Environmental Product Declarations (EPDs): Market Assessment for Canadian Products

Forestry Innovation Investment

Publication Date: March 2011

background paper prepared for:

Forestry Innovation Investment

Original report submitted by:

Jennifer O'Connor
Patrick Lavoie
Lal Mahalle

Energy and Environment Group
Building Systems Program
Wood Products Division

Publication Date: March 2011

Abstract

This report discusses eco-labeling and the rise in interest of environmental product declarations (EPDs). EPDs are ISO Type III labels conveying non-judgemental life cycle assessment (LCA)-based environmental performance data about products. These documents work in principle like nutrition labels on food packages, transparently disclosing standardized data about the contents and enabling side-by-side comparison between products. EPDs are a user-friendly vehicle for bringing LCA data to the marketplace. In Europe and Asia, EPD development is on the rise, and some jurisdictions are moving towards making EPDs mandatory; this may have trade implications for Canadian exporters. Meanwhile, North America has been slow to follow this trend, although there is movement in the US towards development of standards. It is in the best interests of the wood products industry to accelerate North American activity in EPDs and position itself as a leader in industrial sustainability by developing EPDs early. Over two decades of work in LCA by the wood industry has already indicated that environmental metrics for wood products are generally better than those for competing products. In this report, EPDs are explained in terms of applications, benefits, risks and market drivers. We discuss how EPDs are created and identify global activity in EPD development and creation of national infrastructures. We address trade implications, assess Canada's readiness, and provide recommendations for moving more quickly to bring the potential benefit of EPDs to the Canadian wood products sector.

Acknowledgements

The authors appreciate the financial support of British Columbia's Forestry Innovation Investment Ltd. for this work.

Executive Summary

Environmental product declarations (EPDs) are the next wave of eco-labels and likely to become a marketplace and international trade issue. This report addresses the context and ramifications for Canadian wood products of increasing global uptake of EPDs in purchasing policies, product marketing, and trade restrictions.

The world is awash in green labels, most of which are proprietary non-transparent "seal of approval" type labels. These are the familiar logos that convey that a product has passed a particular set of requirements to earn a certification from a program. Examples include forestry certification schemes like FSC and SFI, energy performance labels like Energy Star, and multi-criteria certifications such as EcoLogo and the European flower.

EPDs take a very different approach. They are not a judgement of environmental merit. EPDs are about transparent communication of environmental data, leaving the judgement up to the audience. In this sense, EPDs are analogous to nutritional labels on food packages. A food label does not state whether a food is good or bad, it merely states the nutritional properties of the food. It enables a fair side-by-side comparison across multiple criteria (sodium, calories, saturated fat, etc.). Other types of environmental labels do not facilitate product comparison.

The Canadian wood products industry is well-positioned to be a leader in EPD uptake. The LCA data is already in hand, and twenty years of comparative LCA investigations show that wood's footprint data is generally better than that of competing materials. In other words, the expensive part of the process has been somewhat covered (the LCA) and the risk is low (revealing footprint data is good for wood). If the wood industry moves early towards EPDs in advance of regulations, the industry will be seen as positively influencing the sustainability cause in the building construction and furnishings sector. Taking such a leading-edge position will resonate well with building professionals, consumers and environmental groups.

EPDs are on the rise in Europe and Asia, while North America has yet to see much activity and the domestic market is not asking for them. However, thought-leaders in North American sustainable construction have identified LCA-based decisions and EPDs as important to advancing improvements in the environmental footprint of the built environment. The wood products sector has an opportunity for image improvement among an audience that has had doubts about the commitment of this sector to environmental causes. Ideally, decisions to choose North American wood products over alternatives will increase as a result. In addition, early adoption of EPDs would provide the wood sector with readiness for environmental trade barriers and potential carbon market value for wood products.

Glossary

Business-to-business
A transaction that occurs between a company and another company, as opposed to a transaction involving a consumer.

Business-to-consumer
A transaction between a company and a consumer.

Cradle-to-gate
A portion of the life cycle of a product or process, from the cradle (the resource extraction phase) to the gate (typically the factory gate, but could also mean any point between the factory gate and the site for installation of the product. In a cradle-to-gate life cycle assessment, the use and disposal phases are omitted.

Cradle-to-grave
The full life cycle of a product or process, from the cradle (the resource extraction phase) to the final disposition such as landfill or recycling.

Eco-labels
Documentation such as an on-product label that conveys information about the environmental attributes of the product.

Environmental product declaration
An EPD is a standardized (ISO 14025 – Type III eco-label) and LCA-based tool to communicate the environmental performance of a product or system. The declaration includes information about the environmental impacts associated with a product or service, such as raw material acquisition, energy use and efficiency, content of materials and chemical substances, emissions to air, soil and water and waste generation. There is no qualitative assessment of the environmental information; instead, the declaration provides well-structured and quantitative data certified by an independent third party.
http://www.environmentalproductdeclarations.com/

ISO
ISO (International Organization for Standardization) is the world's largest developer and publisher of International Standards. ISO is a network of the national standards institutes of 160 countries, one member per country, with a Central Secretariat in Geneva, Switzerland, that coordinates the system. ISO is a non-governmental organization that forms a bridge between the public and private sectors. On the one hand, many of its member institutes are part of the governmental structure of their countries, or are mandated by their government. On the other hand, other members have their roots uniquely in the private sector, having been set up by national partnerships of industry associations. Therefore, ISO enables a consensus to be reached on solutions that meet both the requirements of business and the broader needs of society. http://www.iso.org/iso/about.htm

ISO Type I
A voluntary, multiple-criteria based, third party eco-label program that awards a license that authorizes the use of environmental labels on products indicating overall environmental preferability of a product within a particular product category based on life cycle considerations. http://www.globalecolabelling.net/what_is_ecolabelling/

ISO Type II
An environmental self-declaration claim. http://www.globalecolabelling.net/what_is_ecolabelling/

ISO Type III
A voluntary program that provides quantified environmental data of a product, under pre-set categories of parameters set by a qualified third party and based on life cycle assessment, and verified by that or another qualified third party.
http://www.globalecolabelling.net/what_is_ecolabelling/

Life cycle assessment
A technique to assess environmental impacts associated with all the stages of a product's life from-cradle-to-grave (i.e., from raw material extraction through materials processing, manufacture, distribution, use, repair and maintenance, and disposal or recycling). http://en.wikipedia.org/wiki/Life_cycle_assessment

Table of Contents

List of Tables

List of Figures

1 Objective

The objective of this work is to review the global market situation for environmental product declarations, and assess readiness and risks for Canada with respect to wood products.

2 Introduction

The world of "green" products is evolving. There are signs of increasing sophistication among both consumers and producers in a desire for more robust data; this indicates possible movement towards wider adoption of standardized approaches taking into account the whole life cycle of products from resource extraction to end of life which necessarily includes the production and consumption life stages. Meanwhile, the marketplace remains cluttered with a confusing mass of information regarding what makes a product green.

Various approaches exist to identify the greenness of a product or service, covering a great range in rigour, transparency and scientific back-up. At the bottom end of the technical scale are popular beliefs (conventional wisdom) widely reinforced through non-scientific media and advertising; for example, the assumption that recycled content, bamboo, and local procurement are all inherently green attributes. Products that are promoted as green in this approach are simply deemed to be so, and no attempt is made to provide substantiating data. Manufacturers often self-declare these characteristics for their products, and ISO provides standards for this type of eco-labeling (this is ISO Type II labeling). Examples include product statements such as "recycled" (and use of the recycled symbol), "biodegradable" and so forth.

Many other eco-labeling schemes bring a degree of technical rigour to their assessment, in order to move beyond conventional wisdom approaches to green characterization. These programs provide more robust claims against some sort of standard with some form of proof, usually in a proprietary labelling program that may fall in the ISO Type I category of eco-labels. These programs usually allow products to display the program logo. Examples include multi-criteria programs like Canada's EcoLogo™ and Germany's Blue Angel, as well as Type I-like single-criterion programs such as Energy Star, and forest certification schemes such as FSC, SFI and PEFC (CSA).

Type I and similar third-party certification programs are usually robust in approach (standards are carefully developed, etc.), although they typically are not grounded in true performance metrics such as those delivered by life cycle assessment. For example, a common criterion in these programs is a requirement for some recycled content; the programs may be rigorous in their verification of recycled content claims, however, recycled content percentages are a crude proxy for actual environmental impact measures such as embodied energy, impact of resource extraction, and generation of solid waste. A true performance-based approach to eco-labeling must involve life-cycle environmental performance data. This is where environmental product declarations come in; these are ISO Type III labels.

An environmental product declaration (EPD) is a brief document that conveys the environmental profile of a product based on life cycle assessment (LCA)[1]. The intent behind EPDs is to convey relatively complex LCA information in a simple manner. In addition, the intent of an EPD is to provide clear and transparent data enabling side-by-side green product comparisons in the marketplace. This is in contrast to third-party certification schemes where the data is typically not transparent, and the third-party (not the purchaser) is making the green product judgement.

[1] LCA is explained later in this report.

Third-party certifications are intended to simplify a purchase decision, relieving the purchaser of the need to understand complex data or determine which green attributes are most important. However, the hundreds of different environmental certification schemes worldwide are creating consumer confusion and challenges for suppliers who wonder which ones, and how many, to pursue.

EPDs are the next wave in the world of eco-labels and could become a marketplace and international trade issue. This report addresses the context and ramifications for Canadian wood products of increasing global uptake of EPDs in purchasing policies, product marketing, and trade restrictions.

3 Definitions and Types of Eco-labels

There are hundreds of labelling and documentation schemes worldwide whose purpose is to convey environmental information about products. These vary greatly in approach, scope, criteria and transparency. Most eco-label programs are proprietary; they are developed outside of formal consensus standards. Some are nonetheless highly stringent, quite transparent, etc. others less so. Turf and brand wars, competing standards, and a mix of first, second and third-party involvement have resulted in a confusing landscape of logos (Figure 1).

Figure 1 A few examples of certification logos from around the world.

A recent report by the well-respected environmental media and research organization BuildingGreen (Atlee 2010; BuildingGreen 2011) clearly and comprehensively explains the world of green labelling and provides details on all programs of relevance in the North American market. Material in this section was partially drawn from that report and from a similar report released by the United Nations (UNOPS 2009).

There may be as many as 600 green labels worldwide, with about 100 in the US alone; while most of these do not address building products, the landscape is busy in general.[2] Most labels are some form of certification: a statement that the product meets certain criteria. The criteria can be full consensus-based standards, proprietary standards or simply the judgement of the organization issuing the certification. The International Organization for Standardization (ISO) has defined categories for eco-labels and developed standards for each type. The categories are a convenient way to classify all eco-labels, although many do not actually follow ISO requirements. International acceptance of labelling is improved when ISO standards are followed.

Type I labels (ISO 14024) and similar are a third-party "seal of approval" for products that meet multiple criteria which have been selected or established by the certifier. Type I labels are often highly regarded, and many of these are widely recognized and well-established, such as Canada's EcoLogo™ program, the European Union's Ecolabel (the flower), and Germany's Blue Angel.

Note that not all third-party certification labelling schemes fall within any of the three ISO claim types but may be partially covered by ISO 14020 – General Guidelines for Environmental Claims and Declarations. This group of third-party labels often focuses on a single criterion such as energy efficiencyor forest certification. These can be similar to Type I labels.

Type II labels (ISO 14021) and similar are first-party (self) declarations, typically addressing a single criterion. The ISO standard for this type of label is meant to facilitate accurate and verifiable claims. Manufacturers issuing Type II labels can increase credibility by using standardized testing and third-party verification of their claims or test results. An example is the use of the recycled symbol. Credibility is increased if the recycled content is verified and quantified by a third-party.

Type III labels (EPDs: ISO 14025 and ISO 21930) are different in two key respects: they are not a "seal of approval" and their basis must be life cycle assessment (LCA) data that has been developed following the ISO series of LCA standards (ISO 14040, ISO 14044). LCA is a technique for analyzing the entire life cycle of a product or process. The term "life cycle" refers to the major activities in the course of the product's life-span from raw material acquisition to manufacturing, use, maintenance and final disposal. It is an analytical tool designed for comprehensive quantification and interpretation of the flows to and from the environment including emissions to air, water and land, as well as the consumption of energy and other material resources, over the entire life cycle of a product or process or service. EPDs contain information on these environmental metrics. A subset of this data can be used in specialized labels, for example, carbon footprints.

Unlike Type I and II labels, EPDs are not a judgement of environmental merits; EPDs are about transparent communication of environmental data. In this sense, EPDs are analogous to nutritional labels on food packages. A food label doesn't state whether a food is good or bad, it merely states the nutritional properties of the food. It enables a fair side-by-side comparison leaving the judgement to the target audience. Typical green labels do not facilitate product comparison. Current third-party certification programs may eventually establish benchmark levels for various LCA metrics (e.g. maximum values for global warming potential) and then award certification for products with an EPD indicating that the

[2] For example, see www.ecolabelindex.com, www.greenerchoices.org/eco-labels and www.globalecolabellingnet - these are directories of eco-labels.

benchmark has not been exceeded. BuildingGreen (Atlee 2010) suggests that the world of environmental certification labels would be improved if they were based on EPD-like disclosure.

4 Potential Market Drivers for EPDs

The North American marketplace is not expected to be clamouring for EPDs in the short-term (Figure 2 and Figure 3). However, there are indications that this may change. BuildingGreen (2011) suggests that the market data is signalling the importance of backing up claims with third-party verification; the need to provide clear documentation of green characteristics; the need for honest analysis of LEED applicability for a product; widespread distrust of product information; frustration about lack of transparency; and confusion with the overwhelming plethora of standards and labels.

The biggest driver in the short term is related to corporate image. A few North American manufacturers have positioned themselves on the leading edge of industrial sector sustainability by adopting LCA in business practices and developing EPDs. The immediate benefit is differentiation from competitors, especially those who are seen to engage in greenwashing[3] which is something companies try to avoid being associated with (Hopkins 2009). EPDs send a clear anti-greenwashing signal.

A tangible business case for EPDs is likely on the horizon. Leading edge clients and consumers are demanding more sophisticated data than is currently easily available from the industrial sector (for example, 2030 Challenge for Products).[4] How quickly this spreads to the mainstream is hard to predict. North Americans are typically slower than other global consumers to show widespread environmental behaviour changes or favourability towards environmental regulations. In contrast, 72% of Europeans support mandatory carbon labelling (Cherruault 2010).

In addition to demand from leading consumers, it is expected that indirect market demands will occur as a result of environmentally preferable purchasing policies which may begin to ask for more robust environmental information than Type I or Type II labels. The consumer still may not see or want the EPD, but the EPD may earn the product a place on various preferred product lists. Another indirect market driver might be carbon markets, where manufacturers will need product-level greenhouse gas data if product-based carbon incentives emerge.

As EPDs become better known in the marketplace, it is likely that they will affect consumer choices. This may be an indirect effect of new brand-allegiance; in other words, manufacturers who publish EPDs may earn trust and respect. The impact of published data available to consumers is hard to predict and may depend on the influential status of the businesses that adopt EPDs early. For example, Walmart[5] is currently positioning itself to be seen as a leader in LCA-based product information available to retail customers (Walmart 2009); this retail giant has enough weight to seriously turn the tide for consumer goods and other sectors. Similarly, RONA has begun to collect LCA information for many of the products it distributes. This information is presented to consumers through an internet portal[6] and is used as the basis for product selection. EPD uptake by a few key large players could increase consumer awareness and other manufacturers and retailers to adopt this form of communication.

[3] Greenwashing: the deceptive use of communications in order to promote a misleading perception that a company's policies or products (such as goods or services) are environmentally friendly. Adapted from Wikipedia (http://en.wikipedia.org/wiki/Greenwashing).
[4] http://architecture2030.org/2030_challenge/2030_challenge_products
[5] Walmart has been visibly active in sustainability for over 20 years, primarily focused to date on reducing the environmental footprint of their buildings.
[6] http://ronaeco.ca/en/

Architect, builders and their clients are increasingly looking to specify green products in their buildings. Although a significant amount of attention is focused on energy efficiency, some are more and more conscious to other environmental attributes including embodied energy and the impacts the products they select have on the environment. In a survey of service firms, real estate industry, manufacturers and governments conducted in 2010, only 21% of respondents stated that they felt they understood current certification and accreditations options in the marketplace (Sustainable Rhythm 2010.). Interviews and focus groups involving builders and architects have shown that they are increasingly sceptical of environmental claims being made by product manufacturers (Lavoie 2011).

Regulatory activity addressing EPDs would be a major market driver for increased adoption, however this is not currently anticipated in North America. Yet, a few global markets have already begun moving in this direction. Examples of specific countries are discussed in a later section on trade implications (see page 19).

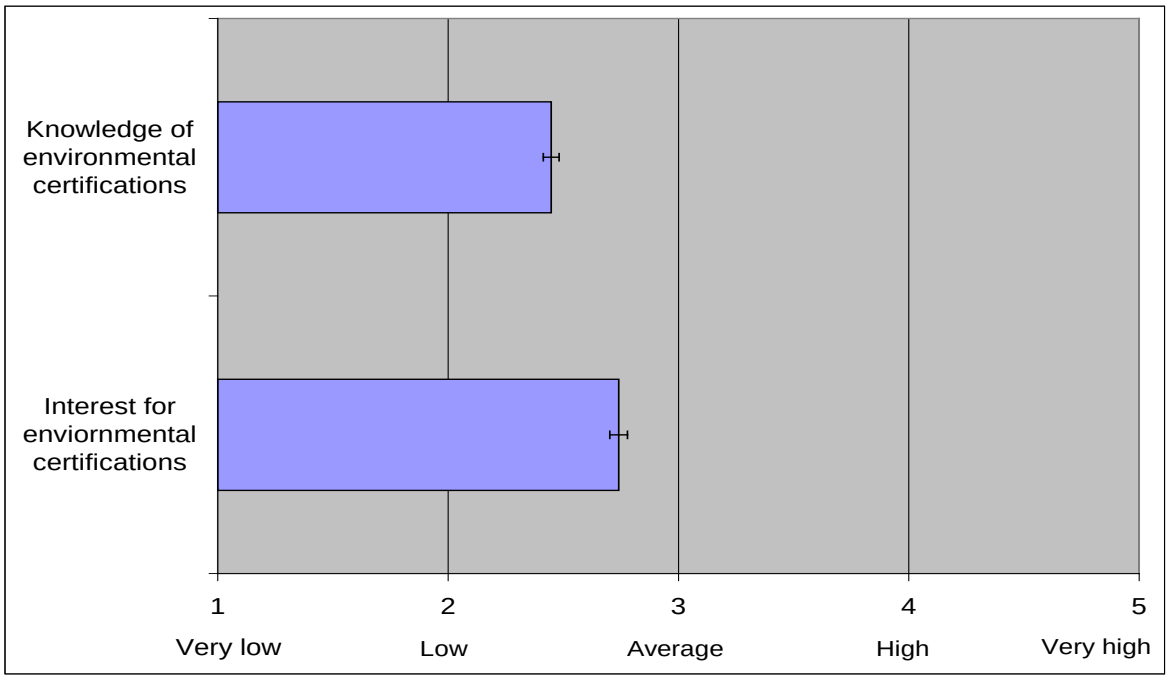


Figure 2 North American self-assessed consumer knowledge and interest in environmental certifications.
Source: FPInnovations / QWEB. 2010.

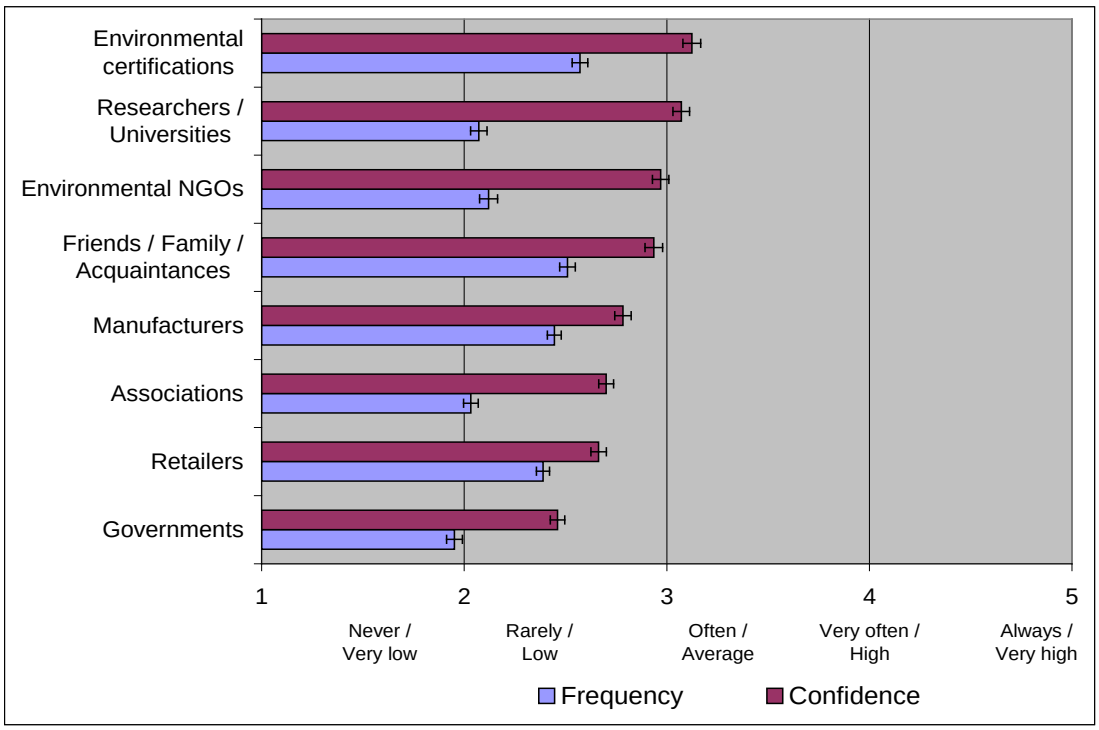


Figure 3 Consumer frequency of consultation and confidence vis-à-vis environmental information sources.

Source: FPInnovations / QWEB. 2010.

5 How EPDs are created

EPDs are generally developed in accordance with ISO 14025 (ISO 2006), a standard for Type III environmental declarations. EPDs for building products would additionally follow the guidelines in ISO 21930 (ISO 2007), which specifically addresses EPDs in the building construction sector. The intention of these standards is to create a common set of rules or guidelines (known as program rules and product category rules) allowing EPDs to be comparable. EPDs are a relatively new area of environmental communication, and there is currently a substantial amount of variation in delivery mechanisms. ISO encourages harmonization between EPD practitioners, which will likely come as the field matures.

An EPD is a document that resembles a brochure or an annual report. Current EPDs in circulation vary from two pages to long reports. Content also varies to some level. EPDs produced by the same organization generally follow a proprietary template, but each organization can choose what to display (beyond mandatory information) and how to display it which results in EPDs from different organizations looking quite different. While the actual documents themselves may appear in different formats, the ISO standards strive to ensure that the data contained in the documents enables comparison to data in other EPDs. Complete standardization of EPDs should happen when it migrates to an on-product label.

EPDs are issued by Program Operators. An organization becomes a Program Operator by assembling a panel of interested parties (stakeholders) to assist in the development of General Program Instructions. The instructions describe the operation of the program and the responsibilities of the Program Operator. Program Operators develop Product Category Rules and EPDs. The Program Operator issues EPDs based

on existing Product Category Rules (PCR) for the product in question. If none already exist, the Program Operator can develop PCRs in collaboration with industry stakeholders.

Creation of a PCR must follow strict rules, and the PCR must be reviewed by a third-party of experts; these steps are all described in detail in ISO 14025. A PCR is a set of specific requirements and guidelines for developing EPDs for a particular type of product. PCRs lay the foundation for credible and comparable EPDs. A PCR for building products addresses the following:

a) Product category definition and description
b) Goal and scope definition for the LCA of the product in accordance with ISO 14040 and ISO 14044 (functional unit, system boundary, etc.)
c) Inventory analysis according to ISO 14044 (data collection, allocation, etc.)
d) Impact category selection
e) Reporting of LCA data
f) Additional environmental information
g) Materials and substances to be declared
h) Instruction for producing the data to develop the EPD
i) Instructions on content and format of the EPD
j) Period of validity

With a PCR in hand appropriate to the product in question, the Program Operator also needs relatively recent LCA data in order to prepare an EPD for the product. The LCA can already be available, or it may be created specifically for the purposes of an EPD. In both cases, the data required to be delivered by the LCA is referenced in the PCR.

EPDs can be developed as a business-to-business communication tool, or as a business-to-consumer tool. If business-to-business, the EPD typically includes only partial LCA data (e.g., cradle-to-gate) and is considered a “module”; this means that for a complete product addressing the full life cycle, several modules would be bundled together. For example, a commodity product like lumber would have a modular cradle-to-gate EPD from resource extraction to the factory gate, omitting the use and disposal phases. If someone wished to develop an EPD for a whole building, numerous EPD modules would be gathered into a whole-building EPD, with the rest of the life cycle added in (use, maintenance, disposal, etc.).

Program Operators maintain public lists of PCRs and EPDs developed in their programs, and may make these publicly available. EPDs and PCRs can additionally be located in third-party registries.

See Figure 4 for a diagram of the EPD development process.

While the content of an EPD can vary from one Program Operator to another, if compliant with ISO 14025 the EPD must include several elements:

a) The name of the organization making the declaration
b) Product description
c) Product identification (i.e. model number)
d) Name of the EPD program including the address of the program developer, logo and website
e) Identification of the product category rules (PCR)
f) Publication date and validity period
g) LCA (or LCI) data

h) Additional environmental information

i) Declaration of contents which need to be declared (impact on human health and environment at all stages of the lifecycle)

j) Identification of life cycle stages included and excluded in the underlying LCA

k) A mention that EPDs produced by different programs may not be comparable

l) Information on where to obtain additional information

m) Name of third-party verifier if appropriate (verification is mandatory for business-to-consumer EPDs)

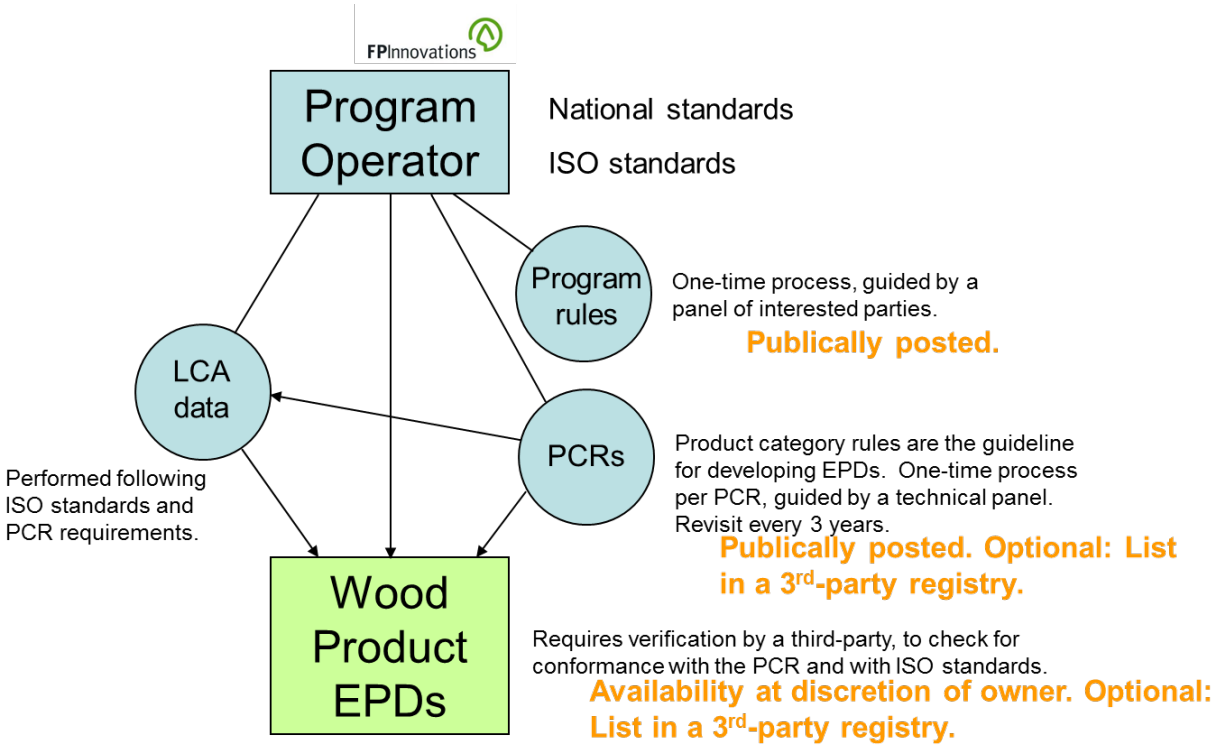


Figure 4 The EPD development process.

6 EPD Applications, Benefits and Risks

The ISO standard for building product EPDs (ISO 21930:2007) states that the objective for such EPDs is to encourage demand and supply of building products that cause less stress on the environment. The application of EPDs is therefore to enable architects and other decision-makers to access credible environmental data about building products, and to motivate manufacturers to provide low-impact products for the purposes of achieving a competitive advantage in the market. Specific application of EPDs is predominately a business-to-business transfer of information, although business-to-consumer vehicles are an option as well. They are typically accessible via the supplier and/or through the party that developed the EPD and/or through EPD registries.

Benefits:

Credibility:	EPDs contain robust and transparent data that addresses multiple environment metrics and is guided by international standards.
Acceptance:	Development in accordance with formal, voluntary, consensus processes such as those delivered by ISO creates automatic buy-in by stakeholders (consumers, manufacturers, etc.), automatic government support, and automatic international clout.
Positive corporate image:	Suppliers using EPDs appear as sustainability leaders, avoid accusations of greenwashing and earn trust by a policy of data transparency.
Simplifies environmental communication:	An EPD might enable a manufacturer to totally bypass the label game. EPDs offer a clean path for businesses wanting to show environmental commitment but unsure of which labelling scheme to go with. The exhausting and confusing proliferation of eco-labels is "weakening the entire field" (Stroud 2009).[7]
Be seen as an environmental leader:	EPDs are a user-friendly way to bring LCA data to the marketplace.
Transform decisional activities:	EPDs leave the environmental comparison and judgement to the consumer.
Highlight opportunities for improvement:	EPDs require industry to engage in LCA, which enables targeted product footprint improvements and possible companion cost savings. Other financial or product improvements can result from employee pride in the

[7] For example, this paper attempts to sort out the differences between four major labeling schemes for sanitary tissue paper: http://www.leonardoacademy.org/download/Janitorial%20Certification%20Programs.pdf

	corporate commitment to sustainability, leading to enthusiasm and creativity; several companies report supporting statistics on this result (Hopkins 2009).
Readiness for market demands:	EPDs will meet increasing sophistication in market expectations of environmental performance, including pending trade requirements, potential advancement in environmentally preferable purchasing policies and pending carbon incentives.
Risks:	
Misinterpretation:	Consumers may have trouble interpreting the content of an EPD and judging the importance of the numbers (Christiansen et al 2006). They may misunderstand the meaning of the data to the detriment of the product.
Not always directly comparable:	While standards are in place to mitigate this, it is not possible to fix all the variables in play in any LCA study. The EPD approach to this issue is to focus on transparency to allow the reader to assess whether or not one EPD can be compared to another – EPDs clearly state LCA methods, functional unit, service life and so forth. Nonetheless, readers may still try to unfairly compare non-comparable EPDs.
Too transparent:	EPDs promote full disclosure. Some manufacturers fear the public doesn't possess adequate knowledge to put this information in context. Manufacturers may fear being punished if they are first on the market with an EPD that exposes footprint information common across the industry but no one else is showing it (Atlee 2010). Some manufacturers are opposed to disclosure that violates their business need for protection of proprietary information, and others feel that LCA does not properly represent the environmental footprint of their products (Bogeskär et al 2002). Full disclosure also means manufacturers have to show all aspects of the product, the good and the bad.

