Zukunft Bauen

ÖKOBAUDAT

Basis for the building life cycle assessment

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Federal Institute for
Research on Building,
Urban Affairs and
Spatial Development

within the Federal Office for
Building and Regional Planning

Zukunft Bauen

ÖKOBAUDAT

Basis for the building life cycle assessment

Dear Reader,

The Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR) in the Federal Office for Building and Regional Planning (BBR) is a departmental research institution under the portfolio of the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB). It advises the Federal Government on urban and spatial development functions and on housing, building and architecture. This encompasses areas such as building-related standards, the strengthening of public-private partnerships in public construction projects, the issuing of technical basis information for building contracts (records of standard services and data exchange) as well as environmental protection. It focuses on three goals: sustainable building, climate protection and energy saving.

With ÖKOBAUDAT, the BMUB – with the support of the BBSR – provides the general public with a free-standardised database for the life cycle assessment of construction works. The datasets are subject to strict quality requirements and therefore provide planners, architects and constructors with a reliable basis for scientifically sound calculations of the influences of construction works on the environment. ÖKOBAUDAT is a key element for assessing the sustainability of construction works and provides an incentive to continually improve the environmental quality of construction materials and buildings.

This brochure describes the technical and content-related quality characteristics of ÖKOBAUDAT, indicates the tools that can be used to calculate life cycle assessments and explains how data can be imported in to and exported from ÖKOBAUDAT.

I hope you will find this brochure insightful reading.

Harald Herrmann

Director and Professor
of the Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR) within the Federal Office for Building and Regional Planning (BBR), Bonn, Germany

Content

What is ÖKOBAUDAT?

The ÖKOBAUDAT platform

ÖKOBAUDAT is a platform with data, information and links related to the life cycle assessment of construction works (Figure 1). ÖKOBAUDAT is published in German and English at www.oekobaudat.de [1]. The ÖKOBAUDAT Users' Advisory Group and the international working group International open Data Network for Sustainable Building (WG InData) have stored their working environments on the ÖKOBAUDAT platform. At the platform's core is the online database with life cycle assessment datasets on building materials, construction, transport, energy and disposal processes. With the help of life cycle assessment tools, such as eLCA provided by the BBSR, the entire life cycle of a building can be reconstructed with the ÖKOBAUDAT database.

The data is subject to strict quality requirements and can be used in many different building assessment systems. The database system with its search and filter functions enables user-friendly online searches of the datasets. Previous datasets are archived online to ensure no information is lost.

DIN EN 15804-compliant data

Currently more than 1,000 datasets are provided on all important construction product groups, and these have been in compliance with DIN EN 15804 since 2013. This means ÖKOBAUDAT is the first life cycle assessment database that completely complies with this standard.

ÖKOBAUDAT

> online database
> compliant with the Assessment System for Sustainable Building (BNB)
> EN 15804-compliant
> high data consistency
> verified data quality
> free of charge
> standardised data format
> data transfer to advanced tools

Image above
Source: enzberg/IBO

BNB-compliant data and additional data

ÖKOBAUDAT is the mandatory database for the Assessment System for Sustainable Building (Bewertungssystem Nachhaltiges Bauen, BNB). It is published regularly, up to twice a year, with the year and version clearly indicated (for example ÖKOBAUDAT 2016-I). The data for the BNB system is primarily available in German.

Suppliers and users of life cycle assessment data outside of Germany are showing increasing interest in submitting and using ÖKOBAUDAT data. The ÖKOBAUDAT platform therefore also offers datasets based on ecoinvent background data as well as datasets available only in English. In all other respects, this data fully adheres to the ÖKOBAUDAT requirements in terms of quality and data format and, in justified cases, can therefore be used for BNB life cycle assessments.

Who is responsible for ÖKOBAUDAT?

The publisher of ÖKOBAUDAT is the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB).

Responsibility under the Press Act lies with the Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR) in the Federal Office for Building and Regional Planning (BBR).

ÖKOBAUDAT was developed with support from the German building materials industry and within the framework of research projects as part of the Future Building (Zukunft Bau) research initiative, in which thinkstep, IBO, KIT (Austrian Institute for Healthy and Ecological Building), Institute for Applied Computer Science ok*worx consulting and Online Now! GmbH were involved.

The BMUB provides the ÖKOBAUDAT data free of charge. The respective owners of the datasets remains responsible for the contents and values.
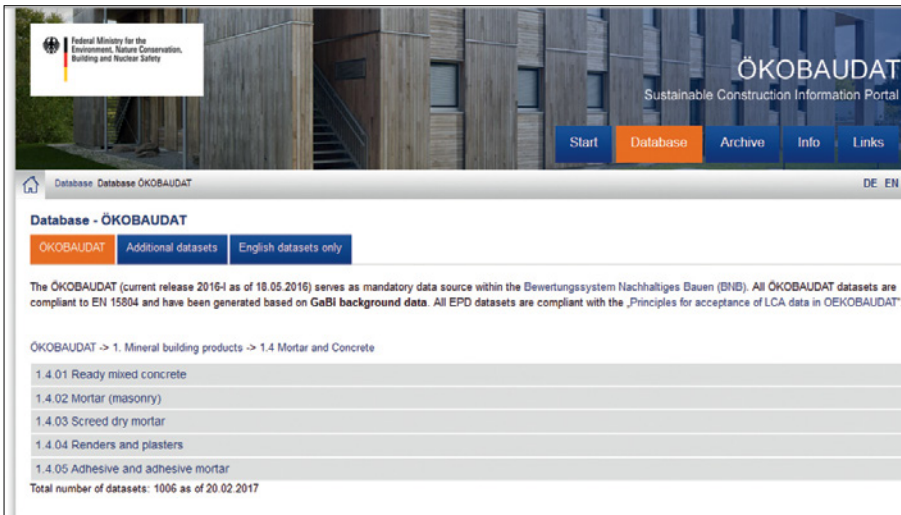

Figure 1
The ÖKOBAUDAT database system.
Source: BBSR

Life cycle assessments and environmental product declarations

Whereas in the classic planning process only the environmental effects of a building's energy requirements as per the Energy Saving Ordinance (Energy Performance Certificate) are taken into consideration, with the holistic planning approach, which is the approach pursued in sustainable construction, ecological effects of the materials used in the building are also included. The entire life cycle is taken into account, from material production and building construction, to the regular maintenance of the construction, dismantling and disposal of the materials. The environmental effects are calculated using a life cycle assessment (LCA).

What are life cycle assessments?

A life cycle assessment is a method for assessing the environmental effects of one or more product systems based on all the essential material and energy flows. It includes the recording of material and energy flows (life cycle inventory analysis), the classification and characterisation of the recorded substances in terms of their environmental effects (impact assessment) and the subsequent evaluation (Figure 2). Here the term "product systems" refers to products, systems, procedures and behaviour patterns.

