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Analysis of Existing Environmental Footprint Methodologies for Products and Organizations: Recommendations, Rationale, and Alignment

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Authors: Kirana Chomkhamsri, Nathan Pelletier

Project Leader and main reviewer: Rana Pant

Action Leader and reviewer: David Pennington

Approved: Constantin Ciupagea (HoU) (April 29, 2011)

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Executive summary

The “Analysis of Existing Environmental Footprint Methodologies for Products and Organizations” forms the starting point for the development of a harmonized European methodology for environmental footprint that can accommodate a broad suite of relevant environmental performance criteria, including greenhouse gas emissions. The results suggest that advancing European guidance documents that provide for a greater degree of methodological specificity than existing methods and standards is required to move towards more consistency and reproducibility of results. This will be much more challenging for the company side where, in contrast to product footprint, life cycle approaches have not previously played an important role.

Background and policy context

In the context of increasing global awareness of anthropogenic climate change, the carbon footprint concept is now widely used both as a marketing tool and to mobilize public sentiment. In its conclusions on the Sustainable Consumption and Production Action Plan the Council invited the Commission "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 organizations and the calculation of the carbon footprint of products".

As a follow-up to the Council conclusions, the European Commission concluded a study on product and corporate Carbon Footprint methods that involved analyzing existing methodologies and initiatives and how they might relate to future policies. One of the main outcomes of this study was that it is important to take into consideration all environmental impacts of products in a balanced way in place of sole focus on greenhouse gas emissions.

Recently, in its conclusion on the "Sustainable materials management and sustainable production and consumption" (December 2010), the European Council invited the Commission to "develop a common methodology on the quantitative assessment of environmental impacts of products, throughout their life-cycle, in order to support the assessment and labeling of products".

The European Commission therefore decided to extend the work on carbon footprinting to include other environmental aspects. Thus, the Product and Corporate Environmental Footprint project was initiated with the aim of developing a harmonized European methodology for environmental footprinting that can accommodate a broader suite of relevant environmental performance criteria.

Scope and objectives

This analysis focuses on key methodologies and standards (or drafts thereof) that aim at calculating the environmental footprint of products and organizations. Seven product-specific and seven organization-specific methodologies are considered. The analysis does not include issues related to communication. Rather, the intention of this study is to provide a more detailed analysis of the selected methodologies as a basis for formulating guidance and requirements for a common European environmental footprint methodology. Key methodological decision points in existing standards are compared. Subsequently, recommendations and supporting rationale are advanced for each decision point as necessary to move towards more reproducible product and corporate environmental footprint.

Results of the analysis

For product-related methodologies, the Life Cycle approach is the common basis, with ISO 14044 as the core reference document. Many methodological issues are addressed in a similar manner (or without practical differences) across the methodologies. There are, however, several important methodological issues where current recommendations are inconsistent. The identification and prescription of preferred methodological choices for such decision points is necessary for a common product environmental footprinting standard. Similar observations arose from the analysis of corporate footprint methods.

For corporate footprinting, it is noted that existing methodological guidance is considerably less advanced and prescriptive than for product footprinting, and that only a few of the corporate footprint methodologies are based on a life cycle approach. The development of stringent, prescriptive and technically detailed life cycle based guidance promises to be more challenging compared to the product footprinting from a technical/scientific, feasibility and a stakeholder acceptance perspective.

The current analysis suggests that advancing common European product and corporate environmental footprinting methods that provide for a greater degree of methodological specificity than existing standards is feasible. This will lead to increased reproducibility and consistency of methodological application and results. However, this can be achieved only by developing rather prescriptive guidance document that reduces the flexibility currently prevailing in many of the existing methodologies and standards.

It also became evident that sectorial guides like product category rules (PCR), PCR-like guides or similar documents play an important role in providing for more reproducibility and consistency. Another outcome is identification of the need for concerted policy development to ensure the availability of high-quality life cycle data at the sectorial level as a basis for robust product and corporate environmental footprinting.

1. Abbreviations

ADEME	Agence de l'Environnement et de la Maîtrise de l'Energie
AFNOR	Association française de normalisation
B2B	Business to Business
B2C	Business to Consumer
CDP	Carbon Disclosure Project
CSR	Corporate Social Responsibility
DEFRA	Department for Environment Food and Rural Affairs
EF	Ecological Footprint
ELCD	European Reference Life Cycle Database
EPLCA	European Platform on Life Cycle Assessment
IPCC	Intergovernmental Panel on Climate Change
LCA	Life Cycle Assessment
LCI	Life Cycle Inventory
LCIA	Life Cycle Impact Assessment
ILCD	International Reference Life Cycle Data System
PAS	Publicly Available Standard
PCR	Product Category Rule
PFCR	Product Footprint Category Rule
UNEP	United Nations Environment Programme
WBCSD	World Business Council on Sustainable Development
WRI	World Resource Institute

2. Glossary

End-Point	Attribute or aspect of any of the areas of protection "natural environment", "human health", "resource availability", and "man-build environment" identifying a societal issue giving cause for concern.
Extended Input output LCA	Combining life cycle assessment and economic input-output table
Hybrid LCA	Combining process based LCA with extended input output LCA
Mid-point	Specifies the results of traditional LCIA characterization and normalization methods as indicators located between emission and endpoint damages in the impact pathway at the point where it is judged that further modelling involves too much uncertainty.
Process based LCA	Itemizes the inputs (materials and energy resources) and the outputs (emissions and wastes to the environment) for a given step in producing a product.[EIOLCA.net]
Recycled content method (allocation for end of life)	known also as "cut-off" method and the "100-0" method
Recycling rate method (allocation for end of life)	known also as "0-100" method, "end-of-life recycling" method, and "recyclability substitution" method

3. Procedure of Analysis

Building on the analysis conducted by DG Environment's contractors in July 2010 in relation to corporate carbon footprinting and product carbon footprints, this analysis focuses on the methodology used to calculate the environmental footprints of products and organizations. Issues related to communication (other than reporting) are not considered.

The intention of this study is to provide a detailed analysis of the following selected methodologies, and to recommend a preferred methodological approach.

Product Environmental Footprint

- ISO 14044: Environmental management -- Life cycle assessment -- Requirements and guidelines
- ISO 14067: carbon footprint of product
- ILCD: International Reference Life Cycle Data System
- Ecological footprint
- Product and Supply Chain Standards Greenhouse Gas Protocol (WRI/ WBCSD)
- French Environmental Footprint (BPX 30-323)
- UK's Product Carbon footprint (PAS 2050)

Corporate Environmental Footprint

- ISO 14064: Greenhouse gases -- Part 1, 2 and 3
- ISO/WD TR 14069: GHG -- Quantification and reporting of GHG emissions for organizations (Carbon footprint of organization)
- ILCD: International Reference Life Cycle Data System
- Corporate Accounting and Reporting Standards Greenhouse Gas Protocol from WRI/ WBCSD
- Bilan Carbon
- DEFRA - Carbon Disclosure Project (CDP)
- CDP water
- Global Reporting Initiative (GRI)

3.1 Methodological issues considered for product environmental footprinting

The table below summarizes the list of methodological issues that were considered in the analysis for Product Environmental Footprinting

Methodological Consideration	Description and/or definition
Life Cycle Thinking? (Life Cycle Approach)	<p>Life Cycle Thinking refers to taking into consideration the spectrum of resource flows and environmental interventions associated with a product, service, or organization from a supply chain perspective, including all phases from raw material acquisition through processing, distribution, use, and end-of-life processes.</p> <p>The life cycle thinking contributes to improved environmental management of business activities, including planning, procurement, and design, marketing & sales.</p>

Methodological Consideration	Description and/or definition
Applications and Excluded Applications	Companies may use the results from product environmental footprint exercises for a variety of purposes, including “hot spot” identification, communication with customers and other stakeholders, benchmarking, tracking, etc. However, certain applications may require fulfilling additional methodological specifications – for example, comparative assertions.
Communication Target Audiences	Intended users as individuals or organizations identified by those reporting as being reliant rely on that information to make decisions. [modified from ISO 14064] NOTE: The intended user can be the client, the responsible party, programme administrators, regulators, the financial community or other affected stakeholders (such as local communities, government departments or non-governmental organizations) [modified from ISO 14064-1].
Functional Unit	The functional unit is the qualitative and quantitative aspects of the function(s) as related to the questions “what”, “how much”, “how well”, and “for how long”. The functional unit allows for making valid comparisons between products. Definition: Quantified performance of a product system for use as a reference unit [ISO 14044].
System Boundary	The system boundary determines which unit processes shall be included or excluded from the study. Normally, the system boundary of an LCA can include all activities from extraction of raw materials through processing, manufacturing, use, repair and maintenance processes as well as transport, waste treatment and other purchased services such as e.g. cleaning and legal services, marketing, production and decommissioning of capital goods, operation of premises such as retail, storage, administration offices, staff commuting, business travel, and end-of-life processes.
Cut Off	A cut off criterion is the specification of the amount of material or energy flow or the level of environmental significance associated with unit processes or product system to be excluded from a study. Cut-off criterion thus provides a clear basis for deciding on the inclusion or exclusion of processes in an analysis. It is generally a threshold on emissions or activity data which ensures that a sufficient part of these data has been included, as far as practical, for providing users with a picture of the environmental dimensions of the product considered. Cut-off rules are important to define an appropriate balance between result representativeness and data collection effort by users. Definition: Specification of the amount of material or energy flow or the level of environmental significance associated with unit processes or product systems to be excluded from a study [ISO 14044].
Covered Emissions / Impact Categories	Potential impacts to the natural environment, human health or the depletion of natural resources, caused by the interventions between the technosphere and the ecosphere that are considered in a given methodological standard. [ILCD] Definition: Class representing environmental issues of concern to which life cycle inventory analysis results may be assigned [ISO 14044].
Data Modeling	Data modelling is part of Life Cycle Inventory step in the LCA approach. There are two main approaches. Attributional modelling: modelling frame that inventories the inputs and

Methodological Consideration	Description and/or definition
	<p>output flows of all processes of a system as they occur. Modelling process along an existing supply-chain is of this type [ILCD].</p> <p>Consequential modeling: modeling principle that identifies and models all processes in the background system of a system that may change in consequence of decisions made in the foreground system [ILCD].</p> <p>Definition: the technical system is constructed using data on inputs and outputs. The flow model is typically illustrated with a flow chart that includes the activities that are going to be assessed in the relevant supply chain and gives a clear picture of the technical system boundaries. The input and output data needed for the construction of the model are collected for all activities within the system boundary, including from the supply chain (referred to as inputs from the technosphere).</p>
Data Quality	<p>Data quality is important to ensure the reliability of results.</p> <p>Definition: characteristics of data that relate to their ability to satisfy stated requirements [ISO 14044].</p>
Primary Data (Data Collection)	<p>Data collection is one of the important parts of life cycle assessment. The data collection must be performed according to the functional unit and system boundaries. The data that should be used is for all the important processes within the system boundaries.</p> <p>The data should include all inputs and outputs from the processes. Inputs are for example use of energy, water, materials etc. Outputs are the products and co-products. Emissions can be divided into four categories: air, water, soil and solid waste depending on what the emissions affect</p> <p>Definition: Data that be collected, measured or estimated for product system [ILCD]</p>
Data Collection Template	<p>Template for collecting inventory data to facilitate methodological application by non-experts</p>
Secondary Data	<p>Secondary data are data that are not directly collected or measured but rather derived from alternative sources such as databases or peer-reviewed literature. Depending on the goals of a study as well as the complexity of the analysed product system, comprehensive primary data collection may not be feasible. In this case, secondary data may be used.</p> <p>Definition: Data obtained from sources other than direct measurement of the processes included in the life cycle of the product [PAS 2050].</p>
Allocation	<p>The analyzed system can produce more than analyzed product therefore the analysis need to partition this environmental load for each product.</p> <p>Definition: Partitioning the input or output flows of a process or a product system between the product system under study and one or more other product systems [ISO 14044].</p>
Allocation for Recycling	<p>Where the life cycle of a product includes a material input with recycled content and/or recycled material output, the emissions and removals arising from that material shall reflect the product specific recycled content and/or recycling rate. There are two different methods commonly applied in Life Cycle Assessment. These are the recycled content method and recycling rate method.</p>
Fossil and Biogenic Carbon Emissions and Removals	<p>There are two sources of carbon (dioxide) emissions: fossil and biogenic. Specific methods exist for accounting for both emissions and removals for each source.</p> <p>Fossil carbon is the carbon emission from non-renewable sources e.g. petroleum.</p> <p>Biogenic carbon is the carbon emission from renewable sources e.g.</p>

Methodological Consideration	Description and/or definition
	wood.
Land Use Change	<p>Refers to emissions or sequestration of carbon associated with changes in land management practices.</p> <p>NOTE 1: Direct and indirect land use change may have an impact on GHG sources and sinks, or other properties of the climate system and may thus have a radiative forcing impact and/or other impacts on climate, locally or globally.</p> <p>NOTE 2: Indirect land use change encompasses changes in the condition of land as a consequence of direct land use change elsewhere [PAS2050].</p>
Indirect Land Use Change	Occurs when the demand for a specific land use induces a carbon stock change on other lands [WRI].
Carbon Storage / Sequestration and Delayed Emissions	<p>Retention of carbon of biogenic or atmospheric origin in a form other than as an atmospheric gas [PAS 2050].</p> <p>Carbon storage and delayed emission is the storage of biogenic or fossil carbon.</p>
Renewable Electricity Generation (Green Power Purchasing)	Green Power: A generic term for renewable energy sources and specific clean energy technologies that emit fewer GHG emissions relative to other sources of energy that supply the electric grid. Includes solar photovoltaic panels, solar thermal energy, geothermal energy, landfill gas, low-impact hydropower, and wind turbines [WRI].
Climate Change Factors	<p>Climate change is a long-term change in the statistical distribution of weather patterns over periods of time that range from decades to millions of years. It may be a change in the average weather conditions or a change in the distribution of weather events with respect to an average, for example, greater or fewer extreme weather events. Climate change may be limited to a specific region, or may occur across the whole Earth.</p> <p>In recent usage, especially in the context of environmental policy, climate change usually refers to changes in modern climate. It may be qualified as anthropogenic climate change, more generally known as global warming</p> <p>Definition: Global Warming Potential (GWP): A metric used to calculate the cumulative radiative forcing impact of multiple GHGs in a comparable way [WRI].</p>
Land Use Impact Category	Impact category related to use (occupation) and conversion (transformation) of land area by product-related activities such as agriculture, roads, housing, mining etc. Land occupation considers the effects of the land use, the amount of area involved and the duration of its occupation (quality-changes multiplied with area and duration). Land transformation considers the extend of changes in land properties and the area affected (quality changes multiplied with the area).
Weighting Factor	<p>Weighting is the process of converting indicator results of different impact categories by using numerical factors based on value-choices. It may include aggregation of the weighted indicator results.</p> <p>Weighting steps are based on value-choices. Different individuals, organizations and societies may have different preferences; therefore it is possible that different parties will reach different weighting results based on the same indicator results or normalized indicator results. In an LCA it may be desirable to use several different weighting factors and</p>