7 Current State of the EPD Landscape

EPDs are currently being developed worldwide, through various mechanisms and not always in full compliance with ISO standards. Many are developed by independent organizations, while others are developed within highly organized frameworks. EPDs have momentum in Europe and Asia, while North America is just making its first steps now. A key to EPD development is the creation of national infrastructure, including standards and LCI databases. This section discusses the extent of EPD infrastructure development worldwide and regulatory activities underway. See Table 1 for a summary list.

Europe

A number of European countries have all components of an EPD infrastructure in place, especially Sweden, Italy, France, Germany and the UK (CME 2010). Sweden was the earliest, and led the creation of the international EPD network (Schenck 2009), discussed further below. The EU is working to ensure compatibility among databases and harmonization of EPD programs. France is the first EU nation to move towards mandatory EPDs. France has developed an EPD-based national strategy for increasing the importance of environmental data in consumer choices and product manufacturing (Cherruault 2010). Mandatory carbon labels will be phased in starting in 2011, with other impact measures to follow. Several national programs (Germany and Netherlands, and perhaps others) were initiated by building product associations. In Germany, small and medium-size companies can receive financial support for developing EPDs through the EU GreenConServe program[8]. In the UK, BRE has taken an LCA approach in sustainable construction for some time, in its Green Guide to Specification[9]. This guide provides ratings for building assemblies based on LCA and an ISO-compliant EPD approach that BRE calls Environmental Profiles.

Asia and Pacific

Japan, Korea, China, Taiwan and Australia have some or all EPD infrastructure in place. Japan has spent significant federal dollars on a national database and is quite advanced with its EPD program EcoLeaf. Korea has a national LCI database.

North America

The USA has a modest national LCI database and has taken some early steps in establishing national standards. As a result, it is not well-positioned to encourage industry development of EPDs. To the best of our knowledge, there are four organizations that have declared themselves as Program Operators, however only two of them have actually produced EPDs and/or PCRs to date. The two active organizations are IERE (Vashon, Washington)[10], whose EPD program is called EarthSure (first EPD was issued in 2005; a total of two PCRs and two EPDs have been developed), and The Green Standard (Chapel Hill, North Carolina)[11], who issued its first EPD in 2008 and has developed six EPDs to date and one PCR. Two other organizations advertise EPD capacity but do not yet appear to be active: Scientific Certification Systems (Emeryville, California)[12] and UL Environmental (Northbrook, Illinois)[13], a new offshoot of the international product-testing organization Underwriters Laboratories. Neither of these organizations responded to a query for more information on their EPD services. According to Schenck (2009), there is a battle underway among organizations that wish to lead the effort in development of standards, and she states that the Leonardo Academy and Scientific Certification Systems are attempting a closed, proprietary attempt at an EPD standard; note that IERE is also positioning to take a lead role. At the public consensus level, the ASTM E60 committee is tackling a national EPD standard.

Canada has virtually no infrastructure in place. There is no federal effort underway to create national standards or a national LCI database. The only Canadian ISO-compliant EPDs developed to date (to the best of our knowledge) are been recently completed by new Program Operator FPInnovations (two EPDs for cedar products – see the Appendix). A number of years ago, well-known Type I certification program TerraChoice[14] (keepers of the long-standing and well-respected Ecologo program) developed an EPD-like program called EPDS, in coordination with the Forest Products Association of Canada and targeted specifically to pulp and paper products. This program was developed prior to the creation of ISO EPD

[8] http://www.greenovate-europe.eu/
[9] http://www.bre.co.uk/greenguide/podpage.jsp?id=2126
[10] http://www.iere.org/earthsure.aspx
[11] http://www.thegreenstandard.org/
[12] http://www.scscertified.com/lcs/
[13] http://www.ulenvironment.com/ulenvironment/eng/pages/
[14] http://www.terrachoice.com/

standards. Note that UL Environment has recently acquired TerraChoice and intends to start developing EPDs according to ISO guidelines.

Table 1 Significant EPD programs worldwide

Country	Name of program/ organization	Number of EPDs to date	Web link	Notes
Sweden	International EPD System, operated by the Swedish Environmental Management Council	148	http://www.environdec.com	Swedish and international EPDs
Japan	Ecoleaf, operated by the Environmental Management Association for Industry (JEMAI)	140	http://www.jemai.or.jp/english/ecoleaf/index.cfm	
Australia	Good Environmental Choice, operated by the non-profit organization Good Environmental Choice Australia	160	http://www.geca.org.au/	This is a Type 1 certification program that develops EPD-like documents and uses the data as the basis for certification. While referred to as EPDs by the program, these documents do not actually report environmental performance data per ISO 14025.
France	INIES database, supported by government and the construction sector	606	http://www.inies.fr/ http://www.aimcc.org/	Standard NF P01-010 developed for the construction sector; includes health and comfort data
Germany	IBU (Institute of Construction and Environment)	44	http://bau-umwelt.de/hp481/Environmental-Product-Declarations-EPD.htm	German and international EPDs; operates also in Austria and Switzerland
	PE International	140	http://www.pe-international.com/america/services-solutions/green-building/environmental-product-declarations/	EPDs issued primarily within the IBU program
Norway	NHO, operated by Confederation of Norwegian Enterprise (NHO) and the Federation of Norwegian Building Industries (BNL)	87	http://www.epd-norge.no/	

Country	Name of program/ organization	Number of EPDs to date	Web link	Notes
South Korea	KEITI - Korean EDP and Carbon labelling program	22	http://www.edp.or.kr/index_eng.asp	
Netherlands	Milieu Relevante Product Informatie (MRPI)	Many	http://www.mrpi.nl/Home	Extensive program – hard to tell how many total EPDS – does not reference ISO but the declarations appear compliant.
Finland	RTS – Building Information Foundation	N/A	http://www.rakennustieto.fi/index/english/productsandservices/environmentaldeclarations.html	
Switzerland	Swiss Association of Engineers and Architects (SIA)	>300	http://www.sia.ch/cf/bauinfosuchen.cfm?Lang=f&ID=5590307	Relies on proprietary guidelines. Unknown whether they satisfy applicable ISO standards.
UK	Environmental Profiles, operated by BRE Global	> 600	http://www.greenbooklive.com/search/scheme.jsp?id=9	

International Coordination

GEDnet (Global Environmental Declarations Network) is an association of organizations providing EPDs, founded in 1999[15]. The purpose of GEDnet is to foster co-operation and encourage information exchange among its members and other parties operating or developing type III environmental declaration programs, and to discuss key issues in developing such programs. This organization maintains a PCR library, currently at 100.

The international EPD consortium (IEC) operates the International EPD system.[16] The IEC is composed of a steering committee (SC), a technical committee (TC) and a secretariat. The IEC[17] secretariat is staffed by the Swedish Environmental Management Council (SEMCo).[18] SEMCo is a company jointly owned by the Swedish government, the Swedish Association of Local Authorities and Regions as well as the Confederation of Swedish Enterprises[19] The role of the International EPD system is to assist organizations (in any country) interested in disseminating verified product information specific to a product. The International EPD system offers assistance to identify recognized LCA calculation rules for a number of product categories as related to EPD requirements stated in ISO 14025. Its objective is to help organizations to communicate the environmental performance of their products (goods and services) in a credible and understandable way by offering a complete program for any interested organisation in any country to develop and communicate EPDs according to ISO 14025, and to support other EPD programmes (i.e. national, sectorial etc.) in seeking cooperation and harmonization and helping

[15] http://gednet.org/
[16] http://www.environdec.com/pageId.asp
[17] Presentation given by Leo Breedveld at the 41st LCA forum in Ittigen on June 22nd 2010.
http://www.lcainfo.ch/df/DF41/DF41-07-Breedveld_EPD_Italy.pdf
Other presentations available at http://www.lcainfo.ch/df/DF41/Program.htm.
[18] http://www.msr.se/en/About-us/Organization/
[19] Business federation grouping more than 50 members representing over 60,000 businesses.
Source: http://www.svensktnaringsliv.se/english/about-us_16830.html

organisations to broaden the use of their EPDS on an international market. The IEC is a member of GEDNet.

8 Trade Implications

Worldwide interest in better environmental data on products and services suggests that EPDs may become a non-tariff, legal barrier to trade for exporters not able to meet that data demand (CME 2010). EPDs are increasingly common in Europe, Asia, Australia and New Zealand. Companies selling to Europe are paying attention, although the North American domestic market is not currently a concern for suppliers (BuildingGreen 2011). For example, the American Hardwood Export Council announced last year that it is undertaking a major LCA and EPD project in preparation for increased international demand for this type of environmental data.[20]

Several countries are moving in the direction of creating mandatory EPD requirements. France is the first to implement such a program, which will apply to all mass-produced consumer goods. Supported by a national database of life cycle inventory data and rapid creation of PCRs (Schenck 2009), the French system has been put in place by law and will apply to various industrial sectors starting in 2011 (Cherruault 2010).

Japan is moving towards a mandatory carbon footprint on-product label for all products sold in Japan. Development of standards is underway, with full implementation originally planned for 2011[21]. This work is being organized by the Ministry of Economy, Trade and Industry. Similarly to France, the Japanese program has a foundation of a national LCI database, national standards, a sectoral approach to PCR development, and government regulations as the driver (Schenck 2009). Similarly, Taiwan is moving towards a mandatory carbon footprint labelling program, and Walmart will require carbon footprint data for products by 2014 (CME 2010).

A Canada Wood activity report (Cooper 2011) states: “The UK Timber Trade Federation’s National Softwood Division has identified that wood’s market share will potentially be lost if data is not available to back-up any environmental claims made in relation to Environmental Profile Declarations (EPDs) and Life Cycle Analysis. Outstanding information requirements will be identified over the next year, covering environmental impacts associated with wood production through to use, re-use and recycling. Competing industries have already invested significant sums in order to promote their products using science-based environmental performance data. EPDs include information on the environmental impacts of products over their entire life-cycle. In the construction sector, EPDs are being used more commonly to make decisions about materials selection, with the wider aim of minimizing the whole-life environmental costs of a project. EPDs contain information utilised by the BRE Green Guide (which looks at data across 13 environmental parameters), that is fed into the wider building sustainability rating system - BREEAM.”

The World Trade Organization has decreed that purchasing criteria developed under criteria developed through formal, voluntary, consensus processes such as those delivered by ISO, ANSI are not barriers to trade (EBN 2010). In other words, a national requirement for EPDs on imported goods appears to not be an illegal barrier to trade. As economic globalization is accelerating, environmental labeling practices are not seen by sustainability proponents as trade barriers but rather as beneficial tools for business enabling competitor differentiation. This may be the case for industrialized countries, but in many developing

[20] http://www.americanhardwood.org/news-events/news-environmental-issues/release/?tx_ttnews%5Btt_news%5D=262&cHash=72af0401ba3ef98a00ac76698e816078
[21] We don’t know if the recent earthquake and tsunami will change this timeline.

countries, EPDs and environmental certifications may be seen as trade barriers because those countries likely lack the resources to develop the necessary databases and other infrastructure. For Canadian products, increasing global interest in EPDs has not yet translated into a trade complication. Canadian international trade field staff appears to be keeping an eye on this situation for acceleration or genuine concerns.

9 Canada's Preparedness

Canada is lagging several other countries in readiness to produce EPDs. Without an EPD infrastructure, many Canadian manufacturers would find the cost to produce EPDs to be prohibitive. The Canadian Manufacturers and Exporters association together with the Athena Institute have prepared a proposal for a national effort to create suitable infrastructure to help Canadian industry be ready (CME 2010), identifying the following required components:

1. Program operators
2. PCRs
3. National LCI database
4. Willing manufacturers
5. LCA practitioners
6. LCA verifiers
7. EPD verifiers
8. An EPD registry

The backbone of an EPD programme is a national LCI database (Trusty 2010). A comprehensive and public database is critical if EPDs are to be financially feasible for the majority of Canadian manufacturers. Canada does not have a national database. The Athena Institute[22] has a significant database of construction materials and processes, much of which is publically available; this is the only organization in Canada currently managing an LCI database (Athena is also a key partner in the US LCI database). The university consortium CIRAIG™ (Le Centre interuniversitaire de recherche sur le cycle de vie des produits, procédés et services / Interuniversity Research Centre for the Life Cycle of Products, Processes and Services) has just received funding from the Province of Quebec to begin developing a comprehensive Quebec LCI database and has announced a new partnership with Swiss LCI database EcoInvent to expand that work to a national database, although timelines, funding and details of the larger plan have not been released[23]. Athena and CIRAIG are currently discussing options to coordinate an effort in development of Canadian data. A national database can be stand-alone or can be integrated within an international system. There may be merit in creating a joint US/Canada database with compatible links to databases in other countries. This is useful when performing life cycle assessment for products that contain materials sourced from several countries.

Until FPInnovations became a program operator and developed a wood products PCR in early 2011, to the best of our knowledge there has been no previous activity in Canada in ISO-compliant PCR and EPD development. Canada will require more program operators and more development of PCRs, both of which would arise with a demand by manufacturers for EPDs. The biggest stumbling block for EPD development is the cost of the LCA data. In that regard, the Canadian wood products sector is well-positioned. FPInnovations has been active in the production of up-to-date LCA data for wood products, typically by contracting with the Athena Institute for that work.

[22] http://www.athenasmi.org/tools/database/index.html
[23] http://www.ciraig.org/PressreleaseLCIDataBaseFINAL_230311.pdf

10 Discussion

In a study of labelling programs for paper products (Miner and Vice 2007), low participation by manufacturers outside of Europe is identified due to lack of a clear connection to the marketplace and complexity of data required; this observation can be applied to North American industry in general, where we see a chicken-and-egg situation – before the infrastructure is in place, who will be first out of the gate and incur the early costs and risks?

The Canadian wood products industry is well-positioned to be a leader in EPD uptake. The LCA data is already in hand for the major commodity products, and twenty years of comparative LCA investigations show that wood's footprint data is generally better than that of competing materials. In other words, the expensive part of the process is somewhat covered (the LCA) and the risk is low (revealing the data will be beneficial). Any industry moving early towards EPDs (in advance of regulations) will be seen as leading-edge by industry professionals, consumers and environmental groups.

Nonetheless, the wood products industry may resist EPDs for several reasons. This could include reluctance to get ahead of regulatory requirements or market demands, and fear of being the first to reveal potentially unfavourable data before anyone else does. The industry probably needs a comprehensive sector-wide strategy for EPDs, including an image campaign and company buy-in. An image campaign will require careful management to maximize the benefit of appearing as an environmental leader. This indicates a need for environmental NGO partners, who could then leverage the actions of the wood products sector to push other sectors in the EPD direction.

Canadian manufacturers may find themselves in need of EPDs in order to maintain some markets. Various overseas markets are moving towards mandatory declarations of environmental information, beginning with the subset of carbon but likely expanding to the full set of environmental impact measures covered in an EPD. Environmentally preferable purchasing policies and Type I environmental certification programs will likely move towards an EPD basis. Increasing consumer sophistication will likely demand the transparency and comparability of data afforded by EPDs.

It seems highly probable that EPDs or similar LCA-based data will eventually become part of the domestic and international market for Canadian products, although the timing is uncertain. Preparation for that situation will require financial resources and time; development of the infrastructure should be accelerated immediately. The two Canadian organizations most active in LCA (the Athena Institute and CIRAIG) are currently negotiating a partnership and seeking funding for development of a national LCI database. These two organizations are ideally equipped to be the founders of a national coalition creating the total infrastructure, including a PCR/EPD registry, technical support to LCA practitioners, and providers of guidance to Canadian EPD program operators.

11 References

Atlee, Jennifer. 2010. What's New in Multi-Attribute Environmental Certifications. Environmental Building News, Vol. 19, No. 20, December 2010.

Bogeskär, Malin, Anthea Carter, Carl-Otto Nevén, Robert Nuij, Eva Schmincke and Heidi K. Stranddorf. 2002. Evaluation of Environmental Product Declaration Schemes. Environmental Resources Management, September 2002.

BuildingGreen. 2011. Green Building Product Certifications: Getting What You Need. BuildingGreen Inc., Brattleboro, Vermont

Cherruault, Jean-Yves. 2010. Environmental Labelling of Goods in France. February 2010, updated October 2010.

Christiansen, Kim, Marianne Wesnæs, Bo P. Weidema. 2006. Consumer demands on Type III environmental declarations. 2.-0 LCA consultants, Denmark.

CME 2010. Environmental Product Declarations: An emerging non-tariff trade barrier. Canadian Manufacturers and Exporters in association with the Athena Sustainable Materials Institute. February 2010.

Cooper, Patrick. 2011. Canada Wood Market and Activity Report (UK), January-February 2011.

EBN (Environmental Building News). 2010. Standards for Standards: ISO and ANSI. Environmental Building News, Vol. 19 No. 11. November 2010.

FPInnovations / QWEB. 2010. Perception de caractéristiques "vertes" de produits d'apparence en bois. VA 201001260.

Hopkins, Michael S. 2009. What the “Green” Consumer Wants. MIT Sloan Management Review, Summer 2009, pp. 87-89.

ISO 14020

ISO 14021:1999 Environmental labels and declarations -- Self-declared environmental claims (Type II environmental labelling

ISO 14024: 1999 Environmental Labels and Declarations: Environmental Labeling Type I, Guiding Principles and Procedures

ISO 14025: 2006, Environmental labels and declarations — Type III environmental declarations — Principles and procedures.

ISO 14040:2006. Environmental Management – Life Cycle Assessment – Principles and Framework.

ISO 14044:2006. Environmental Management – Life Cycle Assessment – Requirements and guidelines.

ISO 21930: 2007. Sustainability in building construction – Environmental declaration of building products.

Lavoie, Patrick. 2011. Isolant thermique ultraléger fait à partir de bois. FPInnovations.

Miner, Reid and Kirsten Vice. 2007. Comparative Review of Environmental Labelling Prrograms. National Council for Air and Stream Improvements (NCASI). August 2007.

Schenck, Rita. 2009. The Outlook and Opportunity for type III Environmental Product Declarations in the United States of America: A Policy White Paper. Institute for Environmental Research and Education. September 23, 2009.

Stroud, Sara. 2009. The Great Eco-label Shakedown. Sustainable Industries, August 2009, pp. 29-32.

Sustainable Rhythm. 2010. Opening the Door to Green Building Market Perceptions: Ohio.

Trusty, W. 2010. Rationalizing Life Cycle Approaches to Production and Consumption: A Focus on Life Cycle Inventory Databases. The Athena Sustainable Materials Institute.

UNOPS. 2009. A Guide to Environmental Labels for Procurement Practitioners of the United Nations System.

Walmart. 2009. Walmart announces sustainable product index. Press release July 16, 2009. http://walmartstores.com/pressroom/news/9277.aspx

Appendix: Background notes

Related environmental regulatory and technical activity worldwide

European Union

On June 18th 2003, the European Commission (EC) adopted its **Communication on Integrated Product Policy (IPP)** which aims at reducing resource use and the environmental impact of waste.[24] The EC thus devised a strategy around products with an assumption that products that are better for the environment offer better performance and support long-term industrial competitiveness. The strategy emphasizes the importance of being able to assess the performance of a product on its entire lifecycle and not just the manufacturing phase. Other principles of the IPP approach are 'working with the market' (taxes and subsidies, voluntary actions, standardization, green public procurement (GPP)[25], etc.), 'stakeholder involvement', 'continuous improvement' and mixed policy instruments based on contribution to sustainable development. IPP is defined as a complement to existing legislation regulating the use of certain products (e.g., CFCs).

Following the publication of its communication on IPP, the EC initiated a coordination body to facilitate the harmonization of LCA data collection efforts. This initiative interacts with the **United Nations Lifecycle Initiative (UNLCI**).[26] As a partnership with SETAC (Society for Environmental Toxicology and Chemistry), the UNLCI aims to put lifecycle thinking into practice mostly through the adoption of ISO 14040 which is a standard for doing LCA.[27]

The UNLCI's work was accomplished in four areas: lifecycle management, inventories, impact assessment and cross-cutting activities. Deliverables achieved by the task forces active in the inventory work area include a registry of LCI databases,[28]characterizations of the quality of LCI databases, analyses of the methodological consistency of LCI databases, a library of completed LCAs as well as a LCI database and capacity building.

UNLCI was launched following the **Malmo declaration**[29] which defines the policy priorities to be achieved by 2015. Content of the declaration emphasizes the transition towards e-government. A 2009 version of the declaration was produced to update progress and objectives going forward.[30] The 2009 Malmo declaration clearly identifies carbon footprint reduction as one of the priorities going forward.

UNEP Governing Council (22nd meeting in 2003) has also expressed support of lifecycle thinking identifying it as a key tool to help consumers make informed consumption choices.

In 2002, the European commission contracted with the company Environmental Resources Management (ERM) to evaluate environmental product declaration schemes.[31] Their report proposes a series of actions including:

1. Improve accessibility and content of LCA databases (stimulate supply)
2. Establish minimum European Product Specific Requirements (PSR), to ensure harmonisation of EPDs in Europe

[24] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2003:0302:FIN:EN:PDF
[25] http://ec.europa.eu/environment/gpp/index_en.htm
[26] http://lcinitiative.unep.fr/default.asp?site=lcinit&page_id=9FDF7FDF-261F-4F0E-A8E3-5FF4E16B33C2
[27] http://lcinitiative.unep.fr/sites/lcinit/default.asp?site=lcinit&page_id=AC5F8210-CF6F-4226-A5B7-F053F4BBED5C
[28] http://www.estis.net/sites/lcitf1/, http://www.estis.net/sites/lcitf2/, http://www.estis.net/sites/lcitf3/ and http://www.estis.net/sites/lcitf5/ (no website for LCA library).
[29] http://www.unep.org/malmo/malmo_ministerial.htm
[30] http://www.epractice.eu/files/Malmo%20Ministerial%20Declaration%202009.pdf
[31] http://ec.europa.eu/environment/ipp/pdf/epdstudy.pdf

3. Link EPDs with public procurement (stimulate demand)

The **Marrakech process**[32] (also known as the 10-year Framework of Programmes for Sustainable Consumption and Production (SCP)) is advanced by UNEP (United Nations Environmental Programme) and UNDESA (United Nations Department of Economic and Social Affairs). The *second phase* of the UNLCI which is planned for 2007-2012 has three main objectives:

- Enhance the global consensus and relevance of existing and emerging life cycle approaches methodology;
- Facilitate the use of life cycle approaches worldwide by encouraging life cycle thinking in decision-making in business, government and the general public about natural resources, materials and products targeted at consumption clusters;
- Expanding capability worldwide to apply and to improve life cycle approaches.

The Marrakech process is organized around five Work Area Interest Groups (WAIG) focusing on the following issues:

1. Approaches in methodology and data
2. Approaches for resources and impacts
3. Approaches for Consumption Clusters (structured in housing, mobility, food and consumer products)
4. Approaches for Capability Development (including institutional empowerment, training, curricular development, etc.)
5. Management in Businesses and Industries

The Clearinghouse mechanism of the Marrakech process is provided by the United Nations Environment Program – Division of Technology, Industry and Economics - Sustainable Consumption & Production Branch (http://www.uneptie.org/scp/)

The Marrakech process involves six types of mechanisms:

a) Programs and strategies developed at the regional / national level
b) Task forces on specific issues led by governments
c) Dialogue between organizations involved in SCP
d) A forum for NGOs
e) A business forum involving the WBSCD and ICC
f) A UN interagency network

With UN activities providing the framework for the development of LCA and ecolabeling (including EPDs) a number of activities, initiatives, policies and institutions have been implemented at the national level.

The European Union is committed to promoting green consumption both for public institutions (Integrated Product Policy (IPP)) which represents 16% of all purchases at the EU level as well as for consumers via its sustainable consumption and production (SCP) initiatives. A key component of these initiatives is the EU Flower logo which is part of the European Ecolabel and the Eco-Management and Audit Scheme (EMAS). In a study conducted by the State,[33] European consumers have shown to be highly favorable (72%) to mandatory carbon labeling. Less than 40% of consumers are aware of the EU flower label.

[32] http://www.uneptie.org/scp/
[33] http://ec.europa.eu/public_opinion/flash/fl_256_en.pdf

France[34]

Of interest is the Grenelle de l'environnement's / 'Grenelle 2' plans to implement legislation[35] requiring the labelling of products of mass-consumption based on their environmental impacts over their lifecycle staring January 2011. It is a multi-criteria approach based on the product and its wrapping (i.e. box)[36] required for a number of products such as food, cellphones, televisions, laundry detergent, tissue and toilet paper, textiles, construction products, upholstered furniture (i.e. chairs), cabinets, particleboard, mattresses, tables, outdoor furniture, paper products, dishes (i.e plates) and cutlery, backpacks, bicycles, skis, balls, racquets, mailboxes, financial services, cars (including parts) and motorcycles, jewels, musical instruments, etc.

The state agency responsible for Environmental and Energy issues (ADEME) has developed (along with the French standards organisation (AFNOR)) a guide to best practices to environmental labelling entitled BPX30 – 323.[37] The guide provides guidelines to foster consumer product discrimination based on environmental performance. Carbon labelling is required. Other indicators, which will vary depending on the product category, will be required. A calculation method will be specified for every indicator.[38] Lifecycle analysis (LCA) is clearly referenced as the means to be used to generate the information contained in the label. Secondary data (from LCI databases) may be used to establish the environmental profile of a product. ADEME will be responsible to create the national database. Each entry in the database will be verified by consultative committees bringing together specific sector stakeholders. While official directives are not yet published, companies are encouraged to initiate pilot projects based on the broad guidelines described in BPX30 -323. Two pilot projects have been publicized: Casino[39] and Leclerc[40]. http://affichage-environnemental.afnor.org/actualites/resume-bpx30-323/resume-bpx30-323

Progress of the different working groups (based on product categories) can be followed at this website: http://affichage-environnemental.afnor.org/documentation/documents-de-la-plate-forme

The group working on construction products (WG6) expects construction products to be labelled according to 16 indicators (based on NFP01-010) which include eutrophication as well as primary energy consumption. Ozone depletion will not be one of the indicators as it is covered by separate legislation. Third-party verification will eventually be enforced.[41]

In 2009, a voluntary agreement was signed between AFNOR, ADEME, the Ministry of Ecology, Energy, Sustainable Development and the Seas, HQE association, the building products industry association (AIMCC)[42], Qualitel and CSTB for the environmental labelling of construction products.[43] The agreement states that products should be labeled according to ten impact categories specified in standard

[34] http://www.un.org/esa/dsd/dsd_aofw_ni/ni_pdfs/NationalReports/france/Full_text.pdf
http://ec.europa.eu/environment/pdf/policy/EPR%202009_SEC_2010_0975_Part%203.pdf
[35] http://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000022470434&dateTexte=&categorieLien=id
[36] http://www2.ademe.fr/servlet/KBaseShow?sort=-1&cid=96&m=3&catid=23735
http://www.dailymotion.com/video/xcgc22_l-affichage-environnemental-des-pro_lifestyle?start=257#from=embed
[37] http://www.boutique.afnor.org/NEL5DetailNormeEnLigne.aspx?MSCSProfile=EA30C420C2E67456193939653819C0BA72BA70118BF597C31331E9E95505BA3B61C4A5D18CAC2361F899F663FFD12DF95248DB9F67C39402652C7108B8613EF78EDDA9650408DDFA0BB052896ABCF4473422C530A4521576C169B3DB302B179C660D7393472AAAA808D81C0764B50E70737669F3F3092FB5936F233E55589DC1213E259756E377F2&nivCtx=Z0Z&aff=1&ts=9244198&CLE_ART=FA165312
[38] http://affichage-environnemental.afnor.org/actualites/resume-bpx30-323/resume-bpx30-323
[39] http://www.produits-casino.fr/developpement-durable/dd_indice-carbone-etiquettes.html
Example: http://www.produits-casino.fr/spip.php?page=indice-carbone&id_article=1727&code_bdq=164
[40] http://www.jeconomisemaplanete.fr/actu.php
[41] http://affichage-environnemental.afnor.org/documentation/documents-de-la-plate-forme (13th meeting)
[42] http://www.aimcc.org/
[43] http://www.legrenelle-environnement.fr/IMG/pdf/Convention_2_Affichage_cle72f531.pdf
Fiche de déclaration environnementale et sanitaire (FDES)
http://www.developpement-durable.gouv.fr/spip.php?page=article&id_article=13396

NFP01-010.. The 'Fiches de declaration environnementales et sanitaires' (FDES) rely on secondary LCA data aggregated in database hosted by the CSTB called INIES.[44] These declarations / records are specific to products. They are meant to be used to calculate the environmental impacts associated to buildings. Two softwares have been developed to estimate ecological impacts of buildings: Élodie (CSTB) and TEAM Bâtiment (PWC). It is expected that 90% of construction product categories will be inventoried in the database by the end of 2012.

A number of ecolabels are used in France. The most common ones are NF Environnement[45] and the EU Flower.[46] NF Environnement is certified by AFNOR which is the French standardization agency. It stands for products that are better (from a quality and environmental standpoint) than comparable products available on the market. The EU Flower is the European green label. It is managed / administered by different organizations for each country. In France, AFNOR manages EU Flower certifications. Depending on the product category, either the EU Flower or NF Environnement is applicable.

Environment information on products and services is one of the key projects resulting from the Environment Grenelle and one of the action triggers most promoted by France. The major objective under the Grenelle 1 Law is to "*generalise environmental information displayed on products and services*". It provides for the development of "*mention of environmental impacts of products and services in addition to price display*". The consumption code is to be modified accordingly.[47]

In order to accompany professionals in the implementation of this measure, an ADEME-AFNOR platform[48] has been set up by the ministry responsible for sustainable development (MEEDDM), with the creation of ten or so workgroups per type of product, piloted by voluntary professional federations. The purpose of this participative process, bringing together over 500 contributors, is to draw up a methodological guide for the calculation of the carbon equivalent content in a product or service, thereby mutualising the costs of implementing this measure and identifying other pertinent environmental impacts for each group of products concerned and methods used to calculate them. These calculations will serve as a reference for the preparation of displays providing environmental information and in particular the carbon content of products. As of January 2011, the decrees will require environmental displays to be based on these reference sets. Finally, ten companies having carried out more in-depth lifecycle analyses may be allowed to use them, but will be invited to make them public.

Beyond the legislative process, the MEEDDM is also committed to supporting and rewarding individual initiatives in this area. Indeed, within the framework of the implementation of the Environment Grenelle, several leaders from major French retail chains have developed voluntary environmental labelling initiatives for their products.

These initiatives have been supported and rewarded by the State, which has made the commitment alongside the professionals from the sector. Thus, several voluntary commitment conventions have been signed as part of the Grenelle21, such as that signed between the MEEDDM and the Association of Construction Products Industries (AIMCC) for environmental and sanitary labelling on construction products. A similar convention was signed by the MEEDDM and professionals from the property sector

[44] http://www.inies.fr/
[45] http://www.ecolabels.fr/fr/la-marque-nf-environnement-qu-est-ce-que-c-est
http://www.ecolabels.fr/fr/content/download/1298/11477/version/1/file/Marque+NF+Environnement.pdf
[46] http://www.ecolabels.fr/fr/l-eco-label-europeen-qu-est-ce-que-c-est
[47] Article 85 of the Grenelle 2 Law: "*As of January 1st 2011, the consumer must be informed of the content of equivalent carbon in products and packaging as well as the consumption of natural resources or the impact on the natural environment that are attributable to these products throughout their product lifecycle through marking, labelling, posters or any other appropriate procedure.*"

[48] French normalisation agency

for displaying energy performance in real estate ads. The implementation of a workgroup on social information displayed on products

Beyond environment-related information on product content, France is now looking at social information. A multipartite workgroup financed by the MEEDDM has been set up within the AFNOR to prepare a guide of good practice. This seeks to promote transparency of information on the social and employment conditions under which products are manufactured. The conclusions of this workgroup should be made public at the end of 2009.

In France, the introduction of energy labelling further to directive 92/75/CEE of the Council of September 22nd 1992 created an obligation for most household appliances to be labelled, assessing their energy efficiency on a scale from A (optimal) to G. Appliances concerned are refrigerators and freezers, dishwashers, ovens, domestic air conditioning and electrical bulbs. Because of the success of this labelling programme, which rapidly oriented the market towards the best-performing products, higher performance categories have been added for certain products (A+ and A++), and a specific directive[23] was adopted in 1999 by Europe for energy/CO_2 labelling for cars.

