Eduqas GCSE D&T Technical Principles Core Knowledge and Understanding 2.1.2

Design and Technology and our World 1

Life Cycle Analysis (LCA), sometimes referred to as Cradle to Grave includes:

- the source of materials for the product or component
- the energy used and pollution caused when manufacturing
- the energy used and pollution caused during a product's useful life
- the disposal of the product at the end of its useful life.

Designers and consumers consider these before purchasing a product. These factors can often influence purchasing decisions.

New or emerging materials, manufacturing methods or energy sources can often provide opportunities for greener products. This could be a more eco-friendly material or a self-repairing material. For example, the inner tube in the tyre below, which contains a sticky liquid that hardens when it contacts air – a perfect cure for punctures.

The Six Rs of Sustainability

Designers can often improve products by using the Six Rs. **REDUCE, REUSE, RECYCLE, REPAIR, RETHINK, REFUSE** can often provoke innovation in products.

Better build quality can improve a product's performance during its expected life – designers can ensure that products are easy to service, maintain and repair.

Ecological footprint

Ecological design can be defined as solving problems alongside minimising environmental damage. Designers must solve problems without creating other problems. Eco is about nature, living things, cycles and patterns.

Eco-efficiency refers to moving towards sustainable development – creating goods, products and services to satisfy user needs and wants while reducing ecological impacts and resource depletion. After all, any natural resources that we use will eventually run out!

The footprint of a product is a measurement of the environmental impact from cradle to grave.

Fair trade

This is an arrangement to help producers in developing countries to achieve trade relationships with other countries. It promotes sustainable development by improving trading conditions, including the rights for the workers.

Worker exploitation

Different countries have different laws about employment for workers. Sometimes workers can be exposed to unfair working conditions including poor or unfair levels of payment. This includes child labour.

Social, cultural, economic and environmental responsibilities

Designers and manufacturers have a duty to ensure that their decisions do not infringe certain codes and laws.

Social – products must not have an unforeseen side effect on a group of people.

Cultural – ensuring that a product is acceptable and not offensive for a specific group.

Economic – ensuring that financial decision making is good for the product. This could relate to material selection, profit margins, running costs or energy efficiency.

Environmental – recently, a lot of legislation and laws have been passed to enforce certain conditions. Many manufacturers now have to comply with targets on lowering CO_2 (carbon dioxide) emissions.

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Renewable and non-renewable energy sources

There are two types of energy sources – **renewable** and **non-renewable.**

- Renewable energy sources include wind, solar, tidal/wave, geothermal, biomass and hydro-electric.
- Non-renewable energy sources include coal, oil, gas and nuclear.

Renewable energy sources are often referred to as 'clean' or 'green' energy sources, because they come from a natural supply that is continuously replaced.

Non-renewable energy sources are often called 'dirty' and 'fossil fuels'. Coal, oil and gas are available in different parts of the world, but in limited amounts. Non-renewable energy sources often need to be extracted from the earth and sometimes processed, which can give off pollution and be very damaging. We currently depend highly on non-renewable energy sources, so a shift to 'greener' sources is underway and developing more and more.

Wind farms use turbines.

Coal fired power stations create lots of pollution.

Advantages and disadvantages of renewable energy

Wind power has relatively little impact on the environment, although some people consider turbines to be unsightly, or 'visual pollution'. They are expensive to install, and reliable when there is wind. Turbines can affect wildlife, particularly birds.

Solar energy is expensive to set up, and is very dependent on sunny weather conditions to be at its most productive, although some electricity will be generated on cloudy days. Home owners fitting solar panels to their roofs can find them space-consuming too. Storing solar energy can also be difficult and expensive.

Wave or Tidal systems are expensive to set up and can damage ecological coastlines and harm marine life. The tidal/wave power generates power for around 10 hours per day. It is around 80% efficient, better than solar or wind-based systems.

Geothermal energy uses 'hot spots' where molten rock close to the earth's crust generates hot water. In some locations, geothermal systems involve drilling into the earth's surface to reach deeper geothermal resources, allowing broader access to geothermal energy. This is a very high-cost resource and also risks triggering earthquakes.

