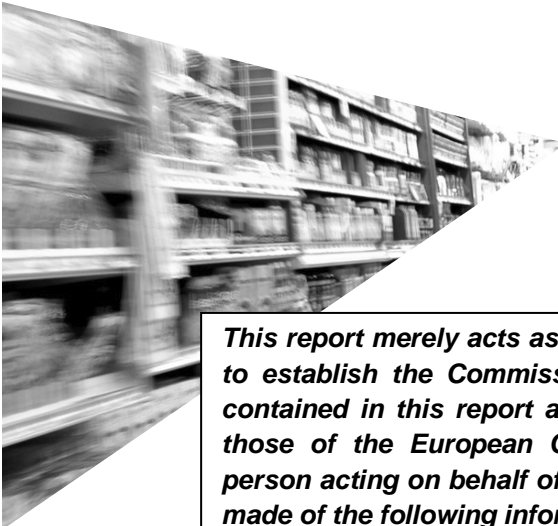


European Commission
DG Environment

Product Carbon Footprinting – a study on methodologies and initiatives

Final report

July 2010



This report merely acts as a guideline document for policy makers and does not seek to establish the Commission's future policy in this area. The contents and views contained in this report are those of the authors, and do not necessarily represent those of the European Commission. Neither the European Commission nor any person acting on behalf of the Commission is responsible for the use which might be made of the following information



A. Introduction

A range of policies are in place to improve the energy and environmental performance of products. The Ecodesign (EuP) Directive¹ establishes a framework for setting ecodesign requirements for energy-using products. A number of other pieces of legislation address specific aspects of the life-cycle of products, such as waste. The labelling schemes set by the Energy Labelling Directive², the Energy Star Regulation³, the Ecolabel Regulation⁴ and other schemes developed by Member States, retailers and other economic operators provide consumers with information on the energy and environmental performance of products. Incentives and public procurement are being implemented by Member States to stimulate the better performance of products. The Energy Star Regulation also obliges EU institutions and Member State authorities to purchase office equipment meeting specific levels of energy efficiency.

However, a number of shortcomings are hampering the potential of these policies. Most product legislation addresses only specific aspects of a product's life-cycle. While the Ecodesign Directive takes a life-cycle perspective, the environmental impact of energy-using products currently covered by the Directive only account for 31-36% of the environmental impact of products⁵. Information to consumers under EU policy has focused on energy efficiency for household appliances and office equipment under the Energy Labelling Directive and Energy Star Programme, or has covered only a limited number of products (under the Ecolabel). Finally, actions at national level are not coordinated.

In its conclusions on the Sustainable Production and Consumption Action Plan 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 Eco-label and energy labelling; and, taking into account Member States' experience, to start working as soon as possible on common voluntary methodologies facilitating the future establishment of carbon audits for organisations and the calculation of the carbon footprint of products.

There are now many different methodologies under development for the 'carbon footprinting' of products in a number of EU countries and in other countries around the world. Some of these initiatives aim to develop the measurement of carbon footprinting into labelling schemes, while others focus on the efficiency benefits companies can gain from undertaking carbon analysis of their products.

Given the different approaches used in these methodologies and initiatives, it is important for the Commission to prepare a sound analysis of these methodologies and initiatives, which would be an adequate input for considering options in the area of carbon footprint of products.

¹ Directive 2005/32/EC of the European Parliament and of the Council establishing a framework for the setting of ecodesign requirements for energy-using products.

² Council Directive 92/75/EEC of 22 September 1992 on the indication by labelling and standard product information of the consumption of energy and other resources by household appliances.

³ Regulation (EC) No 106/2008 of the European Parliament and of the Council of 15 January 2008 on a Community energy efficiency labelling programme for office equipment.

⁴ Regulation (EC) No 1980/2000 of the European Parliament and of the Council of 17 July 2000 on a revised Community ecolabel award scheme.

⁵ See Staff Working Paper SEC (2008) 2110 Impact assessment for recast of Directive 2005/32/EC, Table 3.

The objective of this study is to identify and analyse the existing major methodologies and initiatives in the field of product carbon footprinting. The analysis aims at getting a clear picture and comparison of the existing methodologies and initiatives in the EU and globally, and of features that might be relevant for future policy development.

Terms and definitions

It is assumed that usual terms and definition related to this subject are known and, as a consequence, only the most important are reported here. If this list is not sufficient, please refer to ISO 14067 (1 & 2) where the following definition have been taken.

