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Emerging product carbon footprint standards and schemes and their possible trade impacts

Risø-R-Report

Simon Bolwig and Peter Gibbon
Risø-R-1719(EN)
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Abstract (max. 2000 char.):

Concern over climate change has stimulated interest in estimating the total amount of greenhouse gasses produced during the life-cycle of goods and services - i.e. during their production, transportation, sale, use and disposal. The outcome of these calculations is referred to as "product carbon footprints" (PCFs). The paper reviews the rationale, context, coverage and characteristics of emerging standards and certification schemes that estimate and designate PCFs, and discusses the possible impacts on trade, particularly exports from distant and developing countries. It draws on a survey of PCF certification schemes carried out during 2009, on a review of evolving international and national standards, and on a review of consumer surveys. Since 2007 one public standard, and two public and 14 private certification schemes referring to standards for calculating and communicating PCFs have become operational. Two new international standards and several new schemes, including three public ones, are due to become operational by 2011 or earlier. The private schemes are owned by a mixture of voluntary bodies and private companies, including some large retailers. Many provide assistance for reducing carbon footprints or procedures for certification or labelling. Nonetheless, to date only a few thousand products have been footprinted. As PCFs are already becoming market access requirements for bio-fuels imported to the EU, and may also become EU market access requirements for all mass-produced goods within 10-15 years, there is a danger that developing country exporters will lose out as a result. This is because: they are less likely to have the resources necessary for calculating and verifying PCFs; publicly available datasets are less likely to include processes carried out mainly in developing countries; and some existing standards do not currently include production of capital goods in their definition of product life cycles, which imparts a bias against labour-intensive production methods and hence against typical developing country exports. In contrast, PCF standards and schemes did not discriminate against products from distant countries, since emissions from long-distance transport were not treated differently from those generated by other activities in the product life cycle.

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Preface

This report is based on work done by the authors for the OECD Trade and Agriculture Directorate. However, OECD is in no way responsible for either the content or the conclusions. We thank Ron Steenblik, OECD Trade and Agriculture Directorate, for assisting us in carrying out this study, and the OECD for financial support.

1 Introduction

Concern over climate change has stimulated interest in estimating the total amount of greenhouse gasses (GHG) produced during the different stages in the “life cycle” of goods and services — i.e. their production, processing, transportation, sale, use and disposal (Brenton et al., 2009a; Øresund Food Network, 2008). In this paper we refer to the outcome of these calculations as product carbon footprints (PCFs), where “carbon footprint” is the total amount of GHGs produced for a given activity and “product” is a good or a service. PCFs are thus distinct from GHG assessments performed at the level of projects, corporations, corporate supply chains (or sections thereof), municipalities, nations or individuals.

A PCF like other GHG assessments is expressed in terms of its global warming potential (GWP). GWP embraces the impact of different GHGs (CO₂, N₂O, CH₄, O₃, etc.) on global warming and the GWP of all GHGs are expressed in terms of the impact on global warming of the equivalent weight (usually in grams or kilograms) of CO₂-equivalent (CO₂e).¹ After summing up all the GHGs produced at each stage in the life of the product, the PCF can then be expressed as grams or kilograms of CO₂e per unit of product. For example, the carbon footprint of a 330 ml can of Coca Cola that has been purchased, refrigerated, consumed and then recycled by a consumer in the UK is 170 g CO₂e.² We emphasize, however, that very different footprint values for the same product and country can be obtained, depending on the databases and calculation methods used (Kejun et al., 2008).

As this paper shows, a number of private certification schemes have emerged in the last couple of years that offer retailers and manufacturers methodology and expertise to footprint their products. In many cases they also provide assistance to reducing these footprints as well as procedures for certification and labelling against standards. These schemes are owned by a mixture of voluntary bodies and private companies, including some large retailers and branded manufacturers. In the absence of any dominant public standards for PCF, with the notable exception of standards and regulations pertaining to transport fuels, these schemes can be regarded as supplying *de facto* private standards. Through these schemes, retailers and manufacturers have calculated and sometimes displayed the carbon footprints on a few thousand products. In most cases these initiatives were not launched primarily to increase market share through product differentiation, but as part of a general effort to demonstrate commitment to climate-change mitigation to consumers and stakeholders.

Alongside these private initiatives, national governments, the European Commission, the International Organization for Standardization (ISO) and the World Resources Institute (WRI) have started initiatives to develop public or publicly-accessible PCF standards, but to date only one standard (the PAS 2050) has been published, and two public certification schemes (in New Zealand and the UK) have become operational. While none of these initiatives are regulatory in nature, the possibility of introducing mandatory carbon labelling of products in some form or another is increasingly being discussed, for example in France, while consumers in the EU generally support the idea (Gallup Organisation, 2009). Moreover, government authorities in several countries are supporting the development of private and voluntary public standards.

In view of the experience with other environmental standards, the recent proliferation of PCF standards initiatives and certification schemes raises a number of important questions: Are consumers asking for this information and how are they using it? Which standards and schemes exist and are being developed, and

1 This is because the GWP of 1 kg of a GHG varies between the different GHGs. For example, the impact of 1 kg of CH₄ (methane) on global warming is equivalent to 25 kg of CO₂.

2 Source: <http://www.cokecorporateresponsibility.co.uk/carbontrust/product-carbon-footprints.html>

by whom? What are their rationale, coverage, assessment criteria and methods, level of transparency, and other characteristics? Do these features disadvantage certain producers? What are the major methodological issues in PCF? What are the potential effects of PCF standards on international trade? Do they create market access barriers for producers in developing countries or in countries located far from major markets?

1.1 Aim and scope of the study

The aim of this paper is to provide an overview of existing and evolving PCF standards and certification schemes so as to help inform the discussion of research priorities, policy options and public investments in this area. The paper is limited to an analysis of the contexts, coverage, characteristics, and possible trade implications of PCF schemes as well as their general methodological basis. It does not attempt to assess their effectiveness in terms of costs and the cost-effectiveness of reducing GHG emissions, nor does it examine in detail the technical GHG assessment methodologies used by the schemes. Further research is needed to address these questions. Similarly, the paper examines the salient characteristics of public and international standards and standards initiatives, but without going into depth with the methodological issues (see Section 4).

This paper focuses on PCF standards and schemes for which the life-cycle assessment of individual products is the basis for making climate-related claims, including those on carbon emission reductions and carbon neutrality. It thus largely excludes discussion of schemes which certify companies as “carbon neutral” through the use of carbon off-sets and sometimes emission reduction commitments, and as part of this process allow these companies to designate their products as carbon neutral (Box 1).

The remainder of the paper is structured as follows: Section II briefly discusses the business and environmental rationales of PCF as well as the possible risks and biases. This is followed, in Section III, by a discussion of the methods used in product carbon footprinting, including a review of relevant ISO standards. Section IV discusses PCF standards initiatives taken by governments and international organisations. Based on a global survey of 12 private and two public PCF certification schemes carried out as part of this study, we then examine in Section V some salient characteristics of PCF as carried out in practice. This is followed by a section (VI) considering how consumers perceive and respond to PCF. A final section (VII) sums up the main findings of the paper, including those related to international trade, and concludes.

2 Why carbon footprinting?

Calculating the carbon footprint of products can be the basis for a range of actions undertaken by companies in response to policies and societal trends related to energy and climate change. The outcomes may be environmental or economic or both, and not always certain. Firstly, the provision of information to consumers about the climate impact of different products through labelling or other means such as leaflets and websites can influence purchasing decisions in a more climate-friendly direction, and at the same time be a way to differentiate one’s products from those of competitors. Surveys in several OECD countries suggest that consumers are increasingly interested in information about the climate impact of their consumption, and PCF is one way of responding to such an information demand. But consumer surveys also indicate that many other factors besides a low-carbon footprint determine what products end up in the shopping basket, and some think that consumers will not be able to understand let alone act on carbon labelling (see Section VI). On the other hand, changing consumption patterns in a low-carbon direction can have potentially large emission reduction effects. It has thus been estimated that the consumable goods and appliances that the average consumer in the UK buys and uses account for 20% of her total carbon

emissions (not counting the energy to run them), of which food and non-alcoholic drinks, at 9%, comprise the largest category (Carbon Trust, 2006).³

Box 1. Certifying a company as “carbon neutral” — an alternative to PCF?

A number of certification schemes have emerged recently to help companies or organizations become “carbon neutral”. Product assessments performed by these schemes do not necessarily consider the entire life-cycles of products, but tend to focus on the phases controlled by the company. Some certified “carbon neutral” companies nevertheless off-set emissions from activities carried out by other companies in the supply chain, sometimes covering the entire product life-cycle. These include, for example, some companies certified by Australia’s Greenhouse Friendly™ carbon neutral programme, such as the Cascade Brewery (and its Cascade Green beer). Similarly, the CarboNZero programme, in New Zealand, offers carbon neutral certification for a variety of scopes or levels, including organisation, product (covering the organisation and the product life cycle emission) and partial product (e.g. manufacturing). Already, CarboNZero has certified a taxi firm in Wellington as carbon neutral, as well as Christchurch airport and several companies. Certification in all cases requires GHG emission measurement, reduction commitments, off-setting and third-party verification. For example, the CarboNZero “organisation” and “product” certification obtained by New Zealand’s Yealands Estate Wines took account of emissions from the growing phase up to (i.e., excluding) retailing. In comparison, the “organisation” and “service” certification received by Ricoh NZ Ltd covers emissions resulting from the import, domestic distribution, maintenance and electricity consumption of photocopying machines, while excluding emissions from the manufacturing and disposal of these machines (www.carbonzero.co.nz/members/organisations_certified.asp)

Further research is needed assess to how the “carbon neutral” approaches compare with the kinds of PCF schemes described in this paper, in terms of methodological compatibility, consumer and retailer acceptance, cost effectiveness, emission reductions etc. Another question is how the various PCF schemes would treat the product of a company that has been certified as “carbon neutral”, especially in respect of labelling. In the case of the Carbon Footprint Label issued by the Carbon Label Company, its labels show the carbon footprint of the product *without* the impact of purchased offsets. Thus, if a company wants to claim a product is carbon neutral on a product displaying the Carbon Footprint Label, it first has to measure the footprint of the product. The only circumstance in which a zero result would be shown on the label is if the emissions arising from the life cycle of the product are zero — without the use of purchased offsets.

Second, product carbon footprinting can help companies reduce GHG emissions in a more informed and cost-effective manner by identifying the various emission sources within the company and its supply chain. The potential benefits of targeted GHG emission reduction efforts include significant energy-cost savings, a lower cost of compliance with current or future climate-change regulation, and an improved image among consumers, investors and regulators. Third, a product carbon footprint can also form the basis for reducing emissions elsewhere in the economy through off-setting the life-cycle emissions that cannot so easily be reduced.

Fourth, demonstrating the ability to measure and reduce product (and whole-company) carbon footprints can help inspire confidence in a company’s general performance and capability among key stakeholders –

3 The categories are: food and non-alcoholic drink; other personal effects; household appliances; furnishings and other household; clothing and footwear; alcohol and tobacco; and books and newspapers.

buyers, investors and lenders. Increasing investor confidence through carbon measurement and management activities is emphasised especially by company GHG reporting schemes such as the Carbon Disclosure Project but applies in principle also to product carbon footprinting activities. It is, however, unclear to what extent investment portfolio managers and financial analysts incorporate climate-change related factors into their company analyses and valuations. The only such assessment we have come across in relation to product carbon footprinting suggests that presently they do not consider these factors at all (Garz, n.d.). The same observer suggests a number of reasons for this, in particular the lack of comparable data, the fact that few buyers have implemented product-level GHG criteria for their procurement processes, and the current lack of materiality of the price of carbon emission rights (*Ibid*).

But product carbon footprinting could also have negative economic and social outcomes. If widely adopted, it could have significant cost and negative demand effects on producers and exporters in different parts of the world, including in developing countries (Edwards-Jones et al., 2008). Research on the governance of global value chains for food products shows that retailers and other “lead firms” located near consumers to a large extent define product quality standards and at the same time are able to push the cost of complying with these increasingly demanding standards (along with other performance requirements) down the supply chain to producers (Gibbon and Ponte, 2005). There is also a risk that PCF schemes and standards, if not carefully designed, may involve discriminatory practices that affect competitiveness and trade (Brenton et al., 2009a; Kasterine and Vanzetti, 2009). This is particularly clear where special emphasis is placed on transport, for example by using life-cycle analysis only for this part of the product life cycle, which of course will tend to favour domestic producers over more distant ones (Bolwig, 2008). On the other hand, the failure to account fully for transport emissions will disadvantage products of local origin. Finally, no analysis has been done to assess whether PCF is a more cost-effective way to reduce GHG emissions than other information-based instruments such as company GHG emission reporting, or how these approaches work in different economic and policy contexts.

3 Methodological issues in product carbon footprinting

3.1 Life Cycle Analysis and Environmental Input-Output analysis

Life Cycle Analysis or Assessment (LCA) is the basic method used in carbon footprinting. LCA “studies the environmental aspects and potential impacts throughout a product’s life cycle (i.e. cradle-to-grave) from raw material acquisition through production, use and disposal” (ISO, 2006). Several methodological issues related to LCA stand out in the present context. First, there is no single LCA method that is universally agreed upon and therefore no agreement on PCF calculation methods. Second, different definitions of the boundary of the LCA, in terms of which life cycle stages, emission sources and GHGs area considered, will produce very different results (Büsser et al., 2008). Sensitivity analysis is therefore of key importance. Third, there is a lack of comprehensive data for LCA, data reliability is questionable, and several data bases with different data specifications (e.g. in terms of reference units) are often needed to perform an LCA. Fourth, carbon footprints are rarely accompanied by detailed methodological accounts (or by the results of sensitivity analyses, if performed at all). They are therefore difficult to assess by third parties or to compare with the footprints of like products. Fifth, relatively few analysts have so far acquired the skills to carry out hybrid methods that combine environmental input-output with LCA, which are the best option for product-level GHG assessments, as discussed below. Sixth, the inherent complexity and lack of exactness of carbon footprint analyses contrasts with the need to communicate the results in a simple, clear and unambiguous way to consumers.