Methodological Consideration	Description and/or definition
	<p>weighting methods, and to conduct sensitivity analysis to assess the consequences on the LCIA results of different value-choices and weighting methods [ISO 14044].</p> <p>Definition: weighting: converting and possibly aggregating indicator results across impact categories using numerical factors based on value-choices; data prior to weighting should remain available [ISO 14044].</p>
Emission Off-setting	<p>The term “offset” is frequently used with reference to third-party greenhouse gas mitigation activities.</p> <p>Offsets are discrete GHG reductions used to compensate for (i.e. offset) GHG emissions elsewhere, for example to meet a voluntary or mandatory GHG target or cap. Offsets are calculated relative to a baseline that represents a hypothetical scenario for what emissions would have been in the absence of the mitigation project that generates the offsets. To avoid double counting, the reduction giving rise to the offset must occur at sources or sinks not included in the target or cap for which it is used. [WRI]</p>
Review	<p>An independent assessment of the reliability (considering completeness and accuracy) of an inventory and an impact assessment result [Adapted from WRI].</p>
Reporting	<p>Presenting data to internal management and external users such as regulators, shareholders, the general public or specific stakeholder groups [WRI].</p>
Role of Specific Guides / PCRs	<p>Product category rules or similar documents normally provide more specific rules for each product or product groups. The product or product groups usually programme operators defines base on international code.</p> <p>Definition: Set of specific rules (Product Category Rules), requirements, and guidelines for developing type III environmental declarations for one or more product categories [ISO 14025].</p>
How to Develop PCRs	<p>Recommendations/guidance for the development of product category rules</p>
Interpretation	<p>Systematic review and evaluation of the life cycle inventory and impact assessment results relative to the goals of the study and in light of the achieved accuracy, completeness and precision of the applied data and assumptions.</p>
Uncertainty	<p>In order to determine whether the apparent differences between the compared alternatives are real (statistically significant), it is necessary to perform an assessment of the uncertainties accompanying the results.</p> <p>Three main sources of uncertainty may be addressed:</p> <ul style="list-style-type: none"> • stochastic uncertainty • choice uncertainty • lack of knowledge of the studied system. <p>[ILCD]</p>
General Degree of Flexibility /Specificity (comparison)	<p>Reflection on trade-offs between methodological choice versus prescription</p>

3.2 Methodological issues considered for corporate environmental footprinting

The table below summarizes the list of methodological issues that were considered in the analysis of corporate environmental footprint methodologies.

Methodological Consideration	Description and/or definition
General concept	
Using Life Cycle Approach	<p>Life Cycle Approach refers to taking into consideration the spectrum of resource flows and environmental interventions associated with a product, service, or organization from a supply chain perspective, including all phases from raw material acquisition through processing, distribution, use, and end-of-life processes.</p> <p>The life cycle approach contributes to improved environmental management of business activities, including planning, procurement, design, marketing & sales.</p>
Goals	Defining goals prior to evaluating the corporate environmental footprint provides the necessary opportunity for establishing the context and overall vision for the exercise. The purpose of clearly articulating goals is to ensure that the analytical aims, methods, results and intended applications are optimally aligned, and that a shared vision is in place to guide participants in the exercise.
Applications	Intended uses of corporate environmental footprint reports
Target Audiences	Intended consumers of corporate environmental footprint reports
Accounting and Reporting Principles	Core suite of principles that provide overarching guidance in corporate environmental footprinting
Scope	Defining the scope of the corporate environmental footprinting exercise refers to describing in detail the system to be evaluated along with the associated analytical specifications. For the purpose of calculating the corporate environmental footprint, scope definition therefore includes identification of the organizational and (broader life cycle) analytical boundaries, the methodological approach, and the quality, reporting and verification requirements.
System Boundaries	Defined basis for delineation of included/excluded processes for an analysis.
Functional Unit	Quantified performance of a product system for use as a reference unit [ISO 14044].
Covered Emission/ Impact Categories	<p>Potential impacts to the natural environment, human health or the depletion of natural resources caused by interventions between the technosphere and the ecosphere that are considered in a given methodological standard</p> <p>Definition: Class representing environmental issues of concern to which life cycle inventory analysis results may be assigned [ISO 14044].</p>
Cut-Off Criteria	Specification of the amount of material or energy flow or the level of environmental significance associated with unit processes or product system to be excluded from a study [ISO 14044].
Primary Data	Directly collected or measured data in the foreground system (i.e. unique to the system analyzed).
Secondary Data	Data obtained from sources other than direct measurement of the processes included in the life cycle of the product [PAS 2050].
Data Quality	Characteristics of data that relate to their ability to satisfy stated requirements [ISO 14044].
Allocation	Partitioning the input or output flows of a process or a product system under study and one or more other product systems [ISO 14044].

Methodological Consideration	Description and/or definition
Accounting for External Reductions (offset)	The term “offset” is frequently used with reference to third-party greenhouse gas mitigation activities. Offsets are discrete GHG reductions used to compensate for (i.e., offset) GHG emissions elsewhere, for example to meet a voluntary or mandatory GHG target or cap. Offsets are calculated relative to a baseline that represents a hypothetical scenario for what emissions would have been in the absence of the mitigation project that generates the offsets. To avoid double counting, the reduction giving rise to the offset must occur at sources or sinks not included in the target or cap for which it is used [WRI].
Setting Targets and Tracking Progress	Process of using environmental footprint results for benchmarking and measuring the success of mitigation strategies over time
Reporting	Presenting data to internal management and external users such as regulators, shareholders, the general public or specific stakeholder groups [WRI].
Sectorial Specificity	Availability of guidance at the sectorial level as opposed to more general guidance
Relationship with Product Environmental Footprint Guidance	Formal linkages between corporate and product environmental footprint guidance found in existing methodology guides
Review, Validation/Verification	An independent assessment of the reliability (considering completeness and accuracy) of inventory data and impact assessment results [WRI].
Guide for SMEs	Availability of methodological guidance documents specifically intended for use by small and medium-sized enterprises (SMEs)

The information presented in this Report is based on a review of methodology documents. Recommendations are advanced for EU product and corporate environmental footprint methodology guides, along with a rationale for each recommended decision point.

4. Short description of analyzed methods

This section presents a short description of selected analysis methodologies for both product and corporate footprint.

4.1 Product Environmental Footprint

- **ISO 14044: Environmental Management: Life Cycle Assessment**

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

ISO 14044 was prepared by Technical Committee ISO/TC 207, Environmental management, Subcommittee SC 5, Life cycle assessment. This first edition of ISO 14044, together with ISO 14040:2006, cancels and replaces ISO 14040:1997, ISO 14041:1998, ISO 14042:2000 and ISO 14043:2000, which have been technically revised. ISO 14044:2006 specifies requirements and provides guidelines for life cycle assessment (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, relationship between the LCA phases, and conditions for use of value choices and optional elements. ISO 14044:2006 covers life cycle assessment (LCA) studies and life cycle inventory (LCI) studies.

- **ISO 14067: Carbon Footprint of Product**

ISO 14067 is being prepared by Technical Committee ISO/TC 207, Environmental management, Subcommittee SC 7, Greenhouse gas management and related activities. The International Standards Organization has published a draft standard aimed at measuring the carbon footprint for the lifecycle of products. The proposed standard, ISO 14067, will be used to calculate the greenhouse gas emissions from companies and their activities. This International Standard specifies principles and requirements for studies to quantify the carbon footprint of a product (CFP), based on life cycle assessment (LCA) specified in ISO 14040 and ISO 14044. Requirements and guidance for the assessment of a partial carbon footprint (partial CF) are also provided. ISO 14067 is applicable to CFP studies and partial CF studies with or without the intention to be publicly available. This International Standard provides for the adoption of product category rules (PCR), where they have been developed in accordance with ISO 14025 and are consistent with ISO 14067.

This International Standard addresses the single impact category of climate change and does not assess other potential social, economic and environmental impacts arising from the provision of products. Product carbon footprints assessed in conformity with this International Standard do not provide an indicator of the overall environmental impact of products.

The comparison application using only ISO 14067 is unlikely as it provides only framework therefore the additional requirements are required.

- **International Reference Life Cycle Data System (ILCD)**

In response to commitments in the IPP Communication of the European Commission, the International Reference Life Cycle Data System (ILCD) has been established to help ensure consistent and reproducible life cycle data and robust impact assessments. This system consists primarily of the ILCD Handbook and the ILCD Data Network.

The Handbook is a series of technical guidance documents. It is developed through peer review and consultation and is in line with the ISO 14040 and 14044, while it provides further specified guidance for more quality-assurance than the broader ISO framework can offer. The ILCD Handbook provides detailed provisions for product (situation A and situation B) and corporate analysis (situation C).

To facilitate this development, links have been established with National LCA Database projects in all parts of the world, and with the World Business Council for Sustainable Development (WBCSD) and the United Nations Environment Programme (UNEP).

- **GHG Protocol**

The World Resources Institute (WRI) and the World Business Council on Sustainable Development (WBCSD) started to develop its corporate standard in 2011/1998 and its Product and Supply Value Chain GHG Accounting and Reporting Standard in September 2008. The revised edition of the GHG Protocol Corporate Standard was published in 2004, a culmination of a two-year multi-stakeholder dialogue, designed to build on experience gained from using the first edition. It includes additional guidance, case studies, appendices, and a new chapter on setting a GHG target. The GHG Protocol Corporate Standard provides standards and guidance for companies and other types of organizations preparing a GHG emissions inventory. It covers the accounting and reporting of the six greenhouse gases covered by the Kyoto Protocol—carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF₆).

The Corporate Value Chain (Scope 3) and Product Life Cycle Accounting and Reporting Standards were published in October of 2011 after a 3 year multi-stakeholder development process. These new standards include requirements and 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 purchased energy. These two new standards are based on the life cycle approach. The Scope 3 standard is a supplement to the Corporate Standard, while the Product Standard builds upon the ISO 14040 series of standards.

- **PAS 2050**

PAS 2050 is a Publicly Available Specification for the assessment of the life cycle greenhouse gas emissions of goods and services. It was first published in 2008 and then updated in 2011. It was originally developed over 18 months through a consensus building process involving technical knowledge/expertise from a wide group of international stakeholders. Over 1000 stakeholders consulted over two rounds of consultation. It was overseen by an independent Steering Group of experts, representing academia, NGO, Government, industry, etc. It was also supported by working groups of experts, market research and pilots with companies.

The PAS 2050:2011 specifies requirements for the assessment of the life-cycle GHG emissions associated with the life cycle of goods and services (“products”), based on life cycle assessment techniques and principles (i.e. ISO14040/44). 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 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 place over the past 20 years.

- **Ecological footprint**

The Ecological footprint (EF) standard is developed by Global Footprint Network. The EF provides measure of the extent to which human activities exceed biocapacity. Specifically, the EF integrates (i) the area required for the production of crops, forest products and animal products, (ii) the area required to sequester atmospheric CO₂ emissions dominantly caused by fossil fuel combustion, and (iii) the equivalent area estimated to be required by nuclear energy demand.

- **BPX 30-323**

The repository of good practices, BPX30-323, was prepared under the french law «called « Grenelle I», which establishes the prospect of regulatory communication of environmental information relating to product.

This document was developed with over 300 organisations representing all the various relevant stakeholders, sectors, and NGOs gathered in the ADEME (Agency for Environment and Energy Management) / AFNOR (French Association of Normalization) platform.

BPX 30-323 is in line with ISO 14040 and ISO 14044 and can evolve following international or European community normative evolution.

BPX 30-323 gives general principles for the environmental communication of products. The carbon footprint is required whatever the category of product. The environmental communication includes indicators limited in number and specific to a category of product. These indicators take into account the main relevant impacts generated by the product.

BPX 30-323 defines main principles for drawing up methodological guides specific to product categories (PCR). These methodological guides are developed by relevant stakeholders of different sectors and are validated by the ADEME / AFNOR platform. 10 methodological guides (PCR) are already available.

In parallel, ADEME has initiated the development of a public database to provide generic data that will enable the calculation of these indicators.

4.2 Corporate Environmental Footprint

- **ISO 14064**

ISO 14064-1:2006 specifies principles and requirements at the organization level for quantification and reporting of greenhouse gas (GHG) emissions and removals. It includes requirements for the design, development, management, reporting and verification of an organization's GHG inventory.

ISO 14064-2:2006 specifies principles and requirements and provides guidance at the project level for quantification, monitoring and reporting of activities intended to cause greenhouse gas (GHG) emission reductions or removal enhancements. It includes requirements for planning a GHG project, identifying and selecting GHG sources, sinks and reservoirs relevant to the project and baseline scenario, monitoring, quantifying, documenting and reporting GHG project performance and managing data quality.

ISO 14064-3:2006 specifies principles and requirements and provides guidance for those conducting or managing the validation and/or verification of greenhouse gas (GHG) assertions. It can be applied to organizational or GHG project quantification, including GHG quantification, monitoring and reporting carried out in accordance with ISO 14064-1 or ISO 14064-2.

ISO 14069 GHG -- Quantification and reporting of GHG emissions for organizations (Carbonfootprint of organization) -- Guidance for the application of ISO 14064-refers to an ISO standard currently under development specifying the quantification and reporting of GHG emissions for organizations

Until such time as it has been adopted and published, ISO 14069 is not an actual standard.

