Carbon Footprint

A Catalyst for Life Cycle Assessment?

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Carbon footprint is a new buzzword that has gained tremendous popularity over the last few years—especially in the United Kingdom. Debates on the appropriate use of carbon footprinting are spreading through society like rings in the water. This in large part has been driven by retail chains and proactive companies that request or provide information to the consumers—for example, for the purchase of airplane tickets and carbon offsets.

It is interesting that carbon footprinting has not been driven by research but rather has been promoted by nongovernmental organizations (NGOs), companies, and various private initiatives. This has resulted in many definitions and suggestions as to how the carbon footprint should be calculated. Wiedmann and Minx (2007) suggested that the term *carbon footprint* should only be used for analyses that include carbon emissions. The same study showed, however, that most definitions currently include noncarbon emissions and use carbon dioxide (CO_2) equivalent indicators instead. This is very similar to the global warming potential (GWP) indicator used in life cycle assessment (LCA).

Carbon footprinting has a much broader appeal than LCA. . . . In [carbon footprinting], things are kept simple, and a carbon footprint is easy to calculate online . . . and the calculated value can easily be grasped. . . . It is certainly an eye opener when you discover that your next trip from Copenhagen to San Francisco has a carbon footprint of roughly 2 tons of CO_2 (equivalents), or 20% of the carbon footprint of an average European in an entire year.

So why all this excitement about carbon footprints? A likely answer is that carbon footprinting has a much broader appeal than LCA. The concept is "catchy" and has been promoted and diffused outside the research community. In this approach, things are kept simple, and a carbon footprint is easy to calculate on-line. Furthermore, the calculated value can easily be "grasped" and placed in context. It is certainly an eye opener when you discover that your next trip from Copenhagen to San Francisco has a carbon footprint of roughly 2 tons of CO_2 (equivalents), or 20% of the carbon footprint of an average European in an entire year. In the LCA community, we would probably have become immersed in discussions about the quantification of ozone formation, methane loss, contrails, and cirrus clouds, thus diverging the discussion into technicalities. The strength of these simple on-line calculators is that they focus on what is important—CO_2 emissions. That being said, relying entirely on one indicator can sometimes be misleading; therefore, one should remain conscious of oversimplification.

Global warming and reductions of carbon emissions are at the top of the environmental

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policy agenda today. LCA is from a previous era in which the focus was on creating a holistic picture that avoided problem-shifting—that is, solving one environmental problem but creating a new one in the process. Multiple substances are assessed simultaneously to better understand their contribution to various environmental problems. This complexity has been the backdrop to LCA. It is often complicated stuff, and it is difficult to communicate and frequently hard to make clear-cut decisions from.

Is One Indicator Enough?

For experts working with detailed LCA, it is a thought-provoking idea that problems could be captured in a single indicator. Focusing on GWPs alone is a crude approach that may give a misleading picture of the impacts in certain cases—compared to the multiple-indicator approach in LCA. One example could be biofuels, for which a low carbon footprint could give the impression of a truly eco-friendly product, despite its negative land use impacts, ultimately increasing the pressure on rainforests and other rich habitats. Still, the carbon footprint could be a valid indicator when one wants to compare different types of biofuels or the impact from different food products. Because the carbon footprint includes global warming, at least some impacts of land use change are covered by this approach. These impacts from land use may also be proportional to energy use. This is even the case in fisheries, given that the impacts on the seafloor generally are highest for those fisheries that are also the most energy intensive. Basically the same friction causes the damage to the seafloor habitats and the consumption of fuel (Thrane 2004).

Within the LCA community, we have known for many years that the environmental impacts from energy-related emissions are an important factor (if not *the* most important) that contributes to the overall impact potential for most products.[1] There certainly will be cases in which a carbon footprint indicator can be misleading or is interpreted incorrectly. However, if decisions based on the indicator go in the right direction just 80% of the time, it will still be better to use this indicator than to use no environmental indicator at all.

Should There Be an ISO Standard for Carbon Footprinting?