France made energy labeling a key measure of its **2004-2012 Climate Plan** in pursuit of its Kyoto Protocol commitments. Its success is today broadly recognised throughout the European Union since the market has shifted towards the higher labeling categories (A to A++), with industrialists second-guessing the expectations of consumers in terms of energy performance. France considers that energy labelling is a central instrument of Community policy to make consumption and production attitudes more sustainable and, in this respect, strongly supports a broader scope for the directive which is currently being negotiated to include other products and, where applicable, other relevant essential resources. France believes that environmental labeling tools for products should continue to develop apace. They provide information that consumers are increasingly expecting, and raise awareness as to the environmental and climatic impacts of mass consumption products. This is the interpretation of the conclusions adopted by the Council of Ministers of the Environment of the EU, under the French Presidency of the EU, on December 5th 2008, on the theme “Sustainable consumption and production”.

Eco-labels distinguish the most environmentally friendly products and services. Their criteria guarantee low environmental impact throughout their lifecycle whilst ensuring suitable use of products and services. Two eco-labels are issued in France: the NF Environment stamp for the French market and the European Eco-label for the European Union market. The objective is to identify the 20% most virtuous products in each category. Even though only 1% of the most virtuous products are today labelled, the growth in turnover of eco-labeled products[24] confirms a structural success, since the results did not dip with the economic crisis.

Certification of companies: helping the consumer pick out eco-responsible companies France is currently leading a reflexion on labeling of eco-responsible companies, as detailed below. Also, the Grenelle 1 Law pays particular attention to environmental certification of agricultural operators. Thus, in article 31, the State positions the objective of involving 50% of farms in this approach by 2012, specifying that “*environmental recommendations will be deliberately integrated into products under information on identification of quality and origin”*.

Excerpt taken from ‘France’s national report for the 18th session of the United Nations Commission on Sustainable Development (CSD-18)’

Product lifecycle analysis

The use of product lifecycle analysis for waste has already been introduced in France through policies concerning information to consumers. Law No. 2009-967 of August 3rd 2009 stipulates in article 54 that:

"Consumers must be given access to sincere, objective and complete environmental information concerning the overall characteristics of the product/packaging pairing and be proposed products which respect the environment at attractive prices. France will support the recognition of these requirements at European Union level. Mention of environmental impacts of products and services in addition to the display of their price will progressively be developed, including at Community level, just like the display and availability at the point of sale of traceability and social conditions of their production. The methodology associated with the assessment of these impacts will give rise to consultation with the professionals concerned."

**** G1 Article 40 of Grenelle 1 Law:» *It is planned to submit construction and furnishing products as well as floor and wall coverings, paints and varnishes and all products intended to or resulting in the emission of substances into the atmosphere to compulsory labelling as of January 2012, in particular for emissions and volatile pollutant content."*

*** 12 Article 85 of the Grenelle 2 Bill, completing article L.214-1 of the Consumer Code, by: "*requirements of precision, verification and accountability of substantial elements of product lifecycles in the preparation of claims of an environmental nature or using the term 'sustainable development' or its synonyms when these claims are presented on products intended for sale to consumers or as part of their marketing in the form of references on packaging, publications, advertising, telemarketing or insertions in digital and electronic publications."*

http://www.un.org/esa/dsd/dsd_aofw_ni/ni_pdfs/NationalReports/france/Full_text.pdf

Sweden

The Nordic Swan and the EU Flower are the two main labels being used in Sweden; both are ISO Type I labels. They are both managed by SIS Miljomarkning (Swedish Standards Institute) on behalf of the Swedish government. The Swan uses lifecycle impact of products as the basis for certification. It gives a lot of attention to the impact of products on greenhouse gas emissions. The EU Flower is designed for 28 product categories. The Nordic Swan applies to 65 product areas.

The Nordic Swan is controlled in Sweden by the Swedish Ecolabelling Board consisting of members from the Swedish Environmental Protection Agency, the Swedish Grocers Federation, the Confederation of Swedish Enterprise, the Swedish Chemicals Agency, Friends of the Earth, The Swedish Association of Local Authorities and Regions, The Energy Agency, The Swedish Consumer Agency and the Swedish Consumers Association. The Swedish Ecolabelling Board also has responsibility for the EU Flower and products that apply for the EU Flower ecolabel. The Board further reports to the Swedish government on EU Flower criteria, who in turn decide on Sweden's official position in EU Flower matters. The Nordic Ecolabelling Board consists of members from each national Ecolabelling Board and decides on Nordic criteria requirements for products and services. Criteria are applicable in all Nordic countries, and no country can develop its own criteria or product groups. When a product is granted a Nordic Ecolabel in one Nordic country, the company can even apply, through a simple application procedure, for a Nordic Ecolabel in the other Nordic countries.

http://www.svanen.se/en/
http://www.svanen.se/en/Om-Svanen/About/Q--As/
http://www.un.org/esa/dsd/dsd_aofw_ni/ni_pdfs/NationalReports/sweden/SCP.pdf

A public procurement program (FLIPP – basis for lifecycle−based decisions for government agencies and companies)[49] acknowledging the impact of this sector in transforming the market demand for green products. This explains the government's participation (NUTEK and VINNOVA) in the funding of the Center for the Environmental Assessment of Products and Material Systems (CPM)[50] which is Sweden

[49] http://flipp.dinstudio.se/
[50] http://www.cpm.chalmers.se/

main center of excellence in LCA methodology. The CPM brings together industrial partners, Chalmers University of Technology, Chalmers University Center for Environment and Sustainability and IVL (Swedish Environmental Research Institute).

Ecolabelling Sweden certifies according to the Nordic Swan and EU Flower standards. The company is owned by the state and is non-profit.[51]

Sweden is an international reference for EPDs. The Swedish Environmental Management Council (SEMCo) founded the international EPD system (www.environdec.com).

Excerpt from: http://www.msr.se/en/EPD/
Environmental Product Declarations (EPD) provide information as a factual description of the environmental performance of products and services from a life cycle perspective. One of the most important areas of application EPDs is green procurement.

The international EPD®system is founded by Swedish Environmental Management Council based on a business initiative. Ever since the original EPD®system was launched in Sweden in 1998, it has attracted interest from a number of different countries and has accordingly been gradually transformed into an international system. After a recent revision of the international EPD®system, it complies with most market's requests for a globally-accepted communication system.It also meets most customer needs for quality assurance and provides comparable information between products. The system complies with international standards for life cycle assessments and environmental declarations (ISO 14040, 14044 and 14025).

Italy

The International EPD system website lists the Italian INTEND programs as one of four EPD multiple product category schemes active worldwide (the others being Japan, Norway and South Korea). The project was initially managed by a firm called Macroscopio (website does not to exist anymore).[52] The Italian EPD system was implemented by the Italian Environment Ministry (unit of environmental quality of products). It has been developed in close cooperation with the Swedish scheme. Both systems are virtually the same. Italy is not part of GEDnet which brings together EPD practitioners worldwide. It was in the past.

Denmark

The Danish Building and Urban Research Centre has been developing an EPD scheme for the building materials industry. The Danish Technological Institute (collaboration) and Ministry of Housing and EPA (funding) are involved.[53] Denmark participated in the NIMBUS project (along with Sweden and Norway) which aimed to develop a common EPD system based on ISO 14040 for Nordic countries. Recent cuts in government spending have resulted in less involvement of the EPA on EPDs.

Germany

The Blue Angel label (a Type I label) is owned by the German government and administered by RAL gGmbH.[54] The Angel label references a protection goal (either health, climate, resources or water).

[51] http://www.svanen.se/en/Om-Svanen/About/
[52] http://lca.jrc.ec.europa.eu/lcainfohub/provider.vm?pid=477
[53] http://www.en.sbi.dk/research/energy_and_environment/environmental-declaration-of-building-products
[54] http://www.blauer-engel.de/en/index.php

Climate and health are the two most used labels for wood products. A new line of labels focusing on VOC emissions (health related) has been created.[55]

German Federation of construction Material Producers in collaboration with Stuttgart University Department of Product Engineering developed an LCA database for construction materials along with handbooks on how to use LCI data and produce LCA (around year 2000). Later on (pre-2002), a joint working group including actors from the construction industry, Stuttgart University and EPA developed a type III label for construction products based on the Blue Angel programme. The declaration includes a description of the contents of the product, LCA data and additional information (ex.: health and safety). This label represents a compromise between Type I and Type III labels.

UK

BRE – construction sector
http://www.bre.co.uk/page.jsp?id=1578

In June 2008, BRE published the Green Guide to Specifications following a wide consultation with UK industries. The Green Guide specifications are based on the BRE Global Environmental Profiles Scheme for Type III Environmental Product Declarations (EPD) for construction products. The methodology identifies significant environmental aspects associated with the Life Cycle Assessments (LCA) of construction products. Results from a certified Environmental Profile Scheme can be published and used by BREEAM or Code for Sustainable Homes assessors.

*The BRE scheme uses LCA data for average products (generic product approach) which does not allow differentiating between products (ex.: all solid wood floor covering have the same LCA values). [56]

In 2007 the **Carbon Trust** started a pilot carbon label, with commitments from Walkers (potato crisps), Boots (shampoo), and Innocent (smoothies). The trial was successfully completed in 2008. The current version of the **Carbon Reduction Label** shows the total greenhouse gas emissions from every stage of the product's life cycle, including production, transportation, preparation, use, and disposal. With B2B products (manufactured for use in another product's manufacture), the carbon footprint measurement stops at the factory gates. The figure, which indicates the amount of CO_2 equivalents emitted along the value chain, is printed directly on the product. Recently, an additional version of the label was introduced without gram specifications.

The **Carbon Reduction Label** is supported by the **PAS 2050**, a set of standards and guidance developed in partnership with Defra, BSI, and other stakeholders worldwide. By applying its own set of proprietary data and comparability rules, the **Carbon Label Company** aims to ensure that measurement is comparable across different products within any particular category, enabling manufacturers and consumers to make quick and valid comparisons.[57]

Netherlands

MRPI – construction sector (does not respect the participation of interested parties criterion included in ISO 14025). This scheme uses LCA data for average products (generic product approach) which does not allow differentiating between products (ex.: all solid wood floor covering have the same LCA values). [58]

[55] It is called Evaluation Scheme for Building Products. It is managed by the Committee for Health-related Evaluation of Building Materials (AgBB). http://www.umweltbundesamt.de/building-products/engel.htm
[56] http://ec.europa.eu/environment/ipp/pdf/epdstudy.pdf
[57] http://www.pcf-world-forum.org/partner/carbon-reduction-label/
[58] http://ec.europa.eu/environment/ipp/pdf/epdstudy.pdf

Norway

The Norwegian Planning and Building Act requires documentation of the environmental properties of construction products.[59] The Norwegian EPD Foundation was established in 2002 by the Confederation of Norwegian Enterprise (NHO) and the Federation of Norwegian Building Industries (BNL). The reason for its establishment was an expressed desire from the Norwegian corporate sector relating to the development of credible, standardized and internationally valid Environmental Product Declarations for products and services. The Norwegian EPD Foundation's task is to verify EPDs in accordance with the international standard ISO 14025 – Environmental Declarations Type III. In order for an EPD to be valid pursuant to the ISO 14025 Standard it must be verified by a neutral third party. It is important to the corporate sector that all environmental information be provided in an objective, standardized fashion, and that the competitive conditions are equal for both Norwegian and foreign enterprises. The goal of the Norwegian EPD Foundation is for Environmental Product Declarations to be the preferred communications tool when exchanging environmental information about products and services across all sectors both nationally and internationally.

The Norwegian EPD Foundation collaborates with the leading international research institute SINTEF Building and Infrastructure, Ostfold Research Co. and the Norwegian University of Science and Technology (NTNU) among others on the development of Product Category Rules (PCR). To the extent that the Foundation has financial means available, it also supports the development of Product Category Rules (PCR). The Norwegian EPD Foundation is responsible for ensuring that Norwegian Product Category Rules (PCR) complies with the ISO 14025 Standard as well as ensuring that EPDs are developed in accordance with Product Category Rules – PCR.

Norwegian EPDs contain:

- General information about manufacturer and product (functional unit, foundation year, etc.).
- Overview of use of material, area and water in the life cycle of the product.
- Overview of energy consumption in the life cycle of the product.
- Overview of emissions and contributions to environmental impacts during the production as well as contents of toxic substances in the product.
- Overview of volume of waste and types of handling for the end product
- Information about the status of environmental management, production liability, initiatives

Japan

Japan is actively involved in LCA through its Japanese Environmental Management Association for Industry (JEMAI) a public corporation created by the Ministry of Economy, Trade and Industry. JEMAI collects data according to ISO 14040 guidelines using a using a format called Product Environmental Information Data Sheet (PEIDS). In the Ecoleaf program (initiated in 2002), consumers are presented with a one-page summary sheet, product environmental aspects declaration (PEAD), the PEIDS as well as the product data sheet (presenting inputs / outputs by life stage and product unit).[60] Program guidelines identify required (global warming, acidification and energy consumption) and optional items (ozone depletion, eutrophication, energy resources, mineral resources and power consumption during use).[61] Manufacturers are allowed to produce declarations using the verified PEIDS based on guidelines that are specific to product categories. EcoLeaf labels are numbered specific for each product. Consumers can find out about the environmental impacts of their products by entering the product number on the EcoLeaf website. on the

[59] http://www.epd-norge.no/getfile.php/PDF/EPD%20-%20information%20in%20English%202010.pdf
[60] http://www.jemai.or.jp/english/ecoleaf/program.cfm
[61] http://www.jemai.or.jp/english/ecoleaf/pdf/EcoleafGuideline_ver.1.pdf

South Korea

A cross-sectoral EPD programme (KELA EDP) was launched in Korean in 2000. Parallel schemes (Type I and II labelling) are also managed by KELA. It is in part supported by the Ministry of Environment. KEOCO is charged with developing PCRs and LCI database maintenance. Certification is done by Environment management corporation (EMC). The Korean Environmental Preservation Association (KEPA) trains verifiers. To date, 96 products (all electronics) have been certified via the KELA EDP programme.

Following a nine month pilot programme, the Korea Environmental Industry and Technology Institute (KEITI) introduced a carbon label in February 2009. So far, more than 230 goods and services have been labelled. The labelling covers, consumer goods, transport services, electronic appliances and production goods. The assessment is framed by the Guidelines for Carbon Footprint of Products, which has been amended in December 2009. This year KEITI will check ten items to see if the labelling has led to reductions in CO2-eq emissions. Comparable to the Carbon Reduction Label in Great Britain the Korea Carbon Footprint Label includes a commitment to further emission reductions. The institute plans a two-step system, where the carbon label can be upgraded with a low-carbon label. The certification system is supposed to be available within three years. Recently, a Memorandum of Understanding was signed with the Carbon Trust in partnership with Planet Ark – making it possible for Korean products to carry British and Australian Carbon Labels. An adoption of the ISO 14067 is planned for 2011. In May 2010 the law for Low Carbon Green Growth will become effective. It obliges the state to invest at least 2% of her GDP in low carbon production and consumption.[62]

Australia

A portal for LCA practitioners (AusLCI)[63] has been put in place by CSIRO in collaboration with the Australian Lifecycle Analysis Society (ALCAS), Forest and Wood Products Research and Development Corporation, RMIT and others.[64] Australia's Centre for Design (RMIT) also has LCA capacity.[65] A list of companies providing LCA services is available at:
http://www.alcas.com.au/system/files/LCA%20Consultants%20-%20contact%20details%20table%20July%202010.pdf

USA

ASTM E60 committee is developing standards related to sustainability. Much of the work done by the committee seems focused on buildings. Meeting will be held in October 2010 to determine PCRs for building products.[66] National Renewable Energy Laboratory hosts the US national database (USLCI).[67] American Center for LCA (ACLCA): mission is to build LCA capacity – is the secretariat for the USLCI database (http://www.lcacenter.org/index.html). Institute for environmental research and education (IERE) has an EPD program for the food industry.[68]

Canada

[62] http://www.pcf-world-forum.org/partner/south-korean-carbon-footprint-label/
[63] http://150.229.66.74/auslci/
[64] http://www.csiro.au/news/ps2i8.html
[65] http://www.cfd.rmit.edu.au/programs/life_cycle_assessment
[66] http://www.astm.org/SYMPOSIA/filtrexx40.cgi?U+mystore++-P+MAINCOMM+E60+-P+EVENT_ID+1842+-P+MEETING_ID+58534+/usr6/htdocs/newpilot.com/MEETINGS/sympotherinfo.frm
[67] http://www.nrel.gov/lci/
[68] http://www.iere.org/sustain/LifeCycle.htm

The Athena Sustainable Materials Institute maintains LCA databases for building materials. CIRAIG (Centre interuniversitaire de recherche sur le cycle de vie des produits, procédés et services) trains students interested in becoming LCA practitioners. Quantis acts as the contractual branch of CIRAIG.

Canada has had a proprietary pseudo-EPD scheme specific to the pulp and paper sector since 1996 called EPDS. It was developed as collaboration between FPAC and TerraChoice (its Environmental Services branch). The system focuses mainly on the production stage and targeted professional customers. TerraChoice actively tried to get other sectors interested in the EPDS scheme. EPDS wanted to rate supplier based on their LCA data, thus taking a step towards Type I labelling. This program appears defunct.

Environmental Product Declaration

according to ISO 14025

EGGER
EUROSTRAND® OSB
EGGER OS'Brace®

Declaration number
EPD-EHW-2008112-E

Institut Bauen und Umwelt e.V.
www.bau-umwelt.de

Institut Bauen
und Umwelt e.V.

Summary

Umwelt-Produktdeklaration

Environmental Product-Declaration

Institut Bauen und Umwelt e.V. **www.bau-umwelt.com**	**Program holder**
Fritz EGGER GmbH & Co. Company Head Office Weiberndorf 20 A – 6380 St. Johann in Tyrol	**Declaration holder**
EPD-EHW-2008112-E	**Declaration number**
EGGER EUROSTRAND® OSB boards for construction This declaration is an environmental product declaration according to ISO 14025 and describes the environmental rating of the building products listed herein. It is intended to further the development of environmentally compatible and sustainable construction methods. All relevant environmental data is disclosed in this validated declaration. The declaration is based on the PCR document "Wood-based materials", year 2009-01.	**Declared building products**
This validated declaration authorises the holder to bear the official stamp of the Institut Bauen und Umwelt. It only applies to the listed products for one year from the date of issue. The declaration holder is liable for the information and evidence on which the declaration is based.	**Validity**
The **declaration** is complete and contains in its full form: - Product definition and physical building-related data - details of raw materials and material origin - description of how the product is manufactured - instructions on how to process the product - data on usage condition, unusual effects and end of life phase - life cycle analysis results - evidence and tests	**Content of the declaration**

25. February 2009		**Date of issue**
Prof. Dr.-Ing. Horst J. Bossenmayer (President of the Institut Bauen und Umwelt)		**Signatures**
This declaration and the rules on which it is based have been examined by an independent expert committee (SVA) in accordance with ISO 14025.		**Verification of the declaration**
Prof. Dr.-Ing. Hans-Wolf Reinhardt (chairman of the expert committee)	Dr. Frank Werner (tester appointed by the expert committee)	**Signatures**

Summary

Umwelt-Produktdeklaration

Environmental Product-Declaration

Product description

OSB boards (Oriented Strand Board) is a synthetic-resin bonded, wood-based material board product with a three-layer structure made out of micro-veneer oriented long wood chips called strands according to EN 300 "OSB". "Strands" with a defined thickness and shape which are primarily produced using logwood which is glued in several layers. The middle layer is oriented at a 90° angle relative to the outer layers. The OSB boards are glued with a MUF resin in the outer layers and a polyurethane resin in the middle layer, or only with polyurethane resin. The boards are manufactured in thicknesses of 6-40 mm (different depending on the board type), the raw density of the boards is approx. 600 kg/m^3.

Application

OSB board can be used in all load-bearing and reinforcing components (ceilings, wall cladding, roof shell, subfloor, sill plates) for which the national technical approvals of the respective product or the CE mark according to DIN EN 13986 is a prerequisite for use. Furthermore, OSB boards can be used for non-load-bearing applications in interior design or as wood packing and concrete forms.

Scope of the LCA

The **Life Cycle Assessment (LCA)** was performed according to DIN ISO 14040 following the requirements of the IBU guideline for type III declarations. Both specific data from the reviewed products and data from the "GaBi 4" database were used. The life cycle assessment encompasses the raw material and energy production, raw material transport, the actual manufacturing phase and the end of life in a biomass generating plant with energy recovery. The OSB board product mix was declared.

Results of the LCA

EUROSTRAND® OSB boards

Evaluation variable	Unit per m³	Total	Manufacturing	End of Life
Primary energy, non renewable	[MJ]	-7651	4109	-11 760
Primary energy, renewable	[MJ]	12 564	12 701	-137.6
Global warming potential (GWP 100)	[kg CO_2 eqv.]	-537.9	-864.1	326.2
Ozone depletion potential (ODP)	[kg R11 eqv.]	-7.59E-06	2.13E-05	-2.89E-05
Acidification potential (AP)	[kg SO_2 eqv.]	1.10E+00	9.82E-01	1.23E-01
Eutrophication potential (EP)	[kg Phosphate eqv.]	1.80E-01	1.62E-01	1.83E-02
Photochemical oxidant formation potential (POFP)	[kg ethylene eqv.]	9.59E-02	1.32E-01	-3.62E-02

Prepared by: PE INTERNATIONAL, Leinfelden-Echterdingen
in cooperation with EGGER Holzwerkstoffe Wismar GmbH & Co.

PE INTERNATIONAL
EXPERTS IN SUSTAINABILITY

Evidence and verifications

In addition, the results of the following tests are shown in the environmental product declaration:

- Formaldehyde according to EN 120
  Testing institute: WKI Fraunhofer Wilhelm-Klauditz-Institute, Brunswick
- MDI (diphenylmethane-4,4'-diisocyanate) according to procurement regulation RAL ZU-76 and NIOSH (P&CAM 142)
  Testing institute: Wessling Beratende Ingenieure GmbH
- Eluate analysis according to DIN 38406-4 and EN 71-3
  Testing institute: ECO – Institute, Cologne
- EOX (extractable organic halogen compounds) according to DIN 38414-S17
  Testing institute: ECO – Institute, Cologne
- Toxicity of the fire gases according to DIN 53 436
  Testing institute: University Osnabruck, Chemical laboratory
- Lindane/PCP according to PA-C-12:2006-02
  Testing institute: WKI Fraunhofer Wilhelm-Klauditz-Institute, Brunswick

Publisher:

Institut Bauen und Umwelt e.V.
(formerly Arbeitsgemeinschaft Umweltverträgliches Bauprodukt e.V., AUB)
Rheinufer 108
53639 Königswinter
Phone: 02223 296679 0
Fax: 02223 296679 1
Email: info@bau-umwelt.com
Internet: www.bau-umwelt.com

Layout:
Fritz EGGER GmbH & Co.

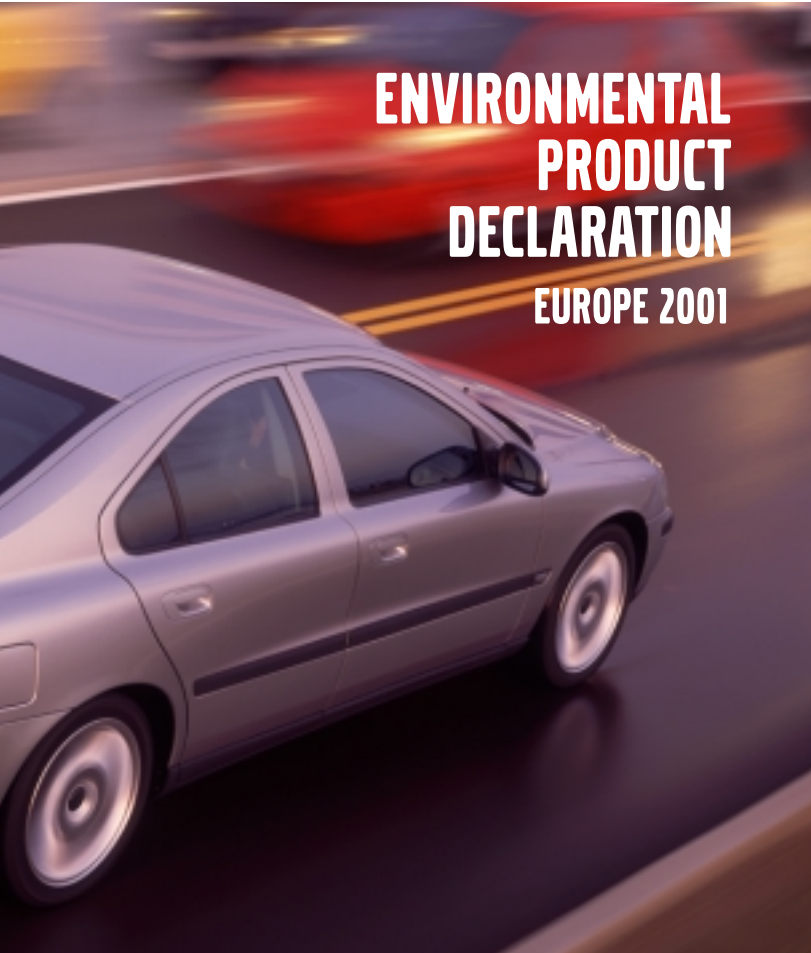
Illustration credits:
Fritz EGGER GmbH & Co.
Company Head Office
Weiberndorf 20
A – 6380 St. Johann in Tyrol

In the case of a doubt is the original EPD “EPD-EHW-2008112-D” applicable.

VOLVO S60

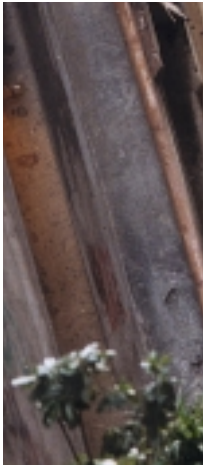
ENVIRONMENTAL PRODUCT DECLARATION

EUROPE 2001



CONTENTS

Verification and Validation Statement



Lloyd's Register Quality Assurance Limited (LRQA) verifies that Volvo Car Corporation's (VCC) Environmental Product Declaration (EPD) relating to model year 2001 and dated April 2000 has used Life Cycle Assessment (LCA) information, VCC environmental strategy objectives and the views of interested parties for the selection of the presented indicators and that:

- *the LCAs are based on the requirements in ISO 14040 series of standards;*
- *the rationale for the selection of indicators is based on ISO 14031;*
- *data and information presented meet the requirements in ISO 14021*[1].
- *VCC internal data management system is designed and implemented to assure that EPD data are consistently collated properly.*
- *the design of the internal audit system, applicable to the EPD, is based on the requirements in ISO 14001.*

VCC continues to work on additional improvement areas. They have completed the work on their internal verification system and work continues in the areas of formalising the techniques used by their LCA practitioners and in the review of the definitions and selections of indicators.

Scope of LRQA's assessment

The assessment was executed as a sampling exercise[2] *based upon requirements in ISO 14021, ISO 14040 series, ISO 14031 and specific requirements in ISO 14001 (focusing on implementation and operation, checking and corrective action and management review). It covered the following activities:*

- *assessment of conformance with the standards identified above;*
- *review of the rationale for the selection, definition and determination of indicators;*
- *verification of VCC internal data management system to evaluate its capability to consistently produce accurate and complete data for the EPD;*
- *validation of the EPD dated April 2000 for consistency and completeness with regard to the definitions, determination methods, data presentation and requirements in ISO 14021.*

on behalf of LRQA, April 2000.

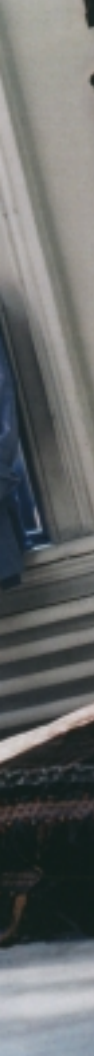
1 ISO 14021 Environmental labels and declarations – Self-declared environmental claims.
2 The assessment was based on the requirements in ISO 14010 and 14011 (international guidelines relating to the general principles of auditing and audit procedures).

Note: the above verification and validation statement is based upon examination of the English version of the Volvo Car Corporation's EPD for model year 2001 – dated April 2000. Other language versions have been subject to review confirming the data but the accuracy of the translation from the original text has not been formally verified.

Can a car be ‘environment friendly’?

No, using present-day technology, the modern car cannot be described as ‘environment friendly'. On the other hand, different cars affect the environment to different extents and in different ways. For example, fuel consumption is significant in terms of the greenhouse effect, while efficient exhaust gas purification reduces atmospheric pollution. The purpose of this environmental product declaration (EPD) is to provide you with a holistic view of the environmental impact of your Volvo car throughout its life cycle. You can also compare different Volvo models in the areas which you consider most important.

The data and information management and retrieval system used for this EPD has been verified by Lloyd’s Register Quality Assurance Limited (LRQA).



Volvo's EPD helps you to compare

In this document, we show you how we, our suppliers and our dealers are working to implement environmental management systems.

We show how much energy is used to manufacture our cars, the quantity of solvents discharged from our plants and the efficiency with which the materials in the cars are utilised.

We also illustrate the emission levels generated by the cars when they are driven and how much fuel they use. This enables you to compare how much carbon dioxide is emitted and the quantity of hydrocarbons released by the car's fuel system as a whole.

Finally, we describe how our dismantling manuals are used, how much material is recovered for recycling, how we are reducing the usage of hazardous substances and the marking of materials used in various car components.

Volvo first with verified environmental data

In 1998, the Volvo S80 became the first car in the world to be supplied with an environmental product declaration verified by LRQA. Since then, Volvo has published EPDs for several other models. This edition contains data on all EU-certified engine variants of the Volvo S60 (2001 model). In conjunction with the introduction of the Volvo S60, we are also launching a home page on the Internet to make it easier to compare the different models.

Volvo obviously hopes that its competitors will follow its initiative by producing open and comprehensive EPDs for their cars. Only then will you be able to compare Volvos with other makes.

Environmental impact based on life cycle

Every product has an impact on the environment throughout its life cycle, from extraction of the raw materials to final disposal and recycling. For this reason, it is important to study its environmental impact from a life-cycle perspective. Volvo was one of the first automakers to use tools to evaluate the life-cycle environmental impact of its products. The tool which we use today is known as EPS (Environmental Priority Strategies in product design)[1]*. EPS enables us to evaluate the impact of our products and processes on natural resources, ecosystems and human health.*

Four main areas

The EPD is divided into the four areas of environmental management, production, useful life and recycling. Of these, the latter three represent the different phases in the vehicle's life cycle, while the first describes how improvements are made continuously during each phase.

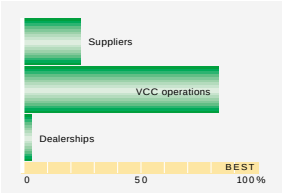
Indicators based on EPS and on Volvo Car Corporation's environmental policy, as well as on demands from various interests within the community, have been developed for each life-cycle phase.

These indicators have been used to develop a scale showing the 'best' and 'worst' cases in each instance, as described in detail in the following pages.

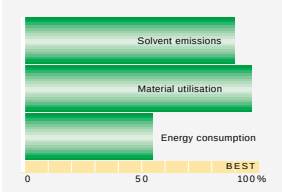
Environmental management	Production	Useful life	Recycling
Suppliers	Solvent emissions	Controlled emissions	Labelling of plastics
VCC operations	Material utilisation	Evaporation of hydrocarbons	Dismantling
Dealerships	Energy consumption	Carbon dioxide emissions	Use of recycled plastics

1 EPS was developed by a number of major Swedish industrial concerns, including Volvo Car Corporation, in collaboration with the Swedish Environmental Research Institute. EPS complies with ISO 14040, ISO 14041, ISO 14042 and ISO 14043.