Structure of the life cycle assessment – overview

Scope of the life cycle assessment

Goal definition

Inventory analysis (LCI)

Impact assessment (LCIA)

Interpretation

Uses
› Development and improvement of products
› Strategic planning
› Political decision-making processes
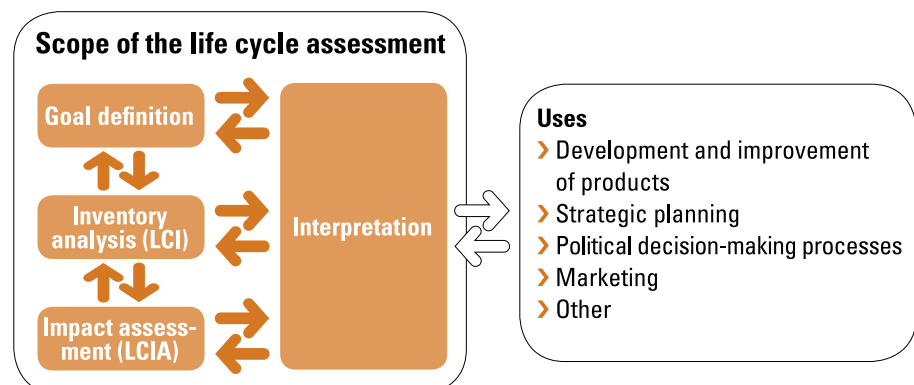› Marketing
› Other

Figure 2
A life cycle assessment is drawn up in four analysis steps. Source: ISO 14040

If the results are to be used to make comparative statements between two product systems, the life cycle assessment must be subject to a critical review by an independent expert.

Principles and framework as well as the requirements and guidelines for life cycle assessments are regulated in the international standards ISO 14040 and ISO 14044.

What are environmental product declarations?

Environmental product declarations (EPDs) provide environmental data on the basis of predetermined parameters. The abbreviation EPD is also widely used in German. An EPD contains life cycle assessment data as an essential element. This comprises parameters on resource requirements, waste materials and environmental impact categories.

In addition to environmental data and information, an EPD contains the product's essential technical and functional properties. This means that the product data can be used as elements in the life cycle assessment of building components and buildings, and products with equivalent functions can be compared with each other.

Environmental declarations are primarily intended for exchanging information within the supplier industry.

Product category rules (PCRs)

Product category rules represent the basis that EPDs – in addition to the standards – must refer to. PCRs contain all the product-specific rules, requirements and test procedures. The product category rules are drawn up in consultation with the interested parties and are examined by a committee of independent third parties (PCR review panel). The core rules for the product category of construction products are listed in EN 15804.

Development and operation of an EPD programme

An overview of the steps involved in developing and operating an EPD programme can be found in Annex A of ISO 14025. According to ISO 14025, key organisational elements of an EPD programme are:

> the programme operator – responsible for managing the EPD programme
> the PCR review panel – responsible for checking the PCRs (product category rules) and verifying the EPDs that are drawn up
> the product group forums – responsible for drawing up the PCRs
> the interested parties (manufacturers, suppliers, associations, users, consumers, non-governmental organisations, government offices, etc.). – The programme operator is responsible for ensuring that the interested parties are appropriately involved.

Core rules for construction products (DIN EN 15804)

DIN EN 15804 "Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products" provides the key rules for drawing up environmental product declarations (EPDs) for construction products. The rules apply to all construction product types ("horizontal standard") in order to minimise branch-specific ("vertical") deviations. At the European level, the standard therefore provides an essential basis for ensuring that the environmental effects of construction products, building services and building processes are determined, verified and represented in a consistent manner. In Europe, most EPD programme operators have switched to EN 15804.

Life cycle modules

The clear subdivision of the life cycle of construction materials and buildings into life cycle stages ("information modules") is one of the key accomplishments of EN 15804. Here the life cycle is divided into Modules A to D (Figure 3). Modules A1–A3 describe the product stage, Modules A4 and A5 the construction process stage (transport to the construction site and construction/installation), Modules B1–B7 the use stage, Modules C1–C4 the end of life stage including demolition and transport, and Module D the potential for recycling, recovery or reuse for the next product system.

Product stage			Construction process stage		Use stage							End of life stage				Benefits and loads beyond the system boundary
Raw material supply	Transport	Manufacturing	Transport	Construction-installation process	Use	Maintenance	Repair	Replacement	Refurbishment			De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5			C1	C2	C3	C4	D
					B6	Operational energy use										
					B7	Operational water use										

Figure 3
Life cycle modules in accordance with EN 15804.
Source: EN 15804

It is in essence possible to differentiate between three types of environmental product declarations following the modular life cycle model in EN 15084:

› cradle to gate (A1–A3)
› cradle to gate with options (A1–A3 + for example C1–C4)[1]
› cradle to grave (A1–C4)

A key change introduced with EN 15804 is that it is no longer permitted to offset the advantages gained from the reuse, recovery or recycling of a product against the expenditure at the start of the life cycle and to present this in the form of a single value. Instead, this potential is shown in a separate Information Module D (Figure 3). This clarifies which positive or negative environmental effects can be expected at which point in time.

Indicators
EN 15804 defines a total of 24 indicators which must be included in EPDs for construction products:

Indicators of environmental effect:
› global warming potential (GWP)
› ozone depletion potential (ODP)
› acidification potential (AP)
› eutrophication potential (EP)
› photochemical ozone creation potential (POCP)
› abiotic resource depletion potential – elements for non-fossil resources (ADP elements)
› abiotic resource depletion potential – fossil fuels (ADP fossil fuels)

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1 EPD covering the production and end of life stage

Indicators of resource use:

> use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE)
> use of renewable primary energy resources used as raw materials (material use; PERM)
> total use of renewable primary energy resources (PERT)
> use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials (PENRE)
> use of non-renewable primary energy resources used as raw materials (material use; PENRM)
> total use of non-renewable primary energy resources (PENRT)
> use of secondary material (SM)
> use of renewable secondary fuels (RSF)
> use of non-renewable secondary fuels (NRSF)
> use of freshwater resources (FW)

Indicators of waste:

> hazardous waste disposed (HWD)
> non-hazardous waste disposed (NHWD)
> radioactive waste disposed (RWD)

Indicators of output of material and energy flows:

> components for re-use (CRU)
> materials for recycling (MFR)
> materials for energy recovery (MER)
> exported energy (EE + carrier)

Life cycle modules and indicators in ÖKOBAUDAT

In ÖKOBAUDAT the environmental parameter values are indicated in a data sheet for all life cycle modules (Figure 4).

Figure 4
Environmental parameters for various life cycle stages as indicated in ÖKOBAUDAT. Source: BBSR

European standardisation committee Sustainability of construction works

EN 15804 is part of a series of standards whose purpose is to describe and evaluate the sustainability of construction works. All of these standards are drawn up by the Technical Committee CEN/TC 350 Sustainability of construction works. Other outputs of the CEN/TC 350 include EN 15978 "Sustainability of construction works – Assessment of environmental performance of buildings – Calculation method", which provides the basis for the life cycle assessment of buildings in the Assessment System for Sustainable Building (see page 14).

