

Missing Link Technologies for Sustainability

The speed of technological advance over the last 20 years has been dizzying, but the environmental and social performance of technology has not kept pace. For example, high-tech composites are impossible to recycle, and microchip manufacture releases toxic cocktails into the air and stores them in the bodies of workers.

In every area, new steps forward in technological performance are accompanied by significant steps backward in terms of sustainability. Space age technology is causing havoc on spaceship earth.

Part of the problem is because while most development goals are easy to visualise and measure -- faster, lighter, stronger, smarter -- environmental goals tend to be diffuse and piecemeal. 'Greener' means many things to many people, and is almost always about moving away from a problem -- less emissions, less energy, less noise -- rather than seeking a goal.

100% Sustainable

That goal of course has to be 100% ecological sustainability. It sounds simple, but even the mention of those words causes apoplexy in many environmentalists. The world is too complex, they say, we don't know what sustainability is, they moan.

But 100% is possible. There are even many different solutions. The most attractive is for industrial systems to both adopt the protocols of material flow used by nature, and, where possible, to integrate natural and manmade ecosystems.

There was a lot in the last sentence, so let's unpack it a bit -- the protocols of nature can be summarised as being cyclic, solar and safe. That's cyclic as in materials is continually reused, solar as in being powered by the sun, and safe as in nothing toxic goes where it shouldn't. Industry has already been adopting these protocols to some extent, and most environmental legislation is derived from them.

Industry already forms an ecosystem of sorts -- interacting flows of materials and energy -- but it's not a particularly good one yet, as it is not self-sustaining, with open input and output loops. Outputs from industrial systems should become food for natural systems, to become integrated with them. At the moment they are poison rather than food. However, with care and vision, the global industrial system can be redesigned to be 100% cyclic, solar and safe.

The beauty of cyclic|solar|safe is that it swiftly summarises the aspirational qualities that any product or process needs to have. It's also relatively easy to quantify, meaning that you can take a product, assess it and then see where you have to improve in order to bring that product system to 100%.

The Missing Link Technologies

As the creator of the cyclic|solar|safe concept, I have taught thousands of designers how to make their products sustainable, as well as analysing over 2000 existing semi-sustainable products. But while a handful have been close, I have not yet come across a 100% sustainable one.

This prompted a small exercise where I designed some rough concepts for a wide range of blue-sky, 100% sustainable products. Each of these trial designs was thwarted by a missing technology. But after covering sectors from automotive and household to food and electronics, a pattern began to emerge.

In every case, the product could become 100% sustainable with the application of just one or two magic bullets, or missing-link technologies. In particular:

Switchable Additives, such as pigments, preservatives and flame retardants, which would perform their function while the product was in use, but then could be deactivated to allow for composting (usually hindered by preservatives e.g. in tanned leather) or recycling (usually hindered by additives such as colours, which contaminate batches of recycle).

Sensing RFIDs, that contain both the designer's details of product composition, but also which sense and memorise what has happened to the material during the complex path of manufacture and assembly, all to tell the right story to the disassembler when the product is eventually recycled.

Solar factories and solar logistics (such as biodiesel lorries) to ensure that all the energy and embergry used in a product's lifetime is solar or renewable.

These three magic bullets solved a lot of problems when designing rough concepts -- an extended study would reveal more directions and consolidate or disprove the assumption that we are very close, that we just need a few nudges to precipitate these things into existence.

The Holy Grail -- Nanocycling

In the longer term, "Nanocycling" is a holy grail of this kind of thinking. Yet it is as at Feb 2004 almost unknown. Nature doesn't bother with the crude recycling that we do, melting down materials under huge heat and remoulding them, it works at a molecular level, disassembling incoming food and reassembling it into the forms the organism needs. Nanotechnology is hurtling towards goals of molecular-level assembly, but there is literally no work being done on nano-disassembly.

What one can envisage is an industrial plant looking like a big warehouse, with unsorted waste going in one end, and pure raw materials coming out of the other. Clearly there are energy and cost barriers, but it is a seductive solution because design for recycling-as-we-know-it would not be necessary.

The 100 Cubed proposal

These design exercises have suggested that far from being pie in the sky, 100% sustainable products are fast coming into our grasp. I have a proposal for a manufacturer or preferably a group of manufacturers, to develop a 100% sustainable product. It would be a flagship, an inspiration for other businesses. Instead of environmental issues being something bad that must be avoided, this would focus on an aspirational ideal, something to work towards.

The context for this is a goal I have been considering. Something amazing yet approachable, daunting yet achievable -- for 100% of products to become 100% sustainable by the year 2100.

100 x 100 x 100, or 100 cubed.

That's a big challenge when in 2004 we don't even have one product that is 100% sustainable. And there are something like 100 million product types in the world.

But unless we start thinking about where we want to go, we will end up where we are headed ...