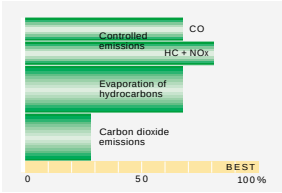
Environmental management, Volvo S60



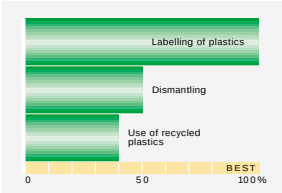
Production, Volvo S60



Useful life, Volvo S60 man. (140 bhp)



Recycling, Volvo S60



Environmental management

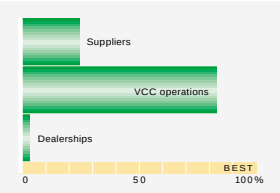
Volvo Car Corporation is the first automaker in the world to have implemented certified or registered environmental management systems[1] at every stage of its operations, including suppliers, VCC operations and dealerships.

An environmental management system is a tool which is used to organise and focus environmental activities. Its primary aim is to identify and evaluate significant environmental impact, establish targets for improvement and direct operations towards the achievement of these targets, obviously in compliance with current legislation. The system employed may be based on the international ISO 14001 standard and/or the European Union's EMAS regulation.

Comprising product development, production and marketing functions, Volvo Car Corporation's chain of activities includes a large number of business units, both company-owned and independent, such as suppliers and dealerships.

The indicators selected for the environmental management area are Suppliers, Volvo Car Corporation operations and Dealerships.

Environmental management, Volvo S60



SUPPLIERS

Suppliers' environmental programmes

Components manufactured by independent suppliers account for 65 to 70% of the value of our cars. Since these components are used to make Volvo products, a supplier's ability to manage environmental issues is an important consideration. For this reason, Volvo Car Corporation has chosen to determine how many suppliers have implemented a certified or registered environmental management system.

Environmental training continues

One of Volvo Car Corporation's stated goals was that its 80 biggest[2] suppliers should have implemented environmental management systems by 1 July 1999. In the event, 35% of the suppliers concerned had achieved this goal by the target date, although this figure is subject to ongoing evaluation. Environmental training for suppliers is also continuing; 67 companies attended the Volvo Car Corporation one-day environmental training programme in 1999.

VCC OPERATIONS

Practising what we preach

Volvo Car Corporation must control its own environmental activities if it is to identify the most important areas for improvement and ensure that ongoing progress is achieved.

Environmental management assists improvement

By June 2000, 83% of the workforce of Volvo Car Corporation's majority-owned operations were working to an environmental management system. Systems of this type help personnel to work towards continuous improvement and provide them with the environmental training required to achieve this. In 2000 to date, environmental management systems have been implemented by Volvo Cars North America, and by VCC's Product and Process Development divisions.

DEALERSHIPS[3]

Customer must perceive environmental awareness

To the customer, the dealer is Volvo. For this reason, dealers must work systematically to reduce the environmental impact of their own facilities, and of the cars that they service and repair. Thus, this indicator shows the proportion of Volvo Car Corporation dealerships in our major markets[4] which have implemented a certified or registered environmental management system.

Development of dealer environmental improvement tools

In 1999, Volvo Car Corporation published a self-assessment tool for dealers as a first step towards certification. Known as 'Focus on the environment', this takes the form of a questionnaire designed to improve dealers' understanding of the environmental implications of their activities and, based on the results, to identify areas of potential improvement.

BEST AND WORST CASES

Suppliers

The best case is when every Volvo Car Corporation supplier[5] has implemented a certified or registered environmental management system. At least one of a supplier's plants must be certified.

The worst case is when no Volvo Car Corporation supplier has implemented a certified or registered environmental management system.

VCC operations

The best case is when each of Volvo Car Corporation's majority-owned[6] operations has implemented a certified or registered environmental management system.

The worst case is when none of Volvo Car Corporation's majority-owned operations has implemented a certified or registered environmental management system.

Dealership

The best case is when every Volvo Car Corporation dealership has implemented a certified or registered environmental management system.

The worst case is when no Volvo Car Corporation dealership has implemented a certified or registered environmental management system.

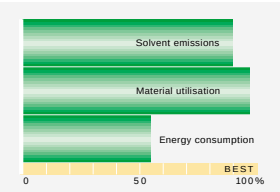
1 ISO 14001 and/or EMAS (Environmental Management and Audit Scheme). **2** In terms of value. At least one of a supplier's plants must be certified. **3** Volvo Car Corporation owns only a small proportion of all dealerships. **4** Europe, North America and Japan. **5** Defined as a supplier of production materials valued at SEK 5 million annually to Volvo Car Corporation. **6** Operations in which Volvo Car Corporation has a shareholding of over 50%.

Production

Volvo Car Corporation has reduced the environmental impact of its production plants significantly over the last thirty years. The problem of solvent emissions, which is a key environmental issue in the automotive industry, provides an example. Emissions of solvents from Volvo Car Corporation's Torslanda plant in Sweden have been reduced by over 90% since 1972. Built in 1991, the paint shop at Torslanda still has one of the lowest solvent emission levels in the industry.

Since EPS analysis indicates that the greater proportion of the environmental impact of car production is due to solvent emissions, energy consumption and materials utilisation, these are the indicators chosen in this area.

Production, Volvo S60



SOLVENT EMISSIONS PER CAR

Solvent emissions must be reduced

The emission of solvents from car production plants has been a central environmental issue over the last thirty years. As the main source of hazardous emissions in the industry, solvents affect both human health and the environment. The inhalation of large quantities of solvents can affect the central nervous system, while hydrocarbons can also combine with nitrogen oxides to generate harmful ground-level (tropospheric) ozone in the presence of sunlight.

The Volvo S60 is produced at Volvo Car Corporation's plant at Ghent in Belgium. The figures for total solvent emissions from the production and painting of car bodies in these plants are estimated.

Cleaner painting process

In Ghent, solvent emissions were reduced from 3.4 to 3.0 kg per car by the replacement of surface treatment agents and the installation of a new paint shop.

MATERIAL UTILISATION PER CAR

Reducing environmental impact in the long term

Apart from depleting natural resources, the extraction of raw materials has a major impact on the environment in the form of mining, processing and transportation activities. For this reason, it is extremely important to use the materials extracted as efficiently as possible and to increase the proportion of recycled waste. In the automotive industry, this can be done by improving the efficiency of the manufacturing processes, and by reusing and recycling waste materials.

The quantity of waste material is measured in all plants and related to the average weight of the finished car.

Steady increase in recycling knowhow

Thorough sorting is an essential part of materials recycling. Training in the area of recycling continued in 1999 and quality control of the waste management systems in all Volvo plants shows that materials sorting improved during the year. The use of reusable packaging has also increased.

ENERGY CONSUMPTION PER CAR

All energy consumption has environmental impact

Energy consumption is essential to car production. At the same time, both energy production and consumption have a major impact on the environment, and consumption must, therefore, be minimised. The nature and extent of the environmental impact are determined by the energy source.

Energy consumption per car is measured regularly in all plants and is the indicator used in this case.

Many small improvements

Energy optimisation takes the form of a series of continuous, minor improvements.

BEST AND WORST CASES

Solvent emissions per car

In environmental terms, the best case is represented by the complete elimination of solvent emissions, which are due mainly to painting with solvent-borne paints and cleaning with solvent-based agents. In practice, this means applying all coats of paint to the body by the dry-powder method and cleaning without solvents. This, therefore, is defined as the best case.

If no action were taken to reduce solvent emissions, these would total 30 kg per car[1]. This is accordingly defined as the worst case figure and will henceforth be used as a reference value.

Material utilisation per car

In environmental terms, the best case is when all of the material is used; in other words, when there is no waste whatever.

The worst case is defined as a hypothetical situation in which none of the material entering the production facility is used in the product. In other words, all of the material is classified as waste.

Energy consumption per car

The best case is a hypothetical situation in which no energy whatever is used. In other words, the energy consumption per car is 0 MJ (0 MWh).

The worst case is represented by an energy consumption of 18,000 MJ (5 MWh) per car.[2]

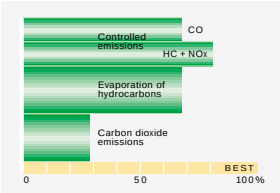
1 Automotive industry figure from the early 1970s.
2 Reference figure based on competitors' production.

Useful life

A car generates most of its environmental impact during its useful life. In 1976, Volvo Car Corporation became the first automaker in the world to develop and introduce a three-way catalytic converter and oxygen sensor (Lambdasond), enabling legally controlled emissions to be reduced by more than 90%.

EPS evaluation carried out by Volvo Car Corporation indicates that legally controlled emissions, evaporation of hydrocarbons and carbon dioxide emissions are the three most significant forms of environmental impact attributable to a car in service. These, therefore, are the chosen indicators.

Useful life, Volvo S60 man. (140 bhp)



LEGALLY CONTROLLED EMISSIONS

Exhaust gases cause major environmental problems

The highest proportion of the environmental impact, local and regional, generated by petrol-engined vehicles in traffic is attributable to emissions of carbon monoxide, hydrocarbons and nitrogen oxides from the exhaust gases. These emissions may be toxic in high concentrations. When exposed to sunlight, hydrocarbons and nitrogen oxides may combine to form ground-level ozone, which not only damages vegetation, but causes respiratory ailments in humans, especially children. Nitrogen oxides also contribute to eutrophication (an excess of nutrients in lakes and rivers which favours plant growth and deprives aquatic life of oxygen) and acidification. These three pollutants are controlled by legislation in almost every country in the world. Statutory limits are lowest in California, where the strictest provisions are contained in the ZEV (Zero Emission Vehicle) standard.[1]

Diagnostic function helps to reduce emission levels

All petrol engine variants with ratings of 140 and 170 bhp comply with the provisions of the European EC05 standard, which are comparable to the Californian ULEV (Ultra Low Emission Vehicle) requirements. This has been achieved by locating the catalytic converter closer to the engine, increasing its working temperature and improving the efficiency of conversion of hazardous emissions. The design of the exhaust manifold has also been improved. Furthermore, improved engine management systems have enabled emissions to be reduced during gear-changing and acceleration. All Volvo petrol engines comply with EC00 and LEV (Low Emission Vehicle), and all are equipped with European On-Board Diagnostics (EOBD), which indicate when the emission levels are too high. In this event, the car should be brought to a Volvo dealer for attention.

EVAPORATION OF HYDROCARBONS

Emissions from car as a whole

The exhaust pipe is not the only source of hydrocarbon emissions from a car. Petrol evaporates when refuelling, when the engine is hot and during hot weather, causing emissions which may be as hazardous to human health and the environment as the exhaust emissions.

Evaporation control systems

All Volvo cars are now fitted with systems, including carbon canisters, to reduce evaporative emissions from the fuel system.

CARBON DIOXIDE EMISSIONS

Petrol consumption and carbon dioxide

Carbon dioxide emissions contribute to global climate change. The carbon dioxide emissions from a car are related to its fuel consumption.

Energy consumption reduced

The models are very competitive in terms of fuel consumption. For instance, the 140-bhp Volvo S60 returns 8.4 l/100 km. This has been achieved by introducing continuous refinements, such as improved engine management systems, and reducing engine friction. Other power train components have also been improved.

BEST AND WORST CASES

Legally controlled emissions

The best case is represented by a car which emits none of these pollutants.

The worst case corresponds to the limits (2.3 g/km for carbon monoxide, 0.2 g/km for hydrocarbons and 0.15 g/km for nitrogen oxides) specified in current European emission control legislation.[2]

Evaporation of hydrocarbons

The best case is represented by zero evaporation under test.

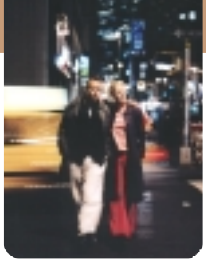
The worst case corresponds to the limit (2 g/test) specified in current European legislation.[2]

Carbon dioxide emissions

The best case is when the exhaust emissions contain no fossil-based carbon dioxide.

The worst case is defined as 283 g/km of carbon dioxide. Corresponding to the carbon dioxide emissions from the model variant with the highest fuel consumption among Volvo Car Corporation's 1997 petrol-engined models, this is used as a baseline for subsequent comparisons.

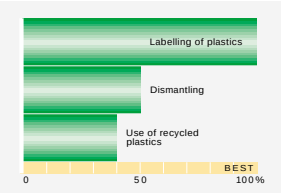
1 California Code of Regulations Title 13. **2** EU Directive 70/220 EC, amendment 1999/102.



Recycling

Improved recycling is one important method of reducing the consumption of finite natural resources. To an automotive manufacturer, this means developing products which both contain larger quantities of recycled materials and are easier to recycle, as well as systems for handling the materials in question. Aspects of importance in the product development context include the labelling of plastic components, the publication of dismantling manuals and minimisation of the number of environmentally hazardous substances used in production.

Recycling, Volvo S60



LABELLING OF PLASTICS

Plastics offer recycling potential

About 75% by weight of a car – mainly metals – is recycled at present. To increase this figure, other materials must also be recycled. Based on current knowledge, market conditions and technology, Volvo Car Corporation believes that priority in this respect should be given to plastics.

The labelling of plastics according to chemical composition is a basic prerequisite for efficient recycling; plastics of different types must be separated when the car is dismantled.

Designing for improved recycling

Focusing specifically on the marking of components and choice of materials, a detailed recycling study of the Volvo S80 was carried out in 1999. Similar studies were carried out on the Volvo S40 and V40 in 1999, and on the Volvo V70 at the beginning of 2000. Analysis of the results shows that the models can be dismantled more efficiently than their predecessors, although areas of potential improvement were also identified.

DISMANTLING

Manual facilitates dismantling

Since fast, efficient dismantling is essential to viable recycling, a manual describing the best dismantling procedures is required. It is also important to minimise the number of environmentally hazardous substances in the car. In practice, a system of controlling and phasing out such substances offers the best means of achieving this. Volvo Car Corporation has drawn up a black list of prohibited substances and a grey list[1] of restricted substances for this purpose.

Computer-based manual and black/grey lists

Volvo Car Corporation has, in cooperation with other car producers, published a computer-based dismantling manual for cars of various makes and models. Known as IDIS (International Dismantling Information System), this was updated in 2000 and will be distributed to more than 5,000 recycling companies throughout the world in January 2001.

In 1999, Volvo Car Corporation developed its Listed Materials Inventory Tool (LIMIT), in which the information contained in the black and grey lists is broken down into system and component levels. The purpose of LIMIT is to help the individual designer to gain an overall view of his or her particular field, and to acquire the necessary knowledge and understanding of events in it.

USE OF RECYCLED PLASTICS[2]

Lower usage of raw materials

In a smoothly functioning recycling system, the recycled materials are used to make new products. In this context, the use of recycled plastics in new cars is one contribution which the automotive industry can make.

New applications

Volvo Car Corporation, in cooperation with its suppliers and the Ford Motor Company, is working to identify areas in which recycled plastics may realistically be used. Projects designed to progressively increase the quantity of recycled materials used in new components are also under way. Cooperation with Ford will provide readier access to greater volumes of recycled plastics.

BEST AND WORST CASES

Labelling of plastics

The best case is when all plastic components weighing 50 g and over are labelled in accordance with international standards.[3]

The worst case is when only plastic components weighing 200 g and over are labelled.

Dismantling

A dismantling manual is awarded 25% of the best score, requirements for phasing out hazardous substances another 25% and the implementation of procedures for monitoring phase-out a further 50%. Thus, the best score is achieved by fulfilling these three conditions.

The worst case is when none of these conditions is fulfilled.

Use of recycled plastics

Volvo Car Corporation estimates that 20 kg of recycled plastics could be used in a new car, subject to prevailing quality standards and the availability of materials. This figure is, therefore, used to define the best case.

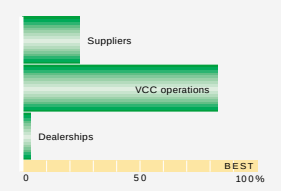
The worst case is when the car contains no recycled plastics.

1 Volvo black list, Reg. No. Volvo std. 1009.1; Volvo grey list, Reg. No. Volvo std. 1009.11. **2** Volvo Car Corporation includes 'post-consumer' and 'post-industrial' in its definition of recycled plastics. However, materials reutilisation in the form of reworking, regrinding or scrapping are not included since this is part of general business as of today. For further information, see the definition of recycled plastics in international standard ASTM D 5033-90, Chapter 3.1.11. **3** Volvo STD 5052.41/ISO 1043-1 (1987)/ISO 1043-2(1988)/AS.1 ISO 1043-1.

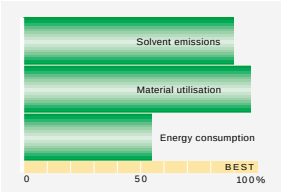
Environmental performance of Volvo S60

This EPD describes the environmental performance of the Volvo S60 built at Ghent in Belgium, and sold on the European market.[1] *The percentage figure quoted in each case represents the value of the parameter in question on the best/worst case scale.*

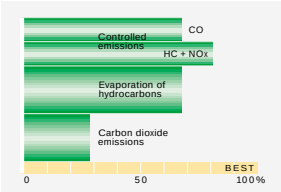
Environmental management



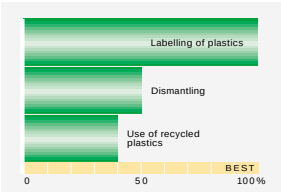
Production



Useful life, Volvo S60 man. (140 bhp)



Recycling



Environmental management

Suppliers	24%		page 11
VCC operation	83%		page 11
Dealerships	approx 3%		page 11

Production[2]

Solvent emissions	90%	3.0 kg/car	page 12
Material utilisation	97%		page 13
Energy consumption	54%	8.280 MJ/car 2.3 MWh/car	page 13

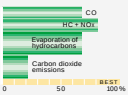
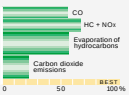
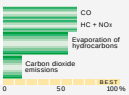
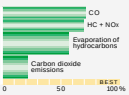
Useful life, Volvo S60 man. (140 bhp)

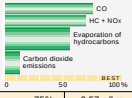
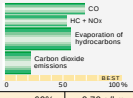
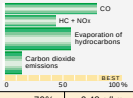
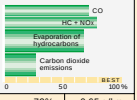
Controlled emissions[3]	CO	68%	0.73 g/km	page 15
	HC + NOx	81%	0.07 g/km	page 15
Evaporation of hydrocarbons		68%	0.64 g/test	page 15
Carbon dioxide emissions[4]		29%	201 g/km	page 15
Fuel consumption, combined[4]			8.4 l/100km	page 15

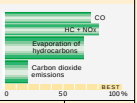
Recycling

Labelling of plastics	100%		page 16
Dismantling[5]	50%		page 16
Manual	Yes		
Requirements	Yes		
Procedures for follow-up	No		
Use of recycled plastics[5]	40%	8 kg/car	page 17

1 This declaration refers to the year 2001 variants of the Volvo S60 engines sold on the European market. The countries which comprise this market are: Austria, Belgium, Denmark, Finland, France, Germany, Great Britain, Iceland, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden and Switzerland. **2** Average value based on 1999 production figures. **3** As measured in accordance with EU Directive 70/220 EC, amendment 1999/102. **4** As measured in accordance with EU Directive 80/1268 EEC, amendment 1999/100. **5** As of June 2000.

Useful life		Volvo S60 (140 bhp) aut.		Volvo S60 2.4T man.		Volvo S60 2.4T aut.		Volvo S60 T5 man.	
									
Controlled emissions[3]	CO	68%	0.74 g/km	56%	1.01 g/km	63%	0.86 g/km	71%	0.67 g/km
	HC + NOx	81%	0.07 g/km	67%	0.12 g/km	63%	0.13 g/km	70%	0.10 g/km
Evaporation of hydrocarbons		68%	0.64 g/test	57%	0.87 g/test	57%	0.87 g/test	57%	0.87 g/test
Carbon dioxide emissions[4]		21%	223 g/km	22%	220 g/km	16%	239 g/km	22%	222 g/km
Fuel consumption, combined[4]			9.3 l/100km		9.2 l/100km		10.0 l/100km		9.3 l/100km

Useful life		Volvo S60 T5 aut.		Volvo S60 2.0T man.		Volvo S60 2.0T aut.		Volvo S60 2.4 man.	
									
Controlled emissions[3]	CO	75%	0.57 g/km	69%	0.70 g/km	79%	0.48 g/km	72%	0.65 g/km
	HC + NOx	70%	0.10 g/km	53%	0.17 g/km	43%	0.20 g/km	79%	0.07 g/km
Evaporation of hydrocarbons		57%	0.87 g/test	57%	0.87 g/test	57%	0.87 g/test	68%	0.64 g/test
Carbon dioxide emissions[4]		13%	246 g/km	22%	220 g/km	14%	242 g/km	27%	208 g/km
Fuel consumption, combined[4]			10.3 l/100km		9.2 l/100km		10.1 l/100km		8.7 l/100km

Useful life		Volvo S60 2.4 aut.	
			
Controlled emissions[3]	CO	74%	0.60 g/km
	HC + NOx	81%	0.07 g/km
Evaporation of hydrocarbons		68%	0.64 g/test
Carbon dioxide emissions[4]		20%	225 g/km
Fuel consumption, combined[4]			9.4 l/100km

Think

Environmental Product Declaration

A presentation of quantified environmental life cycle product information for the **Think** work chair in North America.

Product Description

The model chosen for analysis is the most popular model **Think** work chair (reference 465THINKS4U).

It is a highly adjustable ergonomic chair equipped as follows:

1. *Your Power™ weight activated mechanism*
2. *Your Profile™ seat and back flexors*
3. *Your Preference™ control*
4. *Adjustable seat depth*
5. *Adjustable seat height*
6. *Adjustable lumbar support*
7. *Adjustable armrests*
8. *Plastic base*

Manufacturer

The selected product, the **Think** work chair, is manufactured in Grand Rapids, Michigan by Steelcase.

Steelcase, which was founded in 1912, has been dedicated to creating innovative products and helping people work more effectively for almost a century. Steelcase has quality management systems (ISO 9001), ensuring that our customers are guaranteed the same level of product quality and performance wherever they are in the world.

Steelcase is committed to continually reducing the environmental impacts of its products and activities on a global scale.

The **Think** chair is also manufactured in Sarrebourg, France for the European market and, starting in 2005, in Kuala Lumpur, Malaysia for the Asian market.

For further information visit www.steelcase.com.

Steelcase

Material Declaration

The **Think** work chair consists of the materials listed below. The total weight is 15.1 kg (33.3 lbs.) including packaging.

Metals	kg	%
Aluminum	1.583	12.0
Steel	4.776	31.7

Plastics	kg	%
PA	5.015	33.2
LDPE (for packaging)	0.318	2.1
PET	0.380	2.5
POM	0.533	3.5
PP	0.680	4.5
PU	0.330	2.2

Other materials	kg	%
Cardboard (for packaging)	0.227	1.5
Rubber	0.024	0.2

Environmental Product Declaration

The environmental impacts of the **Think** work chair throughout its entire life cycle – including raw materials extraction, production, transport, use, and end of life – were assessed using the Life Cycle Assessment (LCA) process, during the chair's development (early 2004).

The functional unit used in the LCA was chosen as "Provision of comfortable office seating – with the features stated in the product description – for an average person (99 – 243 lbs.) for 8 hours a day, 5 days a week over a period of 15 years."

Life Cycle Inventory Analysis

The Life Cycle Inventory Analysis covers entire life cycle stages as shown below.

Materials
This stage includes raw materials extraction and transformation, as well as purchased parts, until delivery to the manufacturing site in Grand Rapids.

Production
This stage comprises all production and assembly processes. Data was obtained from the management system of the production site in Grand Rapids.

Transport
Transport from suppliers to Grand Rapids and transport from Grand Rapids to major North American markets is considered.

Use
No relevant environmental exchanges occur during the use of the product.

End of life
A product can be disposed of in different ways, or become a resource itself. Based on current North American averages, it was assumed that about 99% of the products are landfilled, 0% incinerated and 1% recycled at the end of their useful life.

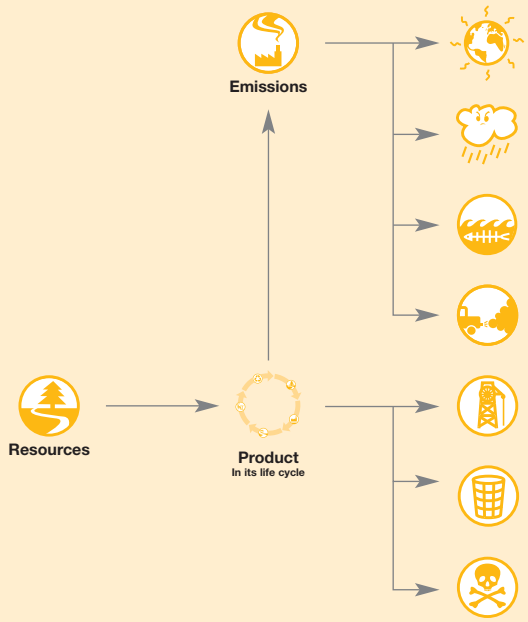
Distribution of the environmental impacts for the relevant life cycle stages

	Category	Unit	Total	Materials	Production	Transport	End of Life
	Global warming	[g CO_2-eq.]	102 610.0	67 800.0	27 700.0	3 720.0	3 390.0
	Acidification	[g SO_2-eq.]	836.6	535.0	266.0	35.3	0.3
	Eutrophication	[g NO_3-eq.]	712.2	471.0	179.0	59.2	3.0
	Photochemical smog	[g C_2H_4-eq.]	24.2	18.0	0.8	4.6	0.7

No relevant environmental exchanges occur during the use stage of the product.

Life Cycle Assessment

Environmental impact categories



Global warming
is the rising of the global temperature due to emissions of greenhouse gases.

Acidification
is the damage to trees and life in lakes and rivers, as well as accelerated degradation of materials such as metals, limestone and concrete, both due to emissions of acids.

Eutrophication
is the loss of plants and animals in aquatic ecosystem due to oxygen depletion following blooms of algae, stimulated by high nutrient concentrations.

Photochemical smog
is a type of air pollution harmful to environment and human health caused by emissions of nitrogen oxides and volatile organic components.

Abiotic resource depletion
is the depletion of non-renewable resources such as oil, coal and metals due to their extraction and consumption.

Waste
is the bulk waste and hazardous waste created during the whole life cycle of the product.

Toxic substances
are substances which cause harm to the natural environment or human health.

Environmental aspects of Think work chair

The contributions of inventory parameters to different impact categories throughout the entire life cycle of the **Think** work chair are listed below. Life cycle inventory parameters are considered only if they contribute more than 1% of the total impact in that impact category.

Category	Parameter		Inventory value	Unit	Characterized impact value	Unit
Global warming					**102 610.0**	**g CO_2-eq.**
	CO_2	carbon dioxide	85477	g	83.3	%
	N_2O	nitrous oxide	276	g	6.7	%
	CH_4	methane	21	g	6.5	%
	HCs	hydrocarbons	10	g	3.0	%
Acidification					**836.6**	**g SO_2-eq.**
	SO_x	sulphur oxides	504	g	60.0	%
	NO_x	nitrogen oxides	466	g	38.8	%
Eutrophication					**712.2**	**g NO_3-eq.**
	NO_x	nitrogen oxides	466	g	87.7	%
	N_2O	nitrous oxide	21	g	8.2	%
	NH_4+	ammonium	4	g	2.0	%
Photochemical smog					**24.2**	**g C_2H_4-eq.**
	C_5H_{12}	n-pentane	25	g	41.1	%
	CO	carbon monoxide	216	g	26.8	%
	NMVOCs *	(from diesel engines)	7	g	17.2	%
	CH_4	methane	276	g	8.0	%
	C_xH_y	aromatic hydrocarbons	1	g	1.9	%
	VOCs *	(from diesel engines)	1	g	1.5	%
Abiotic resource depletion						
	Brown coal (lignite)		1.3	kg	-	-
	Coal		14.0	kg	-	-
	Crude oil		13.8	kg	-	-
	Iron (in ore)		3.5	kg	-	-
	Natural gas		10.3	kg	-	-
	Zinc (in ore)		2.1	kg	-	-
Waste						
	Bulk waste		6788	g	-	-
	Hazardous waste		382	g	-	-
Toxic substances						
	Toxic substances		262	g	-	-

No characterised impacts were calculated for Abiotic resource depletion, Solid waste and Toxic substances, due to lack of credible, internationally agreed characterization factors.
** VOCs = volatile organic compounds, NMVOCs = non-methane VOCs*

Additional environmental information

Certifications

By the end of 2004 **Think** will officially comply with the French environmental certification NF – Environnement, awarded by the CTBA (Centre Technique du Bois et de l'Ameublement).

Think carries the Scientific certification Systems Indoor Advantage™ Gold certification for indoor air qualiity in North America.

LEED

The **Think** chair helps companies work toward LEED (the U.S. Green Building Council's Leadership in Energy and Environmental Design) certification in many ways. The **Think** chair can contribute toward LEED credits because it contains a high percentage of recycled material and it is a low emitting product. Additionally, its ergonomic qualities, production processes and ease of disassembly may contribute towards LEED credits for employee health and for innovation. Because each project is unique, Steelcase will work with customers individually towards LEED application.

McDonough Braungart Design Chemistry

In addition to conducting a Life Cycle Assessment of **Think**, Steelcase consulted with McDonough Braungart Design Chemistry (MBDC) on the safety of materials before they went into the **Think** chair. MBDC analyzed key materials according to their strict protocols, endorsing only those deemed safe to the environment.

Materials

Reduce overall material usage, Think weighs only 15 kg (32 lbs). Made from up to 44% recycled materials it contains no hazardous materials (no PVC, chrome, mercury or lead). The water based foam does not contain CFC or HCFC. Suppliers send materials in reusable totes to reduce packaging waste. Majority of chairs are shipped blanket wrapped, and when used, cardboard boxes are recyclable.

Production

Think was designed to be produced with minimal waste, energy consumption and environmental impact. Powder-coat paint is VOC-free and free of heavy metals. No gluing processes are used in assembly, and all urethane foam is water based.

Transport

To reduce shipping, chairs are manufactured close to customers in North America and Europe, and starting 2005 in Asia. The Think chair is lightweight and can ship ready-to-assemble which uses less packaging and allows more chairs per shipment, requiring less energy and materials for shipping.

Use

To maximize the Think chair's working life, seat and back cushions, arms, headrest, and lumbar support can easily be added or replaced. Maintenance information is available on www.steelcase.com or from Steelcase dealers.

End of Life

Think can be easily disassembled for recycling in about five minutes, using common hand tools. Think is up to 99% recyclable by weight. Parts weighing more than 50g are clearly labelled for recycling.

Compilation and Verification Process

- The LCA and the EPD of the Think work chair (reference 465THINKS4U) were conducted with:
- Institute for Product Development – Denmark (Instituttet for Produktudvikling, IPU)
- Institute for Engineering Design, Vienna University of Technology - Austria (Institut für Konstruktionslehre, Ecodesign, Technische Universität Wien, TUW)
- The LCA was verified through a critical review by Institute of Chambéry - France (Ecole Nationale Supérieure des Arts et Métiers, ENSAM)

References

- ISO/TR 14025: Environmental labels and declarations – Type III environmental declarations, 15-03-2000
- Lee, K.M., Park, P.: "Application of Life-Cycle Assessment to Type III Environmental Declarations", Environmental Management, Vol. 28, No. 4, 2001, pp. 533-546

LCA method and characterization factors

- EDIP method: Wenzel, Hauschild, Alting: "Environmental Assessment of Products" Volume 1 (Methodology, tools and case studies in product development), Chapman and Hall, 1997, ISBN 0 412 80800 5
- Intergovernmental Panel on Climate Change (IPCC), Status report, 1994
- World Meteorological Organization (WMO), Status report on global ozone research and monitoring project, 1992/1995
- Nordic LCA guideline, 1995
- UNECE report, 1990/1992

Contact

For further information please call 1.800.333.9939.

Steelcase®

THE GREEN STANDARD

Environmental Product Declaration

In accordance with ISO 14025

Convert™ Design Platform by *Interface* FLOR®

Modular carpet tile made with post-consumer content type 6,6 nylon and post-consumer content non-virgin PVC backing.

