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Öko-Institut e.V.
Institut für angewandte Ökologie
Institute for Applied Ecology

Product Carbon Footprint

Memorandum

Position statement on measurement and communication of the product carbon footprint for international standardization and harmonization purposes

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1 Background and objective

1.1 Background

Ambitious climate targets can only be met through a massive, worldwide reduction in greenhouse gas (GHG) emissions. For industrialized countries such as Germany this means reducing GHG emissions by up to 95% from their 1990 level by the year 2050. If this is to be achieved there must be major changes in products and consumption patterns – in product development, production and marketing as well as in product use. To identify ecologically and economically efficient ways of progressing towards this target, it is essential to analyse the climate impacts of products and consumption patterns.

The work on product carbon footprinting and CO_2 labelling carried out by Britain's Carbon Trust and also by Tesco, the largest retailer in Britain, has driven forward the necessary discussion on product-related climate change mitigation and product carbon footprinting (PCF) both in Europe and worldwide, and has highlighted the issue of CO_2 labelling.

At the start of 2008 Tesco announced that it would measure the carbon footprint of all the 70,000 products that it sells and pursue carbon labelling for its products. Shortly afterwards it restricted the focus to its 1,500 own-brand products and also extended the implementation time frame. Around 100 products have now had their carbon footprint calculated and been labelled accordingly.

Worldwide there is now a large number of state-run and privately organized product labelling schemes (see Section 4.2) and several dozen PCFs have been published (e.g. by the PCF Pilot Project Germany[1]). From this, two key issues arise:

Firstly, there is an urgent need for developing internationally binding, harmonized standards and guidelines for the methodology of the product carbon footprint.

Secondly, the purpose and usefulness of CO_2 labelling is viewed very differently by the various stakeholders.

The British Standards Institution (BSI), in collaboration with the British Department for Environment (defra) and the Carbon Trust, has produced a Publicly Available Specification 2050 – *Specification for the assessment of the life cycle greenhouse gas emissions of goods and services*. This British pre-standard sets out an initial comprehensive proposal for the methodology of the product carbon footprint, thus contributing to the international debate on this issue.

1 see http://www.pcf-project.de

The final version of the PAS 2050, published in October 2008, is largely based on the life cycle assessment standard ISO 14040 ff.; it refers to this standard on a number of points but also deviates significantly from it in some areas. The International Organization for Standardization (ISO) has now started work on the development of international standards, and harmonized guidelines are being drawn up to supplement the Greenhouse Gas Protocol on product carbon footprint tools (see Section 2.2). However, the results will not be available until the end of 2010 or – more probably – the first half of 2011.

Many companies are taking steps to measure and communicate product carbon footprints and introduce appropriate reduction measures. However, this activity is taking place at a time when fully developed international standards are not yet available and uncertainty about the appropriate messages to be conveyed still prevails.

As part of the project *"CO_2 Labelling of Goods and Services"* the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) therefore commissioned the Öko-Institut to undertake a systematic analysis of CO_2 labelling and the need for further development of PCF methodology.

The project explored PCF methodology and communication requirements both theoretically and through case studies. A large number of stakeholders and scientists at both national and international level were involved in the discussions. Two expert-workshops and two conferences were organized in the context of the project.

In addition, some 50 national and international businesses and organizations took part in a detailed survey of their views and experiences[2]. The cooperation partner Systain Consult, working closely with the Otto Group, calculated a number of PCFs in the textile chain, thereby helping to clarify the practical and methodological requirements of aspects such as data collection and allocation; the results have been made available as a contribution to wider research in the field[3].

The present ***Product Carbon Footprint Memorandum*** summarizes the key positions on the product carbon footprint and communication of it, as revealed by the findings of the above-mentioned project.

The Memorandum describes the key aspects of methodological standardization from the participants' perspective and presents practical recommendations detailing how these points can be addressed in the calculation of product carbon footprints in the transition period until international standards become available.

The Memorandum also discusses the key positions with regard to communication of the PCF that arise from experience with the calculation methodology.

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2 The detailed findings of this survey will be published in the project's final report

3 Systain, "Product Carbon Footprint Analysis of Three Selected Textiles", Hamburg, may 2009

The Memorandum is intended for:

- practitioners, especially producers and retailers
- policy-makers (product-based climate protection policy, PCF, labelling)
- scientists
- standardization boards

All the project's findings will be published in a detailed final report at the end of 2009.

There are also plans for a guide to practical methods of calculating product carbon footprints, to be published in cooperation with the German industry federation Bundesverband der Deutschen Industrie (BDI).

1.2 Aims of the Memorandum

The aims of the Memorandum are:

- where aspects of the methodology are unclear or disputed, to draw up clear positions/policies that can then be incorporated into the international standardization process;
- to suggest practical ways of producing life cycle inventories during the transition period to 2011;
- to formulate the requirements for good and successful communication of issues relating to product-based climate protection and
- to provide an appraisal of CO2 labelling.

The purpose of the Memorandum is to contribute to international methodology development and purposeful application of the product carbon footprint; there is no intention to develop a separate or additional national standard.

Assessment of individual methodological issues and related decisions are based on a conservative approach, i.e. one guided by optimum environmental performance. In addition, the findings of the IPCC on climate change and mitigation are taken into account.

1.3 Definition of the product carbon footprint

The term "product carbon footprint" is defined and used internationally in different ways. There is similar variation in the legal regulations. For example, statements of CO_2 emissions per km for motor cars include only emissions of CO_2 and not those of other greenhouse gases; furthermore, they do not include upstream emissions incurred higher up the supply chain in producing and delivering petrol and diesel.

The Memorandum uses the following definition:

"The product carbon footprint ("CO_2 footprint") *is the outcome of the analysis of greenhouse gas emissions throughout the entire life cycle of a product in a defined application and in relation to a defined functional unit."*

GHG emissions comprise **all** gaseous substances for which the Intergovernmental Panel on Climate Change (IPCC) has defined a global warming potential (GWP) coefficient, and are to be expressed in mass-based CO_2 equivalents (CO_2eq). The life cycle of a product covers the entire supply chain: from manufacture and transport of raw materials and pre-products through production and distribution to use, end-of-life use and final disposal. The term "product" is taken to include both goods and services.

2 Product carbon footprint methodology

2.1 Objective and use of the product carbon footprint

Various objectives for the calculation of PCFs have been put forward in the international debate; for example, they provide a basis for quantifying the CO_2eq value for a CO_2eq label, optimizing internal company processes, introducing tax concessions for biofuels and comparing different products within a retail range. The criteria for the assessment methodology will vary depending on the specific objectives and the associated scoping.

This means that in order to be appropriate to the most important and most usual objectives, the PCF methodology must either be broad in scope or must specify different methodological rules for different uses and if necessary also for different product groups.

In the Memorandum it is assumed that the PCF methodology must be suited to the following general objectives:

- identifying the GHG emissions along the supply chain;
- identifying particular emissions "hot spots" and hence reduction potentials that are particularly large or easy to realize;
- analysing and evaluating the relevance of GHG emissions in comparison to the other environmental impacts of a product which, in the strict sense, PCFs do not cover;
- identifying opportunities for action to reduce GHG emissions that can be taken by stakeholders along the product chain (suppliers, industrial clients, public purchasers, consumers, product policy);
- comparison of GHG emissions with products in the same product group;
- product comparisons of multiple products carried out on behalf of different clients and by different practitioners*,

- public comparison with competing products in ways that are acceptable under competition law (e.g. through reporting of CO2eq values or use of CO2eq labels)*;
- portfolio analysis of multiple products from different product groups for the purpose of specifying the overall GHG balance and identifying priority measures (for example, the portfolios might be: a manufacturer's product portfolio, a retailer's range or the – average – consumption of consumers)*;
- summarized for the consumer stakeholder group: analysis of the GHG balance of private households, identification of priority options for action, identification of options for action in connection with product purchase and use, publication of the above-mentioned findings.

The objectives marked with an asterisk (*) are new and pose significant challenges in terms of methodology and communication.

