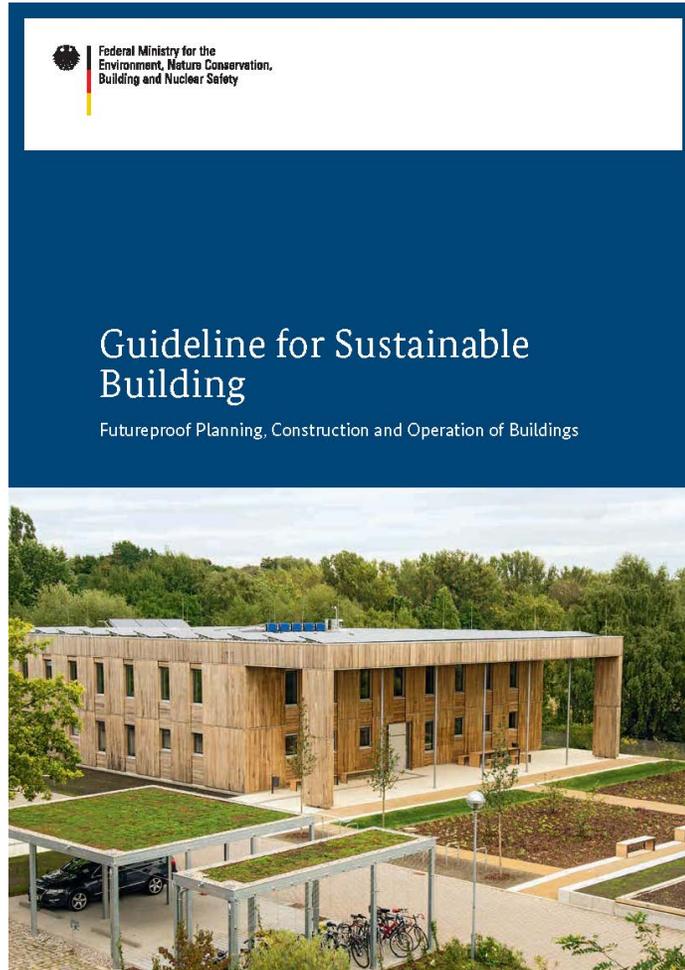


# Building the Future

**ZUKUNFTBAU**  
FÖRDERN FORSCHEN ENTWICKELN

## Assessment Systems and Tools for Sustainable Building

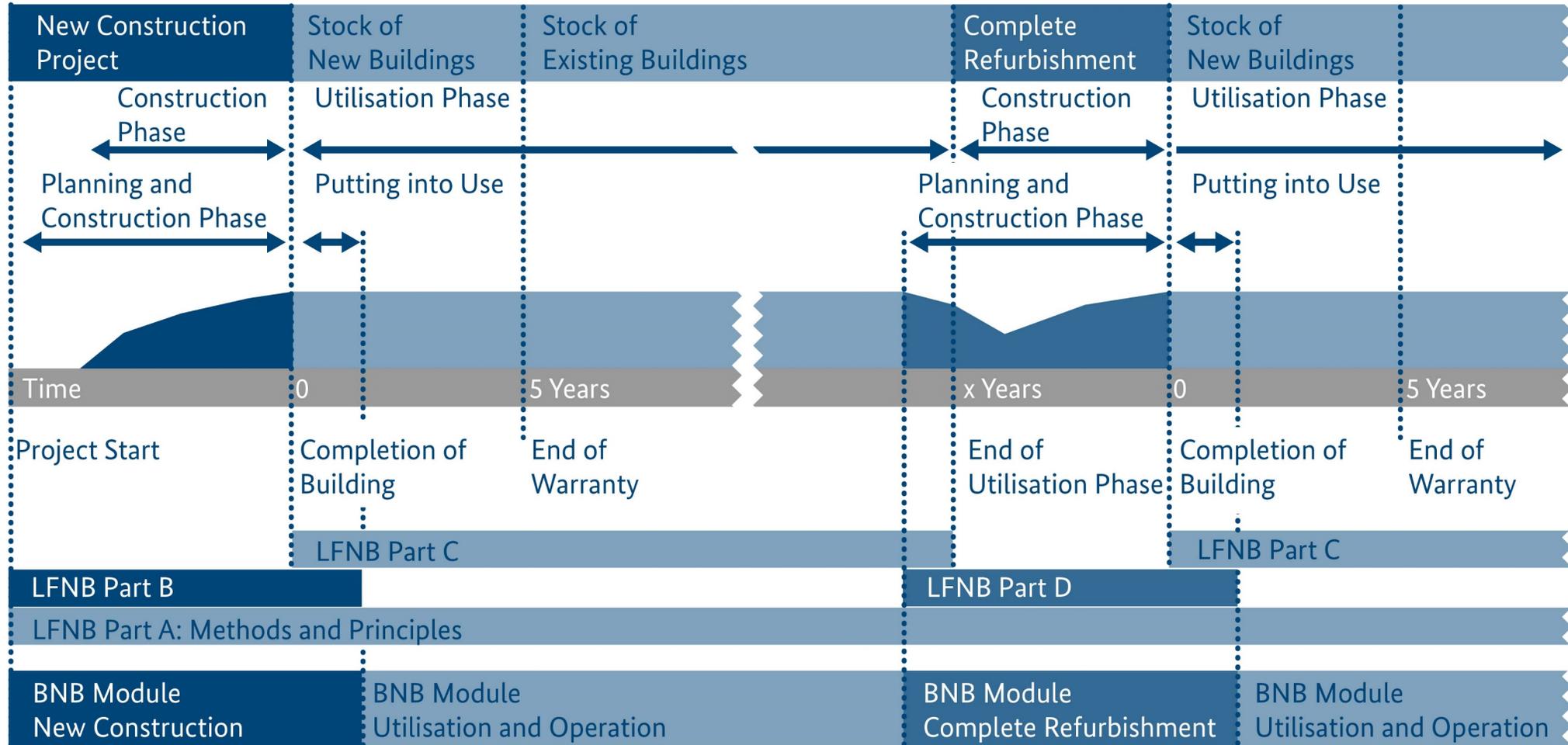
# Guideline for Sustainable Building



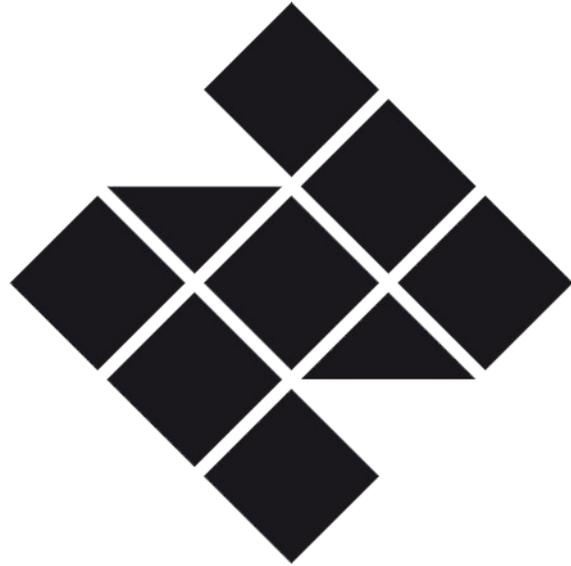
Introduced in 2001 the Guideline for Sustainable Building is continually being under further development with regard to the Assessment System for Sustainable Building for Federal Buildings (BNB). The Guideline provides general principles and methods of sustainable design. It offers a specific practical aid for planning, construction, structural maintenance, operation and utilisation.

The application of the Guideline is mandatory for federal building measurements. Thereby the Federal German Government has set itself the binding quality level “Silver”. It can also be used by other building authorities for construction, such as the Federal States and municipalities as well as the private sector.

# Sustainable Building throughout the Entire Life Cycle



# Assessment System for Sustainable Building (BNB)



**Nachhaltiges  
Bauen**

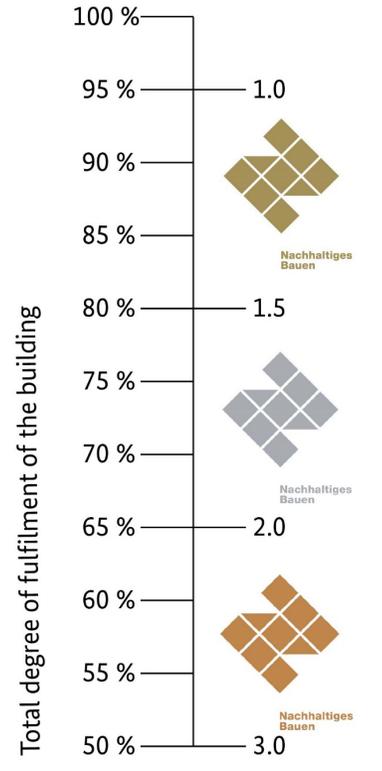
With the Guideline for Sustainable Building Germany introduced the Assessment System for Sustainable Building (BNB) mandatory for federal buildings in 2011. The Guideline serves as a set of binding rules for the use of the BNB.

The BNB is a “second-generation”, i. e. a holistic, assessment system providing a more far-reaching assessment of the building that covers its entire life cycle including all sustainability dimensions.

