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BDI
The Voice of German Industry

Product-related climate protection strategies

Understanding and using Product Carbon Footprints

IMPRINT

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FOREWORD BY FEDERAL ENVIRONMENT MINISTER DR. NORBERT RÖTTGEN

Climate change is one of the greatest challenges facing the international community. To tackle it we have set ourselves ambitious mitigation targets that can only be achieved if everyone – manufacturers and consumers alike – plays their part.

Climate-friendly production and consumption patterns are only possible if we actually know the climate performance of a product. For that reason, a number of initiatives have evolved in recent years to assess the carbon performance of products and map their specific carbon footprint. There are, however, a number of very different calculation methods. To date, there is no uniform procedure for establishing and representing a product's carbon footprint. To address this issue, Germany's Federal Environment Ministry (BMU) and Federal Environment Agency (UBA) commissioned the Freiburg-based Öko-Institut (Institute for Applied Ecology) to develop proposals for a robust methodology. The findings were published at the end of 2009 in a Memorandum on Product Carbon Footprints, which has the status of a recommendation. The most important finding was that the Product Carbon Footprint is a useful tool for manufacturers.

Based on this work, the Environment Ministry, Federal Environment Agency and Federation of German Industries (BDI) have now published this guide, primarily aimed at businesses wishing to measure and use Product Carbon Footprints for their products. It is intended to give them practical guidance on how to go about a footprinting exercise. Calculating a Product Carbon Footprint can help businesses to identify and harness potential for reducing emissions. It motivates them to develop their own climate change mitigation strategies and make their products more climate friendly, while at the same time providing consumers with information on their climate impact. Product labels are an important tool for pointing consumers towards environmentally sound consumption patterns. However, it is not about launching a new label for the Product Carbon Footprint, but about revisiting well established labels such as the Blue Angel.

The greatest benefit of Product Carbon Footprints is considered to be their ability to facilitate reductions in greenhouse gas emissions from goods and services throughout the entire production route. However, the benefit of analysing Product Carbon Footprints can only be fully exploited if the audit does not focus one-dimensionally on the greenhouse gas effect, but also includes other environmental and sustainability criteria. In the case of cotton, for example, it would also be important to include water consumption during manufacture or the chemicals used. Appraising a product throughout its entire life cycle is the best way of comprehensively evaluating and reducing its impact on the climate and the environment.

Dr. Norbert Röttgen, Federal Environment Minister

FOREWORD BY THE PRESIDENT OF THE FEDERATION OF GERMAN INDUSTRIES (BDI) PROF. HANS-PETER KEITEL

Climate change is one of the key challenges facing industry and society. The spotlight has turned to the Product Carbon Footprint (PCF) as a tool to address this challenge. A PCF quantifies the greenhouse gas emissions that a product causes throughout its entire life cycle. Numerous initiatives at international and national level have set themselves the goal of developing or harmonising methods or recommendations for calculating and communicating PCFs. The process of product carbon footprinting can help businesses to achieve transparency about their greenhouse gas emissions along their value chain and identify potential for feasible reductions. The greatest benefit of product carbon footprinting is therefore the opportunity to optimise a product's climate impact along its entire life cycle.

However, the information value of PCFs also has its limitations. For example, the experience of numerous manufacturers has shown that PCFs are not a reliable product labelling tool if the aim is to communicate information to consumers. That is primarily to do with methodological difficulties: data ranges, imponderables, assumptions and the changing parameters along the supply chain affect the capacity to assess PCFs and make them into a valuable indicator for consumers.

Furthermore, it describes just one ecological indicator – greenhouse gas emissions – of products. A pure PCF label, particularly one that has a carbon number, therefore tells consumers nothing about a product's overall environmental and climate friendliness.

This guide therefore seeks to help businesses to assess and communicate their PCFs in a way that is of greatest benefit to them.

Professor Hans-Peter Keitel
President of the Federation of German Industries (BDI)

EXECUTIVE SUMMARY

Climate change is one of the central challenges worldwide that our society has to confront in this century. To be able to even curb the risks to humankind and nature posed by global warming, it is vital that the rise in the average global temperature by the end of the century be limited to a maximum of two degrees Celsius above the pre-industrial level. Based on today's level of knowledge, that means that by 2050 we must reduce greenhouse gas emissions in the industrialised countries by at least 80 % of their 1990 level. That in turn needs a fundamental rethink, including with regard to production and consumption of goods and services.[1] Manufacturers and consumers are called upon to play their part in achieving climate-friendly production and consumption patterns.

In line with the rule "You can only manage what you can measure," it is essential that businesses and consumers have reliable information on the greenhouse gas emissions that are associated with their products throughout their entire life cycle. This information is an important basis for minimising the climate impacts associated with the manufacture, use and disposal of products.

The Product Carbon Footprint (PCF) could provide that kind of information:

> "A 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."[2]

This guide, jointly produced by the Federal Ministry of the Environment, Nature Conservation and Nuclear Safety (BMU) and the Federation of German Industries (BDI), therefore has the following aims:

- to give interested businesses support and recommendations in assessing their PCFs;
- to draft requirements for appropriate and successful product-specific communications about climate change mitigation;
- to communicate BMU's and BDI's joint assessment of the value of PCF labels with carbon numbers;
- to identify the limits and problems of PCFs.

The guide is primarily addressed to businesses that are seeking to assess and communicate their Products' Carbon Footprints. It outlines the practicalities and methodology involved in doing that. The recommendations on how to proceed apply both to consumer products and to products traded business to business along the value chain.

1 In this guide, the term "product" is used to describe both goods and services.
2 Definition from the draft standard ISO 14067 "Carbon Footprint of Products."

Numerous initiatives in recent years at international and national level have aimed to develop or harmonise methods and recommendations for calculating and communicating PCFs. In Germany, BMU commissioned the Öko-Institut (Institute for Applied Ecology) to carry out a systematic analysis of the need to develop the assessment methodology and the communication tools to go with it, including product labelling. The experiences accumulated during the PCF Pilot Project Germany[3] are also used. In this project a number of companies in the manufacturing and trade sector tested the applicability of the calculation methods in practice and also acquired initial experience with communicating PCFs. Furthermore, numerous companies in a broad range of sectors also worked on assessing the climate and environmental impacts of their products.

The results of this work and experience gathered form the basis for this guide on Product Carbon Footprints, which has been jointly produced by BMU and BDI.

In recent decades, a whole series of methods and analysis tools have been developed that can be used to analyse and evaluate the environmental soundness or sustainability of products throughout their entire life cycle: life cycle assessments, eco-efficiency analyses, product-based social life cycle assessments and product sustainability analyses. These methods can be used even now to depict the climate performance of products throughout their entire life cycle, for example. The great advantage of these integrated methods is that they make it possible to achieve optimisation of products beyond the constraints of individual environmental or sustainability categories and thus also beyond the conflicts of interest between those individual categories.

By contrast, limiting a study solely to the greenhouse effect impact category is inadequate, especially if the aim is to achieve overall optimisation of products and can, in individual cases, even be counter-productive. For example, it might lead to preference being given to products with a good PCF even though their overall environmental or sustainability performance may be poor. To avoid wrong choices of that kind it is crucial that a comprehensive analysis and assessment of a product throughout its entire life cycle be performed.

However, a more precise look at the greenhouse effect impact category using the Product Carbon Footprint has shown that additional findings about the methodology used to analyse climate relevance need to be taken into consideration. For example: how should changes in land use required to cultivate biogenic resources be accounted for when carrying out a product-specific greenhouse gas assessment? These new methodological insights are relevant to all forms of product-based environmental and sustainability assessments throughout the entire life cycle of products.

3 Detailed information and documentation of the findings of the PCF Pilot Project Germany can be found at www.pcf-projekt.de

For that reason, BMU and BDI recommend in this guide that the following findings about methods of calculating Product Carbon Footprints be used in assessing products. Generally speaking, Product Carbon Footprints are seen as particularly useful when it is a question of identifying opportunities for reducing the greenhouse gas emissions of goods and services along the entire product's life cycle.

In cases where a more comprehensive evaluation, intended to cover all the dimensions of sustainability, is performed, it is essential that all the relevant social and economic criteria be included. This approach is not necessarily more complex. It does, however, provide more certainty when evaluating products and making recommendations about how to optimise them based on those evaluations. If all the relevant environmental and sustainability criteria are taken into consideration, the PCF calculated can provide maximum benefit.

Calculating Product Carbon Footprints can help businesses in:

- creating transparency in the value chain with regard to upstream and downstream processes and the actors involved;
- raising awareness of greenhouse gas emissions along the value chain and identifying phases that give rise to particularly high emissions;
- identifying potential for reducing emissions, starting with the product development phase;
- documenting improvements in the PCF of products from one generation to the next, for example;
- gaining fresh ideas for developing or refining their own climate strategy;
- analysing and evaluating the relevance of the greenhouse gas emissions associated with a product by comparison with other environmental impacts.

A legally binding international standard (ISO 14067) on Product Carbon Footprints and an internationally harmonised guideline that has the status of a standard (Product Accounting & Reporting Standard under the Greenhouse Gas Protocol) are currently being developed. These endeavours to develop an internationally standardised methodology are welcomed. However, conclusive results are not expected before the end of 2011.

This means that people wishing to use the tool in practice are faced with the challenge that until then there is no internationally agreed method of determining a product's carbon footprint. Nevertheless, many businesses will have to engage with the climate relevance of their products during this time. BMU is therefore issuing recommenda-

tions on methodology to be used in conjunction with the ISO 14040 family of life cycle assessment standards,[4] which are also being fed into the international standardisation processes. The Publicly Available Specification 2050 (PAS 2050), which was published in the United Kingdom in 2008 as a recommendation, was regarded as inadequate for assessing PCFs.

Until an international standard for determining PCFs becomes available, transparent documentation of methods and data used is crucial for evaluating the robustness and credibility of results. That is particularly true for businesses wishing to publish their PCFs. In those cases we would recommend additionally publishing a critical review in line with the requirements for conducting a life cycle assessment.

The use of the Product Carbon Footprint as a basis for product labelling – especially the use of labels with a carbon number – is the subject of highly controversial international debate. A number of countries, such as the United Kingdom, Japan, South Korea and Thailand, have already tested labels of this kind on a voluntary basis or have launched them on a trial basis. The possibility of making it mandatory for products to have PCF labels with a carbon number is also under discussion.

Although the idea of using labels to display CO_2 values on products may initially seem to be an attractive and desirable way of giving consumers information about products, past findings and experience have led BMU and BDI to conclude that simply indicating a PCF as a numerical value – i.e. PCF labels with a carbon number – is not an appropriate or reliable tool for effective consumer communication.

The reasons for this conclusion are:

- the methodological challenges have not yet been fully resolved;
- the variances in the supply chain in terms of assumptions used, data and findings that are typically found in life cycle studies;
- the data ranges along the entire value chain, as a result, for example, of changing suppliers; and
- the lack of a mandatory methodological standard for determining Product Carbon Footprints.

4 Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), Federal Environment Agency (UBA), Öko-Institut (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, www.bmu.de.

For these reasons, it is not likely in the foreseeable future that it will be possible to implement a system of PCF labels on products specifying a numerical value that would allow the CO_2 emissions of products to be compared and that would be compatible with competition law. This is particularly true of food products, which are currently the main focus of the CO_2 labelling discussion, but it also applies to other non-durable consumer goods.

In practice, PCF labels with carbon numbers do not mean much to consumers because:

- they have no benchmark to compare them with;
- the values per se do not indicate any practical recommendations about how best to use the products from the point of view of climate change;
- they do not take the significance of other environmental aspects into account; and
- there is growing confusion as a result of the huge number of environmental labels.

European consumer associations therefore also reject PCF labels with carbon numbers.[5]

Once studies show that PCFs are a meaningful indication of the environmental soundness of a product group, it would therefore be a better option to integrate them into recognised environmental labels (Type 1 as specified in ISO 14024). Instead of introducing new PCF labels with carbon numbers that are limited in what they actually communicate about a product, a more consumer-friendly communication tool using existing labels – such as the Blue Angel – should be used. A project is currently running to develop by 2011 criteria for issuing the Blue Angel environmental label to the 100 product groups that are most significant from a climate perspective.

Beyond product labelling, Product Carbon Footprints are seen as having the potential to provide a sound basis for effectively communicating information about products both to business partners and consumers. Particularly if they include and evaluate other sustainability criteria for products, PCFs can be used to communicate messages that could influence consumer behaviour and make a significant contribution to encouraging climate-friendly consumption patterns. An example of this are the recommendations about sustainable laundry habits, which were developed jointly by manufacturers, consumer organisations, environmental organisations and the Federal Environment Agency, and have been communicated effectively.[6]

BMU and BDI therefore recommend working on credible communication options that go beyond product labelling, raise awareness about how consumption choices impact on the climate and therefore help to harness the reduction potential inherent in how

5 ANEC, BEUC, ECOS, EEB: Joint Position – Sizing up product carbon footprinting, Brussels 2009.
6 Further information on the initiative to promote sustainable ways of washing laundry and dishwashing can be found at www.forum-waschen.de.

products are used. They urge businesses to join initiatives in which relevant environmental and consumer protection experts are involved in a constructive dialogue as early as possible with a view to increasing the acceptance, credibility and effectiveness of any measures developed.