While product LCAs have usually been commissioned by one organization and conducted by one practitioner, product LCAs and carbon footprints from different sources will now need to be compared; they must also stand up to examination arising from competition law disputes[4].

This requires scoping that applies across product groups – i.e. the key conditions and assumptions, the quality of the data and the level of detail for the LCAs must be comparable in all cases.

Product carbon footprints can help identify reduction potentials throughout the entire product life cycle. They can also be an important instrument for promoting more climate-smart consumption – especially if a uniform and internationally recognized standard is available. However, because of the limited availability of data it is unlikely to be possible to meet all the objectives, at least within the next few years (see Section 4).

2.2 International standardization processes

2.2.1 Publicly Available Specification 2050 (PAS 2050)

One of the first steps towards standardization of PCF methodology was taken at national level in Great Britain, initiated by BSI British Standards Solutions in cooperation with the Carbon Trust and the Department for Environment, Food and Rural Affairs (defra). On 29 October 2008 these organizations launched a Publicly Available Specification – *Specification*

[4] We are not aware of any trading company that specifies the PCF of competing products (i.e. not own brands) from different manufacturers!

for the assessment of the life cycle greenhouse gas emissions of goods and services, a guideline under a British standard (PAS 2050: 2008)[5].

PAS 2050 thus represents the first attempt – at least at national level in the UK – to create a standardized basis for the assessment of greenhouse gas emissions arising throughout the life cycle of goods and services (product carbon footprint). The process included two international consultation rounds, in which the German Federal Ministry for Environment (BMU) and Öko-Institut took part. From the final version of the specification that is now available it is not always clear how the comments on particular methodological challenges have been dealt with. Presumably not all the methodological recommendations contained in the PAS 2050 are suitable for inclusion in an international guideline or standard (see also Section 3). For this reason international initiatives and standardization bodies have in recent months addressed this issue without explicitly adopting the PAS 2050 as a basis of their work (see below).

2.2.2 ISO 14067 "Carbon Footprint of Products"

The ISO Technical Committee (TC) 207 on Environmental Management, together with Subcommittee 7 on Greenhouse Gas Management and Related Activities, took up the task of preparing a standard for "carbon footprints of products" (ISO/NP 14067) last year. The standard will consist of two parts – one standard for assessment and quantification and one for communication. ISO standards 14040 ff. on life cycle assessments provide an important basis for the quantification part. The communication part will be based on ISO 14025 on product environmental labels and declarations. The first working drafts were discussed at the TC 207 session in Cairo in June 2009. The aim is to finalize the standard by 2011. On the German side the preparation of the standard *"Carbon Footprints of Products"* is supported by a mirror committee, the Principles of Environmental Protection Standards Committee (Normenausschuss Grundlagen im Umweltschutz; NA 172 NAGUS) of the German Institute for Standardization (Deutsches Institut für Normung, DIN).

2.2.3 Greenhouse Gas Protocol Product/Supply Chain Initiative of the WRI/WBCSD

In August 2008 the Washington-based World Resources Institute (WRI) and the Swiss World Business Council for Sustainable Development (WBCSD) launched an initiative aimed at closing the gaps in the Greenhouse Gas Protocol (GHG Protocol). The need for this had previously been evaluated in a comprehensive stakeholder survey.
A product guideline and a supply chain guideline (within the GRG Protocol: Scope 3) are being drawn up.

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[5] http://www.bsigroup.com/en/Standards-and-Publications/Industry-Sectors/Energy/PAS-2050/

The initiative officially commenced work in September 2008 with the first sessions of the steering committee in Washington and of the technical working groups in London[6].

The GHG Protocol, which was launched in 1998 as a development of the BP greenhouse gas reporting protocol, sets out procedures for corporate greenhouse gas accounting. The protocol includes guidelines on defining the boundaries of the core organization for which the inventory is to be drawn up and on managing data quality.

The existing GHG Protocol covers direct GHG emissions incurred by the company (Scope 1) and purchased electricity (Scope 2) but does not include purchased goods and services (Scope 3); the new initiative sets out to change this.

It is intended that the GHG Protocol Supply Chain Initiative will draw up further reporting guidelines within two years that will enable business to measure greenhouse gas emissions throughout their supply chain.

Scope 3 operates in parallel with the product LCA standards that are likewise in the process of development. The aim is to develop methods that enable the greenhouse gas emissions associated with a purchased product or service to be identified with sufficient accuracy.

Disaggregating specific greenhouse gas data to individual products and services presents a particular problem. Other difficult areas are special issues such as the method of accounting for “green” electricity or waste processes. The distances involved in globalized production networks also pose major challenges for data quality.

These gaps can only be filled by using carefully calculated standard values; however, obtaining these also presents a considerable challenge.

3 Proposals for methodological integration

Calculation of the PCF should at the present time be based in principle on ISO 14040 ff. (in future also on ISO 14067); where feasible (see below) the recommendations of the PAS 2050 should be taken into account.

In some respects there are contradictions between the methodological components of ISO 14040 ff. and those of PAS 2050; in other cases components are insufficiently well described or are not methodologically or practically feasible.

These unclear or disputed elements are elaborated below with recommendations on how they should be handled in the ongoing ***standardization and harmonization processes***.

6 http://www.ghgprotocol.org/wri-and-wbcsd-convening-global-stakeholder-process-to-develop-new-productsupply-chain-guidelines

We also provide recommendations on ***procedures during the transition period*** before completion of the standardization process. In general we suggest taking account of other methodological approaches through alternative calculations or sensitivity calculations. Recommendations for the ***scientific development*** of the methodology and of data processing techniques are also provided.

It becomes clear at almost every turn that detailed specifications must be provided at product group level. The product category rules for the individual groups must therefore be defined or developed at international level.

3.1 General principles

A decision to calculate a PCF is **by implication** a decision to ignore all other environmental aspects such as eutrophication, air pollutant emissions and resource appropriation. Specifying steps to be taken on the basis of the PCF alone can therefore lead to faulty decisions.

Under ISO 14040 it is also possible to restrict the environmental categories that are considered; however, such a restriction must be justified by the objectives of the assessment or by the lesser relevance of the other environmental categories or impacts.

The PAS 2050, by contrast, specifically excludes the analysis of other environmental impacts (PAS 2050: 2008, p. 1).

In practice businesses and product policy managers are poorly advised if they do not at least screen for other relevant impact categories. Life cycle inventories are in any case usually calculated using LCA software anyway.

The following recommendations are therefore made:

Recommendation on the standardization processes:

- Retain the requirement for screening and including other environmental categories.

Recommendation for further scientific development:

- Identify methods for the fast-track identification of particularly important environmental categories and “hot spots” (other than global warming).
- Compile typical hot spots for different product groups (e.g. arable land requirement in the case of biomass, water consumption in the case of cotton products etc.).

Recommendation for calculating PCFs in the transition period to 2011:

- Perform LCAs rather than PCFs and – where feasible – publish greenhouse gas emissions on a standalone basis (Priority 1).

- Carry out advance screening of hot spots, perform a PCF with associated decision-making and publicize the results together with the results of the screening (Priority 2).

3.2 Goal and scope definition

The fundamentally new challenge of the PCF is that it needs to be scoped in a way that enables all products and product groups to be assessed on a comparable basis (and by different practitioners); even the conditions applicable to different product groups must be comparable. This requires **cross-product-group scoping** – the same objectives, the same system boundaries, the same accounting rules, and comparable data quality and depth for all product groups.

In our view this cannot be achieved at present or in the foreseeable future, but it should nevertheless be a requirement of the standardization process. In all probability the requirements will initially be realized within product groups (if relevant product category rules are available).

A systematic approach must involve first setting priorities for the product groups that should be dealt with most urgently.