The previous three columns of sustainability were extended to five quantifiable sustainability qualities, which represent the five main criteria groups of the BNB. Besides ecological, economic, sociocultural and functional qualities, the BNB considers also technical and process quality.

# Assessment Method with Holistic Approach

1. Main Criteria Group: Ecological Quality					Degree of Fulfilment	Weighting 22.5 %
1. 1. Criteria Group: Effects on Global and Local Environment					Based on the main criteria group as the ratio of the achieved and the maximum possible score	Fixed weighting of the result of the main criteria group for the overall score
1. 1. 1 Criterion	Assessment methodology: Calculation, quality level	Qualities: such as quality level 2	Conversion in assessment scale: Defined target, reference, and limit values	Weighting by means of significance factor: Defined from 1 to 3		
partial criterion 1						
partial criterion 2						
1. 1. 2 Criterion						
2. Main Criteria Group: Economic Quality					Degree of Fulfilment	Weighting 22.5 %
3. Main Criteria Group: Sociocultural and Functional Quality					Degree of Fulfilment	Weighting 22.5 %
4. Main Criteria Group: Technical Quality					Degree of Fulfilment	Weighting 22.5 %
5. Main Criteria Group: Process Quality					Degree of Fulfilment	Weighting 10.0 %
Location Profile					Degree of Fulfilment	Weighting 0 %



The degree of fulfilment in the respective main criteria group is calculated from the individual results of the criteria.

