

## LoRe-LCA

### Low Resource consumption buildings and constructions by use of LCA in design and decision making



## Use and availability of Environmental product declarations (EPD)

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## Abbreviations

AP	Acidification potential
BMCC	Building materials and components
BRE	Building research establishment
CEN	Comité Européen de Normalisation
CPD/CPR	Construction product directive / construction product regulation
EC	European Commission
EPBD	Directive 2002/91/EC of the European Parliament and of the Council on the energy performance of buildings
EPD	Environmental product declaration
GPP	Green public procurement
GWP	Global warming potential
ISO	International Organization for Standardization
LCA	Life cycle analysis
LCI	Life cycle inventory
LCIA	Life cycle impact assessment
LMI	Lead market initiative
PCR	Product category rule
PEI	Primary energy content
WP	Work package

## 1 Introduction

“Low Resource consumption buildings and construction by use of LCA in design and decision making (LoRe-LCA)” is a project within the EU-FP 7. The aim is to contribute to an increased use of Life cycle analysis (LCA) as a method to gather, analyse, value and document comprehensive information on buildings and constructions. The specific focus of LoRe-LCA is on building’s resource consumption (water, primary raw materials, energy, land) and waste generation. Work package 2 is dedicated to collect LCA projects and initiatives and to compare the use of LCA for assessing the environmental performance of buildings in (some) EU countries. From this evidence should derive what is meaningful and useful for practice of LCA in the construction sector as well as what are chances and barriers for a broader uptake.

For a building’s LCA, information of all products that were (or will be) used has to be processed. Central notions are: the EPD (Environmental product declaration) of each product and the PCR (Product category rule) of each product category. In a product category all products are summarized that can fulfil equivalent functions.

EPDs are type III environmental declarations which means that they are based on LCA methodology. Type III environmental declarations are described for all products by the ISO norm 14025 and for construction products in ISO 21930. EPDs provide quantified environmental data using predetermined parameters (e.g. certain impact categories of an LCIA) and - where relevant - additional environmental information.

Building products may be used in buildings in various constructions. The special requirement for PCRs is to set significant parameters and to demand meaningful information in the building context. This is the task of CEN TC 350 which has issued as one of its main outputs the norm EN 15804 (Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products).

Summarizing, EPDs are an important part of the calculation of a LCA for the building as a whole. In specific resource consumption during production and transport of the building materials should be based on EPD data.

EPDs may also deliver the information for certification and labelling of products thus supporting the EC environmental policies (LMI, GPP, and others).

## 2 Purpose and scope

The purpose of this report is to give an overview of the current situation concerning the use of EPDs in Europe. The systems are presented at short and the product groups that they are covering as well as the number of EPDs that are available.

Building products pose special problems since they are not end use products but are used in different means and contexts. Construction cultures are different throughout Europe. But harmonisation has made great progress during the last years. The present situation is presented and the available norms and the norms under development are presented in short.

A small survey among the project partners on the status and the use of EPDs has been conducted. The aim was to shed light on the manufactures situation, their needs and barriers to provide standardised EPDs and reliable databases for EPD information. Cooperation with manufacturers is important to understand the barriers and to promote the work of providing more EPDs.

Conclusions are drawn concerning the harmonisation process and contextualisation and whether this is still a barrier for extended use. Examples of contextualisation are: If a product is imported, the EPDs from its manufacturer might need additions for the transport, or if the manufacturing will be in another country, there will be a need to modify the electricity mix. The harmonisation of EPDs is dealt with in CEN TC350.

## 3 Background for EPDs

### 3.1 General

EPDs (Environmental product declarations) disclose quantified life cycle environmental information of products using pre-determined parameters according to the ISO 14040 series of standards. This means that EPDs are built upon Life Cycle Assessment methodology. The pre-determined parameters are environmental impacts (like climate change), resource input, generated waste and output flows. Information generated by LCA is relevant for the product, verified and comparable. Verification should be conducted by a third party. Thus EPDs solve the problems associated with manufacturers publishing selective, un-comparable and often incomprehensible data of their products.

The overall goal of environmental declarations is to encourage the demand and supply of those products that cause less stress to the environment through communication of verifiable and accurate information that is not misleading, thereby stimulating the potential for market-driven continuous environmental improvement. The more detailed objectives of EPDs according to ISO 14025 are to:

- provide LCA-based information and additional information on the environmental aspects of products,

- assist purchasers and users to make informed comparisons between products (but not being so-called comparative assertions),
- encourage improvement of environmental performance, and
- provide information for assessing the environmental aspects of products over their life cycle.

The environmental performance of a product has to be communicated to different customers that also have different needs and a varying level of technical background. Possible customers are for instance the retailer, the contractor or subcontractor, the architect, the client, etc. EPDs contain an abundance of un-aggregated information that has to be put into the right context which is the building as a whole.

After all construction products are not “ordinary end-use products” but are applied in buildings and construction works in various and differing situations: e.g. wooden planks might be part of interior partition walls with a coating of plaster and paint or might become an oiled and waxed flooring. The environmental performance of a product depends generally on its use within the buildings, maintenance and repair demands, and the probable end-of-life scenario. Further on products are not separate: interactions can cause complex impacts. We need to assess the whole building and its entire life cycle to determine the environmental contribution of products.

### **3.2 The framework of EU politics**

Information about the environmental impacts and aspects that are caused by the product is an important part of the strategy of the European Commission towards sustainability. In the integrated product policy (IPP) and in the Lead market initiative EPDs are named as instruments to reach the aims in a general context and in the construction sector context. Consumers, procurers and other client groups ask for environmental information to be able for considerate buying and procurement choices. On the other hand product declarations like the eco-flower that is issued on European level need detailed and reliable product information. To gain wider acceptance more product groups and products should be covered.

Another driver for the implementation of EPDs is the construction product directive (CPD) resp. the construction product regulation (CPR, since 2011). To be traded on the market in all European countries a building product has to be marked with a CE-mark. This shows that the product fulfils the requirements that are demanded. On a general level these are given as the basic work requirements (BWR) in CPD and the Essential requirements (ER) in CPR.

More information can be found in the LoRe-report on European building regulation framework.