There is a vast literature on LCA methodology, which we cannot review here, including a dedicated journal, the *International Journal of Life Cycle Assessment*. The remainder of this section is based mainly

on Wiedmann and Minx (2007), who discuss the different (methodologies of) LCA-based approaches to calculating the carbon footprints of products or activities. They observe that the task of carbon footprinting can be approached from two different directions: bottom-up or top-down. Process Analysis (PA) is a bottom-up method, which has been developed to understand the environmental impacts of individual products (or processes) from “cradle to grave”. The bottom-up nature of PA-LCAs means that they suffer from a system boundary problem so that only on-site, mostly first-order impacts are considered. PA-based LCAs are also not suitable for the assessment of carbon footprints for entities such as households or industrial sectors (*Ibid*).

Environmental Input-Output (EIO) analysis is a top-down approach and provides an alternative to process-based LCAs (*Ibid*). Input-output tables are economic accounts representing all activities at the meso (sector) level. In combination with environmental data they can be used to estimate carbon footprints in a comprehensive and robust way, taking into account all higher-order impacts and setting the whole economic system as boundary. But environmental IO analysis is less suitable for assessing micro systems such as products, as it assumes homogeneity of prices, outputs and their carbon emissions at the sector level. A big advantage of IO-based approaches, however, is that they require much less time and labour to perform once the model is in place, than do bottom-up process-based approaches

These considerations lead Wiedmann and Minx (2007) to propose a hybrid-EIO-LCA approach to the assessment of micro systems such as individual products or services, which integrates the PA and IO methodologies. In this approach, on-site, first- and second-order process data on environmental impacts is collected for the product or service system under study, while higher-order requirements are covered by IO analysis, drawing on generalised tools, such as the Bottomline tool (www.bottomline3.co.uk). Yet they also observe that while such hybrid assessments are considered state-of-the art in economic ecological modelling, the literature and models are still relatively new and few are able to carry them out in practice. This situation is likely to improve fast in developed countries, but the capacity of most developing countries to carry out hybrid-EIO-LCA is likely to remain limited.

There is scant discussion in the PCF literature about the possible biases against developing countries imparted by using one type of methodology rather than another (a notable exception is Brenton et. al. 2009b). This revolves substantially around the issue of where system boundaries are set. Generally, the more direct and indirect inputs to the PCF that are considered, the fewer biases there should be against developing countries. Excluding for example emissions from the manufacture of capital goods used to produce footprinted products could impart a bias against labour-intensive industrial production systems. This discussion parallels that of the implications of excluding ‘other indirect’ or Scope 3 emissions from corporate footprints (see next section).

3.2 ISO environmental standards and carbon footprinting

Since 1997 the International Standards Organisation (ISO) has published a number of standards that are relevant to carbon footprinting.⁴ This process is ongoing: in 2008 the organization announced that its Technical Committee 207 had begun a work programme on carbon footprinting of products (ISO, 2008), as discussed below.

The first ISO standards in this area to be issued were the ISO 14040 series dealing with LCA, which describe the procedures that should be followed in conducting LCAs. They were consolidated into two revised standards in 2006, ISO 14040 and 14044, without substantial change. ISO 14040:2006 describes

4 ISO is a non-governmental organisation and is a federation of the national standards bodies of 161 countries and more than 500 international or regional liaison members.

the principles and framework for LCA including: definition of the goal and scope of the LCA, the life-cycle inventory analysis (LCI) phase, the life-cycle impact assessment (LCIA) phase, the life-cycle interpretation phase, reporting and critical review of the LCA, limitations of the LCA, the relationship between the LCA phases, and conditions for use of value choices and optional elements. The standard covers LCA studies and LCI studies. It does not describe the LCA technique in detail, nor does it specify methodologies for the individual phases of the LCA (ISO, 2006a). ISO 14044:2006 specifies requirements and provides guidelines for LCA including: definition of the goal and scope of the LCA, the LCI phase, the LCIA phase, the life cycle interpretation phase, reporting and critical review of the LCA, limitations of the LCA, relationship between the LCA phases, and conditions for use of value choices and optional elements (ISO, 2006b).

The PCF Pilot Project Germany used the ISO 14040 and 14044 standards as the methodological framework for calculating the PCF for 10 different food and non-food products (PCF Pilot Project Germany, 2009). The objectives of this project were, among others, to compile recommendations for developing and harmonising a transparent and scientifically sound PCF methodology and to make an active contribution to the international debate on the assessment and communication of PCFs (*Ibid*). A key conclusion from this exercise was that the ISO 14040/44 standard and further specifications provide a solid basis for calculating product carbon footprints, and that on this basis a comprehensive assessment of the climate-impact of products is possible, provided that all GHG emissions over the entire life cycle are accounted for. But the project also revealed the existence of a large number of methodological issues, leaving room for interpretation in the application of these methodologies to GHG assessments of products. Of particular importance, according to these case studies, are issues relating to direct and indirect land-use change, the use of renewable-energy-based grid electricity, recycling, and the calculation of emissions associated with a product's use (*Ibid*).

A second standard is ISO 14025 (2000) on "Environmental labels and Declarations – Type III Environmental Declarations". This recommends the functional unit approach in communication of LCA results — as opposed to reporting mass or volume, which are considered as insufficient to allow comparison. This group of standards was adopted against a background wherein several approaches to LCA had been developed over the previous two decades. There was a resulting danger that, as the method became more widely used, its results thus would be incommensurate and lack credibility.

ISO 14064 (2006-07) has a somewhat different focus. This group of standards is concerned not with the measurement of the overall environmental impact of the production, consumption and disposal of specific products or services over an unspecified time period, but with corporate and "project"-level GHG emissions within annual time frames. The initial motivation for this work was to create standards for comparing projects undertaken under the Clean Development Mechanism (CDM). The emergence of a number of emission "cap and trade" programmes or schemes, each with similar though different approaches to emission measurement and validation, also provides impetus for common international standards.⁵ These developments have the potential to create a huge global market in emission credits⁶ and to stimulate a substantial number of new and existing international offsetting mechanisms, including the CDM. In this context, these standards aim at facilitating a harmonized system for organisation- and project-level carbon accounting.

5 Under this concept, ceilings are established for total emissions by covered emitters. Emitters are then assigned some proportion of allowable emissions, and must then reduce their actual emissions to those assigned to them, or acquire offsets that will cover the difference. Offsets can be purchased on a special market from other regulated emitters who reduce their emissions over and above target, or acquired through arrangements with unregistered emitters, or earned through carbon sequestration.

6 The European Union already has an emissions trading scheme, and the United States is considering also adopting a "cap-and-trade" scheme. It is estimated that the US market alone will be worth USD 300 billion (Gray and Edens, 2008).

Although a Working Group that contained experts from 45 countries drew up IS 14064 over a four-year period, most of its elements appear to be derived from a single source, the Greenhouse Gas Protocol (hereafter GHG-P), launched in 1997 by the World Resources Institute and the World Business Council on Sustainable Development and revised in 2000 to include a corporate accounting and reporting protocol. Comparisons of the two standards (McGray, 2003; Spanangle, 2003) agree that their main differences are that (i) GHG-P, unlike ISO 14064, provides detailed guidance notes and calculation tools, while (ii) ISO 14064, unlike GHG-P, covers verification.

ISO 14064-1 deals with corporate GHG accounting while ISO 14064-2 deals with project accounting. ISO 14064-3 deals with validation and verification of GHG plans and accounts and ISO 14065 deals with the accreditation of bodies that carry out third party validation or verification.⁷ In all cases, the standards only lay down a series of managerial steps that shall be followed in planning, executing and monitoring activity. Specific actions to be taken at each step, for example the choice of methodologies for quantifying emissions or how to determine the skills of verifiers, remain at the discretion of the corporation or whatever regulatory authority manages a scheme. In this sense there is a strong resemblance to the ISO 14000 and ISO 9000 series of standards.

The standards have been criticized in some quarters for lack of prescription in what are construed as key areas. For example, with respect to corporate GHG accounting (ISO 14064-1), managers are required to identify the boundaries of the emissions that they will quantify. It is stated, that in doing so, they shall include direct emissions from activities of the corporation and indirect emissions from the generation of electricity consumed by the corporation (Scopes 1 and 2 respectively in the GHG-P) and that they shall “consider” the inclusion of other indirect emissions (the GHG-P’s Scope 3). The standard’s main objective here is to establish transparency in respect of what is being measured, rather than to require that all emissions be considered.⁸

Perhaps the part of ISO 14064 that will prove most relevant to whatever ISO standards are eventually developed for carbon footprinting are the provisions on verification in 14064-3. These state that a verification plan shall be formulated which sets out objectives, a data collection approach, a sampling plan, a schedule for performing tests, and a system for maintaining test records and other relevant documents.⁹ In respect of “objectives”, verifiers shall not only consider where to draw system boundaries (see above) but also be transparent as to whether they are requiring “reasonable” or only “limited” assurance. Finally there are a series of requirements concerning the competence and experience of verifiers. “Competences” are defined in terms of a list of suggested – but not mandatory – skills (rather than specific qualifications), while “experience” is defined in terms both of relevant work experience and attendance at training events and seminars. Examples of suggested skills include knowledge of legal rules, knowledge of the sector, knowledge of emission quantification, knowledge of monitoring methodologies, knowledge of GHG data auditing, and knowledge of risk assessment or verification techniques.

7 ISO 14064-3 uses the term validation in relation to project plans and verification in relation to claims about GHG emissions.

8 According to Braunschweig (n.d.) the standard here reflects a misleadingly narrow interpretation of managerial responsibility. “Typically, many organisational decision responsibilities are hidden in the ‘other indirect emissions’ category.”

9 “Process documentation” and “Communication and reporting documentation”.

4 PCF standards initiatives by governments and international organisations

The development of PCF standards by government agencies and international organisations has been lagging behind private standards development, but has gained considerable impetus during 2009. This section briefly examines these public and publicly-accessible standards and standard initiatives; they are all voluntary, with two notable exceptions: standards for transport fuels and a proposed French mandatory environmental labelling programme for “mass marketed” products that will include carbon footprint information.¹⁰ The review excludes the PCF Pilot Project (www.pcf-project.de) as it does not develop its own methodology, but provides inputs into other standard setting processes.

4.1 The PAS 2050 Standard

The first PCF standard with the ambition to cover a wide range of diverse products, PAS 2050, was published in October 2008 by the British Standards Institute (BSI). It is the most detailed and comprehensive publicly available PCF methodology to date, and is influencing private and international standard setting in this area; it therefore warrants special attention. PAS 2050 was written between June 2007 and October 2008 by BSI Standards Solutions together with the Carbon Trust (CT), and was co-sponsored by the CT and Defra (Department for Environment, Food and Rural Affairs).¹¹ The development of the standard was overseen by a steering committee and involved two stakeholder consultations, input from expert work groups, commissioned research, and insights from testing the draft standard with pilot companies (BSI, 2009). The PAS 2050 is a “Publicly Available Standard”, meaning that its development process and format is based on the British Standard model, but unlike a ‘full’ British Standard, it does not require full consensus between all stakeholders on technical content. This also means a shorter timescale for the development of a PAS (*Ibid*). The PAS 2050 is scheduled for revision in 2010. The standard is supported by two guides: one to support the calculation of specific PCFs in conformity with the PAS (Carbon Trust and BSI, 2008), and another to support the “robust communication” of PCFs (assessed in conformity with the PAS) and PCF reductions to stakeholders for organisations wishing to do so (Carbon Trust, 2008).

The PAS 2050 specifies requirements for the assessment of the life-cycle GHG emissions associated with the life cycle of goods and services (“products”), based on key life-cycle assessment techniques and principles. Requirements are specified for identifying the system boundary, the sources of GHG emissions that fall inside the system boundary, the data requirements for carrying out the analysis, and the calculation of the results. It includes all the six GHGs identified under the Kyoto protocol and covers the whole life cycle of products, including the use phase and emissions from direct land-use changes that have taken

10 We only review the largest and most developed initiatives for which information in English or French was accessible. One initiative not covered here is a report on “the use of climate labels on products” published in December 2008 by the Prime Minister’s Office in Finland, and prepared by the Finnish Environment Institute (SYKE). The report, only available in Finnish, assesses the strengths and weaknesses of various labels, and proposes a carbon footprint label prototype. The results of the report were used in the preparation of the Government’s Foresight Report on Long-Term Climate and Energy Policy, adopted 15 October 2009. Sources: www.environment.fi/default.asp?contentid=296331&lan=EN and www.vnk.fi/hankkeet/tulevaisuusellonteko/en.jsp.

11 The Carbon Trust is an independent company set up by the British government in 2001. It is funded by Defra, the Department for Business, Enterprise and Regulatory Reform, the Scottish Government, the Welsh Assembly Government and Invest Northern Ireland. Its mission is to accelerate the move to a low carbon economy, by working with organisations to reduce carbon emissions now and develop commercial low carbon technologies for the future. Source: www.carbontrust.co.uk.

place since 1990.¹² GHG emissions excluded from the assessment include those associated with: the production of capital goods, such as machinery, equipment and buildings, used in the life cycle of the product; the transport of employees to their workplace; human energy inputs; and animals providing transport services. Seen in isolation, not considering the former two emission sources imparts a bias against products from developing countries, where production is relatively labour-intensive and employees are more likely to use public or non-motorised means of transport to get to work, as it results in an artificial shrinkage of the footprint of goods produced in industrialised countries. Conversely, excluding the latter two sources creates a (likely much weaker) bias in favour of products from developing countries.¹³ All emissions arising from transportation during the product's and its raw materials' life cycle are included in the assessment. The two exceptions are an aircraft emissions uplift factor (due to uncertainty of its impact on global warming) and emissions from the production of the means of transportation (as these are "capital goods"). Altogether, the PAS 2050 methodology does not bias against products which are traded over long distances, nor does it disadvantage local producers.

