



Sustainable building design: the big picture.



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Shelter – we all need it....



and we all want it, yet over one **BILLION** people, one-fifth of the world's population, are either homeless or live in very poor housing

A sheltered life?

- Most of us have homes we can go to. It's hard for us to help those who haven't got a home directly.



- Sometimes it's only when disaster strikes, like the tsunami or earthquakes, that we think what it's like not to have a home.

However, we can design and build for a more sustainable future for everyone.

This presentation will help you think about how. For example by

- reducing carbon emissions
- minimising energy use in construction
- minimising energy in the use of homes
- making sustainable materials' choices
- minimising waste of resources
- thinking about durability
- thinking about biodiversity
- using what we've got

Natural resources: use & abuse



The world has changed



The world's natural resources have been extracted and used on an unsustainable scale. Climate change and global warming are now an accepted reality.

Pollution: carbon emissions



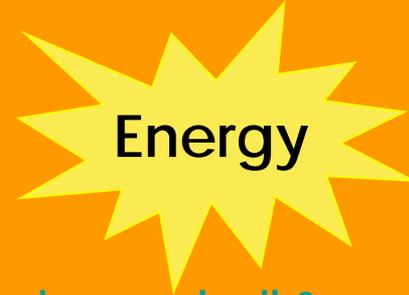
Carbon emissions



Global warming



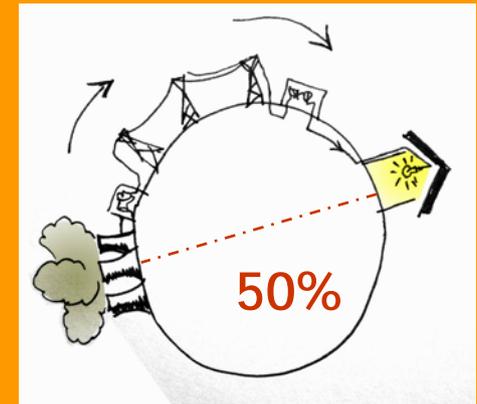
Climate change



Energy

Burning coal, oil & gas (fossil fuels) to heat our buildings and to produce electricity releases carbon dioxide. Carbon dioxide emissions increase global warming which results in climate change.

There is very little doubt that our influence on global warming is real.



Half the world's energy is used by buildings. This means that half of all carbon emissions are indirectly produced by buildings.

Fossil fuels are a non-renewable resource: once we use all the oil, gas and coal, that's it. There will be no more!



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PRACTICAL ACTION
Technology challenging poverty