- **Global Reporting Initiative (GRI)**

The Global Reporting Initiative (GRI) is a large multi-stakeholder network of experts worldwide, who participate in GRI's working groups and governance bodies, use the GRI Guidelines to report, access information in GRI-based reports, or contribute to develop the Reporting Framework. The GRI Reporting Framework sets out principles and performance indicators that organizations can use to measure and report their economic, environmental, and social sustainability performance. GRI's Reporting Framework is developed through a consensus-seeking, multi-stakeholder process. Participants are drawn from global business, civil society, labor, academic and professional institutions.

- **CDP Water Disclosure Project**

The Carbon Disclosure Project is an independent not-for-profit organization. The CDP Water guidance document is intended to support users in completing a questionnaire for corporate disclosure of water use, management and risk. Areas covered by the CDP Water Disclosure questionnaire include:

1. Water management and governance
2. The commercial risks and opportunities relating to water both in companies' own operations and in their supply chains. Particular attention is given to exposure to water scarcity, flooding and pollution; regulation; reputational, product-related and infrastructure risk; and linkages between water-related and carbon-related risks and opportunities
3. Water accounting including withdrawals, discharges and water-intensity

- **GHG protocol**

The World Resources Institute (WRI) and the World Business Council on Sustainable Development (WBCSD) started to develop its corporate standard in 1998 and its Product and Value Chain GHG Accounting and Reporting Standard in September 2008. The revised edition of the GHG Protocol Corporate Standard was published in 2004, a culmination of a two-year multi-stakeholder dialogue, designed to build on experience gained from using the first edition. It includes additional guidance, case studies, appendices, and a new chapter on setting a GHG target. The GHG Protocol Corporate Standard provides standards and guidance for companies and other types of organizations preparing a GHG emissions inventory. It covers the accounting and reporting of the six greenhouse gases covered by the Kyoto Protocol—carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF₆).

The Corporate Value Chain (Scope 3) and Product Life Cycle Accounting and Reporting Standards were published in October of 2011 after a 3 year multi-stakeholder development process. These new standards include requirements and 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 purchased energy. These two new standards are based on the life cycle approach. The Scope 3

standard is a supplement to the Corporate Standard, while the Product Standard builds upon the ISO 14040 series of standards.

- **ILCD**

In response to commitments in the IPP Communication of the European Commission, the International Reference Life Cycle Data System (ILCD) has been established for ensuring consistent and reproducible life cycle data and robust impact assessments. This system consists primarily of the ILCD Handbook and the ILCD Data Network.

The Handbook is a series of technical guidance documents. It is developed through peer review and consultation and is in line with the ISO 14040 and 14044, while it provides further specified guidance for more quality-assurance than the broader ISO framework can offer. The ILCD Handbook provides detailed provisions for product (situation A and situation B) and corporate analysis (situation C).

To facilitate this development, links have been established with National LCA Database projects in all parts of the world, and with the World Business Council for Sustainable Development (WBCSD) and the United Nations Environment Programme (UNEP).

- **Defra 'Guidance on how to measure and report your greenhouse gas emissions'**

The UK's corporate GHG accounting guide is designed to support all organizations in reporting their greenhouse gas emissions, either voluntarily or to meet reporting requirements under the Companies Act 2006, where applicable. It is largely based on the GHG protocol and was developed following extensive consultation with businesses. The guidance sets minimum recommendations for what companies should report including all scope 1 and 2 emissions within the chosen organizational boundary, an intensity ratio, a base year. Reporting significant scope 3 emissions is discretionary but encouraged. The guidance requires reporting of the six Kyoto GHGs in terms of CO₂e. The guidance is accompanied by annually updated emissions conversion factors and calculation tool. As well as the recommendations of how to report, the guidance provides additional information to help companies report emissions reductions, set reduction targets and recalculate their base year. A separate version of the guidance is available for SMEs.

Defra Guidance on Environmental Key performance Indicators – Reporting Guidelines for UK Business

These guidelines, published in 2006 aim to give clear guidance to companies on how to report on their environmental performance using environmental key performance indicators (KPIs). They aim to help businesses address their most significant environmental impacts, and report on these impacts in a way that meets the needs of a range of stakeholders. The guidelines set out 22 environmental KPIs that are significant to UK business and describe which KPIs are most significant to which business sectors.

The publication of guidance by Defra on Green House Gas reporting has necessitated a redraft of the Environmental KPIs. The new draft guidance will be based around five broad themes: water; waste; emissions to air and other emissions; materials; and biodiversity/ecosystem services. A consultation on this new guidance will take place towards the end of 2011 leading to a revised set of guidance which will become available in the latter half of 2012.

- **Bilan Carbone:**

Bilan Carbone is an organizational GHG accounting guidance document and tool produced in France by ADEME. The guidance provided is more comprehensive than most other corporate GHG accounting methodologies. Emphasis is placed on physical realism in GHG accountancy. All greenhouse gases are considered, rather than the six Kyoto Protocol GHGs considered in most guides. Calculation templates

that include emission factors and provide outputs relevant to reporting under several other schemes are provided.

5. Results of the analysis of existing methods

This section presents the results of comparisons of the specified methodological issues for both product and corporate environmental footprinting as represented in the guidance documents reviewed. It should be noted that the information presented in the following tables does not aim at providing an exhaustive account of the methodological specificities for each document. Rather, the purpose is to present information for the decision points identified as pertinent to the current analysis only. For further, methodology-specific information, please refer to the original documents along with the associated websites of the methodology owners.

5.1 Product Environmental Footprint

Life Cycle Thinking (Approach):

Analyzed Methodology	(Applying) Life Cycle Thinking (Approach)
ISO14044:2006	Yes
ILCD	Yes
GHGP (Oct 2011)	Yes
ISO 14067 (Nov2010)	Yes
PAS 2050 (Sept 2011)	Yes
BP X30-323 (june 2011)	Yes
Ecological Footprint	Yes

Communication Target Audiences:

Analyzed Methodology	Communication target audiences
ISO14044:2006	Business to Business and Business to Consumer
ILCD	Business to Business and Business to Consumer
GHGP (Oct 2011)	Business to Business and Business to Consumer
ISO 14067 (Nov2010)	Business to Business and Business to Consumer
PAS 2050 (Sept 2011)	Does not specify requirements for communication
BP X30-323 (june 2011)	Business to Consumer
Ecological Footprint	Public information

Application:

Analyzed Methodology	Communication target audiences
ISO14044:2006	-Identify opportunities to improve the environmental performance of products. -Comparative assertion with additional requirement -Provide information to decision-makers.
ILCD	Application situation "A": Analyze environmental life cycle performance of products for improvement (performance tracking), comparisons, customer information (business, consumer). Including comparative assertion with additional requirement
GHGP (Oct 2011)	-Performance tracking include identifying GHG reduction opportunities -Provide GHG emissions to business and interested stakeholders through public reporting. Additional types of communication (e.g., labels, claims) are supported by the standard with additional specifications (e.g., product rules). Excluded comparative assertion as defined by ISO 14044 (i.e. overall claim of environmental superiority)
ISO 14067 (Nov2010)	-Provide information to consumers for decisions making -Performance tracking -Comparative assertion with additional requirement
PAS 2050 (Sept 2011)	The PAS 2050 does not set requirements for communication. Organisations that wish to communicate are referred to additional specifications e.g. ISO14021/Defra's Green Claims Guidance. The method is intended to be used for internal assessment e.g. - To facilitate evaluation of alternative product configurations, or benchmarking. -Performance tracking include identifying GHG reduction opportunities -Facilitate comparison of GHG emissions goods and services
BP X30-323 (june 2011)	Provide information to consumer, allow comparison of product belonging to the same category and when relevant between product categories
Ecological Footprint	Provide information to decision-makers., consumer on consumption behavior in different level i.e. country level, sub-regional, company,

Covered Emissions / Impact Categories:

Analyzed Methodology	Covered Emissions / Impact Categories
ISO14044:2006	All relevant emission associated with products Numerous environmental impacts arising from the provision of products, including: GHG emissions Ozone Depletion Potential Acidification potential Eutrophication Potential

	Photochemical Ozone Creation Potential other environmental impacts e.g. resource depletion and human health (endpoint)
ILCD	<p>Addresses twelve impact categories in midpoint and three impact categories at end point. The emissions link to these twelve impact categories need to be measured, calculated or estimated. These are:</p> <p>Climate change, Acidification, Eutrophication, Ozone depletion, Summer smog, Human toxicity (Respiratory inorganics, Carcinogenics, Non-carcinogenics), Land use (includes biodiversity, land productivity), and Material and energy resource depletion. Open for other, case-wise relevant impact categories. Spatial differentiation only if necessary.</p> <p>The ILCD Handbook (recommended LICA methods and factors) provides recommendations for mid-point but not for endpoint. Recommended categories and methods are:</p> <ul style="list-style-type: none"> • Ozone depletion Steady-state ODPs 1999 as in WMO assessment • Human toxicity, cancer effects: USEtox model • Human toxicity, noncancer effects: USEtox model • Particulate matter/Respiratory inorganics: RiskPoll model • Ionising radiation, human health: Human health effect model as developed by Dreicer et al. 1995 • Photochemical ozone formation: LOTOS-EUROS • Acidification: Accumulated Exceedance • Eutrophication, terrestrial: Accumulated Exceedance • Eutrophication, aquatic: EUTREND model • Ecotoxicity: USEtox model, • Resource depletion) (mineral, fossil and renewable): EDIP97 update 2004 and CML 2002
GHGP (Oct 2011)	<p>Climate change, including land use change</p> <p>(impact to climate change)</p> <p>The six substances under Kyoto protocol are required to report. Other substances applicable to the studied product or value chain are recommended</p>
ISO 14067 (Nov2010)	<p>Climate change, including land use change</p> <p>(impact to climate change)</p> <p>All GHG emission shall be reported.</p>
PAS 2050 (Sept 2011)	<p>Climate change, including land use change</p> <p>(impact to climate change)</p> <p>All GHG emission shall be reported.</p>
BP X30-323 (june 2011)	<p>LCIA methods recommended by the JRC are followed. Impact categories are fixed by product category.</p>

	<p>Climate change, including land use change</p> <p>(impact to climate change)- All GHG emission shall be reported.</p> <p>Numerous environmental impacts arising from the provision of products, including:</p> <ul style="list-style-type: none"> - GHG emissions - Ozone Depletion Potential - Acidification potential - Eutrophication Potential - Photochemical Ozone Creation Potential <p>other environmental impacts e.g. resource depletion and human health (endpoint)</p>
Ecological Footprint	<p>Ecological Footprint values (e.g., global hectares)</p> <p>The primary production equivalents embodied in a finished product must be translated into Ecological Footprint values (e.g., global hectares) using primary conversion factors drawn from the National Footprint Accounts. In the event that no relevant primary conversion factor is available for a primary product, an original primary conversion factor may be calculated.</p>

System Boundary:

Analyzed Methodology	System Boundary
ISO14044:2006	<p>The system boundary determines which unit process shall be included within the LCA.</p> <p>Iterative Process:</p> <ul style="list-style-type: none"> - Initial system boundaries are defined based on goal and scope of the study. - Final System Boundaries are determined after initial calculations and sensitivity analysis.
ILCD	<p>From raw material acquisition through to end-of-life and disposal. Iterative, focused on most relevant processes.</p> <p>Include all relevant processes (both attributable processes and non-attributable processes).</p> <p>Lack of data (e.g. capital goods, services) to be named and explicitly considered in interpretation.</p>
GHGP (Oct 2011)	<p>From raw material acquisition through to end-of-life and disposal. Attributable processes required, relevant non-attributable processes recommended. Allows for both cradle to grave and cradle to gate analyses</p>
ISO 14067 (Nov2010)	<p>From raw material acquisition through to end-of-life and disposal. Allows for both cradle to grave and cradle to gate analyses.</p>
PAS 2050 (Sept 2011)	<p>From raw material acquisition through to end-of-life and disposal. Allows for cradle-grave and cradle to gate).</p>

	<p>Where industry sector or product specific requirements have been developed in accordance with 'supplementary requirements' (that can include PCRs based on ISO14025), these shall apply. If none is available, further specification is given as in ISO 14044 (from raw material acquisition through to end-of-life and disposal).</p> <p>Defined System Boundary Exclusions:</p> <ul style="list-style-type: none"> - Capital goods (unless provided for in supplementary requirements) - Human energy inputs to processes. - Animals providing transport services - Transport of consumer to and from the point of retail purchase (might be included after revision) - Commuting of employees
BP X30-323 (june 2011)	<p>From raw material acquisition through to end-of-life and disposal.</p> <p>Exclusions:</p> <ul style="list-style-type: none"> - Carbon offset - R&D - Transport of employees from home to workplace - Services associated with product or system (e.g. advertisement, marketing, etc.) - Transport of consumer to and from the point of retail purchase
Ecological Footprint	<p>Standard doesn't provide rules for definition of system boundaries. Requirement that report clearly defines all activities included within system boundaries. Most product EF analyses define the "life cycle" boundaries as including activities from cradle to point of purchase. Other possibilities include (i) purchase plus disposal, (ii) purchase plus consumer activities that use the product (iii) the EF of the societal infrastructure created as a result of consumers using the products (e.g., including the Footprint of road construction in the Footprint of a car). Capital goods may be included.</p>

Functional Unit and reference flow:

Analyzed Methodology	Functional unit
ISO14044:2006	The functional unit shall be consistent with the goal and scope of the study. It shall be clearly defined and measurable. Having chosen the functional unit, the reference flow shall be defined.
ILCD	<p>The functional unit shall be consistent with the goal and scope of the study. It shall be clearly defined, both in terms of quantitative and qualitative aspects.</p> <p>.Separate reference flow for supporting the data collection.</p>
GHGP (Oct 2011)	<p>The magnitude of the function or service, the duration or service life time, and the expected level of quality.</p> <p>Separate reference flow for supporting the data collection.</p>

ISO 14067 (Nov2010)	Clearly defined and measurable
PAS 2050 (Jan 2011)	Refers to functional unit as the unit of analysis. Guidance on functional unit and reference flow is provided in supporting guidance (updated version due to be published Oct 2011). The functional unit can also be established in the supplementary requirements.
BP X30-323 (june 2011)	The functional unit is defined at the PCR-level.
Ecological Footprint	The standard itself does not provide any specific information on functional unit definition, but there are several studies using the functional unit concept based on ISO 14044.