Actual PCFs calculated in conformity with the PAS 2050 may still contain biases against some producers, even if they are not inherent to the standard. This is because the standard does not require the use of specific databases, aside from a set of data quality rules and a prioritisation of primary-activity data, and because of the lack of harmonised LCA data. The Carbon Label Company, a subsidiary of the Carbon Trust, tries to address this weakness by applying a set of additional proprietary data and comparability rules to the Carbon Reduction Label (see below). More generally, while the PAS 2050 remains the most comprehensive and detailed publicized PCF standard, experience with applying the standard to specific products reveal a number of unresolved methodological issues that leave room for interpretation and value judgement in standards application and make the comparison of PCFs difficult (Brenton et al., 2009b). These problems are related to the need to balance methodological rigour with feasibility and cost considerations as well as to data limitations and uncertainties.

4.2 The ISO Carbon Footprint of Products Standard

In late 2008, ISO initiated the "carbon footprint of products" standardisation project, ISO/WD 14067.¹⁴ The standard, ISO 14067, is intended to serve as an international agreed meta standard against which organisations can base the measurement, reporting and verification of GHGs from products. The standard is scheduled for publication in November 2011 and will most likely consist of two parts: ISO 16047-1 (quantifying the carbon footprint, and monitoring and tracking progress in product GHG mitigation), and ISO 16047-2 (harmonising methodologies for communicating the carbon footprint information). The standard will be based on the ISO 14000 series of standards for environmental management systems, especially ISO 14040 and 14044, as well as on the methodology for environmental declarations, ISO 14025.

The first draft of the standard was discussed in June 2009 at a meeting for the "ISO/TC 207/SC 7/WG 2 – GHG management in the value or supply chain" working group, which was attended by more than 70

12 The inclusion of indirect land use change will be considered in future revisions of the PAS 2050.

13 The treatment of emissions arising from capital goods will be considered further in future revisions of the PAS 2050. The reasons for not including them include current lack of carbon footprint data and the cost and complexity of the analysis (Carbon Trust, 2008). In a methods review in support of the PAS 2050, 15 out of 17 experts interviewed favoured inclusion of emissions associated with capital goods, in principle. Eight of these found that these emissions should always be included, while 7 thought that it should depend on whether the contribution is deemed significant (SEI and University of Minnesota, 2008).

14 Source: http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=43278

participants.¹⁵ The meeting addressed the large number of comments received from ISO members: 578 on Part 1 and 184 on Part 2. According to the Convenor of the said WG 2, this significant response demonstrates wide interest in the standard and foreshadows a significant uptake (Radunsky, 2009). Participants concurred that the standard will address communication from business-to-business as well as from business-to-consumers, including guidance on labelling. Quantification will address topics such as the electricity supply system, land-use change, soil carbon change, carbon storage, carbon capture, and carbon sequestration. ISO 14067 will also inform users about the limitations of PCFs (*Ibid*).

The ISO “carbon footprint of products” project will also address the issue of product category rules (PCRs). PCR are sets of specific rules, requirements, and guidelines for developing Type III environmental declarations for one or more product categories. These are dealt with in ISO 14025:2006 and are a prerequisite for a meaningful and reliable comparison of carbon footprints for different value chains and other purposes. It is expected that the consistency and comparability requirements of the ISO 14067 will require changes to existing PCRs (*Ibid*).

4.3 The WRI-WBCSD Product and Supply Chain GHG Accounting and Reporting Standard

The World Resources Institute (WRI) and the World Business Council on Sustainable Development (WBCSD), authors of the widely recognised and used GHG Protocol for project and corporate level GHG assessments, started to develop its *Product and Supply Chain GHG Accounting and Reporting Standard* in September 2008. This new standard will include guidelines on both product life-cycle accounting and calculation and reporting of corporate “Scope 3” emissions – i.e. corporations’ indirect emissions, other than those already counted under “Scope 2” emissions from the generation of bought-in energy.¹⁶ The development of these standards followed a survey of over 300 companies, experts and other stakeholders which showed a clear and urgent need for new guidelines on supply chain and life-cycle GHG accounting, particularly guidelines that were comprehensive and internationally accepted. The precise scope, objectives and development approach of the standard were established through consultations with a focus group representing standards bodies (including the Carbon Trust), companies, programmes, and, to a lesser extent, academic institutions.

The development of the standard is overseen by a steering committee, and supported by seven technical working groups (of which five for the Product standard) and an ‘open-access’ Stakeholder Advisory Group of more than 800 participants. Funders of this initiative include several large private corporations or their foundations, and the United States Agency for International Development, among others. The first review drafts of the complete standards – the Product Life Cycle Accounting and Reporting Standard and the Scope 3 Accounting and Reporting Standard – were published in November 2009 and discussed during the same month at stakeholder workshops held in the United States, Europe and China. The standards will then be tested during the first half of 2010 and a second draft produced for public comments in the 3rd Quarter of 2010, with expected publication of the final draft in December 2010. To avoid conflict of interest between standard design and implementation, the GHG Protocol will not develop a certification programme related to this standard. The convenors of the WRI-WBCSD standard initiative and those of the ISO 14067 described above have agreed to keep each other informed and to participate in all relevant meetings to avoid inconsistencies (Radunsky, 2009). Also, the authors of the PAS 2050 are involved in the development of both the WRI-WBCSD and ISO standards.

15 The very recent release of the first draft of the 14067 prevented a more detailed analysis of it by this study.

16 Source: <http://www.ghgprotocol.org/standards/product-and-supply-chain-standard>

The draft WRI-WBCSD Product Standard was published too late to be described in any detail by this study; however we note that in contrast to the PAS 2050:2008, but similarly to the Japan's Carbon Footprint System, the standard requires the inclusion of capital goods in the boundary of the product system (i.e. emissions from their production must be included) "if deemed significant for the studied product or product sector", using qualitative or quantitative indicators of significance (WRI and WBCSD, 2009).

4.4 Proposed mandatory carbon labelling in France

France has adopted the most ambitious approach to product carbon footprinting of any country.¹⁷ By 1 January 2011, the French Government plans to progressively mandate the display of environmental indications¹⁸ for particular categories of goods and, eventually, services sold in France. The project has been advancing rapidly due to a firm political will coming out of the *Grenelle de l'Environnement*, a public consultative process held in the summer of 2007 to help shape the country's future environmental policy, and to the efforts of all the interest groups involved. In particular, work on environmental indication is being carried out in three areas: (1) supporting private-sector initiatives to test environmental labelling; (2) providing shared references for developing a database to support the calculation of the carbon footprints or the environmental impacts of goods and services ("products"); and (3) developing a regulation of mass-marketed products is provided to consumers.

The *Grenelle de l'Environnement* process led to the preparation of two pieces of draft legislation: *Grenelle 1*, voted on 21 July 2009 and adopted 3 August 2009; and *Grenelle 2*, still in the proposal stage as of November 2009. While *Grenelle 1* is a framework law establishing the general principles of the government's environmental programme, *Grenelle 2* specifically establishes all necessary positive-law measures to implement it. France's legislature (*Assemblée Nationale* and *Senat*) aims to pass and adopt a final version of this legislation before the end of 2009; among the details that still need to be worked out is the number of products covered in the first phase of the policy's implementation.

Article 85 of the proposed legislation concerns environmental indications and introduces new measures into the French Consumer Code (*Code de la Consommation*):

- Consumers must be informed in a "suitable" manner of the carbon content of products and their packaging, as well as the consumption of natural resources or the environmental impact during their life cycles. The specific conditions of the implementation and measurement will be given for specific categories of products by decrees of the State Council.
- The State Council Decrees could define the requirements for accuracy, verification, and consideration of a product's life cycle in the development of environmental indications or using the term "sustainable development" or its synonyms in any form of marketing of the product.
- Providers of transport services (for people, goods, and relocation of goods) to inform consumers of their environmental impact; the method of providing such information will be laid down by decree.

The basic framework for the communication of the environmental impact of mass-marketed products (environmental indications) is outlined in "Repository of Good Practices" (BP X30-323) issued by the AFNOR-ADEME Workgroup in July 2008, with a revised version in September 2009 (AFNOR, 2009).

¹⁷ This section draws on Lucchini and Tran (2009).

¹⁸ France makes reference to environmental indications rather than labels so as not to exclude technical solutions which could indicate the environmental impact of products without using labels.

This was complemented in July 2009 by the adoption of a methodological annex to the “Repository of Good Practices”. The BP X30-323 specifies that the method for assessing the environmental impacts of products will be developed in accordance with the International Organization for Standardization’s standards for life-cycle assessment, ISO 14040 and ISO 14044, and the communication format for environmental indications will comply with the ISO 14020 series of standards. The outline summarizes the broad rules and requirements for the mandatory environmental indications, which include the principles of the communication format to the consumer, a standardized LCA method and public database, and other impacts, in addition to carbon emissions, should be included in a product’s indication.

4.5 Japan’s Carbon Footprint System

In 2009, the Japanese Government launched a programme to trial its new Carbon Footprint System (CFS), which aims at providing information on the emissions of GHGs produced over the life cycle of goods and services (products).¹⁹ The “Carbon Footprint Pilot Programme” (CFPP) was launched by the Ministry of Economy, Trade and Industry (METI) in co-operation with the Ministry of Agriculture, Forestry and Fisheries (MAFF), the Ministry of Environment (MOE) and Ministry of Land, Infrastructure, Transport and Tourism (MLIT). The Government expects that the scheme will encourage companies to compete for customers by reducing their carbon emissions, as well as change consumer behaviour.

While the government is a main programme manager of the CFS, during 2009 METI commissioned the Environmental Management Association for Industry (JEMAI) to serve as the organizing body of CFS during its trial period. JEMAI has expertise in LCA and environmental labelling (through implementing the Eco-Leaf System) and will provide expert support to companies who wish to participate in the CFS.²⁰ Prior to the launch of the CFS, 30 companies had calculated carbon footprints for a total of 54 products and put labels on them for display at the tenth Eco-Products 2008 Exhibition (Tokyo, 11-13 December 2008). The products covered 40 product groups and included potatoes, coffee, shirts, toothpaste, packaging, noodles and beer, among others. Some of them were sold with labels during a trial period between February and March 2009.

Participation in the CFS is voluntary and decoupled from any climate-related regulation. CFS is open to all products; regarding durable goods, Japan has implemented the Eco-Leaf system (equivalent to Environment Product Declaration in Europe) under the ISO-14025:2006 standard. Eco-Leaf is based on the LCA method and covers CO₂ emissions as well as other environmental impacts. Hence many of the 450 products (as of May 2009) certified to Eco-Leaf could relatively easily be integrated into CFS.

The methodology used by CFS is described in two sets of guidelines, published by METI on 3 March 2009. The first is the “Guidelines on the Carbon Footprint System”, which includes general rules for product carbon footprinting and rules for the communication of carbon information on labels and elsewhere. The calculation of PCFs under the scheme must include GHG emissions from the full product life-cycle, i.e. from raw materials to consumer use and disposal or recycling, using the LCA approach. Participating companies must also commit to reduce their GHG emissions, although no specific reduction targets are required. These guidelines also emphasise the need for mechanisms to verify the PCFs in order to ensure effectiveness and credibility, and to this end METI is considering establishing a third-party certification programme. The communication rules include a requirement that information displayed on labels should be precise and easy for consumers to understand, that a commonly agreed label design is used, and that the label as a minimum shows the total PCF of the product, expressed in grams, kilograms or tonnes of CO₂-equivalent. Detailed information about each stage of the product’s life-cycle must,

19 This section draws on Ikezuki (2009). Given that Japan’s Carbon Footprint System is in a constant state of flux, the information contained herein should be regarded as provisional.

20 Details on JEMAI are <http://www.jemai.or.jp/english/>

moreover, be made available to the public (e.g., published on the Internet), while the precise methods for doing so are still being discussed.

The second set of guidelines is the “Guide for Establishing Product Category Rules”. It concerns the development of rules for conducting life-cycle assessments for different product categories, which is a condition for the subsequent PCF assessment and labelling. One set of PCR rules concerns how to define the GHG-assessment system boundary; in this regard, it is stated that GHG emissions arising from capital goods should be included only where it is clear that their contribution to GHG emissions are high, e.g. in the case of processing machinery. Since the start of the CFS trial period, the Government has encouraged industries to develop PCRs for their respective product categories and to submit them to JEMAI for review and approval by a PCR committee organised by METI and related ministries. As of 21 October 2009, JEMAI had received such applications for 49 goods and services, including from the food and beverage, stationary, and containers and packaging sectors. Three of these PCRs – for Japonica rice, canola oil, and washing powder – have been approved so far.

4.6 Initiatives by the European Commission

In its conclusions on the Sustainable Production and Consumption Action Plan of July 2008, the Council of the European Union invited the European Commission to study the introduction of the carbon footprint of products in the existing EU environmental labelling instruments such as the Ecolabel and energy labelling; and, taking into account Member States’ experience, to start working as soon as possible on common voluntary methods to facilitate the future calculation of the carbon footprint of products and the establishment of carbon audits for organisations (EC, 2009). In response, the Commission is considering preparing a robust, reliable and EU harmonised PCF methodology towards the end of 2010, possibly followed by a policy option paper in 2011 (Misiga, 2009). Towards these ends, the Commission has planned a number of activities (*Ibid*; Makela, 2009).

First, given the different approaches used in existing PCF methodologies and initiatives, the Commission will prepare an analysis of these methodologies and initiatives as an input for considering options in the area of PCF. To this effect, in August 2009 the Commission invited tenders for a study on methods and initiatives relating to product carbon footprinting, to be carried out during the first half of 2010.²¹ The study will include analysis of existing and evolving initiatives and technical methodologies used in PCF, analysis of their environmental and economic risks and benefits, and the creation and analysis of different scenarios of application of product carbon footprinting (EC, 2009). Second, the Commission will co-ordinate and support the development of a publicly accessible carbon-footprint data reference system, as part of the continuous development of the existing framework of the European Reference Life Cycle Database (ELCD) and the International Reference Life Cycle Data System (ILCD). Third, a series of policy meetings will be held with Member States, starting in November 2009, and another series of technical meetings with stakeholders, starting in early 2010. Fourth, the European Commission’s Institute for the Environment and Sustainability (located in Ispra, Italy) will draft a technical paper based on the inputs from the Member States, stakeholders and studies.