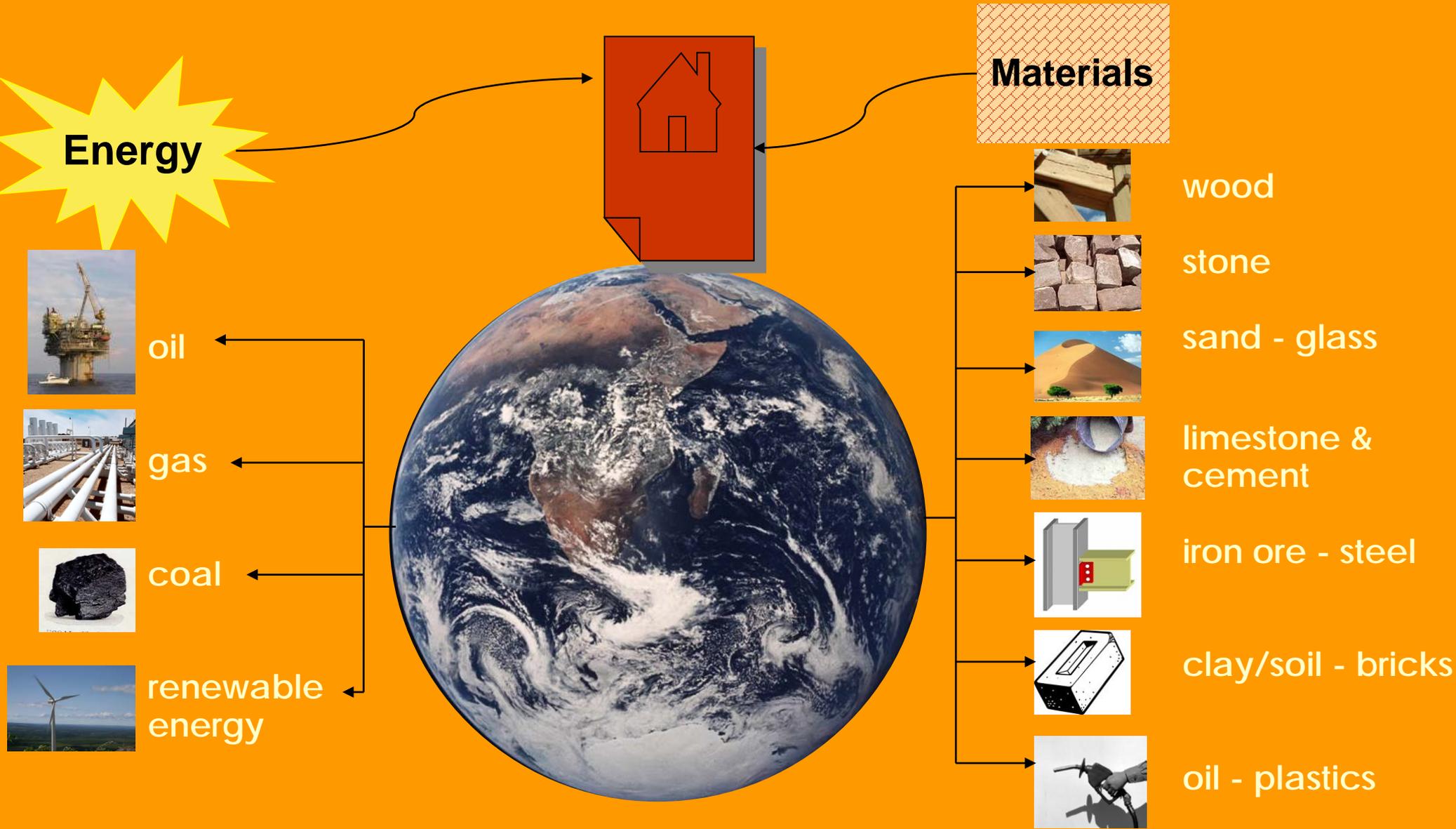


Yet our planet is all we have...

What should we build with? ... So what should we build with?



Resources used for building



Energy use in building

Energy... in use...

...is the energy used when the building is occupied.



Energy used for:

- heating rooms
- heating water
- cooking
- lighting & electrical appliances

Most of the energy is used for space heating (60%).

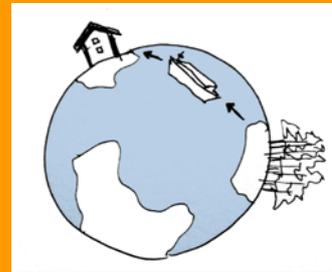


Energy... in construction...

...is the energy used during the whole building production process.



Energy used to extract & process the raw materials.



Energy used transporting materials & components to site.



Energy used during building.

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Think about... Does energy in use or energy in construction have the most environmental impact?