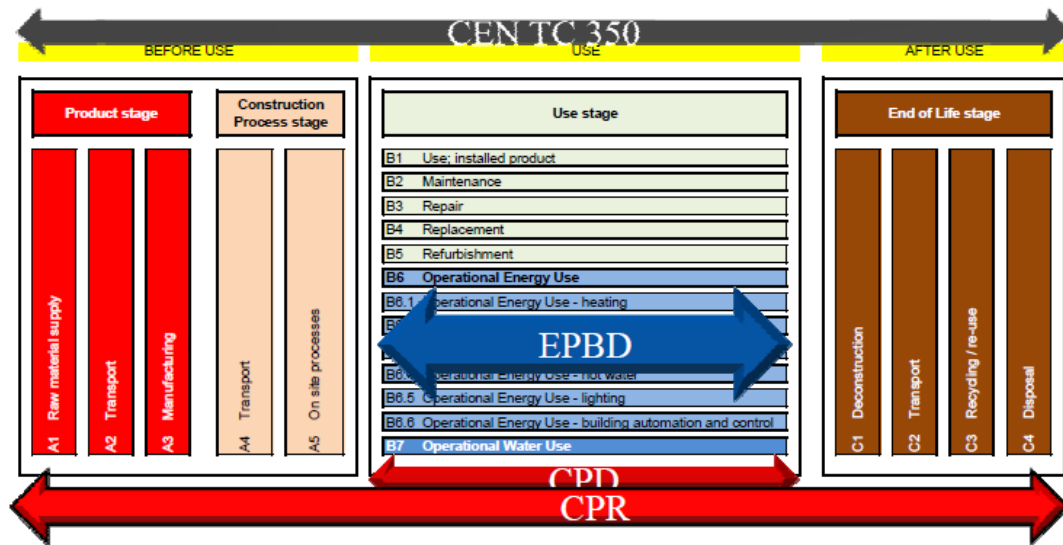


Figure 1: Illustration of building life cycle stages and what is covered by some construction related EC regulation and initiatives (Hamans, 2009, ppt)

#### 4 Standardisation and harmonisation of EPDs

A number of construction product EPD schemes are already existing throughout Europe. They show significant disparities, e.g. whether requiring third party verification or not and regarding to transparency of data sources. This is leading to a degree of confusion at customers and unnecessary duplication of resources for companies trading throughout Europe.

Several norms pursue the aim to define EPDs in the construction sector even better: Whereas ISO 14025 is valid for all products, ISO 21930 is focussing on construction products. The norms of CEN TC 350 draw a link from the products to the building.

For compounded products and for buildings a modular approach has to be taken: A product's EPD is calculated from information modules of parts of the product. E.g. a window-EPD has to sum up appropriately the data in the information modules (EPDs) of the window frame profiles, the glass, the spacers and the fittings. Additional packaging and transport processes have to be considered. For aggregation the EPDs have to be consistent, i.e. they have to be based on common indicators and use defined reference units. This is the scope of the CEN TC 350 core rules for the product category of construction products (EN 15804).

The norms introduce a hierarchy starting with the EPD program, the product category rules (PCR) that are a common set of rules for all similar products and the single EPDs. Table 1 shows the levels of EPD development in an illustrative manner.

Table 1: Schmincke (LCM 2007)

Parties involved	Level of action	Activity
<p><b>Program operator:</b> Industrial associations, -societies, companies;</p> <p><b>Interested parties:</b> authorities, NGO, Science, consumers;</p> <p><b>Verifiers:</b> LCA- and branch experts;</p>	Program	<p><b>Organisation of:</b></p> <p>PCR-development, Invitation of experts and interested parties; Verification of PCR and EPD; Registration of PCR and EPD;</p>
<p>Branch experts: Industry, LCA,</p> <p><b>Interested parties:</b> competitors, authorities, NGO, Science, consumers;</p>	PCR	<p><b>Definition of PCR:</b></p> <p>Goal and scope of LCA including rules for e.g.:</p> <p>system borders, functional unit, allocation, cut-off, calculation, Data quality for specific and background data;</p>
<p><b>Producer</b> of the declared product in co-operation with the LCA experts.</p>	EPD	<p><b>Development, publication of EPD</b></p> <p>Data acquisition, Calculation of the indicator results, Presentation of additional information, Publication as leaflet or file in Internet</p>

#### 4.1 ISO 14025 and ISO 21930

ISO 14025 (Environmental labels and declarations – Type III environmental declarations – Principle and procedures) provides the principles and requirements for type III environmental declarations (EPDs) for products. Background is consumer and business information on products based on the product life cycle. Type III environmental declarations contrast to type I and type II environmental declarations: An example for type I environmental labelling is the European Ecoflower. Type II are company- or brand-specific, self-declared environmental claims. Type III environmental declarations are based on LCA of the product and are suitable for comparison of products with the same functionality.

EPDs are set up in the framework of an environmental declaration programme. In Europe there are several programmes; most of them are national, some are supranational, others are sector specific. The programmes are voluntary and are managed by a system operator. The general programme instructions define the scope and objective of the programme, involvement of interested parties, data confidentiality management, procedure of



independent verification and last not least the procedure for development of product category rules (PCR). In a product category all products that fulfil equivalent functions are united. PCR contain the instructions on how to produce the data required for the declaration.

EPDs may include data from the following categories:

- Data from life cycle inventory analysis according to the PCR, like consumption of resources, emissions to media, etc.
- Indicator results of LCIA, like climate change, etc.
- Other indicators such as quantity and type of waste produced

Moreover additional environmental information shall be given in accordance with the PCR:

- Information on issues such as impact on biodiversity, etc.
- Data on product performance (if environmentally significant)
- Instructions and limits for efficient use
- Human health risk assessment and environmental risk assessment
- Preferred waste management options for used products
- Information on absence (“...free”) or level of presence of certain substances that are considered of environmental significance
- Etc.

ISO 21930 (Sustainability in building construction – environmental declaration of building products) applies to EPDs of building products. The standard provides a general framework for PCR of building products.

In many cases EPDs are prepared for building products for which specific stages of the life cycle are not considered. This may be the case for building materials or components where multiple functions in a building are possible and therefor stages of use and disposal are not known. Thus EPDs may be given for only part of the life cycle stages, e.g. for production (“cradle to gate”). The EPD must then identify that it does not include the whole life cycle. In this case the EPD becomes a modular environmental declaration.