The Green Standard Environmental Product Declaration System

www.TheGreenStandard.org

Declaration Number: TGS – 1000409 – 0411 – B

0.1 Product classification and description

Product description
Modular carpet with post consumer recycled content Nylon 6,6 yarn face cloth combined with GlasBac®RE recycled backing.

Product styles
InterfaceFLOR Convert™ Design Platform – product group including collections RePrise™, Redo™, and Revival™. This includes the specific styles Reissued™, Remade™, Reincarnation™, Reinvent™, Rejuvenate™, Repurpose™, Resurrected™, Recollect™, ReEntropy™, ReFine™, and ReFrain™.

This product collection represents a significant advance in carpet manufacturing by incorporation of post consumer carpet yarn into the wear layer. Post consumer carpet is reclaimed through Interface's ReEntry® 2.0 program and the fibers are separated from backings. Fiber is then melted into Nylon granulate, combined with post industrial granulate, and virgin granulate and then extruded into new carpet yarn. In addition to yarn reclamation, reclaimed carpet tile backing is ground and used as the feedstock for GlasBacRE, the recycled vinyl backing for this group of products. The recycling of post consumer carpet yarn and backing back into new carpet represented in this product collection is a major accomplishment on the path to sustainable carpet construction.

0.2 Range of Application
Modular installation of textile floor covering in commercial buildings.

0.3 Product Standard

• ASTM E-648 Radiant Panel	Class 1
• ASTM E-662 Smoke Density	≤ 450
• AATCC -134 Static	< 3.0 KV
• AATCC 16-E Light fastness	≤ 4.0 @ 60 AFUs
• AACHEN Din 54318 Dimensional Stability	<0.10 %
• EN14041 CE-Labeling	

0.4 Accreditation
- ISO9001 Quality Management System

- ISO14001 Environmental Management System
- Platinum NSF140 Sustainable Carpet Assessment
- CRI Green Label Plus
- NVLAP Accreditation, NIST

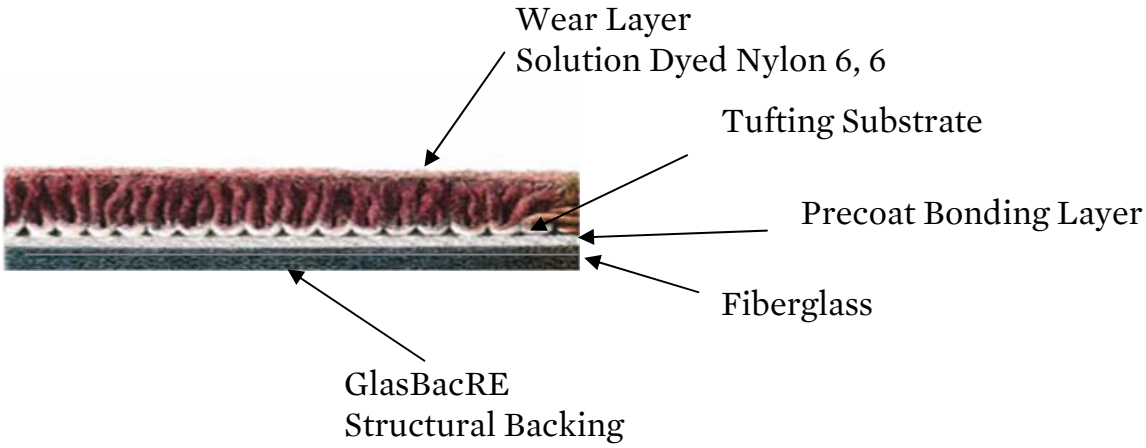
0.5 Delivery Status

Figure 1. Specification of product construction

Characteristics		
Type of manufacture	Tufted Textured Loop	
Yarn Type	Nylon 6,6 with post consumer and post industrial recycled content	
Characteristics	Nominal value	Unit
Pile fiber composition	Nylon 6,6	100%
Total thickness	7.5	mm
Total carpet weight	4454	g/m^2
Surface pile thickness	2.9	mm
Number of tufts or loops/dm^2	2102	loops/dm^2
Surface pile weight	694	g/m^2
Secondary backing	Recycled vinyl with fiberglass	

1 Material Content

Figure 2. Diagram of product construction



Definitions

- **Wear Layer** – Tufts of solution dyed, Nylon 6,6 yarns with high levels of recycled Nylon 6,6 from both post industrial Nylon and post consumer. The post consumer content is from reclaimed carpet, a significant advancement in carpet recycling. The source of the reclaimed carpet is Interface's extensive ReEntry carpet reclamation program.
- **Tufting Substrate** – a nonwoven polyester fabric, a tufting primary, into which the wear layer is tufted.
- **Precoat Bonding Layer** – a latex coating which bonds the tufts into the tufting primary
- **Glass** – a nonwoven fiberglass fabric which provides dimensional stability, a critical feature of modular carpet.
- **Structural Backing** – GlasBacRE, a post consumer recycled vinyl layer which gives structure and additional dimensional stability to the carpet tile. The source of the recycled vinyl is Interface's extensive ReEntry carpet reclamation program.

Figure 3. Material content of the product

Layer	Component	Material	Availability	Mass %	Origin
Wear Layer	Face Cloth/yarn	Nylon 6,6 Virgin	Fossil resource, limited	11.12%	US

		Nylon 6,6 Post Industrial Recycled	Recycled material, abundant	3.36%	US
		Nylon 6,6 Post Consumer Recycled	Recycled material, abundant	1.06%	US
Tufting Substrate	Primary	Polyester	Fossil resource, limited	2.28%	US
Precoat Bonding Layer	Latex	EVA	Fossil resource, limited	4.88%	US
	Filler	CaCO3	Mineral resource, non renewable, abundant	14.37%	US
	Foamer	Soap	Fossil resource, limited	0.28%	US
Glass Stabilization	Fiberglass	Silica	Mineral resource, non renewable, abundant	1.52%	US
Structural Backing	GlasBacRE Backing	Post Consumer recycled carpet tile	Recycled material, abundant	52.33%	US
		Post Industrial recycled vinyl		8.52%	US

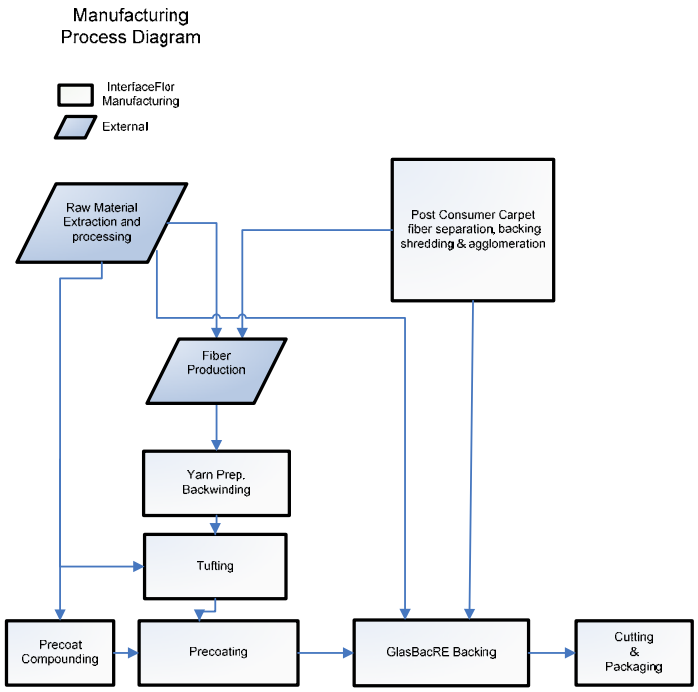
1.2 Production of main materials

Post Consumer content Nylon 6,6
Produced by the shaving of fibers from post consumer carpet, pelletization of this fiber fluff, and extrusion into yarn in combination with post industrial recycled Nylon granulate and virgin Nylon granulate that was produced from the polymerization of hexamethylene diamine and adipic acid which are both sourced from petroleum.
Polyester
Synthetic fiber material, often polyethylene terephthalate produced by the polymerization of terephthalic acid and ethylene glycol which are both sourced from petroleum.
Ethylene vinyl acetate
A copolymerization product of ethylene and vinyl acetate.
Calcium carbonate
Mineral filler from limestone deposits
Soap
Alcohol ethoxy sulfate
Glass
Produced by fusion of sand and other silicate fillers.
Post consumer recycled vinyl
Recovered post consumer vinyl backed carpet tile and other post consumer vinyl sources

2 Production of the floor covering

2.1 Production Process

Figure 4. Diagram of production process



2.2 Health, safety and environmental aspects during production

- ISO 14004 Environmental Management System
- PASS, a raw material review process that goes beyond ISO 14001 and considers all potentially regulated materials
- Sociometrics, measuring and improving social aspects of our business including worker safety
- Compliance with PHE (Public health and Environment) requirements within NSF140 Sustainable Carpet Standard.

3 Delivery and installation of floor covering

3.1 Delivery

An average distance to customers served is 500 miles.

3.2 Installation

Installation of this product does not require adhesive application, but is done using TacTiles preventing damage to the subfloor, increasing ease of removal and recycling, and installation during occupancy. For full installation instructions, see the InterfaceFLOR Installation Guide.

3.3 Health, safety and environmental aspects during installation

The VOCs associated with traditional flooring adhesives are avoided for both the installers and the building occupants by TacTile installation method. Carpet tile does not require a foam cushion underlayment used in traditional broadloom carpet installations. The TacTile method creates a floating floor, preventing damage to the subfloor and simplifying removal at end of life.

3.4 Waste

Waste is minimized by the modular aspect of the carpet tile and by the design pattern that allows for random installation. While installation waste can be sent to landfill or incineration, the preferred method is recycling through InterfaceFLOR's ReEntry 2.0 take back program. Contact InterfaceFLOR ReEntry at 888-733-6873 (US) or 866-398-3191 (Canada).

3.5 Packaging

Carpet tiles are packaged in recycled cardboard boxes (100% post consumer recycled content cardboard).

4 Use Stage

4.1 Use of the floor covering

The product is warranted for a service life of 15 years of heavy use. However carpets are often replaced before their service life expires due to fashion.

4.1.1 Cleaning and maintenance

Carpet and Rug Institute Carpet Maintenance Guidelines for Commercial Applications, which includes regular vacuuming and intermittent extraction cleaning. http://carpet-rug.com/commercial-customers/cleaning-and-maintenance/index.cfm

4.1.2 Prevention of structural damage

Product is intended for commercial applications with heavy wear (CRI Test Method 101 appearance Retention Rating)

4.2 Health aspects during usage

Conforms to CRI Green Label Plus indoor air quality testing program. http://www.carpet-rug.org/commercial-customers/green-building-and-the-environment/green-label-plus/carpet-and-adhesive

5 Singular Effects

5.1 Fire

Radiant Panel: Class 1 (ASTM E-648)
Smoke Density: ≤ 450 (ASTM E-662)

5.2 Water Damage

The product backing is impervious to moisture protecting the subfloor from leaks and spills. Exposure to flooding for long periods may result in damage to the product.

5.3 Mechanical damage

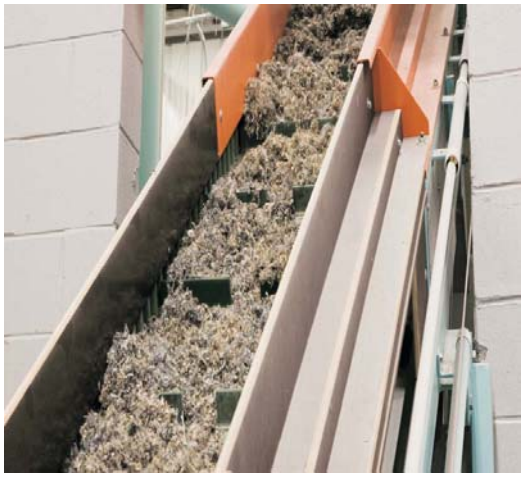
Product is intended for commercial applications with heavy wear (CRI Test Method 101 appearance Retention Rating http://www.carpet-rug.org/commercial-customers/selecting-the-right-carpet/quality-and-performance/retention-rating-scales.cfm). Product should be installed according to InterfaceFLOR installation guidelines.

6 End of Life

6.1 Recycling or reuse

Product should be recycled through Interface's ReEntry 2.0 process by contacting InterfaceFLOR ReEntry at 888-733-6873 (US) or 866-398-3191 (Canada).

InterfaceFLOR Reclamation & Recycling Process



6.2 Disposal
Recycling of the product through Interface's ReEntry 2.0 process is strongly recommended, but disposal in municipal landfill or commercial incineration facilities is permissible.

7 Life Cycle Assessment

7.2 Functional Unit
One square meter of installed modular carpet for heavy use. The use stage is considered for one year of service life. The reference flow is one square meter of modular carpet.

7.3 Cut-off criteria
The cut-off criteria established for the study include or exclude materials, energy and emissions data. For the purposes of this study, the criteria are as follows:

- Mass – If a flow is less than 1% of the mass of the modeled product it may be excluded, providing its environmental relevance is not a concern.
- Energy – If a flow is less than 1% of the cumulative energy of the model it may be excluded, providing its environmental relevance is not a concern.
- Environmental relevance – If a flow meets the above criteria for exclusion, yet is thought to potentially have a significant environmental impact, it will be included.

The total excluded flows do not exceed 5% of overall life cycle.

7.4 Allocation
Allocations were not used in the model of this product. Where relevant, the background data incorporates some allocation as in the power mix, where possible appropriate geographical grid mixes were used.

7.5 Background data
GaBi 4 software system was used for modeling the life cycle of the modular carpet

7.6 Data Quality

For the data used in this LCA, the data quality is considered to be "good to high" quality. The definition of this quality range stems from the following descriptions. The data and data sets cover all relevant process steps and technologies over the supply chain of the represented carpet products. The LCIs from the GaBi 4 database and Plastics Europe are mainly based on industry data and are completed, where necessary, by secondary data. The operations data is representative of a sufficient sampling over and adequate period of time. The temporal correlation falls under a three year window for the vast majority of data considered. The geographical correlation is slightly challenging as there is very little life cycle information available that is country specific in every facet. For Interface, there is a reliance on data produced from European sources with country specific considerations during the LCI creation. Given that the data is from similar production conditions and representative of the technology and production paths used by Interface's direct suppliers, this is acceptable to Interface and deemed to have an appropriate level of quality. A possible source of uncertainty from geographical sources is the incorporation of European electricity grid mixes into many of the LCIs that are used.

7.7 System Boundaries

The Life Cycle Assessment includes all relevant cradle-to-grave environmental information for one square meter of carpet. The system boundaries include raw material production and processing, carpet manufacturing, energy production, packaging, transportation, carpet installation, use and maintenance, as well as the end-of-life options recycling, incineration or landfill disposal.

7.8 Notes on use stage

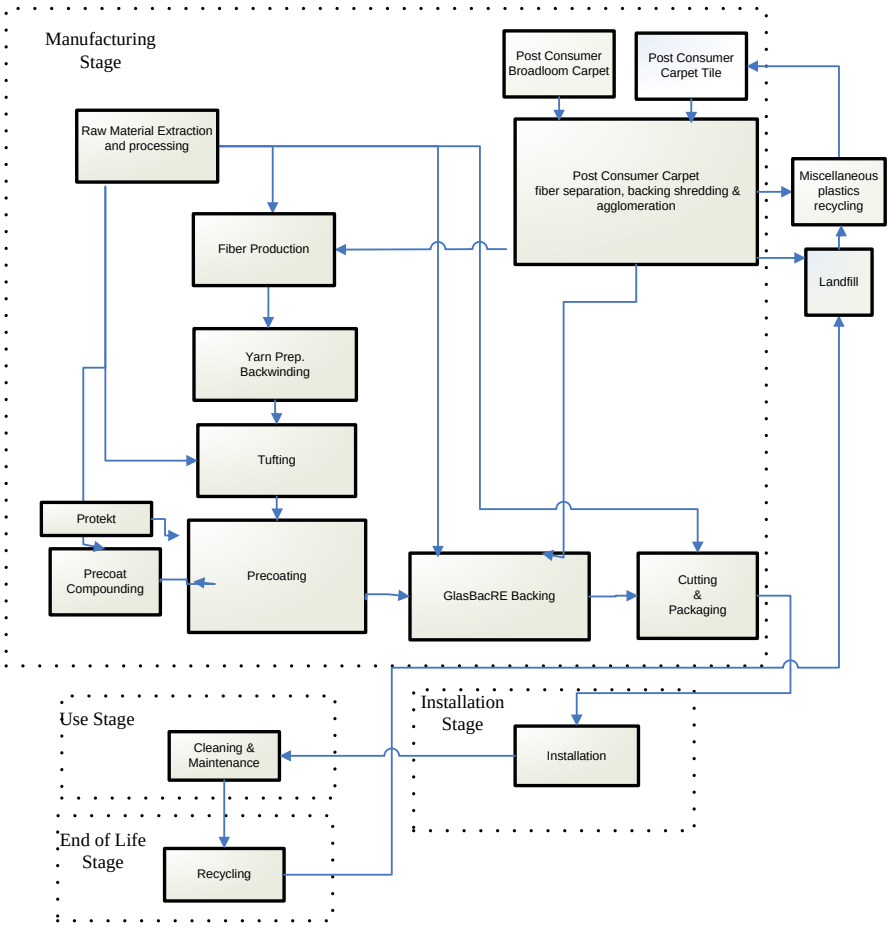
The warranted service life of the product is 15 years. The use stage includes both vacuuming and extraction cleaning according to the maintenance guidelines of the Carpet & Rug Institute and accounts for the electricity, water, and cleaning agents consumed. The use stage impacts have been annualized.

7.9 Results of the assessment

Life Cycle Stages assessed:

- Production Stage
- Installation Stage
- Use Stage
- Recycling Stage

Figure 5. Life cycle stages diagram



7.10 Life cycle inventory assessment

Figure 6. Use of total primary energy for the all life cycle stages from renewable and nonrenewable resources

	Unit	Total Life Cycle	Production			Installation	Use*	End of Life
Total Primary energy from Renewable & Non Renewable Resources	MJ	171.3	159.1			3.0	6.6	2.6
			Primary material	Secondary material	Internal Processing			
			120.3	8.3	30.5			

* service life of 1 year

Figure 7. Relative total primary energy by life cycle stage

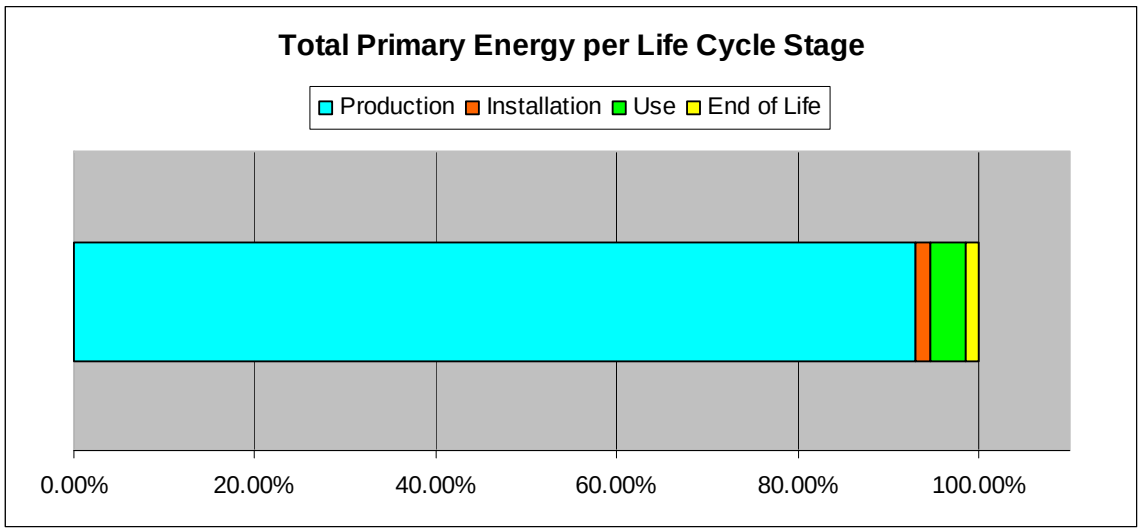


Figure 8. Primary energy of all life cycle stages from nonrenewable resources by source type

Primary energy of non renewable resources	Unit/ m2*	Total Life Cycle	Production	Installation	Use*	End of Life
Total non renewable primary energy	MJ	168.5	156.7	3.0	6.3	2.6
Crude oil	MJ	47.4	42.1	2.6	0.6	2.2
Hard coal	MJ	36.2	33.3	0.07	2.8	0.05
Lignite	MJ	0.9	0.8	0.005	0.04	0.02
Natural gas	MJ	61.3	59.2	0.3	1.5	0.3
Uranium	MJ	22.7	21.3	0.04	1.4	0.04

*service life of 1 year

Figure 9. Contribution of different resources to nonrenewable primary energy

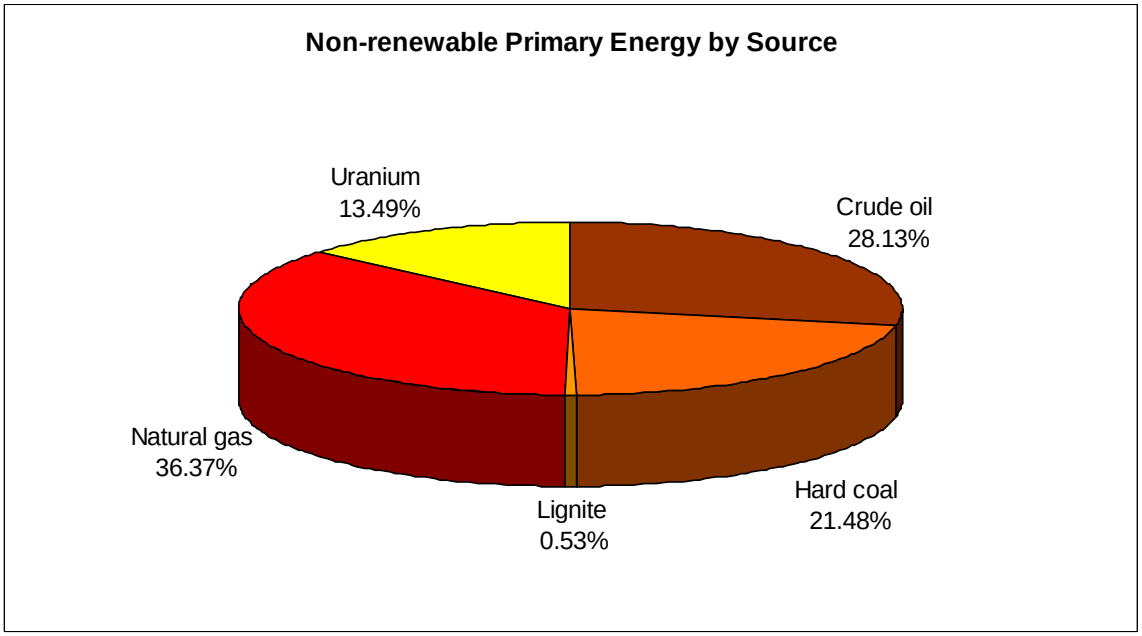
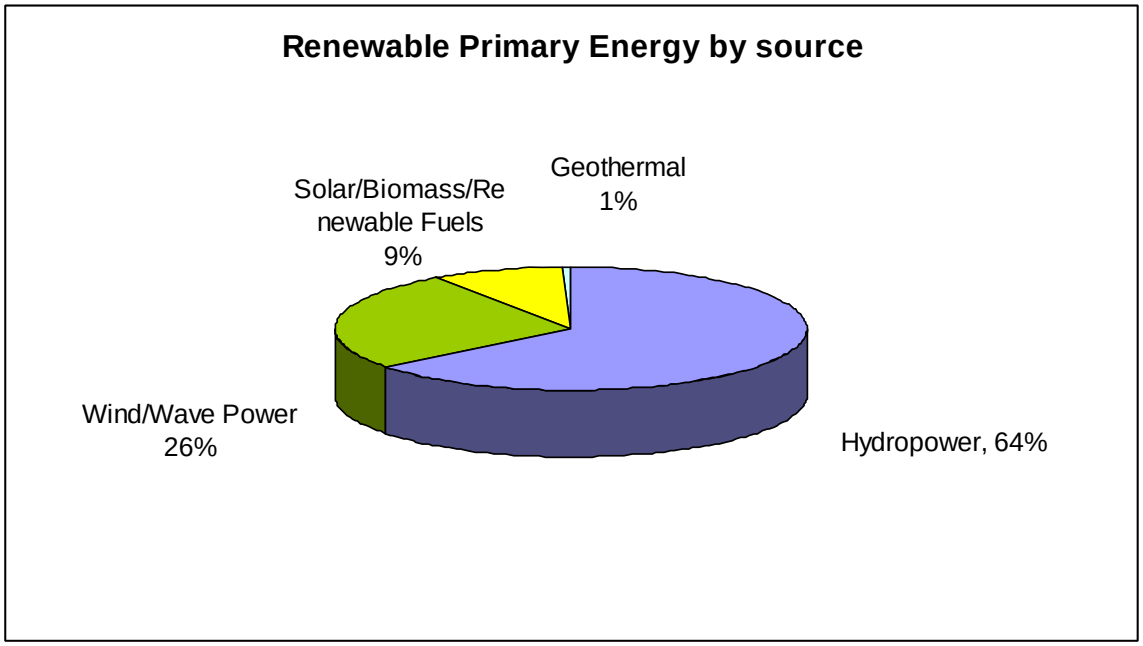


Figure 10. Primary energy of all life cycle stages from renewable resources by source type

Renewable primary energy by resource resources	Unit/ m2*	Total Life Cycle	Production	Installation	Use*	End of Life
Total energy of renewable resources	MJ	2.5	1.5	0.004	0.2	0.005
Hydropower	MJ	1.6	0.5	0.0005	0.1	0.001
Wind / Wave Power	MJ	0.7	0.2	0.003	0.004	0.01
Solar Energy / Biomass/ Renewable Fuels	MJ	0.2	0.01	0.0006	0.001	0.004
Geothermal	MJ	0.02	0.5	0.0005	0.1	0.001

*service life of 1 year

Figure 11. Relative renewable primary energy by source type



Non-renewable material resources, water consumption and wastes

Figure 12. Non-renewable material resources and Water Consumption by life cycle stages

	Unit/ m^{2*}	Total Life Cycle	Production	Installation	Use	End of Life
Non renewable resources	kg	6.45	5.69	0.04	0.59	0.13
Water	m^3	0.37	0.37	0.0004	0.005	0.0004
Wastes						
Non-hazardous waste	kg	5.91	4.73	0.11	0.54	0.53
Hazardous waste	kg	0.044	0.044	0.000	0.000	0.000
Radioactive waste	kg	0.006	0.006	0.000	0.000	0.000

*resource / waste amount per square meter of product

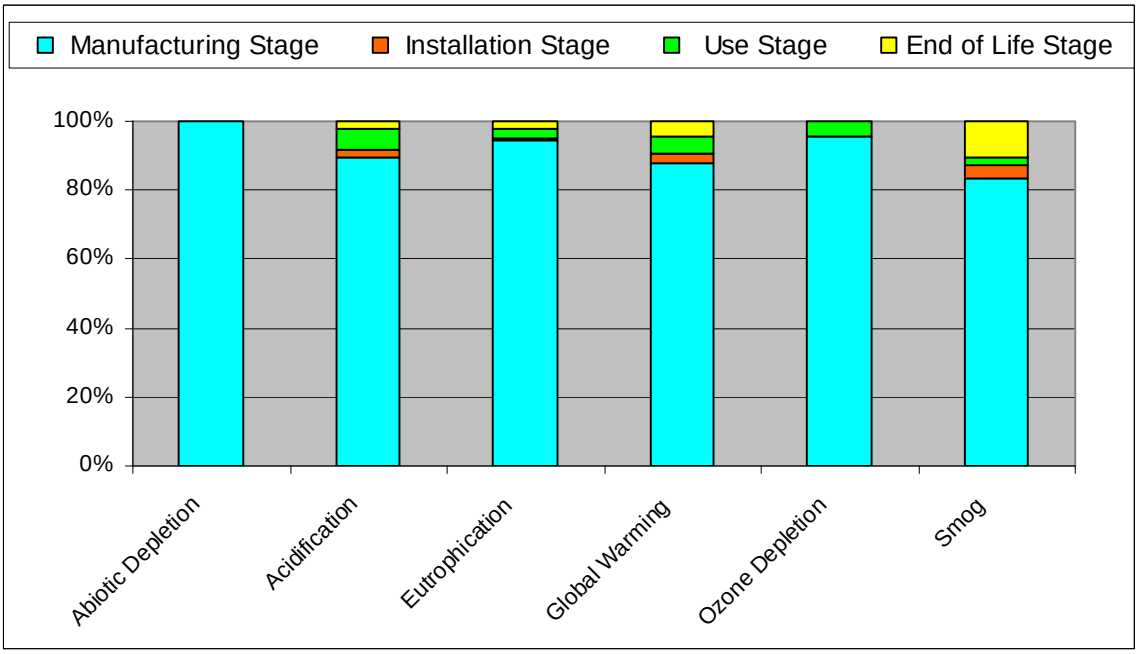
7.11 Life cycle impact assessment

The potential impacts are presented for the manufacture, installation, use, and recycling of the carpet. The use stage is for one year of carpet life.

Figure 13. The potential impacts for one square meter of carpet

PCR Impact Category	Impact	Units/m2
US TRACI		
TRACI, Acidification Potential	2.5	mol H+ Equiv.
TRACI, Eutrophication Potential (Water & Air)	0.01	kg N-Equiv.
TRACI, Global Warming Potential	10.57	kg CO2-Equiv.
TRACI, Ozone Depletion Potential	9.5×10^{-7}	kg CFC 11-Equiv.
TRACI, Smog Air	4.6×10^{-7}	kg NOx-Equiv.
CML 2002		
CML2002, Acidification Potential	0.05	kg SO2-Equiv.
CML2002, Eutrophication Potential	0.01	kg Phosphate-Equiv.
CML2002, Global Warming Potential (GWP 100 years)	10.7	kg CO2-Equiv.
CML2002, Ozone Layer Depletion Potential (ODP, steady state)	8.9×10^{-7}	kg R11-Equiv.
CML2002, Photochem. Ozone Creation Potential (POCP)	0.005	kg Ethene-Equiv.
CML2002, Abiotic Depletion	2.4×10^{-5}	kg Sb-Equiv.