4.7 Initiatives related to the carbon footprints of biofuels

In specific relation to transport fuels, several countries have enacted regulations for biofuels that include requirements relating to the biofuel’s PCF (see, for example, the Case Study on Sweden). In the United States, in April 2009 California adopted a Low Carbon Fuel Standard (LCFS) which from 2011 will require companies to lower the overall carbon intensity of their various fuels at a rate that will increase

21 A parallel study was commissioned on methods and initiatives relating to company GHG emission reporting.

every year until 2020, or else buy credits from companies that sell cleaner fuels.²² The aim of the LFCS is to reduce the average carbon intensity of transportation fuels used in California with an average 10% through incentivizing the use of lower-carbon intensity alternative fuels such as biofuels, compressed natural gas, hydrogen and electricity (ARB, 2009). The LFCS contains carbon intensity values for a variety of fuels, calculated by ARB staff through the use life cycle analyses.

These analyses have been subject to much discussion and lobbying activities from different interest groups. For example, the biofuels industry has contested the inclusion of (or claimed as exaggerated) emissions from land-use changes (including indirect land-use change) in the calculation of the carbon intensity of biofuels, and called for the consideration of emissions from indirect effects of fossil-fuel production such as road building for oil and gas projects.²³ The Brazilian Sugarcane Industry Association argued that the ARB failed to account for the improved fuel manufacturing and harvesting techniques in Brazil. The ARB will review the measurement of indirect land-use change in 2012.

Finally, the U.S. Federal Government and the European Commission also plan to make fulfillment of quota and access to tax credits, tax exemptions or subsidies contingent on the biofuels attaining a minimum improvement in life-cycle GHG emissions compared with the petroleum products for which they are sold as substitutes. Switzerland already applies such criteria.

22 Sources: www.arb.ca.gov/newsrel/nr042309b.htm

23 Source: www.scientificamerican.com/article.cfm?id=california-adopts-low-car&print=true.

5 Characteristics of PCF certification schemes

A review of documents and websites was carried out for this study, resulting in the identification of 34 schemes worldwide that take either a product or a supply-chain approach, or both, to carbon footprinting, as opposed to the more common company and project-level GHG assessments. The schemes are listed in Annex 2. From this list we were able to positively identify 16 schemes worldwide which have carried out carbon footprints for products (as opposed to for supply chains) and that are operational in the sense that at least one product carbon footprinted by the scheme is being retailed.²⁴ Of these we surveyed 14 schemes, while two schemes (Lantmännen Klimatdeklaration and Greenice) were excluded due to time constraints. The survey was carried out by the authors during March and April 2009. Data collection was assisted by a questionnaire, filled in by the scheme operator or by the authors through interviews with scheme staff, or by the authors based on a review of website documentation. The cases where website information alone was used were ones where scheme operators failed to respond to the questionnaire. The remainder of this section reports the results of the survey of 14 PCF schemes.

5.1 Background and context

Annex 1 lists the surveyed PCF schemes; all were launched during 2007 or 2008, though many have antecedents in the various life-cycle-based eco-labelling schemes that have been in existence since the late 1980s. These PCF schemes were typically developed over 1–1½ years, which is a short time when considering the many technical problems involved in PCF; most operators were thus still developing their methodologies as of April 2009. The surveyed schemes cover Canada, the EU, New Zealand, Switzerland and the United States. With the exception of the Carbon Label Company, all operate only in their home markets. Additional PCF schemes are also being developed in Australia, China, Japan, Korea, Sweden and Thailand.

Five of the schemes are operated by private not-for-profit organisations, two by private consultants, and two by public organisations in New Zealand and the United Kingdom. The remaining five are user-operated, proprietary schemes operated by, respectively, retailers, a bioethanol importer, and two clothing and footwear manufacturers (i.e. the companies themselves assess and label the products they manufacture or sell). External funds contributed to the establishment of at least six of the schemes, of which three received support from public environmental agencies in their respective countries.

5.2 Inclusion of additional sustainability criteria in product assessments

Eight schemes limit their product assessments to GHG emissions, while five include one or more other environmental criteria, including chemical use, resource consumption, use of organic production methods, recycling, distance travelled, or an indicator for “total environmental impact”. The former group are all operated by organisations specialising in climate change issues, while the latter are typically proprietary schemes of manufacturers or retailers, for which PCF is part of broader corporate social responsibility strategies, including corporate-level emission reductions. In one instance, the Verified Sustainable Ethanol Initiative, the PCF is combined with a range of environmental and social criteria, with the broader aims of “shifting the entire Brazilian ethanol industry towards more sustainable production” (against a background

24 Because they were not yet fully operational, the review did not include the ISO and GHG Protocol product-level standards discussed earlier as well as a number of country-level PCF schemes, including: Blaue Engel “CO₂ labelling of products and services” project (Germany), Climate Labelling for Food (Sweden), ICA pilot project (Sweden), the Japanese pilot Carbon Footprint System, Cool (CO₂) Label (Korea), Carbon Label Promotion Committee (Thailand). We also excluded from the review the overseas activities of the UK-based Carbon Reduction Company (including one in Australia set up in cooperation with Planet Ark).

of widespread critique of this industry) as well as of “expedit(ing) the development of international regulations for sustainable biofuels.”

Many of the users of the non-proprietary schemes evidently also applied PCF as part of a broader CSR strategy, but we did not collect detailed information on this aspect (the survey was carried out at the level of schemes rather than users). It is clear, however, that for companies such as Casino, Tesco and Patagonia, PCF was a minor part of their climate-change-related CSR activities.

5.3 Product type, volume and origin

Five schemes offer PCF for all goods and services, while the rest limit themselves to specific product types (food and drinks, clothes, footwear, and biofuel) according to the product specialisation of the scheme operator. It was not possible to make a complete inventory of all products certified by the 14 schemes. It is clear that, though agricultural value chains have received the most attention, PCF has by no means been limited to food and drinks, for which GHG LCAs are relatively simple, but has also been done for a diverse range of more complex manufactured goods (e.g. cell phones) and services (e.g. savings accounts), which are more demanding in terms of data and methods.

The largest scheme by far in terms of number of products is the Carbon Reduction Label, operated by the Carbon Label Company (part of Carbon Trust) in the UK, which since 2007 has certified around 2800 products, followed by Bilan CO₂ with 800 product categories, and Indice Carbone Casino with 160 products.²⁵ The 12 remaining schemes have together calculated the carbon footprint for around 200 products, ranging in number from 1 to 70. Not all these footprints have been publicized, however. For example, Climatop performed GHG LCA studies for 70 products in order to label 10 “carbon champions” within 9 product groups, while AB Agri GHG Modelling has not published the carbon footprints that were calculated for dairy products.

It was not possible to enumerate all users of the schemes. The Carbon Reduction Label is used by, for example, Coca Cola Great Britain, PepsiCo (Tropicana brand juices) and Continental Clothing, while a number of companies targeting or based in the German market, such as Voelkel GmbH (juice) and Platanera Rio Sixaola (bananas), have certified products to the Stop Climate Change standard.²⁶ In the United States, Certified CarbonFree has certified a total of 44 products for, among others, Motorola (cell phone), Monarch Beverages (energy drinks), Tandus (carpeting) and GBS Enterprises (mattresses).

The small numbers of products that have been footprinted to date reflect the youthfulness of the schemes, the costs and technical challenges involved in PCF, and continued uncertainty among users about the benefits of PCF (see below). Thus most users have only footprinted a small share of their product range, and often on a pilot basis. For example, the French retailer Casino has labelled only 160 out of a planned 3000 own-brand staple food and drink products under its Indice Carbone Casino scheme (although this represents a significant increase from the 33 products labelled in 2008) (Groupe Casino, 2009); the UK retailer Tesco is selling 100 footprinted products on a pilot basis using the Carbon Reduction Label (up from 20 in April 2008);²⁷ while 10 products sold by Migros, the largest retailer in Switzerland, have received the Approved by Climatop label. At the other end of the scale, Marshalls (UK) has published the footprints of all its 503 domestic landscaping products, using the Carbon Reduction Label. In general,

25 The footprints calculated by the Bilan CO₂ scheme relied on secondary data sources and were designed to compare PCFs across product categories rather than across competing producers of similar products.

26 A list of products certified to the Carbon Reduction Label can be found at <http://www.carbon-label.com/business/productdirectory.htm>; companies certified to Stop Climate Change are listed at <http://www.stop-climate-change.de/en/Mitglieder.htm>; and products certified by Climatop are displayed at <http://www.climatop.ch/index.php?l=d&p=products>.

27 Source: www.tescopl.com/plc/media/pr/pr2009/2009-05-01/

when comparing the numbers of footprinted products today with earlier statements made by users it is clear that many have fallen short of their initial targets.

Nine schemes offer carbon footprinting for all products irrespective of their country of origin, while four schemes only assess domestically produced products. One scheme (for fuel ethanol) only applies to producers in Brazil. Hence no strong bias against imported products was found in terms of this factor.

5.4 Carbon footprinting approaches and methods

Poor access to technical documentation, as far it exists, as well as the limited scope of this study, prevents a comprehensive comparison of the scope and methodological rigour of the PCFs performed by the schemes. In lieu of a full technical evaluation, we discuss key aspects of the approaches and methods used by the schemes for PCF calculations, display of carbon information and conformity assessment.

5.4.1 Publication of methods and assessment results

Regarding the transparency of the assessments, five schemes – Climate Conscious Carbon Label, Stop Climate Change, Certified CarbonFree, Carbon Connect and Verified Sustainable Ethanol Initiative use a written document (standard or description of methodology) published on their websites to guide the product-level GHG emission assessments, though the quality and completeness of this type of documentation differs greatly. Three schemes, AB Agri Modelling, CarboNZero and Carbon Reduction Label use the PAS 2050 standard, but only the latter scheme describes the standard and provides a link to it. The website of CarboNZero mainly refers to the GHG Protocol and ISO 14064 and 14065 standards, and to its own Guiding Principles, while in one place stating that the “measurement of emissions is consistent with the new PAS 2050 standard for measuring the life cycle greenhouse gas emissions of goods and services”.²⁸ None of the individual assessment reports make reference to PAS 2050. AB Agri Modelling writes that its methodology (greenhouse gas model) has been certified by the Carbon Trust, without specifying what this entails. Approved by Climatop does not publish its methodology, but chooses instead to publish the results of the product assessments as well as the peer review reports of these. CarboNZero and Climate Conscious Carbon Label use both a published standard as well as published assessment reports.²⁹ This does not necessarily mean that the remaining 6 schemes apply less rigorous or comprehensive methodologies, only that these are less accessible to the public.

5.4.2 Use of recognised standards for life-cycle analysis

All schemes relied on life-cycle analysis (LCA) for PCF calculations. The measurement methodology of most schemes related, in one way or another, to recognised international or national standards for LCA-based GHG accounting. Seven schemes referred to the ISO 14044, ISO 14064 or the WRI-WBCSD GHG Protocol, without necessarily following these to the letter. Two schemes were certified to PAS 2050 of the British Standards Institute, which “builds on existing methods established through BS EN ISO 14040 and BS EN ISO 14044 by specifying requirements for the assessment of the life cycle GHG emissions of products” (www.bsigroup.com). The PAS 2050 is also the standard used by CarboNZero to certify products under the Certified Emissions Measurement Scheme (CEMS), while a fourth scheme will use PAS 2050 for the further development of its methodology. Indice Carbone Casino builds on ADEME’s *Bilan Carbone* methodology for corporate GHG accounting, which also follows ISO 14064 in several respects (ADEME, 2007, p.85).

28 Source: www.carbonzero.co.nz/steps/market.asp

29 The Climate Conscious Label has produced detailed assessment reports for the first of its footprinted products (The Climate Conservancy, 2008 and 2009). CarboNZero has published assessment summaries for each of the certified organisations, but these do not report PCF values.

As discussed above, it is noteworthy that both the *Bilan Carbone* and the ISO standards are concerned with corporate or project-level GHG emissions, or both, rather than product-level ones. Moreover, ISO 14064 is mainly concerned with the transparency and management of GHG accounting and so it does not specify which methods to use for quantifying emissions or which emission sources or greenhouse gasses to include. The PAS 2050 standard, on the other hand, is specifically designed for product-level GHG accounting and has very detailed methodological specifications.

5.4.3 Scope of GHG emission assessments

Regarding the scope of the PCFs, 12 schemes claim to include GHG emissions from all stages in the product life cycle in the footprint calculation, while one scheme focuses on the production stage and one lets the scope depend on the client's preferences. However, "all stages" clearly mean different things to the different schemes. As noted above, emissions from the production of capital goods is omitted in the otherwise comprehensive PAS 2050 methodology used by the Carbon Reduction Label, while the similarly ambitious Stop Climate Change methodology includes this source but chooses to disregard the "transport of the product to the consumer's house" stage. But most schemes were less explicit about how they set the boundaries of their GHG assessments, preventing a meaningful comparison across schemes, and some claimed not to have omitted any stages in the life cycle in their calculations — although this is clearly almost impossible in practice. A lack of consistent and transparent boundary setting obviously constrains the assessment and comparison of the carbon footprints of different products, especially among products footprinted by different schemes. For example, including the domestic use phase significantly affects the footprint of coffee; the brewing stage thus accounts for about 70% of the total CO₂e emissions from a cup of black coffee and considerably more if the user does not behave in an economic way when brewing (Büsser et al., 2008). Another important methodological choice is which GHGs to include in the assessments. This question was not explored in detail by the survey, but most schemes appear to include all the major GHGs.

5.4.4 Data sources and quality

A key aspect affecting the validity of a PCF is data quality. An indicator for good data quality is the use of primary activity data in the calculation of energy and raw material use at the different stages in a product's life cycle, in addition to secondary data sources (from data bases and literature). All schemes except Bilan CO₂ claim to use both types of data sources, and cite a number of European and US LCA databases, but it was beyond the scope of this study to assess the "appropriateness" of the choice of data sources in each case. A few of the publicised standards used by the schemes are explicit on the use of primary and secondary data. For example, the PAS 2050:2008 states that "primary activity data shall be collected from those processes owned, operated or controlled by the organization implementing the PAS. The primary activity data shall not apply to downstream emission sources" (p. 17). The CarbonCounted Standard 1.2 is more flexible, stating that "Initially, we will use an 80/20 practical approach to determining the footprint. If some data is not available, we should state this and provide a reasonable estimate for its contribution" (item 2.10). Going a step further, the Carbon Label Company applies a set of proprietary data and comparability rules to the PAS 2050, to ensure that consumers can compare similar products and services against one another, to the standard required for the Carbon Reduction Label.