To obtain a complete LCA of a complete product the information modules of all stages of the life cycle and of all parts of the product have to be combined (and obeying to the requirements of ISO 14040 series).

PCR should address the following issues:

- Definition of product category
- Definition of functional unit
- Choice and description of system boundaries
- Choice of allocation rules and cut-off criteria

- Choice of impact categories
- Choice and description of sources/databases
- Etc.

The standard requires that pre-set categories and parameters are to be included in the project report. The elements encompass LC inventory results and/or LC impact category indicators. They are complemented by other environmental information, e.g. on information about influences on indoor air quality. As an example, the use of resources is divided into the following categories:

- depletion of non-renewable energy resources
- depletion of non-renewable material resources
- use of renewable material resources
- use of renewable energy resources
- use of recycled materials
- consumption of freshwater
- land use if quantifiable

The impact category indicator comprises the results for:

- climate change
- destruction of the ozone layer
- acidification
- eutrophication
- formation of photochemical oxidants
- human toxicity
- ecotoxicity

ISO 21930 is not predestined to derive the “EPD of a complete building”. Further guidance has to be given. This is the main objective of the CEN TC 350.

## **4.2 CEN TC 350**

### **4.2.1 Mandate and structure of work of CEN TC 350**

In 2004 the EC issued a standardisation mandate to CEN to foster the development of sustainable construction. In the mandate it reads

“The goal of the Commission is to provide a method for the voluntary delivery of environmental information that supports the construction of sustainable works including new and existing buildings (not all construction works will be included). These buildings should provide all of the necessary functions to the users whilst minimising their

environmental impacts. One way to achieve this goal is to provide environmental information on the construction products and the materials that are used. This results in voluntary Environmental Product Declarations (EPD). The information should be presented in a format that is useful for other parties, such as architects and contractors.” (p.3, par. 1)

“Based on a study commissioned by DG Enterprise and as the result of several workshops with experts the possible routes towards standardisation have been explored. Two routes were identified as most promising:

- The development of a standard for the environmental performance of buildings; and
- The development of a horizontal standard for Environmental Product Declarations (EPD) for building products/materials.

As the result of further discussions DG Enterprise chose to combine these two.” (p.5, par. 12)

In its answer to the mandate CEN outlined the scope of the CEN TC 350. Besides the requirements for standardisation on product level emphasis is moved to the whole building and to an integrated assessment. Not only environmental performance, but although life cycle costs and health and comfort aspects should be considered:

“The field of the work is to develop voluntary horizontal standardised methods for the assessment of the environmental performance of new and existing buildings and for standards for the environmental product declaration of construction products, in the framework of the integrated performance of buildings. The becoming standards will be applicable (horizontal) and relevant for the assessment of buildings over its life cycle.” (p.3, ch. 2.3).

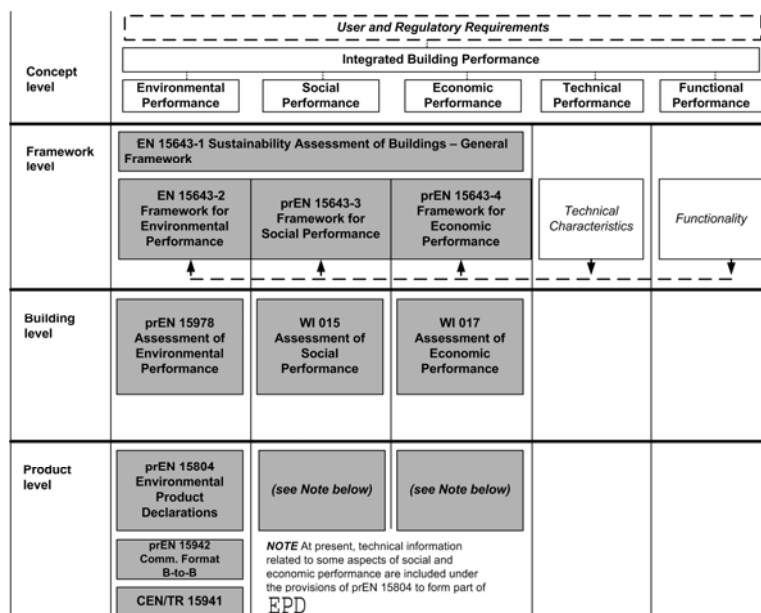


Figure 2: Concept of CEN TC 350

The work programme of CEN TC 350 is illustrated by figure 2. On framework level the general principles and requirements of sustainability assessment of buildings are

expressed in a suite of framework standards (EN 15643-1 General framework, EN 15643-2 Framework for the assessment of environmental performance, EN 15643-3 Framework for the assessment of social performance, EN 15643-4 Framework for the assessment of economic performance). Since it is likely that they all will be combined into one in a first revision the wording is largely the same in all four parts. These standards define the object of assessment from their point of view, consider the building life cycle, give the impacts and aspects that will be used in the building assessment, categorize the data types and state general methodological requirements.

The impacts and aspects are made operational by giving indicators and calculation methods on building level:

- EN 15978 (“Sustainability of construction works – Assessment of environmental performance of buildings – Calculation method”)
- prEN 16309 (“Sustainability of construction works – Assessment of social performance of buildings – Calculation method”)

The standard EN 15978 deals with aggregation of the information at the building level, among other describing the rules for applying EPD in a building assessment. The identification of boundary conditions and the setting up of scenarios are major parts of the standard. Another important part is how to deal with products that have different required service life during the reference study period of the whole building. The predetermined indicators that shall be included in an assessment are given: there are 19 indicators describing environmental impacts, resource use and additional information (waste categories and output flows. More information on the indicators is given in prEN 15804.

On product level EPDs were adapted from ISO 14025 and ISO 21930. The product level CEN standards are described in the next chapter.