Figure 14. Life cycle stages as a percentage of total impacts*



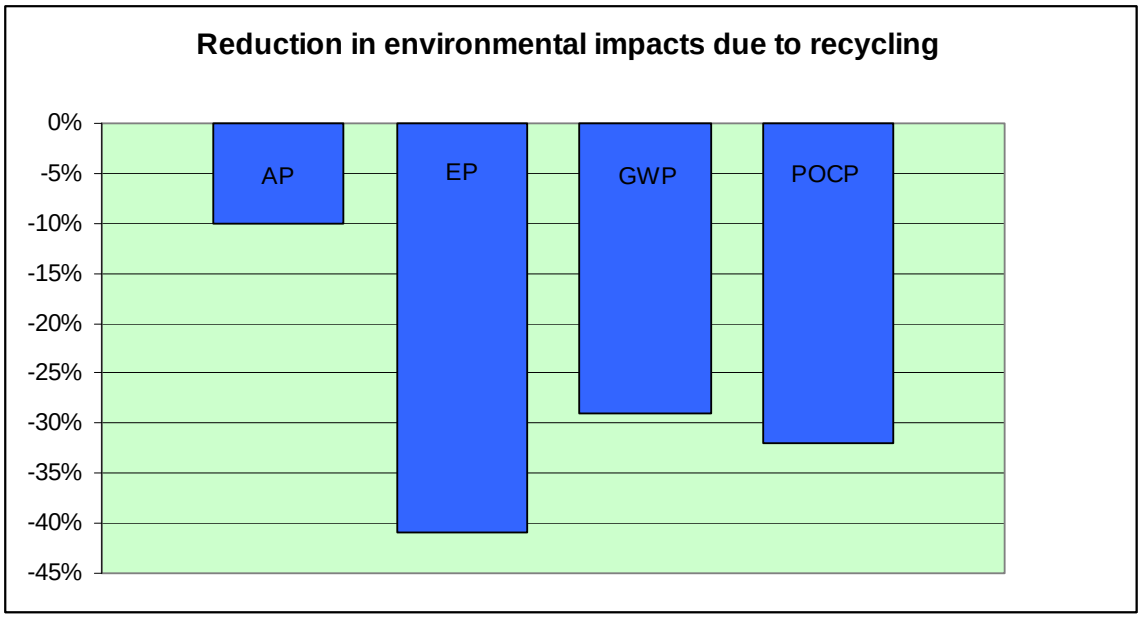
***TRACI**

Figure 15. Distribution of the environmental impacts* to the different stages of the life cycle

Impact Category	Manufacturing Stage	Installation Stage	Use Stage	End of Life Stage
Acidification	89.32%	2.64%	5.56%	2.47%
Eutrophication	94.29%	0.94%	2.71%	2.06%
Global Warming	87.98%	2.49%	4.87%	4.65%
Ozone Depletion	95.40%	0.14%	4.35%	0.10%
Smog	83.28%	3.97%	2.35%	10.52%
Abiotic Depletion	100.00%	0.00%	0.00%	0.00%

***TRACI**

Figure 16. Reduction of impacts* due to recycling



***TRACI**

7.12 Interpretation

The majority of the environmental impacts occur during the extraction of raw materials and processing included in the manufacturing stage. The life cycle impacts of Nylon 6, 6 are the largest contribution to the impacts of the manufacturing stage. The virgin Nylon 6, 6 in this product contributes 44% of the global warming potential in the manufacturing stage, 39 % of the overall GWP. The impacts are reduced by the use of recycled Nylon. As technology permits, Interface will continue to increase the level of recycled content in modular carpets with the intent of eventually eliminating the use of virgin materials.

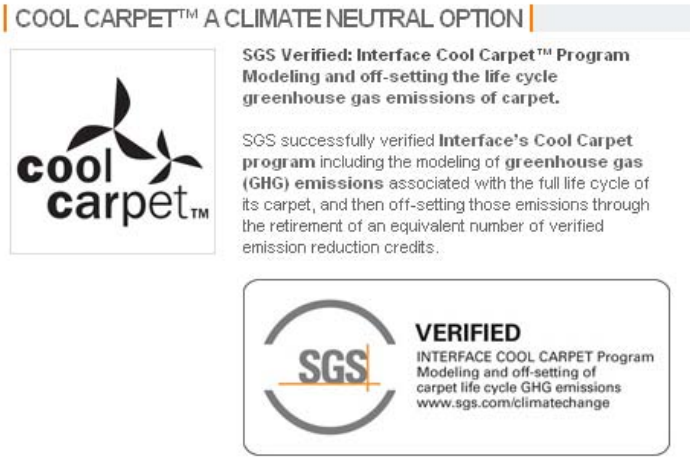
Installation has minimal impact due to the modular nature of carpet tile and the innovative installation method, TacTiles. Modular carpet tile allows for lower installation waste as compared to the 8-14% waste in a broadloom installation. The Convert product platform, in addition to being a modular carpet, uses a design pattern which allows for random installation resulting in a low installation waste of approximately two percent. Modular carpet also eliminates the need for cushion underlayment, another contributor to waste and impact. The TacTile installation method uses small connectors which attach the carpet tiles to each other, creating a floating floor. This

eliminates the need for spread adhesive and all of the wastes and VOC emissions associated with wet adhesive application. In addition to ease of installation, the TacTile technology also supports recycling making carpet removal easier and resulting in returned carpet clean of adhesives improving recyclability.

The use stage is represented in this report for one year of maintenance. The contribution to the life cycle impact is small because carpet requires only regular vacuuming and intermittent extraction cleaning. These processes require electricity and low levels of water and cleaning solution as compared to the cleaning, wax stripping and refinishing required by some hard surface floors.

The end of life stage has minimal impact because this product is recycled back into new product, either into modular carpet or into other Nylon recycled content products, at the end of life. Every effort is made to insure the product is returned to Interface for recycling. The ReEntry carpet reclamation program is an extensive reclamation and recycling program that recovers both yarns and backings from post consumer carpet and the program reclaimed over 18.5 million kilograms of carpet in 2008. This was on sales of over 17 million square meters of carpet or approximately 24 percent by weight.

Interface and its stakeholders share a common concern for the environment with particular interest in mitigating climate change through the elimination of product-related emissions. They have addressed this concern by creating climate neutral products. The total GHG emissions created during the life cycle of the products (raw material acquisition, manufacturing, transportation, use and maintenance, and end-of-life disposition) are modeled using Life Cycle Assessment methodology. These emissions are then neutralized through the purchase and retirement of an equivalent number of verified emission reduction credits. As a result of this program, a majority of Interface's global product offering is climate neutral. This program is verified by SGS Group (http://www.climatechange.sgs.com/home_climatechange_v2/voluntary_activites/cool_carpet_a_climate_neutral_option.htm)



8 Additional Information, evidence and test results

8.1 Emissions

Low VOC emissions are documented by CRI Green Label Plus certification through testing at Air Quality Sciences, test report #83960.

PCR review, was conducted by: PCR - Floor Coverings, Environmental Product Declarations Harmonised Rules for Textile, Laminate and Resilient Floor Coverings, *IBU, Germany www.bau-umwelt.de* *Program operator: The Green Standard* *http://www.thegreenstandard.org/*
Independent verification of the declaration and data, according to ISO 14025 ☐ internal ☒ external
third party verifier: *Dr Eva Schmincke*

9 References

PCR - Floor Coverings, Environmental Product Declarations Harmonised Rules for Textile, Laminate and Resilient Floor Coverings, IBU Institut für Bauen und Umwelt 2008, www.bau-umwelt.de
/1/ (2006). ISO 14025: Environmental labels and declarations – Type III environmental declarations – Principles and procedures
/10/ (2006). ISO 14040 : Environmental management - Life cycle assessment – Principles and framework
/11/ (2006). ISO 14044 : Environmental management - Life cycle assessment – Requirements and guidelines
/12/ GaBi 4 (2003). Software-System and Databases for Life Cycle Engineering Copyright, TM. Stuttgart, Echterdingen
/13/ http://lca.jrc.ec.europa.eu/lcainfohub/index.vm (2008)
/Carpet & Rug Institute/ http://carpet-rug.com/commercial-customers/cleaning-and-maintenance/index.cfm
/Carpet & Rug Institute/ http://www.carpet-rug.org/commercial-customers/green-building-and-the-environment/green-label-plus/carpet-and-adhesive
/Carpet & Rug Institute/ http://www.carpet-rug.org/commercial-customers/selecting-the-right-
/Carpet & Rug Institute/ http://www.carpet-rug.org/residential-customers/selecting-the-right-carpet-or-rug/green-label.cfm
/ CRI Test Method 101/ http://www.carpet-rug.org/technical_bulletins/0307_CRI_TM_101.pdf
/ASTM E-648/ http://www.astm.org/Standards/E648.htm
/ASTM E-662/ http://www.astm.org/Standards/E662.htm

Environmental Declaration ISO 14025 / ISO 21930

epd-norge.no
The Norwegian EPD Foundation

Standard gluelam beam

MOELVEN

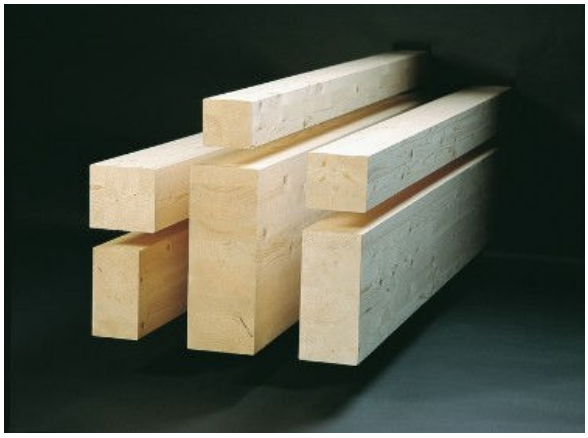


Figure 1

NEPD nr: 115E

Approved according to ISO 14025, § 8.1.4

Approved 01-11-2009

Valid until 01-11-2012

Verification

Independent verification of data and other environmental information has been carried out by Anne Rønning (Østfoldforskning), in accordance with ISO 21930, § 9.1

The declaration has been prepared by:

Silje Wærp, SINTEF Byggforsk

PCR

NPCR 015 Solid wood products, approved by the NEPD verification committee, has been applied.

About EPD

EPD from other program operators than The Norwegian EPD Foundation may not be comparable.

Manufacturer information

Organisation	Moelven Limtre
Adress	Postboks 143, 2391 Moelv
Contact person	Hallvard Thomassen, 62 33 40 19, hallvard.thomassen@moelven.no
Organisation no.	913711300
ISO 14001/EMAS:	_____

Product information

Scope of assessment	cradle to grave
Functional unit (FU)	1m³ standard gluelam beam, installed and maintained, with an expected average service life of 60 years. All figures in this document refer to 1 functional unit (FU)
Expected service life	60 years
Year of study	2009, with data collection representing 2007
Production area	Norway
Expected market area	Norway

Product description

A gluelam beam is an assemblage of timber lamellas that are bound together with glue. Fiber orientation in the lamellas are parallel to the beam length direction. The lamella thickness is 45mm for the standard dimensions. The beam height is a multiple of this, e.g. 225, 270, 315 mm, etc. Special Products and arcs with small radii can / must be produced with other lamella thicknesses. Manufacturing standard for glulam for the Norwegian market is L40. Gluelam beam has a weight of 470 kg/m³ at 12-13% moisture content. Range of use is roof beams, edge beams, joists, girders, hall constructions, bridges. See www.moelven.com.

Origin of round timber 95% of round timbers used in the production of norwegian sawn dried timber are certified in accordance with PEFC's standard.

Environmental indicators

Global warming	79	kg CO_2-eq.
Energy consumption	5144	MJ
Amount of renewable materials	98	%
Indoor classification (according to EN 15251:2007)	NA	

Product specification

Table 1

Composition of final product		Input i LCA*			Weight final product	
Sawn timber	kg	493,5	98,3 %	Spesific data	463,2	98,6 %
Glue	kg	8,3	1,7 %	Generic data	6,8	1,4 %
SUM	kg	501,8			470,0	100 %

*incl. 5 % loss at building site

Resource consumption

Material resources

Table 2

Material resources	Raw material	Production	Building site	Use stage	Demolition	Transport	Total
New, renewable resources							
Timber (incl. bark) [m³]	704,90	0,04	1,9E-09	9,5E-10	1,9E-09	2,3E-08	704,94
Water (fresh) [kg]	604,80	299,83	0,02	0,01	0,02	3,43	908,11
Air [kg]	180,71	5,98	0,01	0,01	0,01	3,23	189,96
Other [kg]	0,26	0,14	5,2E-06	2,6E-06	5,2E-06	4,9E-03	0,41
New, non-renewable resources							
Inert rock [kg]	1,8E+01	1,8E+00	4,4E-03	2,2E-03	4,4E-03	1,9E+00	2,2E+01
Crude oil [kg]	2,8E+00	2,5E+00	7,6E-05	3,8E-05	7,6E-05	1,3E+01	1,8E+01
Natural gas [kg]	8,5E+00	1,6E+00	3,8E-04	1,9E-04	3,8E-04	7,0E-01	1,1E+01
Hard coal [kg]	6,7E-01	6,5E-01	6,1E-04	3,1E-04	6,1E-04	5,9E-02	1,4E+00
Lignite [kg]	1,2E+00	7,0E-02	1,7E-04	8,4E-05	1,7E-04	8,0E-02	1,3E+00
Limestone [kg]	6,1E-01	4,0E-01	1,1E-03	5,4E-04	1,1E-03	2,9E-02	1,0E+00
Soil [kg]	2,9E-01	3,3E-01	9,0E-04	4,5E-04	9,0E-04	3,7E-03	6,3E-01
Sodium chloride (rock salt) [kg]	1,7E-01	2,1E-03	8,8E-07	4,4E-07	8,8E-07	1,4E-05	1,7E-01
Other (ore without minerals and elements) [kg]	5,6E-02	3,9E-02	1,0E-04	5,2E-05	1,0E-04	8,1E-03	1,0E-01
Heavy spar [kg]	5,4E-02	2,8E-03	4,6E-07	2,3E-07	4,6E-07	3,4E-02	9,1E-02
Iron [kg]	2,0E-02	1,4E-02	2,2E-05	1,1E-05	2,2E-05	5,9E-03	4,0E-02
Clay [kg]	1,6E-02	1,4E-02	3,7E-05	1,9E-05	3,7E-05	3,8E-03	3,4E-02
Peat [kg]	2,7E-02	4,4E-03	5,7E-09	2,8E-09	5,7E-09	1,1E-03	3,2E-02
Gypsum [kg]	8,5E-03	9,1E-03	2,5E-05	1,2E-05	2,5E-05	5,2E-04	1,8E-02
Quartz sand [kg]	1,0E-02	1,7E-03	3,6E-06	1,8E-06	3,6E-06	4,6E-03	1,6E-02
Aluminum [kg]	1,7E-03	4,6E-04	1,2E-06	6,0E-07	1,2E-06	5,6E-06	2,1E-03
Zinc [kg]	3,5E-04	8,6E-04	5,7E-07	2,9E-07	5,7E-07	5,8E-05	1,3E-03
Lead [kg]	3,3E-04	6,2E-05	1,3E-07	6,4E-08	1,3E-07	1,3E-04	5,2E-04
Copper [kg]	2,5E-04	2,4E-04	6,5E-07	3,2E-07	6,5E-07	1,6E-05	5,0E-04
Chromium [kg]	2,0E-04	2,5E-04	6,5E-07	3,2E-07	6,5E-07	1,0E-06	4,5E-04
Unspecified [kg]	1,6E+00	1,8E+00	5,0E-03	2,5E-03	5,0E-03	2,5E-02	3,5E+00
Feedstock energy, renewable resources [MJ]							7 200,00
Feedstock energy, non-renewable resources [MJ]							176,98

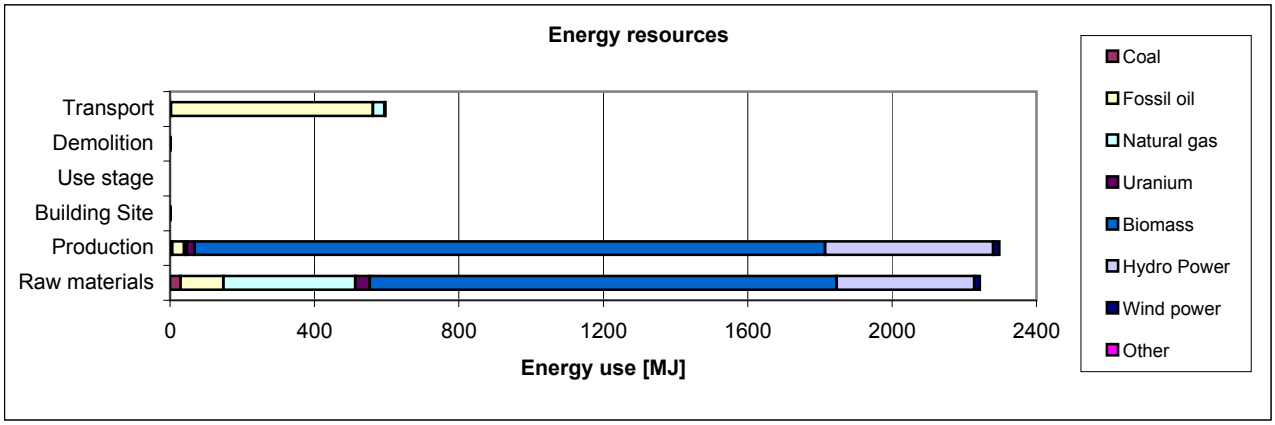
Land use and water resources

Land use has not been quantified. Water consumption is included in Table 2.

Energy resources

Energy carrier distribution for each life cycle fase

Figure 2



Energy consumption specified for the different energy carrier and life cycle stages

Table 3

	Unit	Raw material	Production	Building Site	Use stage	Demolition	Transport	Total
Fossil energy								
Coal	MJ	29,43	6,60	0,02	0,01	0,02	2,40	38,47
Fossil oil	MJ	118,39	32,33	3,2E-03	1,6E-03	3,2E-03	560,04	710,77
Natural gas	MJ	365,21	8,21	0,02	0,01	0,02	31,81	405,28
Uranium	MJ	40,18	21,17	0,06	0,03	0,06	2,94	64,43
Renewable energy								
Biomass	MJ	1293,19	1746,51	1,4E-05	7,0E-06	1,4E-05	1,7E-04	3039,70
Hydro Power	MJ	381,52	465,58	1,27	0,63	1,27	0,62	850,89
Wind power	MJ	15,67	17,78	0,05	0,02	0,05	0,08	33,66
Other	MJ	0,68	0,02	3,4E-05	1,7E-05	3,4E-05	0,05	0,75
Total	MJ							**5 143,94**

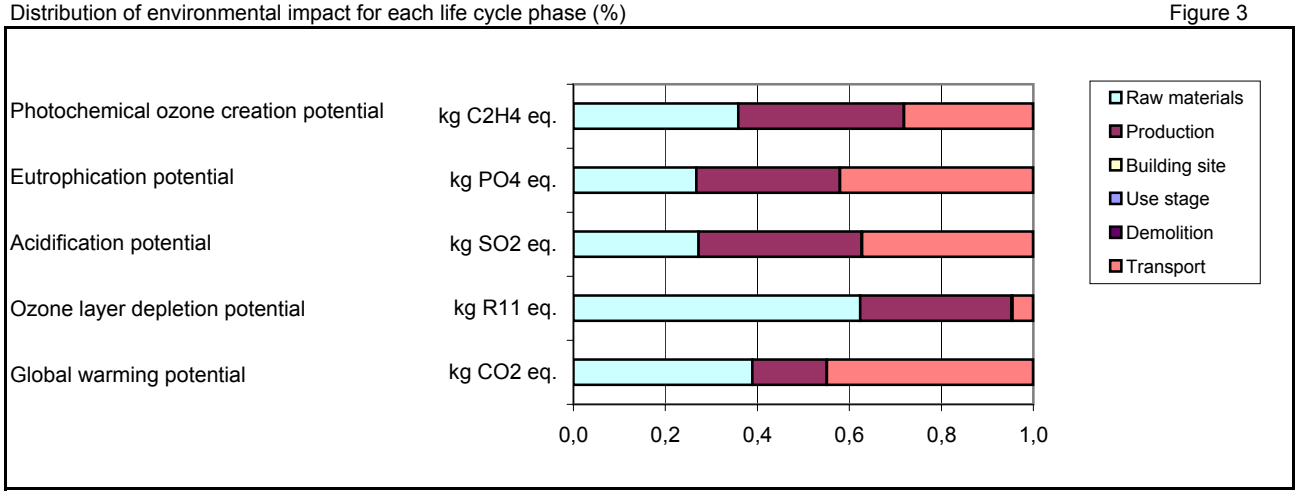
The calculation of electricity use is based on Nordel-mix consumed in Norway in 2007.

Emissions and environmental impacts

Environmental impacts Table 4

Indicator	Unit	Raw materials	Production	Building site	Use stage	Demolition	Transport	Total
Global warming potential	kg CO_2 eq.	30,64	12,80	7,8E-03	3,9E-03	7,8E-03	35,36	78,82
Ozone layer depletion potential	kg R11 eq.	1,1E-06	5,7E-07	1,5E-09	7,7E-10	1,5E-09	7,8E-08	1,7E-06
Acidification potential	kg SO_2 eq.	2,1E-01	2,7E-01	6,4E-06	3,2E-06	6,4E-06	2,9E-01	7,7E-01
Eutrophication potential	kg PO_4 eq.	3,2E-02	3,7E-02	9,1E-07	4,5E-07	9,1E-07	5,0E-02	1,2E-01
Photochemical ozone creation poter	kg C_2H_4 eq.	2,7E-02	2,7E-02	4,9E-07	2,4E-07	4,9E-07	2,1E-02	7,5E-02

Distribution of environmental impact for each life cycle phase (%) Figure 3



Emissions and waste Table 5

	Unit	Raw materials	Production	Building site	Use stage	Demolition	Transport	Total
Emissions to air								
NH_3 [g]		26,099	34,852	1,3E-05	6,5E-06	1,3E-05	0,222	61,173
CO_2 [g]		26203,567	8777,094	7,638	3,819	7,638	34164,778	69164,533
CO [g]		393,798	536,020	0,002	0,001	0,002	59,204	989,027
HCl [g]		0,073	0,225	3,0E-05	1,5E-05	3,0E-05	0,049	0,347
Hg [g]		8,0E-05	2,7E-05	4,9E-08	2,5E-08	4,9E-08	3,5E-05	1,4E-04
CH_4 [g]		97,836	50,618	0,005	0,003	0,005	41,207	189,673
N_2O [g]		7,656	8,775	7,1E-05	3,5E-05	7,1E-05	0,564	16,994
NOx [g]		121,344	170,924	0,006	0,003	0,006	375,635	667,918
NMVOC [g]		24,828	6,565	3,5E-04	1,8E-04	3,5E-04	24,418	55,812
Particles [g]		1,049	2,617	0,001	3,0E-04	0,001	6,537	10,205
Pb [g]		0,001	0,001	1,8E-06	8,9E-07	1,8E-06	0,001	0,002
SO_2 [g]		74,128	86,676	0,002	0,001	0,002	21,890	182,699
Emissions to water								
BOD [g]		0,311	0,121	8,1E-06	4,0E-06	8,1E-06	0,057	0,489
COD [g]		27,775	2,778	0,005	0,002	0,005	1,572	32,136
N [g]		10,785	0,066	1,0E-04	5,1E-05	1,0E-04	0,052	10,903
P [g]		0,018	0,003	8,5E-07	4,2E-07	8,5E-07	0,015	0,036
Waste								
Waste to landfill [kg]		18,014	2,592	25,448	0,003	50,005	1,836	94,898
Hazardous waste [kg]		19,937	2,808	0,005	0,003	0,005	1,837	24,595

Waste treatment of final product

Landfilling of organic wastes is prohibited after january 2009. Estimates based on todays waste treatment and flue gas cleaning technology show that 10% of the final product must be treated with special care.

Energy recovery of after end of product life belongs to the system utilizing the energy. Only feed stock energy is included in this analysis.

Use of chemicals

Chemicals

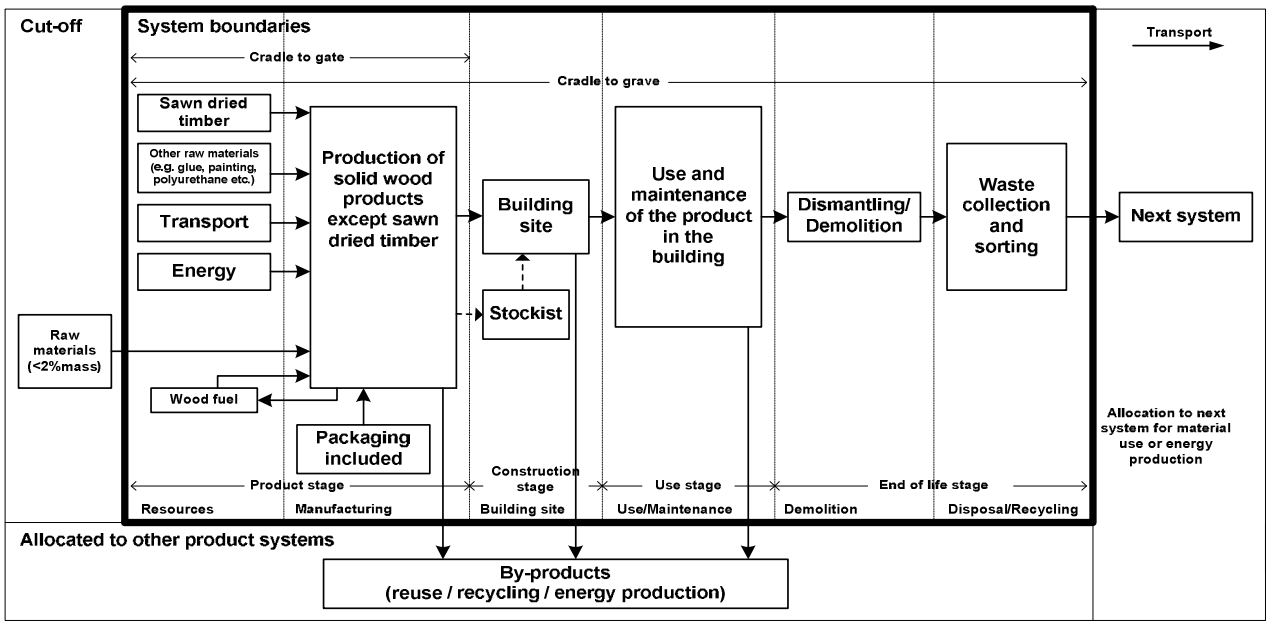
Table 6

Description	Quantity	CAS-nr.	R-phrases	Raw material	Health [4]	Environment [4]
Lambda-cyhalotrin [g]	7,2E-03	91465-08-6	R21, R25, R26, R50/53	Timber	class 2	class 2
Imidakloprid [g]	5,3E-03	13826-41-3	R22		class 4	-
Glyphosate [g]	1,1E-01	1071-83-6	R41, R51/53		class 4	class 3
Formaldehyde [g]	14,8	50-00-0	R23/24/25,34,43,40	Glue	class 1	-
Methanol [g]	78,3	67-56-1	R 11,23/24/25/39/		class 2	-
1,4 Butandiol [g]	69,9	110-63-4	R 22		class 4	-
Epsilon-caprolactam [g]	35,0	105-60-2	R 20/22, R 36/37/38		class 4	-
Formic acid [g]	620,3	64-18-6	R 35		class 3	-
Polyvinyl acetate [g]	541,2	93196-02-2	R22		class 4	-

Methodology

System boundaries

Figure 4



References

[1] NS-ISO 14025:2006, Environmental labels and declarations - Type III environmental declarations - Principles and procedures

[2] ISO 21930:2007, Sustainability in building construction - Environmental declaration of building products

[3] PCR for preparing an environmental product declaration (EPD) for solid wood products, NPCR 015 2009

[4] Abrahamsen et al. (2008): "EPDs as a tool for documentation/information on chemicals and toxicity in the value chains of products - a pre-study for EPD Norge".

[5] Flæte, Per Otto (2009): "Energiforbruk og utslipp fra skogproduksjonskjeden med utgangspunkt i aktivitetsdata fra 2007 - fra frø til industritomt"

[6] Sintef Byggforsk (2009): "Environmental Product Declaration (EPD) of 9 solid wood products", report MIKADO-project

[7] EN 15251:2007, Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics

2005: Ver.2

TOKYO BOARD INDUSTRIES,CO.,LTD.

CERTIFIED ENVIRONMENTAL
PRODUCT DECLARATION
S-P-00072
http://www.environdec.com

Environmental Product Declaration

Product: Wood Particleboard (23M Type)

Manufacturer: TOKYO BOARD INDUSTRIES CO., LTD.
ＵＲＬ：http://www.t-b-i.co.jp/
Place of Corporate Facility: Shinkiba Factory of
TOKYO BOARD INDUSTRIES CO., LTD.

Product: Wood Particleboard (23M Type)

1. DESCRIPTION OF THE PRODUCT AND OF THE COMPANY

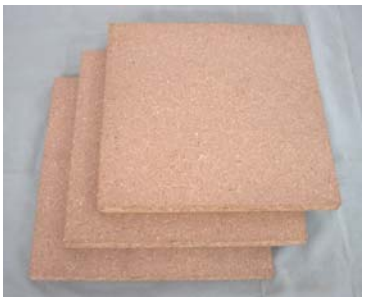
○ Product

Particleboards are wood products, made of small chips of timber, lumber, and wood. First, the wooden materials are crumbled into chips. The chips are bonded with glues, and then compressed into board by thermal compressor.

Particleboards are used in many places in our daily life, such as frames of integrated kitchen system and subflooring. They have been well utilized in the field of construction, building materials, furniture, and woodworking industries.

And 23M Type represents that the bending strength is 23.0N/mm2 and the glue used is melamine resin.

○ Photograph of the product



（The size of the product in the picture above: 300mm × 300mm 20mm thick）

○ Manufacturer

TOKYO BOARD INDUSTRIES CO., LTD. started production of particleboards in April 1984. We are the first particleboard manufacturer in Japan, who has used exclusively forest resources in industrial and general wastes as raw materials since 1991, which would otherwise be incinerated or used for landfill.

Shinkiba Factory of TOKYO BOARD INDUSTRIES CO., LTD. has obtained ISO14001 certification since 1999, which was followed by ISO9001 certification in 2002.

Manufacturer:	TOKYO BOARD INDUSTRIES CO., LTD.
Place of Corporate Facility:	Shinkiba Factory, TOKYO BOARD INDUSTRIES CO., LTD.
Address:	12-5, Shinkiba 2-chome, Koto-ku, Tokyo 136-0082, JAPAN
Telephone:	+81 3 3522 1522
Fax:	+81 3 3522 1525
URL:	http://www.t-b-i.co.jp/
Person in Contact:	Masahide NAGASHIMA

○ Constituent Material

The following table shows the constituent material, the weight, and other specifications of 1 m3 particleboard. This is the main manufacturing size at Shinkiba Factory. 1 m3 particleboard would convert into 45.8 panels of the ordinary size of the product (1820mm x 600 mm x 20mm thick).

Recycled wood	Glues	Thickness	Density	Moisture content	Bone-dry weight of wood	Bending strength
698.7kg	78.3kg	9～35mm	0.777g/cm3	5～13%	663.8～607.9kg	23.0N/mm2

○ Free Formalin

The table below shows that the emission of free formalin is within the standard of JIS A 5908 (Particleboard). Measurement was made by TOKYO BOARD INDUSTRIES CO., LTD. in accordance with JIS A 1460 (Testing Method for the emission of free formalin of architectural boards—Desiccator Method).

Standard	JIS A 5908			JIS A 1460
	Acceptable Criteria			Testing Method for Emission of Free Formalin
Details	Nos. of sample	Average	Maximum	Desiccator Method
	3	Less than 0.5 mg/l	Less than 0.7 mg/l	

(An example of construction of subflooring)

2. *ENVIRONMENTAL PERFORMANCE DECLARATION*

Environmental performance declaration is based on the result of the life cycle assessment.

○ Life Cycle Stage

The LCA results are classified into the following phases:

Manufacturing phase:

- Transport of recycled wood and of chips obtained from chip suppliers
- Manufacturing chips at chip suppliers and within Shinkiba Factory
- Production of raw materials for glues for wood
- Transport of raw materials for glues for wood
- Production of glues
- Manufacturing of particleboards
- Secondary elaboration of particleboards (cutting)

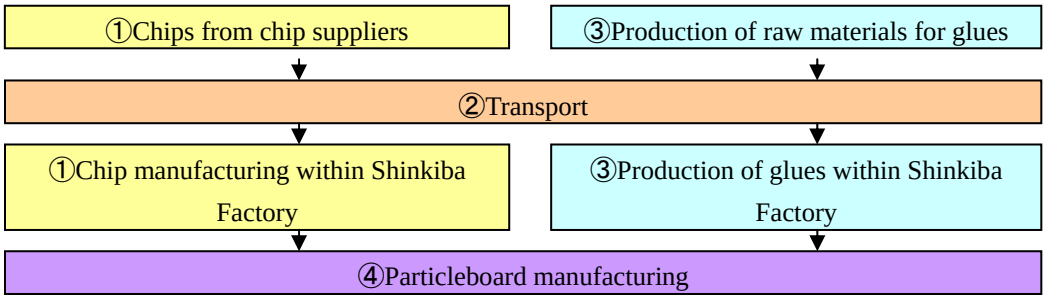
○ Assumptions for Life Cycle Assessment

① Functional Unit: 1m3 of particleboard

② If coated particleboard is validated, coated surface is quantified in m2 specifying coating material. The 18 mm-thick panel is used for calculation as a general value. (This 23M Type particleboard does not have a facing plate.)