The following points should also be borne in mind:

- For products that are traded internationally or throughout Europe, assessment must be based on average european (or international) usage patterns (comparable to the European Driving Cycle for car use or the EuP Directive stipulations for energy-using products). National average patterns or different lifestyle groups can then be added as supplementary scenarios.
- Where supply processes are organized on the basis of major regions, this must be reflected in the accounting and reporting process. For example, electricity data should preferably be based on the European power mix (UCTE).
- The outcomes of large numbers of PCFs are strongly influenced by a small number of input values (e.g. electricity, standard metals, freight transport). In the commonly used LCA programs there are, however, sometimes significant differences between these basic values (because different conditions are applied – e.g. in the case of electricity the distinction between national electricity and imports/exports; different time frames etc.). Scoping in this area must therefore be standardized.

The key objective of many PCF activities is labelling at the point of sale. However, simple extrapolation of the PCF from the functional equivalence is in many cases not practicable. The majority of proposals to date have arisen from experience with (simple) foodstuffs; they are not transferable to all other foods, let alone to many other product groups.

ISO 14040 ff. and PAS 2050 require assessments to be carried out on the basis of a functional unit or functional equivalence. The PAS 2050 allows this to be varied for products that are usually sold on the basis of quantity or volume (PAS 2050: 2008, p. 11).

This key recommendation gives rise to numerous contradictions and has not been fully thought through. In particular there is no clear basis for transferring the results to the PCF of products – despite the fact that the objective in many cases is to label products with their CO_2eq value.

- It is unclear how functional equivalence is applied to products (on an item basis or on a quantity/volume basis). For example, how should the PCF of a t-shirt be stated? If the use phase is included in the assessment as intended, long-life t-shirts (that are worn and washed more often) have a larger PCF than short-life ones.
- How should foods be labelled in the retail trade when there are different ways in which they may be used and processed (e.g. flour, eggs, coffee) or stored (e.g. strawberries)? In the case studies of food that have so far been produced, processing has usually not been included in product labelling. However, this puts all prepared or processed products at a systematic disadvantage by comparison with non-processed products: ready-baked bread compared with baking mixtures, frozen meat dishes compared with fresh meat, ready-made deserts compared with blancmange powder/milk, a prepared fondue compared with a cheese mixture etc.).
- How should one deal with services that are not provided on the basis of unit quantity or weight (dry cleaning, launderette, car wash etc.)? The PAS 2050 provides only for details to be quoted in terms of units of time.

Recommendation for the standardization process:

- Draw up rules for quoting meaningful reference units for products at the point of sale. Reference to product category rules (for the most part still to be developed).

Recommendation for further scientific development:

- As for the standardization process.

Recommendation for calculating PCFs in the transition period to 2011:

- Where possible based on product category rules, otherwise attempt preliminary clarification through sectoral federations.

3.3 Treatment of special sources and sinks

3.3.1 Renewable energy (electricity, heat, fuels)

Climate change mitigation measures for energy can be subdivided into two broad categories, one involving the reduction of energy requirements and the other involving the use of renewable energy sources[7]. Measures for increasing the share of renewables (such as electricity from hydropower or photovoltaic systems) include both requirements imposed by the regulator and voluntary measures (such as the purchase of green electricity) undertaken by businesses or consumers.

Treating renewable energy in PCF implies methodological problems, as the example of green electricity illustrates. The existing electricity mix has long contained some electricity from renewable sources, such as existing hydropower plants. All electricity that is produced from renewable sources is initially included for accounting purposes in the overall electricity mix. State intervention aims to increase this renewable share, for example by setting feed-in tariffs. In addition, many suppliers also offer "green electricity" that customers can purchase if they wish (usually at a higher price). Where the electricity is supplied from existing plants, all that happens is that the "green" electricity is virtually "re-routed" for accounting purposes – away from normal electricity customers (who are usually unaware of this "loss") towards the "green" electricity customers. In environmental terms this re-budgeting has **no** effect, since the amount of green electricity is **not** increased. It only makes sense to include separately purchased green electricity in the PCF if this green electricity creates an **additional environmental benefit**. This involves first checking whether the separately purchased green electricity is **new** (i.e. it comes from newly built plants and not, for example, from existing hydropower plants) and how "new" green power plants are defined. Secondly, one must verify that the "new" green electricity has been produced through an additional and separately paid-for measure and not as the result of a government requirement or feed-in tariff. Thirdly, in the case of a separate assessment there is the problem of double-counting, because under some national regulations separately supplied green electricity is also included in the national electricity mix figures.

However, the PAS 2050 specifies that separately supplied green electricity (with or without additional environmental benefit) must not be counted (2050: 2008, p. 20).

The recommendation of the PAS 2050 is entirely in keeping with the methodological tradition of LCA, but it penalizes the very stakeholders who pursue their commitment to climate

[7] Other options could concern carbon capture and storage (CCS), process-related GHG emissions (e.g. from primary aluminium), those from agriculture, forestry and waste treatment (e.g. CH_4 and N_2O) as well as land use change (LUC) related carbon emissions.

change mitigation through the separate purchase of environmentally friendly green electricity. One must decide between the “purity of the method” and the “purity of the environment”.

The Memorandum proposes the following compromise:

Recommendation for the standardization period to 2011:

(1) **Certified green electricity**, which by comparison with the status quo and government requirements and support programmes produces a **demonstrable additional environmental benefit**, is to be assessed separately. Definition of this certified green electricity can be based on the existing extensive experience of green electricity labelling.

(2) The inclusion of **new plants** is also defined. By the next accounting year, new plants become old plants, thus, logic of “depreciation” is needed. The Memorandum proposes the following procedure: Green electricity from plants not older than six years is assigned 100% of the specific life-cycle emissions from its generation (i.e., including upstream processes). Green electricity from plants between 6 and 12 years is rated as having 50% of the specific emissions arising from its form of generation and 50% of the emissions of the national average mix. Green electricity from plants older than 12 years is accounted for in the same way as the average national mix of electricity. Key to the accounting of green electricity is the documentation of the generation plant portfolio by a label or independent certification.

(3) The separate assessment of “certified new green electricity with additional environmental benefit” has in the past resulted in double-counting, because this electricity is also accounted for in the national electricity mix. It is proposed that this double-counting should be accepted until 2011 as it is of only minor significance (the green electricity that falls into this category constitutes around 1% of total electricity). In parallel with this, new categories of electricity should be planned for: “Overall mix without certified green electricity” (residual electricity mix) and “Certified green electricity with additional environmental benefit”, so that the two types of electricity can be future be assessed separately for statistical purposes.

(4) For other renewable fuels (e.g. biogas, biomethane, renewable heat), a similar procedure should be adopted.

Recommendation for further scientific development:

- Develop the method for calculating the residual electricity mix.

Recommendation for calculating PCFs in the transition period to 2011:

- The same procedure as for the standardization process is recommended.

3.3.2 CO_2 and carbon storage in products

The PAS 2050 proposes measuring the (temporary) storage of CO_2 and deducting it from overall GHG emissions according to a specified formula (PAS 2050: 2008, p. 8). Examples are wood in furniture, paper in books (biogenic carbon in both cases), cement/concrete and calcium oxide or quicklime (geogenic carbon).

With respect to the IPCC and UNFCCC definitions, the temporary storage of biogenic carbon is not considered to be a sink. After all, it only shifts GHG emissions onto future generations. There are also practical reasons for not accounting separately for this type of "storage" – the future life cycle of the products concerned is difficult to predict and in terms of quantity the (deductible) temporarily stored carbon is generally not significant.

For these reasons the storage of biogenic carbon in products should **not** be deducted from the PCF.

The situation with regard to geogenic carbon is somewhat different. Firstly, products such as concrete clearly have a longer life and their life cycle can be more easily predicted. Secondly, in terms of quantity the carbon temporarily stored in these products may be quite considerable. It should be noted, though, that weathering processes occur with respective carbon releases.

There has as yet been little research on the importance of this for different products. It is therefore proposed that the temporary storage of geogenic carbon should, in principle, be included, but details should be decided for individual products (product category rules).

Recommendation for the standardization period to 2011:

- No measurement and no deduction of biogenic carbon storage in products (for the reasons stated above).
- Measurement of geogenic carbon storage in products accepted in principle, but only when adequate product category rules have been set up. Once the rules are in place, additional reporting should still separate those effects from the overall PCF.