#### **4.2.2 Standards and reports of Cen TC 350 on product level**

On product level 3 documents have been developed:

- EN 15804 (“Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products”)
- TR 15941 (“Sustainability of construction works – Environmental product declarations – Methodology and data for generic data”)
- EN 15942 (“Sustainability of construction works – Environmental product declarations – Communication format business-to-business”)

The main document is the EN 15804. It provides so called core product category rules for all construction products and services. The scope is to ensure that all EPDs of construction products, construction services and construction processes are derived, verified and presented in a harmonised way. It thus serves as a superordinate PCR for all construction products and services. The underlying aim is to express EPDs in a form that allows aggregation (addition) to arrive at complete information for a building, allowing to

identify those buildings or alternatives (in design and products) that cause less stress to the environment.

The core PCR (chapter 1 - scope)

- defines the parameters to be declared and the way in which they are collated and reported,
- describes which stages of a product's life cycle are considered in the EPD and which processes are to be included in the life cycle stages,
- defines rules for the development of scenarios,
- includes the rules for calculating the Life Cycle Inventory and the Life Cycle Impact Assessment underlying the EPD, including the specification of the data quality to be applied,
- includes the rules for reporting predetermined, environmental and health information, that is not covered by LCA for a product, construction process and construction service where necessary,
- defines the conditions under which construction products can be compared based on the information provided by EPD.

A structure for information modules (i.e. a unit process or unit processes) is defined according to the life cycle of products and their use in the building context and their disposal. The structure is illustrated in the following figure:

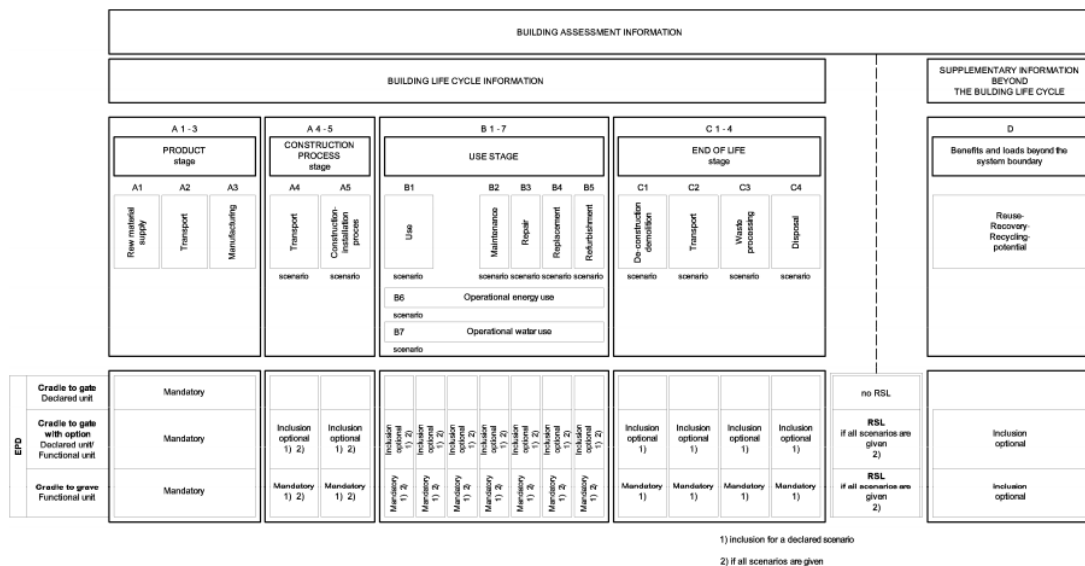


Figure 3: Information modules for EPDs and for building assessment.

The figure 3 also shows which types of EPD (cradle-to-gate, and others) are distinguished and what information modules they require.

The EPD of a product or service shall give the functional unit. The functional unit, used as the denominator provides the basis for the addition of material flows and

environmental impacts for any of the life cycle stages and their modules for the construction product or service. Sometimes the precise function of the product or scenarios at the building level is not stated or is unknown. The EPD covers not all life cycle stages as information modules, i.e. in the case of a cradle-to-gate EPD. The declared unit is used instead of the functional unit then. Examples are: 1 item (e.g. 1 brick), 1 kg of cement, 1 m<sup>2</sup> of wall elements, etc.

Module D (Benefits and loads beyond the system boundary) includes reuse, recovery and/or recycling potentials. E.g. steel can to a great extent be reused without loss of performance. So module D shows the potential future bonus that occurs if the product or material is reused or recycled (in terms of fewer primary materials like ore or less primary energy).

To present environmental information in a structured and consistent way and in a common format, a generic template is needed. This template is described in EN 15942 (“Sustainability of construction works – Environmental product declarations – Communication format business-to-business”). It is called the Information Transfer Matrix (ITM).

The ITM addresses the following types of information according to EN 15804:

- general information;
- declaration of environmental parameters derived from LCA:
  - parameters describing environmental impacts;
  - parameters describing resource input;
- additional environmental information describing different waste categories and output flows;
- scenarios and technical information;
- additional information on emissions to indoor air, soil and water during the use stage.

The last point will in future hold the testing results that have to be compiled as defined by the standards that are generated in CEN TC 351. These standards will be the first step towards analysing the impacts due to emissions during the use phase of products. Currently emissions are given following national directives, e.g. the AgBB scheme in Germany (more details see chapter “Indoor emissions” of report LoRe-LCA-WP3-D3.1\_Armines).

## **5 EPDs in practice: Systems of EPDs and PCRs**

More and more systems of type III environmental declaration programmes have emerged in Europe and worldwide. The following table collects the major systems in Europe that are relevant for the construction sector. Some data are presented which have been determined by investigation of the websites (in August 2011). The systems differ substantially, so numbers are not easily comparable. The systems are described in more detail in the next chapter.

With the exception of the International EPD® system which covers all products, all systems are construction specific.