INTRODUCTION

Background

In recent years, numerous private and public sector initiatives to measure and communicate Product Carbon Footprints have developed in the field of product-based climate assessments (as a result of the PCF Project Germany, for example). This clearly shows that, firstly, there is a great need to develop mandatory internationally harmonised standards and guidelines setting out the methods to be used for measuring Product Carbon Footprints and that, secondly, opinions differ greatly about appropriate communication especially with regard to the value of PCF labels with carbon numbers.

In the United Kingdom, BSI British Standards Institution, in collaboration with the Department for Environment, Food and Rural Affairs (Defra) and the Carbon Trust, developed the Publicly Available Specification 2050 (PAS 2050) "Specification for the assessment of the life cycle greenhouse gas emissions of goods and services" as a recommendation. This was the first comprehensive proposal on methodology for determining Product Carbon Footprints in the international debate. Although PAS 2050 in its final version of October 2008 is in the main based on the life cycle assessment standard ISO 14040 ff., it does deviate from it in a number of important aspects. Processes to develop international standards have now been instigated by the International Organization for Standardization (ISO), along with harmonised guidelines on Product Carbon Footprints to complement the Greenhouse Gas Protocol. However, results are not expected until the end of 2011.

Activities of numerous businesses to analyse and communicate their PCFs and corresponding measures to reduce them are thus taking place at a time in which international standards have not been fully developed and there is also uncertainty about appropriate communication methods.

The Federal Ministry of the Environment, Nature Conservation and Nuclear Safety (BMU) therefore commissioned the Öko-Institut (Institute for Applied Ecology) - as part of a project on CO_2 labelling of goods and services - to undertake a systematic analysis of CO_2 labelling and the need to further develop methodology.

At the same time, ten companies in Germany joined forces with WWF, the Öko-Institut (Institute for Applied Ecology), the Potsdam Institute for Climate Impact Research (PIK) and Thema 1 as lead research institute to launch the PCF Pilot Project Germany. They tested in practice the suitability of existing approaches to analysing and communicating PCFs and developed recommendations on how to take them forward.

Both projects explored the methodological requirements for Product Carbon Footprints and how to communicate them, both in theory and using example cases, and discussed them with numerous stakeholders and scientists at national and international level.

Based on the experiences gained in these projects and numerous activities in individual companies, BMU and BDI decided to jointly produce this guide "Product-based climate-change mitigation strategies: understanding and using Product Carbon Footprints."

The guide summarises the key considerations for assessing and communicating Product Carbon Footprints in practice. It draws up specific recommendations on how to go about footprinting in practice, which are intended for use at least until mandatory international standards have been developed. It also sets out the key positions on how to communicate PCFs, which are based on experience with assessment methods.

The guide is addressed primarily to:

- product manufacturers, trading companies and service providers;
- policymakers (product-based climate change mitigation, environmental labelling); and
- interested members of the public.

It is also intended to be of value for ongoing standardisation processes.

Aims

The guide's aim is to:

- describe the experiences in using the Product Carbon Footprint tool acquired by different projects, showing common analyses and positions;
- give interested companies - irrespective of their size or sector - practical recommendations for calculating, assessing and communicating a PCF, particularly to bridge the time until internationally harmonised standards have been developed;
- draft requirements for good, successful communication in the field of product-based climate change mitigation;
- communicate a joint appraisal of PCF labels with carbon numbers;
- identify the limitations and problems of PCFs.

THE CHALLENGE OF PRODUCT-RELATED CLIMATE PROTECTION STRATEGIES

Climate change: the central challenge of the 21st century

Global climate change is a reality and therefore one of the central challenges facing society, policymakers, industry and the economy. If the effects of global warming on humankind and nature are to be kept within controllable limits, the rise in the average global temperature by the end of the century must be limited to a maximum of two degrees Celsius above the pre-industrial level. That means – as the Intergovernmental Panel on Climate Change (IPCC) has stressed - that by 2050 worldwide greenhouse gas emissions have to be reduced by more than half their 1990 level. Industrialised countries have a particular obligation here; climate models indicate that they need to reduce their annual greenhouse gas emissions by at least 80 % of 1990 levels. To achieve that, substantial changes to products and consumption patterns are needed, from product development and design, production and marketing, through to use. Analysing the climate impacts of products and consumption is crucial to developing ecologically and economically efficient measures.

The climate impacts of products and consumption

Private consumption in the form of using goods, food and services is responsible for over 40 per cent of Germany's per-capita emissions of greenhouse gases.[7] In 2007, each person in Germany emitted an average of 11 tonnes of CO_2 equivalents (an equivalent corresponds to the sum total of all the greenhouse gases covered by the Kyoto Protocol converted into the quantity of CO_2 that would be needed to have the same effect on the climate). This quantity includes emissions from areas of life such as the home, transport, and food, as well as emissions associated with the production and consumption of all types of goods and services.

Eleven tonnes per year is clearly too much. Climate change mitigation targets up to 2050 require per-capita greenhouse gas emissions to be reduced from 11 to a maximum of two tonnes per year as a global average. This comparison clearly shows that, if they are to achieve climate targets, the industrialised countries, including Germany, will have to significantly reduce their greenhouse gas emissions in all areas of life. Whereas in the past the debate on emissions focused on the energy sector and industry in general, the relevance to climate change of private consumption and the products underlying it has now been recognised and is under discussion.

7 Source: Umweltbundesamt: "Die CO_2-Bilanz des Bürgers," Dessau 2007.

Businesses and consumers: joint responsibility for climate-friendly consumption patterns

It is an undisputed fact that companies and their suppliers are responsible for the value chain and for the design of products. It is similarly undisputed that, through their purchasing and consumption behaviour, consumers have a significant influence on which goods are in demand and will therefore be produced. They also determine how goods and services are used and for how long. Thus, manufacturers and consumers share the responsibility for ensuring that products and their consumption produce lower emissions and become more climate friendly.

Manufacturers of products can reduce emissions throughout the life cycle of goods and services in a wide range of ways:

- during product development by improved energy and resource efficiency, including during the use phase, and by reducing material use or optimising choice of materials during the product design phase;
- during purchasing, by choosing lower emission primary products and cooperating with suppliers along the entire value chain;
- in transportation along the supply chain, by optimising logistics processes and choosing climate-friendly modes of transport;
- during manufacture, by improved resource and energy efficiency processes, for example.

Climate-compatible consumption is only possible if consumers are able to judge and evaluate how climate-compatible products are and then act accordingly. Consumers and businesses developing a better understanding of the climate impact of products and services would open up opportunities for targeting specific emission reductions. Consumers would contribute to reducing emissions by opting to buy goods with a long lifetime and very deliberately asking for environment and climate-friendly appliances and products and by reviewing and changing their daily shopping habits and ways of using products.

In recent years, a number of useful tools for providing consumers with information were created, including, for example, the European Energy Label for large household appliances, the energy performance certificate, or Energiepass, for buildings, and regulations on specifying car emissions. These instruments are based on standardised calculation methods to ensure that reliable comparisons can be made.

By contrast, for food and non-durable consumer goods there are to date scarcely any tested and generally accepted instruments that could be used to provide specific information about climate compatibility. There is a lack of information about the relevance

of private consumption to climate change, about climate-friendly products and how to use them in a way that is climate and environment friendly. That means that companies scarcely have a possibility of credibly selling the climate friendliness of their products to customers. And customers and consumers have no consistent way of identifying or comparing climate-compatible goods and services. It is therefore vital to answer the important question of how the results of the Product Carbon Footprint can be communicated to consumers and corporate customers in a way that is transparent and effective.

THE PRODUCT CARBON FOOTPRINT

Definition of the Product Carbon Footprint

The definition and use of the term "Product Carbon Footprint" still differ internationally. Usage in this guide is based on the following definition, which is becoming increasingly accepted internationally:

> "A 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."[8]

In this context, greenhouse gas emissions are all gases for which the Intergovernmental Panel on Climate Change (IPCC) has defined a global warming potential coefficient (GWP). The life cycle of a product covers the entire value chain: from production and transportation of raw materials and primary products through to manufacture, distribution, use and disposal. The term "product" is used to mean goods and services.

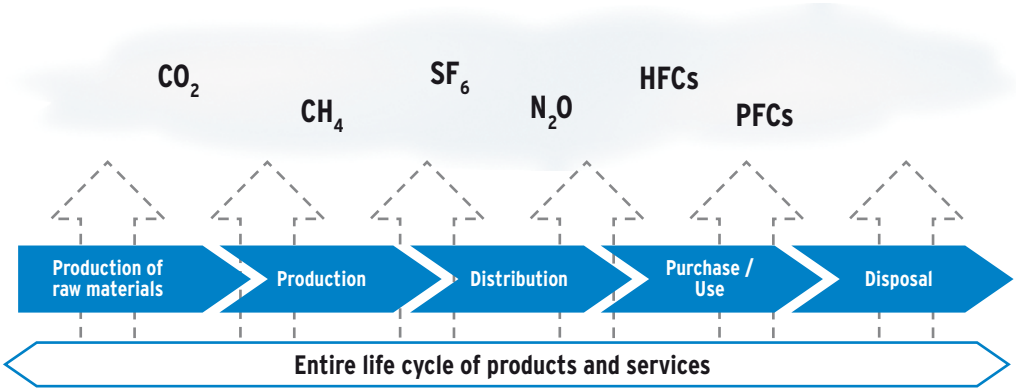

Figure 1: A graphic representation of the definition of a Product Carbon Footprint

International standardisation processes

There are currently no mandatory international standards for analysing and communicating Product Carbon Footprints. To meet this need, a process to develop a standard for carbon footprinting products was initiated at ISO level.

8 Definition from the draft standard ISO 14067 "Carbon Footprint of Products."

ISO 14067 - Carbon Footprint of Products

In 2008, the International Organization for Standardization's (ISO) Technical Committee (TC) 207 "Environmental Management," in conjunction with Subcommittee 7 "Greenhouse Gas Management and related activities," accepted the task of developing a standard for Carbon Footprint of Products (ISO/NP 14067). The standard will be in two parts: Part1 – Quantification; Part 2 – Communication. An important basis for Part 1, PCF quantification, is the ISO 14040 family of standards on life cycle assessment. Part 2 – PCF communication – will be based on ISO 14025 on environmental labels and declarations for products. Every effort is being made to conclude the development of the standard by the end of 2011.

Germany, for its part, will work in parallel to the development of the standard on Carbon Footprint of Products, setting up a mirror committee at the Deutsches Institut für Normung (DIN) within its Principles of Environmental Protection Standards Committee (NA 172 NAGUS).

Greenhouse Gas Protocol, Product Initiative by WRI/WBCSD

In addition to the initiative to develop an ISO standard, in autumn 2008 the World Resource Institute (WRI) and World Business Council for Sustainable Development (WBCSD) initiated a process to close the gaps in the Greenhouse Gas Protocol (GHG Protocol). The GHG Protocol is a guideline for calculating the greenhouse gas emissions of businesses and other organisations and is widely used in practice. Next to the ongoing work on a standard for the value chain (Scope 3 in the terminology of the GHG Protocol) a standard for products, the Product Life Cycle Accounting and Reporting Standard, is also being developed.

The aim of these standards is to make it possible to report on the greenhouse gas emissions of products throughout their entire life cycle. This would enable companies and other organisations to make decisions on how to reduce climate-relevant emissions through product design, manufacturing processes, distribution, use by the consumer and disposal. It has already been pointed out that the standard will not provide an adequate basis for making direct like-for-like comparisons between products and for product labelling. It must also be said that the standard is not aiming to support an accounting procedure for offsetting greenhouse gas emissions ("climate neutrality").

At the end of 2009, a first draft of the standard (developed in a multi-stakeholder process) was published for public comment. This standard is scheduled to be road-tested by companies over the course of 2010, then revised and published in its final version around the end of 2011.