By means of fixed relevance factors, the degree of fulfilment of the five main criteria groups are allocated to the final level of fulfilment and the final score.

According to the final degree of fulfilment respectively, the quality standards will result in Gold, Silver or Bronze. The location profiles are evaluated separately without impact on the score.

Degree of Fulfilment Location Profile (informative)

# Assessment Results: Public and Transparent

Bundesministerium  
für Verkehr, Bau  
und Stadtentwicklung

## Zertifikat

SILBER



**Nachhaltiges Bauen**

Kategorie: Neubau Büro- und Verwaltungsgebäude  
Version: 2008 - konsolidiert  
Objekt: Hauptzollamt Rosenheim - Erweiterungsba  
Standort: Rosenheim  
Fertigstellung: 2007  
Bauherr: Bundesrepublik Deutschland  
Auditor: Dipl.-Ing. Nicolas Kerz, Bundesinstitut für Bau-, Stadt- und Raumforschung im BBR  
Architekt / Planer: Staatliches Bauamt Rosenheim

Bewertungsnummer: V 2008\_kon\_0001  
ausgestellt am: 16.02.2010

Günther Hoffmann  
Leiter der Abteilung Bauwesen,  
Bauwirtschaft und Bundesbauten im BMVBS

The front page of the Certificate shows the overall result

Bundesministerium  
für Verkehr, Bau  
und Stadtentwicklung

### Einzelbewertung

	Erfüllungsgrad	Note
<b>Ökologische Qualität</b>	89%	1,2
<b>Wirkungen auf die globale Umwelt</b>		
1 Treibhauspotenzial (GWP)	100%	
2 Ozonabbauausgleichspotenzial (ODP)	100%	
3 Ozonbildungspotenzial (POCP)	100%	
4 Versauerungspotenzial (AP)	100%	
5 Überdüngungspotenzial (EP)	80%	
6 Risiken für die lokale Umwelt	75%	
8 Sonstige Wirkungen auf die globale Umwelt	50%	
9 Mikroplastik	100%	
<b>Ressourcenanspruchnahme</b>		
10 Primärenergiebedarf nicht erneuerbar (PE <sub>nc</sub> )	100%	
11 Gesamtprimärenergiebedarf und Anteil erneuerbare Primärenergie (PE)	85%	
14 Trinkwasserbedarf und Abwasserankommen	77%	
15 Flächenanspruchnahme	100%	
<b>Ökonomische Qualität</b>	91%	1,1
<b>Lebenszykluskosten</b>		
16 Gebäudebezogene Kosten im Lebenszyklus	95%	
17 Wertebildung	85%	
<b>Soziokulturelle und funktionale Qualität</b>	39%	3,7
<b>Gesundheit, Behaglichkeit und Nutzerzufriedenheit</b>		
18 Thermischer Komfort im Winter	10%	
19 Thermischer Komfort im Sommer	10%	
20 Innenraumhygiene	50%	
21 Akustischer Komfort	0%	
22 Visueller Komfort	62%	
23 Einflussnahme des Nutzers	50%	
24 Dachgestaltung	100%	
25 Sicherheit und Mischrisiken	62%	
<b>Funktionalität</b>		
26 Barrierefreiheit	75%	
27 Flächeneffizienz	24%	
28 Umnutzungsfähigkeit	64%	
29 Zugänglichkeit	20%	
30 Fahrradkomfort	100%	
<b>Sicherung der Gestaltungsqualität</b>		
31 Sicherung der gestalterischen und städtebaulichen Qualität im Wettbewerb	0%	
32 Kunst am Bau	0%	
<b>Technische Qualität</b>	68%	1,9
<b>Qualität der technischen Ausführung</b>		
33 Brandschutz	75%	
34 Schallschutz	70%	
35 Energetische und feuchtschutztechnische Qualität der Gebäudehülle	59%	
40 Reinigung und Instandhaltung	79%	
42 Rückbauweise, Recyclingfreundlichkeit, Demontagefreundlichkeit	57%	
<b>Prozessqualität</b>	35%	4,0
<b>Qualität der Planung</b>		
43 Qualität der Projektvorbereitung	23%	
44 Integrale Planung	64%	
45 Optimierung und Konsistenz der Herangehensweise der Planung	45%	
46 Nachweis der Nachhaltigkeitsziele in Ausschreibung und Vergabe	0%	
47 Schaffung von Voraussetzungen für eine optimale Nutzung und Bewirtschaftung	38%	
<b>Qualität der Bauausführung</b>		
48 Baustelle / Bauprozess	40%	
49 Qualität der ausführenden Unternehmen / Präqualifikation	50%	
50 Qualitätssicherung der Bauausführung	0%	
51 Systematische Inbetriebnahme	50%	
<b>Standortmerkmale</b>	75%	1,7
<b>Standortmerkmale</b>		
56 Risiken am Mikrostandort	71%	
57 Verhältnisse am Mikrostandort	33%	
58 Lage und Zustand von Standort und Quartier	58%	
59 Verkehrsanbindung	97%	
60 Nähe zu nutzungsrelevanten Einrichtungen	94%	
61 Anliegende Medien / Erschließung	88%	

HZA Anlage 2

The appendix shows the results in the single criteria...