Recommendation for further scientific development:

- Analysis of the importance and extent of geogenic carbon storage in products and preparation of corresponding product category rules.

Recommendation for calculating PCFs in the transition period to 2011:

- The same procedure as for the standardization process is recommended. Carry out the accounting procedure but report separately rather than including in the main scenario.

3.3.3 Land use changes

When land use change occurs – i.e. involving changes in the use of land for agriculture or forestry – there is a change in GHG, because the amount of carbon stored in the above- and below-ground (soil) changes. A distinction is made between direct land use change (dLUC) and indirect land use change (iLUC). Indirect land use change can occur when biomass is grown on land that was previously used for growing food, feed or fibre: it can be assumed that land elsewhere will have to be put in use to replace the "displaced" previous production (involving, for example, clearance of rainforest or conversion of grassland).

The PAS 2050 proposes the inclusion of *direct* land use change but rejects the inclusion of *indirect* land use change on the grounds of methodological problems and insufficient data (PAS 2050: 2008, p. 10).

The Memorandum, by contrast, recommends the inclusion of indirect land use change. Scientists have shown that iLUC can take place on a very large scale and can dominate the GHG balance of products or their PCF. The decision on the viability of biomass cultivation will largely depend on the extent of iLUC. It is for precisely this reason that statutory measures for promoting biofuels from biomass cultivation in California now require iLUC to be quantified, and the United States Environmental Protection Agency (US-EPA) has put forward respective proposals. The EU Commission is expected to publish proposals for handling iLUC in connection with liquid biofuels in the spring of 2010.

To exclude iLUC from GHG emissions in LCA or the PCF would mean that important potential climate effects would go unreported. In addition, assessments that may in the foreseeable future be required by law would produce different results to those based on the method recommended by the PAS 2050.

It is true that accounting for iLUC is methodologically difficult, but it can be modelled. ILUC can in principle only be estimated. The development of satellite-based monitoring systems will mean that it will in future be possible to identify the global extent of direct and indirect land use change – without, however, thereby establishing any direct connection between the individual land-use changes.

Various methods of modelling iLUC have been proposed (Searchinger 2009[8]; Öko-Institut and IFEU 2009[9]).

[8] Searchinger, Timothy 2009: Evaluating Biofuels – The Consequences of Using Land to Make Fuel; Brussels Forum Paper Series of the German Marshall Fund of the United States, Washington DC. http://www.gmfus.org//doc/Biofuels%20final.pdf

The Memorandum recommends using the deterministic approach of the Öko-Institut/IFEU – an approach that was also used in the report of the German Advisory Council on Global Change (WBGU) on biomass[10].

For the assessment of indirect land-use change this latest scientific report proposes an iLUC factor ("minimum risk level") of 5 t CO_2 per hectare and year

Recommendation for the standardization period to 2011:

- Inclusion of direct land-use change as recommended by the PAS 2050.
- Additional inclusion of indirect land use change (iLUC), e.g. as described above.
- Inclusion of dLUC and iLUC in the main scenario and separate reporting of the contributions of dLUC and iLUC.

Recommendation for further scientific development:

- Further development of iLUC models and of methods of measuring global land-use change.

Recommendation for calculating PCFs in the transition period to 2011:

- The same procedure as for the standardization process is recommended.

3.4 Treatment of individual life cycle phases

3.4.1 Inclusion of all relevant business processes

The greenhouse gas emissions associated with business or marketing processes such as websites, catalogues etc. have generally not been included in life cycle assessments carried out under ISO 14040. Case studies show, however, that such processes can have a significant impact on emissions and should therefore – where relevant – be included.

Recommendation for the standardization period to 2011:

- Significant processes that are part of the business operation, such as the printing and distribution of catalogues, operation of websites, publication of newsletters and magazines, should be included where relevant.

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9 ÖKO (Öko-Institut)/IFEU (Institut für Energie- und Umweltforschung) 2009: Nachhaltige Bioenergie: Stand und Ausblick; Zusammenfassung bisheriger Ergebnisse des Forschungsvorhabens "Entwicklung von Strategien und Nachhaltigkeitsstandards zur Zertifizierung von Biomasse für den internationalen Handel"; commissioned by the Federal Environment Agency (Umweltbundesamt); Darmstadt/Heidelberg, http://www.umweltdaten.de/publikationen/fpdf-l/3740.pdf

10 WBGU, "Future Bioenergy and Sustainable Land Use", Berlin 2009; see also: Fritsche, Uwe R./Wiegmann, Kirsten 2008: Treibhausgasbilanzen und kumulierter Primärenergieverbrauch von Bioenergie-Konversions-pfaden unter Berücksichtigung möglicher Landnutzungsänderungen; Expert opinion for the WBGU report 2008; Berlin. http://www.wbgu.de/wbgu_jg2008_ex04.pdf

Recommendation for further scientific development:

- None.

Recommendation for calculating PCFs in the transition period to 2011:

- The same procedure as for the standardization process is recommended.

3.4.2 Air and sea transport (of goods and passengers)

Several reliable databases are available for calculating the direct GHG of air transport (see below). Differences between approaches arise in the main from the inclusion or exclusion of additional, non-CO_2 stratospheric climate impacts of aviation. These additional impacts are measured by the radiative forcing index (RFI). The RFI represents the retrospective mean of the forcing attributable to specific types of flights over the last 35–50 years. It is thus a climate impact factor that relates to a shorter period than indices such as global warming potential.

The PAS 2050 recommends not using the RFI, since there is as yet no scientific consensus on this issue (PAS 2050: 2008, p.7).

Within the scientific community there is, however, consensus (see IPCC Fourth Assessment Report) on the fact that aviation emissions at particular altitudes have a greater impact on the climate as a result of physical and chemical reactions with the atmosphere. Since the Memorandum calls for a conservative approach, the RFI should therefore be utilized. Scientists are currently debating values in the range 1.9–4.7; it is thus in order to continue using the IPCC value of 2.7 that was put forward in 1999. Since the additional impacts are associated with particular altitudes, and high altitudes are only reached at distances beyond a certain flight range, the RFI should be applied to all flights over a distance of more than 550 km[11].

The data basis for (international) sea transport is unsatisfactory and in need of further development.

[11] The physical and chemical conditions in question, including particular levels of temperature, humidity etc., are more frequently encountered above certain altitudes. The additional climate impacts of aviation emissions are experienced at altitudes above about 9,000 metres and in particular at latitudes between 30° and 60° north (IPCC 1999). These altitudes are reached by flights of more than about 500 – 600 km in length. The distance boundary of 550 km corresponds to that used by the ICAO in its proposed correction to the great circle distance (ICAO 2008, ICAO Carbon Emission Calculator). The average value of 2.7 proposed by the IPCC (1999) is still the best average available, but in future it may be replaced by more specific values (IPCC 1999: Aviation and the Global Atmosphere. IPCC Special Report. Authors: Penner, J.E.; Lister, D.H.; Griggs, D.J.; Dokken, D.J.; McFarland M.).

Recommendation for the standardization period to 2011:

- Specification that for flights over a distance of more than 550 km the RFI must be used and that the most recent value consensually agreed by the IPCC must be applied. For distances of more than about 550 km it can on the whole be assumed that aircraft will reach an altitude in the stratosphere.

Recommendation for further scientific development:

- Establish specific factors for aviation taking account of geography, distance, altitude etc.
- Undertake further development of the data basis for sea transport and establish specific standard emissions factors.

Recommendation for calculating PCFs in the transition period to 2011:

- The same procedure as for the standardization process is recommended.
- Use of emissions factors for different aircraft from existing databases such as EMEP-Corinair or ICAO.

3.4.3 Cold chain

The cold chain consists of cold stores at the manufacturer's premises, commercial transport of frozen goods (e.g. by ship or lorry), commercial storage and storage in private households. While processes associated with storage at manufacturers' premises and in the retail trade are relatively easy to describe and measure, the situation in the transport chain (refrigerated ships and containers, outgassing of insulation etc.) and in private households is much less clear.

