain Maintenance Management through:

- Utilising durable materials
- Long-life equipment
- Reliable and simple environmental control systems
- Good access for maintenance

Eco-friendly Design by:

- Integrating fauna and wildlife
- Considering green and blue conditions
- Collecting rainwater and recycling
- Effective waste management and recycling

The origins of sustainable development as an environmental approach arose from global meetings and agendas (see Figure 1). An agreement on sustainability was signed by 180 countries at the 1992 Rio de Janeiro summit to protect the earth and prevent environmental, social and economic breakdown. The 1997 Kyoto Protocol set challenging targets for developed countries to reduce pollution and the amount of limited resources used.

The 2002 World Summit in Johannesburg agreed more priorities. European Union Directives are implemented through national legislation, and there are various legal, policy, financial and voluntary measures to tackle the UK Government's sustainable development strategy.

The UK Government have agreed upon a set of shared UK principles that provide a basis for sustainable development policy in the UK. These are:

- Sustainable Consumption and Production
- Climate Change and Energy
- Natural Resource Protection and Environmental Enhancement
- Sustainable Communities

Camden Council have set its only policy, which encapsulates sustainable development at the local level as described in the adopted revised UDP 2006 and associated Supplementary Planning Guidance (SPG).

Policies contained in these documents that have helped to develop the design include, but are not limited to.

Guiding Principle

“Securing the most efficient and environmentally sustainable use of land”

Policy SRE1

“The council will seek to ensure that the development will be sustainable”

Policy SEN2

“The council will seek to ensure that all development maximises the conservation of resources and energy”

SD9 - Resources and energy

A - Air quality

“Where the Council considers that development could potentially cause significant harm to air quality, applicants will be required to submit an air quality assessment. The Council will not grant planning permission for development that would significantly harm air quality, unless mitigation measures are adopted to reduce the impact to acceptable levels.

B - Water

In considering proposals for development, the Council will need to be satisfied that adequate provision can be made for water supply and waste treatment. The Council will only grant planning permission for development that it considers is sited and designed in a manner that does not cause harm to the water environment, water quality or drainage systems and prevents or mitigates flooding. The Council will require developers to include measures to conserve water and where appropriate incorporate Sustainable Urban Drainage Systems.

C - Use of energy and resources

The Council will seek developments that conserve energy and resources through:
a) designs for energy efficiency;
b) renewable energy use;
c) optimising energy supply; and
d) the use of recycled and renewable building materials.
The Council will require major developments to demonstrate the energy demand of their proposals and how they would generate a proportion of the site's electricity and heating needs from renewables wherever feasible. The Council may use conditions or planning obligations to secure recycling of materials on site and/or use of recycled aggregates in major schemes.”

Suggested Development 2006 EcoHomes Credit Summary Table

EcoHomes Credit	Credits Achieved	Requirements
Home User Guide	3 out of 3	A stand alone non-technical document that contains information on the operation and environmental performance of their home and information relating to the site
Considerate Constructors	2 out of 2	A CCS greater than 32
Construction Site impacts	3 out of 3	A commitment to monitor, report and adopt best practice policies relating to construction activities
Security	2 out of 2	Achieve Secured by Design Award and security standards for external doors and windows to achieve a adequate security rating
Dwelling Emission Rate	5 out of 15	CO2 Emissions <26kg/m²/yr
Building Fabric	1 out of 2	Average heat loss parameter (HLP) across the whole site < 1.3
Drying Space	0 out of 1	No Space Allocation
EcoLabelled Goods	1 out of 2	Information on green purchasing ‘A’ rated white goods provided (Washing machines, dishwashers, washer dryers, fridges, freezers etc..)
Internal Lighting	2 out of 2	75% of fixed internal lights dedicated to energy efficient fittings
External Lighting	2 out of 2	Energy Efficient External Lighting and space lighting
Public Transport	2 out of 2	Urban Site must be within 500m of a transport node
Cycle Storage	2 out of 2	Adequate Space Allocation Required
Local Amenities	3 out of 3	Site 0.5k from food shop and post box and 1k from 5 local amenities with safe pedestrian routes
Home Office	1 out of 1	Space allocation required
Insulant ODP and GWP	1 out of 1	No ODP Insulates or insulants with a GWP above 5 shall be used
NOx Emissions	0 out of 3	Boilers emissions rate likely to be greater than 100mg/kWh
Reduction of Surface Runoff	1 out of 2	Runoff attenuation and calcs
Zero Emission Energy Source	2 out of 3	10% Renewable energy
Flood Risk	2 out of 2	
Environmental Impact of Materials	5 out of 16	Green Guide “A” rating for all hard landscaping, fencing and internal walls.
Responsible sourcing of Materials: Basic Building Elements	4 out of 6	
Responsible sourcing of Materials: Finishing Elements	2 out of 3	
Recycling Facilities	6 out of 6	Dedicated bins and space allocation for recycling
Internal Water Use	5 out of 5	Water consumption of less than 32m³/bedspace/yr
External Water Use	1 out of 1	Rainwater collection system
Ecological Value of Site	1 out of 1	Ecological Report from registered Ecological Consultant
Ecological Enhancement	1 out of 1	Ecological features designed in the Development
Protection of Ecological Features	1 out of 1	Existing ecological features not destroyed in construction
Change of Ecological Value of Site	3 out of 4	Positive change in ecological value
Building Footprint	2 out of 2	80% of development has a floor area ratio/footprint ratio of greater than 3.5
Daylighting	2 out of 3	Living rooms, dining rooms, studies meet BS 8206: Part 2 Dwellings in Shadow
Sound Insulation	4 out of 4	3 sets of tests for every 10 dwelling in a group and improvement from Document E (2203) Building Regulations
Private Space	0	No Private outdoor space provided (Generally)