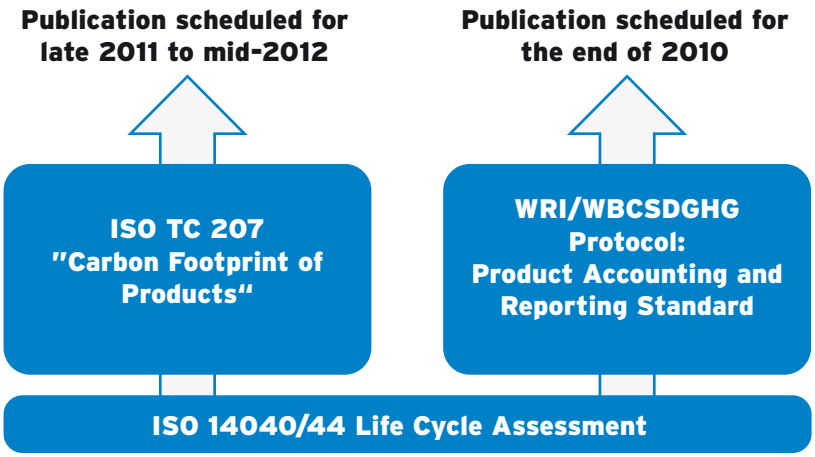

Figure 2: Work in progress to standardise and harmonise carbon footprinting for products

Publicly Available Specification 2050 (PAS 2050)

One of the first activities towards developing methods for product carbon footprinting was launched in the United Kingdom by BSI British Standards Solutions in collaboration with the Department for Environment, Food and Rural Affairs (Defra) and the Carbon Trust, who had initiated the proposal. Activities culminated in October 2008 with the publication of a Publicly Available Specification, "Specification for the assessment of the life cycle greenhouse gas emissions of goods and services." It has the status of a recommendation, one level below a British Standard (PAS 2050:2008).[9]
There also ongoing activities in other countries such as France, Japan and Thailand, in which methods to quantify Product Carbon Footprints are being developed, usually as the basis for national product labelling schemes. BMU and BDI believe that national schemes of this kind are not the right way forward to achieve international standardisation and harmonisation. They have therefore chosen not to develop a national standard and are working towards feeding the recommendations developed by BMU and the PCF Pilot Project Germany into the international standardisation and harmonisation processes, especially at ISO level.
Both processes to develop standards and guidelines are seen as useful and worthy of support. They should be driven forward as quickly as possible to give all stakeholders security about the direction developments are taking and create a binding framework that will fully exploit the potential of PCFs to contribute to climate change mitigation in the areas of production and consumption and also to avert "malpractice" with regard to use and communication.

But even without an international standard, it is actually possible even now to make a scientifically substantiated and consistent appraisal of PCFs, with the primary aim of meeting management related targets to reduce Product Carbon Footprints. Nevertheless, it must be said that the Product Carbon Footprint is still a "work in progress." As work on international harmonisation of methods advances, the methods will evolve and become more specific and the PCF will evolve accordingly. This is especially important

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

for communication with consumers and illustrates how important it is to ensure transparent documentation of the results of a PCF study.

Engaging with the whole PCF issue has already provided a number of important indications about its value and limitations in corporate and product-specific communication about the climate compatibility of goods and services.

Benefits of Product Carbon Footprints

Determining Product Carbon Footprints can help companies to:

- create transparency in the value chain with regard to upstream and downstream processes and stakeholders along the supply chain;
- raise awareness about greenhouse gas emissions along the supply chain and identify stages and processes with particularly high emissions;
- analyse potential for reducing emissions as efficiently as possible, in some cases linked to cost-cutting;
- create stimuli for developing and refining their own climate strategy;
- analyse and assess the relevance of greenhouse gas emissions by comparison with a product's other environmental impacts.

For communication along the supply chain – with product manufacturers, trading companies and consumers – knowledge of a PCF can be used to:

- illustrate the climate relevance of everyday products and services and build on that to point to the fact that everyone involved has a share in the joint responsibility for mitigating climate change;
- work with business partners to reduce emissions in certain parts of the value chain;
- provide consumers with information about alternative action they can take when buying and using products and establish a competitive edge;
- provide information about carbon offsetting possibilities through climate change mitigation projects, for example;
- illustrate the company's social responsibility for climate change mitigation using the example of a specific product.

The greatest value of Product Carbon Footprints is considered to be the fact that they enable companies to achieve transparency about the greenhouse gas emissions associated with their products and to identify and harness realistic potential for reducing them throughout the entire life cycle. The full benefit of PCFs is best realised when they include other environmental sustainability criteria, since poor decisions that could compromise the overall optimisation of products can then be averted.

Limitations of the Product Carbon Footprint

The current status of methodology, inadequate international agreement and harmonisation, and most importantly an inadequate data base, access to data and spread of data along the supply chain mean that it is not yet possible to work on all the possible goals of product carbon footprinting with methodological consistency.

This is particularly true of the following two goals:

- product comparisons, especially when they are commissioned by different companies and carried out by different agencies;
- public comparison of products that is consistent with competition law (e.g. specifying CO_2e values or CO_2e labels).

For PCFs, as for life cycle assessments in general, there is always a certain degree of uncertainty and a possibility that variances in terms of accuracy and reproducibility may occur.

The reasons for this include:

- different provenance and quality of the data(bases) used;
- lack of a uniform definition of certain assumptions during individual phases in the product's life cycle;
- quite simply, the use of different IT tools;
- different system boundaries.

It is unlikely that all the uncertainty arising from this will be eliminated with a uniform international methodology. This fact is especially important for communicating PCFs.

Product Carbon Footprints will not be an appropriate option for evaluating the climate relevance of all products. Particularly with regard to energy-consuming goods, adequate indicators have already evolved (energy efficiency ratings), which could be

further developed, but not necessarily replaced by PCFs. Conversely, the portfolio of products for which a PCF is an appropriate tool that can be used to good effect for management and communication purposes should be more clearly defined.

Carbon footprinting versus life cycle assessments for products

The main focus of product carbon footprinting is to study and assess a product's climate relevance. Other environmental impacts or social aspects are often not taken into account. In certain cases, this could limit the informative value and robustness of recommendations and options for action.

When it is a matter of comparing the climate relevance of different products, and this is to happen exclusively by communicating their PCFs to the public, the question arises as to whether other environmental criteria are not neglected in the process. We therefore recommend taking other environmental impacts into consideration. That would include, for example, eutrophication, land use, energy and raw materials consumption, toxicity or acidification of soil and water bodies. If other environmental categories are also included and examined for relevance, the reliability of PCF-based claims is increased and poor decisions are prevented. The PCF Pilot Project's case studies took other environmental categories into account.

It is important to note that a comprehensive evaluation of a product's sustainability is not possible solely on the basis of its PCF. A number of methods for assessing products have been developed in recent decades, which look at environmental friendliness and sustainability of products throughout their entire life cycle: life cycle assessments, eco-efficiency and sustainability analyses (e.g. PROSA). These tools do not focus on a single environmental category – as the Product Carbon Footprint focuses on greenhouse gas emissions – but take a more comprehensive look at the relevant environmental categories or, in the case of a sustainability assessment, at the economic and social aspects of sustainability (as is the case for a social life cycle assessment) and include this in the overall evaluation.

As a rule they are not much more complex to carry out than a PCF in isolation. But of course, the evaluation is more complicated, because conflicting aims across the individual impact categories have to be described and evaluated. Conflicting aims are always an indication of conflicts of interest, which makes the final interpretation of the results more complex. For some stakeholders, the reduction in complexity does not go far enough so that they are reluctant opt for a wider use of product assessments. The reality is usually more complex than the assessments can depict. For that reason, there may be conflicts of interest even when they are not, or cannot be, described within the assessment process.

Is the Product Carbon Footprint as a tool for assessing the "climate performance" of products helpful as a new method of evaluating products? From the extensive experience with life cycle assessment, the problem of making an objective evaluation is well

known, especially if only one of all the possible environmental categories is evaluated, without taking the other aspects into consideration.

Decisions that are based on a one-dimensional evaluation run the risk of misinterpreting results. For example, on the basis of the results erroneous decisions may be taken, which disadvantage those products that may seem to have a poorer CO_2 performance, but have advantages in terms of overall environmental performance. To avert that kind of misguided decision, a more comprehensive way of assessing the environmental and sustainability performance of a product is needed.

Must we therefore recommend a return to life cycle assessments or eco-efficiency analyses? Well, it is not quite that simple. The particular focus on climate impacts in product assessments has meant that a number of important new methodological challenges have arisen, which have not yet been answered in the life cycle assessment discussion. That means that if some of the unresolved methodological issues can be clarified the life cycle assessment debate will also have taken a further step forward.

We therefore believe it makes sense to engage with Product Carbon Footprints early on so that the possibilities for optimising climate performance and communicating it can be evaluated. The PCF discussion virtually begins at the stage where the discussion on life cycle assessment methods left off. If further decisions about optimising the sustainability performance of products are to be taken on the basis of a PCF, the other relevant environmental impact categories should also be included in the life cycle and sustainability assessment. In this way, it will be possible for people to ensure with little additional expenditure that they are using the latest assessment methodology, without losing sight of relevant environmental and sustainability categories. Only then can the potential of PCFs be effectively used and communicated.

PRODUCT CARBON FOOTPRINTING IN PRACTICE: STRUCTURE AND METHODOLOGICAL APPROACH

The following section describes the practical procedure for analysing a Product Carbon Footprint.

Here, the guide is divided into three key sections:

- preparations for ascertaining the PCF;
- calculating the PCF;
- evaluating and using the PCF.

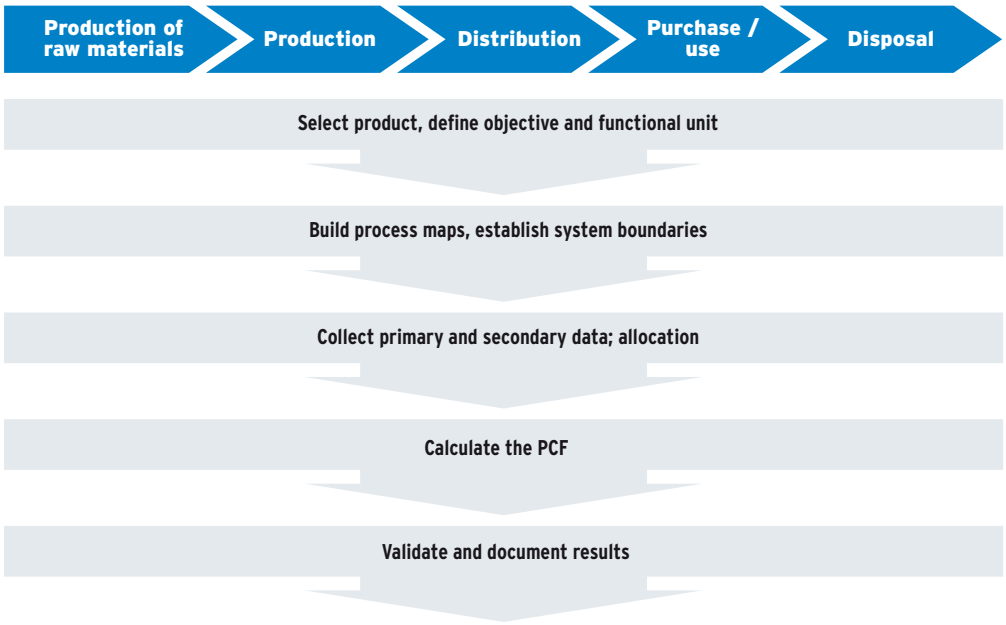

Figure 3: Schematic flow chart for product carbon footprinting

The procedure can be used to review:

- business-to-business (B2B) products, where the customer is another company that uses the product as the basis for its own activities (further processing);
- business-to-consumer (B2C) products, where the customer is the end consumer;
- services (B2B, B2C).

Preparations for measuring a PCF

This section summarises the key preparatory steps needed to actually calculate a PCF. They are crucial to ascertaining the PCF effectively and efficiently and to ensuring that the results support the desired decision-making processes as well as possible. The following steps are key to the preparations:

- define the objective,
- select a product,
- engage suppliers and business partners

Defining the objective

The most common reason companies have for carrying out a product carbon footprinting exercise is the wish to lower the greenhouse gas emissions associated with a product throughout its entire life cycle. Irrespective of that, however, companies may have other aims that motivate them to analyse a PCF. Defining and describing these objectives ahead of the study forms the basis for an effective and efficient process that also includes:

- a well substantiated choice of product;
- the choice of the scope, system boundaries and data collection method;
- the choice of a validation procedure.

How the objective of the study is defined determines to a great extent the footprinting procedure followed. Particularly when defining objectives, and also later when ascertaining a PCF in general, it is helpful to involve all the relevant departments and functions in a company. Which departments should be involved depends on the size of the company. In larger companies, it can be useful to involve colleagues from the following departments: procurement, energy, finance, communication, logistics, marketing, production, senior management, environmental matters. Which department has responsibility for coordinating the activities involved in product carbon footprinting will differ from company to company.

Not all the departments and functions of a company mentioned above need to be involved to the same degree in the footprinting process. However, it is advisable to reach a mutual agreement about the objective of the study, distribution of tasks and interpretation of the results and the steps that may need to ensue. If the objective of the study is to test the feasibility of the methodology and possibly expand to cover more products, then the relevant stakeholders should be involved from the outset.

