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Carbon footprinting, labelling and life cycle assessment

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1 Introduction

In the search for system analysis instruments and methods that provide information and help in decision making for environmental improvements, very simplified and supposedly easy-to-understand indicators/labels are being increasingly called for. In addition, models that the consumer can take into consideration when making his “environmental” purchasing decisions are being discussed. Consequently, within the framework of the general discussion about climate protection, different approaches are being put forward for the recording and labelling of the carbon footprint (CF) of a product or service. Today, after more than 30 years of evolution towards sustainable development, the question is being asked whether this approach with single indicators, such as CF, is a backward step with regard to a concept for sustainable production and consumption. Sustainability, according to the global consensus, is comprised of three key constituents—environmental, economic and social. Concepts concerning how to handle this issue must, therefore, take all three elements into account to avoid improving one to the detriment of another. Even when suggestions for improvements are limited to one element, e.g. ecology, this also takes in more environmental aspects or indicators than the greenhouse effect, such as the consumption of resources, noise and also biodiversity. In addition to environmental issues in general, consumers also take other criteria into consideration when making purchasing decisions, such as the price of a product, its functionality or the contribution it makes to their quality of life.

In the following, several important aspects and issues, which in fact argue against the concept of single indicators, such as CF, will be explained. It would be appreciated if the criticisms made were taken into account when working out models for CF and labelling or could make a contribution to discussions about the sense and purpose of this kind of approach. Tools used to calculate a CF and deliberations about a label are separate entities and will be considered separately in the following.

2 Carbon footprinting

The recent demands for methods to measure greenhouse gas (GHG) emissions associated with consumer products (goods and services) and the efforts regarding standardisation were discussed in detail by the SETAC Europe LCA Steering Committee (2008). With the ISO LCA standards 14040 and 14044, a tool is available for calculating the GHG associated with a product. In principle, there is therefore no need to develop a separate method for calculating the CF (ISO 2006a, b). Nevertheless, if one wants to work out an instrument, it must be compatible with the LCA standards or meet these completely. It is not acceptable if a new CF method for one and the same product comes to a different result for the GHG indicator from the LCA method. Otherwise, the work on ISO LCA standardisation, ongoing for almost a decade now, is reduced to the absurd. In addition to this, the SETAC Europe LCA SC demand concerning the nine key require-

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ments for any potential new product-related GHG standardisation effort must be supported. Particularly worthy of mention here are:

"Coverage of relevant environmental impacts": We know today that a variety of LCA indicators are necessary for describing the environmental impacts of a product. This complex system comes very close to reality and is required for the interpretation as well as the optimisation or reduction of one indicator without increasing another. By focusing complex reality on only one indicator CF, essential information was left out, and reductions in CF could lead us in a completely false direction. Remember the ongoing discussion about biofuels. In view of the latest developments, the increase in admixing by 10% before 2020 is being discussed again in the EU. An announcement issued by the Worldwatch Institute on 16 May 2008 even bore the title "Food vs. Fuel, What's the Real Deal?" A question arises here, which requires answering: If top priority is given to the CF indicator today, then to the Water Footprint tomorrow, to the Fossil Energy Footprint the day after tomorrow and then to the 'Land Use Footprint', etc., how should the others be considered in relation to the one given top priority?

"Coverage of life cycle stages": Non-negotiable is the requirement that all life cycle stages of a product system have to be taken into account and modelled; the same applies to including the share from consumers. In this way, it can be shown how the CO_2 emissions arose and where the major shares are to be found. Only by using such a procedure can specifically tailored handling and reduction measures be taken. It has to be mentioned here that a product system means all components are included, e.g. red wine and glass bottle and not just the packaging as in previous studies.

"Coverage of greenhouse gases": Besides the demand to take all relevant GHGs into account, it must be expressly stated that all considerations taking compensation mechanisms into account in the calculation makes less sense. Otherwise, the results for a product system would be easy to manipulate. It would then be even possible for a specifically chosen group of products to all display zero CO_2 emissions.