Recommendation for the standardization period to 2011:

- In the case of chilling of multiple products, allocation on the basis of weight for the chilling down of products and on the basis of volume for maintaining refrigeration.

Recommendation for further scientific development:

- Analysing the situation with regard to chilled products in private households.
- Research into the environmental behaviour of refrigerated ships and containers; development of emissions factors.

Recommendation for calculating PCFs in the transition period to 2011:

- As for the standardization process, and calculation of different scenarios for chilled products in private households.

3.4.4 Consumers' shopping journeys

The PAS 2050 recommends excluding consumers' shopping journeys (PAS 2050: 2008, p. 16). The majority of life cycle assessments carried out to date likewise exclude such journeys. Various justifications for this are put forward: the shopping trip may be combined with other journey objectives (e.g. travel to work, to a children's nursery or to a leisure activity), a number of products may be purchased simultaneously (with corresponding allocation problems), and there may be considerable fluctuations in consumers' behaviour.

Nevertheless, shopping journeys account for a large proportion of private motor vehicle journeys (approx. 17% in Germany) and can affect a product's overall assessment. There are significant variations in the journey to the place of purchase depending on the type of products being purchased, marketing strategies and settlement structures. According to an Austrian study the distance travelled for perishable foods is 2-4 km, for other foods 4-6 km and for consumer goods 6-9 km. Moreover, Internet sales are increasing considerably, pushing up mail order sales (presenting a requirement for fair comparisons with private shopping journeys). Other services are also growing fast in ways that may obviate the need for some shopping journeys – e.g. to book travels – or trigger additional ones – e.g. to take articles to a launderette or for dry cleaning.

Consumers' shopping journeys should therefore be included in an assessment, but should also be reported separately. It is not necessary to include the purchasing journey in the assessment of intermediate products ("cradle to gate").

Recommendation for the standardization period to 2011:

- Specify that consumers' shopping journeys should normally be included, with two scenarios being reported – one with the purchasing journey and one without (or with the purchasing journey reported separately).
- Specification of assumptions about the purchasing journey in the product category rules.

Recommendation for further scientific development:

- Default values for shopping journeys should be developed, taking account of the influence of different product groups and trade structures, different regions and average cars.
- Testing of allocation procedures, including value or volume as well as weight.

Recommendation for calculating PCFs in the transition period to 2011:

- The same procedure as for the standardization process is recommended.
- Allocation on the basis of the proportion of the products in a typical purchase, which is assumed to weigh on average 20 kg.

3.4.5 Use phase

The use phase is part of the total system; it can have a significant impact on the overall assessment and should therefore always be included. This is a requirement of both ISO 14040 and PAS 2050 and should be retained.

However, inclusion of the use phase (particularly if it is significant) can blur opportunities for action in other phases or make them appear inconsequential. Furthermore, there are often huge differences between households in the extent and type of use, so that the use of scenarios is appropriate. For many products the environmental impacts of the use phase are predetermined by the product's characteristics (e.g. energy-using equipment); for other products (e.g. paper, carrots) this is not the case.

In contrast to energy-consuming products, products that have indirect impacts on other products in the use phase represent a special case. For example, insulating materials affect buildings' energy requirements. According to PAS 2050 these indirect impacts on other products should not be included (PAS 2050: 2008, p. 15). This recommendation of PAS 2050 is too short-sighted, because it prevents appropriate assessment of products that indirectly trigger environmental benefits. The allocation of the positive impacts in such cases is a critical value (e.g. insulating materials, clinker, plaster, windows etc.). Allocation assumptions should be arrived at in a manner that is transparent and open to replication, and different scenarios should be described.

Recommendation for the standardization period to 2011:

- Make reference to existing product category rules.
- Report on the use phase separately from the main scenario.
- Draw up scenarios for different use behaviour/assumptions.
- Specify that it needs to be made clear who causes what environmental impacts in which cases and whether the environmental impacts can be influenced by the product characteristics.
- Measure indirect impacts on other products and report them separately; identify and describe assumptions.
- Specify that communication should adopt a restrained tone: ("With the product customers can reduce … XX CO2eq in the use phase").

Recommendation for further scientific development:

- Compile a list of priorities for drawing up further product category rules.
- Draw up further product category rules.

Recommendation for calculating PCFs in the transition period to 2011:

- The same procedure as for the standardization process is recommended.

3.5 Allocation

ISO 14044 proposes avoiding allocations wherever possible (by extending the product system). For cases in which this is not possible it provides a hierarchy of possible allocation techniques, giving physically based allocation precedence over economic allocation. The PAS 2050 proposes that in these cases economic allocation should have precedence (a stance that is clearly influenced by the focus on product carbon footprinting of foods).

In the Memorandum it is proposed that the allocation rules should wherever possible be specifically defined for product groups and processes; until the necessary rules are in place, precedence should be given to physical allocation, as recommended in ISO 14040 ff. The reason for this is that for many product groups and processes the type of allocation is almost forced upon the practitioner (e.g. allocation on an energy basis for refinery products and on an economic basis for platinum group metals).

Recommendation for the standardization period to 2011:

- Allocation rules and expansions of the system should wherever possible be defined specifically for product groups and processes (preferably in the product category rules). Where such rules are not contained in the product category rules, the hierarchy laid down in ISO 14040 ff. should be retained. The recommendations of the PAS 2050 for emissions from waste and transport should be followed.
- For CHP (combined heat and power) the PAS 2050 (PAS 2050: 2008, p. 23) proposes two values[12]. In the Memorandum it is instead proposed that only one value should be adopted (2.5:1), because it is difficult to differentiate in practice between boilers and turbines, particularly where multiple systems and combined-cycle processes are involved. In addition, there are also other relevant CHP systems (e.g. gas and diesel engines, ORC processes and in future fuel cells).

Recommendation for further scientific development:

- Allocation rules for the most important product groups and process should be drawn up as quickly as possible.

Recommendation for calculating PCFs in the transition period to 2011:

- The same procedure as for the standardization process is recommended.
- Carry out a sensitivity analysis if another type of allocation might also be feasible.

[12] CHP emissions: a) for boiler-based CHP systems (e.g. coal, wood, solid fuel) – emissions per MJ electricity:emissions per MJ heat in the ratio of 2.5:1; b) for turbine-based CHP systems (e.g. natural gas, landfill gas) – emissions per MJ electricity:emissions per MJ heat in the ratio of 2.0:1.

3.6 Critical review

Where the results of an LCA are intended to be disclosed to the public, ISO 14044 requires a critical review to be conducted. The PAS 2050 provides for an alternative in the form of self-verification (PAS 2050: 2008, p. 25). Self-verification should not be adopted in international standardization.

For product comparisons and issues of wider significance (e.g. product policy) a critical review by a panel of interested parties in accordance with ISO 14044 should be conducted.

Recommendation for the standardization period to 2011:

- No adoption of the self-verification option for critical reviews.
- Retain critical review by independent external experts; for product comparisons and issues of wider significance (e.g. product policy) a critical review by a panel of interested parties should be conducted.

Recommendation for further scientific development:

- Draw up a proposal detailing how the findings and critical reviews of multiple LCAs or PCFs of products of the same product group can be evaluated.

Recommendation for calculating PCFs in the transition period to 2011:

- As described for the standardization process.

3.7 Documentation and reporting

Section 2.2 of the Memorandum notes that binding international standards (ISO 14067.1) and harmonized guidelines (GHG Product Protocol) will not be available before the end of 2010 at the earliest, more probably by the first half of 2011. Until then there will be no methodological conventions that are internationally recognized as binding other than the life cycle assessment standard ISO 14040 ff. It is therefore inevitable that the methodology of product carbon footprinting and the numerous case studies that can be expected will not be uniform.

This will limit the usefulness of the product carbon footprint, particularly in communicating the results and in comparing product groups or even individual products. This also poses a major challenge for attempts to incorporate the PCF, as an indicator of the environmental performance of products, into the canon of environmental policy instruments (such as private and public purchasing standards, declaration and labelling) in the near future.