Using ÖKOBAUDAT

Assessment System for Sustainable Building (BNB)

The Assessment System for Sustainable Building (BNB, www.bnb-nachhaltigesbauen.de) [2] provides a scientifically sound and planning-based evaluation system for office, administrative, teaching and laboratory buildings. It gives equal consideration to the different life cycle stages of buildings while taking into account the ecological, economic and sociocultural quality as well as technical and process aspects (Figure 5). The BNB and its system variants are essentially aimed at constructors in the public sector.
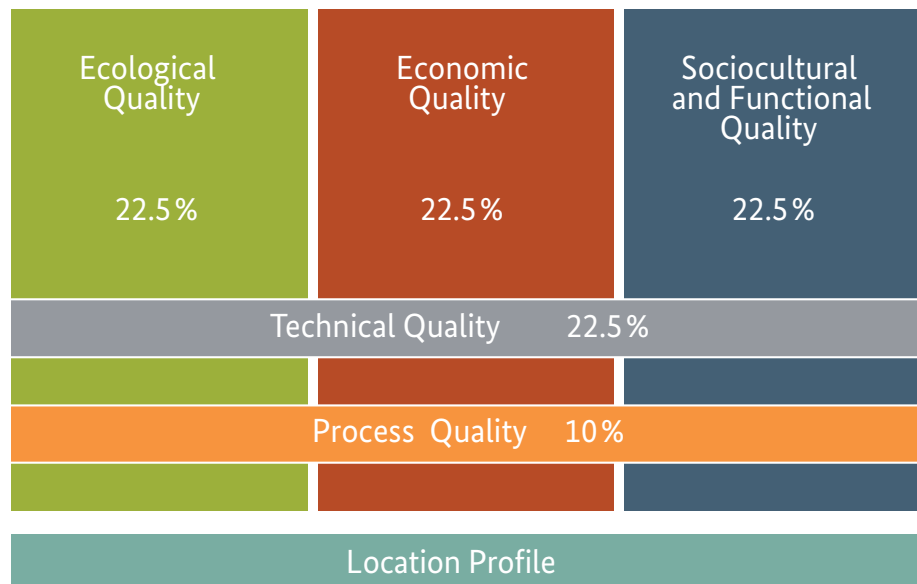
Ecological Quality 22.5%	Economic Quality 22.5%	Sociocultural and Functional Quality 22.5%
Technical Quality 22.5%		
Process Quality 10%		
Location Profile		

Figure 5
In the BNB system, ecological, economic, sociocultural, technical and process aspects as well as site characteristics are represented. Source: BBSR

The core criteria of the BNB system were developed by the BMUB, with scientific support from the BBSR, in a two-year cooperative collaboration with the German Sustainable Building Council (DGNB). Since then, the various system variants and their modules have been regularly updated and published by the BBSR. The assessment bases/methods are based on the currently applicable German laws, directives and regulations as well as national standards and guidelines for non-residential buildings.

Image above
Source: enzberg/IBO

Voluntary use of the BNB system by other market players and the recognition of other assessment systems by the BMUB are subject to a separate regulatory procedure.

With the introduction of the revised Guideline for Sustainable Building for the new construction of civil federal construction measures in the first quarter of 2011, the mandatory use of the Assessment System for Sustainable Building and hence the obligation to perform life cycle assessment calculations at the building level came into effect for the first time, for four federal construction projects. In 2013 the obligation was extended to all major civil federal construction measures. Since 2016, even the corresponding BNB use has required life cycle assessment variant analyses.

In BNB the following life cycle assessment indicators are assessed for the corresponding life cycle modules in accordance with DIN EN 15804 (Figure 6):

Effects on the global environment
1.1.1 Global warming potential (GWP)
1.1.2 Ozone depletion potential (ODP)
1.1.3 Photochemical ozone creation potential (POCP)
1.1.4 Acidification potential (AP)
1.1.5 Eutrophication potential (EP)

Resource use
1.2.1 Primary energy requirement

In these cases, ÖKOBAUDAT is the mandatory database for assessing global environmental effects in the BNB system. The tool eLCA (see page 16) provided by the BBSR must be used as a calculation tool in the BNB.

Ecological Quality	Ecological Quality	Sociocultural and Functional Quality	Technical Quality	Process Quality	Location Quality

CRITERIA OVERVIEW – NEW CONSTRUCTION AND COMPLETE REFURBISHMENT MODULES

ECOLOGICAL QUALITY	22.5 %	BN	BK	UN	UK*	LN
Effects on Global and Local Environment						
1.1.1 Global Warming Potential		●	◉	○	◉	◉
1.1.2 Ozone Depleting Potential		●	◉	○	◉	◉
1.1.3 Photochemical Ozone Creation Potential		●	◉	○	◉	◉
1.1.4 Acidification Potential		●	◉	○	◉	◉
1.1.5 Eutrophication Potential		●	◉	○	◉	◉
1.1.6 Risks to the Local Environment		●	◉	●	◉	●
1.1.7 Sustainable Material Extraction/Biodiversity		●	◉	●	◉	●
Demand of Resources						
1.2.1 Primary Energy Demand		●	◉	○	◉	◉
1.2.3 Drinking Water Demand and Quantity of Wastewater		●	●	○	○	◉
1.2.4 Land Consumption		●	◉	●	◉	●

Figure 6

Representation of the individual criteria for the main criteria group Ecological Quality in the Assessment System for Sustainable Building. Source: BBSR

Life cycle assessment in the BNB – an example of Efficiency House Plus Federal Environment Agency "House 2019"

When planning the Efficiency House Plus (a building which, over the course of a year, gains more energy than the building and its users consume) Federal Environment Agency "House 2019" (Figure 7), the BBR goal was to generate the amount of energy needed to operate the building for a year by using renewable energy sources and to actively minimise the environmental effects resulting from the construction. The corresponding life cycle assessment calculations were carried out using ÖKOBAUDAT data. The resulting global warming potential is extremely low compared to a conventional building, therefore making an important contribution to the Federal Government's CO_2 reduction policy at the building level.

eLCA software for building life cycle assessment

With the eLCA software (www.bauteileditor.de) [4], the online life cycle assessment tool for buildings, the environmental effects of buildings can be easily and quickly determined and assessed taking into consideration the entire life cycle. Here the basis for the calculation and assessment is the calculation rules in the BNB system.