3 Life cycle inventory analysis

With regard to life cycle inventories, frequently too little attention is paid to the degree of detail or informational value of the data in the presentation of results. As a rule, the LCAs for products use data sets—i.e. mean values—for many life cycle stages and little data, which is specific to the particular product under consideration and its specific life cycle. Figures, which presumably show a high degree of accuracy, such as 553.6 kg CO_2 or 40.3 g dust, are stated as a result of these life cycle inventories. This assumed accuracy must, however, be put into perspective in that the mean values used display a range in which the relationship between maximum and minimum value can often be greater than a factor of two; this means that it can amount to 100% and more. A much-quoted example is the aluminium beverage can. When the beverage can is recycled, a multiple of the energy can be saved compared to original production depending on whether the consumer makes the key decision of returning the can for recycling or throws it in the dustbin. Another example can be shown using the parameter 'distribution distance'. An IFEU Study in 2006 showed that, when exact market details about the distribution distance (instead of the mean transport distance!) of drinks containers are considered, the 0.5-l returnable glass bottle performed better than the 0.5-l aluminium can—with regard to GHGs—in the case of short distances (IFEU 2006). In contrast to this, the 0.5-l aluminium beverage can has a clear advantage when higher distribution distances are involved.

In life cycle inventories, it is attempted to determine the deviation from the calculated mean value by means of scenarios. It should be noted that one frequently comes across the term or the method for error estimation with regard to the mean value. This is false and misleading. Various types of technology or exact distribution distances, as seen in the example, have no mean value with error. Since they are independent of one another, they cannot have a mean value to deviate from. In fact, the term 'scenarios' is also misleading because they are always concrete market situations. The significant parameters of a product's life cycle stages, such as technology, selection of energy resources or the length and type of transport, thus essentially determine the range of the life cycle inventory analysis results. Theoretically, a detailed specific life cycle, e.g. for a tin of peanuts at the point of sale, can be configured in such a way that a mean value of 90 g CO_2 emissions does not result, but only 85 g CO_2 or even 95 g CO_2. For the tin of peanuts, it was the same. When this tin of peanuts is on the shelf in competition with another tin that displays only 88 g CO_2 instead of 90 g CO_2, the situation becomes completely different. When the consumer decides to buy the tin of peanuts with 88 g CO_2, he trusts that he is making a contribution to reducing CO_2. This difference of 2 g CO_2 for the two products can, in fact, not be clearly verified. In the future, lawyers specialised in such matters could possibly become involved since, by stating the CF as simple figures, which in fact can display wide ranges, market or competitive disadvantages arise.

These explanations should not be a plea for specific instead of mean life cycles, since the expense for data gathering is not affordable and, for a wide variety of products, this approach is also not manageable. The results of these types of inventory analyses are largely based on mean values. In the future, however, one should take into account that these results are not exact numerical values but concealed behind ranges of the data. They are therefore not suitable for making reliable decisions about the purchase of products.

4 Life cycle impact assessment

In the following, we consider an aspect concerning the element impact assessment of an LCA. The GHGs are summed up to give global warming potential. In this, only the output side of the LCA is taken into account. The input side is not taken into account since, for the greenhouse effect, it does not matter where the CO_2 originates from; furthermore, a CO_2 molecule from the burning of wood cannot be identified as such. However, for regenerative materials such as wood, the CO_2 should not be counted because it remains in the biomass CO_2 loop. Besides the GHG potential, the consumption of resources is summed up in an impact category in LCAs. In a 'Life Cycle Assessment of Beverage Cans' (UBA 2000), for example, Germany's Federal Environmental Agency weighted the energy resources, brown coal, hard coal, gas and oil, along with their statistical range. In LCAs, a separate indicator is therefore shown for the input side and also the output side. If the approach of Germany's Federal Environmental Agency is adopted for the global warming indicator, it does not matter where the CO_2 originates from but related to the resource indicator that is not relevant. When the intent is to show the CF as a separate indicator, the question has to be asked whether the topic of energy consumption is sufficiently taken into account since, with the exception of wood for example, only the output side is considered.