In order to monitor the usefulness of PCF calculations for the various applications mentioned, it is essential that – in addition to the critical review described above – there is also transparent, publicly accessible and informative documentation of the PCF.

Recommendation for the standardization period to 2011:

With or without internationally binding standards on PFC and harmonized international guidelines, documentation will play an important part in evaluation of the validity and usefulness of PCF case studies.

It is therefore recommended that the standardization process should include concrete requirements for the documentation and reporting of case studies.

These requirements should build upon the recommendations of this Memorandum on documentation in the transition period before completion of the anticipated standards.

Recommendation for calculating PCFs in the transition period to 2011:

As described above, adequate documentation will be an important aspect of the validity and usefulness of PCF case studies, especially in the transition period leading up to internationally binding standardization and harmonization of the guidelines. Transparent, publicly accessible and informative documentation is therefore recommended, particularly for this period.

The documentation should commence with a description of the organization of the PCF study and the course that was followed. A key component is documentation of the goal and scope of the study, which should include the following elements:

- definition of the goals of the study
- definition of the functional unit
- description of the system boundaries
- description of the data sources and data quality (see above)
- description of the selection of allocation criteria

Documentation of the LCA and the calculations involved should include a description of the individual life cycle phases and the calculations associated with them. The recommendations of the Memorandum should be followed, particularly with regard to the clear definition of the use profiles and possible scenarios. This is especially important for the use phase of the products concerned. In addition, the documentation – in line with LCA – should cover sensitivity analyses, uncertainty studies and an estimate of error. The documentation should also explicitly clarify whether other environmental categories have been investigated as part of the LCA, and if so in what detail.

3.8 Current limits to the product carbon footprint methodology

The goals described in Section 2.1 cannot at present be pursued with the necessary level of precision. The reasons for this are the state of development of the methodology, insufficient international agreement and harmonization and – most importantly – the inadequate availability of and access to necessary data. This affects in particular the two goals:

- product comparisons of multiple products carried out on behalf of different clients and by different practitioners,
- public comparison with competing products in ways that are acceptable under competition law (e.g. through reporting of CO2eq values or use of CO2eq labels)

For methodological reasons alone it is therefore at present not possible to use CO_2eq labels for the purpose of comparing competing products. Once the recommendations of the Memorandum have been implemented and international standardization procedures are in place this will theoretically be possible, but in many case it will continue to founder on the lack of sufficient data or the excessive costs involved.

As a separate issue one must ask whether and in what form CO_2eq labels can play a major part in the attainment of product-related climate change mitigation goals and the provision of information to consumers – this will be discussed in the following chapter.

4 Communication of the product carbon footprint

4.1 Diversity of labels and marks

CO_2eq marking and labelling initiatives have in their early stages paid scant regard to other existing labels and experiences with them. There are now around 400 different labels and marks. Most consumers find this too much to take in and make little use of the information to purchase labelled products. The range of CO_2eq marks and labels therefore adds to an already over-saturated information environment. Within the labels and marks there are a few lead labels and correspondingly marked products that are both more familiar and more frequently purchased. These include the German Blue Angel (Blauer Engel) eco-label (and other national eco-labels in other countries), the German Biosiegel (organic food label), energy efficiency labelling, the Energy Star and the Fair Trade Label. One must examine how possible CO_2eq labels relate to these lead labels.

Some typical CO_2 labelling and marking initiatives are described below. Their importance for different product groups is then described.

4.2 Examples of CO_2 labels and climate-related product labelling

The number of international initiatives on CO_2 labelling and climate-related product labelling increased sharply in 2008. In the context of this Memorandum it is not possible to mention all these initiatives and explain them in detail; the most important basic types of labels and marks will therefore be summarized.

CO_2eq labels and carbon reduction labels

The most common types of label in current use – but also the most controversial – are CO_2eq labels (also called carbon labels) and carbon reduction labels. The best known of these is probably the Carbon Trust's carbon reduction label. The label displays the exact value of the product carbon footprint, but does not necessarily have to cover all the stages of the product's life cycle[13]. Moreover, it is a condition of the label that it is only awarded to companies who have pledged to reduce the PCF over two years. The label also includes explanatory comments, such as product comparisons or information for the customer on how the PCF of the use phase can be reduced.

This label is displayed on the product packaging (as for example at Tesco), in shops (at the point of sale) or on the Internet, for example on company websites. The label is voluntary and is monitored by the Carbon Trust and accredited service providers.

The carbon reduction label provides the model for a range of comparable international schemes – for example in South Korea and Japan, where similar labels have been introduced.

CO_2eq seals

There are also schemes that use the product carbon footprint as a basis for awarding a label or seal to the best products in a product group (e.g. detergents). One of the most high-profile schemes is the pilot project involving the "approved by climatop" CO_2eq seal, which is used by the Swiss retail chain Migros. The seal is awarded to those products in a product group that are shown by the PCF to perform at least twenty percent better than a comparable average product. The process takes account of the product's entire life cycle including use and disposal. However, Migros only uses this label for its own brands. The calculations on which labelling is based are carried out by an external research partner (*climatop*). Those involved in the system see the greatest challenges in the food sector.

Climate neutral labels

In addition to the types of label referred to above that are based on the PCF, there is an ever-increasing number of schemes that label products as climate neutral. Such schemes involve calculating the PCF of various products and offsetting their emissions through investment in climate change mitigation projects. Approaches vary widely. There are important differences with regard to the questions:

- Which greenhouse gases are taken into account?
- Are all phases of the product's life cycle covered or only certain parts of it?

[13] For example, the product carbon footprint quoted on the carbon reduction labels of T-shirts produced by Continental Clothing cover only the acquisition of the raw materials, production and transport to the United Kingdom. The use phase and final disposal of the product are not included.

- Are there requirements for the reduction of the PCF before offsetting takes place?
- What (quality) requirements are attached to the offsetting projects?

A well-known example in Germany is the "*Stop Climate Change*" label. This covers GHG emissions throughout the production process, including transport to the point of sale (use and disposal are not included); ways of reducing GHG emissions are considered and the remaining emissions are offset through climate change mitigation projects that meet transparent standards. The GHG figures are calculated by AGRA-TEG GmbH, which is in turn monitored by an independent certification body (Gesellschaft für Ressourcenschutz mbH) active in the environmental field. The seal has so far been applied mainly to organic food products.

Environmental labels with a climate focus

Alongside these product labels, which are based mainly on GHG assessments, there are also specific variations of the "classic" environmental label, in some cases with an emphasis on climate change mitigation. Criteria for awarding these labels are being developed for a range of product groups; they reflect the climate-related impacts of the products in question. The PCF is not necessarily the criterion used; for example, in the case of energy-using products energy consumption may be a more useful yardstick. Other environmental categories are also taken into account in the form of minimum criteria before the eco-label is awarded. Approximately the best 20% of the products on the market in a particular product group are awarded the label, provided that the manufacturer applies for this voluntary label. The criteria are updated with increasing regularity; the process is thus a dynamic one and takes the form of a "top runner" scheme.

The best known and also the most recent example of an environmental label of this type is the German eco-label (Blauer Engel). This label will in future be awarded in four different clusters: "Protects the climate", "Conserves resources", "Protects water" and "Protects health". The cluster to which a product belongs will be indicated by an addition to the Blauer Engel logo. Irrespective of these clusters, the Blauer Engel continues to cover all the relevant environmental and health-related characteristics of goods and services. It takes account of the fact that consumers are also concerned about other aspects of health and the environment, such as protection against pollutants, noise or excessive use of water. A further advantage of the eco-label is that the criteria are derived from LCA; they are discussed by a panel of experts and finally decided by a panel of stakeholders.

The awarding criteria for the hundred most important climate-related product groups in the climate protection cluster are being drawn up in an ongoing project that will run until 2011. Panels of experts have already reviewed the first nine product groups, consisting of netbooks, DVD recorders/Blu-ray disc recorders, fridges and freezers, laundry dryers, washing machines, gas hobs, espresso machines, electric kettles and automatic master/slave power strips.