Cut Off Criteria:

Analyzed Methodology	Cut off criteria
ISO14044:2006	Cut off criteria are mass, energy, or environmental significance. The use of a specified criterion is based on the characteristics of the analyzed process.
ILCD	Cut-off criteria are to be defined based on need for precision or pre-set goals. In general, this should consider the quantitative degree of completeness with respect to the overall environmental impacts of the product system. It is also possible to apply the cut off individually for each impact category. For comparative studies the cut-off shall additionally also always relate to mass and energy.
GHGP (Oct 2011)	No cut off rule as need 100% (include estimation). Justified exclusions of attributable processes can be made in no data is available (including proxy data) and an estimation proves the process is insignificant based on mass, energy, or volume and environmental significance. The insignificance threshold (e.g., cut off) used is reported to justify any exclusions.
ISO 14067 (Nov2010)	No specific cut off rule provided in the standard
PAS 2050 (Jan 2011)	5 % GWP (All emissions that make a material contribution (i.e. >1% of emissions) must be included and at least 95% of total)
BP X30-323 (june 2011)	5% mass and energy and environmental impact
Ecological Footprint	Does not provide any specific guidance.

Data Modeling:

Analyzed Methodology	Data modeling
ISO14044:2006	Provide principle how to calculate environmental burden associated with products. Avoid allocation is preferable approach
ILCD	Attributional approach plus substitution for end of life and other multi-product processes. . Avoid allocation is preferable approach
GHGP (Oct 2011)	Attributional approach, plus direct system expansion for multi-product processes and closed-loop approximation for recycling (following the requirements of the standard)
ISO 14067 (Nov2010)	Provide principle how to calculate GHG emission (climate change) associated with products. Avoid allocation is preferable approach
PAS 2050 (Sept 2011)	Attributional approach. . Avoid allocation is preferable approach

BP X30-323 (june 2011)	<p>Attributional approach</p> <p>End of life scenarios (recycling, incineration and landfilling rates only depends on PCR group. Only French EoL scenario will be developed. Allocation rules for recycling and energy recovery are proposed per material.</p>
Ecological Footprint	<p>Accounting approach (similar to attributional approach).</p> <p>Allows for process LCA, Input-output or hybrid modeling</p> <p>Consumption land use matrix (CLUM) may be constructed using process-based or input-output methods.</p>

Data Quality:

Analyzed Methodology	Data Quality
ISO14044:2006	<p>a) time-related coverage: age of data and the minimum length of time over which data should be collected;</p> <p>b) geographical coverage: geographical area from which data for unit processes should be collected to satisfy the goals of the study;</p> <p>c) technology coverage: specific technology or technology mix;</p> <p>d) precision: measure of the variability of the data values for each data expressed (e.g. variance);</p> <p>e) completeness: percentage of flow that is measured or estimated;</p> <p>f) representativeness: qualitative assessment of the degree to which the data set reflects the true population of interest (i.e. geographical coverage, time period and technology coverage);</p> <p>g) consistency: qualitative assessment of whether the study methodology is applied uniformly to the various components of the analysis;</p> <p>h) reproducibility: qualitative assessment of the extent to which information about the methodology and data values would allow an independent practitioner to reproduce the results reported in the study;</p> <p>i) sources of the data;</p> <p>j) uncertainty of the information (e.g. data, models and assumptions).</p>
ILCD	<p>Modified from ISO 14044:</p> <p>Technological representativeness, , Geographical</p>

	<p>Representativeness,</p> <p>Time representativeness,</p> <p>Completeness / Precision,</p> <p>Methodological appropriateness and consistency</p>
GHGP (Oct 2011)	<p>Technology representativeness</p> <p>-Temporal representativeness</p> <p>-Geographical representativeness</p> <p>-Completeness</p> <p>-Precision</p> <p>Qualitative uncertainty is required for significant processes covering methodological sources</p>
ISO 14067 (Nov2010)	Adopts ISO 14044
PAS 2050 (Sept 2011)	Data quality guidelines in the PAS 2050 are adapted from ISO 14044.
BP X30-323 (june 2011)	<p>Even no detailed information provided in the general principles but ADEME set up a Governance Advisory Committee for the public database. This committee issues advisories on the rules on data integration and management (form issues) and on new data integrations (substance issues)</p> <p>This Committee issues advisories on:</p> <p>Consistency</p> <p>Quality and critical review</p> <ul style="list-style-type: none"> - Geographical representativeness - Technological representativeness - Time-related representativeness - Completeness of the elementary flows - Precision and uncertainty - Reproducibility <p>Compliance with methods</p> <p>Clarity</p> <p>Recognition</p> <p>Transparency</p> <p>Format</p> <p>Updates</p>
Ecological Footprint	No specific data quality requirements in the methodology. It refers to ISO 14044.

Primary Data (collection):

Analyzed Methodology	Primary data (Data collection)
ISO14044:2006	Collected (measured, calculated or estimated) from production sites associated with the unit processes within the system boundary.
ILCD	Primary data for the foreground system and main background processes preferred; secondary data can be used as well, provided it is ILCD-compliant and has good and demonstrable representativeness for those processes/products. Note: The same data quality requirement is applied for both primary and secondary data.
GHGP (Oct 2011)	Primary data are required for all processes under the reporting company's ownership or control.
ISO 14067 (Nov2010)	Adopts ISO 14044
PAS 2050 (Sep 2011)	Primary activity data are required for all processes owned or operated by the implementing organization. Exception: IF the organization implementing this PAS does not contribute 10% or more to the upstream GHG emissions prior to its provision to another organization or the end-user THEN: Primary data is required from the emissions arising from those processes owned, operated or controlled by the organization and any upstream supplier(s) that cumulatively contribute 10% or more to the upstream GHG emissions of the product or input..
BP X30-323 (june 2011)	Primary data is preferred. Specific requirement provided at PCR-level.
Ecological Footprint	If using process LCA, primary data requirement/ recommendation must follow ISO 14044.

Data Collection Template:

Analyzed Methodology	Data collection template
ISO14044:2006	See ISO/TR 14049
ILCD	The methodology guide acknowledges that the data management plan should include a data collection template.
GHGP (Oct 2011)	The methodology guide acknowledges that the data management plan should include a data collection template. However, no example is provided in the standard.
ISO 14067 (Nov2010)	No example of data collection template provided.
PAS 2050 (Jan 2011)	Provided in PAS 2050 guide (currently draft to be published late Oct 2011).
BP X30-323 (june 2011)	Provides data collection template for transport and for unit process in Annex E.

Ecological Footprint	No example of data collection template provided.
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Secondary Data:

Analyzed Methodology	Secondary data
ISO14044:2006	Data derived from other sources such as literature or databases. No specific data source is recommended. The practitioner must follow the defined data quality requirements for selecting secondary data.
ILCD	For all other data needs, the best quality, ILCD-compliant secondary data is preferred. Remaining data gaps shall be filled using “data estimates” of minimum quality. Gaps for which no minimum quality data can be obtained are kept and reported, as well as explicitly considered in interpretation and data quality indicator results.
GHGP (Oct 2011)	The best quality data is recommended, with primary data preferred if available
ISO 14067 (Nov2010)	Shall be used only for input where primary data is not possible or practicable. Secondary data sources include literature data, calculated data, estimates or other representative data. The secondary data should be verified.
PAS 2050 (Jan 2011)	<p>Secondary data shall be used for inputs where primary activity data have not been obtained.</p> <p>First Choice:</p> <p>Preference that secondary data conforms with the requirements of the PAS. Selection of secondary data shall be based on</p> <ul style="list-style-type: none"> ● Data quality rules, which are taken from ISO 14044 ● Preference for secondary data from peer review publications, together with data from other competent sources (e.g. national governments, official United Nations publications, and publications by United Nations-supported organizations). <p>Future Choice:</p> <p>ILCD/ELCD: “It is intended that a reference to the ILCD as a source of secondary data will be considered in a future revision of this PAS following final agreement of the structure and scope of the ILCD”.</p>
BP X30-323 (june 2011)	<p>The ADEME plans to feed the database using the following three methods:</p> <ol style="list-style-type: none"> 1. Feeding via the adaptation of existing data batches (processes: flows and metadata) and purchasing the requisite rights¹ from existing LCI data developers. 2. Feeding via the integration of batches of data that are jointly produced specifically by or for the ADEME (e.g. Agri-BALYSE Project). 3. Feeding via the integration of isolated supplementary data, following third-party requests.

¹ The corresponding rights are specified in Article 12 of the draft framework agreement.

Ecological Footprint	No specific source given, but usually practitioners use data from the United Nations Food and Agriculture Organization, the United Nations Statistics Division, and the International Energy Agency (FAOSTAT, 2007, UN Comtrade, 2007a, IEA, 2007), national input-output tables, or other commercial databases.
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Allocation:

Analyzed Methodology	Allocation
ISO14044:2006	Allocation should first be avoided through process subdivision or system expansion where possible. If not possible, physical relationships (e.g. mass, energy) between products or functions should be used to partition inputs and outputs. When physical relationships cannot be established, other relationships shall be used instead (e.g. economic value)
ILCD	Further developed and specified from ISO 14044: <ul style="list-style-type: none"> - Avoiding allocation by subdivision or virtual subdivision. - Substitution / system expansion (also of wider functions) of market mix. - Causal physical relationship allocation. E.g. mass ,energy - Economic allocation.
GHGP (Oct 2011)	Adapted from ISO 14044 : <ul style="list-style-type: none"> - Companies shall avoid allocation wherever possible by using process subdivision, redefining the functional unit, or using system expansion - If allocation is unavoidable, companies shall allocate emissions and removals based on the underlying physical relationships between the studied product and co-product(s) - When physical relationships alone cannot be established or used as the basis for allocation, companies shall select either economic allocation or another allocation method that reflects other relationships between the studied product and co-product(s)
ISO 14067 (Nov2010)	Adopt ISO 14044
PAS 2050 (Jan 2011)	Further developed from ISO 14044: <ol style="list-style-type: none"> 1. Co-product allocation is avoided by dividing unit processes into sub-processes, or expanding the product system. 2. If 1 is not applicable, allocation according to supplementary requirements 3. If there are no supplementary requirements economic value is preferred. <p>Additional procedures for allocation from specific sources including waste, renewable energy, and transportation are included.</p>
BP X30-323 (june 2011)	Adopt ISO 14044 hierarchy: <ul style="list-style-type: none"> -Process subdivision -distributed according to relations (mass, energy, ...) related

	<p>to relevant units of the product;</p> <p>-System expansion including the function of co-products when we can assess the impacts avoided by co-producing the product;</p> <p>-divided according to economic value;</p> <p>-divided according to several rules above.</p>
Ecological Footprint	If the analysis includes a novel calculation of P-LCA data that disaggregates a finished product into its primary product equivalents, it must comply with the ISO LCA Standards 14040 and 14044.

Allocation for Recycling:

Analyzed Methodology	Allocation for recycling
ISO14044:2006	This issue addressed separately, providing general principle by avoiding allocation but no specific rule provided
ILCD	Substitution of market average primary production of avoided product
GHGP (Oct 2011)	Either the closed loop approximation or recycled content method shall be used. If neither method appropriate, other methods – consistent with ISO 14044 - may be used if disclosed and justified in the inventory report. Guidance is given on applying and choosing between each method.
ISO 14067 (Nov2010)	Substitution of primary production of avoided product
PAS 2050 (March 2011)	Provides equation to calculate recycled content for allocation (sets out criteria where to apply 0/100,100/0 or other methods)
BP X30-323 (june 2011)	<p>The operator responsible for environmental communication shall first identify whether the material is recycled in a closed loop or an open loop system. Then depending on the material the product is made of, the operator shall apply the corresponding calculation formula.</p> <p>(Closed-loop system recycling with or without energy recovery, Open-loop system recycling with or without energy recovery Individual case of a specific energy recovery format)</p> <p>For open loop system, 100:0, 50:50 or 0:100 rules are proposed for each material type (exemple : 50:50 for plastics).</p>
Ecological Footprint	No specific provision

Land Use Impact Category (not related to climate change):

Analyzed Methodology	Land use impact category (not related to climate change)
ISO14044:2006	Not specified in ISO 14044
ILCD	Soil Organic Matter (SOM) as a soil quality indicator

GHGP (Oct 2011)	-
ISO 14067 (Nov2010)	-
PAS 2050 (Jan 2011)	-
BP X30-323 (june 2011)	-
Ecological Footprint	The primary production equivalents embodied in a finished product must be translated into Ecological Footprint values (e.g., global hectares) using primary conversion factors drawn from the National Footprint Accounts. In the event that no relevant primary conversion factor is available for a primary product, an original primary conversion factor may be calculated and is treated as a non-conventional element.