The core component of eLCA is the component editor (Bauteileditor). In the component editor users can model components very easily and clearly (Figure 8). Changes can be made to the materials used and dimensions at any time. The dynamic graphic displays the component with the corresponding materials and enables the user to visually inspect the input data. In addition, an integrated component library with typical example constructions helps the user to work with eLCA. The templates can be loaded into the particular project and individually adapted to the specific conditions.
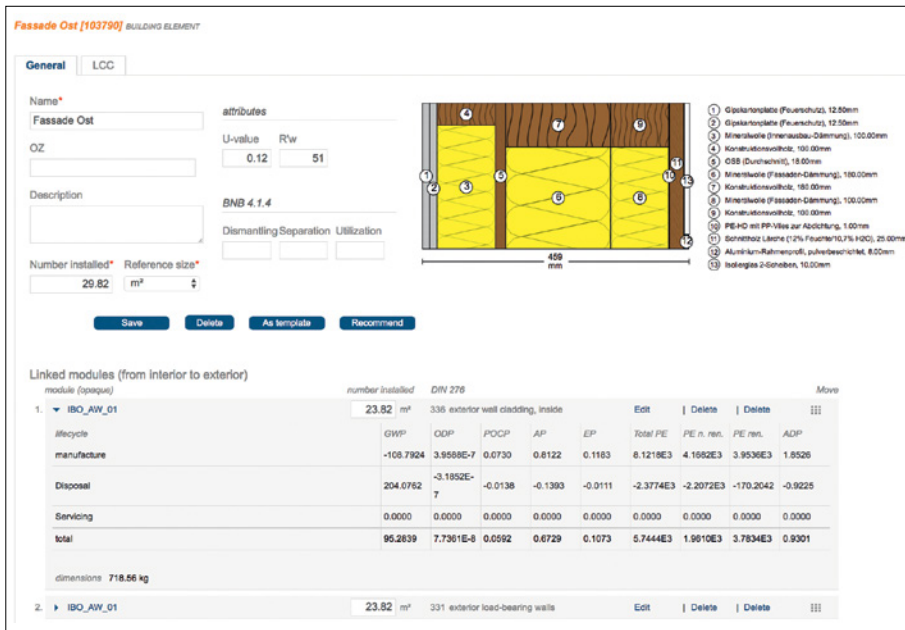
With the aid of the assistant, complex components can also easily be created in eLCA
(Figure 9).
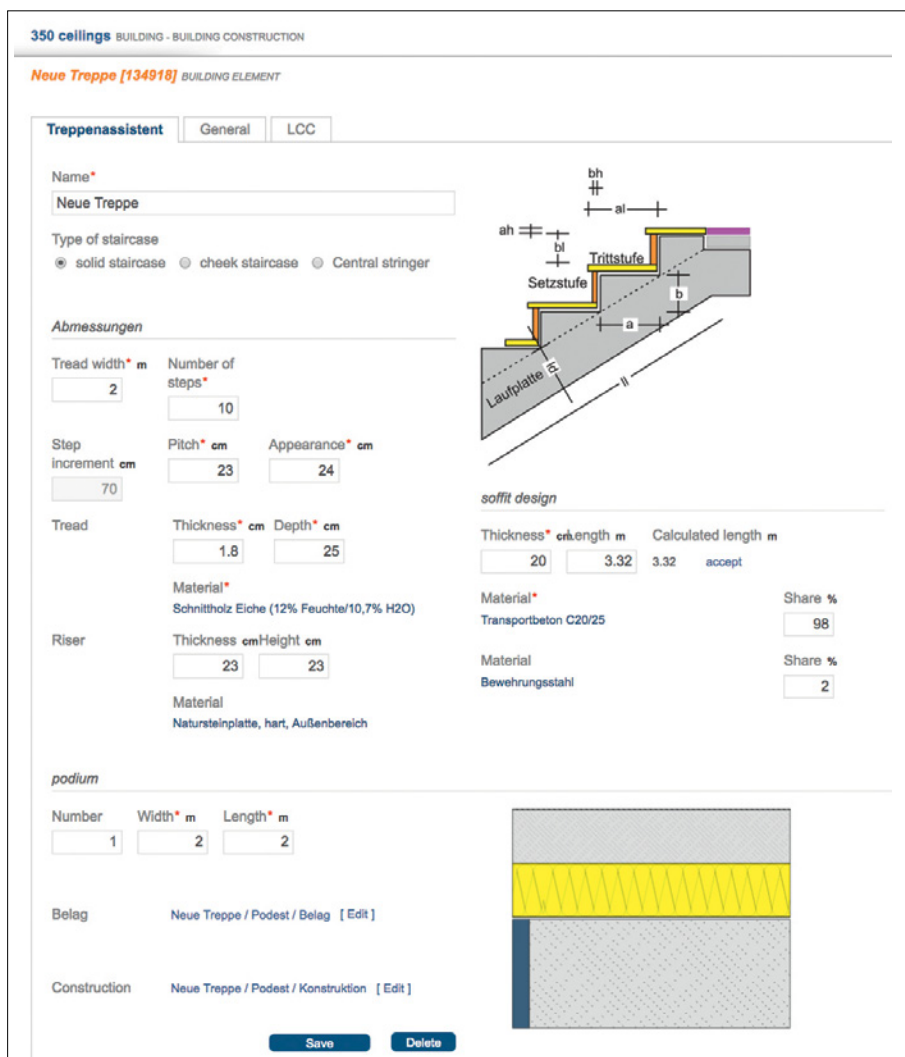
The results - the calculated environmental effects - are derived from the proportion of the building construction that the components represent and the amount of energy needed to operate the building for a year. They can be read directly and can be compared with the benchmarks for the assessment systems. The project results are then shown as a percentage of the benchmark (Figure 10).
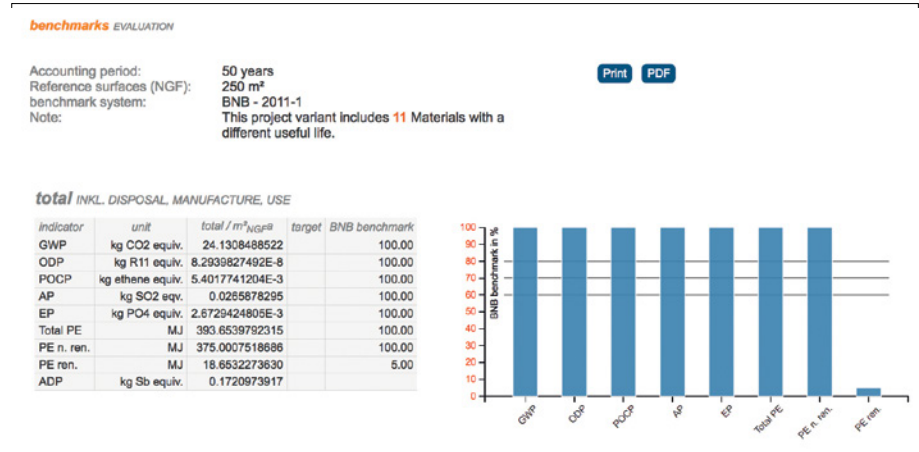
Practical evaluations integrated in eLCA present the calculated results clearly and transparently, and thereby enable detailed analysis of the results (Figure 11).
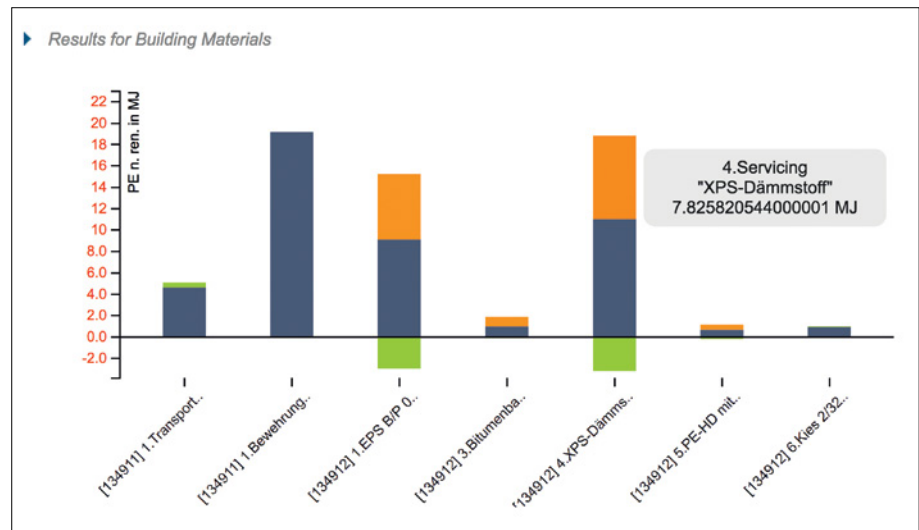

Figure 11
Material-related evaluation of the PENRT (total use of non-renewable primary energy resources) in eLCA. Source: BBSR

Image right
Source: enzberg/IBO

The calculations are based on the ÖKOBAUDAT datasets. To ensure that incomplete ÖKOBAUDAT building material datasets that do not represent the entire life cycle can also be used directly in life cycle calculations, the missing data is completed in eLCA with the aid of generic disposal datasets (and the required version is selected here in each case).

eLCA is provided free of charge in German and English by the BBSR online [4].