Bundesministerium  
für Verkehr, Bau  
und Stadtentwicklung

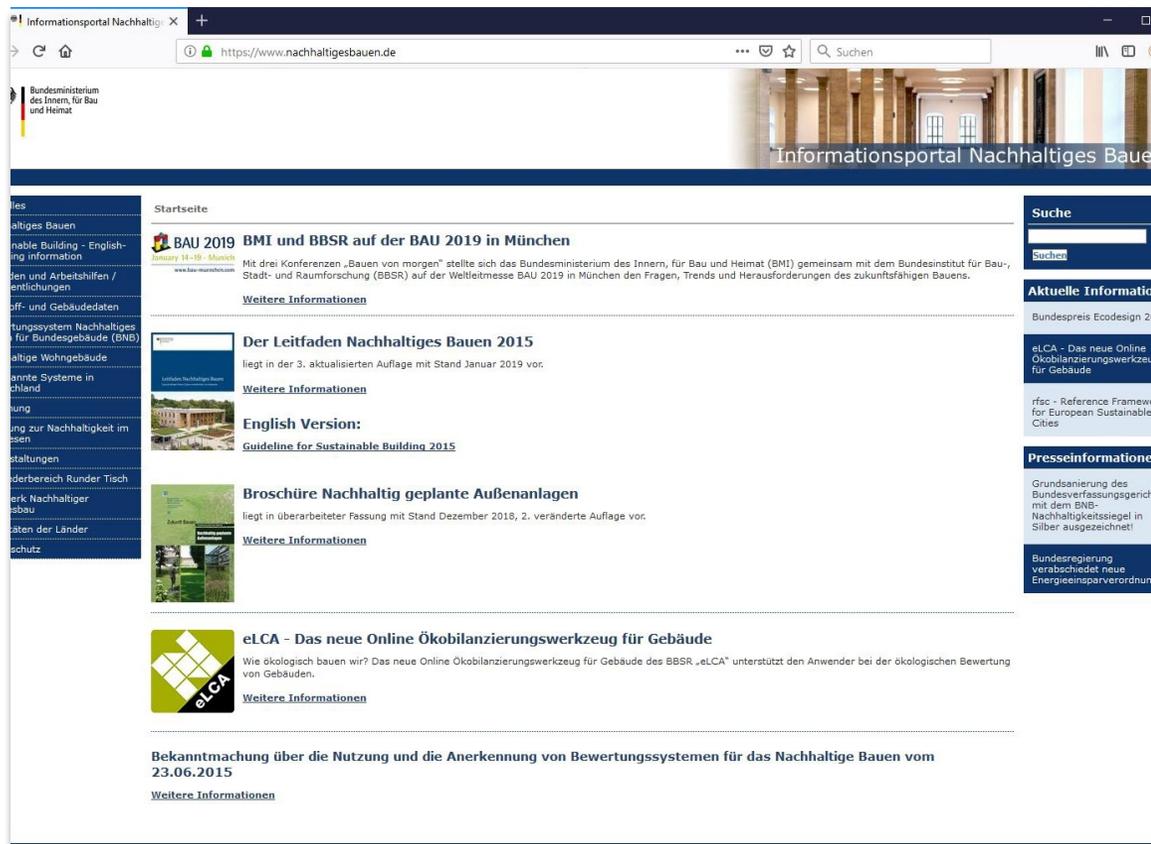
### Bewertungsgrafik der Hauptkriteriengruppen

Hauptkriteriengruppen	Erfüllungsgrad	Anteil gesamt
Ökologische Qualität	89 %	22,5 %
Ökonomische Qualität	91 %	22,5 %
Soziokulturelle und funktionale Qualität	39 %	22,5 %
Technische Qualität	68 %	22,5 %
Prozessqualität	35 %	10,0 %