Other Impact Categories and used method

Analyzed Methodology	Other impact categories
ISO14044:2006	For general LCA study, no specific provision provided. For comparative assertions: include only international agreed impact categories only.
ILCD	<p>The ILCD Handbook provides recommended methods both at midpoint and endpoint (for areas of protection).</p> <p>Ozone depletion Steady-state ODPs 1999 as in WMO assessment</p> <p>Human toxicity, cancer effects USEtox model</p> <p>Human toxicity, noncancer effects USEtox model</p> <p>Particulate matter/Respiratory inorganics RiskPoll model</p> <p>Ionising radiation, human health Human health effect model as developed by Dreicer et al. 1995</p> <p>Photochemical ozone formation LOTOS-EUROS</p> <p>Acidification Accumulated Exceedance</p> <p>Eutrophication, terrestrial Accumulated Exceedance</p> <p>Eutrophication, aquatic EUTREND model</p> <p>EcotoxicityUSEtox model,</p> <p>Resource depletion, water Model for water consumption as in the Swiss Ecoscarcity</p> <p>Resource depletion, mineral, fossil and renewable EDIP97 update 2004 and CML 2002</p> <p>There is very few recommended method for endpoint categories due to lack of scientific robustness.</p>
GHGP (Oct 2011)	-

ISO 14067 (Nov2010)	-
PAS 2050 (Jan 2011)	-
BP X30-323 (june 2011)	<p>Greenhouse effect IPCC 2007 (100-year GWP)</p> <p>Depletion of natural non-renewable resources EDIP 97 with 2004 updates (Hauschild & Wenzel, 1998a update 2004)</p> <p>Eutrophication of water bodies EUTREND model (Struijs et al, 2009b) implemented in ReCiPe</p> <p>Photochemical pollution LOTOS-EUROS (Van Zelm et al., 2008) applied in ReCiPe</p> <p>Acidification ReCiPe</p> <p>Aquatic ecotoxicity USETox model (Rosenbaum et al, 2008)</p> <p>Biodiversity</p> <p>Land use</p> <p>Water (the BP X30-323 provides for characterization of water consumption, but does not provide a recommended method)</p> <p>LCIA methods recommended by the JRC are followed.</p> <p>Selecting relevant impact categories for a product will be addressed in the specific PCR.</p>
Ecological Footprint	<p>Exclusion from ecological footprint</p> <ul style="list-style-type: none"> - Depletion of non-renewable resources such as metal, mineral, or fossil fuel reserves; - The release of long-lived toxic materials into the biosphere; - Greenhouse gases other than carbon dioxide (may be included in future editions, or added as non-conventional elements); - Impacts on human health

Weighting Factor (aggregated impact assessment):

Analyzed Methodology	Weighting factor
ISO14044:2006	Weighting is an optional step in the Life Cycle Impact Assessment.
ILCD	Weighting is an optional step in the Life Cycle Impact Assessment.
GHGP (Oct 2011)	-
ISO 14067 (Nov2010)	-
PAS 2050 (Sept 2011)	-

BP X30-323 (june 2011)	Must not include in the assessment
Ecological Footprint	Implicitly in the national factor

Review:

Analyzed Methodology	Review
ISO14044:2006	Provides requirement for comparative studies: If the study is intended to be used for a comparative assertion to be disclosed to the public, interested parties shall conduct this evaluation as a critical review, and provide general information as to the type of review.
ILCD	Provides minimum requirements for review type, reviewer qualifications and how to review (e.g. for a general LCA study, independent external review is a minimum requirement).
GHGP (Oct 2011)	Assurance is required and can be achieved through: <ul style="list-style-type: none"> - First party verification - Third party verification - Critical Review -
ISO 14067 (Nov2010)	- CF declaration: Third party verification shall be conducted according to the CF communication programme instructions including procedures according to ISO 14025:2006, 5.7 and ISO 14025:2006 (review) and independent verification (ISO 14025:2006, 8.1), along with the requirements for independence and competencies of verifiers (ISO 14025:2006, 8.2). -CF claim: Third party verification shall be conducted according to ISO 14021 by verifiers accredited or otherwise recognized according to ISO 14065 (see ISO 14021:1999, 6.4) fulfilling the requirements for evaluation and claims of verification in ISO 14021:1999, Clause 6. - CF label: Third party verification according to programme instructions including verification procedures according to ISO 14024:1999, 5.10 on compliance and verification, ISO 14024:1999, 6.5 on verification of key performance elements, ISO 14024:1999, 7.2.2 procedures for testing and verification and ISO 14024:1999, 7.4.2 supervision and control.
PAS 2050 (Sept 2011)	Independent third party certification body accredited to provide assessment and certification to the PAS 2050. There are other possibilities for verification, including self-verification and non-accredited body verification, depending on intended communication.
BP X30-323 (june 2011)	Secondary data not derived from recommended sources must be reviewed by committee. In the PCR, temporal validity of data and update frequency and validation process for data and results are defined. Sector-specific guides specify data that does not have to be communicated to the consumer but that must however be kept for the inspection authorities.
Ecological Footprint	Specifies that report should be independently assessed, but no specific guidance provided.

Reporting:

Analyzed Methodology	Reporting
ISO14044:2006	<p>Provides general requirements for reporting and additional requirements for third party reporting.</p> <p>There is no LCA report template example in the ISO 140xx. The ISO 14048 provides the template and/or requirements for the data set only.</p>
ILCD	<p>Provides general requirements for reporting and additional requirements for third party reporting.</p> <p>Provides data set and study report format and templates; supports electronic / web-based data exchange and workflow.</p>
GHGP (Oct 2011)	<p>Provides a list of required and optional elements for public reporting (template available on the GHG Protocol website).</p> <p>The GHG impact is reported as CO2 eq</p>
ISO 14067 (Nov2010)	<p>Provides general requirements (adapted from ISO 14044).</p> <p>Additional requirements for third party reporting:</p> <ul style="list-style-type: none"> a) modifications to the initial scope together with their justification; b) description of the stages of the life cycle including a description of the selected use profiles and end-of-life scenarios; c) system boundary, including type of inputs and outputs of the system as elementary flows, decision criteria about treatment of unit processes, considering their importance for the conclusions of the study, and cut offs; d) description of significant unit processes, including decisions about allocation and the rules used; e) data, including decisions about data, details about individual data, and data quality assessment; f) results of the interpretation, including conclusions and limitations.
PAS 2050 (Sept 2011)	No report template provided.
BP X30-323 (2010)	No report template provided.
Ecological Footprint	<p>No report template provided.</p> <p>Requirements include;</p> <ul style="list-style-type: none"> - must discuss the truncation errors and potential for double counting common in Process based LCA (P-LCA), their likely effects on final results of the analysis, including the direction of any biases and any efforts taken to mitigate these errors. - for each major error type, the Report indicates whether the error is believed to be random or to produce a systematic bias in the final results. The direction of known probable biases should be indicated. - A description of how the error estimates were derived . -If the analysis uses P-LCA data from an outside source to disaggregate a finished product into its primary product equivalents, the source of the P-LCA data must be referenced.

	<p>- for extended input-output LCA, the report must provide sources and data year for national input-output</p> <p>- for extended input-output, provide assumptions</p>
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Communication Report (labeling or declaration):

Analyzed Methodology	Communication report
ISO14044:2006	No specific information provided. The communication aspect for environmental assessment is provided in ISO 1402x.
ILCD	No specific information provided in the handbook. Refers to ISO 140xx standards.
GHGP (Oct 2011)	Public reporting (according to the reporting requirements) is required to claim conformance to the standard. The standard supports other forms of communication (e.g., labels, declarations) with additional specifications (e.g., product rules). Guidance on what those specifications are is included in the standard (Chapter 5, Appendix A)
ISO 14067 (Nov2010)	Refers to ISO14021, 14024, 14025
PAS 2050 (Sept 2011)	Communication is not part of PAS 2050
BP X30-323 (june 2011)	<p>1) The label/declaration must display the selected environmental impacts for the product. It should not refer to improvement options.</p> <p>2) The label/declaration must clearly refer to a functional unit of product.</p> <p>3) Guidelines will be developed specifically to clarify the format of the label/declaration. They will be developed in accordance with the Consumer Code and the series of ISO 1402X (NF EN ISO 14020: 2002, EN ISO 14021: 2001, EN ISO 14024: 2001 and NF ISO 14025: 2006).</p> <p>4) Information relating to the preparation of the label/declaration must be accessible to all, freely and transparently, under appropriate conditions (i.e. report, website ...). Assumptions, method of data acquisition, data links between primary and secondary emission factors or impacts and limits of evaluation must be specified.</p> <p>5) A statement of compliance with the standards can be affixed to the product, or can be part of an institutional communication. This communication will be developed in accordance with the rules of DIN EN ISO14021: 2001.</p>
Ecological Footprint	Provides voluntary communication principles as guidelines, but not as requirements.

Role of Specific Guides / PCRs:

Analyzed Methodology	Role of specific guides / PCRs
ISO14044:2006	No specific provision in ISO 14044. The PCR is addressed under ISO 14025 in the context of Environmental product declaration. .
ILCD	Encourages development of sectorial specific guides or product category rules (PCR); have formal role within ILCD. The PCR or PCR-like documents has to be inline with the

	ILCD Handbook
GHGP (Oct 2011)	Not required for public reporting, but encourages use of product rules (e.g. PCRS) when available and in accordance with the standard (guidance on which is provided).
ISO 14067 (Nov2010)	Requires PCR, which shall be made publicly available.
PAS 2050 (Sept 2011)	The PAS 2050 uses the term “supplementary requirement” (of which can include “PCR”). The product specific supplementary provides additional or specific requirements for the analyzed product. The supplementary requirement has to be inline with PAS, and meet the principles for supplementary requirements set out in the PAS.
BP X30-323 (june 2011)	The guidelines are developed by the search for a consistency of recommended methods for the various categories of products so as to guarantee readability for the consumer, make conducting the assessment easier and to optimise cost content of guidelines (PCR) is: 1 Functional unit 2 Main environmental impacts 3 Life cycle inventory data contributing to environmental impacts 4 Relevant environmental indicators, precision rate and calculation methodology 4 Allocation rules for products and by-products 5 End of life 6 Scope of the assessment and calculation methodology for the selected indicators 7 Primary data, Semi-specific data, Secondary data 8 Temporal validity of data and update frequency 9 Validation process for data and results The PCRs specify also primary and secondary data for the calculation of each product category Note: Climate change is mandatory. For biodiversity, water consumption and land use need to be included if relevant.
Ecological Footprint	No specific PCR-like document is foreseen.

How to Develop PCR:

Analyzed Methodology	How to develop PCR
ISO14044:2006	No information provided in ISO 14044. Once using LCA for product declaration there are information available in ISO 14025.
ILCD	No information provided except with respect to review process.
GHGP (Oct 2011)	Provides limited criteria (i.e. need peer review by expert requires development input from diverse group of stakeholders).
ISO 14067 (Nov2010)	See ISO 14025.
PAS 2050 (March 2011)	The PAS 2050 uses the term “supplementary requirement”. The supplementary provides additional or specific requirements for particularly product categories or sectors, including: a) supplementary: requirements and related guidance for which specific provision is made in this PAS and that are supplementary to and not in conflict with it; b) broadly recognized: internationally, nationally,

	<p>industry or sector wide;</p> <p>c) inclusive and consensus-based: developed through a transparent process that is open to stakeholders;</p> <p>d) scoped appropriately: having scope and requirements that are directly applicable to the specific stakeholder base;</p> <p>e) harmonized: developed after having regard to relevant existing product sector or category rules, guidance or requirements by adopting, referencing or building on these. Where there is a valid reason for them not being adopted, the reason shall be clearly justified and referenced within the supplementary requirements.</p> <p>f) comprehensive: address all stages of the relevant product life cycle either by the inclusion of specific requirements where permitted by PAS 2050 or by deference to it;</p> <p>g) justified: by the inclusion of rationales identifying and explaining the supplements to the assessment method provided in PAS 2050 and confirming how the principles set out in a) through h) of this clause have been met;</p> <p>h) publicly available: free from use restrictions and in the public domain;</p> <p>i) maintained: ensuring validity over time.</p>
BP X30-323 (june 2011)	<p>Sector working groups will define product category rules.</p> <p>The general guidelines/ requirements for the development of PCRs are provided.</p> <p>The guidelines per product category (PCR) are validated by the ADEME / AFNOR platform.</p>
Ecological Footprint	Not relevant

Interpretation:

Analyzed Methodology	Interpretation
ISO14044:2006	<ul style="list-style-type: none"> - identification of the significant issues based on the results of the LCI and LCIA phases of LCA; - an evaluation that considers completeness, sensitivity and consistency checks; - conclusions, limitations, and recommendations.
ILCD	Further specify from ISO 14044
GHGP (Oct 2011)	aspects of interpretation are included in chapters on uncertainty, reporting, and performance tracking.
ISO 14067 (Nov2010)	Adopt ISO 14044
PAS 2050 (Sept 2011)	No detailed guidance provided.
BP X30-323 (2010)	No detailed guidance provided.
Ecological Footprint	No detailed guidance provided.

Uncertainty:

Analyzed Methodology	Uncertainty
ISO14044:2006	Listed as a requirement, but no detailed guidance provided.

ILCD	No specific method in the existing guide. Provides framework only.
GHGP (Oct 2011)	Requires reporting on qualitative uncertainty for significant processes, Guidance and tools for performing quantitative uncertainty available as supplementary information on the GHG Protocol website.
ISO 14067 (Nov2010)	Listed as a requirement, but no detailed guidance provided.
PAS 2050 (Jan 2011)	No guide provided in PAS 2050 but provide in separate document.
BP X30-323 (june 2011)	The sector-specific working groups shall conduct uncertainty and sensitivity analysis based on the standard ISO 14040:2006. Specific focus will be given to significant environmental aspects to ensure that the information communicated to consumers stays relevant and makes good sense. The sector-specific working groups shall ensure that calculation methods do not lead to communication on a negative value.
Ecological Footprint	No detailed guidance provided, but indicates that an estimate of the following types of uncertainty should be given separately: <ul style="list-style-type: none"> • Input parameters (e.g., uncertainty inherent in data gathered from other sources) • Proportionality assumptions (e.g., uncertainty associated with the assumption that changes in one type of data reflects changes in another, such as assuming that monetary flow through the economy represents flows of physical goods) • Category errors (e.g., the assumption that the properties associated with a group of items apply equally to all of the individual items) • Incomplete or partial coverage

Specific Issues for Carbon Footprint or Climate Change:

Fossil and Biogenic Carbon Emissions:

Analyzed Methodology	Fossil and Biogenic Carbon emissions
ISO14044:2006	No specific provisions.
ILCD	Report removals and emissions separately for carbon emissions from both fossil and biogenic sources. (mandatory)
GHGP (Oct 2011)	Both carbon emissions and removals from fossil and biogenic sources are included in the inventory results and reported separately for transparency (mandatory unless not applicable)
ISO 14067 (Nov2010)	Both carbon emissions and removals from fossil and biogenic sources should be reported separately. (mandatory)
PAS 2050 (Sept 2011)	Both carbon emissions and removals are included in the assessment (mandatory), except biogenic emissions and removals from food and feed (which is not mandatory). Any impact of carbon storage is included in the inventory but must also be recorded separately.
BP X30-323 (2010)	Both carbon emissions and removals from fossil and biogenic sources should be reported separately (Annex G in

	BP X30-323). (mandatory)
Ecological Footprint	No specific provision, as this standard focuses on appropriation of biocapacity only.