Scope of functions in eLCA:
> dynamic screen graphics
> transparent calculations
> comparison of variants
> BNB-compliant results
> graphical evaluation
> life cycle analysis of new buildings and existing buildings
> BNB-compliant linking of material datasets over the life cycle
> import and export interfaces
> online availability

What content and formal requirements apply to ÖKOBAUDAT datasets?

The complete current content and formal requirements can be found in the document "Principles for acceptance of LCA data in ÖKOBAUDAT", published on the ÖKOBAUDAT website (under Database/Submit data).

Data categories

Generally the life cycle assessment data in ÖKOBAUDAT can, depending on its origin, be divided into Data Categories A to C (Table 1). Generic datasets in ÖKOBAUDAT correspond to Data Category C.

Data Category	Description
Category A	Verified EPD created in accordance with DIN EN 15804 and in accordance with the rules in DIN EN ISO 14025 and as a programme operation in accordance with DIN EN ISO 14025
Category B	Verified EPD (B1)/life cycle assessment data with external review (B2), that has been created in accordance with DIN EN 15804, but not as part of a programme operation in accordance with DIN EN ISO 14025
Category C	Life cycle assessment data in accordance with DIN EN 15804 without external verification/critical review, for example "generic datasets"

Table 1
Categories of life cycle assessment datasets

Category A data (EPDs with programme operation)
Data in Category A is life cycle assessment data in accordance with DIN EN 15804 from environmental product declarations (EPDs). Behind the EPD is a programme that operates in accordance with DIN EN ISO 14025. The programme instructions and product category rules (PCRs) must be available for the public to be read, and being compiled in accordance with DIN EN 15804 and DIN EN ISO 14025.

Category B data
(Verified EPDs/life cycle assessment data in accordance with EN 15804)
Data in Category B is not generated as part of an EPD programme that operates in accordance with DIN EN ISO 14025 (Category B1) and is not published as part of an EPD (Category B2). However, it has been externally verified/subject to a critical review like the Category A data.

Submitting Category B data requires coordination with the ÖKOBAUDAT Users' Advisory Group. Here the respective requirements for the submission of data to ÖKOBAUDAT are set out depending on the requirements, including the origin of the data. In principle, proof of compliance with DIN EN 15804 must be provided separately for the respective datasets via an external verification process (Category B1) or critical review (Category B2) by the applicant or supplier of life cycle assessment data. The critical review must be in the form of an "external review", which must to be carried out analogous to verification according to DIN EN ISO 14025. Similarly, the requirements for Category A data apply to the datasets in Category B.

Category C data ("generic datasets")
Data in Category C is generated based on DIN EN 15804, but is not subject to an external review by an independent third party. Category C data includes replacement data that ÖKOBAUDAT provides for product categories for which no Category A or Category B data is available ("generic data"). This life cycle assessment data is provided with safety margins of 10% to 30% when the data is generated. Generic datasets are commissioned by the BBSR where necessary. Other datasets of Category C are not included in ÖKOBAUDAT.

The generic datasets in ÖKOBAUDAT are verified internally by the data supplier, and the data generation process itself is subject to a critical review by an external third party.

Other data
Life cycle assessment data that is not compliant with DIN EN 15804 (note: this can also include verified EPDs in accordance with to DIN EN ISO 14025) is on principle not included in ÖKOBAUDAT.

Data transfer to ÖKOBAUDAT
Currently the BBSR recognises the following institutions for the delivery of life cycle assessment data to ÖKOBAUDAT (Figure 12):

Category A (EPD data with programme operation)
› IBU Institut Bauen und Umwelt e. V. (German programme operation)
› ift Rosenheim (German programme operation)
› Bau EPD GmbH (Austrian programme operation)

Category B (critically reviewed life cycle assessment data)
› Johann Heinrich von Thünen-Institut

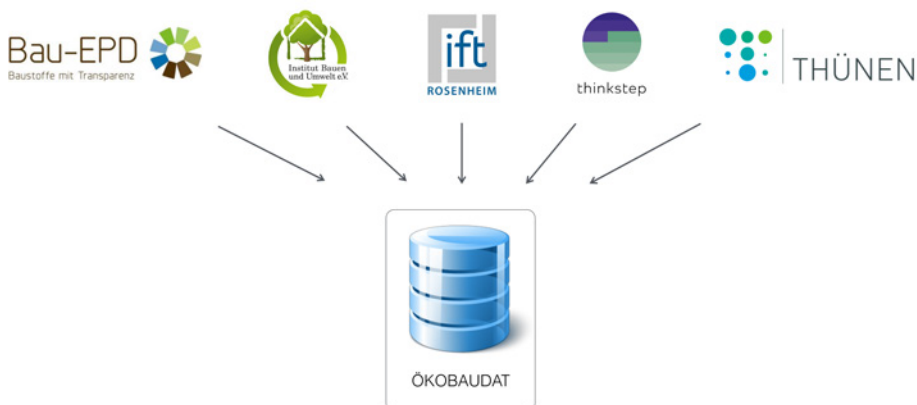Category C ("generic data")
› thinkstep

Formal submission criteria

To ensure data quality in ÖKOBAUDAT, life cycle assessment data must fulfil several fundamental requirements (Table 2):

› The EPD programme corresponds to the specifications of ISO 14025 (only applies to Category A data).
› There are product category rules (PCRs).
› The datasets have been subject to an inspection by an independent external third party (verification in accordance with DIN EN ISO 14025 or an external critical review).
› The data was generated/calculated in accordance with DIN EN 15804.
› Other formal criteria:
    › The owner of the datasets has approved the use of the data in ÖKOBAUDAT.
    › All the required declarations/information have been supplied.
    › The period of validity for the data has been indicated.
    › The datasets have been subject to a plausibility check (completeness, plausibility) before approval in ÖKOBAUDAT.

The complete and currently applicable "Principles for acceptance of LCA data in ÖKOBAUDAT" have been published on the ÖKOBAUDAT website.

Rules/proof	Data category		
	Category A	Category B1	Category B2
(1) EPD programme operation (DIN EN ISO 14025)	X		
(2) Set of rules (PCRs) (DIN EN ISO 14025)	X	X	(X)
(3) External EPD verification (ISO 14025)/ external review (based on ISO 14025)	X	X	X
(4) EPD (Type A and B1)/life cycle assessment data (Type B2) in accordance with DIN EN 15804	X	X	X
(5) The datasets fulfil the other formal requirements.	X	X	X
(6) The data fulfils the modelling requirements for	X	X	X
Acceptance in ÖKOBAUDAT	If the criteria are fulfilled, datasets are generally accepted	As no general set of rules is available, an external review must be carried out for each dataset.	