③ The calculation is made on the basis of the data collected from November 2003 through October 2004.

④ The below is a flow chart of LCA particleboard. Chip manufacturing phase, glue production phase, glue transport phase, and particleboard manufacturing phase are tinted in different colors.



○ The Table Below Shows The Chemical Substances Used in Particleboard Manufacturing.

Chemical substances	Regulation	Purpose	Amount used (kg)/Functional unit
Methanol	Industrial Safety and Healthy Law	Raw material for glues for wood	9.73E-01
	Tokyo Ordinance		
Formaldehyde	Pollutant Release and Transfer Register Law	Raw material for glues for wood	2.58E+01
	Industrial Safety and Healthy Law		
	Tokyo Ordinance		

○ Use of Particleboard Resources

Resource	Energy Content	Unit	Total	Chip Manufacturing	Transport	Production of Glues	Particleboard Manufacturing
Non-renewable	Without	kg	5.54E+02	5.94E-01	--	5.54E+02	3.78E-02
	With	MJ	9.66E+02	3.59E+01	1.04E+02	4.06E+02	4.20E+02
Renewable	Without	kg	2.66E+03	1.12E+00	--	1.94E+03	7.20E+02
	With	MJ	1.98E+02	--	--	1.04E-02	1.98E+02
Non-renewable electricity		kWh	2.58E+02	2.17E+01	--	9.20E+01	1.44E+02
Renewable electricity		kWh	6.14E+01	5.18E+00	--	2.19E+01	3.43E+01

○ Electricity Consumption

Power generation facility ratio of Tokyo Electric Power Co., Ltd. in fiscal year 2003 is as follows.

The difference between electricity consumption in non-renewable resource and that in renewable resource was quantified based on the power generation facility ratio.

Power generation facility ratio	Electricity consumed at Shinkiba Factory	Total electricity consumed
①Thermal power generation (57%)	1.77E+02 kWh	3.19E+02 kWh
②Generation of electricity by nuclear power (24%)	8.02E+01 kWh	
③Hydraulic power generation (19%)	6.14E+01 kWh	

○ LCA Results of Particleboard (Environmental Impact and Amount of Waste)

Environmental impact	Unit	Total	Chip Manufacturing	Transport	Production of glues	Particleboard Manufacturing
Global warming	CO2-eq (kg)	3.55E+02	1.26E+01	6.35E+00	2.49E+02	8.72E+01
Ozone layer depletion	CFC-11-eq (kg)	7.30E-11	--	--	7.30E-11	--
Acid precipitation	mol H+	1.76+01	1.77E+00	2.04E+00	8.28E+00	5.48E+00
Photochemical oxidant formation	ethene-eq (kg)	1.64E+00	3.73E-01	6.78E-01	4.16E-01	1.69E-01
Eutrophication	O2 (kg)	2.28+01	3.54E-01	5.34E-01	2.08E+01	1.16E+00
Industrial waste	kg	2.73+01	1.36E-01	--	1.54E+00	1.05E+00

*Data used concerning electricity is from "Life Cycle Inventory of Standard Electric Power at Receiving End by Ten Electric Power Companies in Japan" written by Matsuno et al . in the bulletin Vol. 77 No. 12, issued by Japan Institute of Energy.
*The definition of industrial waste is in accordance with Waste Disposal and Public Cleaning Law.

○ Other Information

Since the product is mostly made from wood, avoid the handling near the fire. In order to lengthen the life of the product, avoid the use in high-humidity environment.

○ Recycling Declaration

① The product itself can be recycled repeatedly as raw material for particleboard. For the purpose, plastic resin, non-ferrous metal, cloth, paper etc. should be removed from the product.
In recycling the particleboard used for furniture or woodworking such as frames of integrated kitchen system, case goods, plastic resin, non-ferrous metal, surface material, should be removed. When the particleboard used for construction and/or building material eg subflooring is recycled, plastic resin, non-ferrous metal, height adjusters should be removed.

② Thermal recycling of the product is not recommendable as the products broken into particle generate 16.7 MJ/kg of energy in combustion.

3. INFORMATION PROVIDE BY THE COMPANY AND THE CERTIFICATION BODY

○ Information on the Certification Body

Accreditation Number from SWEDAC: 1813

Environmental Product Assessment Department
Japan Gas Appliances Inspection Association (JIA)
JIA Bldg., 4-10, Akasaka 1-chome, Minato-ku, Tokyo 107-0052
Telephone: +81 3 5549 9811 Fax: +81 3 5570 1198
ＵＲＬ：http://www.jia-page.or.jp/jia/epa/

○ Disclosure of Information

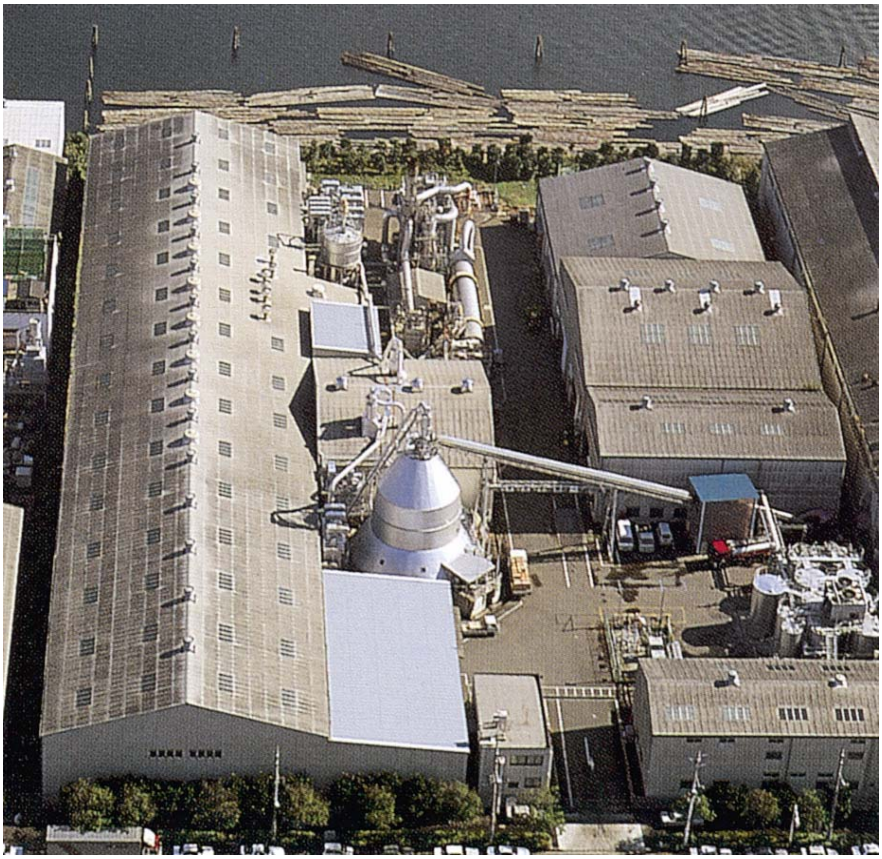
For detailed information on the certified environmental product declarations, see the web page of the Swedish Environmental Management Council (http://www.environdec.com/).

○ References

- ISO14020 and ISO TR 14025
- ISO14040, 14041, 14042, 14043
- PERSTORP:MYRSYRA85%(EPD)
- Requirements for Environmental Product Declarations, EPD, (MSR 1999:2) published by the Swedish Environmental Management Council
- Product-Specific Requirements: Wood Particleboards (PSR 2003:8 Version 10) published by the Swedish Environmental Management Council
- LCA Report (2005:ver.2) by TOKYO BOARD INDUSTRIES CO., LTD.

Registration Date: May 28, 2004
Expiration Date: May 27, 2007

Revised on June 20, 2005



（Shinkiba Factory of TOKYO BOARD INDUSTRIES CO., LTD.）

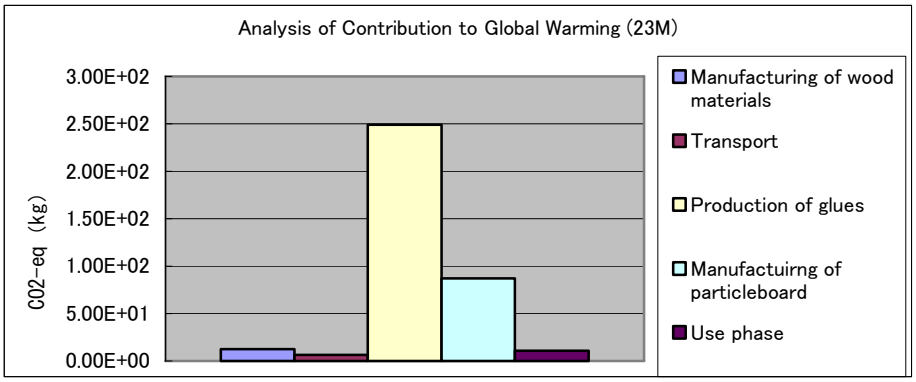
Appendix

1. *USE PHFASE*

As for quantification in use phase, the transport of particleboard from manufacturing facility to a client was quantified. The table below indicates the results of environmental impact in use phase. And the product in the lower manufacturing phase (eg production of wooden raw materials, production of glues, transport, and manufacturing of particleboards) and in the use phase was quantified separately in conjunction with the impact of global warming (greenhouse gases).

Resource	Energy Content	Unit	Use Phase
Non-renewable	Without	kg	--
	With	MJ	1.73E+02
Renewable	Without	kg	--
	With	MJ	--

Environmental impact	Use phase	Unit
Global warming	1.07E+01	CO2-eq（kg）
Ozone layer depletion	--	CFC-11-eq（kg）
Acid precipitation	3.80E+00	mol H+
Photochemical oxidant formation	1.28E+00	ethene-eq（kg）
Eutrophication	9.98E-01	O2 (kg)
Industrial waste	--	kg



２．*INTERPRETATION OF LCA RESULTS*

The results show that a high level of impact of global warming is observed in the production process of glues. The results also show that the emission of global-warming gases in the glue production phase occupied more than 95% of all, the largest, is observed. And as for the second largest, the emission in particleboard manufacturing phase occupies more than 83% is observed. It is assumed because many big motors installed in the facility in the particleboard manufacturing phase and heat sources in pressing such as electricity and city gas are attributed to it.

Environmental Product Declaration

Typical Western Red Cedar Bevel Siding

"½ x 6" Clear Grade, Painted

Type III environmental declaration developed according to ISO 21930 and 14025 for average cedar siding products manufactured by the members of the Western Red Cedar Lumber Association.

Issued April 2011
Valid until April 2016

WESTERN RED CEDAR LUMBER ASSOCIATION
REALCEDAR
WRCLA

FPInnovations®

Manufacturer Information

This EPD addresses products from multiple manufacturers and represents an average for the membership of the Western Red Cedar Lumber Association (WRCLA), a non-profit trade association representing manufacturers of western red cedar products. This average is based on a sample that included two lumber mills in British Columbia (BC), Canada and three remanufacturing mills (two in BC and one in Washington State, USA), which represented 12% and 18% of western red cedar lumber and siding production respectively, in 2007.

Product Description

Wood siding is a board-type weatherproof product applied to a building as a final surfacing for exterior walls. Western red cedar siding is produced in various dimensions and different profiles (shapes) including bevel, board and batten, tongue and groove, and channel. This EPD addresses the following product:

- Cedar siding type: Bevel siding
- Board size: "½ x 6" (12.7 mm x 152.4 mm)
- Grade: Clear
- Product composition (on the basis of 1 m^2 installed siding with a 50-year service life):
  - Western red cedar lumber: 4.65 kg (oven-dry basis) (0.0141m^3)
  - Coatings
    - Alkyd primer (solvent-based): 0.20 litres
    - Acrylic paint (water-based): 0.93 litres
  - Fasteners (6D 2" galvanized nails): 0.05 kg
- Installed and used according to Western Red Cedar Lumber Association specifications *(See http://www.wrcla.org/installation_and_finishing/finishing_siding/default.htm)*. Information reported here is for a product that is painted on installation and then repainted every 15 years.

Scope: Cradle-to-grave.

Functional unit: 1m^2 of siding assumed installed over a wood-frame wall.

Service life: 50 years.

System boundary: Life cycle activities from resource extraction through product use for a 50-year life span inclusive of maintenance, replacement and end-of-life effects. Wood-framed wall substructure is excluded as it is common to other siding types.

Geographic boundary: North America.

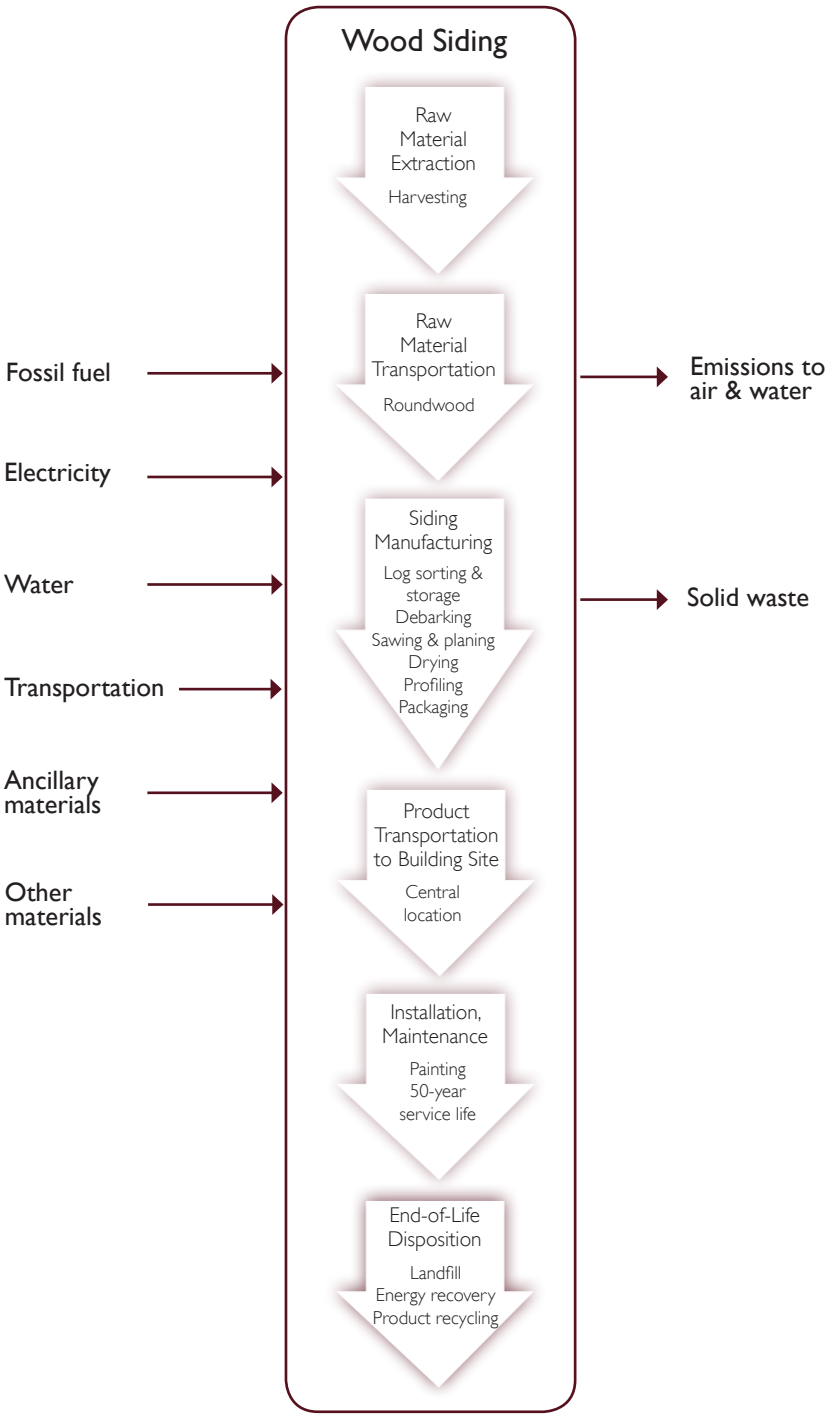
Life Cycle Assessment

Life cycle assessment (LCA) is a rigorous study of inputs and outputs over the entire life of a product or process and the associated environmental impact of those flows to and from nature. The underlying LCA supporting this EPD was performed by FPInnovations for WRCLA in 2009 and was third-party peer-reviewed by two organizations. The LCA study collected primary data from western red cedar lumber and siding manufacturing operations in 2008 for the production year 2007.

The system boundary includes all the production steps from extraction of raw materials from the earth (the cradle) through to final fate of the product at the end of its service life (the grave). See Figure 1. The boundary includes the transportation of major inputs to, and within, each activity stage including the shipment of products to a hypothetical building site location in North America and eventual transportation to landfill. The city of Minneapolis, USA was chosen as the typical building location, as a central location in North America.

Ancillary materials and other materials such as coatings, fasteners and packaging are included in the boundary unless below the cut-off criteria. Mass or energy flows are excluded if they account for less than 1% of model flows and less than 2% of life cycle impacts in all categories. Human activity and capital equipment are excluded. For the use phase, the consumption of water and cleaning solutions is common to all siding types and is excluded.

Figure 1. System boundary and process flows



Fifty years is the expected life span for cedar siding according to WRCLA. This figure is supported by expert opinion, anecdotal evidence and product warranty claims. A 15-year repainting schedule is used based on manufacturer warranties. According to cedar siding industry standards, an initial flood-coat primer and paint finish is applied with a 15 to 20 year service life. The final painting at year forty-five is fully allocated to the siding as a conservative approach, rather than pro-rated to reflect the remaining life span of the final paint coat at year fifty.

End-of-life assumptions

In the LCA used for this EPD, materials at the end of their service life are assumed to be transported through municipal solid waste collection to inert material landfills, as is estimated by Franklin Associates to be the fate for 70 to 80% of construction and demolition debris (USEPA, 1998). Organic materials in landfills decompose into the greenhouse gases methane and carbon dioxide; the methane portion of which may be captured for heat recovery or flaring. The USEPA (2006) estimates that 59% of landfills are equipped with gas collection systems and 75% of emitted gases are captured; of that, 53% is burned for energy recovery and 47% is flared. The handling of municipal solid waste is modeled with representative process data provided in the ecoinvent database (Doka, 2007), with electricity-fuel breakdown, energy supply chain, and combustion processes substituted with USLCI data. Wood products are known to not completely decompose in landfill (leaving some or most of the carbon essentially in permanent storage); estimates for the proportion of wood that will decompose vary from very low to the most recent estimate of 23% (Skog, 2008). The figures discussed in this paragraph are directly applied in the LCA, along with the assumption that landfill gas is equal parts carbon dioxide and methane.

Environmental Performance

The U.S. Environmental Protection Agency's TRACI (Tool for the Reduction and Assessment of Chemical and other Environmental Impacts) life cycle impact assessment methodology is used to characterize the flows to and from the environment. Energy and material resource consumption, waste and impacts per functional unit of cedar siding are shown in Table 1. Impact measures shown are global warming potential (GWP), acidification potential, eutrophication potential, smog potential, and ozone depletion potential. The LCA model tracks overall life cycle carbon emissions, including those from biomass combustion. Carbon emissions are addressed in the GWP measure, which reports all carbon fluxes, including the carbon stored in the product and all carbon emissions throughout the product life cycle. A carbon balance at each life cycle stage is also shown on page 8. Landfilling is the assumed end-of-life fate. Landfill gas emissions and management are modeled per a USA average (see page 3). Water consumption does not include the amount of water consumed for maintenance (periodic washing) during use, as it is difficult to estimate and common to all siding types.

Allocation of environmental burdens to cedar siding and its co-products is done according to economic allocation principles. Environmental burdens are allocated entirely to cedar siding due to the low value of co-products relative to ½" cedar bevel siding (95% of the revenue flows are associated with the main product).

Table 1. Environmental performance, base case

Impact category	Unit	Per 1 m^2 of siding	Per 100 ft^2 of siding
Total primary energy:	MJ	280.08	2601.96
Non-renewable, fossil	MJ	138.84	1289.80
Non-renewable, nuclear	MJ	8.28	76.89
Renewable (SWHG)	MJ	17.00	157.97
Renewable, biomass	MJ	4.50	41.81
Feedstock, non-renewable fossil	MJ	6.46	60.00
Feedstock, renewable biomass	MJ	105.00	975.49
Renewable material consumption (wood)	kg	4.65	43.24
Non-renewable material consumption (nails, paint)	kg	0.37	3.42
Fresh water use	L	1.01	9.40
Total waste	kg	5.02	46.66
Hazardous	kg	0.00	0.00
Non-hazardous	kg	5.02	46.66
Global warming potential (GWP)	kg CO_2eq	4.64	43.11
Acidification potential	H+ moles eq	4.15	38.59
Eutrophication potential	kg N eq	6.71E-03	6.23E-02
Smog potential	kg NO_x eq	6.17E-02	5.73E-01
Ozone depletion potential	kg CFC-11 eq	3.20E-07	2.97E-06

SWHG: Solar, wind, hydroelectric and geothermal
Note: GWP includes all biogenic carbon sinks and sources throughout the product system boundary.

About 60% of energy use associated with ½" cedar bevel siding over its lifetime is attributed to harvesting and manufacturing of the product. Another 32% of the lifetime energy consumption occurs during installation and use, largely due to periodic repainting of the siding. Only 8% of total energy use is due to transportation of the product to a building site. Energy used during disposal at end-of-life is negligible, at about 0.1% (Figure 2).

The types of energy used in the life cycle of ½" cedar bevel siding are shown in Figure 3. Fossil fuels are the predominant source at 82%. Biomass (wood fuels, typically from recovered waste within the facility itself) comprises only 3% of the energy.

Coatings (primer and paint) are a significant contributor to the environmental profile of painted cedar siding (Table 2). Impacts for cedar siding are reduced if the siding is left uncoated, or if coating products are improved for reduced environmental impact.

Figure 2. Proportional consumption of primary energy by life cycle stage

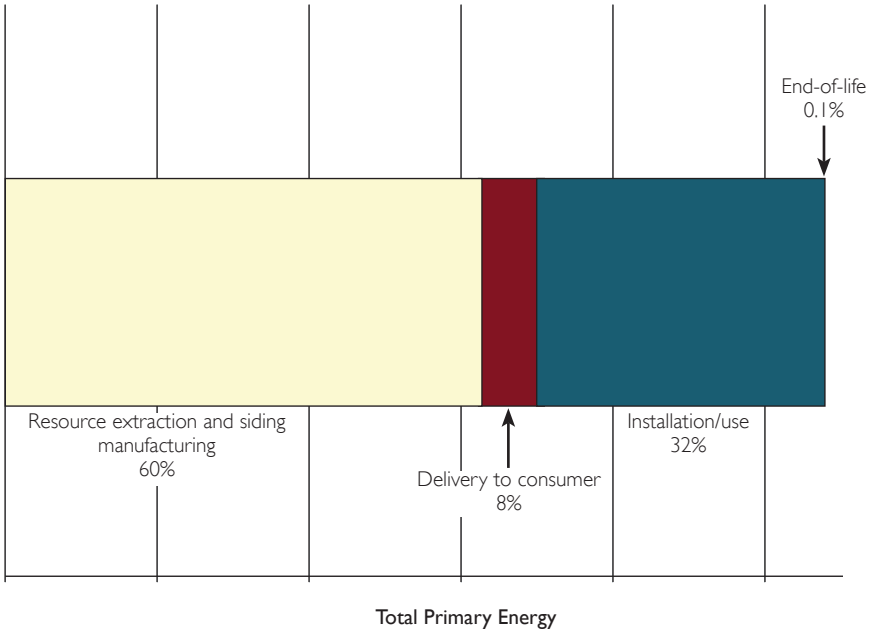


Figure 3. Total primary energy, proportional by source

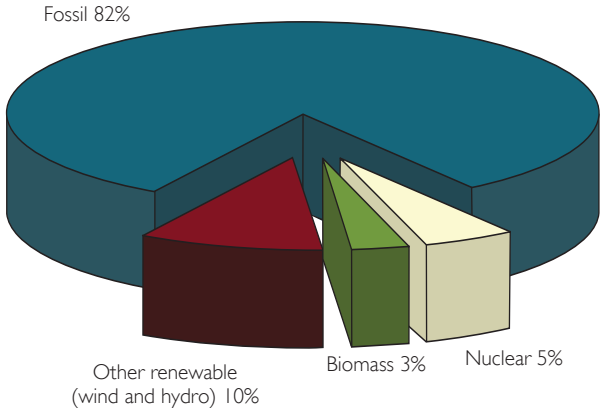


Table 2. Contribution by material, from cradle to end-of-use phase

Impact category	Total	Percent contribution by material			
		Cedar boards	Nails	Alkyd primer	Acrylic paint
Fossil energy use	100%	44.03	1.62	18.39	35.96
Global warming potential	100%	53.82	3.19	10.85	32.14
Acidification potential	100%	73.15	1.39	8.20	17.27
Eutrophication potential	100%	18.01	5.98	46.98	29.03
Smog potential	100%	86.05	0.56	4.21	9.18
Ozone potential	100%	0.67	0.15	33.61	65.57

Note: GWP includes biomass combustion CO_2.

Glossary

Primary Energy Consumption

Primary energy is the total energy consumed by a process including energy production and delivery losses. Energy is reported in megajoules (MJ).

Global Warming Potential

This impact category refers to the potential change in the earth's climate due to accumulation of greenhouse gases and subsequent trapping of heat from reflected sunlight that would otherwise have passed out of the earth's atmosphere. Greenhouse gas refers to several different gases including carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). For global warming potential, these gas emissions are tracked and their potencies reported in terms of equivalent units of CO_2.

Acidification Potential

Acidification refers to processes that increase the acidity of water and soil systems as measured by hydrogen ion concentrations (H+) and are often manifested as acid rain. Damage to plant and animal ecosystems can result, as well as corrosive effects on buildings, monuments and historical artifacts. Atmospheric emissions of nitrogen oxides (NO_x) and sulphur dioxide (SO_2) are the main agents affecting these processes. Acidification potential is reported in terms of H+ mole equivalent per kilogram of emission.

Eutrophication Potential

Eutrophication is the fertilization of surface waters by nutrients that were previously scarce, leading to a proliferation of aquatic photosynthetic plant life which may then lead to further consequences including foul odor or taste, loss of aquatic life, or production of toxins. Eutrophication is caused by excessive emissions to water of phosphorus (P) and nitrogen (N). This impact category is reported in units of N equivalent.

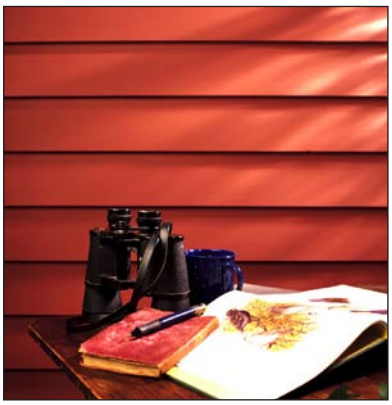
Smog Potential

Photochemical smog is the chemical reaction of sunlight, nitrogen oxides (NO_x) and volatile organic compounds (VOCs) in the atmosphere. Ground-level ozone is an indicator, and NO_x emissions are a key driver in the creation of ground-level ozone. This impact indicator is reported in units of NO_x equivalent.

Ozone Depletion Potential

This impact category addresses the reduction of protective ozone within the atmosphere caused by emissions of ozone-depleting substances such as chlorofluorocarbons (CFCs). Reduction in ozone in the stratosphere leads to increased ultraviolet-B radiation reaching earth, which can have human health impacts as well as damage crops, materials and marine life. Ozone depletion potential is reported in units of equivalent CFC-11.

Source: Bare et al, 2003.



Additional Environmental Information

Improved performance with alternate end-of-life scenario

Western red cedar siding has an improved life cycle environmental footprint if at least some of the product is diverted from landfill at end-of-life and used for energy recovery and/or product reuse. An alternate scenario for end-of-life disposition is shown in Table 3. In this case, at the end of its service life, 50% of the cedar siding is recovered for bioenergy (replacing fossil fuel consumption), 25% is reused, and 25% is landfilled. This improves GWP by lengthening product life (25% remains in service) and reducing landfill greenhouse gas emissions. GWP further improves when taking into account the avoided fossil fuel use and associated reduction in greenhouse gas emissions from recycling discarded siding boards for bioenergy. In this scenario, the product becomes a net carbon retainer (a pool) rather than a minor greenhouse gas contributor as in the base case landfilling scenario.

Table 3. Environmental performance, alternate end-of-life scenario

Impact category	Unit	Per 1 m^2 of siding	Per 100 ft^2 of siding
Total primary energy:	MJ	247.10	2295.57
Non-renewable, fossil	MJ	83.87	779.18
Non-renewable, nuclear	MJ	8.08	75.03
Renewable (SWHG)	MJ	16.95	157.44
Renewable, biomass	MJ	26.74	248.43
Feedstock, non-renewable fossil	MJ	6.46	60.00
Feedstock, renewable biomass	MJ	105.00	975.49
Renewable material consumption (wood)	kg	4.65	43.24
Non-renewable material consumption (nails, paint)	kg	0.37	3.42
Fresh water use	L	1.01	9.40
Total waste	kg	5.02	46.66
Hazardous	kg	0.00	0.00
Non-hazardous	kg	5.02	46.66
Global warming potential (GWP)	kg CO_2eq	-2.28	-21.19
Acidification potential	H+ moles eq	2.86	26.55
Eutrophication potential	kg N eq	6.50E-03	6.10E-02
Smog potential	kg NO_x eq	5.96E-02	5.54E-01
Ozone depletion potential	kg CFC-11 eq	3.20E-07	2.97E-06

SWHG: Solar, wind, hydroelectric and geothermal
Note: GWP includes all biogenic carbon sinks and sources throughout the product system boundary..

Carbon balance

The carbon that is part of the molecular composition of wood is derived from carbon dioxide removed from the atmosphere by the growing tree that produced the wood; this carbon is often a consideration in greenhouse gas calculations and carbon footprints for wood products. At the manufacturing gate, wood products are typically carbon-negative; that is, more carbon is stored in the product than was emitted during harvesting and manufacturing. Emissions from transportation to a building site, product maintenance such as repainting, transportation to landfill, and decomposition in landfill can render wood products into net carbon emitters at the end of the full life cycle. See Tables 4 and 5 for the carbon balance at each life cycle stage, that is, the net carbon footprint per functional unit considering the carbon contained in the wood (a negative number) and the life cycle carbon emissions (a positive number). A negative number indicates a net climate change benefit (a greenhouse gas removal); a positive number is a net greenhouse gas emission. One square meter of ½" cedar bevel siding stores the equivalent of 8.53 kilograms of CO_2. The sum of the greenhouse gas emissions during harvesting, manufacturing, transportation, installation and maintenance are less than 8.53 kg CO_2eq, meaning at the end-of-use phase, cedar siding is still net carbon negative (i.e., a carbon pool). However, at the complete end-of-life (end of landfill decomposition and product/energy recovery processes), under the landfill assumptions in the underlying LCA for cedar, cedar siding is ultimately a minor source of greenhouse gas emissions.