Land Use Change (impact for climate change):

Analyzed Methodology	Land use change (impact for climate change)
ISO14044:2006	No specific provision/ information.
ILCD	Specific IPCC derived guidance with default table; allocated to products for 20 years after land use change (can be adjusted in case of better specific, reviewed data).
GHGP (Oct 2011)	Direct land use change required when attributable. Additional guidance for calculation available, data sources refer to IPCC.
ISO 14067 (Nov2010)	Uses IPCC guidelines.
PAS 2050 (Jan 2011)	Specifically includes emissions from land use change that occur within the last 20 years .
BP X30-323 (june 2011)	Reference to IPCC methodology. Indirect land use changes shall be taken into consideration once there an internationally-recognised method becomes available
Ecological Footprint	Land use types used in the Report are consistent with the National Footprint Accounts, both for footprint and biocapacity.

Indirect Land Use Change:

Analyzed Methodology	Indirect land use change
ISO14044:2006	No specific provision/ information.
ILCD	Indirect land use changes (ILUC) are considered under consequential modeling, but not for product level (attributional-based) LCAs.
GHGP (Oct 2011)	Indirect land use change is not required. If indirect land-use impacts can be calculated and are determined to be significant for a given product, the magnitude of the impacts should be reported separately from the inventory results. (recommendation) .
ISO 14067 (Nov2010)	Will be considered once an internationally agreed method has been established.
PAS 2050 (Sept 2011)	Excludes indirect land use change.
BP X30-323 (june 2011)	Note: BPX 30-323 will consider indirect land use changes only when there an internationally-recognised method becomes available
Ecological Footprint	No specific provision/ information.

Carbon Storage / Sequestration and Delayed Emissions:

Analyzed Methodology	Carbon storage / sequestration and delayed emissions
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ISO14044:2006	No specific provision/ information provided. However, interpretation of the definition of LCA provided suggests that carbon storage and delayed emissions are excluded from the usual scope of study.
ILCD	Excluded from the usual scope of study. However, if included because part of the goal of study, the ILCD handbook provides detailed operational guidance. Similar to the recommended approach in the PAS 2050 for methods by which carbon storage impacts are calculated. Differentiate temporary storage from permanent storage if guaranteed for over 10000 years.
GHGP (Oct 2011)	Carbon that is not released as a result of end-of-life treatment over the time period of the study is treated as stored carbon. The time period should be based in science to the extent possible , or be a minimum of 100 years. Delayed emissions or weighting factors (e.g. temporary carbon) shall not be included in the inventory results, but can be reported separately.
ISO 14067 (Nov2010)	Carbon storage shall be reported separately.
PAS 2050 (Sept 2011)	Carbon storage shall be reported separately. Weighting factors for delayed emissions are not included in the inventory result, but a method is provided in (Annex B) if organizations wish to apply them. If so, this must be recorded separately to the inventory result.
BP X30-323 (june 2011)	Biogenic and fossil carbon. Time-weighted average for storage/delay for up to 100 years. The decision of applying the concept of delayed emissions is optional and will be decided in each PCRs. GHG removal can be taken into account for product containing biomass if this biomass is derived from replanted forest. Note: The BPX 30-323 will be revisited after finalization of the ILCD Handbook.
Ecological Footprint	No information provided.

Renewable Electricity Generation(Green power purchasing):

Analyzed Methodology	Renewable electricity Generation
ISO14044:2006	No specific provision.
ILCD	No specific provision. However the double counting shall be avoid according to principle chapter
GHGP (Oct 2011)	Some guidance is given on selecting electricity emission factors, but not specific to green power purchasing
ISO 14067 (Nov2010)	Exclude from footprint if the renewable energy sources are already claimed elsewhere e.g. CDM
PAS 2050 (Sept 2011)	Specifically addresses additionally available energy and double-counting issues associated with renewable electricity generation.

BP X30-323 (june 2011)	The energy analysis model may be replaced by any of a number of models that incorporate electricity production from renewable energy sources if the electricity generated is consumed within a closed loop unconnected to the mains network.
Ecological Footprint	No specific provision.

Climate Change Method and Factors:

Analyzed Methodology	Climate change method and factors:
ISO14044:2006	Not specified in ISO 14044.
ILCD	GHG emissions are referenced to 100 years, based on GWP 100 from IPCC.
GHGP (Oct 2011)	GHG emissions are referenced to 100 years, based on GWP 100 from IPCC. consider six substance in Kyoto protocol as mandatory
ISO 14067 (Nov2010)	GHG emissions are referenced to 100 years, based on GWP 100 from IPCC.
PAS 2050 (Jan 2011)	GHG emissions are referenced to 100 years, based on GWP 100 from IPCC.
BP X30-323 (2010)	GHG emissions are referenced to 100 years, based on GWP 100 from IPCC.
Ecological Footprint	The assessment calculates the Footprint of carbon dioxide emissions (e.g., converts tonnes of carbon dioxide into global hectares) using the same methods as the National Footprint Accounts (CO2 only). The National Footprint Accounts currently calculate this Footprint as the amount of forest land that would be necessary to absorb carbon dioxide emissions from fossil fuel combustion through the use of sequestration values for world-average forests, after adjusting for uptake by the oceans.

Emission Off-setting:

Analyzed Methodology	Emission off-setting
ISO14044:2006	No specific guidance provided.
ILCD	Must not include in the assessment.
GHGP (Oct 2011)	Must not include in the assessment.
ISO 14067 (Nov2010)	Must not include in the assessment.
PAS 2050 (Jan 2011)	Must not include in the assessment.
BP X30-323 (2010)	Must not include in the assessment.
Ecological Footprint	No provisions provided. However, as this standard refers to ISO 14044, emission offsetting is not included.

5.2 Corporate Environmental Footprint

Using Life Cycle Thinking (Approach):

Analyzed Methodology	Using life cycle thinking
ILCD	<ul style="list-style-type: none"> • Yes
GHG Protocol	<ul style="list-style-type: none"> • Scope 3 is based in life cycle thinking (by definition, Scope 1 and 2 are not).
DEFRA	<ul style="list-style-type: none"> • Not required for scope 1 and 2 reporting (discretionary to report “significant” Scope 3 emissions”)
Bilan Carbone	<ul style="list-style-type: none"> • Yes
ISO 14064	<ul style="list-style-type: none"> • For Scope 3 reporting only
ISO 14069 (draft technical guidance to 14064)	<ul style="list-style-type: none"> • Yes, for Scope 3 reporting
GRI	<ul style="list-style-type: none"> • Not explicit, but for some indicators such as energy use and greenhouse gas emissions, both direct and indirect impacts must be accounted for, suggesting a life cycle (Scopes 1 through 3) approach in these domains.
CDP Water	<ul style="list-style-type: none"> • No

Goals:

Analyzed Methodology	Goals
ILCD	<ul style="list-style-type: none"> • Must specify at least: <ul style="list-style-type: none"> ○Intended applications e.g. performance tracking, strategic plan ○Limitations (due to methods, assumptions, and impact coverage) ○Study rationale and decision context ○Target audience ○Whether comparative and/or intended for disclosure ○Study commissioner and other stakeholders
GHG Protocol	<ul style="list-style-type: none"> • Provide guidance to companies in creating a true and fair account of their GHG emissions • Simplify and reduce costs of compiling GHG inventory • Support participation in voluntary and mandatory GHG programs • Increase consistency and transparency in corporate GHG reporting • Stresses alignment with business goals • No further study-specific goal definition guidance provided
DEFRA	<ul style="list-style-type: none"> • Guidance in measuring and reporting organizational GHG emissions and setting reduction targets • The reporting template (annex I) suggests that companies will wish to outline their climate change strategy , as well as identifying risks and opportunities that climate change poses to the organisation
Bilan Carbone	<ul style="list-style-type: none"> • Guidance (and tools) to evaluate the GHG emissions associated with the ensemble of physical processes necessary to the existence of an organization • No further study-specific goal definition guidance provided
ISO 14064	<ul style="list-style-type: none"> • Provide principles and requirements for organizational design, development, management and reporting of

	<p>GHG emissions</p> <ul style="list-style-type: none"> No further study-specific goal definition guidance provided
ISO 14069 (draft technical guidance to 14064)	<ul style="list-style-type: none"> Detailed guidance (draft) for the implementation of ISO 14064 Goal definition is not considered, although there are several references to ensuring that methodological choices are in line with the goals of the study
GRI	<ul style="list-style-type: none"> Provide a general framework for reporting on an organizations social, economic, and environmental sustainability performance in a balanced, reasonable, and transparent manner No further study-specific goal definition guidance provided
CDP Water	<ul style="list-style-type: none"> Provide guidance to assist companies in corporate water footprint disclosure for the purpose of informing institutional investors No further study-specific goal definition guidance provided

Application:

Analyzed Methodology	
ILCD	<ul style="list-style-type: none"> Organization-level analyses (Type C1 and C2 for organizational design, development, management and reporting (C1 is for monitoring))
GHG Protocol	<ul style="list-style-type: none"> GHG Protocol intended to support accountancy and disclosure for both internal use and a range of external applications including. <ul style="list-style-type: none"> “Managing GHG risks and identifying reduction opportunities Public reporting and participation in voluntary GHG programs Participating in mandatory reporting programs Participating in GHG markets Recognition for early voluntary action” For use by businesses and other private or public organizations
DEFRA	<ul style="list-style-type: none"> DEFRA guidance is intended to support GHG disclosure for businesses and other private or public sector organizations, including SMEs (specific SME-guidance provided) , voluntary sector organizations and local authorities.
Bilan Carbone	<ul style="list-style-type: none"> The Bilan Carbone standard has the broadest intended organizational application, as it may be applied to GHG accountancy and disclosure for industrial organizations, legal entities, territories, or territorial structures, as well as specific projects or activities. However, potential applications of study outcomes other than for internal information purposes are not discussed in any detail. It is also intended to be applicable for use within the frameworks for reporting provided by ISO 14064, the GHG Protocol, and the Carbon Disclosure Project.
ISO 14064	Organizational design, development, management and reporting of GHG emissions for the purpose of corporate risk management, voluntary initiatives, GHG markets, or regulatory reporting.
ISO 14069 (draft technical guidance to 14064)	<ul style="list-style-type: none"> See ISO 14064.
GRI	<ul style="list-style-type: none"> GRI guidance intended to inform sustainability accountancy for corporate disclosure to all relevant

	stakeholders.
CDP Water	<ul style="list-style-type: none"> • CDP Water guidance intended to inform corporate disclosure to investors.

Target Audiences:

Analyzed Methodology	
ILCD	<ul style="list-style-type: none"> • Business to Business (B2B), Business to Consumer (B2C)
GHG Protocol	<ul style="list-style-type: none"> • B2B, B2CB2B, Business to interested stakeholder (e.g., customer, investor, consumer) through public reporting
DEFRA	<ul style="list-style-type: none"> • B2B, B2C, Internal, public, voluntary and private sector.
Bilan Carbone	<ul style="list-style-type: none"> • Internal
ISO 14064	<ul style="list-style-type: none"> • B2B, B2C
ISO 14069 (draft technical guidance to 14064)	<ul style="list-style-type: none"> • B2B, B2C
GRI	<ul style="list-style-type: none"> • B2B, B2C
CDP Water	<ul style="list-style-type: none"> • Specific to institutional investors

Accounting and Reporting Principles:

Analyzed Methodology	
ILCD	<ul style="list-style-type: none"> • Relevance, completeness, consistency and reproducibility
GHG Protocol	<ul style="list-style-type: none"> • Relevance, completeness, consistency, transparency, accuracy
DEFRA	<ul style="list-style-type: none"> • Relevance, completeness, consistency, transparency, accuracy
Bilan Carbone	<ul style="list-style-type: none"> • Emphasis on biophysical realism in GHG accountancy. Accordingly,
ISO 14064	<ul style="list-style-type: none"> • Relevance, completeness, consistency, accuracy, transparency. Additional principles for verification are independence, ethical conduct, fair presentation, and due professional care.
ISO 14069 (draft technical guidance to 14064)	<ul style="list-style-type: none"> • Relevance, completeness, consistency, accuracy, transparency. Additional principles for verification are independence, ethical conduct, fair presentation, and due professional care.
GRI	<ul style="list-style-type: none"> • For report content: <ul style="list-style-type: none"> ○Materiality ○Stakeholder inclusiveness ○Sustainability context ○Completeness • For report quality: <ul style="list-style-type: none"> ○Balance ○Comparability ○Accuracy ○Timeliness ○Clarity ○Reliability
CDP Water	<ul style="list-style-type: none"> • Relevance, completeness, consistency, transparency, accuracy, materiality

Scope:

Analyzed Methodology	
ILCD	<ul style="list-style-type: none"> Full cradle-to-grave life cycle accountancy
GHG Protocol	<ul style="list-style-type: none"> Scope 1, 2 (Corporate standard) and Scope 3 (Value Chain Standard)
DEFRA	<ul style="list-style-type: none"> Scope 1, 2 recommended as a minimum and discretionary for significant scope 3 emissions
Bilan Carbone	<ul style="list-style-type: none"> Scope 1, 2 and 3
ISO 14064	<ul style="list-style-type: none"> Scope 1, 2 and optional for Scope 3
ISO 14069 (draft technical guidance to 14064)	<ul style="list-style-type: none"> Scope 1, 2 and optional for Scope 3
GRI	<ul style="list-style-type: none"> Scope concept is not referred to (rather, users are instructed to account for impacts of activities over which the company has control or significant influence).
CDP Water	<ul style="list-style-type: none"> Does not refer to Scopes (nor life cycle based)