5.4.5 Scheme scope and kinds of certification offered

Besides the calculation of PCFs, ten schemes require meeting one or more additional climate-change related criteria. The most common is a commitment to reduce the overall carbon footprint at either the product or corporate level. The proprietary schemes operated by Timberland, Patagonia and Casino France all include reduction commitments at the corporate level, although these are often stated in a very general way. Common to these schemes is also that PCF seems to be (still) a minor element in their climate-related CSR activities. Commitments to reducing PCF over a specified time period are embodied in five schemes.

Two schemes use economic incentives to encourage – rather than require – such reductions. One, Certified CarbonFree, offers financial incentives for users who can prove reductions of more than 10% per year. In the other, Approved by Climatop, a product is certified as a “carbon champion” if its carbon footprint is 20% or below than that of 6 – 7 like products (within a given category) with which it is compared. Because certification must be renewed every two years, comparison between products in this scheme allegedly encourages producers to reduce their emissions.³⁰

Second, product endorsement in two schemes requires the footprint to be lower than a “baseline” value: In the Verified Sustainable Ethanol Initiative, the “field-to-wheel” emissions of the ethanol has to be 85% lower than the “well-to-wheel” emissions from petrol, while Approved by Climatop only certifies a few “carbon champions” within each product category, as just mentioned.

Third, two schemes — Certified CarbonFree and Stop Climate Change — require carbon neutrality at product level to be achieved through carbon offsetting. The latter scheme has formulated detailed minimum standards for projects that qualify as offsets, while the former is silent on this aspect. A third scheme, CarboNZero, offers a “certified product” certification mark to companies that have also been certified “carbon neutral” at the organisational level, on the condition that claims about the scope of the product’s life-cycle assessment are consistent with the boundary of the organisation that has been off-set. This rather stringent requirement is related to the scheme’s historical focus on carbon neutrality for organisations and projects through emission reductions and off-sets.

Altogether, the surveyed schemes show great variation in the actual content of their requirements. It is not possible to judge from this overview which general approach is “better” from a climate-change perspective; rather the diversity found points to opportunities for cross-learning and the need for work to identify best practices suitable for different kinds of operators, users and countries. This level of diversity is not unusual during the first few years when standards emerge in a new area. Later diversity may become reduced through natural selection and pressures for harmonization.

5.4.6 Does the transportation stage get special treatment?

GHG emissions from the transportation of goods across long distances have been the subject of much debate in recent years, and in this context some retailers, standard-setting bodies and Northern farmer advocacy groups launched various initiatives to measure, label, restrict or “green” the transportation of especially food (Bolwig, 2008; AEA, 2005, Kasterine and Vanzetti, 2008).³¹ The authors have argued elsewhere (Gibbon and Bolwig, 2007; Bolwig, op.cit;) that a narrow focus on emissions from transportation, as opposed to considering all stages in the product life cycle, may discriminate against exporting nations, especially poor countries that are often located distant from OECD markets and moreover typically have less access to high-volume shipping systems that are usually more energy efficient.³² At the same time, a number of LCA studies show that favouring locally produced goods does

30 Comparing the carbon footprint with that of like products is an option in the display or labelling technology offered by at least two other schemes – the Carbon Reduction Label and the Climate Conscious Label. It is unclear if displaying such comparative information is meant to directly incentivise users to reduce product footprints, rather than indirectly through consumer behaviour.

31 An example is Wal-Mart’s “Food Miles Calculator, which allows our buyers to enter information on each supplier and product, determine product pickup locations and select which of our 38 food distribution centres the product will reach. With this information, the calculator computes the total food miles, which the buyer can use when making buying decisions.” (Source: http://instoresnow.walmart.com/food-article_ektid44214.aspx).

32 For example, the capacities of container ships serving West Africa range between 2,000 and 3,000 containers, while those landing at the major ports in the EU, the US and East Asia have a tonnage from 8,000 to 12,000 containers (personal communication with Morten Nielsen, SAFE Shipping). Moreover, the low level of development of rail transport in many developing regions, especially in Africa, means higher dependence on road transport, which is less

not guarantee a reduction in GHG emissions. This is due to the fact that producers in distant locations may be more carbon efficient than those nearby, and that this gain may outweigh the higher emissions from transportation (Edwards-Jones et al., 2008). It has also been observed that the mode of transport — sea, air, road, rail — as well as the transport technology used within each mode can significantly influence the size of a PCF (Michaelowa and Krause, 2000). In this regard, the relatively high carbon efficiency of sea freight can in some cases be an advantage for distant producers. For example, transporting broccoli 12,000 kilometres by boat from Ecuador to the Netherlands (en route to Sweden, the remaining distance being covered by truck) produces only 40% of the emissions of trucking broccoli 3,200 kilometres across Europe from Spain to Sweden, resulting in similar footprints for the two product origins (Angervall et al., 2006).

All surveyed schemes except Green Index rating³³ include the transport stage in the calculation of the PCF, up to at least the stage of wholesale and in most cases up to the retail outlet, while some also include transport to the consumer's house. Assuming that the calculation methods in these cases also take account of the different modes of transport used (which is relatively easy to do), this suggests that the schemes at least do not under-estimate emissions from transportation or disregard especially climate-unfriendly modes of transportation such as air freight and diesel-based trucking.³⁴ The survey also asked whether a scheme placed special emphasis on transport-related GHG emissions. Only two schemes, appears to do this. The first, Patagonia's footprint chronicles displays information on the website on the distance (in km) travelled by the product from the stage of raw material to garment delivery at the company's Nevada distribution centre. It is noteworthy that a draft version of the Indice Carbone Casino label highlighted, as the only source, GHG emissions from transport, while the version finally used shows emissions from all stages in the life cycle.³⁵

The second, Bilan CO₂, highlights transport emissions indirectly by encouraging consumers to buy fruits and vegetables that are "in season" and products that are "locally" cultivated or manufactured.³⁶ The scheme argues that failing to do so will contribute to global warming through increased emissions from heated greenhouses or from the transportation of goods from distant countries, further stating that "when a product is cultivated or manufactured close to where I buy it, its CO₂ balance is more moderate" (authors' translation from French).³⁷ No mention is made of the fact that buying produce in season will also reduce emissions from storage activities.

We can thus conclude from this that, with a few exceptions, the design and methods adopted by the schemes generally do not discriminate against products originating in distant countries. We underline, however, that the users of the schemes themselves may still decide to focus on reducing emissions from

carbon efficient. Africa also has a relatively large proportion of land-locked regions. Finally, less reliable and more expensive sea freight systems in poor countries, combined with sometimes low and variable export volumes, mean higher dependence on air freight for certain products, especially fresh produce (Gibbon and Bolwig, 2007).

33 A second scheme, AB Agri GHG Modelling, does not consider emissions from the wholesale and retail distribution of the product (dairy) because the scheme is focused at the farm level.

34 It was outside the scope of the study to qualify this statement through examining possible biases caused by the choice of emission factors for different transport modes or the accuracy with which distance travelled with different determined transport modes and technologies is determined in each case.

35 This development is mirrored in the evolution of the KRAV Climate Labelling for Food standard (Gibbon, 2009).

36 To guide consumers, a table is provided listing the "harvesting and consumption" seasons of a range of fruits and vegetables. The list, apparently sourced from the website of L'Association Consodurable (www.consodurable.org; reference to the table: http://consodurable.org/faq_detail.php?id=12), contains several products such as peaches and oranges that are not grown in the area of the scheme (Nord-de-Calais in Northern France), suggesting that "local" in this case refers to France or Europe as a whole (curiously, it also lists Kiwi fruits in season from January to March). Source: www.jeconomisemaplanete.fr/achats.html, accessed 02-22-09.

37 Source: www.jeconomisemaplanete.fr/achats.html, accessed 02-22-09.

transportation through other initiatives, which may disadvantage certain exporting nations. For example, in 2008, Tesco “continued to use [their] ‘By Air’ sticker in the UK to identify airfreighted products and achieved [their] target of limiting airfreighted produce to under 1% of the products [they] sell, with a bias towards products from developing countries.”³⁸ These stickers were eventually removed, in 2009.

5.4.7 Conformity assessment

In ten of the schemes examined, the product GHG assessments are carried out by the scheme operator’s own staff or by external consultants hired by the operator, while in four schemes these calculations were done by the user (client) independently of with the assistance of an external consultant. The schemes can be divided according firstly, to whether any independent verification is (required to be) performed of these calculations, and secondly who is supposed to perform this verification where it is required.

No independent verification is performed of GHG assessments in four schemes, i.e. in the proprietary Footprint Chronicle, Green Index Rating and Indice Carbone Casino schemes, and in the Climate Conscious Carbon Label (although it is planning to do so in the future). That said, the general methodology of Indice Carbone Casino has been validated by a public agency (ADEME), while Casino sometimes audits the information given by its suppliers. Nor does there seem to be an independent stage of verification in the Carbon Connect, Certified CarbonFree and Verified Sustainable Ethanol Initiative schemes, although in all three of these cases calculations have to be performed by consultants or companies independent of the standard setter and specified in a list.

A system of independent (third-party) verification, i.e., one where consultants or companies independent of those making the calculations perform a check of these calculations, is required in seven schemes, i.e. AB Agri GHG Modelling, Approved by Climatop, Bilan CO₂, Carbon Reduction Label, Carbonlabels.org, CarboNZero, and Stop Climate Change.

Systems of accrediting consultants or companies qualified to carry out both original calculations and verifications of them generally lack transparency. In the case of Bilan CO₂, Stop Climate Change and the Verified Sustainable Ethanol Initiative approved consultants or companies are ISO 14065 accredited, although in neither case is it clear that this is a requirement.

5.5 Costs of life-cycle analyses and certification

GHG life-cycle assessments are generally believed to be very expensive to perform, but little reliable information exists on this important issue. The survey therefore asked scheme operators to estimate the cost of calculating the footprint of one product. We received comprehensive answers from only three schemes. The first one observed that LCAs for “typical” agricultural products cost between €2 500 and €6 000 to perform, depending on the size of the company. The annual adjustments of the LCAs cost considerably less. According to the experience of the second scheme, which certifies both food and manufactured products, LCAs cost USD 5 000–USD 15 000 but can cost as much as USD 70 000 or more, depending on the complexity of the product and its supply chain. The third scheme said costs range from USD 5 000—USD 10 000 depending on the complexity of the value chain. One scheme operator also observed that calculating the footprint of the first products in a given category, or for a given company and supply chain, naturally is more expensive than subsequent ones, as the client (and the scheme operator) is progressing along a learning curve. In this regard, the costs of future assessments and audits can be

38 Source:

http://www.tescopl.com/plc/corporate_responsibility/caring_environment/climate_change/empowering_customers/carbon_labelling/

lowered by building the LCA data models in a modular way, which would allow for future flexibility in calculations and the inclusion of new data.

The survey did not systematically ask about the cost of verification, but some information was nevertheless obtained. In one scheme certification costs between €1 500 and €5 000 per product, while another observed that the annual certification of the PCFs costs typically USD 100-USD 250 for small to medium-sized businesses where this only requires a documentary review, and USD 1 000-USD 5 000 for larger businesses that require on-site audits. The above brief discussion suggests the need for further research into the costs of compliance and certification to PCF standards.

5.6 Communication of product carbon information

The survey revealed great variation in the way the schemes and its users chose to communicate through text and graphics the product carbon information related to the certification. All schemes offer a carbon label or mark as a proof of certification, often in the form of a seal carrying a logo and the name of the scheme or the organisation operating it (Annex 4 shows some examples). In eight schemes, the label also shows the actual value of the PCF, expressed in CO₂e per unit of product. One of these, Bilan CO₂, displays the PCF on the price label on the product shelves as well as the total carbon emissions of the purchase on the sales receipt, allowing the customer to place the latter figure on a scale illustrating the average emissions from in-store purchases for different family sizes. In one case — the Green Index rating — the footprint is placed on a scale from 1 to 10 (where 1 denotes <2.5 kg and 10 denotes >100 kg per pair of shoe). Two schemes show both the CO₂e value and its position on a scale. Some of the labels display additional information relating to the certification on the packaging; for example, the Carbon Reduction Label reads “we have committed to reduce this carbon footprint” while the Indice Carbone Casino label states that “Casino s’engage pour l’environnement en collaboration avec ses fournisseurs pour réduire ses émissions de gaz à effet de serre” (“Casino works for the environment in collaboration with its suppliers to reduce its GHG emissions”). Both these labels also carry a brief explanation of what a PCF is. Other labels for display on packaging carry simpler but not less powerful messages, such as “certified carbon free” (Certified CarbonFree), “climate friendly” (Stop Climate Change) or “verified sustainable” (Verified Sustainable Ethanol Initiative). In most cases, the more complex information associated with the certification is displayed on websites (see URLs in Annex 2) and in cases such as Bilan CO₂ also in the store. A few users choose not to publicise any specific carbon information, such as Sainsbury’s Dairy Development Group applying the AB Agri Greenhouse Gas Modelling scheme, instead using it for internal purposes only.

6 Consumer perceptions of and reactions to product carbon footprinting

In April 2009, The Gallup Organisation conducted a survey on “European attitudes towards the issue of sustainable consumption and production” (Gallup Organisation, 2009) at the request of the European Commission. The survey interviewed 26 500 randomly-selected citizens, aged 15 and over, in the 27 EU Member States and Croatia, via telephone. The results of the survey are reported at the level of the EU and the individual Member States; we report here key results of relevance to this paper, mainly at the EU level.