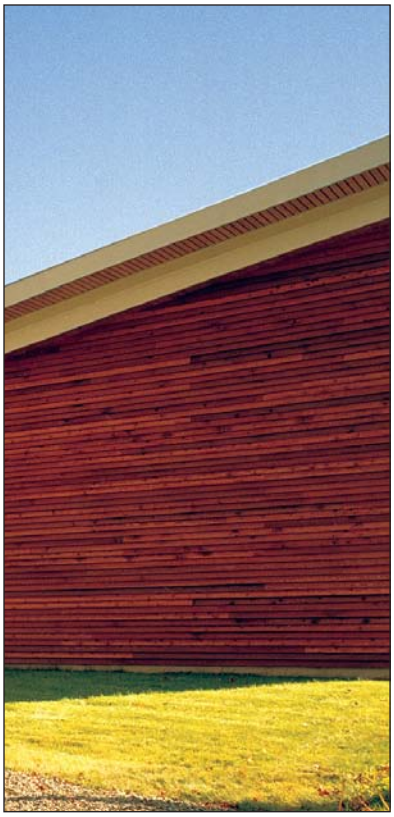


Table 4. Carbon balance per 1m² of cedar siding

	kg CO_2eq	
	Base case end-of-life scenario 100% landfill	Alternate end-of-life scenario 50% energy recovery, 25% reuse, 25% landfill
Forest carbon uptake	-8.53	-8.53
GWP harvesting and manufacturing	4.77	4.77
Net carbon balance cradle-to-gate	-3.77	-3.77
GWP transportation to customer	0.96	0.96
Net carbon balance cradle-to-site	-2.80	-2.80
GWP installation and use	2.30	2.30
Net carbon balance cradle-to-end-of-use	-0.50	-0.50
GWP end-of-life processes	5.14	-1.78
Net carbon balance cradle-to-grave	4.64	-2.28

GWP: Global Warming Potential
Note: GWP includes all biogenic carbon sinks and sources throughout the product system boundary.

Table 5. Carbon balance per 100 ft^2 of cedar siding

	kg CO_2eq	
	Base case end-of-life scenario 100% landfill	Alternate end-of-life scenario 50% energy recovery, 25% reuse, 25% landfill
Forest carbon uptake	-79.27	-79.27
GWP harvesting and manufacturing	44.28	44.28
Net carbon balance cradle-to-gate	-34.99	-34.99
GWP transportation to customer	8.95	8.95
Net carbon balance cradle-to-site	-26.04	-26.04
GWP installation and use	21.36	21.36
Net carbon balance cradle-to-end-of-use	-4.68	-4.68
GWP end-of-life processes	47.79	-16.51
Net carbon balance cradle-to-grave	43.11	-21.19

GWP: Global Warming Potential
Note: GWP includes all biogenic carbon sinks and sources throughout the product system boundary.

Alternate allocation method

In a production process where more than one product is generated, it is necessary to allocate the environmental impacts from manufacturing in some proportional manner to the various products. This is most typically done based on mass of the co-products. However, if a co-product has far less economic value than the main product, it may be more appropriate to allocate proportionally by value. In such cases, a conservative approach is to allocate 100% of the environmental burdens to the main product. For many wood products, a co-product (or by-product) is wood chips, which typically have market value as feedstock for other forest products, as mulch, or as fuel. In the LCA study underlying this EPD, the value of this by-product was found to be very low, hence 100% allocation to the main product was used. Had that study reported LCA results using allocation by mass, the numbers shown in Tables 1 and 3 would be reduced by two-thirds.

Sustainable forestry

Western red cedar products from WRCLA members come from forests that are independently certified as legal and sustainable.

References

Bare, J. C., McKone, T., Norris, G. A., Pennington, D. W. 2003. *TRACI: The Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts*. Journal of Industrial Ecology, Vol. 6 No. 3-4.

Doka, G. 2007. *Life Cycle Inventories of Waste Treatment Services*. Ecoinvent report No. 13, Swiss Centre for Life Cycle Inventories, Dubendorf, December 2007.

ISO 14025:2006. *Environmental labels and declarations – Type III environmental declarations*. International Standards Organization.

ISO 21930:2007. *Environmental labels and declarations – Sustainability in building construction*. Environmental declaration of building products. International Standards Organization.

Skog, K. 2008. *Sequestration of carbon in harvested wood products for the United States*. Forest Products Journal. Vol. 58 No. 6.

USEPA. 2006. *The role of recycling in integrated waste management in the US*. Franklin Associates. Municipal Industrial Waste Division, Washington, DC, EPA/530-R-96-00; 1995.

USEPA. 1998. *Characterization of Building-Related Construction and Demolition Debris in the United States*. The US Environmental Protection Agency. EPA530-R-98-010, prepared by Franklin Associates, June 1998.

USLCI. *US Life Cycle Inventory Database*. http://www.nrel.gov/lci/.

About this EPD

PCR:

North American Structural and Architectural Wood Products. April 2011. Prepared by FPInnovations and available at www.fpinnovations.ca. PCR panel chaired by Wayne Trusty.

Program Operator:

FPInnovations
Wood Products Division
Energy and Environment Group
2665 East Mall
Vancouver, BC, V6T 1W5 Canada
1 (604) 224-3221
www.fpinnovations.ca

EPD Owner:

Western Red Cedar Lumber Association
1501 – 700 West Pender Street
Vancouver, BC V6C 1G8
Canada
1 (866) 778-9096
www.wrcla.org

EPD Verification:

Dr. Eva Schminke,
Five Winds International
72074 Tubingen
Gartenstrasse 26, Germany
+49 7071360589
www.fivewinds.com

Issued: April 2011
Valid until: April 2016

Cradle-to-grave LCA results can be used for comparison between different EPDs provided products and systems have been assessed on the basis of the same function, quantified by the same functional unit in the form of their service life reference flows. EPDs from different programs may not be comparable.

EPDs do not address all issues of relevance to sustainability.

FPInnovations®

WESTERN RED CEDAR LUMBER ASSOCIATION
REALCEDAR
WRCLA

Environmental Product Declaration

Typical Western Red Cedar Decking

Type III environmental declaration developed according to ISO 21930 and 14025 for average cedar decking products manufactured by the members of the Western Red Cedar Lumber Association.

Issued April 2011
Valid until April 2016

WESTERN RED CEDAR LUMBER ASSOCIATION
REALCEDAR
WRCLA

FPInnovations®

Manufacturer Information

This EPD addresses products from multiple manufacturers and represents an average for the membership of the Western Red Cedar Lumber Association (WRCLA), a non-profit trade association representing manufacturers of western red cedar products. This average is based on a sample that included two lumber mills in British Columbia (BC), combined with recent secondary data on western red cedar resource extraction from the Athena Institute. The total data represents 20% of western red cedar decking production in the year 2007.

Product Description

Wood decking is a board-type product horizontally applied in a load-carrying capacity and as the final surfacing for an outdoor flat surface attached to a house and typically elevated above the ground. A decking product in the most common size is modeled for this EPD.

- Typical board size: 5/4" x 6" (31.75 mm x 152.4 mm)
- Grade: Average
- Product composition (on the basis of 1 m^2 installed decking with a 25-year service life):
  - Western red cedar lumber: 8.14 kg (oven-dry basis) (0.0247m^3)
  - Optional coating
    - Stain: 1.25 litres
  - Fasteners (2½" galvanized nails, N° 8 or 10): 0.1 kg per 1 m^2 installed decking
- Installed and used according to Western Red Cedar Lumber Association specifications *(See http://www.wrcla.org/installation_and_finishing/finishing_cedar_decks/default.htm)*. Base case is an uncoated deck. An alternate scenario has regular applications of a stain coating.

Scope: Cradle-to-grave.

Functional unit: 1m^2 of decking assumed installed over a wood substructure.

Service life: 25 years.

System boundary: Life cycle activities from resource extraction through product use for a 25-year life span inclusive of maintenance, replacement and end-of-life effects. Wood-framed deck substitute is excluded as it is common to other decking types.

Geographic boundary: North America.

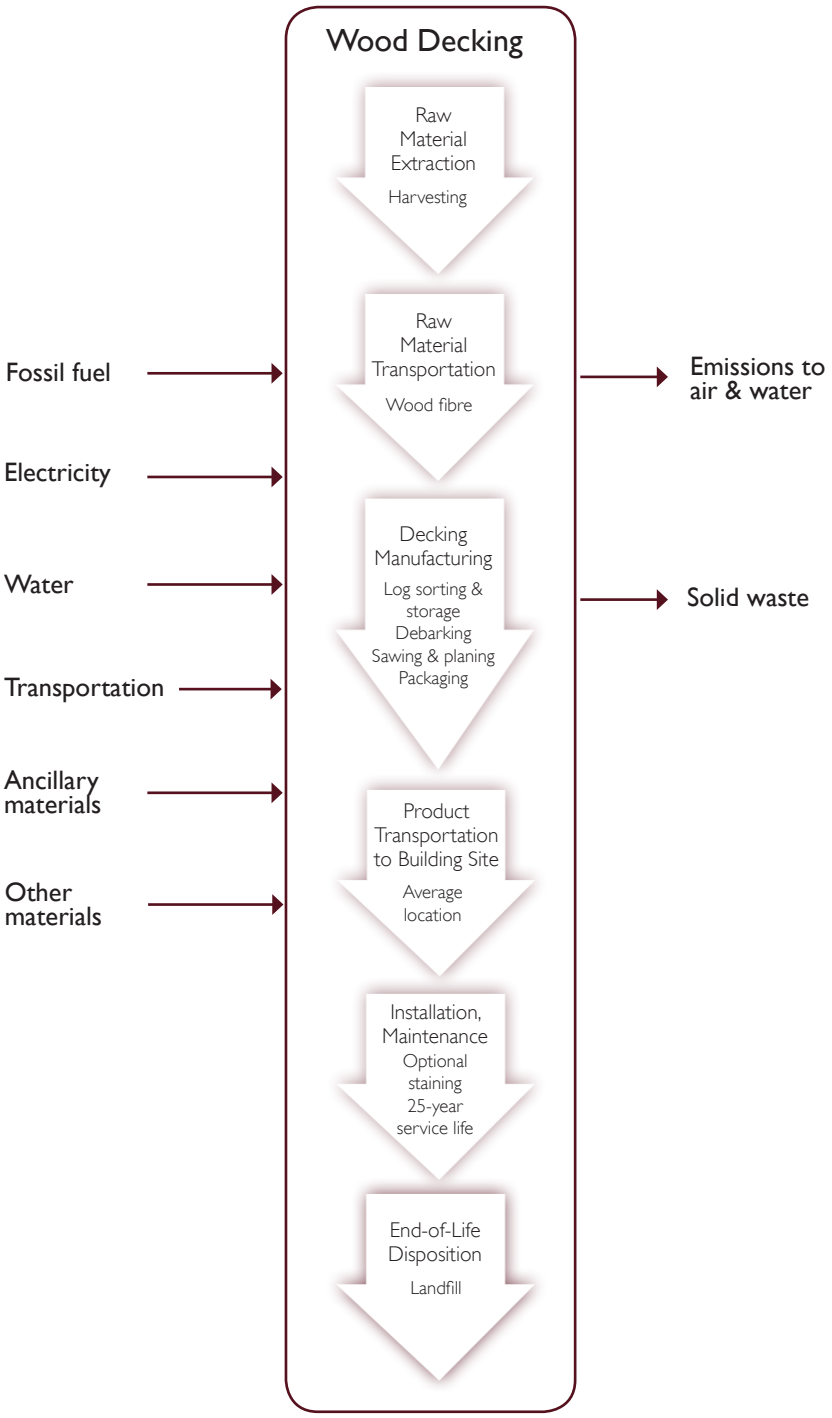
Life Cycle Assessment

Life cycle assessment (LCA) is a rigorous study of inputs and outputs over the entire life of a product or process and the associated environmental impact of those flows to and from nature. The underlying LCA supporting this EPD was performed by FPInnovations for WRCLA in 2009 and was third-party peer-reviewed by two organizations. The LCA study collected primary data from western red cedar lumber operations in 2008 for the production year 2007, which was combined with recently developed secondary data on red cedar resource extraction available from the Athena Institute.

The system boundary includes all the production steps from extraction of raw materials from the earth (the cradle) through to final fate of the product at the end of its service life (the grave). See Figure 1. The boundary includes the transportation of major inputs to, and within, each activity stage including the shipment of products to a hypothetical building site location in North America and eventual transportation to landfill. The city of Minneapolis, USA was chosen as the typical building location, as a central location in North America.

Ancillary materials and other materials such as coatings, fasteners and packaging are included in the boundary unless below the cut-off criteria. Mass or energy flows are excluded if they account for less than 1% of model flows and less than 2% of life cycle impacts in all categories. Human activity and

Figure 1. System boundary and process flows



capital equipment are excluded. For the use phase, the use of water and cleaning solutions is common to all decking types and is excluded.

Twenty-five years is the expected life span for cedar decking according to WRCLA. This figure is supported by expert opinion, anecdotal evidence and product warranty claims. The base case deck is uncoated (no stain is applied and the deck is allowed to take on a natural weathered appearance). An alternate scenario is modeled that includes a stain application at installation and a re-application every three years thereafter.

End-of-life assumptions

In the LCA used for this EPD, materials at the end of their service life are assumed to be transported through municipal solid waste collection to inert material landfills, as is estimated by Franklin Associates to be the fate for 70 to 80% of construction and demolition debris (USEPA, 1998). Organic materials in landfills decompose into the greenhouse gases methane and carbon dioxide; the methane portion of which may be captured for heat recovery or flaring. The USEPA (2006) estimates that 59% of landfills are equipped with gas collection systems and 75% of emitted gases are captured; of that, 53% is burned for energy recovery and 47% is flared. The handling of municipal solid waste is modeled with representative process data provided in the ecoinvent database (Doka, 2007), with electricity-fuel breakdown, energy supply chain, and combustion processes substituted with USLCI data. Wood products are known to not completely decompose in landfill (leaving some or most of the carbon essentially in permanent storage); estimates for the proportion of wood that will decompose vary from very low to the most recent estimate of 23% (Skog, 2008). The figures discussed in this paragraph are directly applied in the LCA, along with the assumption that landfill gas is equal parts carbon dioxide and methane.

Environmental Performance

The U.S. Environmental Protection Agency's TRACI (Tool for the Reduction and Assessment of Chemical and other Environmental Impacts) life cycle impact assessment methodology is used to characterize the flows to and from the environment. Energy and material resource consumption, waste, and impacts per functional unit of cedar decking are shown in Table 1. Impact measures shown are global warming potential (GWP), acidification potential, eutrophication potential, smog potential, and ozone depletion potential. The LCA model tracks overall life cycle carbon emissions, including those from biomass combustion. Carbon emissions are addressed in the GWP measure, which reports all carbon fluxes, including the carbon stored in the product and all carbon emissions throughout the product life cycle. A carbon balance at each life cycle stage is also shown on page 7. Landfilling is the assumed end-of-life fate. Landfill gas emissions and management are modeled per a USA average (see page 3). Water consumption does not include the amount of water consumed for maintenance (periodic washing) during use, as it is difficult to estimate and common to all decking types.

Allocation of environmental burdens to cedar decking and its co-products is done according to economic allocation principles. Environmental burdens are allocated entirely to cedar decking due to the low value of co-products relative to cedar decking (95% of the revenue flows are associated with the main product).

Table 1. Environmental performance, base case

Impact category	Unit	Per 1 m^2 of decking	Per 100 ft^2 of decking
Total primary energy:	MJ	275.86	2562.71
Non-renewable, fossil	MJ	74.13	688.64
Non-renewable, nuclear	MJ	0.60	5.62
Renewable (SWHG)	MJ	14.08	130.79
Renewable, biomass	MJ	3.46	32.12
Feedstock, non-renewable fossil	MJ	0.00	0.00
Feedstock, renewable biomass	MJ	183.59	1705.54
Renewable material consumption (wood)	kg	8.14	75.60
Non-renewable material consumption (nails)	kg	0.10	0.91
Fresh water use	L	0.03	0.30
Total waste	kg	8.24	76.51
Hazardous	kg	0.00	0.00
Non-hazardous	kg	8.24	76.51
Global warming potential (GWP)	kg CO_2eq	-1.45	-13.39
Acidification potential	H+ moles eq	2.72	25.31
Eutrophication potential	kg N eq	2.62E-03	2.43E-02
Smog potential	kg NO_x eq	5.91E-02	5.49E-01
Ozone depletion potential	kg CFC-11 eq	2.55E-09	2.37E-08

SWHG: Solar, wind, hydroelectric and geothermal
Note: GWP includes all biogenic carbon sinks and sources throughout the product system boundary.

About 70% of energy use associated with cedar decking over its lifetime is attributed to harvesting and manufacturing of the product. Another 29% of the lifetime energy consumption occurs during transportation to the building site. Less than 1% is attributed to end-of-life and less than 0.1% to the installation and use phase (see Figure 2).

The types of energy used in the life cycle of cedar decking are shown in Figure 3. Fossil fuels are the predominant source at 80%. Biomass (wood fuels, typically from recovered waste within the facility itself) comprises only 4% of the energy.

The application of a coating (a stain) to cedar decking increases the environmental impacts of decking. See Table 2 for results with a scenario where the deck is initially stained at installation and then recoated with stain every three years over the life of the deck.

Figure 2. Proportional consumption of primary energy by life cycle stage

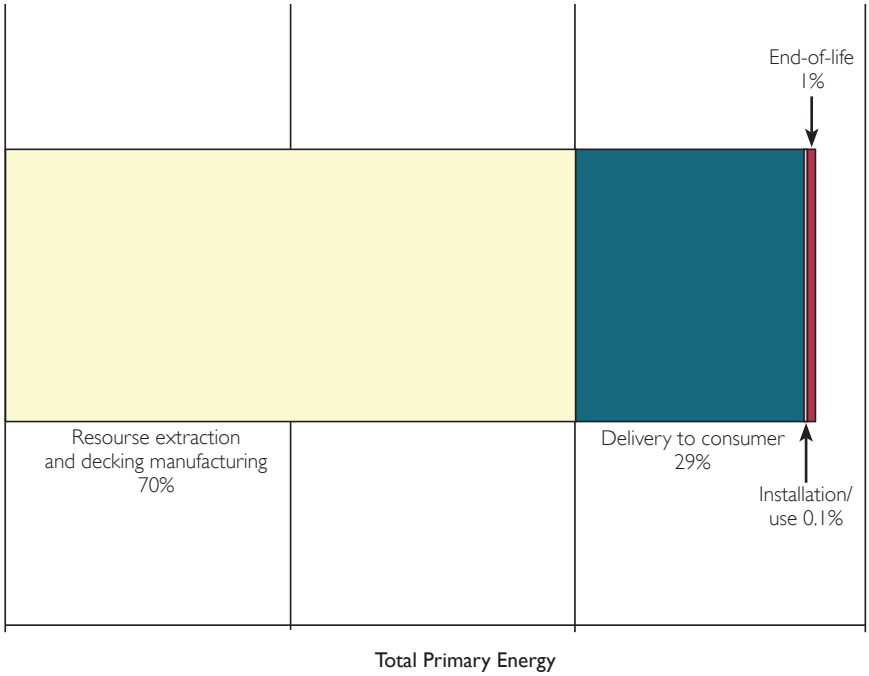


Figure 3. Total primary energy, proportional by source

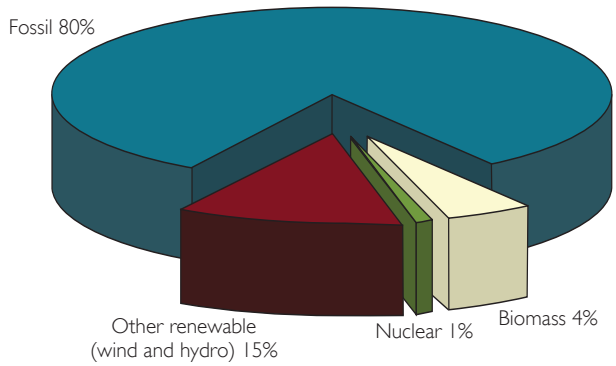


Table 2. Environmental performance, decking with regular applications of stain

Impact category:	Unit	Per 1 m^2 of decking	Per 100 ft^2 of decking
Total primary energy:	MJ	308.89	2869.56
Non-renewable, fossil	MJ	102.35	950.80
Non-renewable, nuclear	MJ	5.07	47.10
Renewable (SWHG)	MJ	14.37	133.48
Renewable, biomass	MJ	3.51	32.64
Feedstock, non-renewable fossil	MJ	0.00	0.00
Feedstock, renewable biomass	MJ	183.59	1705.54
Renewable material consumption (wood)	kg	8.14	75.60
Non-renewable material consumption (nails, stain)	kg	0.90	8.33
Fresh water use	L	3.16	29.31
Total waste	kg	9.03	83.93
Hazardous	kg	0.00	0.00
Non-hazardous	kg	9.03	83.93
Global warming potential (GWP)	kg CO_2eq	-0.02	-0.15
Acidification potential	H+ moles eq	3.02	28.06
Eutrophication potential	kg N eq	5.38E-03	5.00E-02
Smog potential	kg NO_x eq	6.10E-02	5.67E-01
Ozone depletion potential	kg CFC-11 eq	1.95E-07	1.81E-06

SWHG: Solar, wind, hydroelectric and geothermal
Note: GWP includes all biogenic carbon sinks and sources throughout the product system boundary.

Glossary

Primary Energy Consumption

Primary energy is the total energy consumed by a process including energy production and delivery losses. Energy is reported in megajoules (MJ).

Global Warming Potential

This impact category refers to the potential change in the earth's climate due to accumulation of greenhouse gases and subsequent trapping of heat from reflected sunlight that would otherwise have passed out of the earth's atmosphere. Greenhouse gas refers to several different gases including carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). For global warming potential, these gas emissions are tracked and their potencies reported in terms of equivalent units of CO_2.

Acidification Potential

Acidification refers to processes that increase the acidity of water and soil systems as measured by hydrogen ion concentrations (H+) and are often manifested as acid rain. Damage to plant and animal ecosystems can result, as well as corrosive effects on buildings, monuments and historical artifacts. Atmospheric emissions of nitrogen oxides (NO_x) and sulphur dioxide (SO_2) are the main agents affecting these processes. Acidification potential is reported in terms of H+ mole equivalent per kilogram of emission.

Eutrophication Potential

Eutrophication is the fertilization of surface waters by nutrients that were previously scarce, leading to a proliferation of aquatic photosynthetic plant life which may then lead to further consequences including foul odor or taste, loss of aquatic life, or production of toxins. Eutrophication is caused by excessive emissions to water of phosphorus (P) and nitrogen (N). This impact category is reported in units of N equivalent.

Smog Potential

Photochemical smog is the chemical reaction of sunlight, nitrogen oxides (NO_x) and volatile organic compounds (VOCs) in the atmosphere. Ground-level ozone is an indicator, and NO_x emissions are a key driver in the creation of ground-level ozone. This impact indicator is reported in units of NO_x equivalent.

Ozone Depletion Potential

This impact category addresses the reduction of protective ozone within the atmosphere caused by emissions of ozone-depleting substances such as chlorofluorocarbons (CFCs). Reduction in ozone in the stratosphere leads to increased ultraviolet-B radiation reaching earth, which can have human health impacts as well as damage crops, materials and marine life. Ozone depletion potential is reported in units of equivalent CFC-11.

Source: Bare et al, 2003.

Additional Environmental Information

Carbon balance

The carbon that is part of the molecular composition of wood is derived from carbon dioxide removed from the atmosphere by the growing tree that produced the wood; this carbon is often a consideration in greenhouse gas calculations and carbon footprints for wood products. At the manufacturing gate, wood products are typically carbon-negative; that is, more carbon is stored in the product than was emitted during harvesting and manufacturing. Emissions from transportation to a building site, product maintenance such as repainting, transportation to landfill, and decomposition in landfill can render wood products into net carbon emitters at the end of the full life cycle. See Tables 3 and 4 for the carbon balance at each life cycle stage, that is, the net carbon footprint per functional unit considering the carbon contained in the wood (a negative number) and the life cycle carbon emissions (a positive number). A negative number indicates a net climate change benefit (a greenhouse gas removal); a positive number is a net greenhouse gas emission. One square metre of decking stores the equivalent of 15.41 kilograms of CO_2. The sum of the greenhouse gas emissions during harvesting, manufacturing, transportation, installation, maintenance, transportation to landfill and decomposition in landfill is less than 15.41 kg CO_2eq, meaning at the complete end-of-life cycle, cedar decking remains carbon negative. The addition of a triennial regime of staining adds greenhouse gas emissions but not enough to outweigh the embodied carbon.

Table 3. Carbon balance per 1m^2 of cedar decking

	kg CO_2eq	
	Base case No stain	Alternate scenario Regular applications of stain
Forest carbon uptake	-15.41	-15.41
GWP harvesting and manufacturing	2.74	2.74
Net carbon balance cradle-to-gate	-12.67	-12.67
GWP transportation to customer	1.96	1.96
Net carbon balance cradle-to-site	-10.71	-10.71
GWP installation and use	0.00	1.42
Net carbon balance cradle-to-end-of-use	-10.71	-9.29
GWP end-of-life processes	9.26	9.27
Net carbon balance cradle-to-grave	-1.45	-0.02

GWP: Global Warming Potential
Note: GWP includes all biogenic carbon sinks and sources throughout the product system boundary.

Table 4. Carbon balance per 100 ft^2 of cedar decking

	kg CO_2eq	
	Base case No stain	Alternate scenario Regular applications of stain
Forest carbon uptake	-143.17	-143.17
GWP harvesting and manufacturing	25.49	25.49
Net carbon balance cradle-to-gate	-117.68	-117.68
GWP transportation to customer	18.25	18.25
Net carbon balance cradle-to-site	-99.43	-99.43
GWP installation and use	0.03	13.18
Net carbon balance cradle-to-end-of-use	-99.40	-86.25
GWP end-of-life processes	86.01	86.10
Net carbon balance cradle-to-grave	-13.39	-0.15

GWP: Global Warming Potential
Note: GWP includes all biogenic carbon sinks and sources throughout the product system boundary.

Alternate allocation method

In a production process where more than one product is generated, it is necessary to allocate the environmental impacts from manufacturing in some proportional manner to the various products. This is most typically done based on mass of the co-products. However, if a co-product has far less economic value than the main product, it may be more appropriate to allocate proportionally by value. In such cases, a conservative approach is to allocate 100% of the environmental burdens to the main product. For many wood products, a co-product (or by-product) is wood chips, which typically have market value as feedstock for other forest products, as mulch, or as fuel. In the LCA study underlying this EPD, the value of this by-product was found to be very low, hence 100% allocation to the main product was used. Had that study reported LCA results using allocation by mass, the numbers shown in Tables 1 and 2 would be reduced by two-thirds.

Sustainable forestry

Western red cedar products from WRCLA members come from forests that are independently certified as legal and sustainable.

References

Bare, J. C., McKone, T., Norris, G. A., Pennington, D. W. 2003. *TRACI: The Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts*. Journal of Industrial Ecology, Vol. 6 No. 3-4.

Doka, G. 2007. *Life Cycle Inventories of Waste Treatment Services*. Ecoinvent report No. 13, Swiss Centre for Life Cycle Inventories, Dubendorf, December 2007.

ISO 14025:2006. *Environmental labels and declarations – Type III environmental declarations*. International Standards Organization.

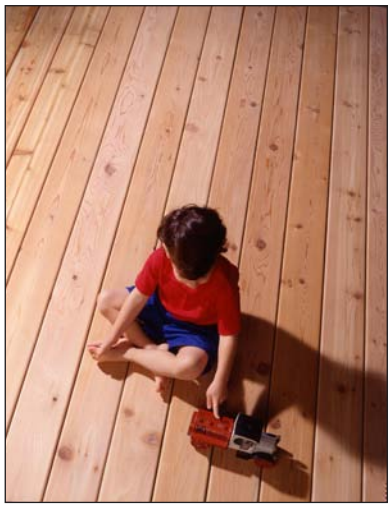
ISO 21930:2007. *Environmental labels and declarations – Sustainability in building construction*. Environmental declaration of building products. International Standards Organization.

Skog, K. 2008. *Sequestration of carbon in harvested wood products for the United States*. Forest Products Journal. Vol. 58 No. 6.

USEPA. 2006. *The role of recycling in integrated waste management in the US*. Franklin Associates. Municipal Industrial Waste Division, Washington, DC, EPA/530-R-96-00; 1995.

USEPA. 1998. *Characterization of Building-Related Construction and Demolition Debris in the United States*. The US Environmental Protection Agency. EPA530-R-98-010, prepared by Franklin Associates, June 1998.

USLCI. *US Life Cycle Inventory Database*. http://www.nrel.gov/lci/.



About this EPD

PCR: North American Structural and Architectural Wood Products. April 2011. Prepared by FPInnovations and available at www.fpinnovations.ca. PCR panel chaired by Wayne Trusty.

Program Operator:

FPInnovations
Wood Products Division
Energy and Environment Group
2665 East Mall
Vancouver, BC, V6T 1W5 Canada
1 (604) 224-3221
www.fpinnovations.ca

EPD Owner:

Western Red Cedar Lumber Association
1501 – 700 West Pender Street
Vancouver, BC V6C 1G8
Canada
1 (866) 778-9096
www.wrcla.org

EPD Verification:

Dr. Eva Schminke,
Five Winds International
72074 Tubingen
Gartenstrasse 26, Germany
+49 7071360589
www.fivewinds.com

Issued: April 2011
Valid until: April 2016

Cradle-to-grave LCA results can be used for comparison between different EPDs provided products and systems have been assessed on the basis of the same function, quantified by the same functional unit in the form of their service life reference flows. EPDs from different programs may not be comparable.

EPDs do not address all issues of relevance to sustainability.

FPInnovations®

WESTERN RED CEDAR LUMBER ASSOCIATION
REALCEDAR
WRCLA

Approved Environmental Profile

Characterised and Normalised Data for:

1 square metre over 60 Year Study Period: Commercial Windows: Commercial Windows: Profile 22 PVC-U window (replacing steel reinforcement with 100% RCM and replacing virgin PVC with 100% PCW)

Quality of Data for Profiled Material (Data for other constituent materials are available from BRE Global)

Start Date:	**01/01/2009**	Source of Data:	**Company Records**
End Date:	**31/12/2009**	Geography:	**UK**
Representativeness:	**2 sites representing 100% production**		
LCA Methodology:	**2008 BRE Environmental Profiles Methodology**		
Allocation:	**100% to product**		
Date of Data Entry:	**11/01/2011**		
Boundary:	**Cradle to Grave over 60 Year Study Period**		
Applicable Buildings:	**Commercial**		

Issue	*Characterised Data*	*Unit*
Climate Change	**100**	**kg CO2 eq. (100yr)**
Water Extraction	**0.96**	**m³**
Mineral Resource Extraction	**0.069**	**tonnes**
Stratospheric Ozone Depletion	**0.000082**	**kg CFC11 eq.**
Human Toxicity	**18**	**kg 1,4-DB eq**
Ecotoxicity to Freshwater	**1.7**	**kg 1,4-DB eq**
Nuclear Waste (higher level)	**0.0000002**	**m³ high level waste**
Ecotoxicity to Land	**0.14**	**kg 1,4-DB eq**
Waste Disposal	**36**	**kg**
Fossil Fuel Depletion	**1400**	**MJ**
Eutrophication	**0.06**	**kg PO4 eq.**
Photochemical Ozone Creation	**0.05**	**kg ethene eq.**
Acidification	**0.69**	**kg SO2 eq.**

Issue	*Normalised Data*	*Western European Citizen's Impacts*
Climate Change	**0.0083**	**12300 kg CO2 eq. (100yr)**
Water Extraction	**0.0025**	**378 m³**
Mineral Resource Extraction	**0.0028**	**24.4 tonnes**
Stratospheric Ozone Depletion	**0.00038**	**0.217 kg CFC11 eq.**
Human Toxicity	**0.00093**	**19700 kg 1,4-DB eq.**
Ecotoxicity to Freshwater	**0.0013**	**1320 kg 1,4-DB eq.**
Nuclear Waste (higher level)	**0.0085**	**2.37E-05 m³ high level waste**
Ecotoxicity to Land	**0.0011**	**123 kg 1,4-DB eq.**
Waste Disposal	**0.0095**	**3750 kg**
Fossil Fuel Depletion	**0.0051**	**273 GJ**
Eutrophication	**0.0018**	**32.5 kg PO4 eq.**
Photochemical Ozone Creation	**0.0023**	**21.5 kg ethene eq.**
Acidification	**0.0097**	**71.2 kg SO2 eq.**

BRE Ecopoints Score	**0.43**	*Ecopoints*

Appendix No: 432 a
Issue No: 1

Valid From: 04/02/2011
Last Revised: 04/02/2011

Signed On Behalf of BRE Global: V.Blake V Blake

BRE Global Ltd., Garston, Watford WD25 9XX. Tel 01923 664100 Fax 01923 664603 www.breglobal.com