- **Carbon footprint (CF):** weighted sum of greenhouse gas emissions and greenhouse gas removals of a process, a system of processes or a product system, expressed in CO₂ equivalents
- **Product Carbon Footprint (PCF):** carbon footprint of a product system
- **Product Category Rules (PCR):** set of specific rules, requirements and guidelines for developing environmental declarations for one or more product categories
- **Carbon footprint product category rules (CF-PCR):** set of specific rules, requirements and guidelines for developing carbon footprint declarations for one or more product categories
- **Product system:** collection of unit processes with elementary and product flows, performing one or more defined functions and which models the life cycle of a product
- **Life Cycle Assessment (LCA):** compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle
- **Life Cycle Inventory Analysis (LCI):** phase of life cycle assessment involving the compilation and quantification of inputs and outputs for a product throughout its life cycle
- **Functional unit:** quantified performance of a product system for use as a reference unit
- **Products:** any good and services
- **Primary data:** quantified value originating from a direct measurement or a calculation based on direct measurements of a unit process of the product system at its original source
- **Secondary data:** quantified value of an activity or life cycle process obtained from sources other than the direct measurement or calculation from direct measurements
- **Greenhouse gas (GhG):** gaseous constituent of the atmosphere, both natural and anthropogenic, that absorbs and emits radiation at specific wavelengths within the spectrum of infrared radiation emitted by the Earth's surface, the atmosphere, and clouds.
NOTE: GHGs include among others carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF₆).
[ISO 14064-1]
- **Global warming potential (GWP):** factor describing the radiative forcing impact of one mass-based unit of a given GHG relative to an equivalent unit of carbon dioxide over a given period of time
- **Carbon dioxide equivalent (CO₂e):** unit for comparing the radiative forcing of a GHG to carbon dioxide
NOTE: The carbon dioxide equivalent is calculated using the mass of a given GHG multiplied by its global warming potential.

The following definitions have been used in the analysis

- **Carbon footprint declaration:** claim indicating the quantified carbon footprint of a product

- **Adjustive LCA:** LCA in which the product specific information comes from a baseline assessment adjusted with a limited amount of product specific data. This is a new concept, developed in this report to describe a new type of LCA approach identified within the studied methodologies.
- **Simplified LCA:** LCA not fully compliant with ISO standards, due to time and resource constrains, that is based on a higher number of hypothesis and generic data with less environment impact categories considered, and less sensitivity and uncertainty analysis performed.
- **Full LCA :** LCA compliant with the ISO standards (ISO 14 040 – 14 044)
- **Environmentally extended input/output analysis:** method of estimating the GHG emissions (and other environmental impacts) arising from sectors within an economy through the analysis of economic flows (source: PAS 2050)
- **Mono-criterion:** environmental impact of the product is only considered under the carbon footprint aspect (contrary: multicriteria)
- **Multi-criteria:** environmental impact of the product is evaluated through various indicators that can depend on the type of product: carbon footprint, water consumption, eco-toxicity...
- **Initiative:** political framework or organizational structure related to a carbon footprint action.
- **Methodology:** calculation rules and guidelines enabling to evaluate a carbon footprint.
- **Labelling:** on-pack or off-pack information related to product characteristics

B. Executive summary

During the early phase of this study, a wide spectrum of product environmental footprint methodologies and implementation policies were studied. They can be international, national or local, and initiated by public authorities or private actors (retailers for instance). Among them, 11 methodologies and 11 implementation policies were considered both interesting and representative of the current picture.

Regarding methodologies, the points that were investigated in order to select the most suitable cases for our studies were the following:

- Maturity and acceptance
- Reliability and robustness
- Ease of use and cost
- Consistency
- Suitability for EU wide implementation

The table below summarizes the list of studied practices:

Methodologies	Implementations policies
PAS 2050 (UK)	Ecocheck (Belgium)
GhG Protocol - Product Life Cycle Accounting and Reporting Standard (worldwide)	Ecological Bonus-Malus (France)
BP X30-323 (France)	The "Grenelle 2" Act (France)
ISO 14067 (General title: "Carbon Footprint of products", Part 1:"Quantification", Part 2: "Communication") (worldwide)	The Korean PCF label (in the frame of the Korean EDP Program) (Korea)
Korea PCF (Korea)	Carbon Label for California (US)
Carbon Footprint Program (Japan PCF)	Carbon Label of Carbon Trust (UK)
Sustainability consortium (Wal-Mart)	Carbon Disclosure Project (worldwide)
Carbon index Casino (France)	Climate Bonus (Finland)
Greenext (Leclerc - France)	Cities for Climate Protection (CCP) Campaign (USA)
Food labelling SE (Sweden)	Carbon Tax (Sweden)
Climatop (Switzerland)	"Japan as a low carbon society" (Japan)