Table 2: EPD systems in Europe

System	System operator	Country	PCRs	Number of EPDs
IBU (former AUB)	IBU (Institut Bauen und Umwelt)	Germany	34	195
International EPD® system	International EPD® system secretariat	Sweden; also used in Italy, Czech Republic, Germany, Belgium, Japan, Portugal, Lithuania, Latvia, and others.	6 PCRs in category “construction and construction services”	0 in category “Constructions and construction services”, but 33 building materials and elements are registered in other categories
EPD-Norge	Norwegian EPD foundation	Norway	17	60 EPDs in the category building materials
Environmental profiles	BRE Global (Building research establishment)	UK	1	42
FDES (Fiches de declaration environnementale et sanitaire des produits de construction)	INIES	France	-	661 in 10 product categories
MRPI (Milieu Relevante Product Informatie)	MRPI-bureau	The Netherlands	? (not available)	? (not available)
RT Environmental declaration	RTS Building Information Foundation	Finland	-	27
MVD (Miljøvaredeklaration)	MVD-secretariat at Dansk	Denmark	3 (Electricity, windows, roof)	? (not available)

	Standards		windows)	
DAPc – Declaración Ambiental de Productos en el sector de la Construcción	CAATEEB (Collegi d'Aparelladors, Arquitectes Tècnics i Enginyers d'Edificació de Barcelona)	Spain	2 (Ceramics, Insulation)	11 (8 ceramics + 3 insulation)
EAA Europe (Aluminium)	EAA-Building group of the European Aluminium Association	Europe	1	2 (windows, flat products)
Plastics Europe	Plastics Europe	Europe	?	Several

### 5.1 Description of the (national) systems

Several European countries have developed and implemented in recent years systems for the environmental declaration of building products - the degrees of implementation are quite different, though. They all are based on LCA, and have a similar basic approach, but there are differences in their specific application, so the results are not straightforward comparable.

E.g. some systems do not put emphasis on elaborating PCRs. In all systems product categories are defined differently, so a product might be listed in another category in another system. Sometimes there are several products of a manufacturer that are covered in one EPD. There are also sector- or branch-EPDs that provide average data of several manufacturers. The EPD is valid for the named products and manufacturers then.

ISO 14025 states that programme operators should contribute towards a common understanding by considering already existing PCRs in the same product category and the appropriate market area. A justification has to be given if readily available PCRs are not used.

The necessary harmonisation has only started recently with the standards of CEN TC 350. The major aim is to provide rules and definitions to ensure comparability of all systems based on EN 15804. It can be expected that this standard will be implemented by all major systems.

A platform on supra-european level is provided by GEDnet (Global environmental declarations network). This is an international non-profit association of type III environmental declaration organisations and practitioners. GEDnet fosters co-operation and information exchange by operating a PCR database, organising meetings, etc.



In addition to the systems described there exist several other construction related databases that offer environmental information of products. E.g. the Austrian Baubook is a database that is used for calculating the grant of the housing subsidy. 3 LCA indicators, the PEI, the GWP and the AP are summed up to give the so called OI3-index of the materials comprising the thermal envelop of the building. Producers can enter their products into the database themselves after submitting the relevant product information (certificates) to the Baubook GmbH.

Another recently established example of a database that contains product EPDs is the Envimat from Czech Technical University.

### **5.1.1 IBU (Germany)**

IBU (Institut Bauen und Umwelt) has been founded by construction product manufacturers. IBU certifies consistently based on the ISO standards. Independent experts from research, Germany's Ministry of Construction, the German Environmental Agency (UBA), and health and environmental experts are involved in audits.

Environmental product declarations are created by means of a three-stage process for which at any time different people are involved. The aim of this procedure is to produce transparency and confidence. In the first stage, a draft PCR (Product Category Rules) document is created in a production group forum. The draft is checked and improved by an open consultation of interested parties.

In the second stage, the actual declaration is created. The manufacturer has to provide all information required by the PCR document. The testing methods and Lifecycle Assessment methodology are laid down in the PCR document. In the third stage, the declaration is checked. The committee of experts organises the checking of individual declarations by independent third parties.

Titels of IBU-PCRs are e.g.: Coatings with organic binding agents, Building metals, construction steel, prefabricated concrete units, roofing stones, roofing tiles, dispersion adhesives and precoats, plastic and metal screw anchors/wall plugs, fibre cement, floor coverings, plasterboards, glass reinforced mesh, glass for façade and ceiling coverings, wood materials, etc.

### **5.1.2 International EPD® system (international)**

The secretariat is staffed by Swedish environmental management council. The international EPD®system is following the ISO standards upon the general programme instructions, the instructions for developing the PCR and the data collection and calculation for the EPDs. It is spread in specific in Sweden and Italy and is used by international companies.

The products covered are ranging from Agriculture, forestry and fishery products, ores, minerals, stone, energy and water, food and beverages, textile and furniture, wood and

paper, rubber, plastics, glass and chemicals, metals, machinery and appliances, transport equipment and services, constructions and construction services, and other.

At the moment there are 212 PCRs for 12 categories; among them 6 PCRs in category “construction and construction services”. In category “Construction s and construction services” no EPDs are registered because PCRs are in consultation (PCR buildings, PCR highways, PCR Concrete). But most building materials and elements are anyhow registered in “Wood and paper” (6 EPDs of building materials), in “Textile and furniture” 2 EPDs, in “Rubber, plastics, glass, chemicals” (19 EPDs), and in “Metals” (6 EPDs).

The international EPD® system has introduced a PCR classification on a hierarchic approach building on the UN CPC product code: a PCR basic module contains the requirements which are common for all products which belong to the specified product group (CPC 2 digit level). The PCR basic module identifies also specific requirements or information, which is decided upon on a more detailed level (PCR modules for detailed products: CPC 3 digit to 5 digit levels).

### **5.1.3 EPD-Norge (Norway)**

Norwegian EPD foundation was founded by the Confederation of Norwegian Enterprises (NHO) and the Federation of Norwegian Building Industries (BNL). The Norwegian EPD Foundation is responsible for ensuring that Norwegian Product Category Rules (PCR) comply with the ISO 14025 Standard as well as ensuring that EPD's are developed in accordance with PCR.

The Norwegian EPD Foundation collaborates with the 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). 17 PCRs are available in the categories furniture, building materials (9 PCRs), packaging, chemicals and other (which are Wild caught fish and soccer pitches).

### **5.1.4 BRE environmental profiles (UK)**

BRE's environmental profiles were set up even before the ISO 14040 norm was issued because a reliable way of assessing and certifying materials was needed to prove environmental performance e.g. within the BREEAM building assessment scheme. The focus is on building materials and products.

Environmental profiles measure the impacts of a construction material, product or building system throughout its life – not only during its manufacture, but also its use in a building over a typical building lifetime. This includes its extraction, processing, use and maintenance and its eventual disposal. Once certified, environmental profiles are reviewed on an annual basis to ensure they remain valid, and are recalculated every three years.