construction



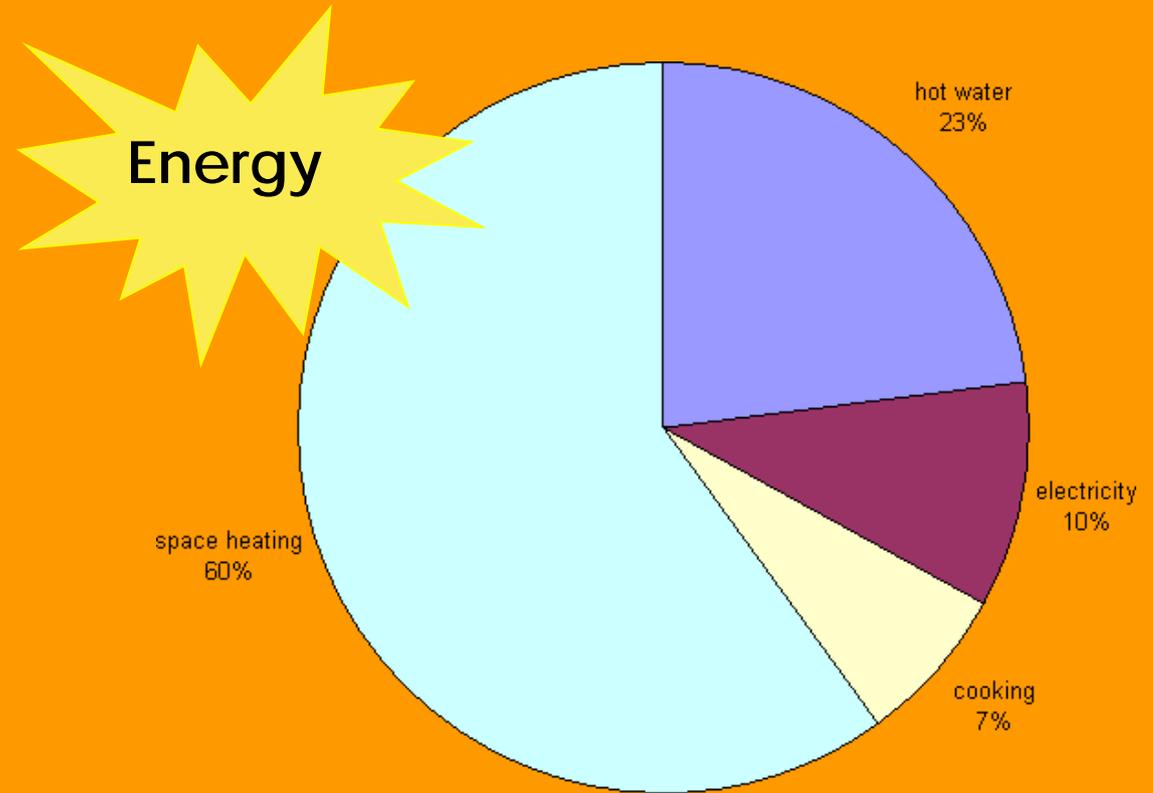
use

Energy put to what use?

More than half the energy consumed in buildings is used for heating the rooms - space heating.

How do you think we can minimise demand for energy in our homes?

There are many ways designers, builders and occupants can reduce the consumption of energy. Think about how your design would achieve it and look for more ideas and issues in the other SDA resources.



Typical energy use pattern in a UK home

Right click for links to more information



What about energy to build?

Embodied energy

Buildings use a large amount of materials; 50% of all raw materials are used in buildings. These materials have to be transported long distances, often flown, shipped and driven from countries around the world. This uses fuel and produces a lot of greenhouse gas.

The embodied energy of a material is the amount of energy that has gone into extracting it, producing it, and transporting it to the point of use. It's the amount of energy 'locked up' in the material.

Think about... **How do you think we can reduce energy in construction?**

Right click for links to more information



A timber frame structure: trees are felled, sawn, treated (often more than once) and transported before they are used in building.



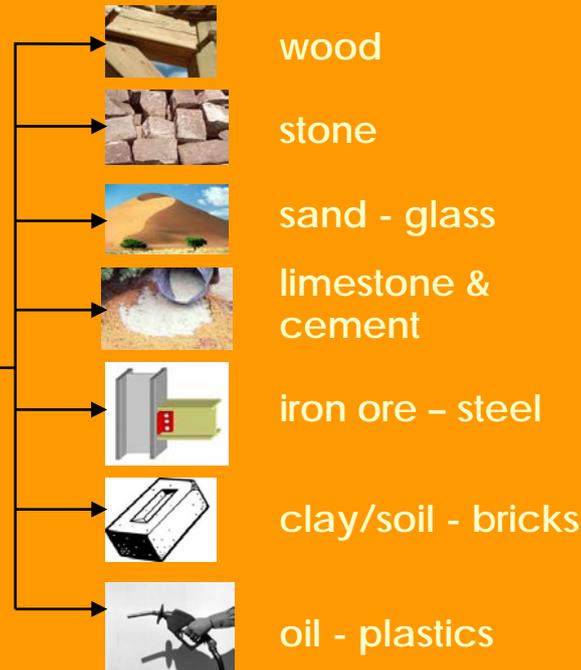
A brick wall: clay is extracted, moulded or extruded, fired & transported before it is laid in a bed of mortar to form a brick wall.