Eighty-four percent of EU citizens said that the product’s impact on the environment is “very important” or “rather important” when making purchasing decisions. This puts the environment in a third place among the product attributes that consumers say influence their purchasing decisions, after quality (97%) and price (87%), and before brand name (39%). Regarding electricity or fuel consuming products, 77% of respondents said they always or often take energy efficiency into account when buying these products.

Some 47% of EU citizens said that eco-labelling plays an important role in their purchasing decisions, while 26% said they never read labels.³⁹ Regarding the kind of information that ecolabels should present, then 38% of the respondents found that the most important information was whether the product can be recycled or reused, while 32% said that it should confirm that the “product comes from environmentally-friendly sources”. Only 10% said that the carbon footprint (“total amount of GHG emissions created by the product”) was the most important information that an ecolabel should contain.

Strong support for product carbon labelling was nevertheless identified. Hence, 72% of EU citizens thought that a label indicating a product’s carbon footprint should be mandatory in the future, ranging from 90% in Greece and Croatia to 47% in the Czech Republic. In France, 78% of respondents were in favour of mandatory product carbon labelling, and in the UK this figure was 80%. Fifteen per cent said that such labelling should be voluntary, and only 8% expressed no interest in a product’s carbon footprint (this figure was above 10% in only 9 Member States). Interestingly, there was also support for mandatory product carbon labelling among those who said they never read labels (63%), while this support was higher (82%) among the respondents for whom ecolabelling plays an important role, as might be expected. Finally, EU citizens were divided in their opinion as to whether they trust producers’ claims about the general environmental performance of their products; 49% said they “completely” or “rather” trust such information, and 48% said they do not trust such claims.

A number of country-level studies have been carried out on climate-change issues since 2006, including at least six studies of UK consumers, two of Swedish consumers, one of US consumers and one of UK and US consumers jointly. Almost all deal with the climate-change impacts of food. No recent, separate studies of German or French consumers on this issue could be traced on the Internet, but data from these countries are reported in the Gallup report discussed above. Most of these studies deal with consumer decision-making, such as overall determinants of purchase decisions, decisions concerning choice of retailer, and decisions concerning willingness to pay a premium. A number also or instead deal with consumers’ perceptions of retailers and manufacturers, in relation to their overall credibility on environmental issues, whether they provide enough information in the climate area, and whether the information that they do provide is trustworthy. A few studies also cover consumers’ views on how GHG emissions from products should be labelled. The studies mostly take the form of reports on survey results. In a majority of cases these were obtained during so-called “omnibus” surveys by market-research companies, i.e. surveys covering a variety of unrelated topics. In most cases the sample size was between one thousand and three thousand respondents. A few focus group studies have also been reported.

The main conclusions from the country-level studies can be summarized as follows. UK consumers are largely sceptical about the overall environmental and climate convictions of manufacturers and retailers. They, and Swedish consumers, are also interested in obtaining more information from manufacturers and retailers on the climate impact of specific products. However, neither in the US or the UK do they trust business to report this information accurately. Hence, they would prefer statements and claims in this area to be verified independently.

While there is interest among consumers in obtaining relevant information in this area, climate-change concerns are unlikely to become a major driver of most consumers’ buying decisions relative to factors such as price and food safety. All other things being equal (especially price), businesses that carry out carbon labelling and products that are carbon labelled are likely to be preferred over comparable business and products that do not or are not. But if they were required to pay more than 20% more for a product with a significantly lower PCF than a comparable one, less than 10% of UK and US consumers, and 27.5%

39 The survey defined an ecolabel as “an ecolabelled product (or service) is entitled to bear a logo that can claim that the product (or service) is of good environmental quality” (p. 18).

of Swedish ones, would do so. These figures are considerably higher than the market shares represented, for example, by organic food sales, which on average also command a premium of roughly 20%. Notable in this context is that the proportion of UK consumers reporting regular purchase of organic food is three times higher than the actual share of organic sales in total food sales.

Only very limited *ex post* information is available on consumers' reactions to products that have been PCF labelled. Timberland publishes quarterly information, direct or indirect, on sales of its Green Index labelled products. This label has been applied to eight of Timberland's models within the Mios sandal and Outdoor Performance ranges. Sales of labelled products declined sharply during 2008, although according to Timberland this was mainly an effect of the phase out of the Mios range. It is not clear whether labelling positively affected the Mios range of shoes at an earlier stage.⁴⁰ The surveys show no consistent response on the type of carbon labelling consumers would prefer. All the results are reported in more detail in Annex 3.

7 Discussion and conclusion

This paper has discussed the rationale, context, coverage and characteristics of emerging product carbon footprint schemes and standards, and has reported on how consumers perceive carbon footprinting and labelling and companies' climate change policies in general. We found that since 2007, one public standard, and two public and around 15 private schemes referring to standards for calculating and communicating PCFs have become operational, of which we provide detailed information on 14. Most schemes are operated owned by small private consultants or not-for-profit organisations, and a few by public organisations, retailers or manufacturers. Only a few thousand carbon footprinted products have so far found their way to retail outlets, however. This may relate to the technical difficulty and associated high cost of calculating PCFs (especially in the initial stages of this activity) or a hesitancy amongst private users about consumer reactions to PCFs, or both.

The investigated schemes display large differences in scale and product coverage, type of claim made and (where applicable) certification offered, GHG assessment methods, communication approaches, and levels and means of verification and transparency. A range of factors may account for this diversity: differences in ambition, technical competence and access to external support; differences in economic resources; different country and business contexts; and the absence of a dominant PCF standard.

Retailers, especially of food and beverages, have been involved in the development of several of the identified PCF schemes. Sometimes they have piloted products in their stores certified to standards owned by others, for example Tesco's use of the Carbon Reduction Label and Migros's use of the Approved by Climatop scheme. But more often retailers have developed proprietary schemes drawing on technical assistance from consultants or government agencies (e.g. Casino France, Lantmännen, and Walmart) or applied their own PCF 'brand' to an existing methodology (E.Leclerc's partnership with Greenext). Their motives may involve any combination of wanting to be seen to be responding to perceived consumer demand for more information on the effects of their consumption on GHG emissions; an interest in identifying carbon "hot spots" in their supply chains, so as to be able to demonstrate to stakeholders that they are taking steps to reduce their emissions; or to provide a means to differentiate their products from those of competitors. Producers have also found carbon-accounting methods useful for some of the same reasons as retailers, though with less emphasis on labelling, but generally they prefer to use existing

40 Source: Timberland CSR Quarterly Reports, Quarters 3 and 4 2008: Product Data. At <http://www.justmeans.com/usercontent/companydocs/docs/company-docs/1229713191.pdf> (Q3) and .../1238577936.pdf (Q4).

schemes rather developing their own (the two exceptions being the proprietary schemes of Patagonia and Timberland).

Meanwhile, consumers are showing some interest in PCF information and would probably prefer carbon-labelled products and firms over others, other things being equal. It is also likely that a minority are, or would be, willing to pay a price premium for products with significantly lower footprints than like ones, not much different from organic price premium. But consumers are also sceptical about the credibility of the “climate-friendly” claims made by retailers and manufacturers and show a preference for third-party verification. This contrasts with the relatively weak verification systems currently used in PCF. All this indicates that there are limits to the direct commercial benefits from PCF in terms of increased sales, as opposed to benefits related to cost reductions and to compliance with future climate-change legislation.

National governments and international organisations have played a minor role in the development of PCF standards⁴¹ or in the establishment of PCF certification schemes, although their involvement increased markedly in 2009. The exceptions, however, have been influential. The UK Department for Environment, Food and Rural Affairs (Defra) supported the development of the first public PCF standard (the PAS 2050) as well as helped establish the organisation (the Carbon Trust) which has already certified a relatively large number of products to this standard. On a smaller scale, the French *Agence de l'Environnement et de la Maîtrise de l'Energie* (ADEME) assisted the development of the schemes operated by the retailers Casino and E.Leclerc, based on its elaborate methodology for corporate GHG accounting, and is now supporting the development of national standards for implementing a mandatory environmental labelling scheme that will likely include information on the carbon footprint of products. In Japan, the government launched a PCF pilot project in April 2009, and is actively involved in its implementation, while in New Zealand the CarboNZero scheme was developed and commercialised through public support. Finally, the European Commission considers preparing a voluntary PCF methodology towards the end of 2011 in the context of the existing EU environmental labelling instruments.

The international standards relating to carbon footprinting at the corporate and project levels are the WBCSD-WRI Greenhouse Gas Protocol and the ISO 14040 and 14064 standards series, as well as the PAS 2050, which is increasingly being used outside the UK. WRI-WBCSD and ISO recently commenced work to develop PCF standards, namely the WRI-WBCSD Product Life Cycle Accounting and Reporting Standard and the ISO14067 standard, drawing on the experience from the PAS 2050 process and from each other's work. The first drafts of the standards were discussed by stakeholders in June 2009 (ISO) and November 2009 (WRI-WBCSD); while the WRI-WBCSD standard is due for publication in late 2010 and the ISO one in late 2011. Hence, in two years time there will be three, possibly quite similar international standards available to guide product carbon footprinting. The major challenge now is not the compatibility of these methodologies, given that the international standard setters seem to be co-ordinating their work quite closely. Rather it is to enable an affordable, consistent and credible standard implementation through the development of comprehensive and harmonised LCA databases (e.g. in the context of the ILCD) and product category rules (under ISO 14025) relevant to product carbon footprinting. These should also take account of the special characteristics of production and distribution systems in developing countries. There is also need for common guidelines for communicating product carbon footprint information to increase its credibility, consumer and stakeholder acceptance, and, ultimately, contribution to combating climate change.

41 Again, the notable exception is standards based on the life-cycle emissions of transport fuels, especially biofuels.

7.1 Possible trade implications

The rapid proliferation of private PCF schemes raises two issues of concern to exporters. One is that the application of multiple schemes in the marketplace may lead to confusion in the minds of consumers about what information is relevant and useful and thereby diminish consumer confidence in such information. A second, related, concern is that as such schemes proliferate one may become the *de facto* standard and thereby create a market access barrier for products using other carbon-footprinting schemes. If product labelling under a single scheme becomes a condition of shelf-access in offshore markets, this could place a significant compliance burden on exporters, particularly SMEs and companies from developing countries. It is critical, therefore, that international standards be developed in a fair and transparent manner based on robust science and measurement methodologies, and that such standards be applied equitably across products, producers and countries.

In light of such concerns, we examined, although somewhat superficially, factors that help assess the potential effects of PCF on international trade, particularly on exports from developing countries and from countries located far from large OECD markets. First, the current lack of an internationally accepted PCF standard could favour producers based in countries with national public standards (so far only the UK), with trusted private standards, or with well-functioning, non-proprietary scheme operators (Canada, Germany, the United Kingdom and the United States). In this regard, only two schemes, the Carbon Label Company and CarboNZero, operate internationally. Second, PCF calculation and certification is expensive and demanding on human resources (for data provision and effective communication of the PCF). This tends to favour large and resourceful producers, who may benefit from significant economies of scale (low cost of certification per product sold) and hence could exclude most companies in developing countries. Third, no bias was found in the way the PCF methodologies treated long-distance transport relative to other emission sources, although we did not investigate this aspect in depth. Only two schemes highlight the distance travelled by the product. Finally, the methodology of the only public PCF standard published to date, the PAS 2050:2008, imparts a bias against labour-intensive production systems that are typical of developing countries by not including production of capital goods in its definition of product life cycles (resulting in an artificial shrinkage of the footprint of goods produced by capital-intensive methods). However, there is provision for the possible inclusion of emissions from capital goods in a future version of the PAS, while both the Japanese and the WRI-WBSCD draft standards include these emissions. Private standards may also contain biases against products in developing or distant countries, in principle or in practice, but further research is needed to document this.

7.2 The likely future of PCF

Although PCF, because it is based on LCA, is likely to have a higher degree of credibility with consumers than any other sort of claim made by operators in relation to the climate change attributes of products, it is also difficult and costly to perform and its impact on sales remains unclear. PCF has nevertheless proceeded fairly rapidly to date. Some schemes report strong interest in PCF from producers and retailers, and are expanding their clientele and product range. The total number of products worldwide subject to third party-verified PCFs is growing but remains rather small. For example, while the numbers of labelled products sold by Tesco and Casino have both increased over the last 12 months, in neither case does the number covered yet exceed 200. The current recession does not favour a steep change in the use of PCFs. Against this background, our best guess is that progress will continue steadily but slowly until comprehensive and modularized LCA databases become available, which will radically reduce the cost of calculating PCFs. This prognosis applies also to the French government's scheme, which seems unlikely to take full force until well after 2011. However, international databases are already improving and becoming

more accessible, as is illustrated by the publication in October 2009 of a new version of the European Reference Life Cycle Database, now containing more than 300 process data sets.

7.3 The role of development assistance

Development assistance could usefully be channelled toward research institutions in the South for performing PCFs on processes typically carried out there, as well as toward providing access to consultants who could perform PCFs for uniquely Southern products that are more complex. As stakeholders in wider research and standard-setting fora, development-minded governments in the North could also support the extension and modularization of existing Reference Life Cycle databases, underwrite their provision on an open access basis, and support the development of non-discriminatory PCF standards.