System Boundaries

Analyzed Methodology	
ILCD	<ul style="list-style-type: none"> Inclusive of raw material acquisition through end-of-life and disposal (all relevant processes) related to activities in the company e.g. production, overhead advertisement Iterative, focused on most relevant processes. Omissions to be described and explicitly considered in interpretation.
GHG Protocol	<ul style="list-style-type: none"> Scope and organizational/operational system boundaries defined based on equity share or control (financial or operational) criteria. Further specify system boundary criteria for Scope 1, 2 and 3 activities. Scope 3 standard requires modeling of GHG emissions for all 15 Scope 3 categories. Examples include : goods/services sold over reporting interval, employee commuting, business travel, leased assets, capital goods purchased during the reporting interval, and investments.
DEFRA	<ul style="list-style-type: none"> Scope and organizational/operational system boundaries defined based on equity share or control (financial or operational) criteria. The use of financially-determined system boundaries is recommended, in large part for alignment with traditional financial accounting and reporting mechanisms. Further specify system boundary criteria for Scope 1, 2 and 3 activities. DEFRA guidance recommends a 12 month reporting interval, corresponding to the corporate financial year. DEFRA guidance recommends accounting for Scope 1 and 2 emissions, with Scope 3 accounting discretionary
Bilan Carbone	<ul style="list-style-type: none"> Bilan Carbone provides rationale for defining system boundaries so as to include all biophysically-relevant flows of matter/energy and associated waste (whether direct or indirect) associated with the existence of an organizational entity as opposed to using financially-defined system boundaries. This is because the latter do not accurately reflect biophysical flows and associated

	<p>environmental footprints. Specifically, the system boundaries are defined according to the “ensemble of physical processes that are necessary for the existence of a human organization.”</p> <ul style="list-style-type: none"> • Bilan Carbone defines similar scopes, but using different terminology from other guidance documents. It also offers calculation templates consistent with ISO-1064 scopes and the GHG Protocol. • Requires modeling of full life cycle GHG emissions for all products/services sold over reporting interval. • For capital goods, provides option of amortizing over relevant time periods.
ISO 14064	<ul style="list-style-type: none"> • Scope and organizational/operational system boundaries defined based on equity share or control (financial or operational) criteria. • No guidance provided with respect to capital goods
ISO 14069 (draft technical guidance to 14064)	<ul style="list-style-type: none"> • Scope and organizational/operational system boundaries defined based on equity share or control (financial or operational) criteria. • Current draft indicates that guidance will be developed for accounting for emissions related to capital goods
GRI	<ul style="list-style-type: none"> • Scope and organizational/operational system boundaries defined based on equity share or control (financial or operational) criteria. Preference is seemingly given to financially-determined system boundaries, in large part for alignment with traditional financial accounting and reporting mechanisms. • GRI also emphasizes stakeholder inclusiveness and sustainability context as determinants of system boundaries • No guidance provided with respect to capital goods
CDP Water	<ul style="list-style-type: none"> • Scope and organizational/operational system boundaries defined based on control (financial or operational) criteria, with reference to GHG Protocol guidance. • No guidance provided with respect to capital goods

Functional Unit:

Analyzed Methodology	
ILCD	<ul style="list-style-type: none"> • Applies functional unit concept for organization analyses (what, how much, for how long).
GHG Protocol	<ul style="list-style-type: none"> • Does not use functional unit concept
DEFRA	<ul style="list-style-type: none"> • Does not use functional unit concept
Bilan Carbone	<ul style="list-style-type: none"> • Does not use functional unit concept
ISO 14064	<ul style="list-style-type: none"> • Does not use functional unit concept
ISO 14069 (draft technical guidance to 14064)	<ul style="list-style-type: none"> • Does not use functional unit concept
GRI	<ul style="list-style-type: none"> • Does not use functional unit concept
CDP Water	<ul style="list-style-type: none"> • Does not use functional unit concept

Covered Emissions, Impact Categories and method used:

Analyzed Methodology	
ILCD	<ul style="list-style-type: none"> • All relevant emission need to be consider in studied system • Provides recommendation both at midpoint and endpoint • Recommended categories and methods at midpoint are: <ul style="list-style-type: none"> ○Ozone depletion Steady-state ODPs 1999 as in WMO assessment ○Human toxicity, cancer effects USEtox model ○Human toxicity, noncancer effects USEtox model ○Particulate matter/Respiratory inorganics RiskPoll model ○Ionising radiation, human health Human health effect model as developed by Dreicer et al. 1995 ○Photochemical ozone formation LOTOS-EUROS ○Acidification Accumulated Exceedance ○Eutrophication, terrestrial Accumulated Exceedance ○Eutrophication, aquatic EUTREND model ○EcotoxicityUSEtox model, ○Resource depletion, water Model for water consumption as in the Swiss Ecoscarcy ○Resource depletion, mineral, fossil and renewable EDIP97 update 2004 and CML 2002 • May include others, with appropriate documentation, as suited to the study
GHG Protocol	<ul style="list-style-type: none"> • Climate Change
DEFRA	<ul style="list-style-type: none"> • Climate Change
Bilan Carbone	<ul style="list-style-type: none"> • Climate Change
ISO 14064	<ul style="list-style-type: none"> • Climate Change
ISO 14069 (draft technical guidance to 14064)	<ul style="list-style-type: none"> • Climate Change
GRI	<ul style="list-style-type: none"> • All relevant social, economic and environmental sustainability impacts • For environmental indicators, GRI includes resource inputs (material, energy, water), waste outputs (emissions, effluents, waste), biodiversity, environmental compliance, environmental expenditures, and impacts of transport and products/services • GRI recommends inclusion of core (required) and additional performance indicators for each of the above
CDP Water	<ul style="list-style-type: none"> • Water footprint

Cut-Off Criteria:

Analyzed Methodology	
ILCD	<ul style="list-style-type: none"> • Cut-off criteria are to be determined relative to study requirements for precision
GHG Protocol	<ul style="list-style-type: none"> • Recommends against the use of cut-off criteria • When deciding if exclusions are merited for Scope 3 reporting, the following criteria should be considered: <ul style="list-style-type: none"> ○Size ○Influence ○Risk ○Stakeholders ○Outsourcing ○Other

DEFRA	<ul style="list-style-type: none"> Does not refer to cut-off criteria specifically. Discourages exclusions, and recommends explicit justification and estimation of importance of any exclusions made.
Bilan Carbone	<ul style="list-style-type: none"> Does not refer to cut-off criteria specifically. Discourages exclusions, and recommends explicit justification and estimation of importance of any exclusions made. Encourage for identifying and prioritizing emissions to be included versus those to be excluded based on criteria for relevance.
ISO 14064	<ul style="list-style-type: none"> ISO 14064 permits exclusions based on considerations of materiality, feasibility and cost effectiveness, although objective is to include 100% of direct (Scope 1) and energy indirect (Scope 2) emissions.
ISO 14069 (draft technical guidance to 14064)	<ul style="list-style-type: none"> Further specifies that exclusions may be justified relative to the goals of the study. Provides guidance for identifying and prioritizing emissions to be included versus those to be excluded based on criteria for relevance.
GRI	<ul style="list-style-type: none"> GRI recommends exclusions of flows over which the corporation has no significant control/influence and/or where no significant sustainability impacts are anticipated
CDP Water	<ul style="list-style-type: none"> Does not refer to cut-off criteria. Suggests cut-offs are allowed where data is limited or reporting is not feasible, but recommends explicit justification and assessment of importance of any exclusions made.

Data Modeling:

Analyzed Methodology	
ILCD	<ul style="list-style-type: none"> For situation (organizational), attributional modeling and industry-average substitution for end-of-life processes is applied
GHG Protocol	<ul style="list-style-type: none"> Provides modeling spreadsheets with embedded (but customizable) default emission factors that are applied to activity data. Provides 15 categories e.g. business travel, investment for modeling Scope 3 emissions, with recommended inclusions for each.
DEFRA	<ul style="list-style-type: none"> Provides modeling spreadsheets with embedded default emission factors that are applied to activity data. Also provides a high level diagnostic tool for indirect emissions from the supply chain. These emission factors are updated annually.
Bilan Carbone	<ul style="list-style-type: none"> Provides modeling spreadsheets with embedded (but customizable) default emission factors that are applied to activity data. Bilan Carbone method aims to provide average emissions factors which are accurate within one order of magnitude
ISO 14064	<ul style="list-style-type: none"> No specific guidance provided
ISO 14069 (draft technical guidance to 14064)	<ul style="list-style-type: none"> Guidance provided for data modeling in 23 categories for Scope 3 reporting
GRI	<ul style="list-style-type: none"> No specific guidance provided
CDP Water	<ul style="list-style-type: none"> No specific guidance provided

Primary Data:

Analyzed Methodology	
ILCD	<ul style="list-style-type: none"> Primary data for the foreground system and main background processes preferred; secondary data can be used as well, provided it is ILCD-compliant and has good and demonstrable representativeness for the processes/products of interest.
GHG Protocol	<ul style="list-style-type: none"> Provides guidance on the collection of “activity data” for corporate scope 3 activities
DEFRA	<ul style="list-style-type: none"> Requires collection of “activity data” for corporate activities within the defined system boundary. Other approaches are a) direct measurement and monitoring of emissions; and b) calculating emissions based on mass balance or theoretical combustion specific to a facility or process but activity data is most common method.
Bilan Carbone	<ul style="list-style-type: none"> Requires collection of “activity data” for corporate activities within the defined system boundary
ISO 14064	<ul style="list-style-type: none"> Requires collection of “activity data” for corporate activities within the defined system boundary
ISO 14069 (draft technical guidance to 14064)	<ul style="list-style-type: none"> Provides list of 23 categories for which primary “activity” data should be collected for Scope 3 modeling. Guidance is provided for different approaches to data collection – for example, in the case of the “Client and Visitor Transportation” category, guidance is provided for using directed collected or estimated data.
GRI	<ul style="list-style-type: none"> Does not refer to “activity” data or “primary” data, nor does the guidance distinguish between primary and secondary data. Rather, it is stipulated that data should be collected for all aspects over which the company has control or significant influence.
CDP Water	<ul style="list-style-type: none"> Does not refer to “activity” data or “primary” data, nor distinguish between primary and secondary data.

Secondary Data:

Analyzed Methodology	
ILCD	<ul style="list-style-type: none"> For all other data needs, the best quality, ILCD-compliant secondary data is preferred. Remaining data gaps shall be filled using “data estimates” of minimum quality. Gaps for which no minimum quality data can be obtained are kept and reported, as well as explicitly considered in interpretation and data quality indicator results.
GHG Protocol	<ul style="list-style-type: none"> For Scope 3 reporting, provides description of secondary data for each category. If secondary data is used, encourages sourcing it from internationally recognized, government, or peer-reviewed sources.
DEFRA	<ul style="list-style-type: none"> Provides emission factors in place of reliance on independently sourcing secondary data Notes that where an organization has more site specific emission factors they should be used if they will give a more accurate measurement of emissions. May use EUTS data, CCA data and CRC data but this should be noted in the report
Bilan Carbone	<ul style="list-style-type: none"> Provides default emission factors and average activity data Public database linked with the database for the product is under development by ADEME Other secondary data should be sourced from <ul style="list-style-type: none"> oELCD

	oPeer-reviewed data
ISO 14064	<ul style="list-style-type: none"> Distinguishes between use of activity data with emission factors and direct measurement approaches. For emission or removal factors, specifies that they should be derived from an recognized source and that they should be current and appropriate.
ISO 14069 (draft technical guidance to 14064)	<ul style="list-style-type: none"> ISO 14069 describes range of situations where secondary data may be sourced (i.e. for emission factors)
GRI	<ul style="list-style-type: none"> No provision provided
CDP Water	<ul style="list-style-type: none"> No provision provided

Data Quality:

Analyzed Methodology	
ILCD	<ul style="list-style-type: none"> Adapted from ISO 14044 Technological, temporal and geographical representativeness Completeness Accuracy Methodological appropriateness and consistency Provides guidance for accounting for uncertainty
GHG Protocol	<ul style="list-style-type: none"> GHG Protocol recommends implementation of a data quality monitoring system (taking into account institutional, managerial, and technical considerations), and qualitative data quality scoring for Scope 3 calculations. Also, it is stipulated that secondary data should be derived from internationally-recognized, government, or peer-reviewed sources. Guidelines are provided on the GHG Protocol website for uncertainty assessments, with attention to parameter, scenario, and model uncertainty Specifies minimum criteria for a data management plan, which contributes to the quality assurance process. Data management plan checklist provided.
DEFRA	<ul style="list-style-type: none"> Indicates that companies may wish to establish a data quality management systems, and refers organisations to GHG Protocol for guidance
Bilan Carbone	<ul style="list-style-type: none"> Bilan Carbone recommends the calculation of 95% confidence intervals. Spreadsheet calculators are provided for the purpose of uncertainty estimates.
ISO 14064	<ul style="list-style-type: none"> Requires that the organization develop and implement a data management system Requires completion and documentation of an uncertainty assessment. Refers to 14064-3 for validation/verification requirements
ISO 14069 (draft technical guidance to 14064)	<ul style="list-style-type: none"> No further details above and beyond those provided in 14064-1
GRI	<ul style="list-style-type: none"> GRI does not provide specific guidance, although it is recommended to assess and communicate uncertainty
CDP Water	<ul style="list-style-type: none"> Requests indication of percentage of water withdrawals and discharges that have been verified or assured (following GHG Protocol definitions) but no specific guidance provided

Allocation:

Analyzed Methodology	
ILCD	<ul style="list-style-type: none"> follows the ISO 14044 allocation decision hierarchy, with additional guidance For Situation C, attributional modeling with allocation and industry-average substitution for end-of-life processes
GHG Protocol	<ul style="list-style-type: none"> GHG Protocol follows ISO 14044 allocation decision hierarchy Calculation tool for stationary combustion provides two allocation options
DEFRA	<ul style="list-style-type: none"> No guidance provided The supplementary transport and logistics guidance provides details on allocation.
Bilan Carbone	<ul style="list-style-type: none"> Bilan Carbone stipulates that avoided impacts method (credits for displacement) should be used for open loop recycling. Stock method (material GHG intensity already adjusted to reflect lower emissions associated with recycled content) should be used for closed-loop recycling. Elsewhere, allocation decisions should follow the ISO decision hierarchy, but economic allocation should not be used as it does not provide a basis for realistic representation of biophysical flows and associated impacts.
ISO 14064	<ul style="list-style-type: none"> No guidance provided
ISO 14069 (draft technical guidance to 14064)	<ul style="list-style-type: none"> No guidance provided beyond indicating that choice must be made between mass, volume, or economic allocation for categories related to transport
GRI	<ul style="list-style-type: none"> No guidance provided
CDP Water	<ul style="list-style-type: none"> No guidance provided