The certification process commences with the manufacturer supplying information about the factory and the manufacturing process. This information is reviewed by BRE and verified with a site audit. The Life Cycle Assessment (LCA) modelling to derive the environmental profile then takes place. On completion of the profiling, a client obtains a certificate, a Certified Environmental Profile, a Green Guide rating (if the product type is covered in the Guide), and a report of the assessment findings.

Products are assessed using the LCA methodology BES 6050 developed by the Sustainability Group at BRE Global. This document has the status of a PCR called “BRE Methodology of construction materials, components and buildings: Product Category Rules (PCR) for Type III environmental product declaration of construction products 2008”. This methodology is used to generate the Environmental Profiles for 1 tonne of each product as well as various elemental profiles to show their environmental performance as a square metre of a building construction.

### **5.1.5 FDES (France)**

FDES is the abbreviation of “Fiches de declaration environnementale et sanitaire des produits de construction”. They are gathered in the “Inies”-database which is operated by CSTB. A strategic committee lead by the French ministry of housing makes sure that the INIES data are relevant. A technical committee grouping building products manufacturers (AIMCC), the French energy and environment agency (ADEME), CSTB and other professionals ensures the clarity and homogeneity of data available in INIES.

In INIES-database all products are admitted that meet the general standard AFNOR PF P01-010 “Qualité environnementale des produits de construction – Déclaration environnementale” (December 2004). This standard gives the calculation method and declaration format of the environmental (requires LCA) and health information (often requires additional tests). The technical committee checks the conformity of the manufacturer’s data. Since 2006 producers can in addition ask for verification which is funded by a AFNOR programme of for the environmental and health declaration of construction products. Products that have been checked by an independent third party are distinguished in INIES database. However not all INIES products are verified.

The EPD is valid until the producer decides that the EPD shall be updated.

### **5.1.6 MRPI (Netherlands)**

MRPI (Milieu Relevante Product Informatie) stands for environmentally relevant product information. MRPI was initiated by the Dutch Builders Association (NVTB) and the Ministry of Housing. A Dutch standard NEN 8006 (“Environmental information for building products”) was issued in 2004. In 2006, about 25 branch organisations and more than 400 companies have obtained MRPI certificates.

The certificate is a type III label using LCA methodology for cradle-to-gate LCA (obligatory) or cradle-to-grave LCA (voluntary). An ISO "Technical Report" describes the results. After a third party review the MRPI logo can be used.

### **5.1.7 RT Environmental declaration (Finland)**

The RT Environmental Declaration is based on a national methodology (“Methodology for Compiling Environmental Declarations for Building Products and Assessing Environmental Impacts of Buildings”) following the basic principles of ISO 14040 series, 14020 series and ISO 21930. It is developed in cooperation with the Confederation of Finnish Construction Industries RT, the Building Information Foundation RTS, VTT Technical Research Centre of Finland and companies in the construction business.

The declaration is granted for three years provided that the composition and method of manufacturing the product have not changed. All verified declarations are published on the Web site of RTS.

### **5.1.8 DAPc (Spain)**

DAPc is an EPD system, pioneer in Spain, based on the ISO 14025 and following the guidelines of the draft European standard.

The Regional Government of Catalonia has promoted and co-led the project. The Col·legi d'Aparelladors, Tècnics i Enginyers Arquitects of Barcelona d'Edificació also co-led the project and acts as the DAPc Administrator. The Research Group “GIGA-ESCI” was contracted for the creation of the DAPc system and the drafting of all the DAPc documents. On the other hand, the “Institut de Tecnologia de la Construcció de Catalunya” (ITeC) is the verifying entity of the LCA studies of the products.

In addition to these entities, some companies are participating, such as Isover, Rockwool, Roca, Porcelanosa, Basf, etc.

So far, two Product Category Rules have been developed in DAPc: ceramics and insulation products; and 11 products have obtained the DAPc certification.

For more information see: [http://csostenible.net/sistema\\_dapc/index.php/dapc/es/inicio](http://csostenible.net/sistema_dapc/index.php/dapc/es/inicio)

## **5.2 Data handling (requirements and sources)**

General requirements on data, like representativeness, appropriateness, completeness, etc. are formulated in the fundamental ISO norms for LCA (ISO 14044) and for type III declarations (ISO 14025). Several handbooks help to understand the standards and give practical examples<sup>1</sup>. Verification ensures that the datasets meet the requirements.

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<sup>1</sup> E.g. the ILCD handbook (International Reference Life cycle Data System: General guide for Life Cycle Assessment – Detailed guidance), JRC, European Union, 2010

Transparency of data (with respect to system boundaries, allocation and cut off procedures, scenarios for use and end of life, etc. as specified in EN 15804) remains to be one of the most important aspects notably because of the vast amount of data that have to be joined into a building assessment.

Guidance on generic data for building product EPDs is given by TR 15941 (“Sustainability of construction works – Environmental product declarations – Methodology and data for generic data”). This TR (Technical report) of CEN TC 350 distinguishes the types of generic data and addresses the following data quality issues: time-related coverage, technology coverage, plausibility check, completeness, documentation of data sources and uncertainty. Sources, selection and use of generic data are described.

Until now it is not required that EPD have to do a periodical update of data. Also a third party verification is not mandatory. EPD systems deal differently with respect to this. There have to be further commitments in this area to foster the use of EPDs in regulation (e.g. in future CE-marking).

## 6 Survey on EPD in practice

A small survey on the status of use and availability of EPDs has been conducted in 2009 among the project partners and some external experts (see questionnaire in Annex 1, question 5). However at that moment the national committees and organisations that are engaged or assigned to this topic (e.g. mirror committees to CENT C 350, etc.) were just starting to discuss the national implications of harmonisation.

In the last years several EPDs have been set up by product manufacturers that are dedicated to environmental issues. At the moment sector- or branch-EPDs start to be compiled by industry sector associations on national level. These EPDs will provide reliable data from the member companies.

In the survey the experts and partners felt that there is a disparity between European countries: On the one hand there are front-runners like UK, Germany, France and the Scandinavian countries that operate advanced EPD systems. They are already described in the preceding chapter. On the other hand some countries do not offer or promote any system, e.g. Hungary and Bulgaria. Other countries (e.g. Malta) are observing EU politics and trying to actively promote the national consequences, e.g. organising seminars for professionals, etc.

