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What's your **footprint?**

THE RULES ARE CHANGING. NO LONGER IS COST THE ONLY ITEM ON 'THE BOTTOM LINE' WHEN A NEW PRODUCT, BUILDING OR SERVICE IS PROPOSED. INCREASINGLY, THE ENVIRONMENTAL IMPACT MUST ALSO BE CONSIDERED AND ACCOUNTED FOR. IT IS ESTIMATED THAT OVER 80% OF A PRODUCT'S ENVIRONMENTAL IMPACT IS DETERMINED DURING THE DESIGN PHASE, (THE BEHAVIOUR OF THE END-USER MAKING UP THE REST) AND NEW LEGISLATION WILL SOON ENSURE THAT THIS IMPACT MUST BE CONSIDERED BY MANUFACTURERS, AND MINIMISED.

In August 2007, the Energy-using Products (EuP) directive came into force in Europe and will lead to mandatory EcoDesign measures being applied to the design of certain products. The term EcoDesign indicates that during the product development process, the engineer has made design decisions based not only on the cost of the material, the ease of manufacturing or the appearance of the product, but also on its environmental impact.

Manufacturers of a wide range of volume-manufactured products in fifteen broad product groups, ranging from boilers to consumer appliances, will soon have to comply with the new EcoDesign requirements in order to maintain their CE marking. These measures have been designed to encourage designers to select materials with lower environmental impact, design-out restricted substances and to design for maintenance and recycling.

But how can one quantify environmental impact? Is it possible to compare the disparate effects of greenhouse gas emission, pollution to water supplies or reduced air quality? This is where Life Cycle Assessment (LCA) is an invaluable tool. During an LCA one looks at the production, transport, use and end-of-life phases of the product. The aim is to collect the data on all the processes, materials used and energy consumed, but there are several ways to handle the assessment and these figures cannot just be added up. These methods range from listing the energy used or the CO^2 emitted in the different stages, to the standard LCA method - following ISO 14040 and using an Eco-indicator.

For this article we will not go into all the different forms of performing an LCA, but we will look at the ISO 14040 method, which describes the following steps to be taken:

- Goal and scope definition, which determines what is investigated and why
- Inventory analysis that lists the input and output of the system
- Impact analysis, in which the effect of the system is quantified
- Interpretation, to qualify the effect of the system

In the impact analysis, an Eco-indicator is used. Several Eco-indicators exist (e.g. Eco-Indicator '99, EPS, EDIP) and these indicators are stored in databases (IdeMat, Ecoinvent 2000, BUWAL 250). These databases are then referenced by different LCA software tools, such as SimaPro, Eco-it and GaBi 4, enabling designers to identify the environmental effects of material or manufacturing choices at every stage of the design process.

One of the most-used indicators is the Eco-Indicator '99 (EI99). It indicates the environmental impact of a material or process in points per functional unit, say a kg, a m3 or a litre, with a higher score indicating greater damage to the environment. In order to calculate the environmental points, a lifecycle inventory is made and is divided into the following three damage categories:

- Impact on ecosystems
- Impact on human health
- Impact on resources

Human health and ecosystem quality are regarded to be twice as important as resource depletion, and are weighted accordingly. This weighting remains a contentious issue, but it is argued that market forces always drive design decisions when resources become scarcer, whereas the impact of damage to humans or ecosystems, including climate change, has no financial imperative.

A score is then given, which is based on the choice of one of the following three perspectives:

- Hierarchic perspective (the default perspective that has a balance between long and short term, where problems are avoided by proper policy and the inclusion of effects is based on consensus)
- Individualistic perspective (short term, problems avoided by technology, only proven effects)
- Egalitarian perspective (very long term, problems can lead to catastrophe, all possible effects are included)

Using an LCA program, a designer produces a Bill of Materials for the product, listing every component. To each component entry is added the material, with its weight and each step of the manufacturing process. Estimates are made about the average use profile of the product, and how the product will be disposed of at the end of its life. The software then calculates the different scores and shows what weighs heavily on the impact.

You might ask, do I really need to do this extensive LCA? Why could I not just list the energy use and leave it at that? First and foremost, the LCA looks at all the environmental impacts, such as ozone layer depletion, acidification, eutrophication, heavy metals, carcinogenicity and smog. Furthermore, by doing several LCAs the designer gets a feeling for which parts of the design are contributing most to the overall environmental impact - and these results can often be counter-intuitive.

As an example, for a recent project involving the design of food and beverage containment in the FMCG sector, Cambridge Consultants was asked to replace a robust, re-usable product container with a single-use, disposable version. This was thought necessary to accelerate the penetration of the product into new markets, where infrastructure for the collection, cleaning and re-filling of the containers was not yet available.

By considering the lifecycle of the existing product, including the non-reusable elements such as the label and closure, the additional transportation by road and the requirement for steam cleaning of the container, we were able to propose a minimalist packaging solution that could be used once and recycled with a lower overall environmental impact than the original design. This proved a surprise to the client, whose original development of the re-usable system had been based on the premise that re-using was inevitably preferable.

Although an LCA requires the commitment of financial investment and time, identifying and making critical decisions based on the entire lifecycle of a product should not only benefit the environment, but it will also endear your products to consumers and present opportunities for all-round better design. After all, those who embrace the environment won't just be following the rules, they'll be setting them.

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