In addition to the eco-label there are other ongoing product-related climate change mitigation schemes, such as the EuP process and the planned revision of the EU energy efficiency labelling scheme. The changes in the EU energy efficiency labelling scheme over the coming years may cause some confusion among consumers who have purchasing decisions to make; by contrast, the long-established Blauer Engel environmental label will provide a reliable guide for consumers.

Similar schemes are currently being discussed for the European eco-label (Euro Flower) and in China.

The vast majority of schemes in connection with the product labels described above operate on a voluntary basis. In some cases, however – for example in France – mandatory forms of labelling are being considered. The *grenelle environnement*, as the government initiative is called, includes plans that would require consumers to be informed – via a label or other suitable process – of the greenhouse gas emissions and other environmental impacts of a product and of the resources consumed over the product's life cycle. The scheme would come into operation in January 2011.

The scheme has not yet been adopted by the French parliament. In addition, it has not yet been specified which environmental properties of a product would be covered by the labelling and what form the labelling would take. To clarify these issues, a platform has been set up under the leadership of ADEME (the French energy agency) with the support of the French standardization organization Afnor and the involvement of all relevant stakeholders (scientific experts, retailers, NGOs, producers). Different working groups are working on different product categories. Twelve such groups are discussing the environmental categories to be considered, appropriate assessment methods and possible communication forms on a product-specific basis. On the basis of the results, and presumably before the end of 2009, the further procedure will be decided.

In addition to the types of product label mentioned above, there is a confusingly large array of schemes operated by individual companies to draw attention to particularly climate-friendly products in their portfolio, in some cases separate from labels of the types described above.

It is likely that additional schemes will be launched in forthcoming years. In this situation there is a risk that consumers, instead of finding the labels helpful, will become confused by the variety of different information provided and may as a result make inappropriate decisions.

To prevent this happening, considerably more information is needed about the climate and environmental impact of products in answer to the following questions:

- In the light of the methodological state of knowledge, what credible and robust statements about the climate relevance of products can be made?

- In what form can this information be communicated best to consumers so that it conveys a reliable message about the implications for climate protection while also serving as a basis for action?

Consideration of these questions results in key criteria for the communication of the climate relevance of products and their use.

4.3 Criteria for communication in product-related climate protection

The necessary information can be communicated in various ways. In addition to labels, campaigns enable sustainability information to be communicated in a participatory way and targeted at a particular area of need. Examples of successful campaigns include the German consumer information campaign “Echt Gerecht. Clever kaufen” and internet platforms designed to motivate and provide information such as “lifeguide München”, EcoTopTen and “Utopia – Internetportal für strategischen Konsum”.

All communication measures should meet the following criteria:

- as comprehensive as possible
- clear setting of priorities
- usable in everyday situations (not 400 different labels)
- fair comparison of products
- good documentation

4.3.1 Systematic analysis for different product groups

As has already been explained, product carbon footprinting activities and communication measures currently concentrate on foods rather than on energy-consuming products (e.g. boilers, cars, electrical appliances), which are more important in climate terms. This is surprising, not least because if other environmental categories are to be ignored, this can most readily be justified for energy-consuming products but is far less appropriate for food. It is interesting that comparatively little is reported in the media about the existing labelling requirements for electricity and cars, while food labelling proposals are covered in great detail.

It is as yet unclear how CO_2eq labels should relate to other labels or labelling requirements such as the EU energy efficiency label.

The usefulness of CO_2eq labels for various product groups is discussed below.

4.3.2 PCF for particularly climate-relevant products

A small number of products account for a particularly high proportion of per-capita GHG emissions. These products are boilers (using fuels such as oil or gas), cars, flights and electricity (and electricity-consuming appliances). In Germany this **small number** of products

and purchasing decisions accounts for approximately 5–6 tonnes CO_2eq per person per year; by contrast, the GHG emissions of food (totalling around 1.5–2 tonnes CO_2eq per person per year) arise from the purchase of thousands of different food items bought in a hundred or more purchases per year.

There are already climate-related labelling requirements for electricity and cars (CO_2/km for cars[14] and type of electricity production for electricity); systems for other products could be put in place fairly simply[15] (good statistics, easy to calculate, to be shown on the invoice). At present, however, there is little demand from consumers for the data that is available. The situation is similar to that which applies to electricity costs: when asked about the approximate level of their electricity consumption or the amount they spend on electricity, the majority of consumers are unable to give accurate answers.

4.3.3 PCF of electrical appliances with high energy requirements

4.3.3.1 Energy efficiency labelling

Selected electrical appliances must be labelled with their energy efficiency. Originally this applied mainly to large household appliances; as implementation of the European EuP Directive progresses this labelling requirement is being extended to other large appliances such as computers, and further down the line smaller appliances (such as vacuum cleaners and espresso machines) will also be covered. Appliances are classified according to their energy efficiency and compared with a defined standard appliance, with size and functionality being taken into account. Under the EuP Directive, LCAs have been and are being drawn up, based on an average *European* use pattern. For the majority of energy-consuming appliances (besides electronic devices) it has become apparent that manufacture and disposal of the appliance together account for only a small proportion (of the order of 10%) of total energy requirements, while the use phase accounts for a far larger share of around 90%). PCFs yield similar results. GHG emissions associated with the manufacture of complex devices have in the main been calculated fairly roughly for guideline purposes, because the significance of the manufacturing process is relatively small and data collection would be very difficult. From the point of view of consumers, however, necessary distinctions are often not made; in the case of washing machines, for examples, consumers need information on electricity consumption at different temperatures and for loads of different sizes.

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[14] However, only CO_2 emissions without upstream emissions are quoted. This underestimates the PCF by about 15%.

[15] Other than for the production of cars – which is, however, less relevant than petrol consumption.

The PCF of large electrical appliances varies between 100 and several hundred kg CO_2eq per year; over the life of the appliance it is usually above 1,000 kg CO_2eq.

Although these products thus have a large PCF, there are currently no major schemes for measuring the PCF and displaying it on the appliance or for providing appliances with a CO_2eq label.

It would be costly and time-consuming to calculate the PCF of electrical appliances if the aim was to measure exactly the emissions associated with the manufacture of many hundreds of different devices. If average values were used for the manufacture of products in different categories and otherwise only electricity consumption were assessed, the PCF would be comparatively easy to calculate.

It must, however, be assumed that quoting the PCF without a comparison scale is of little information value for consumers. Is a refrigerator with a PCF of 3,000 kg (for a life span of 15 years) a good or a bad refrigerator? One would need to provide a comparison scale for each type of electrical appliance, but this would then be very similar to the existing energy efficiency system. Quoting a numerical figure for the PCF or providing a CO_2eq label would therefore serve little purpose; it might, however, make sense to quote additional information relating to average electricity consumption and the electricity consumption associated with the use of the appliance's different programmes – and to quote the average PCF for electricity.

4.3.3.2 Eco-labels

In addition to energy efficiency labels a number of electrical appliances also bear national environmental labels (such as the German Blauer Engel) or the European environmental label (the Euro Flower). Eco-labels usually impose strict criteria for energy consumption as well as criteria for other environmental factors (e.g. noise, water consumption, materials used, pollutants, radiation etc.). Eco-labels such as the Blauer Engel involve a comprehensive and integrated environmental assessment (not just assessment of the PCF) and are thus more informative and of higher quality than the energy efficiency label. The PCF itself is not currently shown on eco-labels, but adding it to the eco-label – as described above for the energy efficiency label – would present no difficulties.

Recommendation: For electrical appliances with high energy requirements, relevant electricity consumption figures or power values should be added to the energy efficiency label. In addition, such electrical appliances should be included in the eco-labelling system.

4.3.4 PCF of electrical appliances with low energy requirements

The position here is similar to that for of electrical appliances with high energy requirements – with the important difference that the manufacturing phase may represent a larger share and that the significance of other environmental aspects is likely to be greater. There is thus an even greater need for an integrated environmental assessment or eco-label.

