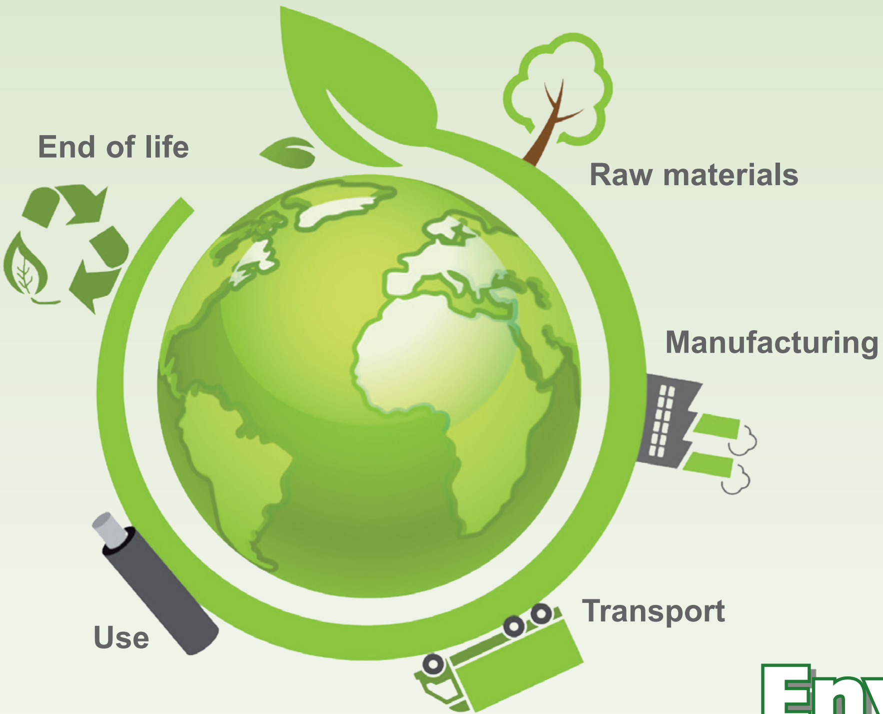

Environmental Product Declarations for Technical Insulation Materials

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Introduction

Construction is one of the most raw material- and energy-intensive industries. The building sector is the single largest consumer of raw materials worldwide and the greatest producer of greenhouse gas emissions. Some 30% of all raw materials are used to build and maintain buildings. 30 to 40% of greenhouse gases result from the construction, use or disposal of buildings. In the industrial nations a huge amount of energy is used in transport and industry, but the building sector accounts for the majority – around 40% of European energy consumption.

In view of advancing climate change, the shortage of finite resources and rapid urbanization throughout the world, it is becoming more and more important that buildings are planned and built with sustainability in mind. Buildings that consider aspects of sustainability in their design, construction or operation are known as 'green buildings'.

Green buildings not only emit less CO_2, they can also be operated more economically and sold more profitably. Alongside the internationally recognized LEED certificate (Leadership in Energy and Environmental Design) awarded by the US Green Building Council, the UK's BREEAM system (Building Research Establishment Environmental Assessment Method), the French HQE standard (Haute Qualité Environnementale) or the assessment system established in 2008 by the German DGNB (Deutsche Gesellschaft