Manufacturing using renewable energy

Industrial and commercial manufacturing plants and factories around the world are implementing alternative methods of power generation from renewable energy sources, in order to increase production and reduce their energy usage.

Currently, about 66% of the energy used by the industry and manufacturing sector is fossil fuels, with a small percentage of renewable energy and biofuels.

Government targets

The UK government has made a commitment for the UK to be net zero emissions by 2050.

This includes increasing clean wind energy, slashing carbon emissions and increasing offshore wind capacity.

Fossil fuel powered road vehicles

By 2030, the UK will ban the production of petrol- and diesel-powered cars. Some hybrid vehicles that use both electricity and petrol or diesel will still be allowed to be produced until 2035.

In addition to some cities having congestion charges to help reduce congestion and pollution, electric vehicles and hybrids are becoming a more popular choice for motorists. There is often reduced or no road tax, as these vehicles are very clean and some produce zero emissions. Lots of car manufacturers are now producing fully electric cars, however battery technology and charging facilities remain problematic.

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Changing society's views

There are many ways in which society is encouraged to reduce waste and recycle more, because:

- 90% of waste is dumped or burned, mostly in low income countries
- lots of poorly managed waste contaminates the world's oceans
- waste causes clogging of drains, flooding, the spread of disease and harm to wildlife.

Recycling – with economic development and population growth, the generation of waste will also increase. High income countries provide nearly universal waste collection, and more than one third of waste in high income countries is recovered through recycling and composting.

Low income countries collect about 48% of waste in cities, but only 26% in rural areas, and only 4% is recycled.

Overall, only 13.5% of global waste is recycled, and 5.5% is composted.

The circular economy refers to society putting waste back into a good use and continuing this cycle. This means that once a material, component or product comes to the end of its useful life with the owner, it is disposed of and becomes re-usable in some way. This prevents new materials being required, saving resources and reducing waste.

Designers need to build this kind of thinking into products!

Living in a greener world

Being kinder to the planet should be on everyone's minds, but especially designers who are producing products for users in today's world.

- Waste food is a problem in most households, so portion control and re-using leftovers will help.
- Cutting down on packaging is a great way of reducing unnecessary waste that is not really an essential part of the product we purchase.
- Reducing plastics where possible will be a massive gain. Plastics can be difficult to recycle and biodegrade, so finding an alternative would be very helpful.
- Recycling waste correctly is another area for improvement.
- Repairing products or choosing not to upgrade when a newer version becomes available can be beneficial.
- Green energy should be used where possible.
- Greener travel options, car sharing, or cycling should be chosen instead of driving, where possible.
- Economise your home – optimise your 'white goods' to operate correctly. Set your fridge and freezer to eco settings if possible, turn off lights when not needed, and try to lower the central heating thermostat – wear another layer instead.

Before purchasing a product, think about its Life Cycle Analysis (LCA). Consider where the material comes from, how the product has been made, running costs and eventual disposal.

Opt for sustainable design

Whether you are a designer or consumer, making the right choice is critical. Sustainable, eco or greener alternatives are much better for the environment. They have been designed and manufactured with minimising damage and promoting sustainability at the core.

Average life of a mobile phone

Research reveals that the average life of a mobile phone is two and a half years, and 15 to 18 months for a smart phone. Often, this short life is because the user has damaged the device, dropping or breaking the screen for example, which requires replacement. Using a protective cover is one option to improve the life of the phone. Mobile phone manufacturers often release new models frequently to replace previous versions. This is known as 'incremental' development and can help ensure consistent sales.

Products using 'greener' power supplies

Solar power can often improve energy consumption for users and also makes the product more flexible and less reliant on 'plugging in'. Photovoltaic (PV) cells can be used as power supplies and 'trickle chargers', converting free sunlight into electricity.

Wind-up technology offers far more opportunities for designers. A wind-up torch uses the mechanical movement provided by turning the handle of the device. This can then operate without the need for batteries.