



## WHAT IS LIFE CYCLE ASSESSMENT (LCA)?

LCA is a way to find out how a product (e.g. a shoe, a toothbrush, or a smartphone) affects the environment in the process of making it, using it and getting rid of it.

These environmental effects or impacts can be different things, so we need to ask various questions about what happens when we make, use, or get rid of a product. For example...

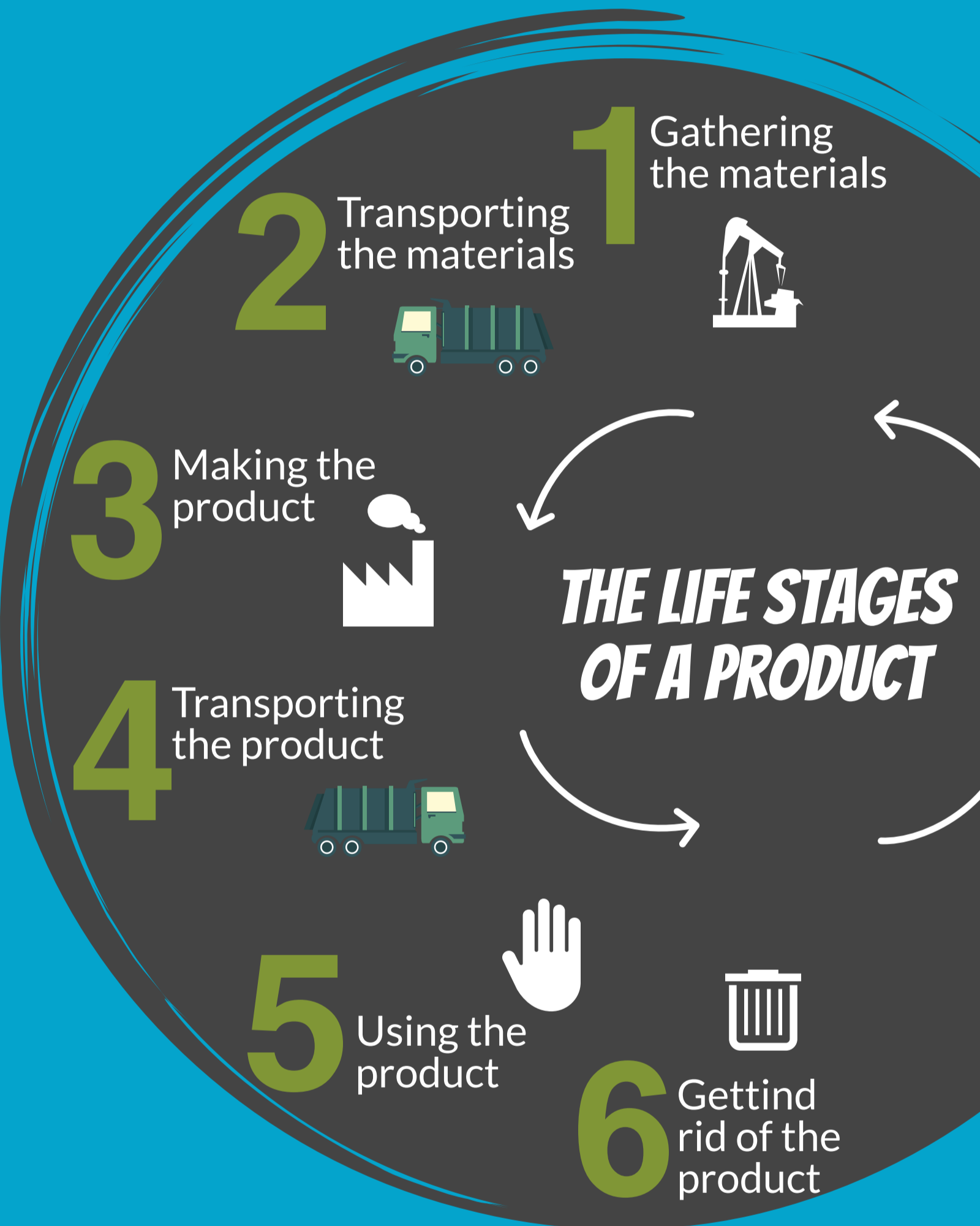
How much does this product add to global warming in the form of greenhouse emissions?

How much water or energy do we need to use to make this product or get rid of it?

During the life cycle, is there a release of any particles that could harm human health?

Will we need to build or farm on land where animals and plants already live?

Do we need to use any scarce resources (e.g. fossil fuels) to make, use or get rid of it?