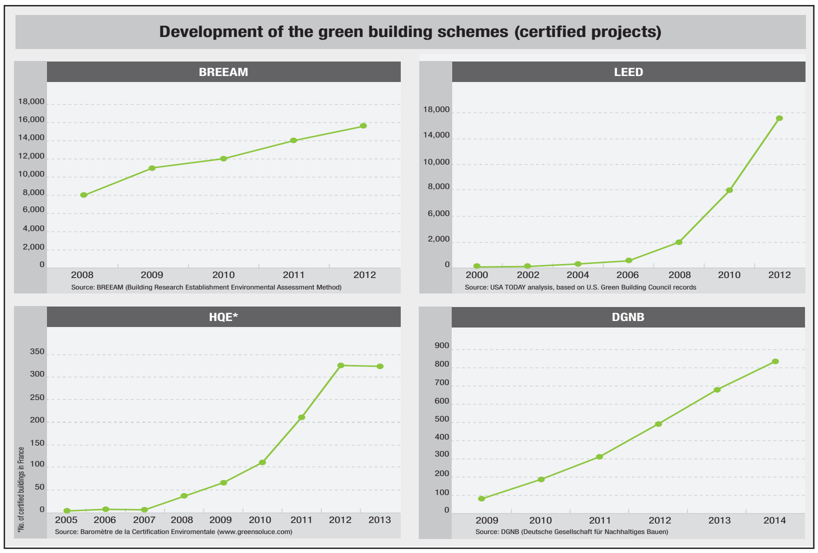

Figure 1: Development of the green building schemes

continued on page 66

continued from page 64

für Nachhaltiges Bauen), there are numerous other public and private initiatives on both national and international level. BREEAM and LEED in particular have gained significance throughout the world in recent years and, in many countries, have become the recognized standard with national chapters and country-specific versions. Especially for larger construction projects of international companies, endeavours are now made to attain LEED certification, sometimes in combination with a national assessment. The triumph of these voluntary green building schemes is reflected in the rapidly increasing number of certified construction projects (see *Figure 1*).

In future green building certification will play an ever greater role in the construction and real-estate sector. Many architects and specifiers already take the aspect of sustainability into account in their invitations to tender as a matter of course. Nowadays, not only the ease of installation and technical properties of the building materials used count, but also their environmental compatibility and their energy and economic efficiency.

Sustainability in the Building Sector

The simple, but profound, definition of sustainability: 'Act in such a way that the effect of your action is compatible with the permanence of real human life on Earth' [1] is the most condensed form of all subsequent attempts to describe the concept of sustainability.

Sustainable building takes an integrated and holistic view of the economic, ecological and social impacts of building activity on human beings and the environment. This includes various aspects such as energy efficiency, the origin (resources) and recyclability of building materials. Ingredients may be assessed for the role which the location of a building plays for its sustainability.

At building level sustainable construction includes all life cycle phases: planning, construction, operation, demolition. Of course the same also applies at the level which forms an important basis for the overall assessment of a building: the product level. Green building requires that the individual components of the building (i.e. the construction elements and products used) can also be described as being sustainable – compatible with the environment, energy efficient and economical. To prevent them getting lost in the jungle of advertising messages, green washing and numerous very different eco marks, specifiers need the greatest possible transparency – independent, standardized facts covering all aspects of the life cycle.

Life Cycle Assessment Provides Reliable Environmental Data

In order to evaluate construction products in all their complexity and impacts, a life cycle assessment (LCA) needs to be carried out. Only an LCA can take into account all the individual aspects which, viewed cumulatively or sequentially, allow a relative evaluation of the product. The basis for this assessment is ISO 14044, which together with ISO 14040 is the standard for an ISO-compliant, generally accepted LCA.

According to the International Standards Organization (ISO), an LCA consists of the following basic elements: inventory analysis, impact assessment and interpretation (see *Figure 2*),

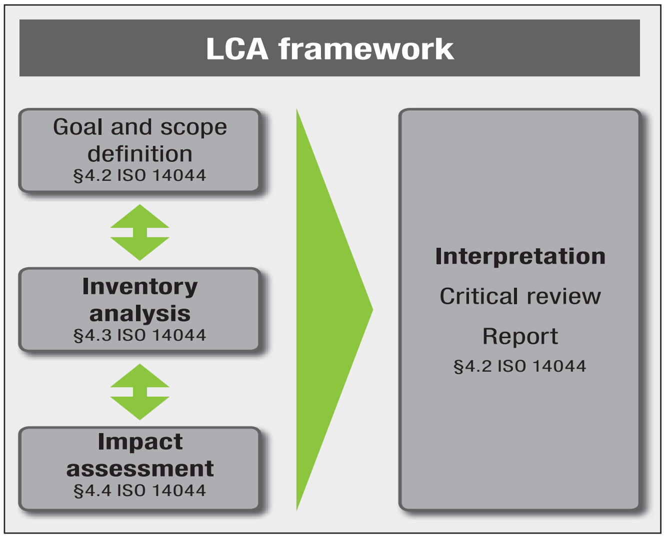

Figure 2: The structure of a life cycle assessment

which represent the framework for assessment. Three additional points – goal and scope definition, critical examination and report – are explicit requirements of DIN ISO 14040 and make the results of LCAs reproducible and comparable.