Smaller companies do not usually have separate departments for all the corporate functions with staff who would be able to participate. Nevertheless, an attempt should be made to ensure that any relevant areas within the company should be included in the process.

Key questions when preparing the footprinting exercise that should be answered within the process of defining objectives could include:

- Why is the footprinting exercise being carried out? What are the specific objectives and anticipated results?
- Based on these objectives, what are the criteria for selecting products?
- Which products from the company's own portfolio could meet these criteria?
- Who are the most important suppliers along the value chain in question?
- What resources (personnel, time) and what budget can be made available?
- Does the company have sufficient competencies in-house? Will external competencies have to be brought in? Which tasks will be outsourced and which should be performed internally?
- How long will the project take?

A footprinting exercise requires basic competency in carrying out life cycle assessments. Larger companies often already have these competencies. Small companies are faced with the challenge that they often do not have these capacities nor can they finance them. In that case, they should consider involving external experts. When taking this decision, existing capacities and competencies must be weighed against the costs of external consultants. The level of internal or external human and financial resources needed depends to a great degree on the complexity and extent of the products for which a carbon footprint is to be analysed.

Choosing the product and defining the functional unit

The criteria for selecting products should be based on the objectives of the footprinting exercise. Key questions to consider when choosing which products to footprint may include the following:

- What time frame and what financial resources are available for the PCF study?
- How transparent and stable are the supply chains for the different products?
- How would you gauge the willingness of suppliers and business partners to support the footprinting, at the very least by making data available?

- For which products can good quality primary and secondary data be collected, including within the company? Which products present the greatest methodological challenges?
- Which products are reputed to be most significant in terms of greenhouse gas emissions throughout the entire life cycle?
- Which products are thought to have the greatest potential for reducing emissions?
- Which products are especially relevant in terms of market positioning relative to competitors and in terms of making the company stand out from others?
- For which of the company's products could the carbon footprint have the greatest significance in terms of brand and market position?
- What significance could the PCF have for the company's key stakeholders?

Defining the functional unit

Once the products have been selected, the next step is to define the functional unit. This is crucial to calculating the Product Carbon Footprint. It is also the basis for making any comparison of one product with another product, should that be one of the objectives of the study. The functional unit reflects the quantity and the way in which a product is used – either by end consumers or business customers and what benefit is associated with it.

Examples of this might be:

- 500 ml of a soft drink in a PET bottle;
- 1,000 hours/year of light from a light bulb;
- 1 tonne of a chemical solvent used to manufacture paint.

Many products a company manufactures may have different uses or types of use. The significance of these uses should be taken into account when defining the functional unit. Often industry associations or standards for products may be able to provide indications of important uses and hence the functional units of products.

The choice of functional unit is also particularly important when calculating a PCF for a service:

- What does the customer regard as a "unit" of a service purchased (e.g. one night's hotel stay)?
- What quantity of a service is representative (e.g. holding a current account for a year)?
- With what other products is the customer comparing the service (e.g. a nappy laundry service versus disposal nappies)?

Engaging suppliers and business partners

Involving suppliers and business partners who are connected with the relevant value chain is important for understanding the life cycle of the product and for collecting data. Typically, companies know their own production processes very well, whereas how much they know about what goes on beyond the factory gates in terms of processes, materials used, energy used, transportation or disposal volumes can differ greatly.

For that reason, it is important to explore the following questions for the selected products early on during the internal preparations for ascertaining a PCF:

- Who are the most important suppliers and sales and disposal partners in the supply chain?
- How can they support the product carbon footprinting and what information do they need to provide?
- How do you gauge their willingness to support the process? How sensitive is the information you need from them in terms of their positions relative to competitors?
- Who will ensure that the key suppliers and business partners are involved in the process?

Before beginning the process of studying and calculating a PCF, it is important to decide which partners should be involved and in what way.

In summary, it can be said that the more comprehensive and thorough the preparations for the footprinting exercise, the more efficient the analysis and calculation process will be, making it more likely that the objectives of the footprinting will be achieved and the benefits fully exploited.

Measuring and calculating a carbon footprint

The procedure for measuring and calculating a PCF essentially follows the principles of a life cycle assessment in analysing the greenhouse gas emissions associated with products. The idea of this is to enable businesses to minimise these emissions throughout the entire product life cycle with the greatest cost efficiency possible.

The process can basically be divided into five steps, which are also closely based on life cycle assessments:

- build process maps;
- establish the system boundaries;
- collect primary and secondary data;
- calculate PCFs after establishing allocation rules;
- assess uncertainty and perform sensitivity analyses.

Building a process map

The aim of this step in a carbon footprinting exercise is to identify all the materials, activities and processes that are part of the life cycle of the product. To begin building the process map it is helpful to break the chosen functional unit down into key life cycle phases. A product's key life cycle phases are:

- production of raw materials
- manufacture
- distribution
- use
- disposal/recycling

When analysing a PCF for a B2B relationship, it may be advisable to map it up to the distribution stage only. This is in line with the "cradle to gate" approach in the ISO 14040 family of standards on life cycle assessment.

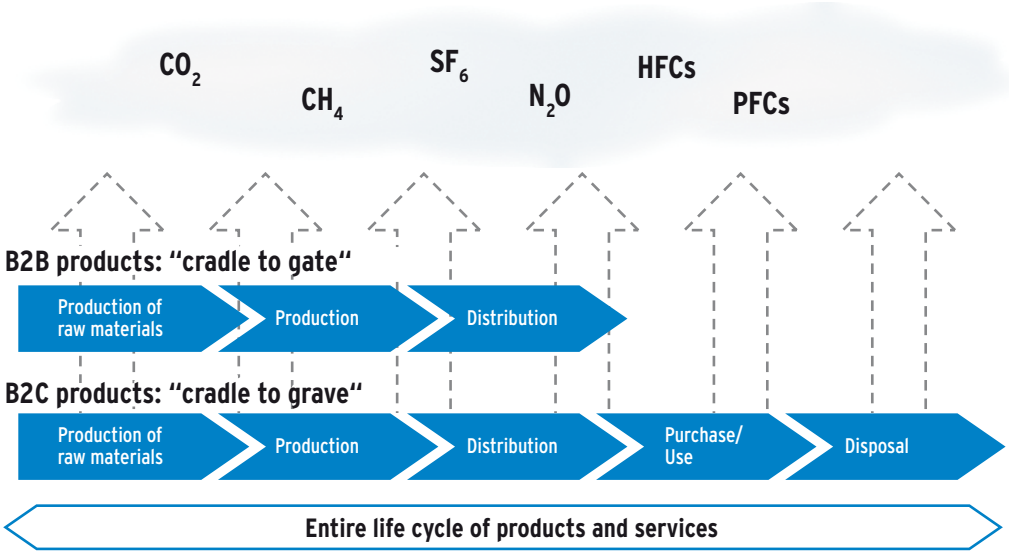

Figure 4: Figure 4: Life cycle phases of B2B and B2C products

Considering the life cycle as far as distribution may make sense because B2B products may be used in a wide range of different applications and products for customer use (e.g. glass can be used in windshields for cars).

Process maps for services do not differ fundamentally from those needed for goods. They are developed from the process maps established for all activities and goods needed to perform or use a service.

Once a complete overview (see Figure 5 on the next page) of the process maps for the relevant product life cycle has been obtained, the next step is to establish the system boundaries and prioritise the processes within those boundaries.

Establishing system boundaries

System boundaries define the scope of a Product Carbon Footprint, i.e. they define which processes (inputs and outputs) need to be included in the study. Specifications on this already exist for some products – within what are known as product category rules (PCRs).

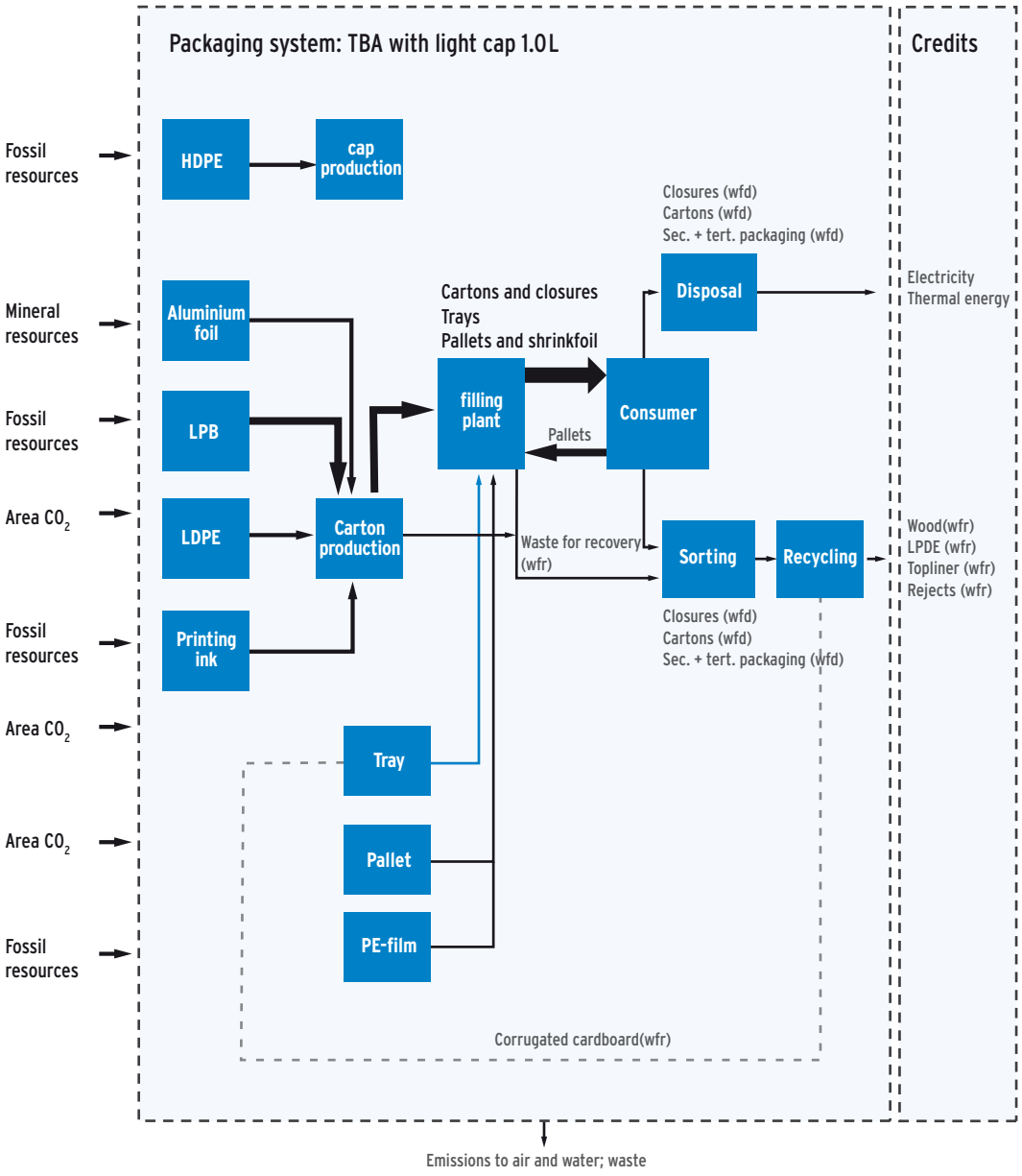

Figure 5: Example of a process map illustrating the Product Carbon Footprint of a 1-litre drinks carton[10]

10 The chart is taken from a case study of Tetra Pak GmbH carried out as part of the PCF Pilot Project Germany

Definition: **Product category rules (PCRs)** are a set of specific rules, requirements and guidelines on developing environmental product declarations for one or more product categories that can fulfil equivalent functions. PCRs are a consistent, internationally accepted method of describing a product life cycle. They are rapidly being developed at international level (partly boosted by the current PCF debate), but are still only available for a limited number of product groups. You can check on the following website whether PCRs already exist for the product studied: www.environdec.com

If PCRs do not exist, system boundaries must be established for each specific product, following the principle that all processes that make a material contribution to the PCF result must be included within the system boundaries. As a rule, a material contribution is considered to be a contribution from a process that results in more than 1 % of the greenhouse gas emissions per functional unit.

In practice, it is highly likely that the exercise of building and refining the process maps and establishing the system boundaries is something that will be achieved by repeating the same procedure several times. People's understanding of their products' life cycles and the processes underlying them will steadily increase and they will develop a good sense of how to reconcile the process map and system boundaries.

The system boundaries should be set in a way that covers the greenhouse gas emissions that make a material contribution to the direct and indirect emissions of the product in question during manufacturing, use and disposal. In practice, that means that an attempt should be made to include all emissions that have at least a 1 % share in the anticipated overall result.