Notes:

- Some initiatives have been studied for governance aspects; as so, they are not directly related to product carbon footprint issues (e.g.: carbon disclosure project).
- Sustainable Consortium (Wal-Mart): in this report the methodology evaluated is the PCF methodology developed by the Sustainable Consortium, not the questionnaires sent by Wal-Mart to its suppliers. Wal-Mart initiative sets the beginning of the Sustainable Consortium approach but PCF methodologies which will be used by Wal-Mart in the future will be based on Sustainable Consortium work, which goes further.

Current methodologies are mainly characterized by:

- The calculation scheme used: LCA, simplified LCA, Input/output approach, etc., and other technical options;
- The implementation system that frames the use of the methodology and the use of the results provided by its application.

The selection of one methodology has consequences in terms of both technical features (environmental issues covered, definition of the functional unit, cut-off rules, allocation rules, etc.) and possible implementation policies. Therefore relevance of methodologies for future EU policy development should be assessed in regards to the objectives targeted and the implementation options. That is why it is important to consider scenarios rather than methodologies alone when assessing methodological options. A scenario is the combination of a methodology (calculation rules and guidelines enabling to evaluate a carbon footprint) and an implementation system (political framework or organizational structure related to a carbon footprint action, with specific objectives).

Definition of the scenarios

Based on our analysis of the risks and benefits associated to the various initiatives we examined, we defined 5 main scenarios:

- **Scenario 0: Business as usual.** The objective of this scenario is to identify the risks associated with the upholding of the European Commission's current position on carbon footprint (intervention limited to communication)
- **Scenario 1: Favouring the internal use of Product Carbon Footprint (PCF) by companies.** This scenario consists in allowing companies to better assess the PCF of their products and include these elements into their strategic choices.
- **Scenario 2: Encouraging communication to consumers.** This scenario covers all means of communication of PCF information (either on-pack or off-pack), aiming at improving the consumers' knowledge of the footprint of the products they buy and ultimately diverting their purchases towards products with low PCF.
 - **Sub-scenario 2a: The voluntary best in class label**
 - **Sub-scenario 2b: The voluntary index or reduction claim**
 - **Sub-scenario 2c: The mandatory index**

- **Scenario 3: Implementing market-based incentives.** This scenario comprises financial bonuses and taxes towards various actors (consumers, producers and retailers) that target the promotion of products with low PCF and/or taxation of high emitting products.
- **Scenario 4: Setting minimum requirements.** This scenario corresponds to the implementation of mandatory minimum requirements for producers in terms of ecodesign, in line with the Ecodesign Directive.

Limitations in the scenario building and analysis

Our approach has limitations that should be born in mind. They are linked to the varying availability of information, the limited comparability of methodologies due to different national contexts and/or the divergence of objectives, and to the fact that some technical features were hardly assessable.

Moreover, focusing on carbon footprint may in some cases create a risk of burden shifting to other environmental impacts. Indeed, carbon footprint can represent a good indicator of the overall environmental impact only for specific product categories, mainly those considered as highly energy intensive and simple in terms of emission sources (no land use change, no biogenic emission, etc.).

Eventually, the environmental efficiency improvement of each product does not guaranty the intended global environmental impact reduction because the number of products consumed may increase and compensate the environmental benefits generated by each product. Individual product carbon footprint reduction can therefore results in a global GHG increase. This phenomenon, known as the “Rebound effect” is an intrinsic limitation of the studied scenarios even if its risk of occurrence and consequences depend on each scenario.

Methodologies assessment according to the scenarios

For scenarios/sub-scenarios 1 to 4, all methodologies were graded according to some of the following 20 criteria (depending on the scenario), with grades ranging from 0 to 3 and weighted according to the importance of the criterion for each scenario/sub-scenario.

