

Material Selection: Environmental Properties of Materials

Companion to the video: Script and Illustrations

When looking for sustainable materials, the first step is to know where their ecological impacts come from. Here are some guidelines.

Abundant materials are usually more sustainable than scarce materials.

To make a profit in the 1920's, a copper mine had to get a kilo of copper out of every four kilos of ore. This meant small mines with high ore grades. But now mines can afford to dig up A HUNDRED kilos of ore to get that same kilo of copper. The other 99 kilos become waste. So today, because copper has become scarcer, mines are much larger and produce more waste than they used to.



Even certain renewable resources are becoming scarce.

Some trees, like Caribbean mahogany, are being harvested too quickly and are becoming endangered. When using wood, try to find sources that are certified as sustainably harvested.



Materials like bamboo are called “rapidly renewable,” because they can be re-grown and harvested fast enough to keep up with heavy demand. This often makes them a good choice.

You also need to look at the energy and resources that go into gathering a material and refining it into a useful form.

It takes about forty megajoules of energy to mine and manufacture one kilo of virgin steel. But it takes nearly SIX TIMES MORE energy to produce virgin aluminum.

And when either material is processed, like rolling or extruding, even more energy is consumed.

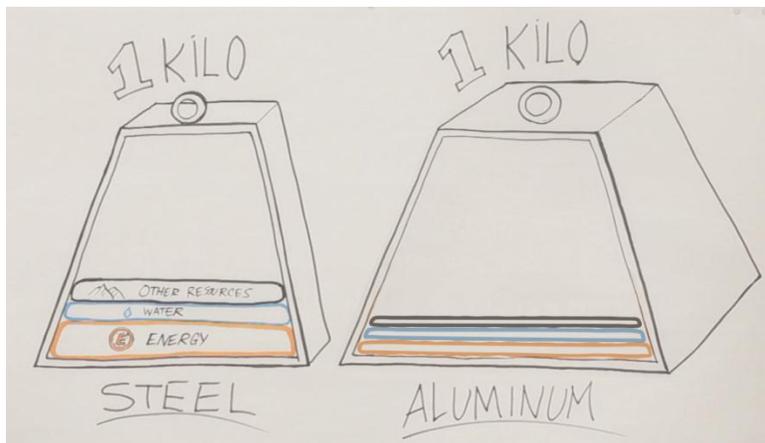
Energy consumed this way is called "Embodied Energy." Usually the material's carbon footprint is directly proportional to its embodied energy.

But it's not just energy that gets embodied in a product – other resources like water are embodied in the same way.



A great way to reduce the embodied energy and resources in your products is to specify RECYCLED materials for your designs.

Using recycled aluminum cuts the embodied energy by NINETY PERCENT!



And of course, recycling materials keeps them out of the dump, too.

Some materials also have negative health impacts.

For instance, the lead in some solder is toxic.

Even some materials that aren't harmful can require toxins to manufacture. For instance, extracting gold from ore usually uses cyanide.

Whenever possible, avoid hazardous substances. But if you can't completely eliminate them:

clearly label toxins,

build-in product safeguards,

and use suppliers with high safety standards.

Luckily, you're not on your own in your search for materials with the lowest eco-impacts. You can find databases published by companies like Granta Design. And this data is now being included within CAD tools, like the Eco-Materials Adviser within Autodesk Inventor.

If you can't find the data you want, ask the manufacturer to publish it. This will benefit the whole community of designers and engineers.

Improving these eco-impacts is the most obvious way of choosing a greener material.

But your product also won't be sustainable if its physical properties aren't up for the task it was designed for!

That's exactly what we'll look at next.