Introduction

In accordance with the requirement of clause 1.3.14 contained in Camden’s SPG, the development which contains 10 dwellings (minimum level of requirement) will be assessed using EcoHomes. A minimum score of Very Good is expected.

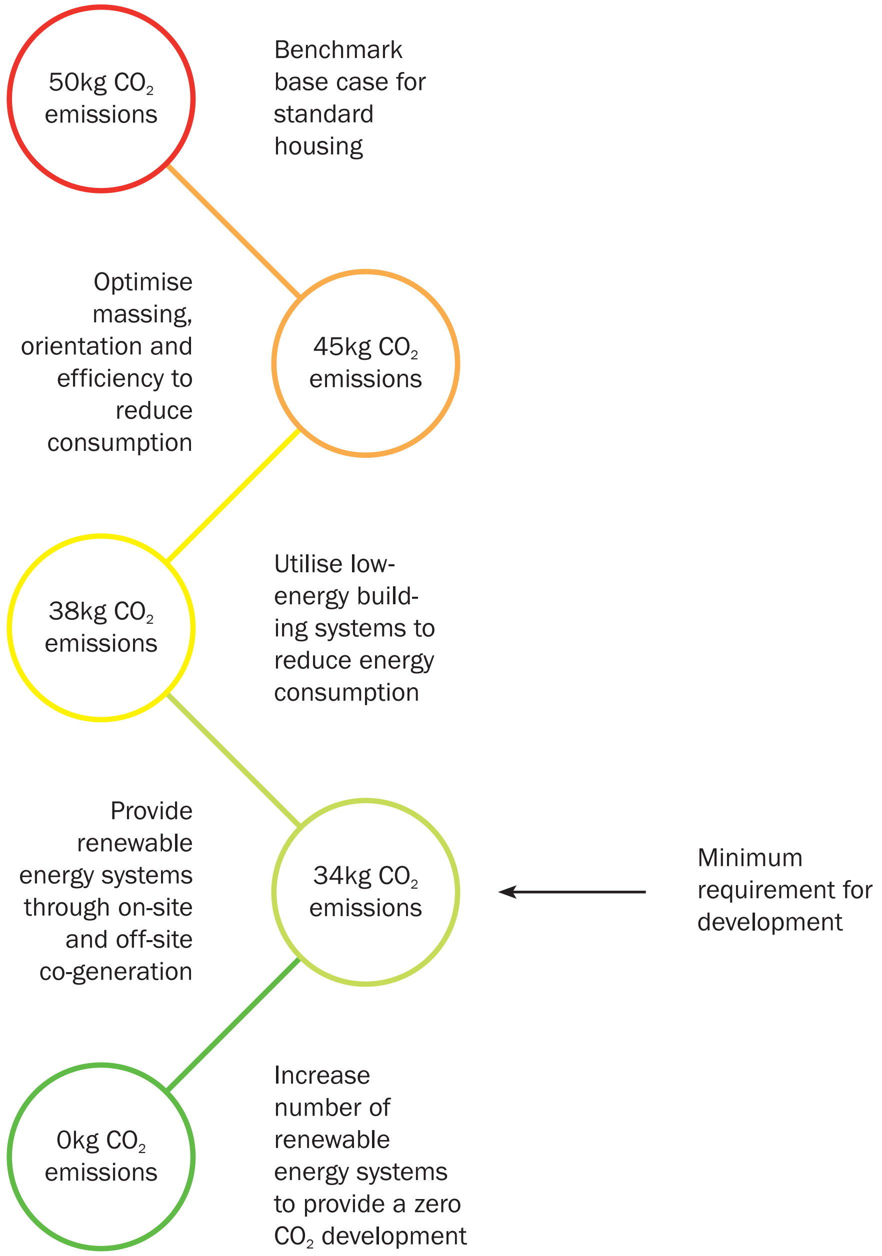
EcoHomes is a BRE residential energy assessment system that assesses the property in regard to the environment, social and ecological standards.