- Consistency with the scenario’s objectives
- Stakeholders diversity
- Involvement of public authorities
- Existence of specific working groups (by industry, by product category, etc.)
- Existence of an international structure
- Methodology validation
- Methodology documentation availability
- Methodology maturity
- Possibility to use default values in case of absence of primary data
- Transparent description of the required primary data
- Amount and detail of information required
- Expected product range of application
- Existence of an uncertainty assessment / sensitivity analysis

- Level declared for product comparability
- Time scale validity of the carbon footprint assessment
- External critical review of the results
- Transparent procedure to identify the best in class
- Availability of a database
- Existence of PCR-like documents
- Tools - Tool availability

Below are the total weighted grades of the studied methodologies for each sub-scenario.

Sub-scenario 1: voluntary assessment of PCF by companies

	Product GHG Protocol	ISO 14067	BP X30-323	PAS 2050	Food labelling SE	Japan PCF	Korea PCF	Sustainability Consortium (Wal-Mart)	Carbon Index Casino	Climatop	Greenext (Leclerc)
Weighted scoring	26	26	27	25	16	26	25	24	15	15	16

Methodologies with a performance greater than 20 points have few differences and a weakness on a criterion is generally compensated by other criteria. Since having a widespread management structure involving many and diverse stakeholders, and/or a structure with various working groups that focus on specific products categories are important criteria for this scenario, **an extension of ISO 14067, Product GhG Protocol or BP X30-323 structures seems to be the best solution for this scenario.**

Sub-scenario 2a: The voluntary best in class label

	Product GHG Protocol	ISO 14067	BP X30-323	PAS 2050	Food labelling SE	Japan PCF	Korea PCF	Sustainability Consortium (Wal-Mart)	Carbon Index Casino	Climatop	Greenext (Leclerc)
Weighted scoring	41	39	49	37	33	40	39	38	21	34	25

The scores reveal the necessity of a precise and transparent definition of the LCA calculation rules for this scenario. The “best in class” methodologies (Climatop and Food Labelling SE) lack transparency and therefore do not get the highest scores, although their objectives are in line with those of the scenario.

Indeed, for this scenario, an ideal methodology would combine:

- a precise and transparent definition of the LCA calculation rules with a large implication of the stakeholders in the production of LCA studies that would guide the definition of simple environmental criteria (BPX 30-323)
- a definition of simple environmental criteria (Food Labelling SE)
- a best in class labelling scheme (Climatop).

Sub-scenario 2b: The voluntary index or reduction label

	Product GHG Protocol	ISO 14067	BP X30-323	PAS 2050	Food labelling SE	Japan PCF	Korea PCF	Sustainability Consortium (Wal-Mart)	Carbon Index Casino	Climatop	Greenext (Leclerc)
Weighted scoring	36	30	32	33	19	32	34	27	20	17	19

Current major schemes (Product GhG Protocol, Korea PCF, PAS 2050, BPX30-323, etc.) are appropriate for this scenario, as many of them rely on the same methodological basis. Two points are however of first importance for implementing such a scheme at a European level:

- **Consistency with other schemes:** in order to avoid “wasting” PCF already calculated by some users, a gap analysis has to be performed with locally used methodologies to correct existing PCFs. Regarding this issue, **PAS 2050** seems to be the currently best option since other methodologies have been developed on its basis and it is recognized as an important and reliable methodology. Worldwide methodologies which are under development (**Product GhG Protocol** and **ISO 14067**) may be suitable options when finalized.
- Possibilities to highlight **the user’s carbon footprint reduction engagement**: current schemes are not designed to highlight user engagement, except the **Korea PCF** which has 2 logos (one for PCF, one for low carbon products) and **PAS 2050** in the private Carbon Label of Carbon Trust.

Sub-scenario 2c: The mandatory index

	Product GHG Protocol	ISO 14067	BP X30-323	PAS 2050	Food labelling SE	Japan PCF	Korea PCF	Sustainability Consortium (Wal-Mart)	Carbon Index Casino	Climatop	Greenext (Leclerc)
Weighted scoring	50	44	52	43	30	49	46	50	29	29	38

A mandatory index scenario would require a methodology with:

- a precise and transparent definition of the LCA calculation rules that reaches a consensus among the stakeholders
- a sufficient level of data collection requirements to ensure robust results that allow scientifically sound PCF comparisons
- a data management system that could provide default values for all users affected by the mandatory scheme.

The studied methodologies, in their current state of development, do not fulfil all those requirements and therefore are not yet mature enough for a mandatory implementation. The development of CF-PCR may be useful in the future to reach an international agreement on criteria such as functional unit, allocation rules, etc.