## WHY IS LCA IMPORTANT?

- A product's life cycle is very complicated, especially when it comes to understanding its environmental impact!
- We can use it to compare two similar products (e.g. two different types of lunchbox) to decide which has the lowest impact on the environment and, therefore, would be best to use.
- LCA can help us to find areas where the environmental impact is highest – we call these “hotspots”. For example, if an LCA shows that the stage where the product is made is a hotspot because a lot of polluting waste is produced, then we can focus on reducing this waste.



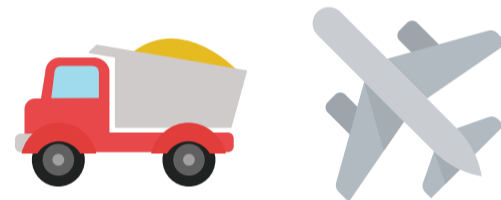
## 1. GATHERING AND PROCESSING RAW MATERIALS

Raw materials are the things needed to create any product. For example, if we think of a cake as the final product:



- All raw materials have originally been taken from the Earth or from living organisms. For example: metal ores (rocks), wood (trees) and fossil fuels (underground).
- Processing raw materials can damage the environment by using up scarce resources, or by using lots of energy which creates emissions and pollution.
- Raw materials don't always have to come from the Earth. Instead, they can be recycled and reused for another product (e.g. old milk cartons can be used to make park benches!).
- Reusing or recycling materials reduces the environmental impact compared to taking raw materials directly from the Earth.

## 2 & 4 TRANSPORTING THE MATERIALS AND THE PRODUCT



**Remember! LCA is not about saying whether a product is 'good' or 'bad' for the environment.**

It's about finding areas of improvement and making informed decisions which benefit the environment.

The product, and the materials used to make it, need to be transported. We need to consider:

- How far away is each stage? The materials must travel from their source to the factory, to the shop and then to you!
- How quickly does the material or product need to arrive at the next stage? Will the products/materials be damaged if they aren't transported quickly?
- How much does each transport option cost?

## 3. MAKING THE PRODUCT

Making a product can be very complicated and usually needs many raw materials from different places. Some might have even been through another manufacturing process before. For example, a laptop maker will need to buy batteries which have already been through their own process.





**Making a product can impact the environment by:**

- using space where plants and wildlife used to live
- using lots of energy which generates emissions
- creating waste that is harmful to the environment

**But these processes can be made more sustainable by:**

- minimising waste
- reusing waste to make another product
- capturing waste and treating it safely
- using energy from renewable, non-polluting sources



Everyone uses products in different ways, so this stage can be very difficult to analyse using LCA! For example, one person might be very careful with their product, look after it and use it for a long time. Others might only use something once or twice before throwing it away and buying a new one.



A lot of different things can happen to a product when we have finished using it. For example:

- Broken products can be repaired
- Products in good condition can be sold or donated
- Products can be repurposed (such as using old jam jars as paint pots!)
- Some of the materials can be recycled and reused



Your options depend on many things:

- Your area – are you able to recycle a certain material?
- Cost – is it too expensive?
- Environmental impact – does recycling a product generate more emissions than other options would?

For example, a product might be recyclable, but this process could take a huge amount of energy. If this energy doesn't come from renewable sources, the emissions generated during the recycling process might be higher than using new raw materials!

## PLASTIC VS GLASS - WHICH IS BEST?



The answer may not be so simple...

Plastic is often deemed 'worse' for the environment than glass because glass is recyclable while most plastic is not.

But what about all the other stages of the product's life? Without a full LCA, we don't know how glass compares to plastic in terms of raw materials, making or using it.

For example, plastic is much lighter than glass so we use less fuel to transport it, therefore generating less emissions.

When we consider all the stages of a product's life cycle, not just its End of Life, we might find that it could be less impactful if it were made from plastic instead of glass.

Can you think of another product which might be more complicated than it first seems?

## WHY ARE WE USING LCA AT THE CSCT?

To identify technologies that will help us achieve our goal of net-zero CO2 emissions by 2050. Achieving this target will be a major step towards combatting climate change. We also need LCA to identify renewable materials for the products we make, for example using plants, rather than fossil fuels, to make plastic. More specifically, we are using LCA to:

- Improve how we recycle plastics, for example with chemical recycling. [Read more](#) about our work with industry to improve plastic recycling.
- Look at the life cycle of marine biorefineries - an exciting new technology where we can [turn invasive seaweed into biofuels](#) and fertilisers! You can also [check out this graphic novel](#) to find out more about biofuels in general.
- Evaluate the sustainability of new biomaterials. Find out more about our work examining the [environmental impact of biodegradable plastics](#) or how we are developing new materials using [sustainable sources like wood and sugar](#).

