

'Cleaner' design and technology- a products life cycle

Material selection:

Source:

- Their extraction and processing is costly both financially and environmentally
- This is due to the vast amounts of energy required to convert ore into the finished product
- Polymers are derived from crude oil, which is a finite resource, for this reason designers must consider recycled materials to reduce consumption
- The UK relies heavily upon imported raw materials, resulting in high transport costs and carbon dioxide emissions

Quantity:

- Reduce the amount of materials used in order to conserve resources, which will in turn reduce energy consumption and pollutions
- Minimise material usage by redesigning products

Quality:

- Consider using recycled materials to reduce consumption
- Use materials that are recyclable
- Depends on what the product is intended for

Range:

- Use materials that don't need to be transferred from large distances away
- Keep manufacturing sites close to the area of material extraction

Recyclability:

- Use materials that can be recycled at the end of the products lifespan to reduce waste

- Design products so that they can easily be recycled at the end of the products lifespan

Biodegradability:

- Many polymers don't biodegrade very well over time and so waste often ends up in landfill
- Many woods can be repurposed for other things, eventually the wood will biodegrade

Manufacture:

Minimising energy use:

- Use materials that use less energy during manufacture and produce less waste
- Use more efficient manufacturing techniques/machines to reduce energy cost

Simplification of processes:

- A simple design with fewer components to reduce materials use and assembly time
- Use simpler manufacturing techniques that are

Achieving optimum use of materials and components:

- Simpler components that are easier to machine or mould and produce less waste

Giving consideration to material form:

- Different materials to reduce their weight or the quantity used
- Using less materials

Cost and scale of production:

- A simplified or different work flow with improved quality control to reduce waste

Distribution:

Efficient use of packaging:

- Reducing/lightening the amount of packaging used in products
- Optimise packaging use
- Use bulk delivery of materials/JIT to reduce packaging

Reduction of transport:

- Driving smoothly or efficiently
- Use local resources to reduce transport
- Geographical locations of distribution centres close to consumers

Alternatives to fossil fuels:

- Using trains for transport to reduce emissions (especially electric trains)
- Using water ways for transportation where appropriate

Fuel type	Advantages	Disadvantages
Liquefied petroleum gas (LPG)	<ul style="list-style-type: none">• Relatively good fuel availability• Good range of kits available• Reduced emissions• Increasingly good supply of used vehicles• Low-cost fuel – less than 50 per cent of diesel• Reliable performance	<ul style="list-style-type: none">• Not available for diesel vehicles• No factory-fit models available
Bio ethanol	<ul style="list-style-type: none">• Reduced emissions• Increased power• Factory-fit models now available• Renewable fuel	<ul style="list-style-type: none">• Very poor availability of fuel• Limited availability of vehicles• Similar price to diesel• Up to 30 per cent lower economy than petrol
Compressed natural gas	<ul style="list-style-type: none">• Kits fit to existing diesel vehicles, such as HGVs• Similar economy to diesel• Reduces emissions	<ul style="list-style-type: none">• Very poor availability of fuel• Limited availability of kits and vehicles• Slow refuelling times
Hydrogen	<ul style="list-style-type: none">• Zero emissions• Renewable fuel	<ul style="list-style-type: none">• Very poor availability of fuel• Limited availability of kits and vehicles
Electricity	<ul style="list-style-type: none">• Zero emissions	<ul style="list-style-type: none">• Very limited range• Slow charging/refilling time

Use:

Repair versus replacement:

Advantages of repair:

- Cost effective
- Less material waste
- Extends the products lifespan

Advantages of replacement:

- Latest technology
- Relatively new products that are replaced can be used in the second-hand market

Energy efficiency:

Goal to reduce the amount of **energy** required to provide products and services

- Insulating home to reduce heat loss
- Use more efficient machinery
- Use less energy intensive materials

Efficiency ratings:

The **energy efficiency** of the appliance is **rated** in terms of a set of **energy efficiency** classes from A to G on the label, A being the most **energy efficient**, G the least **efficient**.

Repair and maintenance:

Standardisation:

- Standardisation means all parts are of a fixed size
- Makes it easier to find replacements and repair products
- Parts can be quickly ordered

Modular construction:

- Use of factory-produced pre-engineered building units that are delivered to site and assembled as large volumetric components or as substantial elements of a building
- Allows easy and quick replacement of broken modules
- Already prefabricated to reduce repair times

Bought in parts:

- Can be found easily to replaced broken one
- Standardised size so will be correct part
- Can be quickly ordered

End of life:

Design for disassembly:

- Easy to dismantle for repair or reuse and so extending product life
- Easy to separate different materials for recycling
- Easy to remove components that must be treated separately for repair
- Use as few different materials as possible
- Mark the materials/polymers in order to sort them correctly
- Avoid surface treatments in order to keep the materials 'clean'

Recovered material collection:

- Materials are collected and then separated so that they can be recycled and reused for other products
- It stops materials ending up in landfill sites

Sorting and re-processing methods:

- Material recovery facility's (MRFs) sort out material and separate them
- They are then re-processed into new materials
- Paper is a good example, it can be recycled/reprocessed many times

Energy recovery:

- Recycling and reusing energy intensive metals that use a lot of energy from extractions
- Steel/copper/aluminium can be recycled and repurposed without the need for lots of energy

Environmental implications of disposal to landfill:

- MRFs struggle with unwanted items such as plastic bags so these often end up in land fill
- Air pollution
- Groundwater pollution
- Biodiversity impacts
- Soil fertility effects