In principle an LCA is simply the analysis and interpretation of material flows during the manufacturing of a product and the environmental impacts in the course of its use and disposal. The outcome of an LCA are data sets which describe the various environmental impacts, such as global warming, ozone depletion, acidification, etc.

Environmental Product Declarations

The data resulting from an LCA are recorded according to special rules and then made available in the structured and validated form of environmental product declarations (EPDs).

In the European Standard EN 15804, the rules for Type III environmental declarations are described which should be used as the basis for EPDs in Europe (see *Figure 3*).

Drawing up EPDs in accordance with EN 15804 is an integrated method for making core environmental statements on construction products which can in turn be used to assess the building as a whole.

Types of environmental declarations (eco labels according to ISO standards):	
Type I	Declarations are made by a third party (according to ISO 14024) affirming compliance with pre-determined, multi-attribute, life-cycle based environmental performance requirements (e.g. German 'Blauer Engel' or 'US Green Seal').
Type II	Declarations reflect environmental performance claims made by a product manufacturer (according to ISO 14021). The performance criteria have not been independently verified (e.g. US 'GreenGuard' or 'Energy Star').
Type III	Declarations (according to ISO 14025) present in a consistent manner objective, quantifiable, life-cycle based environmental product information which has been independently verified by a third party. Also known as environmental product declarations (EPDs).

Figure 3: Types of environmental declaration

continued on page 68

continued from page 66

The provisions of EN 15804 ensure that comparable information on the environmental impact is presented, which does not depend on where the product was manufactured or is used. This information can apply to energy usage, resource consumption or degree of recyclability, for example. Declarations regarding environmental impacts such as over-fertilization, greenhouse effect or smog and also toxic effects on human beings and the environment arise from the underlying LCA and can also be described.

The results provided in EPDs create a high level of transparency and data security. They therefore represent an optimal basis for assessing buildings.

EPDs for Technical Insulation Materials

EPDs themselves do not contain any comparative statements. This makes sense because the same or similar products may be used in different situations.

An acceptable and reproducible comparative assessment of construction products can only be carried out by considering the entire use phase (i.e. usually in the building). And even then only by taking into account the impacts of conditions in the respective situation (building process, disposal, etc.) and the influences of the system boundaries.

EPDs in accordance with EN 15804 describe the sustainability performance of a product related to 17 life cycle modules: the product stage consists of three modules: Raw materials supply (A1), Transport (A2) and Manufacturing (A3). EPDs that only consider these three modules are referred to as cradle-to-gate declarations. The environmental information provided by an EPD which covers all stages of the life cycle (from the cradle to the grave) must be divided into the information module groups A1 - A3, A4 - A5, B1 - B5, B6 - B7, C1 - C4 and module D. (See *Figure 4*). However, only the declaration of the product stage modules, A1 - A3, is mandatory for compliance with EN 15804. The declaration of modules for the other stages of the life cycle is voluntary.

In the LCA the boundary between the specific system examined (technosphere) and the surrounding environment (resource or emissions boundary) is known as the 'system boundary'.

EPDs for technical insulation materials require the definition of product category rules (PCRs). Work is currently being carried out at European level (CEN/TC 88, Thermal insulating materials and

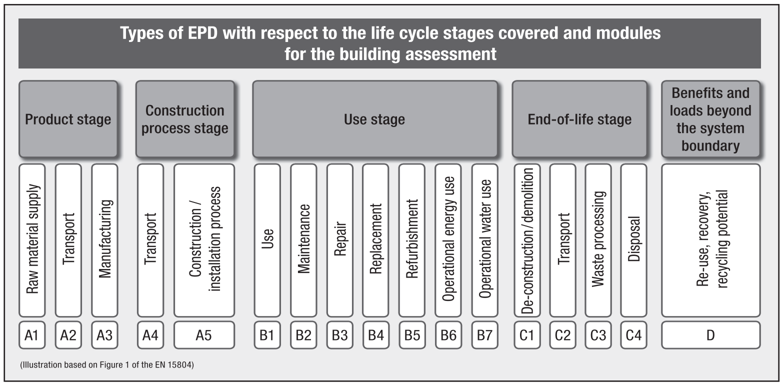

Figure 4: Life cycle phases and modules for describing and assessing the building