EcoHomes

EcoHomes considers the broad environmental concerns of climate change, resource use and impact on wildlife and balances these against the need for a high quality of life and a safe and healthy environment. All the issues in EcoHomes are optional, making it flexible and enabling developers to adopt the most appropriate aspects of sustainability for their particular development and market.

The issues assessed are grouped into seven categories:

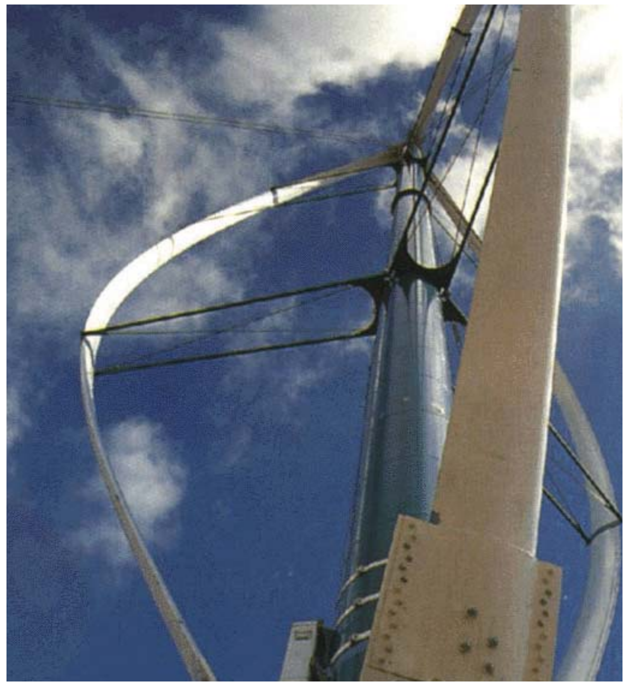
- Energy
- Transport
- Water
- Ecology and Land-Use
- Pollution
- Health and Well-Being
- Materials

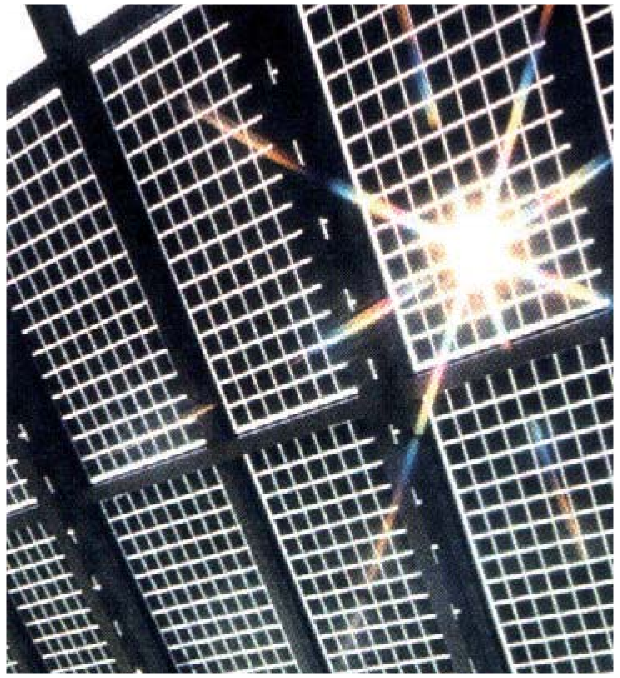


Responses

It is the intention of the development to be considerate to the issue of Global warming and its impact on the issue. Therefore the development has been specifically designed to reduce energy consumption.