HZA Anlage 3

...and the fulfillment of the main criteria groups

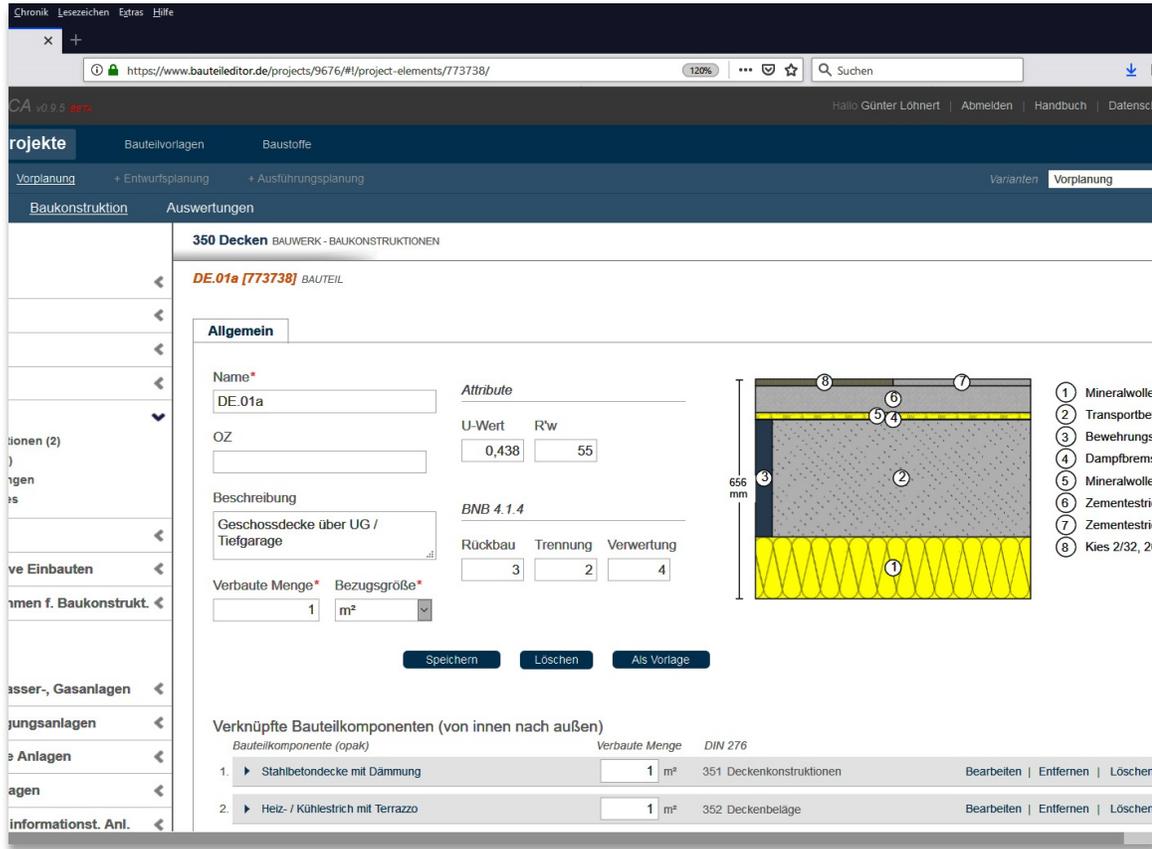
# Tools for Sustainable Building



## Sustainable Building Information Portal

The Sustainable Building Information Portal provides general information and basics on sustainable building as well as a number of guides and tools, construction material and building databases along with information about research projects and events. Additionally, all criteria profiles of the BNB modules or system variants can be downloaded from the linked BNB portal.

# Tools for Sustainable Building



## Life Cycle Assessment (LCA)

Life cycle assessment (LCA) has an important function in the Assessment System for Sustainable Building (BNB). LCA calculates indicators of environmental impacts like global warming, acidification or the ozone hole. The Federal Ministry of Building provides openly accessible data and tools for the life cycle assessment for buildings.

The eLCA software is an online LCA tool for buildings based on ÖKOBAUDAT data. It standardises LCA calculations according to the rules of the BNB system.

The main feature of eLCA is a component editor (Bauteileditor) where users can create building components very easily—supported by dynamic graphics and an integrated library of building elements.

# eBNB: Electronic Rating System for Sustainable Building

## eBNB: Electronic Rating System for Sustainable Building

The internet-based tool (eBNB) centrally collects complex building information for all certified federal buildings in the form of dynamised building data. It was developed as a project management system for implementing the BNB system in federal buildings.