Data collection

Data is collected in basically the same way as for life cycle assessments. However, in the case of a PCF, the greenhouse gas emissions are confined to one impact category: the greenhouse effect. However, since the assessment processes are so similar, we recommend including, if possible, data on other environmental impact categories and additional sustainability criteria. That makes it possible at a later date to look at the carbon footprint in relation to other impacts on the environment or on economic and social factors and to undertake reduction measures that aim to optimise the overall situation, not just one aspect of it.

Data is collected on the level of the individual processes that take place within the life cycle of a product.

In order to evaluate the quality of the data, the following questions should be systematically answered:

- How specific is the data to the time period under study?
- How specific is the data to the geographical scope?
- How specific is the data to the particular technologies used within the product' life cycle?
- How accurate is the data and what uncertainties need to be taken into account?
- Is the data complete?
- Are the data sets consistent?
- Is the data reproducible?
- What are the sources of the data?

Data selection
Basically, a distinction is made between two different types of data: activity data and emission factors. **Activity data** refers to all the quantities of material, energy and transportation as inputs and outputs during the life cycle. By contrast, **emission factors** describe the link between these quantities and the greenhouse gas emissions per reference unit. For example: the electricity used in a process is seen as activity data, whereas the emissions per kilowatt hour are referred to as an emission factor.

Both activity data and emission factors can be obtained from either primary or secondary data sources:

- **Primary data** refers to direct measurements within the specific product life cycle being assessed.
- **Secondary data** refers to external measurements outside the specific process map for the PCF being assessed. It is less specific and may be generic or expressed as an average, based on comparable processes.

Within the discussion on PCF methodology, the question of whether primary data can generally be better evaluated than secondary data is the subject of intensive debate. However, this question cannot be answered without a detailed evaluation of the data quality. In general, an attempt should be made to obtain primary data wherever possible, at least for the activity data, and to include secondary data in the evaluation of its quality to create the best possible data basis for calculating the PCF. The more primary data is available, the easier it will be to create a good understanding of the process maps involved. This in turn will produce the greatest potential for reducing environmental

impacts. However, it is basically possible to use primary and secondary data for product carbon footprinting.

Sources of secondary data
In cases where primary data is not available or its quality cannot be reliably gauged, secondary data from other sources must be used. Relevant databases are being continually set up and expanded.

Databases that are typically used to calculate PCFs are:

- comprehensive life cycle assessment databases that are either freely accessible or run on a commercial basis;
- sector-specific databases (e.g. for plastics and metals);
- average data provided by industry associations;
- country-specific databases (e.g. PROBAS at the Federal Environment Agency (UBA).[11]

It is anticipated that other databases will be established and made accessible in the future, such as the International Reference Life Cycle Data System (ILCD), which already contains life cycle assessment datasets for selected materials and processes. At the present time, it is not really possible to make a conclusive recommendation about the use of specific databases for secondary data. This decision must be made on a case by case basis. However, it is important that the choice of database is comprehensible at a later date and that it is documented, along with an assessment of the data quality (following the quality criteria listed above in the form of questions).

We recommend using standardised data sheets to systematise and formalise the data collection. They can help to:

- structure the survey of suppliers;
- ensure that the data collected is complete;
- support the prioritisation of potential emission reductions.

Once the data collection process has been provisionally concluded and allocation rules established, the work of analysing the PCF can begin.

11 Further information on PROBAS is available at www.probas.umweltbundesamt.de. The EU has published a list of other life cycle assessment databases, which can be accessed at http://lca.jrc.ec.europa. eu/lcainfohub/databaseList.vm.

Allocation

Allocation describes a process that is hugely important in the entire discussion about life cycle assessments. In the context of a life cycle assessment, allocation means attributing the environmental impacts occurring throughout the life cycle – in the case of a PCF the greenhouse gas emissions – to co-production processes, recycling and waste disposal.

Classic issues include questions such as:

- how to divide up the emissions from combined heat and power generation between the electricity used and the heat used, or
- how to divide up the emissions from a recycling process between the recyclable by-product and the product in which the recycled material is used.

Generally speaking, when using the allocation procedure, it should be noted that it influences the result and the size of the Product Carbon Footprint to a great degree.

In principle, the same rules apply to calculating a PCF as to life cycle assessment. According to the life cycle assessment rules, the priority is to break co-production processes down into individual sub-processes. If that is not possible, the system should be expanded. Only if neither of these options is possible should the emissions be allocated using physical (mass or energy) or economic criteria.

In some cases, these rules have already been established for particular groups of products in what are known as product category rules (PCRs). In other cases, the rules for life cycle assessments should be applied to PCFs and the allocation carried out should be documented transparently. We recommend that the influence of different allocation methods on the final result be documented and evaluated using alternative calculations for footprinting, which are known as sensitivity analyses.

Calculating the PCF

Carbon accounting or calculating the Product Carbon Footprint can fundamentally be carried out following the ISO 14040 family of standards (and in future in line with ISO 14067). The equation for product carbon footprinting is the sum of all mass, energy and waste streams throughout a product's entire life cycle multiplied by their emission factors. The calculation itself essentially involves multiplying the activity data by the appropriate emission factors.

To check the reliability of the PCF, the life cycle assessment provides for an energy and mass balance. It compares the total amount of materials and energy going into the product system with the materials and energy leaving it again. The mass balance provides confirmation that all materials and energy have been accounted for and that no streams have been forgotten.

It is easiest to calculate mass balances at the data collection stage.

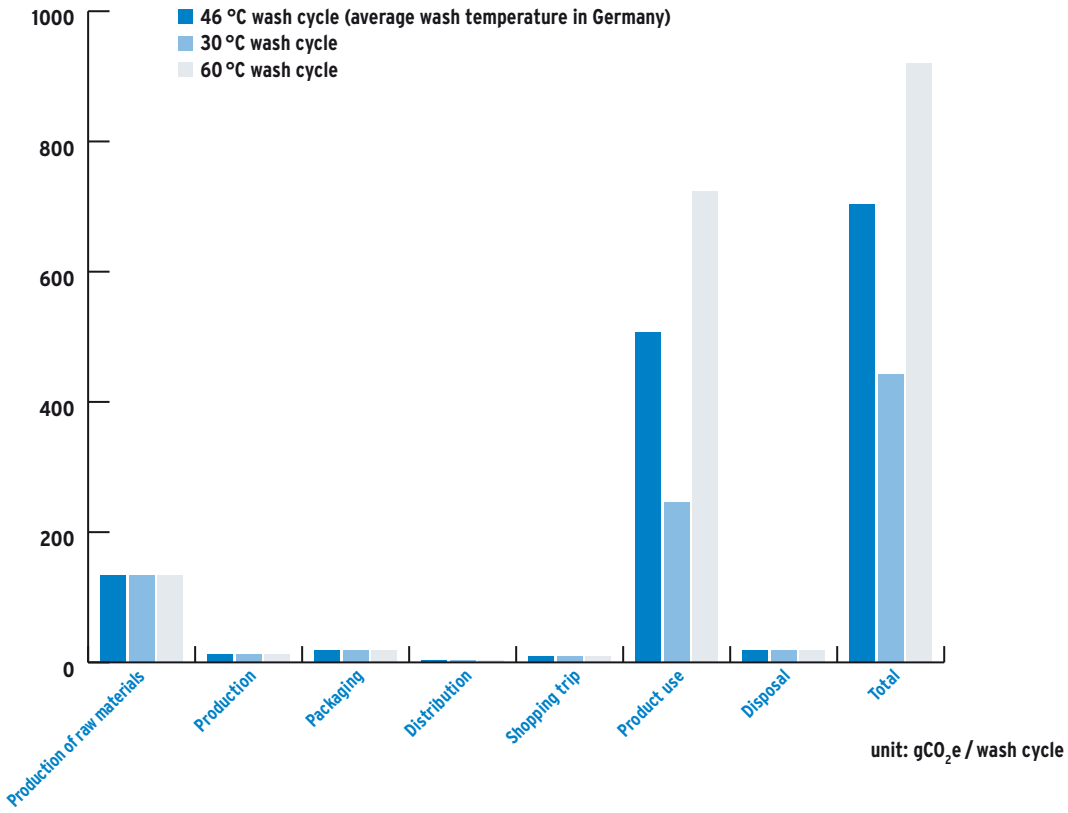

Figure 6: Example of the results of calculating the PCF of a washing machine cycle using detergent[12]

As outlined above, there is currently no internationally harmonised PCF standard and a number of issues concerning a consistent method of calculating Product Carbon Footprints remain to be clarified. Currently a number of methodological elements in the ISO 14040 family are at odds with methodological approaches such as PAS 2050, and some elements have not been adequately described or are methodologically and practically not feasible.

It was particularly with this in mind that the Federal Ministry of the Environment, Nature Conservation and Nuclear Safety (BMU) and the Federal Environment Agency (UBA) commissioned the Öko-Institut (Institute for Applied Ecology) to carry out a systematic analysis of the need to further develop methodology and on carbon labelling, as part of a project on CO_2 labelling for goods and services. The project explored the requirements for product carbon footprinting methodology and for communicating PCFs and discussed them with a large number of stakeholders and scientists at national and international level. The project included two expert workshops on methodology and two conferences. It also conducted an extensive survey of the experiences and opinions of around 50 national and international businesses and industry associations. Cooperation partner Systain Consulting worked in close collaboration with the Otto Group to analyse a number of PCFs in the textiles chain. Practical and methodological challenges, in data acquisition or allocation, for example, were identified and fed into the work in general.

12 The chart is taken from a case study of Henkel AG & Co. KGaA carried out as part of the PCF Pilot Project Germany.

Additional input and support for this project came from the PCF Pilot Project Germany, in which the organisations involved - Öko-Institut (Institute for Applied Ecology), Potsdam Institute for Climate Impact Research (PIK), Thema1 and WWF Deutschland - in conjunction with 10 business partners - used 15 case studies of a variety of products to explore the feasibility of measuring and calculating PCFs.

This project resulted in practical recommendations regarding the methods for ascertaining and communicating PCFs.

Specific methodological recommendations

The key positions on the Product Carbon Footprint, based on the results of the above-mentioned projects, are summarised in a Memorandum on Product Carbon Footprints.[13] The Memorandum presents the principal methodological challenges from the point of view of stakeholders and drafts concrete recommendations for standardisation processes and for practical ways of dealing with these points when performing product carbon footprinting exercises in the transition period until international standards have been drawn up.

BMU recommends that in view of the fact that a number of methodological issues regarding life cycle assessment have not been conclusively resolved and harmonised, interested businesses should base their work on ISO 14040 ff. and the current standardisation debate on ISO 14067, in addition to following the Memorandum's methodological recommendations.

The most important positions pinpointed in the Memorandum address the following points:

1. including other environmental categories;
2. product category rules (PCRs);
3. treatment of particular sources and sinks, especially when it comes to accounting for renewable energy, carbon stored in products and land use change;
4. calculating the use phase.

The Memorandum describes in detail the exact positions on these points.

13 The paper is published on the website of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety: www.bmu.de

Evaluating and using PCFs

Checking uncertainty

Checking the uncertainty (carrying out an uncertainty analysis) of the results of a PCF calculation is crucial for designing measures to reduce the PCF effectively and efficiently and for being able to appraise the opportunities and limitations for communicating PCFs.

An uncertainty analysis helps to:

- review the appropriateness of decisions intended to reduce the PCF made on the basis of the footprinting exercise;
- identify where data quality may need to be improved;
- better assess the robustness of the footprint and better communicate it – if communication of the PCF is planned;
- generally contribute to understanding how modelling of life cycle assessments works.

Basically, the footprinting exercise should be designed in a way that minimises uncertainty.

Validating a PCF by a critical review

ISO 14044 stipulates performance of a critical review ahead of any proposed publication of life cycle assessments. This way of validating results has largely proved its worth and should also be adopted for product carbon footprinting. PAS 2050 also includes the possibility of self verification (PAS 2050: 2008, p. 25). Self-verification should not be adopted in international standardisation practice, since it does not guarantee credibility.

For the purposes of comparing products and for more general questions (e.g. product policy), a critical review by a panel of interested parties should be carried out in accordance with ISO 14044.

Documentation and reporting

As already outlined above, mandatory international standards (ISO 14067.1) and harmonised guidelines (GHG Product Protocol) are not anticipated before the end of 2010 and, in fact, are more likely to be completed in the first half of 2011. Until then there will be no internationally agreed and mandatory methodology beyond the life cycle assess-

ment standard ISO 14040 ff. It will therefore be inevitable that the methodological approach to product carbon footprinting and the numerous anticipated case studies will not be standardised.

As a consequence of that, the practical value of Product Carbon Footprints - particularly when it comes to communicating the results or comparing groups of products or even individual products - will be limited. That presents very serious challenges to efforts to achieve integration of the PCF into environmental policymaking's canon of instruments in the near future and enable it to act as an indicator of the environmental performance of products (such as standards for private and public procurement or environmental declaration and labelling).