The Sustainability Consortium (Wal-Mart), the GhG Protocol and the BPX 30-323 stand out but they are still under development and we therefore lack insight to fully assess their applicability to a mandatory index scenario.

However, current schemes based on a governmental initiative (BP X30-323, Japan PCF) may be suitable for further implementation. They should be improved taking into account experience from methodologies which have been able to:

- reduce the amount of information required (e.g. Sustainability Consortium, Greenext),
- involve the stakeholders belonging to the same value chain and have them work together (e.g.: Sustainability Consortium) in order to have appropriate and accepted industry approaches.

Sub-scenario 3: mandatory market-based incentive towards consumers or retailers

	Product GHG Protocol	ISO 14067	BP X30-323	PAS 2050	Food labelling SE	Japan PCF	Korea PCF	Sustainability Consortium (Wal-Mart)	Carbon Index Casino	Climatop	Greenext (Leclerc)
Weighted scoring	45	45	52	42	30	46	44	45	25	30	32

BP X30-323 seems to be slightly more efficient for this scenario than other PCF methodologies, partly due to the direct involvement of public bodies and the presence of working groups by industry to support the definition of the differentiating criteria.

Responsibility sharing is a key point that requires to be clearly addressed when implementing such a scheme. Indeed, this scenario will have a significant impact on some economic operators and the environmental performance of one of them could be degraded because of previous links in the value chain. This high level of risk is currently not sufficiently mitigated and may lead to stress the value

chain, but networking structure like the one used in **Sustainability Consortium** could be a good source of mitigation.

Sub-scenario 4: implementation of minimum requirements on individual products

	Product GHG Protocol	ISO 14067	BP X30-323	PAS 2050	Food labelling SE	Japan PCF	Korea PCF	Sustainability Consortium (Wal-Mart)	Carbon Index Casino	Climatop	Greenext (Leclerc)
Weighted scoring	51	45	56	44	30	50	48	52	29	30	38

The ranking is similar to the other mandatory sub-scenarios (2c and 3). This is mainly due to the fact that defining minimum requirements will require being able to define quite precisely the range of products performances and to compare them.

Given the uncertainty of current schemes (e.g.: non assessable criteria) and the absence of a recognized basis of work (e.g.: insufficient basis of products assessed to build a scale of performance for each product), **it is not recommended to implement such a system for the moment.**

Conclusions

The main observations issued from the present study are that:

- **Product footprint specific methodologies are quite recent** (the oldest is dated 2008) **and none of them has presently been sufficiently tested over all product categories as to conclude on their perfect suitability for a wide-scale implementation on consumer products** (even if they were built from ISO 14044 norm which has been used for 10 years). However, some products categories have already been tested and most consumer product categories could be tested within the next two years, while PCR are being developed.
- **Current systems are presently not mature enough to implement a mandatory scheme based on a non-biased assessment of PCF.** There is a need to define appropriate and commonly agreed methodological rules providing a balance between PCF robustness and complexity/cost of implementation for users, enabling objective choices for consumers. This might be achieved through the development of PCR-like documents.
- **Several methodologies are suitable** for a specific objective and have similar global performances but attributable to different strengths, which should be **combined for European implementation.**
- **Future European schemes will have to consider consistency with existing international initiatives** aiming to homogenise PCF methodologies (Product GhG Protocol, ISO 14067, ...) and to take into account experience from their more mature predecessors (such as PAS 2050).

- The selection of the appropriate methodology to be applied at EU level should take into account the **possibility of widening the environmental scope of the methodology to include environmental impacts other than climate change.**

The appropriate scenario should fulfil, in the long term, the ultimate goal of such initiative: to reduce the global environmental impact of consumption. A relevant action plan for the European Commission could consist in:

- **Actively supporting current operations for homogenising PCF methodologies.** International methodologies with a general approach like ISO 14067 would be a good framework to promote, since they provide a global framework for other methodologies and are developed within a widely accepted structure.
- **Once defined a global and commonly accepted framework, undertaking a gap analysis with existing methodologies** as to identify points to be covered and corrected.
- **Defining the level of ambition of the EU policy regarding PCF** (communication to consumers; market-based incentives; minimum requirements) and the corresponding timeframe. These three options could even be considered as **three implementation steps**. With this objective, the best compromise among the studied methodologies should be selected, in parallel with supporting homogenisation works.