UBA\_2019 - Umweltbundesamt Schichauweg, Berlin (1032) - Smart Project Manager

Suchen Druck Vorschau Export/Import

Dashboards Gesamtbewertung

Nr. In.	Kriterium	Gewichtung [%]	Min-Punkte	BNB-Punkte	Ziel-Punkte	Abweichung Zielpunkte	Erfüllungsgrad [%]
	<b>Zertifizierungsziel: Gold (80% - 85%)</b>						<b>79,705 %</b>
1	<b>Ökologische Qualität</b>	22,5 %					86,269 %
1.1	<b>Wirkung auf die globale Umwelt</b>	12,375 %					
1.1.1	Treibhauspotenzial (GWP)	3,375 %	80,0	100,0	99,0	▲ 1,0	
1.1.2	Ozonschichtabbaupotenzial (ODP)	1,125 %	80,0	100,0	99,0	▲ 1,0	
1.1.3	Ozonbildungspotenzial (POCP)	1,125 %	80,0	100,0	100,0	▲ 0,0	
1.1.4	Versauerungspotenzial (AP)	1,125 %	80,0	100,0	100,0	▲ 0,0	
1.1.5	Überdüngungspotenzial (EP)	1,125 %	80,0	100,0	100,0	▲ 0,0	
1.1.6	Risiken für die lokale Umwelt	3,375 %	50,0	75,0	100,0	▼ -25,0	
1.1.7	Nachhaltige Materialgewinnung Holz	1,125 %	80,0	80,0	100,0	▼ -20,0	
1.2	<b>Ressourceninanspruchnahme</b>	10,125 %					
1.2.1	Primärenergiebedarf nicht erneuerbar (PEne)	3,375 %	80,0	100,0	100,0	▲ 0,0	
1.2.2	Gesamtprimärenergiebedarf (PEges) und Anteil erneuerbarer Primärenergie (PEe)	2,25 %	75,0	100,0	100,0	▲ 0,0	
1.2.3	Trinkwasserverbrauch und Abwasseraufkommen	2,25 %	50,0	40,19	80,0	▼ -39,81	
1.2.4	Flächeninanspruchnahme	2,25 %	50,0	70,0	70,0	▲ 0,0	
2	<b>Ökonomische Qualität</b>	22,5 %					79,592 %
2.1	<b>Lebenszykluskosten</b>	13,5 %					
2.1.1	Gebäudebezogene Kosten im Lebenszyklus	13,5 %	65,0	100,0	75,0	▲ 25,0	
2.2	<b>Wertentwicklung</b>	9,0 %					
2.2.1	Drittverwendungsfähigkeit	9,0 %	65,0	48,98	75,0	▼ -26,02	
3	<b>Soziokulturelle und funktionale Qualität</b>	22,5 %					65,611 %
3.1	<b>Gesundheit, Behaglichkeit und Benutzerzufriedenheit</b>	12,857 %					
3.1.1	Thermischer Komfort im Winter	1,607 %	70,0	100,0	100,0	▲ 0,0	
3.1.2	Thermischer Komfort im Sommer	2,411 %	85,0	100,0	100,0	▲ 0,0	
3.1.3	Innenraumhygiene	2,411 %	60,0	85,0	100,0	▼ -15,0	
3.1.4	Akustischer Komfort	0,804 %	0,0	25,628	0,0	▲ 25,628	
3.1.5	Visueller Komfort	2,411 %	35,0	55,0	75,0	▼ -20,0	
3.1.6	Einflussnahme des Nutzers	1,607 %	48,0	100,0	100,0	▲ 0,0	
3.1.7	Aufenthaltsmerkmale im Außenraum	0,804 %	35,0	100,0	40,0	▲ 60,0	
3.1.8	Sicherheit und Störfallrisiken	0,804 %	35,0	85,0	85,0	▲ 0,0	
3.2	<b>Funktionalität</b>	6,429 %					
3.2.1	Barrierefreiheit	1,607 %	10,0	100,0	75,0	▲ 25,0	
3.2.2	Flächeneffizienz	0,804 %	30,0	45,7	70,0	▼ -24,3	
3.2.3	Umnutzungsfähigkeit	1,607 %	35,0	60,0	67,0	▼ -16,61	

source: BBSR

View of the overall evaluation table

# eBNB: Electronic Rating System for Sustainable Building

UBA\_2019 - Umweltbundesamt Schichauweg, Berlin (1032) - Smart Project Manager

Suchen Druck Vorschau Export/Import

Dashboards Gesamtbewertung

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3.2.3	Umnutzungsfähigkeit	1,607 %	35,0	60,0	67,0	▼ -16,61	