The energy strategy for the development is to achieve savings in Carbon dioxide emissions by following the route map as set out on the adjoining image. In order to achieve this, three energy steps have been and shall continue to be incorporated in the design based on achieving the maximum reductions for a viable level of economic expenditure.





Process

Step 1: Passive Design

Correct massing and orientation are vital to the success of any sustainable development. With it significant savings in energy can be achieved with not net increase in capital cost.

Although due to the existing urban site constraints limited options in regards to massing and orientation are available great care has been taken to gain maximum benefit where possible. The development has been designed to harness this opportunity, without being prescriptive, in order to preserve the urban design strategy

Fortuitously the site, due to it being a corner site, enjoys access to both the southwest and southeast ideal for residential use. Living rooms have been purposely located on either the southwest or southeast elevation to ensure good access to sunlight for a large proportion of the day all year round vital for human well-being but also a free source of heating. Bedrooms have also been located where possible to enjoy good access to the sun which although not vital is preferable, however where this is not possible, in very limited occasions in the inner corner, this loss of access has been compensated for by the provision of rooflights.

Good daylight access is provided to all bedrooms, living rooms and kitchens via good sized windows and rooflights.

Size of dwellings and rooms allows single sided natural ventilation to be possible to the majority of rooms excluding the toilets and kitchen which will have mechanical ventilation. Where rooms may have difficulty being naturally ventilated notably the bedrooms located in the inner corner the adjoining bathroom extracts will be used to facilitate air movement and aid passive ventilation.

Optimising the Orientation of the dwellings and the space within them ensuring good passive design, has the lowest cost implication, and can improve the buildings energy performance by more than 10%.

Step 2: Reduce Energy Loads

After step 1 it is the proposed design strategy to reduce CO_2 emissions further by improving the performance of the building and its systems.

The intention is to maximise the building envelope performance (very low U-values, high performance glazing, very low infiltration) thus lowering the energy consumption for the development.

To incorporate Controls and monitoring to limit energy wastage throughout e.g. thermostatic radiator valves, daylight light sensors, localised switching to allow for individual light control, time switching and set controls for daytime and 'out of hours' use.

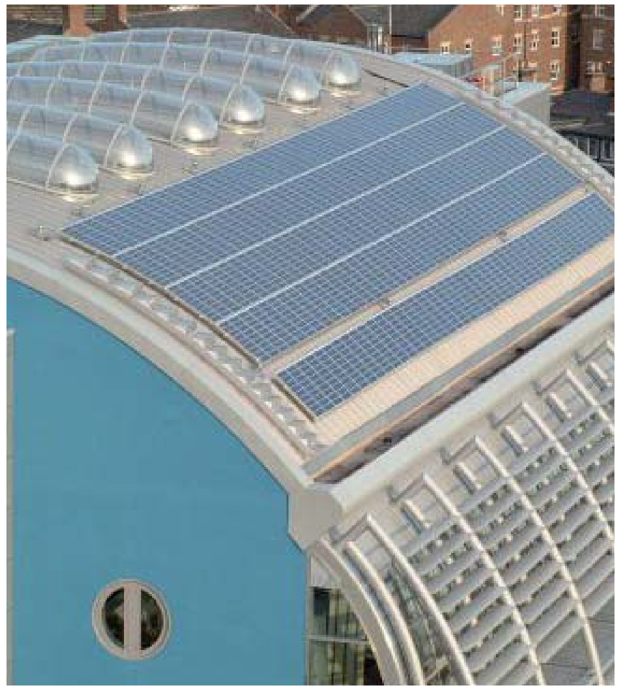
To chose Building systems chosen based on efficiency, reliability and effectiveness in operation monitored against current and future environmental conditions.

To harness the mixed use nature of this site and ensure symbiosis between different modes of operation. A centralised heating and cooling ring will allow the bar and restaurant to expel unwanted heat, via heat exchangers in the exhaust and through creating a balanced centralised system to the residential units providing welcomed free heat.

Improving the building envelope, choosing building systems responsibly and by providing adequate controls is the most cost effective way of reducing energy consumption, these improvements will have a very high impact on meeting this target with the lowest cost.