Accounting for External Reductions:

Analyzed Methodology	
ILCD	<ul style="list-style-type: none"> Shall not be accounted for
GHG Protocol	<ul style="list-style-type: none"> GHG Protocol requires use of the inventory method (comparing changes in actual emissions from base year) as opposed to the project method (reductions associated with mitigation projects) for corporate disclosure.
DEFRA	<ul style="list-style-type: none"> Emissions should be reported as “gross emissions”, prior to accounting for reductions from external projects, which should only be included in reported “net emissions”. DEFRA guidance also refers to a set of “good quality” criteria for offsets and green tariffs, and recommends that businesses report whether or not their purchased offsets are “Kyoto compliant” In addition guidance is provided to aid reporting of emissions reductions from investment in domestic woodland creation.
Bilan Carbone	<ul style="list-style-type: none"> Bilan Carbone method specifically excludes emission reductions from purchased offsets and similar mitigation projects on the basis that they are typically not verifiable nor physically linked the organization in question
ISO 14064	<ul style="list-style-type: none"> Reductions from purchased credits or other external projects must be documented and reported separately
ISO 14069 (draft technical	<ul style="list-style-type: none"> Refers to 14064-1

guidance to 14064)	
GRI	<ul style="list-style-type: none"> Refers to offsets, but no guidance provided
CDP Water	<ul style="list-style-type: none"> No guidance provided

Setting Targets and Tracking Progress:

Analyzed Methodology	
ILCD	<ul style="list-style-type: none"> No requirement for setting targets and tracking progress
GHG Protocol	<ul style="list-style-type: none"> requires justification of base year choice, and development of a base year recalculation policy. Base year emissions are to be recalculated if there are significant changes in company structure or inventory method. Base year emissions are not recalculated in response to organic growth or decline. recommends setting Scope-specific targets
DEFRA	<ul style="list-style-type: none"> suggests the following steps for setting (GHG) reduction targets: <ul style="list-style-type: none"> Obtain senior management commitment Decide on target type Decide on target boundary Set target base year Define target completion date Decide on permissibility of using offsets or credits to reach target Decide target level Track and report progress Provides guidance on the advantages and disadvantages of absolute and intensity based targets. Guidance on recalculating base years
Bilan Carbone	<ul style="list-style-type: none"> provides a spreadsheet feature to manage reduction targets over the shorts and long-terms. Encourages use of absolute as opposed to intensity-based targets.
ISO 14064	<ul style="list-style-type: none"> Requires establishment of base year, justification of base year choice, and development of a base year recalculation policy. Base year emissions are to be recalculated if there are significant changes in company structure or inventory method. Base year emissions are not recalculated in response to organic growth or decline.
ISO 14069 (draft technical guidance to 14064)	<ul style="list-style-type: none"> No further guidance provided beyond 14064-1
GRI	<ul style="list-style-type: none"> refers to “base year” concept, but no guidance provided recommends reporting trends using current and at least two previous reporting intervals recommends core and performance indicators for each sustainability domain of concern
CDP Water	<ul style="list-style-type: none"> refers to “base year” concept, but no guidance provided provides option of reporting water intensity on an economic or physical (activity) basis

Reporting:

Analyzed Methodology	
ILCD	<ul style="list-style-type: none"> Specifies three levels of reporting requirements, depending on application <ul style="list-style-type: none"> Internal use

	<ul style="list-style-type: none"> ○Third-party ○Comparative assertion • Corporate disclosure would correspond to a third-party report
GHG Protocol	<ul style="list-style-type: none"> • ProtocolThe Corporate Standard requires reporting all Scope 1 and Scope 2 emissions. • The Value Chain (Scope 3) Standard requires reporting of scope 1, 2, and 3. A reporting template with all required elements is available on the GHG Protocol website.
DEFRA	<ul style="list-style-type: none"> • Provides an example report template which provides details of what an organization should include in its directors' report e.g. strategy and supporting explanations. • Recommends that organizations should report their scope 1, 2 and 3 although • Scope 3 reporting is optional. Also recommends organizations should report their gross emissions, any carbon offsets or green tariffs and a total net emissions figure,
Bilan Carbone	<ul style="list-style-type: none"> • Suggests that results from a GHG audit following the Bilan Carbone method can be used for reporting within framework of ISO 14064,the GHG Protocol, the Carbon Disclosure Project, or other such reports, but does not provide method-specific reporting guidance • Provide recommended report contents
ISO 14064	<ul style="list-style-type: none"> • Provides detailed list of recommended report contents • For ISO 14064-1,if the organization makes a public disclosure and claims compliance with ISO 14064-1, then it must also provide a publically available report which conforms to the standards or which has been third-party verified (with associated report made publicly available) • Refers to 14064-3
ISO 14069 (draft technical guidance to 14064)	<ul style="list-style-type: none"> • Will further specify guidance for reporting
GRI	<ul style="list-style-type: none"> • Stipulates base content for a sustainability report, and encourages inclusion of three standard types of disclosures (Strategy and Profile, Management Approach, and Performance Indicators). Specific guidance provided for each disclosure • provides a generic report template
CDP Water	<ul style="list-style-type: none"> • Guidance document itself is a reporting guide, intended to help companies answer on-line disclosure survey. No guidance specific to other reporting initiatives is provided.

Sectorial Specificity:

Analyzed Methodology	
ILCD	<ul style="list-style-type: none"> • Encourages development of sector specific guides based on ILCD Handbook
GHG Protocol	<ul style="list-style-type: none"> • GHG Protocol provides both general guidance along with several sector-specific calculation tools on website. Additional guidance documents are also available for quantifying project-related reductions.
DEFRA	<ul style="list-style-type: none"> • Sector specific guidance is provided for freight transport
Bilan Carbone	<ul style="list-style-type: none"> • Bilan Carbone provides separate guidance for corporate versus local authorities • Several sectorial guidance are provided (i.e waste,

	building, water, sports federations, wine production, liquors and spirits, industrial bakery, super/hypermarkets)
ISO 14064	<ul style="list-style-type: none"> No sector-specific guidance provided
ISO 14069 (draft technical guidance to 14064)	<ul style="list-style-type: none"> No sector-specific guidance provided Some specific guidance are given for local authorities
GRI	<ul style="list-style-type: none"> GRI provides both general guidance along with a range of sector-specific supplements describing core and additional indicators
CDP Water	<ul style="list-style-type: none"> No sector-specific guidance provided

Relationship with Product Environmental Footprint Guidance:

Analyzed Methodology	Relationship with Product Environmental Footprint Guidance
ILCD	<ul style="list-style-type: none"> Provides coherent methodological reference point for both product and corporate environmental footprint methods
GHG Protocol	<ul style="list-style-type: none"> Not intended for product-level analysis but can serve as a tool for identifying product “hot-spots”.
DEFRA	<ul style="list-style-type: none"> Not intended for product-level analysis
Bilan Carbone	<ul style="list-style-type: none"> No direct relationship with BP X30-323 but similarities in terms of using life cycle principle and e.g. prioritizing use of ELCD for secondary data Several works on consistency of data sources and scopes between corporate database (Base Carbone®) and product (BPX30-323) database Common methodological rules for carbon biogenic and allocation for recycling are under construction
ISO 14064	<ul style="list-style-type: none"> ISO 14067 draft refers to ISO 14064 part 3
ISO 14069 (draft technical guidance to 14064)	<ul style="list-style-type: none"> Refers to 14067, in particular with respect to emission factors derived from product studies
GRI	<ul style="list-style-type: none"> No specific relationship with a product standard
CDP Water	<ul style="list-style-type: none"> No specific relationship with a product standard

Review, Validation/Verification:

Analyzed Methodology	Review, Validation/Verification
ILCD	<ul style="list-style-type: none"> Provides minimum requirements based on intended application
GHG Protocol	<ul style="list-style-type: none"> Provides detailed guidance verification for assurance, but this is not a requirement of the standard
DEFRA	<ul style="list-style-type: none"> Does not require third party verification of disclosures, but recommends consulting an assurance expert Requires third-party verification for external reduction projects to ensure they meet the “good quality criteria” if purchased or sold emissions reductions are reported in net CO₂-e figure Refers to ISO 14064 for verification standards
Bilan Carbone	<ul style="list-style-type: none"> Encourage third-party critical reviews for comparative assertions and other external applications

ISO 14064	<ul style="list-style-type: none"> • For public assertions, stipulates that organization should make their report publicly available or provide a third-party verification statement • Additional specific provisions provided in Scope 3 standard • Required level of validation and verification depends on: <ul style="list-style-type: none"> ○Required assurance level ○User needs ○Validation and verification objectives ○validation or verification criteria • Scope 3 standard also includes the accreditation and conformity assessment of emissions trading and emissions or removal offset programs
ISO 14069 (draft technical guidance to 14064)	<ul style="list-style-type: none"> • Will provide further detailed guidance with respect to verification
GRI	<ul style="list-style-type: none"> • no specific requirements for third-party verification
CDP Water	<ul style="list-style-type: none"> • requests information for % of withdrawals that are third-party verified

Guide for SMEs

Analyzed Methodology	Guide for SMEs
ILCD	<ul style="list-style-type: none"> • No guide for SMEs
GHG Protocol	<ul style="list-style-type: none"> • No guide for SMEs
DEFRA	<ul style="list-style-type: none"> • Provides additional guidance for SMEs
Bilan Carbone	<ul style="list-style-type: none"> • No guide for SMEs but mainly used by SMEs (60-70% of users) • First tools developments were dedicated to SMEs, training sessions, friendly tools,
ISO 14064	<ul style="list-style-type: none"> • No i guide for SMEs
ISO 14069 (draft technical guidance to 14064)	<ul style="list-style-type: none"> • No guide for SMEs
GRI	<ul style="list-style-type: none"> • No guide for SMEs
CDP Water	<ul style="list-style-type: none"> • provides limited guidance for SMEs

6. Key insights for the development of guidelines

6.1 General issues

All methodology guidance documents reviewed were developed via multi-stakeholder processes. This is viewed as important to ensuring the legitimacy and acceptability of the associated recommendations. Moreover most of guidelines also included pilot studies and a revision based on the findings.

Most guidance documents reviewed claim suitability for public reporting . However, a general lack of prescription means that analytical outcomes may be heavily influenced by subjective choice. As such, existing methodologies do not provide an adequate basis for comparative assertions this may be true even for studies using the same methodology guides. Ensuring higher levels of reproducibility and robustness of analytical outcomes for product and corporate environmental footprinting will require more prescriptive methodological standards than are available in current methodologies and standards.

It should be noted, the cradle to gate environmental footprint analyzes at the corporate level will likely provide information of sufficient robustness to support mandatory policy applications. This is due to the large number of assumptions necessary to modeling downstream processes for goods/services outputs, particularly where companies produce inputs to other products or have large product/service portfolios.

With respect to possible complementary Product Category Rules (PCRs) and sectorial guide (EDG)-like guidance in furtherance of the environmental footprint method guidance, harmonization of general programme instructions and particularly product category rules (PCR) will be necessary to ensure comparability. This includes mutual recognition of rules with respect to PCR/EDG development, review and verification procedures, administrative procedures and declaration format.

6.2 Common approaches

Product:

Common elements amongst the product footprint guides reviewed include:

- Life cycle approach from perspective of including all stages in the life cycle, but not necessarily all emissions, associated impacts, etc.
- General intended application and target audience of the guideline and target audience of application
- All methodology guides required unit of analysis i.e. reference flow or functional unit
- Data quality principle (ISO 14044 principle adopted or slightly modified)
- Data modeling principle
- Data collection template
- ISO allocation framework open for interpretation (PAS2050 changes priorities In framework)

A different allocation rule setting could change the conclusions of a comparative LCA. The ISO 14040 fixes some general indications to set the allocations rules. These indications are taken up in some studied methodologies (i.e. BP X30-323, ISO 14067). However, they allow some freedom of interpretation. Therefore it is important that allocation rules are fixed through a transparent and participative process to ensure acceptance and comparability of results, because choosing an allocation rule conditions the environmental impact distribution between economic actors in a given domain (e.g. economic or mass allocation of the livestock farming impacts between leather and meat).

- GWP 100 for climate change (except for EF)
- IPCC frame for land use change
- Carbon storage or delayed emissions excluded or report separately
- Indirect land use excluded
- Weighting is not part of the guideline as most case focus only single impact
- Off-setting excluded
- Require at least independent review (will be function of intended application?)

Corporate:

Common elements among the corporate footprint guides reviewed include:

- Accounting Principles
- Existing methodologies do not use life cycle approach, especially for Scope 1 (except for ILCD and in Scope 3)
- Focus on report for management e.g. reduction
- Many build upon old WRI/ WBCSD GHG protocol
- Most use Scope 1 2 3 approach

6.3 Divergent approaches

Product:

- Explicit use of PCRs
- System boundaries (e.g. capital goods in/exclusion)
- Cut-off criteria (mass, cost, impact, ...)
- Allocation in end of life processes
- Uncertainty
- Interpretation

Corporate:

- Intended audience and applications
- Setting system boundaries
- Allocation
- Review and verification requirements

Taken together, existing methodology guides provide a diverse suite of tools for enabling more effective and efficient environmental accountancy, including data collection templates, impact factor tables, impact assessment tools, data quality assessment frameworks, and reporting templates. The current initiative should identify and adopt the most relevant and useful of these diverse approaches.

In general, existing product guides are better developed, more prescriptive, and more comprehensive than corporate accounting guides. The latter tend to focus on reporting-related issues, whilst lacking in terms of substantive technical guidance. Given the diversity of businesses in terms of size and product/service portfolios, sector-specific guides may be necessary to provide more detailed and prescriptive guidance above and beyond that which will be possible in the corporate environmental footprint methodology guide.

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