Some countries have a slightly different strategy with own declarations and own databases. In Sweden EPDs on building products are hardly available at all – although the international EPD® system originates from Sweden. Instead the Swedish Eco cycle council for the building industry has introduced the Building Product Declaration (BPD). This is a standardised format for reporting, but a self-declaration. In the Eco cycle’s database there are currently 196 BPDs available for the public. The BPD is a voluntary system, however since the BPDs form an important information source for the two competing tools for material choice in Sweden today (see report LoRe-LCA-WP2-D2.1-

IFZ); most building products have this kind of declaration even though it is not according to the latest guidelines by the EcoCycle council. Guidelines and format of the BPD can be downloaded in English at:

<http://www.kretsloppsradet.se/home/page.asp?sid=5287&mid=2&PageId=45786>

In some countries national construction product databases are capable to incorporate products that have acquired an EPD (or at least part of the EPD information). E.g. the Austrian Baubook is a database that is used for calculating the grant of the housing subsidy. 3 LCA indicators, the primary energy (PEI), the GWP and the AP are summed up to give the so called OI3-index of the materials comprising the thermal envelop of the building. Producers can enter their products into the database themselves after submitting the relevant product information (certificates) to the Baubook GmbH.

In Germany the database Ökobau.dat by the Federal Ministry of Transport, Building and Urban Affairs (BMVBS) delivers also generic LCA information of building materials which is used in the building assessment scheme DGNB (“Deutsches Gütesiegel Nachhaltiges Bauen - The German Sustainable Building Certification”).

Being long established systems other environmental labels (type I and type II according to ISO nomenclature) are often better known and of bigger importance in the communication to consumers and end-users (architects, clients) than EPDs. So these labels are often mentioned in the questionnaires’ answers. They may also provide additional information e.g. about health issues<sup>2</sup>. Additional information on safety aspects of chemical products are included in safety data sheets.

Prospective activities that will foster the use of EPDs are e.g. the inclusion in the HQE building label in France and the evolving Spanish “DAPc” system (Declaraciones Ambientales de Productos de la Construcción), coordinated by the Association of Architects of Barcelona. But In Germany the introduction of the national building certification system DGNB has moved the focus rather to environmental information of buildings than to products.

Several barriers were stated:

- The benefits of EPDs concerning the environment are not yet recognized by users and politics.
- There is no motivation for providing EPDs. The producers are not incited or required to compile EPDs. There is a lack of legislative requirements.
- EPDs means to disclose information on production processes. This could reveal too much information to business competitors and it could conflict with protecting own interests.
- There are some difficulties in understanding the implications of the EPDs, due to the poor knowledge of the environmental impact assessment methods, the product-category rules (PCR) and the general LCA methodology.

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<sup>2</sup> EPDs according to EN 15804 will also comprise information on dangerous substances - however, a business to consumer format has not been established.

- There is in most countries no financial support for the development of environmental product declarations (EPDs).

## 7 Summary and conclusions

Environmental Product Declarations (EPD) enable the dissemination of quantified environmental information about the life cycle of products. The standards ISO 14025, ISO 21930 and EN 15804 normalize these eco-labels. Several European countries have developed and implemented in recent years systems for the environmental declaration of building products. Others will follow in the very next years (Belgium, etc.) The background is often to provide construction material data for building assessment. However, the number of products that are included is still very limited. As a first step databases often contain generic information about “average products” or “average processes”. This is well justified for assessing buildings during the early design phase. As soon as the choice of materials and products is on the agenda EPDs specific to individual manufacturers are needed.

Currently, EPDs start to become important on expert level spurred by the work of CEN TC 350. Companies that are active on the European market as well as more and more consultants in the field of sustainable buildings are supporting the development of EPDs. Nonetheless a discussion in a larger audience is still pending<sup>3</sup>.

It is important for the construction business that environmental information be provided in an objective, standardised form to avoid costly adaptations of the calculation in every country the product shall be traded. It is also important that the competitive conditions are equal for both national and foreign enterprises.

To remove the barriers mentioned in the preceding chapter a strategy has to be developed that comprises information on benefits and tools to get useful results out of EPDs and to relate this to the business (i.e. money). Construction business representatives especially of small and medium sized enterprises today are struggling with several new requirements in their sector like REACH and CE-marking. EPDs are not high on their agenda. Only few manufacturers have experiences with eco-design or LCA, let alone with standardized EPDs. Branch organisations have an important role as intermediaries in the process towards the broader uptake of EPDs.

Generic data from branch-organisations are first but in the long run companies want to distinguish from competitors. For this goal instructions have to be even better detailed and give better guidance to companies that want to set up EPDs themselves. A possible role for product TCs (CEN Technical committees for product standards) was to translate the horizontal EN 15804 into product type specific and more detailed rules. For this, TCs need a clear picture of what environmental or sustainability aspects are required to be declared in future, with regard to the intended use of their product.

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<sup>3</sup> Recently ANEC, the European consumer association has taken a rather critical position (September 2011) as for the ability of consumers to deal with information from EPDs.

A European platform “ECO” for supporting the merge of existing EPD formats to a common European format was initiated by IBU in autumn 2011. The platform follows a “grass root approach”: It aims to facilitate the implementation of EN 15804 and at the same time encourages a regional language and regional additional demands<sup>4</sup>.

Until now it is not required that EPD have to do a periodical update of data. Also a third party verification is not mandatory. There have to be further commitments in this area to foster the use of EPDs in regulation (e.g. in future CE-marking).

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<sup>4</sup> Schmincke, E.: „European EPD, an information tool for performance oriented building assessment”, Proceedings of the World Sustainable Buildings Conference 2011 (SB 11), Helsinki 2011.



# Appendix 1

## Questionnaire to project partners and to external experts

LoRe-LCA  
("Low resource consumption buildings and constructions by use of LCA in design and decision making")

Questionnaire for external experts

**LoRe-LCA** ("Low Resource consumption buildings and construction by use of LCA in design and decision making") is a project within the EU-FP 7. **The aim** is to contribute to an increased use of Life cycle analysis (LCA) as a method to gather, analyse, evaluate and document comprehensive information on buildings and constructions. **The specific focus** of LoRe-LCA is on building's resource consumption (water, primary raw materials, energy, land) and waste generation. **This questionnaire** is dedicated to collect and compare various practices of assessing environmental performance of buildings used in different countries. From this evidence should derive:

- Is LCA meaningful and useful for practice in the construction sector,
- What are chances and barriers for a broader uptake of LCA.