Table 2
Acceptance of data in ÖKOBAUDAT

Requirements for modelling and calculation of indicators for life cycle assessment datasets

EN 15804 allows various interpretations in several areas relevant to modelling and evaluation. To ensure high consistency and comparability of the ÖKOBAUDAT datasets, specifying requirements have been formulated for ÖKOBAUDAT, including:

› Datasets for the BNB must be based on the background database GaBi [5]. If data from other sources (other background databases, literature data, etc.) was used in the life cycle assessment, this must be indicated in the dataset and a reason provided. The data used must either not have a significant influence on the result or must be equivalent to the GaBi data modelling in terms of method and data quality.

› On the ÖKOBAUDAT platform, additional datasets are also published; these essentially meet the requirements of ÖKOBAUDAT, but are based on ecoinvent background data [6]. They are only intended for use in the BNB in exceptional cases, they are therefore not available in either the downloadable ZIP file or in the life cycle assessment tool eLCA.

› The life cycle assessment data is not intended to contain any credits for CO_2 certificates because CO_2 certificates are political measures for offsetting greenhouse gas emissions that are not related to the production process itself.

› Carbon uptake must be included as a negative value in the calculation of A1–A3 scenarios. Counting twice is not permitted.

› Module B1 must be modelled solely with reference to inherent product characteristics (for example, energy savings generated by using the product must not be presented in B1).

› Module D may be declared only if the information module it refers to is also part of the system boundary.

› When modelling the end of life, it is possible to compare several scenarios with each other for Modules C and D. Each disposal scenario must be calculated and declared separately.

› Energy flows generated within Modules A1–A3 and whose temperature level is comparable with that of the required thermal energy can be treated as a closed loop. This applies until the amount of energy needed in Modules A1–A3 is reached. Generated energy in excess of this amount must be allocated in accordance with the rules in DIN EN 15804.

The above list is not exhaustive. The complete and currently applicable "Principles for acceptance of LCA data in ÖKOBAUDAT" have been published on the ÖKOBAUDAT website.

Image below
Source: enzberg/IBO

What technical requirements apply to ÖKOBAUDAT data-sets?

EPD data format

Syntactically, ÖKOBAUDAT datasets correspond to the ILCD data format [7] with extensions for EPD data that cannot be presented in the ILCD format. In simplified form this adapted ILCD format is called ILCD+EPD data format. Information on the EPD data format can be found on the ÖKOBAUDAT website (under Database/Interfaces).

Dataset types in ÖKOBAUDAT

ÖKOBAUDAT differentiates between four dataset types in order to express the representativity of life cycle assessments:

> specific dataset – manufacturer/manufacturing company-specific dataset for a specific product
> average dataset – average datasets provided by industrial associations, several companies or several works (i. e. on the basis of data on the industrial production of companies)
> representative dataset – data that is representative for a country/region (for example average for Germany)
> template dataset – unspecific datasets for specific products created on the basis of a "template EPD"

There is also the generic data dataset type:
> generic dataset – generic data in accordance with EN 15804 and other data that is not modelled on the basis of industrial data (for example on the basis of literature, expert knowledge, etc.)

The type of dataset must be indicated for every dataset (in the "Subtype" field).

Table 3 shows the possible variations of dataset types and data categories occurring in ÖKOBAUDAT.

The dataset type is of decisive importance for the applicability of life cycle assessment datasets.

The type of "conformity check" required depends on the data category (Category A to Category C, see page 20 and onwards). It is not indicated in the data format.

Depending on what is being viewed, ÖKOBAUDAT data can also be divided into the groups: construction products and other life cycle data.

Group	Data category	Description	Database	Conformity check	Dataset type ("subtype" in the data format)
Construction product datasets	A	Construction product EPD in programme operation	Manufacturer, works location	Independent external verification via programme operation	specific dataset
					average dataset
			Association, country		template dataset
	B1	Construction product EPD without programme operation	Manufacturer, works location	Independent external verification without programme operation	specific dataset
					average dataset
			Association, country		template dataset
	B2	Construction product dataset (no EPD)	Manufacturer, works location	Independent external critical review	specific dataset
			Representative data for a country/region		representative dataset
Construction product datasets	C	Construction product dataset (no EPD)	Replacement data for a country/region	No	generic dataset
Other life cycle data		Transport processes			
		Use processes			
		General end-of-life processes			
		Energy supply			

Language

In principle, the data and corresponding text information must be delivered in German. In ÖKOBAUDAT, however, datasets can be displayed in several languages. All language versions of a dataset are shown in an ÖKOBAUDAT dataset.

Note: the data supplier is responsible for the correct reproduction of the dataset contents in all languages in which a dataset is to be published.

With regard to the acceptance of English-language EPD/life cycle assessment datasets in the central area of ÖKOBAUDAT (use in eLCA), the core information in the ÖKOBAUDAT data sheet must be delivered in German – at a minimum as an outline with reference to more detailed versions in the English-language dataset. Datasets solely in English that, aside from the language, essentially fulfil the ÖKOBAUDAT requirements are stored in a separate area of the database headed "English datasets only". As datasets that are also in German are preferred within the Federal Government's field of activity, this data is not available in either the downloadable ZIP file or in the life cycle assessment tool eLCA. They can be entered manually in eLCA.

Product categories

The datasets must be allocated to one of the given product categories. The current product categories can be found on the ÖKOBAUDAT website (under Database/Submit data).

If is no suitable product category is available in ÖKOBAUDAT, a new category can be proposed to the BBSR so as to establish a new category.

1. Mineral building products
1.1 Binder
1.1.01 Cement
1.1.02 Lime
1.1.03 Gypsum
1.1.04 Clay

Identification of datasets

Each dataset is indicated by a universally unique identifier (UUID). If there are small changes or corrections within the dataset, a version number is incremented so that the latest version can be identified at all times. If an EPD is updated (new calculation with new reference year), a new dataset must be generated for this with a new UUID.

Presentation of the indicator values

The environmental indicators required in accordance with EN 15804 are shown in ÖKOBAUDAT (see page 12). If no data is available for individual indicator values, the value must be indicated with a dash ("–") ("0" means a calculated or proven "0"). All indicators that are assessed in the BNB must be present in all cases.

As in DIN EN 15804, Modules A1 to A3 (product stage) may be indicated individually and/or in aggregated form; all other modules must be presented individually. The total of A1 to A3 must be calculated from the individual values A1 to A3 (no rounded data).

At least three significant decimal places must be entered.

References

All product, contact and source datasets referenced from the actual EPD dataset and, if necessary, connected external documents (for example PDF documents and diagrams) must be provided if these are not already contained in ÖKOBAUDAT. Alternatively this data can also be provided on a publicly accessible internet web server and connected accordingly.

Data exchange

Data networking

With ÖKOBAUDAT, the federal government has provided one of the most comprehensive and high-quality databases on an international scale for life cycle assessment data of construction products. This refers to areas such as the number of datasets, the quality of the data contents and the high data consistency. ÖKOBAUDAT is used internationally in life cycle calculations within certification systems or other applications such as building information modelling (BIM). As the first program operator in Germany, the IBU has used the program rules and verification processes to set important quality standards that, via the requirements for the acceptance of data, have been integrated into ÖKOBAUDAT.