source: BBSR

View of the overall evaluation table

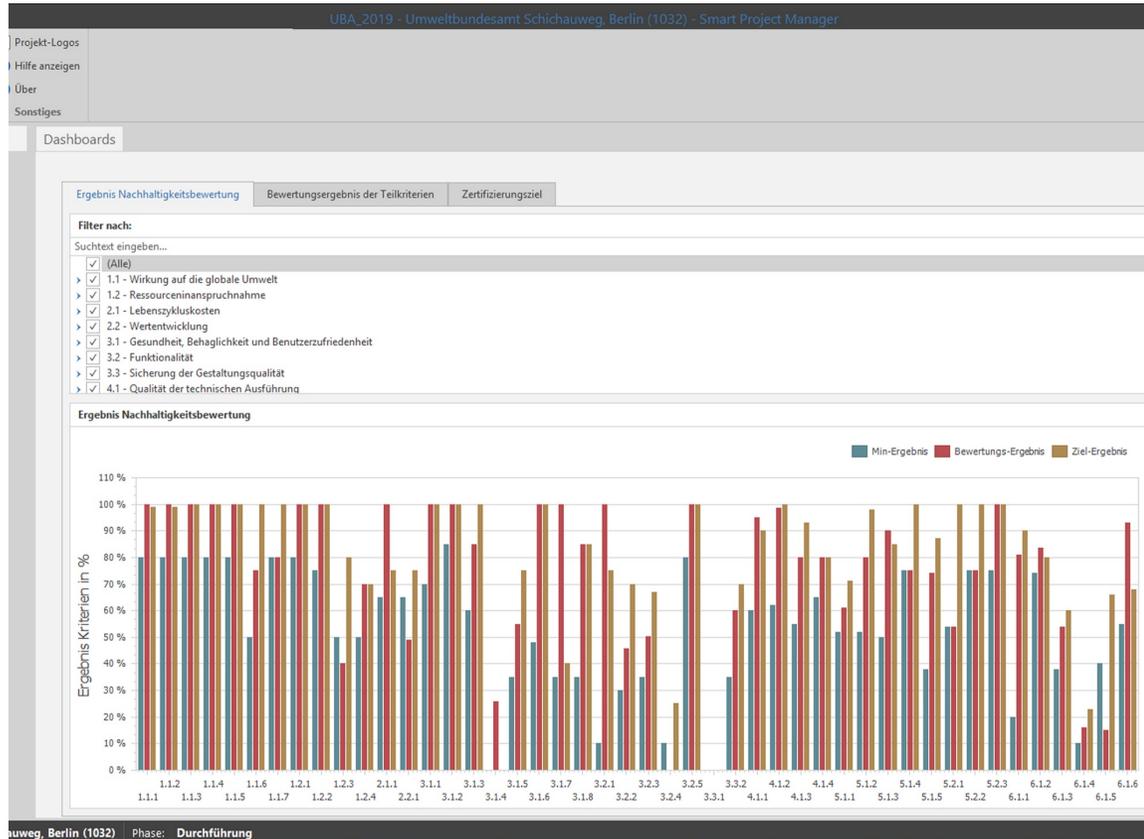
## Project Focus

The aim of the project “eBNB” is a uniform and efficient digital application of the rating system for sustainable building.

With the introduction of the BNB in federal as well as in parts of the Federal Buildings, the task of collecting building information from 16 federal administrations is centralised.

In order to map the quality requirements described in the BNB, a proprietary logic model was developed in the framework of ‘Zukunft Bau Forschung’ (lit. built future research) and implemented in the Smart Project Manager (SPM, developed by the company Smart Enterprise Solutions).

# eBNB: Electronic Rating System for Sustainable Building



*display design, menu navigation*

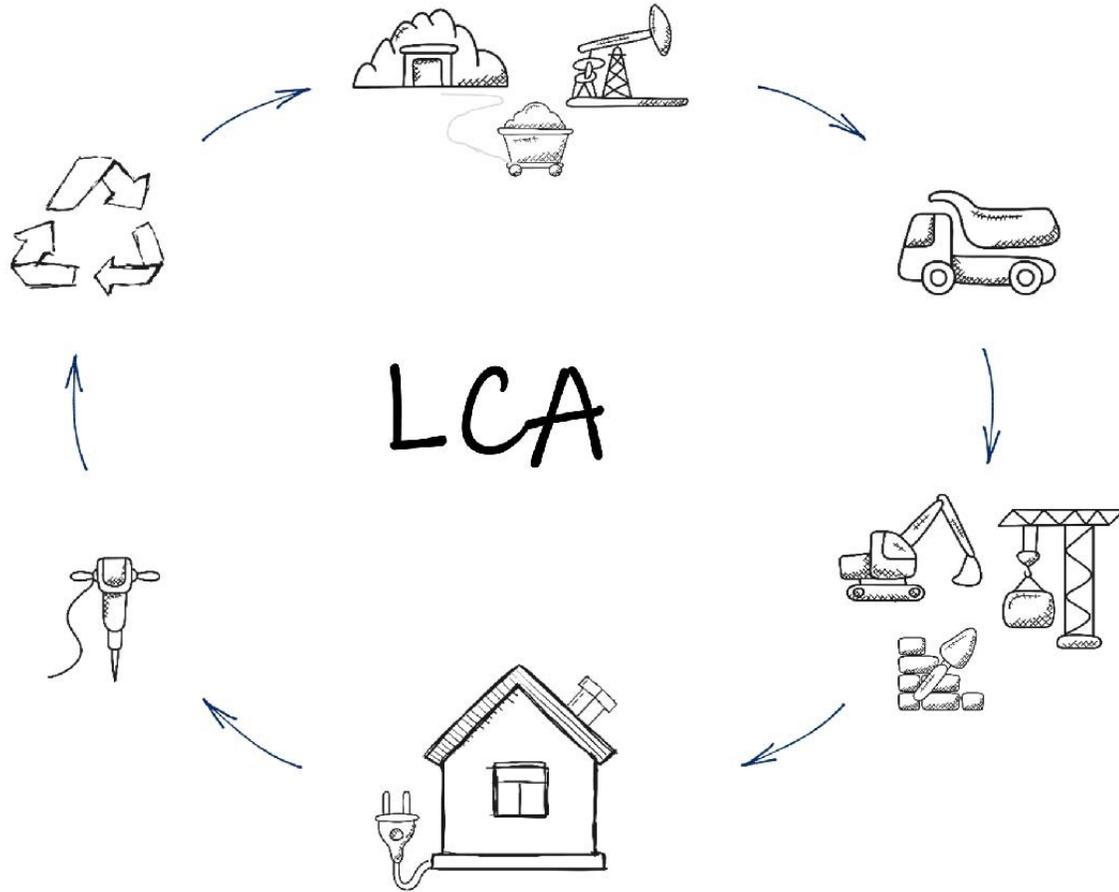
source: BBSR, Berlin in collaboration with smenso (Smart Enterprise Solution), Pforzheim

## Added Value

In addition to the pure BNB application, the chosen approach allows for the first time a permanent scientific evaluation of centrally collected building data.

The added value of the eBNB goes well beyond the field of sustainable building. The first digital interfaces are currently under development.