### Questionnaire

#### on the use of LCA and EPD in your practice

#### 1.) Please assess the current situation of life cycle assessment in your construction practice

Where could LCA tools help in your construction practice?

Are there any requirements that have to be met and that are related to life cycle thinking (or LCA, LCC<sup>1</sup>)?

*Either in building acts, in building permits or subsidies or in procurement practice of influential clients during the life cycle stages of a building or of construction works (highways and streets, etc.)*

Describe current/envisaged legislation in the construction sector (products, works and building/construction) concerning life cycle issues.

*Examples of life cycle issues are: EPD<sup>2</sup>, CPD/CPR<sup>3</sup>, labelled products, environmental impact assessment, waste management, etc. Is the legislative situation perceived as complicated?*

Besides the requirements (mentioned above) are there any other common (formal and informal) ways involving life cycle-information on a building/construction (like documentation or transfer)?

*Communication on subjects like e.g. energy consumption, durability of structure and materials, disassembly, construction related transport.*

Regarding the operational costs of a building/construction: how important is it in practice?

*Are there requirements by regulations, subsidies, clients, etc. in your country? E.g. maximum heating energy consumption, maximum cleaning costs, etc.*

Regarding the working life/durability of buildings/constructions and its components: how important is it in practice?

*Are there requirements by regulations, subsidies, clients, etc. in your country? E.g. waste management, etc.*

<sup>1</sup> Life Cycle Cost

<sup>2</sup> Environmental Product Declaration

<sup>3</sup> Construction product Directive / Construction Product Regulation

LoRE-LCA

("Low resource consumption buildings and constructions by use of LCA in design and decision making")

Questionnaire for external experts

**2.) Please select your row in the table below and insert information on your company's/institution's and sector's use of LCA**

Please add a row if none is appropriate.

- Which life cycle stages **of the building/construction** should be covered:
  - Manufacturing of building products (raw material acquisition and processing, transports, manufacturing processes)
  - Transport to building site and construction
  - Interior: painting, flooring, "fixtures and fittings"
  - Operation and use, servicing and maintenance
  - End of use of the building: disassembly and disposal (including transport)
- Level of detail required:
  - No LCA, life cycle thinking only
  - Simplified with respect either-or/and
    - a) to the input data (e.g. estimated or representative of commonly used materials or processes),
    - b) to the "modelling" (e.g. qualitative),
    - c) to the building (e.g. covering only major elements of the building like the structure, or a very detailed description )
    - d) to the output (only few categories or single score indicator),
    - e) to the user interface
    - f) other
  - Detailed, including all materials and flows during the buildings life cycle, in specific considering the use phase and resource consumption within the use phase of the building, data collection on the whole building

Do you know the situation of any other actor / user group? Please complete also these rows or add row.

LoRE-LCA  
 ("Low resource consumption buildings and constructions by use of LCA in design and decision making")

Questionnaire for external experts

actor / user group	Life cycle stages of building important for the actor	Level of detail of LCA appropriate for actor (please refer to categories described in the text above)	Relevance of LCC of building for actor	Fields of business which could profit from LCA	Barriers concerning LCA
Producer of building products (either big / SME, national / internat.)					
Producer of prefabricated homes					
Client: investor					
Client: own use, also public administration					
architect, consultant, engineer					
construction company					
(local) authority, public					
Research Centre, University and LCA specialist (construction related)					

LoRE-LCA

("Low resource consumption buildings and constructions by use of LCA in design and decision making")

Questionnaire for external experts

**3.) Tools used in practice for building/construction assessment**

Best known LCA tool(s) available with national database:

Alternative tools and methods that are widely used or relevant in practice by the actors (see table above) to provide information on the building downstream or to the client or to the public, e.g. building assessment scheme, energy certificate, etc.:

Could you provide a concrete example (to be used as a short case study in the report), too?  
Please give a header/reference; we will contact you separately.

**4.) Your conclusions concerning the national situation**

What is the current status of LCA use in practice?

Have there been initiatives to introduce LCA? Are there LCA platforms or networks in your country? (Please provide information)

What barriers (technical, social, economic, by law) do exist in general and in particular concerning the LCA tool you mentioned above?

How could barriers be overcome? Which priorities, which strategies (cooperation with ..., etc.) are needed?

**5.) EPD in practice**

The ISO-standard 21930 "Sustainability in building construction -- Environmental declaration of building products" sets the criteria for EPDs of building products. But only few EPDs according to this standard are available. Information on products is also published in environmental labels and declarations of products. Reliable information should comply with the ISO-standards 14020 ff<sup>\*</sup> on environmental labelling and declarations. Information on a general level is issued in sector specific environmental reports. However, usually it is not possible to relate environmental impacts to certain products then.

What is the current status of environmental information on building/construction products in your country?

*How many EPDs are available in your country? Which other information is available?  
Who is dealing with environmental information? Are there already EPD requirements (of administration etc.) in place by now?*

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\* ISO-standards 14020 (Environmental labels and declarations -- General principles), 14021 (Environmental labels and declarations -- Self-declared environmental claims - Type II environmental labelling), 14024 (Environmental labels and declarations -- Type I environmental labelling -- Principles and procedures), 14025 (Environmental labels and declarations -- Type III environmental declarations -- Principles and procedures)

LoRE-LCA  
("Low resource consumption buildings and constructions by use of LCA in design and decision making")

Questionnaire for external experts

What are prospective activities concerning environmental information on building products?  
*What are the actors in this field? Are there any programmes?*

What are the barriers related to EPDs or to provide EPDs?  
*What are the actors in this field? Are there any programmes?*

Can you provide us with a copy (file or hard-copy) of a particular EPD in your country?  
*In your language, for illustrating the report.*

**Information on respondent:**

Name:

Company/institution and division:

Position and/or function (e.g. research):

E-mail and telephone number:

Field of expertise:

Country:

Date: