

Unit R103 – Sustainable engineering

Sustainable design

Instructions and answers for teachers

*These instructions should accompany the OCR resource ‘**Sustainable design**’ activity which supports OCR Cambridge Nationals in Engineering.*

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Sustainable design

Task 1

Choose a product of your choice and describe the lifecycle of the product stating what happens during each of the following stages.

- The stages leading to the introduction of the product.
- The product in use and further developments of the product as it grows in popularity.
- Sales and interest in the product start to decline, and the older products in use are becoming unreliable.
- What happens at the end of life of the product.

The Activity:

This resource comprises of 2 tasks. Learners may need to use online resources to research material uses or check their understanding to complete the activities.



This activity offers an opportunity for English skills development.

Associated materials:

‘Sustainable design’ activity sheet

Suggested timings:

Task 1: 45 minutes **Task 2:** 45 minutes

Learners will choose a product of their choice to identify and research considering the lifecycle of the product through production, use and disposal. Learners will identify and state the environmental impact of the product and the materials used through the product lifecycle.

Task 1

Choose a product of your choice and describe the lifecycle of the product stating what happens during each of the following stages:

Example – Excavator (digger)

- The stages leading to the introduction of the product.

Following the design of a new digger, the excavator (digger) is manufactured at a production plant using mostly new raw materials, recycled materials and components entering the factory at one end of the large production site. Completed diggers once tested and come out of the opposite end of the building or factory site and transported to their owners made up of dealers and agents, and customers.

- The product in use and further developments of the product as it grows in popularity.

The digger is hired out to customers and used on construction sites throughout its useful lifetime. It consumes diesel and oils are used to maintain it, which pollutes the environment and atmosphere through normal use and disposal of waste oils. From time to time it needs servicing and repairing. Materials and packaging from replacement parts can sometimes be recycled but otherwise contribute to landfill waste. During the usage of the digger, the manufacturer makes changes to the design and starts to produce updated versions of the digger.

- Sales and interest in the product start to decline, and the older products in use are becoming unreliable.

The manufacturer designs a new digger to respond to the market, competition and advances in technology used in manufacturing methods and materials.

For the diggers already produced and in use, eventually, after many years in service, it is not economical to keep repairing the digger and it can no longer be repaired any further, it may break down for the last time. This is likely to be after ten years or more.

- What happens at the end of life of the product.

The digger is transported to the scrap yard where the parts are separated and either sold or scrapped, recycled. Some tertiary recycling may be possible for components such as the tyres. The digger may stay in the scrap yard a while and be stripped of useful components for other customers to use for repairs.

Increasingly, the useful parts are immediately stripped from the digger. This will include a wide range of materials and components such as wheels, recyclable rubber, plastics and metals, glass which will be sold to either other customers looking for spares or usually sold on to companies that can reclaim (recycle) the materials for further use. For example, the rubber from the old tyres can be reduced into granules and reused in the making of new products. Many of the plastics used in vehicles can be recycled in a similar way, turning waste plastic into granules that can be used to manufacture many modern products.

Steel panels and aluminium parts will be either crushed or melted into ingots. These are then melted down in special furnaces; the waste is removed leaving the usable metal which is mixed with new raw materials. The recycled metal mix can be used to manufacture new products.

Task 2

Identify what environmental considerations should be considered in the design of the product for each of the following criteria?

- Material usage.

Which materials are sustainable and have the least negative environmental impact though production, the product in use and at the end of the lifecycle. Which materials are available locally?

- Design for obsolescence.

How long will the product be in use before a improved version of the product is released? What will be the impact of a product with a short useful lifespan? Can the materials or product parts be reused using less natural resources? Can the old product be sold on to another customer to extend the life of the product to lessen the impact on the environment?

- Energy usage of the produce in use.

Does the product use up natural and finite resources or can the design allow for sustainable energy to be used to provide power? Do the materials used in the production processes use more energy sources than other materials?

Using rape seed oil and bio fuels may help using less natural finite resources.

- Carbon foot print of production and use.

Production methods will increase the carbon foot print of the product through the use of energy sources in heating and forming materials and energy consumption for the factory. However the factory uses some renewable sources such as solar power to offset some energy use. The product in use produces carbon dioxide but the use of alternative fuel sources helps reduce these emissions. Sourcing local product materials will reduce the carbon footprint of

- End of life disposal.

At the end of the product life, most of the materials can be recycled or reused in other products such as metals, rubber and glass. Oils can be reprocessed and very little of the product should end up in waste landfills or incineration.

You may need to use online resources to research material uses to complete this activity.

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