5 Life cycle interpretation

Finally, a critical point arises in connection with the element 'interpretation' of a LCA. First of all is the quotation from the German Committee of Experts on Environmental Issues from the Environmental Report of 1994 (SRU 1994): "The variety of material and non-material interactions within and between the different environmental compartments makes it clear that no 'environmental indicator' can be stated as a one-dimensional value; furthermore, the variety of different protective goods does not allow a total aggregation." Despite this insight and knowledge about the complexity, a range of evaluation models exists, which essentially condenses the LCA results so that clear and simple statements about the environmental compatibility of the products under consideration can be made. In the aforementioned study of Germany's Federal Environmental Agency, an evaluation approach was also worked out so that recommendations could be made from comparing different types of beverage packaging with one another. Granted, this approach was drawn up for a consensus to be reached in Germany. In other countries, another evaluation approach could achieve a consensus, which leads to other conclusions and recommendations for the same product life cycle assessment. As a rule, the life cycles of the products under consideration are global and not completely country-specific—French red grapes, however, do not grow in Germany. The companies and parties involved in global life cycles, which are outside the country where the end product is found at the point of sale, would thus be directly affected by the consensus formed or the evaluation method in the market country. In addition, the question basically arises: If no one-dimensional environmental indicator can be given for LCA results, is it then not merely negligent to want to draw up the CF indicator for products?

To avoid any misunderstandings, it is to be welcomed that, with LCAs, a tool is available for carrying out complete product life cycle analyses of product systems. Along with other industrial sectors, the aluminium industry has worked for years on the compilation and further development of this standard and the European Aluminium Association makes data on aluminium available. On behalf of the industry, we have very clear ideas about what LCA can achieve and what it cannot. With detailed life cycle inventory analyses and impact analyses, the optimisation of process and product systems in a specific manner is possible. In addition, the instrument is used as a management tool in innovation and efficiency strategies. It is, however, not suitable for making product comparisons on the basis of one-dimensional evaluation results, such as those mentioned above. The same would apply to a CF insofar as a dedicated approach is drawn up.

6 Carbon-footprint labelling

Before going into the current developments and suggestions for a CF label, a few CO_2 examples will be explained to show the proportionality that should be discussed. A crisp is labelled to have a load of 75 g CO_2. However, what does this mean for a consumer. For example, 2 h of watching television generates 200 g CO_2, the filling of a dishwasher is equivalent to 622 g CO_2 or a flight of 1,000 km would generate 170,000 g CO_2.

Among other things, the examples highlight the following: For a CF label to make any sense at all, all products/product areas and activities have to be included. Only in this way can consumers become aware of the connections and evaluate the information in order to act appropriately. What sense would it make if a consumer goes to fetch the aforementioned tin of peanuts with 88 g CO_2 instead of 90 g CO_2 in his car from a shop 1 km away and in doing so generates 200 times more CO_2 than the difference of 2 g CO_2 he saves.

Even more difficult to understand for consumers are the objections that arise in comparison to other labels and contribute more to their confusion than clearing up. The ISO Standard 14025 'Environmental Labels and Declarations—type III environmental declarations' for products already exists (ISO 2006c). In principle, this standard is based on life cycle assessments and contains few pages. The CF label would only be a figure. Compared to the Declaration, can the facts and meaning of the label be communicated in an understandable manner?

Another contradiction arises from the comparison with e.g. the CE mark, which denotes the energy consumption of the appliance. Besides giving details of the energy-efficiency category, e.g. A, the CF label with the CO_2 value would then be on the refrigerator. The same refrigerator would have a different CO_2 value in France than in Germany, its neighbour, since the electricity mix is different. Should distortion of competition and of the markets not to be feared if consumers decide on buying seemingly better appliances in neighbouring countries (CF Label tourism)? The confusion would be even greater if the consumer had already decided to purchase renewable electricity. He would then ask himself whether and how much less CO_2 he generated compared with the value stated on the label. It could be explained to him that the calculations are based on mean values; on average, he would save nothing. He could then come to the conclusion that the energy label whether, for example A or C, regarding CO_2 is irrelevant since he already uses electricity from renewable sources.

7 Conclusions

In conclusion, when all the statements are taken together, they allow us to determine that, with the introduction of the CF as the single indicator, the path to sustainable production and consumption may go astray. In the end, the purpose of a CF or a CF label can only be to enhance our knowledge and understanding of GHG emissions arising from each life cycle stage of a product system. Only in this way can each stakeholder group involved in the life cycle—be it industry or consumer—assume their responsibility and make their contribution to optimising the whole. A simple figure or label does not achieve this. In addition, the LCA tool, which is already available, facilitates the environmental optimisation of product systems as a whole.

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