To be able to review the practical value of PCF calculations for the different applications mentioned, it is crucial to have transparent, publicly accessible and informative documentation on PCFs, in addition to the critical review already mentioned.

As described above, adequate documentation will play a key role in defining the validity and practical value of PCF case studies. That is particularly true for the transitional period until mandatory international standardisation and harmonisation of guidelines have been completed. We would therefore recommend transparent, publicly accessible and informative documentation particularly for this period. It should begin by describing the structure and sequence of steps involved in the PCF study. A description of the framework (goal and scope) set for the study should occupy a central position in the documentation.

Key elements are considered to be the following:

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

The documentation of the inventory and the calculation should include an explanation of the individual life cycle phases and the calculations for each of them. In particular for the use phase of products, the recommendations made in the Memorandum should be observed - especially with regard to clearly defining the use profile and possible scenarios. The documentation – as is the case for life cycle assessments – should also describe sensitivity analyses, uncertainty analyses and an estimation of error. It is also important to make explicitly transparent whether and in what detail other environmental categories of the life cycle assessment were included in the study.

Work and cost involved in product carbon footprinting

Depending on the product, measuring a PCF can be quite costly in terms of time, human resources and money and - as is the case with life cycle assessments - requires expert knowledge and experience. This will not change in the foreseeable future – not even as a result of expanded databases. Many companies, especially small and medium-sized businesses, have not yet been able to build expertise in this field and have to rely on external consultants. Any call for broader use of PCFs therefore entails great expense, especially the first time the footprinting exercise is performed. That means that a PCF is currently of interest to businesses mainly for strategic or exemplary products, the results of which are transferable to other goods within the same group of products or even other groups of products. For a company with a broad product portfolio, it is not really conceivable that a PCF analysis could be carried out for each product within an acceptable time frame and at acceptable cost. The companies themselves are responsible for deciding which product categories to select; they do this in dialogue with stakeholders.

COMMUNICATING PRODUCT CARBON FOOTPRINTS

The decision about whether the results of the product carbon footprinting should, or can, be communicated, depends partly on the objective of the exercise, but also on whether the method used and the quality of the individual case study were sufficient to achieve that objective. In view of the lack of international standards, the potential for communicating PCFs must still be seen as quite limited. This is particularly true in the light of the discussion of the fundamental requirements of adequate and credible communication about products' climate performance.

Specifying the greenhouse gas emissions of products can be helpful if a number of basic communication requirements are met. They were for the most part identified by the PCF Pilot Project Germany and drafted as a checklist:

1. Impact on consumer behaviour

Any communications about a product's greenhouse gas emissions should be designed in such a way that consumers' decisions can actually contribute to reducing these emissions and the product's overall impact on the environment.

The following checklist of questions provides important pointers as to whether or not this is the case:

- Is CO_2 the most relevant issue in the life cycle of the product? Or are other factors more important (water consumption, for example)?
- Can the type of information given help the consumer to make a conscious contribution to mitigating climate change?
- Does the way in which the information is presented provide help for consumers and pointers about climate-conscious behaviour?
- Is the information on climate relevance presented in a way that influences purchase decisions and how a product is used?
- Does the communication ensure that reporting the Product Carbon Footprint does not obscure the product's other environmental impacts?

2. Credibility

Communication must be credible to ensure the trust and acceptance needed for success.

The following questions are relevant to the criterion of credibility:

- Is there transparency about the methodology used, the carbon footprinting process and the players involved?
- Have all the relevant greenhouse gas emissions across a product's entire life cycle been included?
- Were the specifications for evaluating climate relevance verified by independent third parties and did they also have a role in setting them?
- Do the specifications for ascertaining and communicating the Product Carbon Footprint also include providing details of the product's overall environmental impact?
- Does the communication of products' greenhouse gas emissions go beyond individual ideal cases?

3. Uniformity

Tools for communicating with customers, consumers or business partners are not used exclusively by individual companies. It is therefore important to ensure they have a uniform basis:

- Do the same methodological specifications for product carbon footprinting apply to all comparable goods and services?
- Are the assumptions that have been made transparent, comparable, consistently described and documented?
- Have individual changes (e.g. a subsequent change of unit or system boundaries) been clearly and comprehensibly recorded?

4. Comprehensibility

Communication has to be comprehensible to the recipient. The information tools used must therefore be tailored to the target group and use situation and be flexible:

- Does the information meet the needs of the target group?
- Is the information tailored to the target group's communication skills (ability to deal with abstract thought, language skills etc.)?
- Is the amount of information and form of presentation appropriate to the specific situation?

5. Comparability

Information about the climate relevance of products is often of value only if it allows comparison with alternatives to be made:

- Does the information given (e.g. values or range of values) allow for a comparison with alternative products that serve an identical or similar purpose?
- Does it enable a comparison to be made between different products or different types of use?
- Does the information include suggestions for more climate-friendly behaviour choices?

If these requirements are observed, PCFs can be useful tools for communicating a product's climate performance. However: to promote climate-friendly consumption in the long term, standardised and internationally accepted guidelines based on harmonised footprinting methodology must be established for communicating the climate performance of products.

Recommendations for communicating climate performance of products

Based on their own practical experience with jointly evaluating various international communication approaches and after intensive dialogue with relevant stakeholders, the participants in the PCF Pilot Project Germany put forward the following recommendations:

- Information about the carbon footprint of a product or service should be presented on different levels in a differentiated manner: first of all for the entire life cycle, and then broken down into individual phases such as production, use and disposal phase. This enables the manufacturer to make reduction claims or claims about CO_2 reductions that would be possible if consumers changed the way they use the product.
- PCF labels with carbon numbers (specifying an aggregated number of grams on the product) – which have already been tested by a number of companies – are not helpful and have little impact on behaviour. A number of this kind implies a degree of precision and informative value for the consumer that cannot be achieved with the methodology currently available.
- The Product Carbon Footprint is a tool that manufacturers can use to provide information about individual reductions in emissions they have already achieved or are planning – albeit only if the PCF was consistently measured and documented over a specific period of time. It is particularly important here to disclose the assumptions underlying the process.

- As the methodology currently stands, calculations can produce a range of results and leave scope for interpretation. It is therefore important to document clearly the purpose of the product carbon footprinting and on what assumptions and weightings it is based. All the data must be published in a way that is clear, comprehensible, informative and open to scientific scrutiny. Last but not least, the degree of reliability and uncertainty of the PCF calculation is important, as is the question of whether other significant environmental impacts were considered.

- It is important that the documentation of the PCF calculation be transparent and accessible. The project partners agreed when communicating the results of the case studies to include references to key documentation on the Internet (www.pcf-projekt.de) and include the option of using mutually agreed visual reference material.

- Information used in external communication about environmental and climate friendliness of products and services should be reviewed by an independent third party. As soon as a generally recognised standard becomes available, this should take the form of a critical review.

- In view of dynamic international developments, cross-product and cross-sector approaches are helpful in creating credibility, avoiding isolated claims and reflecting developments in methodology of a given time.

If these recommendations are followed, Product Carbon Footprints can be an effective basis for useful production communication. Ideally, simple messages that inform consumer behaviour can be developed from them.

CO_2 label versus environmental labels

The initiatives to introduce CO_2 labels initially made little reference to other existing labels or experience with these labels. There are currently around 400 different labels. The vast majority of consumers find that overwhelming and make little use of the information to purchase more advantageous products based on the corresponding label. The possibility of CO_2e or CO_2 labels therefore encounters an information situation that is already more than saturated. Within the overall range, there is a handful of labels and products bearing them that people pay greater attention to and purchase more often. They are the Blue Angel environmental label in Germany (or the corresponding national environmental logo in other countries), the organic label, energy efficiency labels, the Energy Star and the Fairtrade label. It would be important to find out how potential CO_2 labels are regarded by comparison with these familiar and recognised labels.

Below is a description of some typical CO_2 labelling initiatives and an exploration of their significance for different groups of products.

Examples of CO_2 labels and climate-related product labelling

The number of international initiatives to introduce CO_2 labelling and climate-related product labelling increased vastly during 2008. It is not possible to mention and describe in detail all the initiatives within the scope of this guide. We shall simply introduce at this point the most important basic types of label and product labelling schemes.

CO_2 label and carbon reduction label

The labels that are probably the subject of the most controversial discussion at present are CO_2 labels (also known as carbon labels) and carbon reduction labels. The Carbon Reduction Label awarded by the Carbon Trust is perhaps the most well-known. It assigns a specific value to the Product Carbon Footprint, yet does not necessarily cover all the product's life cycle phases.[14] Furthermore, a condition for awarding it to a product is that the manufacturer commits to reducing the product's PCF over a period of two years.

The label conveys explanatory information, including comparisons with other products or information for consumers, such as how they can contribute to reducing the PCF during the use phase. The label is used on product packaging, at the point of sale in retailing outlets or on a company's website. The label is voluntary and is certified by the Carbon Trust or accredited service providers.

A number of comparable international approaches, in South Korea or Japan, for example, where similar labels are being introduced, were modelled on the UK Carbon Reduction Label.

Carbon seal of approval

In addition to this, there are also approaches that take the Product Carbon Footprint as the basis for awarding the best products within a particular category (e.g. laundry detergent) a seal of approval. One of the most prominent of these is a pilot project for a scheme used by the Swiss retailer Migros that uses a seal declaring that a product's CO_2e emissions are "approved by climatop." It is given to products in a category with a PCF that is at least 20 per cent better than an average comparable product. The entire life cycle of products, including use and disposal, are assessed.[15] However, Migros uses this seal of approval exclusively for its own brands.[16] The calculations the labelling is based on are performed by an external research partner (climatop). The greatest challenges are seen as being in the food sector.

14 For example, the Product Carbon Footprint that Continental Clothing specifies for a T-shirt on a Carbon Reduction Label covers the production of the raw materials, production of the T-shirt itself and transport within the United Kingdom. The use phase and disposal of product are not included.

15 At the beginning of the project only CO_2e assessments were carried out. Now, however, the system is based on life cycle assessments that take the other relevant environmental categories into consideration.

16 Migros does not use the seal on brands other than its own, even if their performance is equivalent to their own labelled products.

Climate neutral label
As well as the types of label mentioned above that are based on a product's PCF, we are now seeing an increasing number of initiatives that label products as climate neutral. This means that the carbon footprint for the products has been measured and offset through investment in climate change mitigation projects. The approaches currently vary enormously.

There are important differences with regard to the following:

- What greenhouse gases were assessed?
- Were all the life cycle phases taken into account or just particular stages?
- Are there any requirements that the PCF be reduced before investment in offsetting begins?
- What (quality) specifications are the offsetting projects required to meet?

A well known example in Germany is the "Stop Climate Change" label. For this the GHG emissions throughout the entire production process, including transport to the point of sale, are assessed. Use and disposal are not included. Reduction in GHG emissions is assessed and the remaining emissions that were offset through climate change mitigation projects are certified, providing they meet transparency standards. The GHG calculations are performed by AGRA-TEG GmbH and checked by an independent environmental certification body (Gesellschaft für Ressourcenschutz mbH). To date, this label has primarily been used on a voluntary basis by food manufacturers in the organic sector.

Environmental labels with a climate focus
Apart from these product labelling schemes that are based mainly on GHG assessments, a number of approaches are evolving that give more differentiated information than "classic" environmental labels (Type 1 under ISO 14024), some of them focusing on climate change. Criteria for awarding labels that describe the climate relevance of a product are being developed for diverse groups of products. This is not necessarily expressed in terms of PCF, but, particularly in the case of energy-consuming products, it describes the energy use. However, other environmental categories are also taken into account in the form of minimum criteria when awarding environmental labels. For example, the best 20 % in any group of products on the market may be awarded the label, if the manufacturer applies for it; participation in the scheme is entirely voluntary. The criteria are updated with increasing regularity, giving the labels a dynamic character that takes a top-runner approach.

The most prominent and also latest example of the kind of environmental label is Germany's Blue Angel.

In future the Blue Angel label will be awarded in four different clusters, testifying that the product "Protects the climate," "Protects resources," "Protects water," or "Protects health." The focus is reflected in an additional feature in the Blue Angel logo. Irrespective of the particular focus, the Blue Angel continues to take into consideration all the characteristics of goods and services that are relevant to the environment and health. Consumers do, after all, pay attention to other environmental and health aspects, such as protection from harmful substances and noise or water consumption issues. Another advantage of the environmental label is that the criteria developed on the basis of life cycle assessments are discussed with a panel of experts before they are definitively established by a stakeholder committee.

For the climate cluster, an ongoing project is scheduled to develop award criteria by 2011 for the 100 most important climate-relevant groups of products. Technical expert hearings have already been held for the first nine groups of products: netbooks, DVD / blu ray disc recorders, refrigerators and freezers, tumble dryers, washing machines, gas cookers, espresso machines, electric kettles and automatic socket strips (MasterSlaves).