In addition to the absolute energy consumption, the savings potential can also be very important. For example, a study of espresso machines has shown that the savings potential – i.e. the difference between the best machines and average ones – is around 100 kWh per year; this is roughly the same as the difference between refrigerators of Class A^{++} and Class A.

4.3.5 PCF of energy-saving products

In their use phase products such as insulating materials, power strips and 20° detergents can produce considerable saving effects and reduce the PCF of *other* products. The PCF of the energy-saving products themselves is by comparison usually small and less significant. To inventory the indirect saving is methodologically complex and it is not easy to associate the saving with the energy-saving product (which is why the PAS 2050 excludes this type of analysis).

Quoting the PCF of energy-saving products without quoting the PCF saving effect would be meaningless. Similar considerations apply to a possible CO_2eq label.

Energy-saving products are, however, often already marked with an eco-label. The eco-label takes into account both the GHG potential of the product itself and the saving effect, but also covers other environmental criteria such as hazardous substances (e.g. insulating materials!).

4.3.6 PCF of technical products with no energy requirement in the use phase

For these products a number of environmental aspects and not energy consumption alone play an important part in manufacture. This argues for an integrated environmental assessment or eco-label and against standalone CO_2eq labels.

In view of the large number of such products, a relevance analysis should first be carried out.

4.3.7 PCF of foods

4.3.7.1 Data needed for calculating the PCF of foods

In Germany food accounts for around 1.5–2.0 tonnes CO_2eq per person per year, or around 20% of per-capita emissions. Varying figures are quoted depending on the boundaries used (with or without drinks, with or without consumption outside the home, with or without packaging, with or without chilling and cooking). This overall value is high but it is distributed over thousands of different foods and hundreds of purchases. The PCF of individual foods ranges from a few dozen grams to several kilos CO_2eq. An example of a very high value is beef, which has a PCF of around 13 kg CO_2eq per kilo of meat.

Calculating the PCF of foods is usually complex; it is particularly costly and labour-intensive if specific rather than generic data is required, as in the original idea behind the Tesco initiative.

The reasons for the complex data situation are:

- a very large number of farms, of diverse sizes
- frequent changes of supplier
- major differences in cultivation methods
- annually and seasonally fluctuating yields
- a large number of different processing techniques and processing businesses
- a range varying from relatively simple products such as apples and bananas to more complex convenience products
- highly variable transport routes – from regional to global, from tractor to aeroplane
- extensive and time-related influence of storage and chilling
- a large number of different package sizes and types
- different methods of preparation and major differences between convenience products and products freshly prepared at home by the consumer.

For these reasons there may be considerable fluctuations in the PCF values of foods and it may be possible to identify significant reduction potentials. It therefore makes sense to calculate the PCF of foods and to identify and realize optimization potentials in cultivation, processing, transport and storage. By contrast, it is far more difficult for retailers to continuously quote the PCF of thousands of different foods in ways that are compatible with competition law, or for them to provide consumers with appropriate standards for comparison.

The difficulty of calculating the specific PCF of foods and awarding CO_2eq labels to foods can be illustrated by reference to a relatively “simple” product, apples:

The amount of energy involved in producing and storing apples varies from farm to farm; the difference between large and small farms sometimes corresponds to a factor of two or three. Transport distances also vary widely: German apples produced on the shores of Lake Constance may be sold locally or as far away as Kassel and Berlin. Apples may also be imported from New Zealand or Chile. Apples produced in Germany are stored until late spring, so chilling is required; the PCF thus rises from month to month.

To give even an approximate indication of the PCF of apples at the point of sale, information would have to be available on the production values of the farm on which they were grown, the means of transport and distance covered, and the duration and type of chilling. The figures would have to be calculated separately for each variety of apples sold. While that it is in principle possible, it is extremely laborious and it would, moreover, have to be carried out not just for apples but for thousands of other products as well.

Furthermore, to enable consumers to interpret the specific PCF quoted, ranking systems would have to be developed – as for electrical appliances – for comparable products, e.g. for apples of climate classes A, B, C etc. (if one really wanted to put all apples together in a class).

In view of these difficulties it will not be possible in the foreseeable or even more distant future to devise a system that will enable thousands of different foods in shops to be regularly marked or labelled with their current CO_2eq value in a way that meets the requirements of competition law, or to develop corresponding ranking systems.

4.3.7.2 Organic labels

In addition, in the case of food other environmental aspects are also important: such aspects include land take, conservation of soil fertility, water consumption, pesticide use, harmful ingredients, and additives. It was for just this reason that organic labelling was developed. By contrast, quoting the PCF on its own does not provide consumers with sufficient information. It would, though, be possible to add the criterion of GHG potential to the organic label. However, for the reasons stated above this is likely to pose a major challenge.

4.3.7.3 Consumer information on environmental and climate relevance

Incomplete and unsystematic publication of CO_2eq values without standards of comparison and without reference to the other environmental aspects of food does NOT contribute to consumer guidance but serves only to confuse the public.

Instead, LCAs covering all relevant environmental aspects (average values and ranges) should be carried out for the products groups that are most important from a climate perspective. If the resulting data is sufficiently robust, it could be used to identify basic statements and options for action for communication to consumers and to answer typical questions such as:

- Is the LCA and climate relevance better for regional apples or for imported ones? Are organic apples from abroad better than conventional regional apples? Are there regional organic apples that are not chilled? What are the best apples from an environmental point of view? Is it true that small pressing systems usually use far more energy than large ones to produce and sterilize apple juice?
- From environmental, health and climate perspectives, does it make sense to eat less meat? If one eats meat, is it better for the climate to eat chicken? From a climate perspective, is organic meat better than conventionally produced meat?
- Is industrially produced frozen food worse from a climate perspective than food freshly prepared at home? Or are there significant differences in this area depending on the type of food and the length of time for which it is frozen in the home?

- From the point of view of climate and the environment, how do different nutrition styles compare? Is it true that from a climate perspective a higher share of milk products makes up for a lower share of meat products?

The quality of consumer information on nutrition would rise significantly if these questions could be answered on the basis of LCAs (checked by critical reviews).

Here too, though, a considerable amount of work is required; the product groups to be assessed should therefore be prioritized before work commences. In considering the use of additional information, not only aspects of technical feasibility but also matters relating to the capacity of consumers themselves to take in and process information are important. Consumers use different information channels and different opportunities to inform themselves, depending on the level of cognitive involvement (for example, whether the purchase is a matter of everyday routine, as with food, or a special investment, as with household appliances) and must therefore be addressed in different ways to reflect these differences.

4.4 Lead labels: Eco-labels in accordance with ISO 14024 (Type 1)

The above considerations clearly support retention of eco-labels in accordance with ISO 14024 (Type 1), such as the Blauer Engel eco-label, as lead labels. The advantages of eco-labels over CO_2 labels are summarized again below (the arguments apply both to the Blauer Engel and by analogy to other national eco-labels and the European eco-label):

- easily understood and reliable information for consumers: *from an overall environmental perspective an eco-labelled product is clearly better than comparable products*;
- inclusion of all relevant environmental and health aspects;
- identification of criteria on the basis of LCAs and eco-toxicological assessments;
- subsequent discussion by a panel of experts;
- final decision by an “environmental jury” on which relevant stakeholder groups are represented;
- certified award process and checking of the criteria for products marked with the eco-label.

5 Recommendations for further action

The following activities should take place over the next few years:

- prompt conclusion of international standardization (as planned);
- consideration of the methodological recommendations of the Memorandum during the standardization process (cf. Chapter 3);
- scientific efforts to clarify open methodological points and fill data gaps (cf. Chapter 3);
- conducting of further PCF analyses, taking account of the recommendations of the Memorandum for product carbon footprinting during the transition period (cf. Chapter 3);
- transparent documentation of PCFs, accompanied by conducting of critical reviews;
- special emphasis on reduction from present levels, implementation and monitoring of success;
- drawing up product category rules for particularly relevant products;
- identifying and prioritizing product groups for which the PCF is a good indicator for assessment of climate and environmental relevance;
- work on communication forms other than labels, in order to raise awareness of the climate-relevance of consumption and exploit reduction potentials on the use side.