Accounting for carbon footprints is a question of quantifying and presenting emissions data for the whole life cycle of products in a consistent manner. In this sense, the existing ISO standards for LCA, product declarations, and greenhouse gas accounting (ISO 14040/44, ISO 14025, and ISO 14064) should be indispensable. Nevertheless, a number of developments indicate that individual methodologies are underway. The most notable of these is the UK carbon footprint label currently under development in British Standard (BS) as a Public Available Specification (PAS) document at the request of the Carbon Trust and the British Department for Environment, Food and Rural Affairs (DEFRA). But is there a need for the additional standard? Yes and no. The existing standards do cover the same areas as those developed under the auspice of BS, and in that respect a new standard would be redundant. But it must be acknowledged that the existing ISO standards are vague on several crucial points, as we point out below. In the words of the BS Technical Advisory Group, the ambition of the new standard is to be both rigorous and easily applicable in practice. Although it is not yet clear what the result will be concerning the choice of methodology, the upcoming PAS 2050 standard from the British Standards (BSI) will include guidelines for the handling of system boundaries, which will contribute to closing the gap between bottom-up and top-down approaches to system modeling. The British PAS could therefore play an important role in providing specifications that may eventually feed back into the LCA community and the ISO LCA standards. As long as the new PAS provides more stringency without losing any of the progress already made by the existing standards, the British initiative should be welcomed and an international platform for the carbon footprint standard considered.

System Boundaries—A Key Issue

When one browses through Web sites on carbon footprinting, it becomes apparent that the basis of its development is most likely life cycle thinking. It is not always clear, though, whether the numbers for carbon footprinting actually include the complete life cycle. One example of this is a typical flight calculator, where it is unspecified whether the tons of CO_2 (or equivalents) include the production of the airplane and other capital goods. While the ISO 14025 requires the inclusion of all life cycle stages in environmental product declarations, it is still debated how carbon footprinting should, in practice, deal with the use stage for "active products" such as cars and electronics.

An important system boundary issue is the rules for coproduct allocation, where the ISO 14044 LCA standard is unnecessarily open for misinterpretations. With the current state of the art of LCA practice, it is possible to provide a much clearer and simpler wording without changing the meaning of the current ISO standard.

Likewise, current LCA practice has abandoned cutoff rules altogether, due to the availability of more complete input–output-based hybrid databases, while cutoff rules receive large and unnecessarily complicated treatment in the ISO 14044. Besides allowing a simplification of the standards, the availability of hybrid databases increases the opportunity for providing a central database that all users of CF can draw on, thus avoiding arbitrary differences between footprints due to differences in the data used.

Presentation of Results

The way that the carbon footprint results are presented to the consumer is an important issue. Today, the unit of measure for most results is CO_2 equivalents per product. It is also possible to use CO_2 equivalents per monetary unit, as foreseen in the U.S. initiative by the Climate Conservancy (<www.climateconservancy.org>), or CO_2 equivalents that compare to a reference product (Christiansen et al. 2006). The measurement per product is insufficient for informed environmental decisions, except in cases where product alternatives all have the same price. If the products have different prices, the information on CO_2 equivalents caused by the change in consumption related to the money saved or extra money spent is hidden. To alleviate this problem, one can use the measurement per monetary unit instead. Nonetheless, a comparison would require that an alternative product be at hand. Therefore, it would be relevant to provide results both as CO_2 equivalents per product and normalized to a reference product within the respective product group. This way, the consumers are provided with information that directly specifies whether the current product is an environmentally desirable choice.

Final Comments

From a regulatory perspective, we can see two trends in dealing with global warming. One follows the path of voluntary agreements, product labeling, and consumer choice (the PAS 2050 is the main driving force behind this), while the other relies on the responsibility of authorities to legislate and internalize the environmental costs in the product prices. The latter is achievable through environmental taxes or tradable quota on carbon emissions (a recent example announced by the Dutch government is a packaging tax based on calculations of embedded CO_2). It is important to maintain a balance between these two approaches, stimulating the innovation of cleaner technologies and smarter products through market pressure but not using this as an excuse for politicians to do nothing. Limiting emissions of greenhouse gases needs clear political targets and operative measures, and we see it as an absolute necessity to have global, binding quotas. Neither LCA nor carbon footprinting will do the job alone.

Carbon footprint analysis is not the only place where we see LCA being "slimlined" to cover solely CO_2 emissions. This is also seen in many assessment methodologies and in environmental management systems. But the carbon footprint, more than any other method or concept, has been able to catch the attention of the public. An overwhelming abundance of Web sites—some even government sponsored—exist to calculate a

person's impacts and offer suggestions for offsetting emissions.

Carbon footprints carry the potential of being a good entry point for increasing consumer awareness and fostering discussions about the environmental impacts of products. This, in turn, facilities the diffusion of life cycle thinking and LCA. It may even have the potential to promote a more consistent framework for environmental assessment of products and services.

Note

1. Editor's note: For a discussion of energy indicators as proxies for overall environmental impact, see the column in this journal by Udo de Haes (2006).

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