A concrete example. Cement is energy intensive to produce, has to be mixed with aggregate and water, sometimes at the point of use, sometimes at a batching plant, before it can be poured.

The building blocks

Materials

- Building uses lots of raw materials. In the past, the raw materials needed were quarried, worked and used locally.
- As a result of industrialisation, exhaustion of local natural resources, centralised production, higher levels of processing and increased demand, a sophisticated global market for construction materials has developed.



These are some common building materials.

There is an increasing number of composite materials used in construction some of which make highly efficient use of raw materials.

Think about...

- What are the environmental impacts of these materials?
- Which do you think are more 'sustainable'?



Materials

What type of material is it?

Materials can be categorised in different ways: renewable or non-renewable; plentiful or scarce; energy intensive or not...

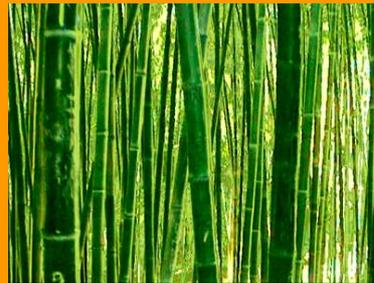
Renewable

These are materials which can be replenished. How plentiful they are depends on how much land we have available to grow them, and how fast they grow.

These resources should be used at a rate that they can be replenished.



Timber is renewable if you replant it.



Bamboo: very fast growing but not indigenous to the UK.

Non-renewable

These are materials which are available in finite quantities: once we have used them all up they can not be replenished.



Plastics made from oil



Corrugated plastic



Steel made from iron ore

Think about... What are the environmental impacts of these materials? Which do you think are more 'sustainable'?



Materials

How much is available?

What are the environmental impacts of these materials?
Which do you think are more 'sustainable'?

Plentiful

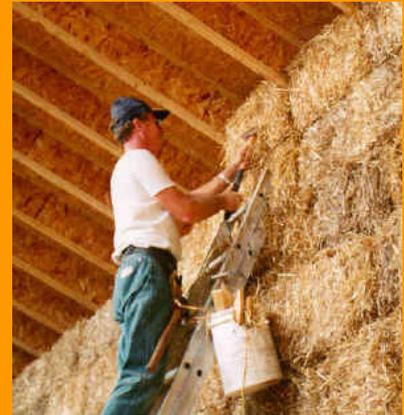


Clay

Earth



Stone



Straw bale

Scarce

Lead for roofing



Oil for plastics



Copper for pipes



Why bother about...waste?

Construction materials constitute

- 420 million tonnes of material consumption (7 tonnes per person)
- 20% of the UK's total ecological footprint
- 19% of the UK's total greenhouse gas emissions
- 30% of all UK road freight



We're throwing so much away

- Landfill – we are running out of places to put our rubbish.
- Construction waste accounts for 25% of landfill
- Waste of precious resources

Think about...

- Can the amount of material required be reduced through design?
- Is there an alternative material that can be re-used or recycled?
- Can the building process be better managed to reduce waste?

Why think about... water?

Our lives depend on it
but ...

- We're using more - consumption has risen by 70% over last 30 years.
- It's getting scarcer
- Droughts are more common, even in UK



So, we need to think about recycling
& efficient use

- efficient appliances
- rainwater harvesting – grey water systems and butts
- local treatment – reed beds
- reducing run-off and improving drainage
- pollution



Think about...