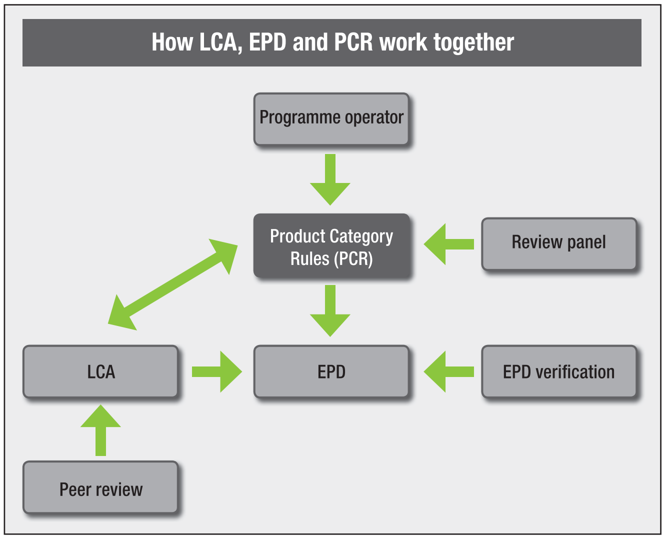

Figure 5: How LCA, EPD and PCR work together

products) on a standard for PCRs. For the time being, this is only available in draft form [2]. Until it is introduced the interpretative document (PCR) of a programme operator such as the Institut Bauen und Umwelt e.V. (IBU) can be used. Furthermore, the programme operator ensures that the important steps for drawing up an EPD in agreement with the ISO standards are followed. The IBU is currently the only EPD programme operator in Germany which has the required know-how and consistently certifies in accordance with the internationally agreed regulations. *Figure 5* shows the information flow and how LCA, EPD and PCR work together.

For insulation materials made of foam plastics such as FEFs (flexible elastomeric foams), the IBU has determined calculation methods and requirements based on the PCRs [3].

Comparison of types of environmental declaration

Type	LCA required	Confirmed by independent organization	Informative value
Type I – Label	–	✓	average
Type II – Claim	–	–	average
Type III – EPD	✓	✓	very high

Figure 6: Comparison of types of environmental declaration

All parties involved in the construction process benefit equally:

Architects, specifiers and those inviting tenders use EPDs as the basis for calculating the ecobalance, which is a prerequisite for green certification for buildings. Alongside the technical performance, costs, acceptance and aesthetics, environmental aspects are key criteria when selecting construction products. Ultimately EPDs are part of invitations to tender and the method by which environment-related requirements for planning the building are managed.

Real-estate companies and builder-owners evaluate their investments and property higher when EPDs and

continued on page 70

continued from page 68

green certification are presented. It is now becoming easier to market property which is designed and certified as sustainable.

Wholesalers, retailers and end users find verified environment-relevant product information in EPDs. They benefit from the added value resulting from sustainability in the building sector.

EPDs do not Allow Direct Comparisons

As already explained, the environmental performance of building products can only be assessed against the backdrop of the building concept and use.

For an ecological assessment it is always necessary to evaluate the materials in context, for example in connection with the structural element or the entire construction. The planning and design of the building, the concept behind the structure and equipment and the standard of workmanship achieved are decisive. Therefore a direct comparison even of the same or similar products makes little sense. The results of such comparisons cannot be reproduced and are therefore irrelevant as far as sustainability is concerned. Only in individual cases is it possible to decide whether construction product A is preferable to construction product B from an ecological point of view. LCAs and EPDs do not provide a practical approach for classifying or systematizing building materials.

Insulation materials made of sheep's wool may appear to be more ecological than FEFs, but if they were used to insulate refrigeration or air-conditioning systems, their contribution could hardly be described as sustainable – they would soon become completely soaked and would have to be replaced. As materials are used in different applications in buildings, general recommendations cannot be derived from EPDs.

Conclusion

Construction products are neither 'good' nor 'bad'. Their performance – whether technical, aesthetical or ecological – must always be viewed in the complete system. The proper use of building construction materials in the building, their performance, ease of installation and long-term behaviour are decisive for the planning, construction and maintenance of sustainable buildings.

Nowadays green building certificates are very important in the construction and real-estate sector. This is true for the erection of new buildings and the renovation of existing ones. The trend towards sustainable buildings will grow further in the future and all those involved in the construction sector should enhance their knowledge and competence accordingly.

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