

About design



Great designs start with people, not things. Great designers work out what the problems are and how design can solve them. People don't need to notice a great design, but they should notice that their problems have been solved.

Use these questions to come up with a great design:

WHO...

... is this product for and what benefits do they want from it?

WHY...

...will people use this product?
...would they prefer it to other products?

WHEN...

...will people use this product?

WHERE...

...would it be used and how does this affect the design?

HOW...

...will people use this product?
...can we make this simpler, easier, safer, better?

WHAT...

...will we make it out of?
...will happen at the end of its lifetime?

“THE ONLY IMPORTANT THING ABOUT DESIGN IS HOW IT RELATES TO PEOPLE.”

VICTOR PAPANEK (1923 – 1998)
DESIGNER, EDUCATOR AND ADVOCATE FOR
SOCIALLY AND ECOLOGICALLY RESPONSIBLE
DESIGN

“DESIGN IS NOT JUST WHAT IT LOOKS LIKE AND FEELS LIKE. DESIGN IS HOW IT WORKS.”

STEVE JOBS (1955 – 2011)
CO-FOUNDER AND CEO OF APPLE

About aluminium

The raw source of aluminium is bauxite, a clay found in wet tropical or sub-tropical climates such as Latin America, South America, Africa and Australia.

EXTRACTING ALUMINIUM

Bauxite mining, (4 kg bauxite)

About 240 million tonnes of bauxite is mined every year! The clay is usually found in the top five metres of top soil, so great care is taken to restore and replant land after the mineral is extracted. 97% of all bauxite mines have formal rehabilitation procedures for reforestation once mining is complete.

Alumina production (2 kg alumina)

To extract alumina (aluminium oxide) bauxite must be chemically treated. Bauxite is mixed in a hot sodium hydroxide solution to remove impurities. The solution is then precipitated and heated to 1,000 °C to form pure alumina.

Primary aluminium production (1 kg aluminium)

The alumina then goes through a process of electrolysis in a bath of molten cryolite (a mineral containing sodium aluminium fluoride) to produce aluminium metal.

It is estimated that bauxite reserves are sufficient to last another 300 years! However, the process of converting bauxite to aluminium requires a lot of energy. For example, converting 4 kg of bauxite into 1 kg of aluminium consumes **13-15 kWh of electricity** – compare this to the energy needed to produce aluminium from recycled material and there is a huge 95% energy saving!



Bauxite



Bauxite Mining



Bauxite, alumina, aluminium



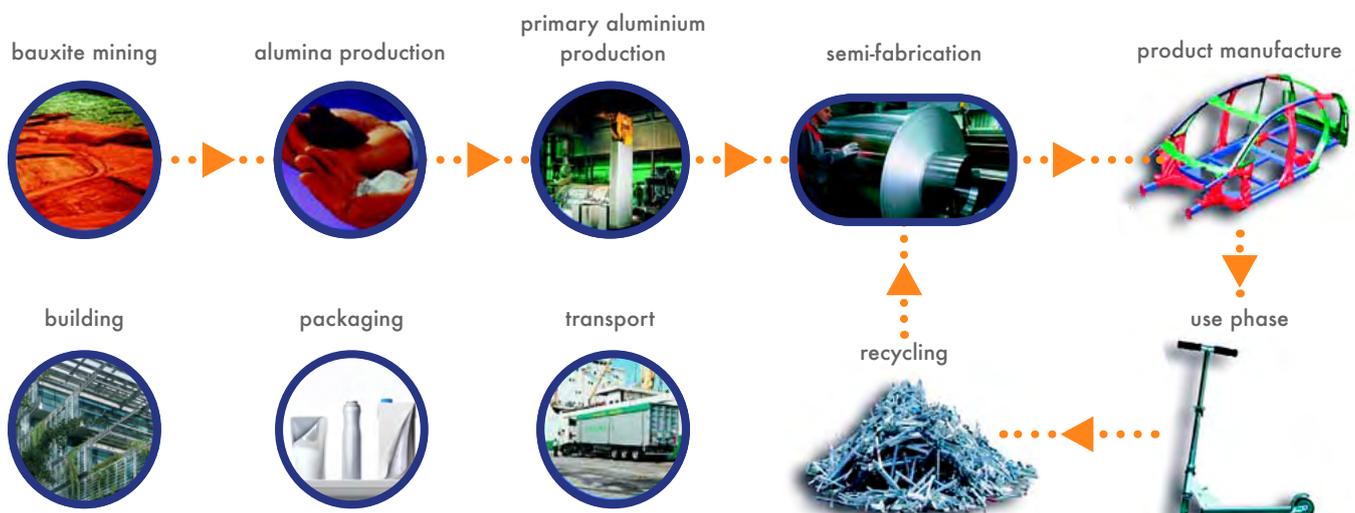
Hydroelectricity turbines



Aluminium

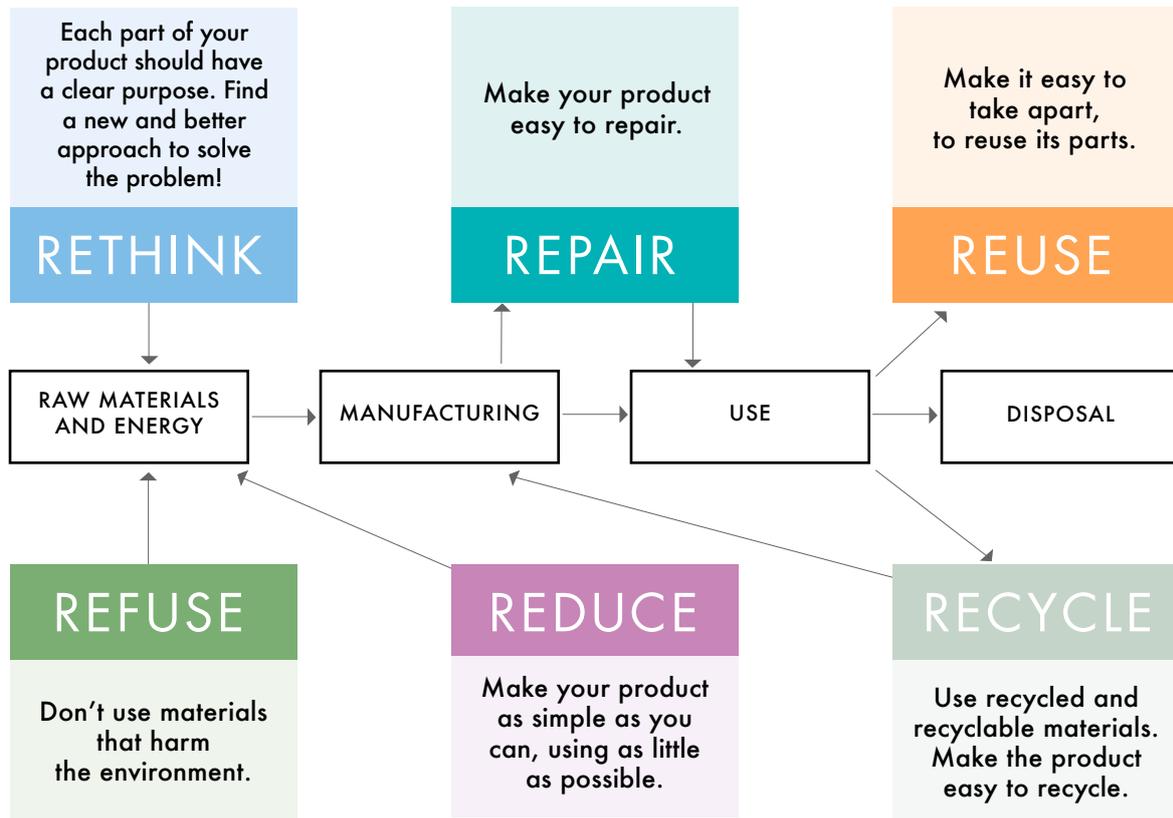
THE ALUMINIUM LIFE CYCLE

Although energy for primary aluminium production is increasingly produced through renewable sources, such as hydroelectricity, more important to the sustainability of aluminium production is the metal's suitability for recycling. Producing secondary aluminium provides an amazing 95% energy saving compared to the same weight of primary metal.



About sustainability

Use the 6Rs of sustainability as you generate ideas and develop your design. Try to use each of these six ideas in the lifecycle of your design solution.



ALUMINIUM AND SUSTAINABILITY

When the best technology is used, recycled aluminium is equal in quality to the primary (or newly formed) metal.

Recycling aluminium uses just 5% of the energy needed to produce new aluminium

75% of aluminium ever made is still in use today

90% CARS
70% CANS
96% BUILDINGS

Aluminium is widely recycled in the UK

What other properties of aluminium could help make your design sustainable throughout its lifecycle?