Step 3: Renewable Energy Systems

The building and efficiency optimization undertaken in Step 1 & 2, will allows for renewable energy systems to be incorporated effectively.



How these steps will be achieved:

Energy efficiency and RES specification

Step 1 : Orientation, Solar Shading and Passive Design

- Maximise daylighting to reduce electrical demand. Site layout designed to exceed BRE guidance on daylighting and solar penetration.
- Minimise losses due to glazing and maximise passive solar gain - high performance double-glazing - low-e Argon filled and conservatories with high thermal mass floors to the south, where appropriate and a limiting of glazing to the north.
- Solar shading to restaurant and bar minimise solar gain and overheating
- Units sized to maximise natural ventilation facilitating passive cooling in summer.

Step 2: Energy Efficiency

Building envelope:

- External walls: 0.2W/k/m²
- Roof: 0.16W/k/m²
- Ground floor: 0.2W/k/m²
- Glazing: Residential Low-e Argon filled double glazing: 1.7W/k/m²
  Bar and Restaurant Low-e Air filled double glazing:
  1.8W/k/m² with solar control coating

Ventilation and Air Tightness:

- Air tightness should be less than 4m³/m²/h at 50pa (with no trickle ventilation)
- Whole house mechanically ventilated in winter with heat recovery from residential and commercial kitchen exhaust and no additional trickle ventilation. Heat recovery should operate at least 75% efficiency

Step 3: Incorporate building mounted renewable energy sources for the Exemplar Element

It is predicted at this time that by implementing all of the design steps, the following energy figures can be achieved:

Residential:	105kWh/m²	Heating + DHW
	42kWh/m²	Electricity
Commercial:	1100kWh/m²	Heating + DHW
	650kWh/m²	Electricity

If provided by traditional grid energy sources, this equates to a total CO_2 emission rate for the whole development of 197 tonnes per annum. It is suggested that 10% of this can be reduced by providing on-site renewable energy. A dual fuel (gas+bio-diesel) boiler located in the basement of the building is one such opportunity. To achieve the 10% reduction, the bio-diesel must provide 12.5% of the heating and DHW requirement for the development. Based on a fortnightly delivery, this would require a storage capacity of 660 litres.

Alternatively, a photovoltaic array could be used. To provide the full 10%, would however require an area of 360m² using high quality photovoltaics (£1000/m²) an area which is not available.

It is therefore likely that the bio-diesel boiler will be progressed. If availability of bio-diesel suggests these quantities are unviable to secure, a mixture of bio-diesel heating + photovoltaic cells and solar thermal tubes will be explored.

Response

Building materials can have a very large impact on the environment; their manufacture, use and disposal involves the use of significant levels of energy and natural resources. Recent statistics show that 10 per cent of UK carbon dioxide emissions were related to the production and transportation of building materials.

Building materials will be chosen based on the following selection criteria where applicable and will follow the guidance provided by the Building Research Establishment's 'Green Guide to Specification'. If salvaged or locally sourced recycled materials are not available the development will aim to use A rated materials wherever possible.

Salvaged Building Materials

The building will conserve the embodied energy of salvaged materials, if possible, instead of consuming natural resources to manufacture new materials. For example: salvaged stone and bricks.

Recycled Materials

Use of recycled materials will be encouraged as this helps in reducing solid waste problems, toxins, energy consumption in manufacturing and saves on natural resource use. For example: cellulose insulation; pulverised flue ash [PFA] or Ground Granulated Blast Furnace Slag [GGBS] to reduce the proportion of cement in the concrete, etc.

Ozone-Depleting Materials

The building will avoid ozone-depleting materials [ODP]. The insulation in following elements will be given consideration:

- Building fabric including walls, roof, floor, window frames, doors, cavity closures and lintels.
- Building services including; chilled water pipework, ductwork, hot & cold water pipes and water tanks etc.

Low Embodied Energy

Embodied Energy contributes to between 10-15% of the total energy consumption over the building life. Special attention will be given to building elements such as Floor coverings, Structural Slab, External facade and Roof structure as typically they embody the highest component of energy.

Responsible Wood Suppliers

The timber for key elements including structural timber, cladding and internal joinery will come from sustainably managed sources. Certification schemes such as Forest Stewardship Council [FSC], Forest Council [FC], and WoodmarkTM will be used to demonstrate compliance.