References

- ADEME (l'Agence de l'Environnement et de la Maîtrise de l'Energie). (2007). Bilan Carbone® Entreprises et Collectivités. Guide méthodologique, version 5.0, objectifs et principes de comptabilisation.
- AEA (2005). The Validity of Food Miles as an Indicator of Sustainable Development: Final Report. Department for Environment, Food and Rural Affairs, United Kingdom.
- AFNOR (Association française de Normalisation) (2009). General principles for an environmental communication on mass market products (BP X30-323) (in French). AFNOR, September 2009. www.boutique.afnor.org/
- Angervall, T, B. Florén, and F. Ziegler. (2006). *Vilken bukett broccoli väljer du?* The Swedish Institute for Food and Biotechnology.
- Berry, T., D. Crosslet and J. Jewell (2008). Check-out carbon. The role of carbon labeling in delivering a low-carbon shopping basket. Forum for the Future and Lloyd's Register.
- Bolwig, S. (2008) 'The Food Miles Debate and Developing Country Exports'. Short paper presented at the "Buying Local: Miles Better?" session of the World Export Development Forum (WEFD) of the International Trade Centre UNCTAD/WTO, Montreux 08-11 October.
- Braunschweig, A. (n.d.). The relation between LCA and GHG accounting. EZ Management Consulting AG, Zurich.
- Brenton, P., G. Edwards-Jones, M. Friis-Jensen. (2009a). Carbon labelling and low-income country exports: A review of the development issues. *Development Policy Review*, vol. 27, no. 33: 243-267.
- Brenton, P., G. Edwards-Jones, M.F. Jensen, K. Plassmann, A. Norton, N. Attarzedeh (2009b). Carbon Footprints and Food Systems: Do Current Accounting Methodologies Disadvantage Developing Countries? Unpublished manuscript, June 25, 2009.
- BSI (British Standards Institute) (2008). PAS 2050. Specification for the assessment of the life cycle greenhouse gas emissions of goods and services.
- BSI (2009). PAS 2050 – Assessing the life cycle greenhouse gas emissions of goods and services. www.bsigroup.com, accessed 25-03-09.
- Büsser, S., R. Steiner, N. Jungbluth (2008). LCA of packed food products – the function of flexible packaging. ESU-services Ltd., Uster, Switzerland. Report made for Flexible Packaging Europe.
- Carbon Trust (2006). The carbon emissions generated in all that we consume, London: The Carbon Trust.
- Carbon Trust and BSI (2008). Guide to PAS 2050. How to assess the carbon footprint of goods and services.
- Carbon Trust (2008). Code of Good Practice for Product Greenhouse Gas Emissions and Reduction Claims. Guidance to support the robust communication of product carbon footprints.

- ARB (Air Resources Board) (2009). Proposed Regulation to Implement the Low Carbon Fuel Standard, Volume I, March 5, 2009, California Environmental Protection Agency.
- EC (European Commission, DG Environment). (2009). Call for tender no. ENV.G2/ETU/2009/0072.
- Edwards-Jones, G., Plassmann, K., York, E.H., Hounsome, B., Jones, D.L. and Milá i Canals, L. (2008) “Vulnerability of exporting nations to the development of a carbon label in the United Kingdom”. *Environmental Science and Policy*, vol. 12, no. no 4: 479-490.
- Gallup Organisation, The. 2009. Europeans’ attitudes towards the issue of sustainable consumption and production. Analytical report, April 2009. Flash Euro Barometer Series no. 256. Survey conducted at the request of the Directorate-General for the Environment of the European Commission.
- Garz, H. No date. Toward a Product-level standard: Life cycle analysis of greenhouse gas emissions – A commentary from the financial market perspective. The London Accord and WestLB. www.london-accord.co.uk/images/reports/pdf/e3.pdf, at 17-11-2009.
- Gibbon, P. (2009). European standard setting organisations and climate-change standards. Background document, OECD Global Forum on Trade and Climate Change, 9-10 June 2009. www.oecd.org.
- Gibbon, P. and Bolwig, S. (2007) The Economic Impact of a Ban on Imports of Air freighted Organic Products to the UK. DIIS Working Paper 2007/23, Danish Institute for International Studies.
- Gibbon, P. and Ponte, S. (2005) *Trading Down: Africa, Value Chains and the Global Economy*. Philadelphia: Temple University Press.
- Gray, P. and Edens, G. (2008). Carbon accounting: A practical guide for lawyers. *Natural Resources and Environment*, 22 (3) 41-49.
- Groupe Casino (2009). Rapport d’activité & de développement durable 2008. www.groupe-casino.fr.
- Ikezuki, T. (2009). Japan’s carbon footprint system. Background document, OECD Global Forum on Trade and Climate Change, 9-10 June 2009. www.oecd.org.
- ISO (International Organization for Standardisation) (2008). Responding to the global and related challenges of climate change, energy, water and nutrition. APEC Conference on Standards and Conformance, August 2008/SOM3/SCSC/CONF/012
- ISO (International Organization for Standardisation). (2006a). ISO 14040:2006. Environmental management – Life cycle assessment – Principles and framework. Geneva: ISO.
- ISO (International Organization for Standardisation). (2006b). ISO 14044:2006. Environmental management – Life cycle assessment – Requirements and guidelines. Geneva: ISO.
- Kasterine, A and Vanzetti, D. (2009). Market based instruments and voluntary measures to mitigate greenhouse gas emissions from the agri-food sector, In: Trade and Environment Review 2009, United Nations Conference on Trade and Development (UNCTAD), Geneva.
- Kejun, J., A. Cosby and D. Murphy. (2008). Embedded carbon in traded goods. Background paper for the Trade and Climate Change Seminar, June 18-20, 2008, Copenhagen, Denmark. Energy Research Institute, China, and International Institute for Sustainable Development, Canada.

Makela, T. (2009). "Product carbon footprinting in EU environmental policy". PowerPoint by Tim Makela, DG for Environment, European Commission, presented at the 2nd PCF World Summit, Berlin, 23-24 September 2009.

Lucchini, C. and Tran. M. (2009). The Display of Environmental Information in France: Private and Public Engagement. In: Counting Carbon in the Market Place: Part II – Case Studies. OECD Trade and Agriculture Directorate. Unpublished manuscript.

McGray, H. (2003). GHG accounting: the GHG-P versus the ISO draft standard, at <http://www.ecologia.org/ems/ghg/news/cop9/summary.html>, accessed 24-03-09

Michaelowa, A. and K. Krause (2000). "International maritime transport and climate policy." *Intereconomics*, 35 (3), p. 127-136.

Misiga, P. (2009). "The future role of European Commission in Product Carbon Footprinting", PowerPoint by Pavel Misiga, DG for Environment, European Commission, presented at the 2nd PCF World Summit, Berlin, 23-24 September 2009.

Øresund Food Network (2008). Climate change and the food industry, Climate labelling for food products: potential and limitations, Copenhagen, Denmark www.oresund-environment.org.

PCF Pilot Project (2009). Product Carbon Footprinting – The Right Way to Promote Low Carbon Products and Consumption Habits? Experiences, findings and recommendations from the Product Carbon Footprint Pilot Project Germany. www.pcf-projekt.de, accessed 04-11-09.

Radunsky, K. (2009). Carbon footprint standard moves forward. *ISO Focus*, Vol. 8 (6), September 2009.

Spanangle, M. (2003). A comparison of ISO 14064-1 and the GHG-P corporate module.

SEI (Stockholm Environment Institute) and University of Minnesota (2008). Methods review to support the PAS for the calculation of the embodied greenhouse gas emissions of goods and services. Department for Environment, Food and Rural Affairs, London.

The Climate Conservancy (2008). The Carbon Footprint of Fat Tire[®] Amber Ale, at www.climateconservancy.org, accessed 30-10-09.

The Climate Conservancy (2009). Reducing the Carbon Footprint of Fat Tire[®] Amber Ale by Changing Agricultural Practices: Potential and Limitations, at www.climateconservancy.org, accessed 30-10-09.

Wenzel, H., Hauschild, M. and Alting, L. (1997) Environmental Assessments of products –Vol 1: Methodology, tools and case studies in product development. London. Chapman & Hall.

Wiedmann, T. and J. Minx (2007). A Definition of "Carbon Footprint". ISA Research Report 07-01. ISA (UK) Research and Consulting. Available at www.isa-research.co.uk.

WRI (World Resources Institute) and WBCSD (World Business Council for Sustainable Development) (2009). Product Life Cycle Accounting and Reporting Standard. Review Draft for Stakeholder Advisory Group. November 2009.

Annex 1. List of surveyed product carbon footprinting schemes

No.	Scheme	Country	Operator or Certifier	Operator type	Year launched	No. of certified products	Products types that certification is offered for	External funding for scheme development?
1.	AB Agri GHG Modelling	UK	AB Agri	Private consultant	2008	1	Dairy (will expand to wider product range)	?
2.	Approved by Climatop	Switzerland	Climatop	Private not-for-profit organisation	2008	10 (70 were assessed)	All goods and services	No
3.	Carbon Connect	Canada	The Carbon Counted	Private not-for-profit organisation	2007	22	?	Anonymous philanthropic
4.	Carbon Reduction Label	UK	Carbon Label Company (Carbon Trust)	Public organisation	2008	2800	All goods and services	Defra (UK government)
5.	Carbonlabels.org	Canada	Conscious Brands	Private consultant	2008	1	All foods	Zerofootprint (a group of companies)
6.	CarboNZero	New Zealand	Landcare Research	Public organisation	2008	100	All goods and services	New Zealand Foundation for Research
7.	Certified CarbonFree	US	Carbonfund.org	Private not-for-profit organisation	2007	44	All goods and services	No
8.	Climate Conscious Carbon Label	US	The Climate Conservancy (Stanford University)	Private not-for-profit organisation	2007	3	All goods and services	No
9.	Footprint Chronicles	US	Patagonia	Manufacturer	2007	14	clothing and footwear	?
10.	Green Index rating	US	Timberland	Manufacturer	2007	8 models	footwear	?
11.	Indice Carbone Casino	France	Casino France	Retailer	2008	160	Own-brand food and drink products.	ADEME (government)
12	J'économise ma Planète (Bilan CO ₂)	France	E.Leclerc (Templeuve and Watrelos stores) and Greenext (consultant)	Retailer	2008	800 product categories (covering 380,000 products)	Food products	ADEME (Nord Pas de Calais region)
13.	Stop Climate Change	Germany	AGRA-TEG	Private not-for-profit organisation	2007	11	All goods and services (focus on food)	No
14.	Verified Sustainable Ethanol Initiative	Sweden	SEKAB	Importer and wholesaler	2008	1	Ethanol	?

Annex 2. List of product or supply-chain carbon accounting schemes and standards ¹

Name of scheme	Operator	Partners and 'stakeholders'	Level of implementation	Methodological basis	Web site
AB Agri Greenhouse Gas Modelling	AB Agri (Associated British Agriculture), part of Associated British Foods plc.	Carbon Trust Sainsbury's Dairy Development Group Kingshay Farming Trust PRJ Associate	Product (dairy) Farm	Own methodology compliant with PAS 2050 and certified by Carbon Trust.	www.abagri.com/page2.cfm?pageid=1791 www.abagri.com/Nimoi/sites/abagri/resources/CarbonTrustBrochure_1st%20ed.pdf www.sddg.co.uk/
Air freight consultation	Soil Association	Licensees	Product (organic food). Monitoring use of air freight	Not applicable	www.soilassociation.org/airfreight
Air freight restriction	Biosuisse	Licensees	Product (organic food). Ban on certification of airfreighted imports (with exceptions)	Not applicable	www.bio-suisse.ch/en/biosuisseimportpolicy.php
Approved by Climatop	Climatop (Switzerland) Myclimate Migros	Migros is currently the only user of the scheme, but it is open to others.	Product	LCA (www.ecoinvent.org database)	www.climatop.ch/ www.migros.ch/FR/A_propos_de_Migros/Durabilite/Produits_labels/Declaration_CO2/Seiten/Apercu.aspx
Bilan CO ₂ (J'économise ma planète)	E.Leclerc	Greenext (with Energies Demain) L'ADEME Le Conseil Régional Du Nord Pas de Calais; ETHICITY Association Environnement Conseil	Product (on tabs)	Not published	www.jeconomisemaplanete.fr
Blaue Engel "CO ₂ labelling of products and services" project	Blaue Engel (German Eco-label)	Federal Ministry for the Environment (BMU) Federal Environment Agency Öko-Institut e. V	Product	Under development	www.blauer-engel.de/en/consumer/news/newsletter/newsletter_detail.php?we_objectID=198&print www.blauer-engel.de/downloads/publikationen/Pressemappe_BE_Klimaschutz_Hintergrundtext_Langfassung.pdf
Carbon Action Plan (CAP)	Zenith International Ltd	NSF International (not-for-profit certifier) Trucost Ltd (research)	Supply chain (bottled beverages)	Not published.	www.trucost.com/pressreleases/CAP.html (there is no CAP website)
Carbon Disclosure Project Supply Chain	Carbon Disclosure Project (an NGO)	475 institutional investors 40 listed corporations work with CDP on their supply chain, out of 3700 members.	Supply chain (recent extension of company-level assessments)	Questionnaire sent to suppliers on behalf of the client company.	www.cdproject.net/en-us/programmes/pages/cdp-supply-chain.aspx
Carbon Label Promotion Committee	Thailand greenhouse gas management organisation (TGO)	Thailand Environment Institute Other government agencies	Product (Not operational)	UNFCCC/CDM (GHG accounting limited to production stage)	www.tgo.or.th/english/
Carbon Reduction Label	Carbon Label Company (Carbon Trust)	BSI	Product Company	PAS 2050 (among others)	www.carbontrust.co.uk/default.ct

Name of scheme	Operator	Partners and 'stakeholders'	Level of implementation	Methodological basis	Web site
CarbonCounted™ Standard	CarbonCounted Carbon Footprint Solutions	11 consulting partners Advisory Team	Product	Own method 'aligned in practical manner with GHG Protocol and ISO 14064' and subject to annual reviews.	www.carboncounted.com www.carboncounted.com/downloads/CarbonCounted_Standard.pdf
Carbonlabels.org	Conscious Brands	International organisations and NGOs. 10 Pilot Clients	Product	Builds on PAS 2050	www.carbonlabels.org
CarboNZero	Landcare Research	Independent Advisory Panel New Zealand Wine Company (test case) Auditing firms NZ Government (owns the Operator)	Product Organisation (focus) Event	PAS 2050 (for products)	www.carbonzero.co.nz
Certified Carbonfree	Carbon Fund (Washington, US)	Edinburgh Centre for Carbon Management (ECCM) Technical Advisory Group.	Product	Product Life-Cycle Assessment (LCA)	www.carbonfund.org/products
Climate Conscious Carbon Label	The Climate Conservancy (US)	Advisory Board of Stanford University scientists Experts from The Carbon Trust, Defra, BSI, WRI, and Stanford University faculty.	Product	Full LCA (own methodology until product-level GHG Protocol is finalised)	www.climateconservancy.org/
Climate Labelling for Food (Version 2009:1)	KRAV	Svenskt Sigill Kvalitetssystem AB (Swedish Seal of Quality). Federation of Swedish Farmers (LRF) Swedish food companies (Milko, Skånemejerier, Lantmännen, Scan).	Product (food)	"Standard for reducing climate impact in the production and distribution of food" Version 2009:1 adopted 17/06, 2009.	www.klimatmarkningen.se/in-english/
Cool (CO ₂) Label	Korea Eco-Products Institute, Seoul	Korean government	Product (carbon label certified for 23 products in April 2009)	TOTAL (Tool for Type III labelling and LCA), based on LCA and PAS 2050.	www.koeco.or.kr/eng/index.asp .
Eco Options	The Home Depot	?	Unclear if carbon footprint analysis is used.	Not published	www6.homedepot.com/ecoptions/
Footprint Chronicles™	Patagonia	Bluesign Technologies (data)	Product	LCA	www.patagonia.com/web/us/footprint/index.jsp www.thecleanestline.com/footprint_chronicles/index.html
German Product Carbon Footprint Project	Product Carbon Footprint Project	10 German companies; WWF Institute for Applied Ecology; Potsdam Institute for Climate Impact Research THEMA1	Product (Not operational)	Work towards an international standard methodology for PCF measurement in 2010 or 2011.	www.pcf-projekt.de