Based on the life cycle assessment developments supported by the BMUB as part of the BNB and the provision of ÖKOBAUDAT as an online database with data transfer to the life cycle assessment tool eLCA, and the development of an online database structure on an open source basis with suitable interfaces, it has been possible to develop a comprehensive life cycle assessment system. ÖKOBAUDAT is therefore the focal point of a comprehensive infrastructure consisting of data producers, databases and data users (Figure 14) in a national and international context. Data is delivered and transferred via standardised or individual interfaces.

Image above
Source: enzberg/IBO

Data delivery to ÖKOBAUDAT

One of the particularly pioneering aspects is the option to directly import life cycle assessment data into ÖKOBAUDAT via suitable interfaces.

There are in essence two ways to import data:

Direct import via an interface

EPD programme operators can import life cycle assessment data directly into ÖKOBAUDAT online from their own database systems via a suitable interface. Institut Bauen und Umwelt e.V., the most important German EPD programme operator, follows this route. Suitable life cycle assessment data from IBU environmental product declarations is imported into ÖKOBAUDAT via the IBU's online EPD tool [8]. In addition to generic data, the IBU provides the majority of EPD life cycle assessment data.

Import via openLCA

Life cycle assessment data is entered and imported via the free software openLCA. With openLCA, EPD datasets can be modelled and then imported into the ÖKOBAUDAT database, under the responsibility of the EPD programme operators and using a suitable background database or existing EPD data can be converted to the required data format for ÖKOBAUDAT (conversion of corresponding Excel data, for example).

Currently the German EPD programme operator ift Rosenheim and the Austrian EPD programme operator Bau EPD GmbH import life cycle assessment datasets from their environmental product declarations in this way, and the Thünen-Institut also imports representative average datasets into ÖKOBAUDAT in this way.

Data transfer from ÖKOBAUDAT

In the BNB, data from ÖKOBAUDAT is transferred to the life cycle assessment tool eLCA and used for calculations and evaluations within the evaluation system. The data can also be imported by commercial life cycle assessment tools or BIM tools, and used for further calculations.

Figure 14

ÖKOBAUDAT – data generation, delivery, distribution and use. Source: Oliver Kusche
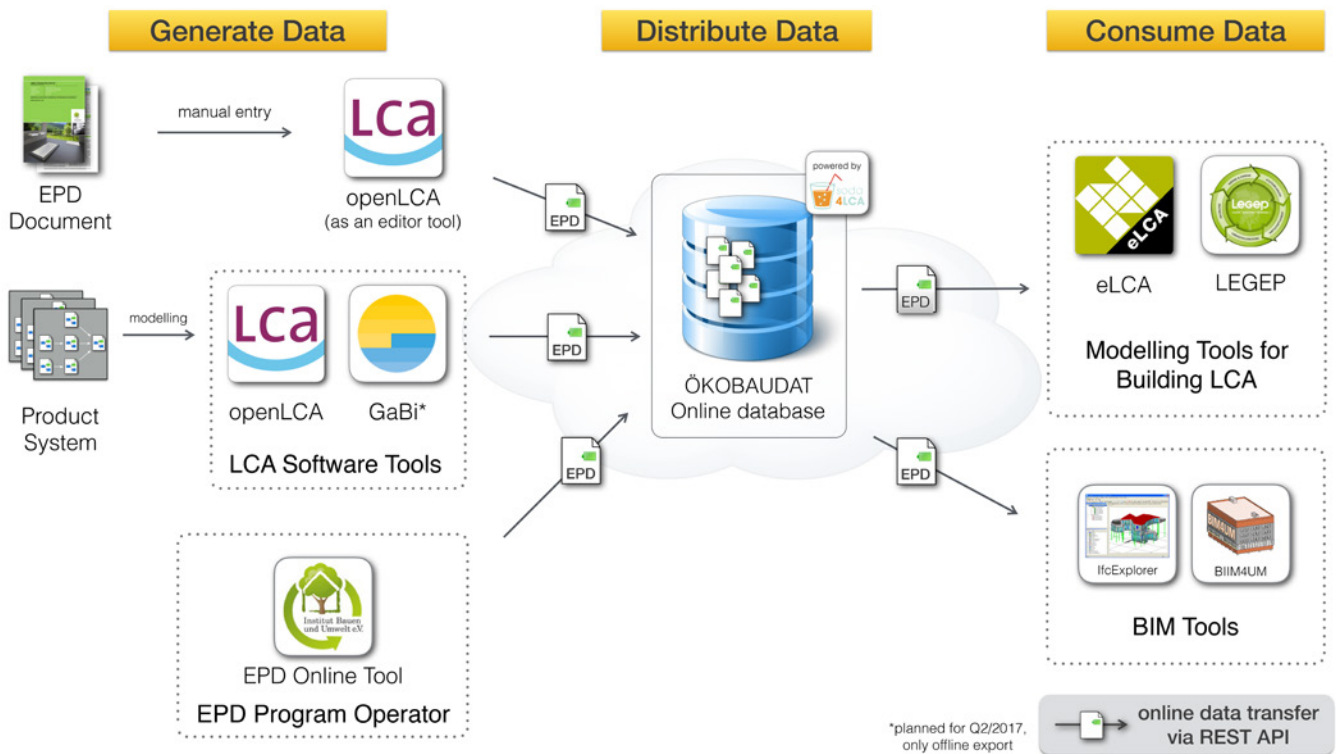
Internationalisation and further developments

The infrastructure provided by the federal government opens up the opportunity to network data nationally and to establish an international database structure. Compliance with internationally used standards and the open source-based tools enable global data exchange on a technical level. However, mutual understanding and rules on handling the data are required, for example with regard to data quality, contents, responsibilities.

The WG InData initiated by the BBSR pursues the goal of providing harmonised EPD data across regional borders, and essential shared principles have already been agreed. Agreement has been reached on the following needs: shared data format, compliance with EN 15804, requirements for verification processes, the definition of core information and data characteristics, indication of the background database used, etc.

These essential questions are analysed in the WG InData and examined in research projects (for example the Future Building research initiative by the BMUB/BBSR, UFOPLAN by the BMUB/Federal Environment Agency) as well as in bilateral cooperation projects, amongst other initiatives.

With the infrastructure developed for the BNB, the federal government has created the basis for extensive developments that clearly promote and support sustainable construction in terms of the selection of environmentally suitable building materials and constructions and the international harmonisation of the data and processes for building life cycle assessment.

Software and interfaces

soda4LCA

In technical terms, the ÖKOBAUDAT database is based on the software soda4LCA [9] and is equipped with a standardised interface (API) for data exchange. Via the interface, other applications and software tools can read datasets from ÖKOBAUDAT and import them directly in to ÖKOBAUDAT with the corresponding authorisations. The API documentation is provided on the ÖKOBAUDAT website (under Database/Interfaces in the folder doc) in HTML and PDF formats.

openLCA

Currently the free open source life cycle assessment tool openLCA supports data input via the standardised interface. The EPD Editor plugin has to be installed in openLCA for this, and then the ÖKOBAUDAT reference database has to be imported.

A basic technical requirement for importing a dataset is that it must have been allocated to one of the given ÖKOBAUDAT product categories (see page 25 and onwards, Product categories).