Packaging Waste

Efforts need to be made to avoid excessive packaging.
However, there will be some products, which must be carefully packaged to prevent damage and waste.

Use Materials with Longer Product Life

The more a component requires replacing - the larger will be its 'life cycle environmental impacts'. For example, a material with a low initial environmental impact and a product life of 5 years may cause more damage to the environment than a material with high initial impact but a product life of 10 years.

Adaptability, Flexibility

Materials that allow adaptive reuse and flexibility will be considered to ensure that the materials that make up the buildings are not scrapped before the end of their useful life.
Non-Toxic Finishes

Products that have minimal chemical emissions and emit low or no volatile organic compounds [VOC] will be specified. For example, adhesives, carpeting, upholstery, manufactured wood products, paints, thinners and cleaning agents can emit VOCs. including formaldehyde.

Reduce Quantity

Low environmental impact material that has to be used in large quantities may cause more environmental damage compared to another material that requires a smaller quantity to perform the same function.

Purchase Locally Produced Building Materials

As transportation is costly in both energy use and pollution generation.
For materials such as aggregates, timber etc., almost the entire embodied energy value is attributed to its transport component.

Response

Some form of waste management is required to meet the requirements of the Planners.

Currently 27m tonnes of domestic waste is generated every year and this is estimated by DEFRA to be rising by 3% a year. Because waste is an important issue for local authorities, recycling targets and waste regulations becoming increasingly stringent. The household Waste recycling Bill 2003, places a duty upon local authorities to provide a collection of at least 2 types of recyclable waste from every household by the year 2010. This duty became law in November 2003 after gaining Royal Assent.

Procuring recycled materials from local sources for use in the construction i.e. recycled aggregate in the concrete, blockwork that contains at least 50% by volume of recycled material etc. is to be explored and implemented where possible. Building structure designed to be long lasting. The incorporation of adaptability allows short life parts (services, facades etc.) that have worn out or become obsolescent to be changed easily prolonging the life span of the total package.

Process

Design

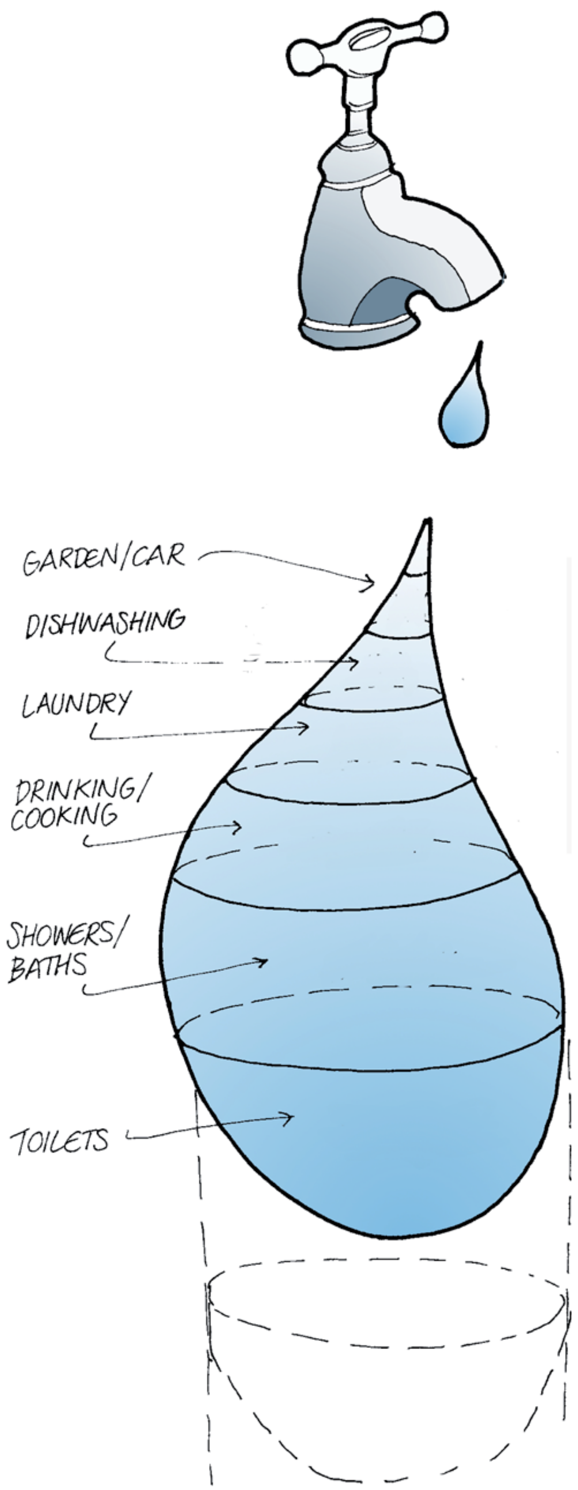
- New buildings designed so as to maximise the life span of the development through consideration of interchangeable layers dependent upon individual life span, technological advancements and changing fashions.