In addition to environmental labels, there are other ongoing processes in the field of product-based climate change mitigation, such as the Eco-Design Directive and the proposed recast of EU legislation on energy efficiency labelling. Particularly the changes to EU energy efficiency labelling over the next few years could cause consumer uncertainty about purchasing choices, whereas the well-established Blue Angel eco-label will continue to be a reliable guide for consumers.

A similar approach has also been established in the European ecolabel (the Euro flower) and is being discussed in China (sack of rice). Most of the product labelling schemes mentioned currently operate on a voluntary basis. However, in some cases – in France, for example – the possibility of mandatory types of labelling is being debated. As part of what is known as the Grenelle Environment Project, a proposal has been developed, under which from January 2011 it will become mandatory to provide consumers with information about greenhouse gas emissions and other environmental impacts, and about resource consumption during the life cycle of products, using either a label or other appropriate method. This regulation has not yet been passed by the French parliament and it has not yet been decided which environmental characteristics of products should be covered by the labelling scheme nor what form it will take. To resolve these issues, a platform has been set up with Ademe (the French environment agency) as lead agency, supported by the French standardisation organisation Afnor and involving all relevant stakeholders (scientific experts, trading companies, NGOs, manufacturers). The work is being carried out in working groups specific to particular groups of products. Twelve working groups are discussing the environmental categories that should be considered, appropriate measuring methods and possible forms of communication, each focusing on the specific group of products it is responsible for. Based on the results of these discussions, an agreement on how to proceed further is scheduled to be reached in 2010 if possible.

In addition to the categories of product labels mentioned, there is also a vast – and indeed confusing - number of schemes run by individual companies that take different

approaches to providing information about particularly climate-friendly products in their portfolio.

We anticipate that even more initiatives will spring up over the next few years. Against this backdrop, there is a risk that the vast amount of different information is more likely to confuse consumers, or even lead them to make the wrong choices, than to provide guidance. If that risk is to be averted, there is a clear need for more knowledge in the area of climate and environmental relevance, particularly with regard to the following questions:

- What credible and robust information and claims about the climate relevance of products is possible on the basis of our current level of knowledge about assessment methodology?

- What form is best suited to communicating this information to consumers, so that it can be easily understood and used to guide behaviour and stay on track to achieve climate change mitigation?

These questions generate key requirements for communicating the climate relevance of products and how they are used.

Systematic analysis for different groups of products

As outlined above, current activities and communication of Product Carbon Footprints focus on food, not on energy-consuming products (such as heating systems, cars or electrical appliances), which are far more important from the climate perspective. This is surprising because it might just be possible to make a case for not including other environmental categories in assessments for energy-consuming products, but certainly not for food. Interestingly, there is relatively little media coverage about existing labelling requirements for electricity and cars, whereas reporting of proposed food labelling schemes has been extensive.

To date there are no clearly defined ideas about how CO_2e labels might tie in with other labels or labelling requirements, such as the EU's energy efficiency label. Below, we look at the usefulness of CO_2e labels for different groups of products.

Climate-relevant products
A small number of products account for a particularly high share of the per-capita emissions of greenhouse gases. They are heating systems (fired by oil or gas), cars, air travel and electricity (or electricity consuming appliances). With just a few products and purchasing decisions, each German citizen causes about 5 – 6 tonnes of CO_2e per year, whereas the greenhouse gas emissions associated with food (a total of 1.5 to 2 tonnes of CO_2e) are made up of the purchase of thousands of different food products in 100 or more shopping trips per year.

For electricity and cars, climate-relevant labelling requirements (grams of CO_2/km for cars[17] and type of generation in the case of electricity) already exist.

High-energy electrical appliances

Energy efficiency labelling

Energy efficiency labelling is mandatory for certain electrical appliances. The ongoing implementation of the Eco-Design Directive foresees an extension of the labelling requirements from large household appliances to other large appliances such as IT equipment, and in the future possibly to smaller appliances (e.g. vacuum cleaners or espresso machines). Life cycle assessments show that for most energy-consuming appliances, it is the energy consumed during the use phase that accounts for a very high share of their overall energy requirement (usually 80–90 %) and that the energy required for their manufacture and disposal is not as relevant. This is true to a similar degree for their climate performance and PCF. The PCF of large electrical appliances ranges from one hundred to several hundred kilograms of CO_2e per year and for the entire lifetime usually exceeds 1,000 kg of CO_2e.

Thus, although these products have a high PCF, there are currently no major initiatives to footprint them and declare it on the product nor to label the appliances with a sticker showing a CO_2e number.

However, it can be assumed that indicating a product's PCF without some kind of scale of comparison would provide consumers with little useful information. Is a refrigerator that has a PCF of 3,000 kg (assuming a service life of 15 years) a good refrigerator or a poor refrigerator? A scale of comparison would have to be developed for electrical appliances, which would be similar to the existing energy efficiency system. A PCF label that indicates a specific CO_2 value would be of little use. It is conceivable that the energy efficiency label might also indicate average electricity consumption, the electricity consumption for important individual programmes when the appliance is in use, and the average PCF for electricity.

Environmental label

In addition to energy efficiency labelling, there are also national environmental labels for electrical appliances (such as the Blue Angel in Germany) or the European ecolabel (the Euro flower). The criteria for environmental labels usually set high requirements for energy use, but also for other environmental aspects (criteria for noise, water consumption, materials used, pollutants, radiation etc.). Environmental labels such as the Blue Angel reflect a comprehensive and integrated environmental assessment (not just an assessment of the PCF) and are therefore more informative and more useful than energy efficiency labelling. The PCF itself has not to date been shown on environmental labels, but this could easily be changed, as described above under the energy efficiency labelling scheme.

17 However, only direct CO_2 emissions are specified. Upstream processes are not included. That means that the PCF is underestimated by about 15 %.

Recommendation: For high-energy electrical appliances, the electricity consumption or performance values should be added to the energy efficiency label. The appliances should also be included in the environmental labelling scheme.

Low-energy electrical appliances
The situation here is similar to that of high-energy electrical appliances – with the key difference that the manufacturing phase may account for a higher share and the significance of other environmental aspects tends to be greater. This is a further argument in favour of an integrated environmental assessment and label.

In addition to absolute energy consumption, the potential for energy-saving can be very important. For example, a study of espresso machines showed a potential for energy-saving between average and best appliances of around 100 kWh per year – which is roughly equivalent to the difference between category A++ and A refrigerators.

Energy-saving products
Products such as insulation materials, socket strips or 20-degree laundry detergent can produce significant savings in the use phase and reduce the PCF of other products. The PCF of energy-saving products themselves is usually small and not so relevant. The methodology for assessing indirect savings is complex and difficult to relate directly to the energy-saving product, which is the reason that PAS 2050 rules out that kind of assessment.

To declare the PCF of energy-saving products without specifying the PCF-reduction effect would be pointless. The same is true for any possible CO_2e label.

However, energy-saving products often have an environmental label. This means that the global warming potential of the product itself and the savings effect have been taken into account, but also other environmental criteria such as pollutants (insulation materials, for example).

Technical products that consume no energy in the use phase
For these products several environmental aspects, not just energy used during manufacture, play an important role. This is an argument in favour of integrated environmental assessment and environmental labels and against isolated CO_2e labels. In view of the large number of products, it would be advisable to carry out a relevance check first.

Food
Challenges to data collection
Food's share in per-capita emissions is Germany in around 2.0 tonnes CO_2e or 20 %. Different figures emerge depending on how "food" is defined, i.e. whether drinks are included, whether eating out is included, with or without packaging, with or without refrigeration and cooking. However, this quite high figure is spread across thousands of different food products and hundreds of shopping trips. The PCF of individual food products ranges from a few dozen grams to several kilograms of CO_2e. Beef, for example, has very high values at around 13 kg of CO_2e per kilogram.

Ascertaining the PCF of food is usually complex and requires a great deal of time and money if specific (rather than generic) data are to be collected – which was the original idea of the Tesco initiative.

The reasons for the complexity of data are:

- very many farms of different sizes;
- frequent change of supplier;
- significant differences in the type of cultivation;
- annual and seasonal fluctuations in yield;
- many different processing technologies and companies;
- a wide spectrum of products, ranging from relatively simple ones such as apples or bananas through to more complex convenience foods;
- very different routes and modes of transport – from regional to global, from tractor to aeroplane;
- great influence – depending on the time involved - of storage and refrigeration;
- great number of different package sizes and types of packaging;
- different types of preparation and huge difference between convenience food and food cooked from scratch.

For these reasons, there can be significant fluctuations in the PCF values of food and sometimes considerable potential for reductions can be identified. It is therefore useful to ascertain the PCF of food products and use them to identify and act upon potential for optimisation in cultivation, processing, transport and storage. However, it is far more difficult for trading companies to continually specify the PCF of thousands of different food products in a way that is reliable under competition law and provides consumers with adequate comparative benchmarks.

The difficulty with ascertaining specific PCFs for food and labelling them with a CO_2e number can be illustrated even by a “simple” product – apples: the energy involved in producing and storing apples varies from farm to farm and can differ between large and small farms by a factor of 2 – 3. Transport distances can also vary enormously – fruit from Lake Constance is sold in that region but also in Kassel or Berlin. But the apples may also have been imported from New Zealand or Chile. The apples produced in Germany are stored under refrigeration into late spring. That means that their PCF increases from month to month.

To be able to specify the PCF of apples in a retail outlet with any degree of precision it would be necessary to know the production values of the farms, the distances the apples were transported, along with the mode of transport, and the type of refrigeration used and how long it was used for. They would all have to be calculated individually for each variety of apple sold. That is theoretically possible but very complicated and would have to be done not just for apples but for thousands of other products.

Furthermore, to enable consumers to adequately evaluate a specific PCF, rating systems for comparable products would have to be developed – like the ones that exist for electrical appliances –– with apples, for example, being rated in climate category A, B, C ... (if we really wanted to put all apples in a single overall category).

In view of these difficulties, it is obvious that in the foreseeable - and probably also in the more distant - future, no system is likely to evolve for routinely labelling the thousands of different food products in the retail outlets with the latest CO_2e value in a way that is reliable under competition law. The likelihood of developing ratings systems for each product is equally low.

Organic label
Furthermore, other environmental aspects play a major role in food: land consumption, conservation of soil fertility, water consumption, use of pesticides, harmful ingredients, additives. The organic label was developed for that very reason. By contrast, specifying a PCF in isolation does not provide consumers with adequate information. However, it would be conceivable to add the criterion of greenhouse gas potential to the organic label. Due to the difficulties named above, this would also present a considerable challenge.

Consumer information on environmental and climate relevance
An incomplete and unsystematic publication of CO_2e values without comparative benchmarks and without reference to other environmental aspects of food does NOT help to provide guidance for consumers, but is more likely to confuse them. Instead, life cycle assessments should be carried out for the most important groups of products from the point of view of the climate, in which all the relevant environmental aspects (average values and ranges) are ascertained. On this basis – if the data is robust – basic claims and options for action can be developed to provide information to consumers and answer typical questions:

- Do the life cycle assessments and climate relevance studies show that local apples or apples from abroad are better? Are organic apples from abroad better than local, non-organic apples? Are there local organic apples that have not been refrigerated? Which are the best apples from an environmental point of view? Is it true that producing and sterilising apple juice in smaller presses usually consumes a great deal more energy than using large presses?

- Is it a good idea to eat less meat from the point of view of health, the environment and the climate? Is it better for the climate to opt for chicken instead of other kinds of meat? Is organic meat also better than conventionally produced meat from the climate point of view?

- Does industrially produced frozen food have a worse impact on the climate than food freshly prepared at home? Or are there significant differences here, depending on the type of food and length of time it was in the freezer at home?

- How do different diets compare in terms of impact on the environment and climate? Is it true that including more dairy products in our diet cancels out eating less meat from the point of view of the climate?

The quality of consumer information on food would improve enormously if it were possible to answer these questions on the basis of life cycle assessments (verified by critical reviews). However, this too would be very complex, so that the groups of products to be studied should be prioritised in advance. When looking at the possibility of using additional information, not only technical feasibility considerations but also the extent to which consumers can take in and process information should be taken into account. Depending on the cognitive involvement (is it a question of everyday routines such as food, for example, or special investments as is the case with household appliances) consumers use different channels of information and have different motivation for seeking information, which means they must be addressed differently.

All of these considerations clearly argue in favour of keeping the environmental labels prescribed under ISO 14024 (Type 1) and the Blue Angel label. The advantages environmental labels have over labels that specify CO_2 values are summarised once more below. The arguments apply both to the Blue Angel and by extension to other national environmental labels and the European environmental label.