Validation of datasets

Before datasets are imported into the backend of ÖKOBAUDAT, the data format and product category allocation can be validated with a validation tool. The tool runs on a standalone, cross-platform basis. It is highly user-friendly and intuitive. Instructions for use can be found on the ÖKOBAUDAT website (under Database/Submit data).

A link to the latest version of the validation tool can also be found there. [10]

Reading ÖKOBAUDAT datasets

ÖKOBAUDAT is available as an online database under the Database tab (ÖKOBAUDAT browser). The complete ÖKOBAUDAT database can also be downloaded in XML format as a ZIP file. A CSV extract of datasets that have been prepared especially for BNB evaluations is also available. The zipped ÖKOBAUDAT versions released in recent years can also be found under the Archive tab.

No authorisation is required to export data from the database.

For read access to ÖKOBAUDAT via the service interface, the base URL
http://www.oekobaudat.de/OEKOBAUDAT/resource
must be entered as the address in the software tool.

Every dataset is indicated by a universally unique identifier (UUID). The BBSR can provide the identification numbers for different ÖKOBAUDAT versions on request.

Procedure for importing datasets into ÖKOBAUDAT

Procedure for the application and submission of life cycle assessment data to ÖKOBAUDAT

The application and submission of life cycle assessment data to ÖKOBAUDAT consists of the following steps:

1. The applicant classifies the life cycle assessment data in to the corresponding data categories.

2. The applicant declares that the submission complies with the requirements in the application form (date, signature, company stamp).

3. The applicant provides the required declarations and supporting documents.

4. The documents and data are checked under the responsibility of the BMUB/BBSR in coordination with the ÖKOBAUDAT Users' Advisory Group.
   Dataset Type A: EPD datasets corresponding to the ÖKOBAUDAT principles can subsequently be accepted in to ÖKOBAUDAT without any further fundamental checks of the contents.
   Dataset Type B: Since no programme and no set of rules are available in accordance with DIN EN ISO 14025, proof of external verification or a critical review must be provided for each dataset.

5. If the check of the contents for the acceptance of life cycle assessment data has been successfully completed, corresponding access data for importing the data can be requested from the BBSR.

6. After this, the data is imported in to the backend of ÖKOBAUDAT by the applicant.

7. After importing the data, the BMUB/BBSR carries out a plausibility check and, if necessary, checks the contents of the datasets randomly. Only after this is the data approved.

Declarations and supporting documents

The applicant must provide the declarations and supporting documents listed in the application form (in hard copy or electronic form). These include the following:

›	Completed application form including the declaration of compliance with the "Principles for acceptance of LCA data in ÖKOBAUDAT"
	(Category A and B data)
›	Programme rules
	(Category A data only)
›	List of the members of the PCR review panel stating their names, positions and institutions
	(Category A data only)
›	List of the verifiers/external reviewers stating their names, positions and institutions
	(Category A and B data)
›	Description of the requirements for verifiers/external reviewers and the verification process/external review process
	(Category B data; covered via programme rules for Category A data)
›	Verification reports/reports of external review (to be provided at a minimum on request)
›	Access to the PCR documents, indicating the internet link including the required access data where necessary
	(Category A and B data)
›	List of submitted life cycle assessment datasets including the period of validity
›	Consent of the owner of the datasets for use in ÖKOBAUDAT

The application form is available for download on the ÖKOBAUDAT web pages.

Image right
Source: enzberg/IBO

Standards

DIN EN ISO 14020	Umweltkennzeichnungen und -deklarationen – Allgemeine Grundsätze (ISO 14020:2000); German version EN ISO 14020:2001, February 2002 (Environmental Labels and Declarations – General Principles)
DIN EN ISO 14025	Umweltkennzeichnungen und -deklarationen – Typ III Umweltdeklarationen – Grundsätze und Verfahren (ISO 14025:2006), German and English version EN ISO 14025:2011 (Environmental Labels and Declarations – Type III Environmental Declarations – Principles and Procedures), October 2011
DIN EN ISO 14040	Umweltmanagement – Ökobilanz – Grundsätze und Rahmenbedingungen (ISO 14040:2006); German and English version EN ISO 14040:2006 (Environmental Management – Life Cycle Assessment – Principles and Framework)
DIN EN ISO 14044	Umweltmanagement – Ökobilanz – Anforderungen und Anleitungen (ISO 14044:2006); German and English version EN ISO 14044:2006 (Environmental Management – Life Cycle Assessment – Requirements and Guidelines)
DIN EN 15804	Nachhaltigkeit von Bauwerken – Umweltproduktdeklarationen – Grundregeln für die Produktkategorie Bauprodukte; German version EN 15804:2012, April 2012 (Sustainability of Construction Works – Environmental Product Declarations – Core Rules for the Product Category of Construction Products)
DIN EN 15978	Nachhaltigkeit von Bauwerken – Bewertung der umweltbezogenen Qualität von Gebäuden – Berechnungsmethode; German version EN 115978:2011, January 2012 (Sustainability of construction works – Assessment of Environmental Performance of Buildings – Calculation Method)

Image above and right
Source: enzberg/IBO

Abbreviations

API	Application programming interface
BBR	Federal Office for Building and Regional Planning
BBSR	Federal Institute for Research on Building, Urban Affairs and Spatial Development
BMUB	Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety
BNB	Assessment System for Sustainable Building
eLCA	Software provided by the BMUB/BBSR for building life cycle assessment
EPD	Environmental product declaration
ILCD	International Reference Life Cycle Data System
LCA	Life cycle assessment
ÖKOBAUDAT	Platform provided by the BMUB/BBSR with data, information and links related to the life cycle assessment of construction works
PENRT	Total use of non-renewable primary energy resources
PCRs	Product category rules
WG InData	Working group International open Data Network for Sustainable Building
CO2	Carbon dioxide
GaBi	The life cycle assessment database Ganzheitliche Bilanzierung
IBU	Institut Bauen und Umwelt e. V. (Institute for Building and the Environment)
openLCA	Open source life cycle assessment tool
Soda4LCA	Software on which the ÖKOBAUDAT database is based in technical terms

Table of figures

Websites

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6.   www.ecoinvent.org/
7.   http://eplca.jrc.ec.europa.eu
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9.   http://www.iai.kit.edu/soda4LCA
10.   https://bitbucket.org/okusche/ilcdvalidationtool/

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Bonn 2016

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Federal Institute for
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Urban Affairs and
Spatial Development

within the Federal Office for
Building and Regional Planning

ÖKOBAUDAT is a platform with data, information and links related to the life cycle assessment of construction works. At the platform's core is the online database with life cycle assessment datasets on building materials, construction, transport, energy and disposal processes. The datasets are subject to strict quality requirements and therefore provide planners, architects and constructors with a reliable basis for scientifically sound calculations of the influences of construction works on the environment.

ÖKOBAUDAT is provided free of charge to the general public by the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) with support from the Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR).

This brochure describes the technical and content-related quality characteristics of ÖKOBAUDAT, indicates tools that can be used to calculate life cycle assessments, and explains how data can be imported to and exported from ÖKOBAUDAT.

With the Future Building research initiative, the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) is strengthening the future viability and potential for innovation, in cooperation with the Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR). The aim is to improve the competitiveness of the German building sector in the European Single Market and, in particular, to support the strengthening of knowledge and findings in the area of technical, building culture and organisational innovations.

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