Construction

- Assessment of Modular or prefabricated construction techniques should be carried out and the design of the buildings adapted to suit appropriate technologies. The benefits gained from these construction techniques include:
  - Less waste produced on site
  - Off-site assembly will reduce noise levels
  - Fewer deliveries will result in less traffic
  - Improved efficiency
- Materials waste arising from construction will be reclaimed and reused where possible, for example timber used for shutterings / hoardings and excavation spoil used in the landscape.
- Un-reusable waste materials should be segregated as they are generated for recycling. Landfill disposal off site should be minimised
- An environmental Plan will be produced and will include procedures for managing waste during the construction phase including the appointment of a Waste Co-ordinator to manage the construction waste.
- Facilities will be provided for segregation waste on site for recycling
- Wastage of materials will be reduced through the implementation of measures including avoiding over-ordering, supervising deliveries to avoid damage, contamination or loss through theft or vandalism and requesting Suppliers to supply products using packaging that can be returned to the supplier for reuse where possible.

Operation

- Designated waste storage areas have been provide for collection and storage of waste for both domestic and commercial activities. Located for ease of deposit by residents and for collection by waste collection services
- Recycling bins provided to segregate compost, glass and paper will be provided in each dwelling and storage areas and will be developed in conjunction with Camden waste collection services to maximise recycling opportunities.
- Any waste that cannot be recycled will be disposed of according of Duty of Care legislation
- Waste containers will be suitable for the type of waste generated and will clearly be marked with their contents
- Measures will be put in place to ensure risks of spillages and leaks are minimised and to prevent wastes being able to blow away.
- Measures will be put in place to ensure risks of spillages and leaks are minimised and to prevent wastes being able to blow away.



Responses

The average UK resident uses over 55.3m^3/person/year of highly treated mains water per day, up to a third of which is flushed down the toilet. People in recently built homes with power showers use more like 230 litres per day or 84m^3 per year. In order for the development to achieve reasonable targets, it must reduce the water demand 35m^3/person/year.

In order to achieve this target the development must implement the use of a number of water efficient appliances and water resource management systems.

Process

Low-Flush Toilet

A typical toilet uses 7.5 to 9 litres per flush and accounts for 25% of our annual household waste consumption. If the development are fitted with 2 and 4 litre dual flush toilets it would save 11m^3/person/year.

Bathing and Showering

Bathing and showering account for 17% of household water consumption. If the development is fitted with carefully selected shower fittings instead of the standard power showers, which use as much water as a bath a further 11m^3/person/year can be saved.

Spray Taps

Self-regulating flow restrictors to taps reduce pressure and flow rates and minimise wastage through splashing. This reduces water consumption by around two thirds, saving 9.5m^3/person/year.

Water Resource Management Systems

The development shall use water saving devices 4/2 Low flush Toilets, aerating taps, and PIR sensors or push-to-open automatic-shut-off taps in WC's to reduce consumption

Water use shall be monitored throughout the development through the inclusion of pulsed output water meters. By identifying usage patterns and highlighting wastage, informed water saving measures can be identified and implemented during the operation of the building.

Meters for the commercial element of the design shall be programmed to identify through an audible alarm, excessive periods of water use and periods of excessive high water flow rate in order prevent leakage and the associated waste of water and damage to property.

Rainwater Collection

Correctly collected and stored rainwater shall be used in the development for toilet flushing in the restaurant and bar.

In addition to reducing water consumption the development has integrated ways to reduce its impact on the water infrastructure. Although the development will not increase its net impact from the current conditions several measures shall be integrated to reduce its impact. The provision of green roofs and water recycling will reduce quantities of rainwater, through increased evaporation and alternative use, from entering the water infrastructure. In addition these measures will also reduce peak flow rates in storm conditions.