- reliable information for consumers that is easy to understand: the product that has an environmental label is better for the environment than comparable products;

- inclusion of all relevant environmental and health aspects;

- development of criteria on the basis of life cycle assessments and ecotoxicological assessments;

- subsequent discussion by an expert panel;

- final decision by a jury comprising representatives of relevant social groups;

- certified award and review of criteria for those products with environmental labels.

On the basis of knowledge and experience to date, the editors of this guide have come to the conclusion that a numerical PCF value is not an appropriate or reliable way of labelling products if the label is intended to be a tool for consumer communication.

For that reason, putting in place a CO_2 labelling scheme using a numerical value that allows comparison across products and is consistent with competition law is not conceivable in the foreseeable future. That is particularly true of food, which is currently the

main focus of the CO_2 label discussion, but it is also true of other consumer goods.

In practice, labels with carbon numbers mean very little to consumers because:

- they do not come with any comparative benchmark;
- the values do not translate into recommendations for action during the important use phase;
- the importance of other environmental aspects remains unclear;
- there is increasing confusion as a result of the huge number of environmental labels.

For these reasons, European consumer associations also reject labels that show CO_2 values.[18]

Studies have shown that PCFs do provide valuable information about the environmental friendliness of a group of products, but that it makes more sense to integrate them into seals of environmental quality or other recognised environmental labels (Type 1 under ISO 14024). Instead of introducing new labels with carbon numbers that provide only limited useful information, it would be better to produce consumer friendly communication by upgrading existing environmental labels – such as the Blue Angel. Environmental labels such as the Blue Angel are currently being extended to include more groups of products, so that there will be a basis for awarding a so-called "Climate Angel" for the 100 groups of products considered to be most important from the point of view of the climate.

However, above and beyond product labelling, the Product Carbon Footprint is seen as having potential for creating a workable basis for effective product communication to business partners and the end consumer. Particularly if other sustainability criteria for the products are also analysed and assessed, it will be possible to use them to develop messages for consumers that inform their choices and can make an appreciable contribution to moving towards more climate-friendly consumption patterns. An example of this can be seen in the recommendations about sustainable ways of washing laundry, which were developed jointly by manufacturers, consumer and environmental organisations and the Federal Environment Agency and have been successfully communicated in the past.[19] The editors therefore advocate working on credible forms of communication that go beyond product labelling, raise the awareness of people to the impact consumption has on the climate, and help to harness the reduction potential of products on the use side. We would urge interested businesses to launch initiatives in which business partners - in particular all stakeholders in the company in the field of environmental and consumer protection - are involved at an early stage, to ensure that the initiative's acceptance, credibility and effectiveness are increased.

18 ANEC, BEUC, ECOS, EEB: Joint Position – Sizing up product carbon footprinting, Brussels 2009.
19 Further information on the initiative to promote sustainable ways of washing laundry and dishwashing can be found at www.forum-waschen.de.

FUTURE PROSPECTS FOR THE PRODUCT CARBON FOOTPRINT

Over the next few years, the following activities should be carried out:

- rapid conclusion of the international standardisation process (as scheduled);
- scientific work on unresolved methodological issues and filling data gaps;
- perform further PCF analyses, taking into consideration the recommendations made in the Memorandum for PCFs during the transitional period;
- transparent documentation of PCFs accompanied by critical reviews;
- particular emphasis of ongoing reductions from the current levels, implementation and success checks;
- develop product category rules for particularly relevant products;
- identify and prioritise groups of products for which PCFs are a good indicator for assessing climate and environmental relevance;
- work on forms of communication other than labels to raise the awareness of people to the climate relevance of consumption and identify potential for reduction on the part of users.

GLOSSARY

Activity data
Activity data is all the quantities of materials, energy and transport services that are relevant as inputs and outputs throughout the life cycle of a product.

Allocation
Allocation is a procedure that is used when two or more products are involved in a process and the environmental costs or impacts have to be distributed across all the products. Examples of this are growing wheat (products: grain and straw); chlor-alkali electrolysis, which produces sodium hydroxide, chlorine and hydrogen; a heavy goods vehicle that transports several different products.

Blue Angel environmental label
The Blue Angel is a seal of approval and quality launched in 1978 by the Federal Minister of the Interior and the ministers of the Länder responsible for environmental protection at Federal state level. It is awarded by an independent jury (representatives of environmental and consumer associations, industry, the scientific community etc.) to environmentally friendly products that meet certain criteria. Since the end of 2008, the Blue Angel has been awarded in different categorises known as clusters that focus on the climate, water, resources and health.

Business-to-business (B2B)
This marketing term describes business relationships between two or more companies along the value chain.

Business-to-consumer (B2C)
Business-to-consumer describes all communication and trade interactions between companies and private individuals (end consumers).

Carbon Trust
The Carbon Trust is a not-for-profit organisation that was set up in 2001 by the UK government. It advises the private and public sector on strategies for reducing greenhouse gas emissions and promoting environmental technologies.

Co-product
If, during a chemical or technical agricultural process, two or more products are produced at the same time they are referred to as co-products (for example: sodium hydroxide, chlorine and hydrogen during chlor-alkali electrolysis).

Critical review
A critical review is an appraisal or comment on a life cycle assessment or PCF exercise performed by independent experts. For life cycle assessments to comply with ISO 14040, the critical review must be carried out in accordance with section 7.3.3 of the Standard.

Eco-efficiency analysis
The eco-efficiency of products describes the relationship between the environmental impact of a product or an alternative and the costs associated with it. By contrast with CO_2 efficiency or energy efficiency, several environmental impacts are viewed together, which means that the first step has to be to aggregate all the environmental impacts to a single value or unit of measurement, following a described assessment model.

Emission factor
An emission factor in product carbon footprinting is the amount of greenhouse gases emitted relative to the input material (e.g. petrol) used in a process. An example of this would be the greenhouse gas emissions associated with the oil used in a heat generation plant or an individual heating system.

Energy efficiency label
A product labelling scheme for electrical appliances introduced by the EU in 1998 provides information about the relative energy efficiency of products. Appliances are rated on a scale of energy efficiency (A+++, A++, A+, A, B, C ...).

Energy star
The Energy Star is a label awarded to energy-saving household appliances, electronic appliances and building products (such as windows or building materials). The Energy Star was developed by the U.S. Environmental Protection Agency (EPA), the U.S. Department of Energy (DOE) and manufacturers. Since 2001, the Energy Star scheme has also been used in the EU and is managed by the European Community Energy Star Board (EGESB).

Fairtrade label
The not-for-profit organisation TransFair, which was set up in 1992, awards the Fairtrade label to products (predominantly food) that meet the standards of the Fairtrade Labelling Organizations International (FLO). The standards establish criteria for improving the living and working conditions associated with products. To date, Fairtrade labels have been used mainly for agricultural and craft products and textiles.

Functional unit
A functional unit describes the use of the product under study and is the unit to which the results of the life cycle assessment or PCF refers (for example: packaging for 500 ml of bottled water; 1,000 kg of washed and dried household laundry; 100 km of car journeys).

Global warming potential (GWP)
Greenhouse gases (greenhouse gas emissions) are converted into carbon dioxide equivalents on the basis of their global warming potential (CO_2 equivalents) so that the impact of different greenhouse gases can be compared and calculated. Since carbon dioxide is the reference gas its global warming potential is 1.

Greenhouse gas emissions
Greenhouse gases are substances that contribute to the greenhouse effect. The most important and well known greenhouse gas is carbon dioxide. Other greenhouse gases

include methane and nitrous oxide. Gaseous substances in the atmosphere that contribute to the greenhouse effect are referred to as greenhouse gas emissions. The term greenhouse gas emissions refers to those gases for which the Intergovernmental Panel on Climate Change has ascertained a global warming potential.

Greenhouse Gas Protocol
The Greenhouse Gas Protocol (GHP) is a guideline for calculating greenhouse gas emissions, which is in widespread use in practice by businesses and organisations. The GHP was developed by the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD) in 1998. The GHP covers direct emissions caused by the company's core activities (Scope 1) and indirect emissions from purchased electricity, for example (Scope 2). Since 2008, the GHG Protocol has been extended to include purchased goods and services (Scope 3) and a product standard has been added (Product Accounting and Reporting Standard).

Intergovernmental Panel on Climate Change (IPCC)
The Intergovernmental Panel on Climate Change, which is based in Geneva, was set up in 1988 by the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO). It analyses the findings of scientific publications and assesses the consequences and risks of climate change. Every five years it produces an Assessment Report outlining the current position on global climate change.

International Reference Life Cycle Data System
The International Reference Life Cycle Data System (ILCD) is a database being developed for the European Commission. The ILCD will contain standardised and verified life cycle assessment datasets for selected materials and processes.

Life cycle assessment
A product life cycle assessment[20] measures and systematically analyses the ecological impacts of a product throughout its entire life cycle ("from the cradle to the grave"). That includes the environmental impacts (such as substances removed from the environment or emissions to the environment) during the production, use phase and disposal of the product and any upstream and downstream processes associated with it (e.g. production of the raw materials). The family of standards DIN EN ISO 14040 sets out general principles for conducting life cycle assessments.

Organic label
The organic label is a seal of approval certifying that products have been produced and processed in compliance with organic standards. An organic label certifies that the requirements of the European EU Organic Regulation No. 834/2007 have been met at the very least. Compliance is monitored by the relevant control body.

PCF Pilot Project Germany
The PCF Pilot Project was carried out by THEMA 1, the Öko-Institut (Institute for Applied Ecology) - Institute for Applied Ecology, WWF, and the Potsdam Institute for Climate

20 It is comparable, for example, with a life cycle assessment for a company, process or service.

Impact Research (PIK) in collaboration with companies in the manufacturing industry and commerce (www.pcf-project.de). Its aim is to gain practical experience with product carbon footprinting (assessing, reduction potential, communication) and support the development of internationally recognised methods. The first phase of the PCF Pilot Projects was completed in 2009 and the second phase began in 2010.

Primary data
In the context of life cycle assessments and PCFs, primary data refers to data that has been collected or measured directly and is specific to a company or process (e.g. emissions of solvents from a spray painting process). Data that is derived from primary data or aggregated is called secondary data (for example: average emissions from electricity generation in Germany).

Process map
A process map describes all the materials, activities and processes that belong to the individual life cycle phases of a product and will be included in the footprinting process.

Product Carbon Footprint (PCF)
Product Carbon Footprint describes the total amount of greenhouse gas emissions throughout the entire life cycle of product in a defined application and in relation to a defined functional unit (Draft ISO 14067 "Carbon Footprint of Products"). The PCF is an appropriate tool for identifying opportunities for reducing the greenhouse gas emissions of products throughout their entire life cycle.

Product category rules (PCRs)
Product category rules are a set of specific rules, requirements and guidelines for developing environmental declarations for one or more groups of products with the same functional unit. PCRs are a consistent, internationally accepted approach for describing the life cycle of a product.

Product sustainability analysis (PROSA)
PROSA is a method developed by the Öko-Institut (Institute for Applied Ecology) e. V. and tested on case studies for performing an integrated analysis and assessment of ecological, social and economic aspects of products, product portfolios and services (see www.PROSA.org).

Publicly Available Specification (PAS) 2050
PAS 2050: "Specification for the assessment of the life cycle greenhouse gas emissions of goods and services," was developed by BSI British Standards and co-sponsored by the UK Department for Environment, Food and Rural Affairs (Defra) and the Carbon Trust and published in October 2009. It provides a methodological basis for measuring Product Carbon Footprints and, apart from some specific modifications, is broadly based on the ISO 14040 life cycle assessment standard.

Scope
Scope describes the objective and framework within which a life cycle assessment or PCF exercise is carried out (cf. ISO 14040). It defines the categories of the greenhouse

gas emissions to be measured over a product's life cycle (direct, indirect, external) and describes which processes will be included in the study. The Greenhouse Gas Protocol differentiates three different scopes (Scope 1, 2, 3).

Secondary data
Secondary data in the context of a life cycle assessment or PCF is data that has been derived from primary data or aggregated from primary sources (for example: average emissions caused by electricity generation in Germany).

Social life cycle assessment of products
A social life cycle assessment for products (SLCA) analyses and evaluates the social impact of products throughout their entire life cycle.

Top runner approach
The top runner approach is a product policy that aims to facilitate market penetration for the most environmentally sound or resource and/or energy efficient technology. A range of tools are available to implement it. The top runner approach was first used - under this name at least - in Japan.

FURTHER READING AND USEFUL LINKS

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Links

www.blauer-engel.de
www.bsigroup.com/en/Standards-and-Publications/Industry-Sectors/Energy/PAS-2050/
www.energystar.gov
www.environdec.com (on product category rules)
www.forum-waschen.de
www.ghgprotocol.org
www.iso.org
www.pcf-project.de

"Mindful also of its responsibility toward future generations,
the state shall protect the natural foundations of life ..."

German Basic Law, Article 20a

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