FIND OUT MORE:

learningaluminium.co.uk/about-aluminium

About aluminium manufacture

ALUMINIUM IS...

- the second most-used metal, after steel
- lightweight: just 1/3 the weight of steel
- a good conductor of heat and electricity
- as strong as steel when alloyed with other metals
- resistant to corrosion and non-magnetic
- infinitely recyclable: you can use it again and again.

The combination of these properties makes it a valuable, versatile material to designers.

ALUMINIUM CAN BE...

FORMED	JOINED	FINISHED
<p>CAST</p> <p>Molten aluminium is poured into moulds. Casting can create complex parts or decorative shapes. Ingots – or blocks – cast from molten aluminium are also supplied to aluminium producers for further manufacturing. Decorative hard-wearing garden furniture is often made from cast aluminium.</p> <p>ROLLED</p> <p>Aluminium can be rolled into foils, sheets and thick plates. These can be cut, formed and joined. Thin foils can be laminated with plastics and paper. Applications for rolled aluminium include body panels, packaging and lithographic plates, which are used in the printing industry.</p> <p>EXTRUDED</p> <p>Extrusion is used to force heated, softened aluminium through a shaped die to form a long product. These can be used as long lengths or cut into smaller pieces. Extrusion is used to create long, thin products like aluminium handrails, greenhouse frames and curtain tracks, for example.</p> <p>FORGED</p> <p>Forging uses presses and other tools to apply pressure to shape the aluminium. Forging is ideal for applications where strength and safety are key, but efficiency is crucial too. So wheels of race cars, for example, are often made from forged aluminium.</p> <p>LASER CUT</p> <p>Laser cutting uses a high-power computer-controlled laser to cut accurate shapes from aluminium sheets or plates.</p>	<p>MECHANICAL FASTENERS</p> <p>Fasteners, like screws, bolts or rivets can hold sheet or formed aluminium together at single points or along longer seams. In aircraft construction for example, the sheets of aluminium which, are used for the body are joined together with aluminium rivets.</p> <p>ADHESIVES</p> <p>Special adhesives can bond aluminium together. Aluminium window frames are smaller pieces of aluminium joined with strong adhesive.</p> <p>SPOT WELDING</p> <p>Spot welding uses resistance to heat the metal so it forms a joint. This can help form complex structures from pressed or rolled sheets. In the automotive industry, spot welding is a very popular method for joining the aluminium sheets which form the body of a vehicle.</p> <p>CONTINUOUS WELDING</p> <p>Continuous welding creates a seam to join sheets of aluminium together. This takes place at a temperature high enough to melt the aluminium. This technique is popular in the automotive industry.</p> <p>BRAZING OR SOLDERING</p> <p>Brazing or soldering creates spot joints or seams, but at a lower temperature so the aluminium does not melt. A filler metal with a lower melting point fills the joint. This is used in plumbing, where leaks are not at all desirable!</p> <p>CLIP TOGETHER</p> <p>Due to its elasticity, aluminium can form snap-fit (clipped) joints. Aluminium extrusions are shaped to hook together, allowing for quick assembly. If the joints will be repeatedly opened, plastic clips or steel springs are used for the joint's bending portion to prevent any loss of shape.</p>	<p>ANODISED</p> <p>Anodising uses an electrical process to coat the surface of the aluminium with its oxide. This helps the treated part resist corrosion. The anodised surface can be dyed to add colour to the part.</p> <p>POWDER COATED</p> <p>Aluminium parts are dipped in or sprayed with dry paint powder. The part is then placed in an oven and the powder particles melt to form a continuous coating.</p> <p>UNCOATED</p> <p>Aluminium doesn't always need protecting from the elements, because it doesn't corrode. Using aluminium uncoated reveals its natural 'shine', which is seen as an asset by designers. This appearance is said to be 'mill finish', meaning that it looks like it has come straight from the mill. Ladders, for example, are often sold this way. Uncoated aluminium is an economical choice when appearance is not of primary importance.</p> <p>ETCHED</p> <p>Etching – or engraving – on to aluminium can create a very decorative product, as you can apply as intricate a design as you require. Etching is also useful because the design will not wear easily – you will see it for a long time!</p> <p>PAINTED</p> <p>Special aluminium paint is long-lasting and durable. Painted products still retain a realistic aluminium finish. With an infinite choice of colours available, very unique aluminium products can be created using aluminium paint.</p>

What other ways to form, join and finish aluminium can you discover?

FIND OUT MORE:

learningaluminium.co.uk/about-aluminium