- Can design features reduce the demand for water – e.g. dual flush WCs,
- Can the water used be recycled?

Other issues to think about...

...serviceability & durability

In the UK people often move houses more than once in their lifetimes. People starting out buy their first new home, extend or move when they have a family and may move again when their family moves on or their physical health dictates new housing requirements

Does your site layout and floor plan easily allow for expansion?



Is your design accessible for wheelchair use?



Sustainable homes must be healthy homes. The space we live in has many direct impacts upon our physical and mental well-being.

<http://www.warmerhealthyhomes.org.uk/>

Why think about...where to put it?

Land-use

Greenfield or brownfield?

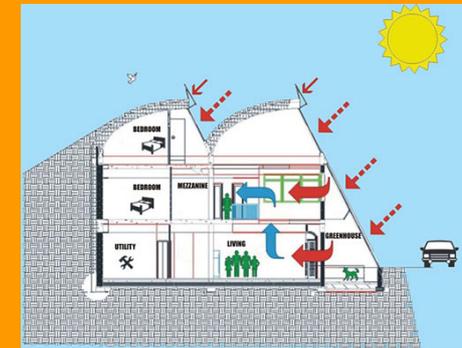
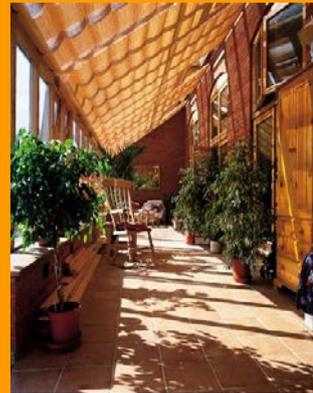


Urban or rural?



Orientation

Capturing the sun and hiding from the wind



Siting

Local features – lie of the land and plants



Why think about...biodiversity?

Using certain materials can destroy the natural habitat of many species of animals and plants. Entire ecosystems can be rendered obsolete, e.g. clear felling of virgin rainforests to harvest timber or quarrying swathes of countryside for stone.

Many negative environmental impacts can be offset with well designed production, responsible resource management practices, careful reinstatement and deliberate counter measures.

What price sustainable design?

Capital cost

Constructing buildings is expensive... Any comparison of materials must involve an analysis of cost over time. How long will the building last – are some construction materials longer lasting than others? Are sustainable choices also cost-effective or beneficial in other ways that make them value for money?



Life-cycle analysis

The cost of maintenance and replacement of buildings is greater over 30 years than the cost of building it. A design choice that reduces building costs may be a false economy in the longer term.

Building costs include the land, labour, materials, management, financial costs, legal and professional fees

In a typical house the top 10 life cycle cost items are:

- Redecorations
- Boilers
- Kitchens
- Light fittings & lamps
- Windows
- Doors & ironmongery
- Floor finishes e.g. carpets
- Sanitary ware
- External fencing
- Roofs



Why think about...global equity?



The Amazon forest is being felled rapidly for timber.

The forest is the home & livelihood for many communities; their way of life is threatened.



A rubber tapper at work.



Think about...

- Where does the material come from?
- How does its use affect the lives and livelihoods of local people?
- Does it pollute their local environment?
- Have the materials been fairly traded?



So to sum up...

To minimise your impact on the world, here are the choices you need to think about when designing anything, buying anything, or using any material:

1. Will it lead to climate change? – does it or it's manufacture produce greenhouse gases?

- does it have to be transported from far away

2. Are the materials and energy sources plentiful and renewable?

Am I using the right material for the right task?

3. Will using these materials and energy affect the biodiversity of the planet?

4. Will using this material harm anyone's life?

This includes the occupants, the general public, the builders, and also anybody affected by the material extraction often in other countries.

There is no need to be gloomy...

We do the best we can – we can only minimise our impact.

It is possible to create healthy well designed buildings that don't have huge impact on the planet or other people. We just need to put a little bit more thought into it... and that is the fun of design.

Design can address the causes of problems, not just their symptoms.



Straw bale theatre, CAT



ATEIC, CAT