Name of scheme	Operator	Partners and 'stakeholders'	Level of implementation	Methodological basis	Web site
GHG Protocol Product and Supply Chain Accounting and Reporting Standard	World Resources Institute & World Business Council for Sustainable Development	Members of Technical Working Groups 'Pilot Testers'	Product, Supply chain (Not operational)	Own methodology	www.ghgprotocol.org/standards/product-and-supply-chain-standard#usermessage3a
Green Index™ rating	Timberland	GreenNet Clean Air-Cool Planet (CACP) The Climate Group	Product	Based partly on LCAs performed using GaBi (www.gabi-software.com).	www.timberland.com/corp/index.jsp?page=csr_green_index
Greenice ISA Methodology for Carbon Footprints	Greenice R&D and Sustainability consultants	Centre of Integrated Sustainability Analysis, University of Sydney	Company Supply Chain Project Product (but no label)	Own "ISA Methodology" based on Input-Output Analysis and compliant with ISO 14044.	www.greenice.com.au
ICA (title not yet determined)	ICA Group (Swedish retailer).	Swedish Institute for Food and Biotechnology (SIK).	Product (food) (pilot project to analyze 100 own-brand food products. Not yet operational)	?	www.ica.se/file_archive/pdf/2008_ICA_Annualreport_ENG_final.pdf (ICA Annual Report 2008).
Indice Carbone Casino	Casino France	K Développement Durable Bio Intelligence Service ADEME (l'Agence de l'Environnement et de la Maîtrise de l'Energie) for validation and support.	Product	Method developed by ADEME WRI GHG Protocol ISO 14064	www.groupe-casino.fr/legroupe/?sr=99&id_article=172&lang=fr www.produits-casino.fr/spip.php?page=developpement_durable_infos_produits&debut_articles=15#pagination_articles
ISO Carbon Footprint of Products (ISO/NP 14067-1/2)	International Organisation for Standardization	National standards organisations, expert members of technical committee	Product (standard) (Not operational)	To be developed between January 2009 and November 2011.	www.iso.org/iso/iso_catalogue/catalogue_toc/catalogue_detail.htm?csnumber=43278
Lantmännen Klimatdeklaration	Lantmännen (Swedish food, energy and agriculture company, owned by Swedish farmers)	IVL Svenska Miljöinstitutet (verifier of the product carbon footprints) Lantmännen Food R& D, carried out the LCAs using 'LCAiT' software.	Product (food)	LCA, following ISO 14040:2006, ISO 14044:2006, and ISO 14025:2006.	www.lantmannen.com/sv/Lantmannen-COM/Om-koncernen/Hallbar-utveckling/Klimatdeklaration/
Méthode Bilan Carbone®	ADEME (l'Agence de l'Environnement et de la Maîtrise de l'Energie)	?	Corporate Supply Chain	Own methodology	www2.ademe.fr/servlet/KBaseShow?sort=-1&cid=15729&m=3&catid=15730
METI Carbon Footprint System	Ministry of Economy, Trade and Industry (METI) (Japan)	Japan Environmental Management Association for Industry (JEMAI); Ministry of the Environment; Ministry of Agriculture, Forestry and Fisheries; Ministry of Land Infrastructure and Tourism; University of Tokyo	Product (Not operational)	"Guidelines on the Carbon Footprint System" & "Guide for Establishing Product Category Rules"	www.meti.go.jp/english/press/data/nBackIssue20080731_03.html

Name of scheme	Operator	Partners and 'stakeholders'	Level of implementation	Methodological basis	Web site
PAS 2050	British Standards Institute	Carbon Trust and Defra	Product	Own methodology	www.bsi-global.com/en/Standards-and-Publications/How-we-can-help-you/Professional-Standards-Service/PAS-2050/
Stop Climate Change	AGRA-TEG GmbH	University of Göttingen Independent Governing Board	Product (food) Company	Company specific, builds on ISO 14064	www.stop-climate-change.de/en/
UNEP Life Cycle Management	UNEP	Danish Standards	Supply chain Company	GHG Reduction Management tool	www.unep.org/pdf/dtic/DTI0889PA.pdf
Verified Sustainable Ethanol Initiative	SEKAB Biofuels and Chemicals (Sweden)	Ethanol producers and sugar cane industry (UNICA) in Brasil. BioAlcohol Fuel Foundation SGS Group (auditor)	Product (ethanol only)	Field-to-wheel (LCA) RTFO principles	www.sustainableethanolinitiative.com
Walmart Sustainable Product Index	Walmart (US)	Consortium of universities to develop a global LCA database for products.	Product Suppliers	Supplier Assessment (15 questions) (Index Step 1) LCA database (Index Step 2) Consumer product information (Index Step 3)	www.walmartstores.com/Sustainability/9292.aspx

Notes: ¹ The list includes only manufacturers who are using their own 'in-house' carbon footprinting standard/scheme, and not those that implement PCF using schemes/standards operated by other organizations (e.g. Carbon Label Company, Stop Climate Change). ² Several large GHG assessment schemes are not included in the table because they do not make assessments for products or supply chains, including: a) The Voluntary Carbon Standard by the Climate Group (www.theclimategroup.org), which is a standard for carbon off-set projects; b) The Carbon Footprint Approved System (<http://www.carbonfootprint.com/carbonfootprintapproved.html>) by Carbon Footprint Ltd, which is implemented at the company level; c) The CarbonNeutral Company (<http://www.carbonneutral.com>) is using the Carbon Neutral Protocol (<http://www.carbonneutral.com/uploadedfiles/TCNC%20Protocol%202008.pdf>) and is implemented at the company, event and project levels.

Annex 3. Consumer survey material on carbon labelling

Businesses

Business performance on environment and climate issues

'Satisfied with the industry's efforts to reduce its environmental impact', 17%. 'Dissatisfied with the industry's impact in reducing environmental impact', 24%. 'The industry could do better on reducing its environmental impact', 29%. (EDS, own survey, **UK**)

Provision of information

About 56.3% of US and 64.4% of UK respondents want companies to provide more product-based information on climate impacts. (Accountability & CI, own survey **US-UK**).

'When making a buying decision would you value information in the form of a product CL?' Yes, 56% 'No', 27% 'Don't know', 17% (LEK, own survey, **UK**).

'59% of consumers want to know more about the climate change impacts of the everyday products that they buy'. (Berry, Crossley and Jewell, own survey, **UK**)

'Would it be a good or a bad thing if there was a climate label that informed you which products were produced with low GHG emissions?' 'Very good idea', 65%, 'Quite a good idea', 28% (Naturvårdverket, own survey, **SE**)

Trust of information provided by business on climate change issues

'Do you trust information on climate change issues from retailers and manufacturers?' (UK and US combined) 'A lot', 9% 'A little', 46% 'Not very or not at all', 45%. (Accountability & CI, own survey **US-UK**).

'How credible are the green claims made by retailers and manufacturers from whom you buy?' 'Not very or not at all', 57%. (LEK, own survey, **UK**)

63% of US and 76.8% of UK respondents stated that, where businesses made climate change claims, these should be verified by independent parties. (Accountability & CI, own survey **US-UK**).

Consumer choices

'Hierarchies of need' in buying decisions

Consumers' informational priorities in relation to fresh and processed foods: price took clear preference, followed by food safety (in form of use-by dates) and whether the product was subject to a promotion (e.g., 'buy one get one free'). Country of origin/locally produced was prioritised next, followed by nutritional and environmental claims (about equal). (EDS, own survey, **UK**)

Even for 'green' consumers, consideration of these issues...was subsequent to price in purchase decisions. (Vision21, own focus groups **UK**)

Choice of retailer and climate change issues

48.5% of US and 51.6% of UK respondents agreed with a statement that 'they would rather do business with companies willing to reduce their contribution to climate change'. (Accountability & CI, own survey)

66% stated they prefer to buy from businesses that work to reduce climate change impacts. (Naturvårdverket, own survey, **SE**)

Carbon Labels and purchasing decisions

59% of 'concerned consumers' and 41% of non-concerned consumers said that they would be more likely to buy a product if it carried a CL.' (Upham and Bleda, own survey, **UK**)

Over half of those participating thought that a carbon label would make some difference to their shopping decisions, although the great majority of these said it would make only 'a little' difference. (Vision21, own focus groups, **UK**)

'If you had reliable information on the CF of a product...would you...' 'Switch to a product at the same price with a lower CF, 44%', 'Pay more for a product with a smaller CF', 14%, 'Do nothing' 17%. (LEK, own survey, **UK**)

'How much extra cost per year would you incur to minimize your (shopping) CF?' 'None', 40%, '<£20', 16%, '£20-£50', 20%, '>£50', 7%. (LEK, own survey, **UK**)

'Pilots reveal no clear impact on shoppers' behaviour' (Aitken, no source cited, **UK**).

‘Consumers overwhelmingly said that they would not be willing to pay a premium for carbon labeled products – even those who said they might pay a little more for ethically-sourced, local or organic products.’ (Upham and Bleda, reporting Pepisco focus groups, **UK**)

‘Would you buy carbon labeled products?’ ‘Yes, if there was a 5-10% price increase (only)’, 9% ‘Yes, but only if there was no price increase’, 44%, ‘No’, 25% ‘Don’t know’, 22%. (Pirog & Rasmussen, own survey, **US**)

‘What would you pay for a product that had a PCF 50% lower than another in the same category?’ ‘I’d pay less’, 8% ‘I’d only pay the same amount’, 54% ‘I’d pay 10% more’, 29% ‘I’d pay 20% more’, 5% ‘I’d pay 30% more’, 2%. (Pirog & Rasmussen, own survey, **US**)

‘How often would you choose climate labeled food if this was possible?’ ‘Always’, 16%, ‘Often’, 57%, ‘Sometimes’, 20%, ‘Never’, 5%. (Toivonen, own survey, **SE**)

‘32% would certainly pay 5% more for a product from a business they knew was working to reduce GHG emissions, and 48% would probably pay more’. (Naturvårdverket, own survey, **SE**)

‘How much extra would you be willing to pay for climate labeled food?’ ‘Nothing’, 10%. ‘10%’, 40%, ‘20%’, 22.5%, ‘30% or more’, 5%, ‘Don’t know’, 15%. (Toivonen, own survey, **SE**)








Carbon Label Design

Labels stating PCF in grams were considered unhelpful since they required the consumer to find and review other products before making a decision. A traffic light system would avoid this problem. (Vision21, own focus groups, **UK**)

The most popular format with consumers would be traffic lights or a low carbon stamp. ‘Our research showed a mismatch between the information that consumers want and what they are likely to get through the Carbon Trust approach.’ (Berry, Crossley and Jewell, own focus groups, **UK**)

72% said that they thought that, on a CF label, the number of grams CO₂e should be stated.’ (Upham and Bleda, reporting Boots Advantage Cardholders’ survey, **UK**)

Annex 4. Product carbon footprint labels

Scheme	Label/Logo				
Certified CarbonFree					
Carbon Reduction Label	<table border="1"> <tr> <td data-bbox="596 521 967 1043"> <p>working with the Carbon Trust</p>  <p>100g CO2 per xxxx</p> </td> <td data-bbox="967 521 1305 887"> <p>The carbon footprint of this product is xxxx per (functional unit). This is the total carbon dioxide (CO2) and other greenhouse gases emitted during its life, including production, use and disposal</p> </td> </tr> <tr> <td data-bbox="596 1043 967 1135"> <p>We have committed to reduce this carbon footprint</p> </td> <td data-bbox="967 887 1305 1135"> <p>This compares to the carbon footprint of xxxx which is xxxx per (functional unit)</p> <p>You can reduce this carbon footprint by xxxx</p> </td> </tr> </table>	<p>working with the Carbon Trust</p>  <p>100g CO2 per xxxx</p>	<p>The carbon footprint of this product is xxxx per (functional unit). This is the total carbon dioxide (CO2) and other greenhouse gases emitted during its life, including production, use and disposal</p>	<p>We have committed to reduce this carbon footprint</p>	<p>This compares to the carbon footprint of xxxx which is xxxx per (functional unit)</p> <p>You can reduce this carbon footprint by xxxx</p>
<p>working with the Carbon Trust</p>  <p>100g CO2 per xxxx</p>	<p>The carbon footprint of this product is xxxx per (functional unit). This is the total carbon dioxide (CO2) and other greenhouse gases emitted during its life, including production, use and disposal</p>				
<p>We have committed to reduce this carbon footprint</p>	<p>This compares to the carbon footprint of xxxx which is xxxx per (functional unit)</p> <p>You can reduce this carbon footprint by xxxx</p>				
Green Index rating					
Carbonlabels.org					
Carbon Connect					

Scheme	Label/Logo
Approved by Climatop	
Stop Climate Change	
L'Indice Carbone Casino	
Verified Sustainable Ethanol Initiative	
CarboNZero	

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