# Digital Sustainable Construction

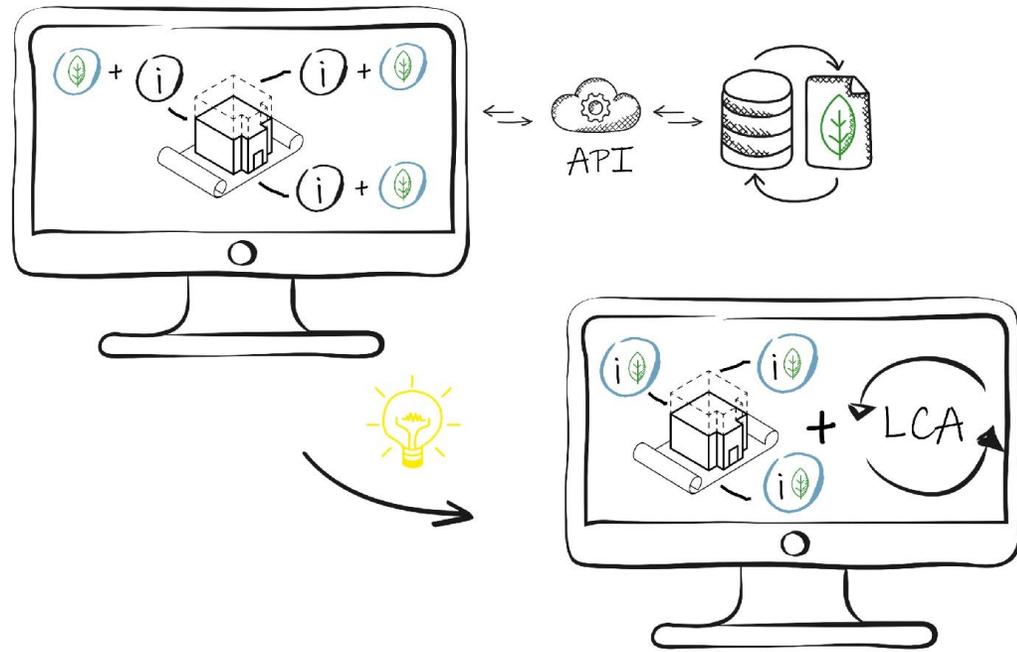


## The Use of BIM to Simplify Whole Building LCA

Digital building models offer a great potential to link external LCA and material databases for sustainable assessments and their live visualization. This contributes to achieving climate targets. The construction and operation of buildings is the largest emitter of CO<sub>2</sub> in the world, consumes a large amount of resources and generates 25% of solid waste.

Life Cycle Assessment (LCA) is a method for the holistic evaluation of the environmental impact of buildings. However, this method is quite complex and time-consuming because energy and material flows are extracted manually from 2D drawings and building descriptions.

# Digital Sustainable Construction



## Digitalization as a Tool

Building Information Modeling (BIM) has a high potential to integrate LCA into day-to-day planning more efficiently.

By using digital models, the information required for the LCA calculation can be provided earlier, more structured and easier to access. Combined with a new method, developed in this project, the LCA data sets of the German open source LCA database ÖKOBAUDAT are integrated into the model and linked to the data of geometry.

This is done by using an Application programming Interface (API) which enables a mapping of ÖKOBAUDAT LCA data sets per Universally Unique Identifier (UUID). As a result, a very fast calculation of the whole building LCA is possible and provides a foundation for automated sustainable assessments.

# SNAP: Sustainability Requirements in Architectural Planning Competitions



*Science building for biodiversity, Berlin  
1st Prize: Glass Kramer Löbbert Architekten  
Sustainability objective: BNB-Gold*

© Glass Kramer Löbbert Architekten

## Aims and Focus

Initiating architectural competition is of outstanding importance in order to combine sustainability with architectural development early in planning process. Therefore, the „Classification for Sustainability Requirements in Planning Competitions (SNAP)“ was published in 2013 as a result of a research project.

Accordingly the ongoing research project collects and evaluates the practical experience that has been gained in the meantime and is still developing the SNAP methodology.

Thus, the „SNAP update“ should help to ensure that sustainability aspects are taken into account as an obvious part of public and private planning competitions.

# SNAP: Sustainability Requirements in Architectural Planning Competitions

## Determine the Direction

- BNB objective agreement and analysis of the central sustainability aspects
- Feasibility check of programme, construction site and objectives
- Selection of suitably competent participants in the competition

## Accentuating Impulses

- Clarification of the sustainability requirements

## Comprehensive Assessment

- Concise communication of the results of the preliminary reviews
- Consideration of the assessment and sustainability criteria during evaluation rounds
- Written assessment of the shortlist including sustainability qualities and deficits



## Increase Hit Rate

- Pre-design sustainability requirements as an inherent part of the competition call
- Provision of suitable planning bases („predefined energy concept or renewable energy potentials“)

## Grasp the Essentials

- Identifying the relevant sustainability characteristics
- Adjustment of the pre-testing methods (especially energy, LCA, LCC)
- Condensed and graphically plausible sustainability evaluation

## Promoting Solutions

- Presentation of the competition objectives and results in form of press release, exhibition and documentation

# SNAP: Sustainability Requirements in Architectural Planning Competitions

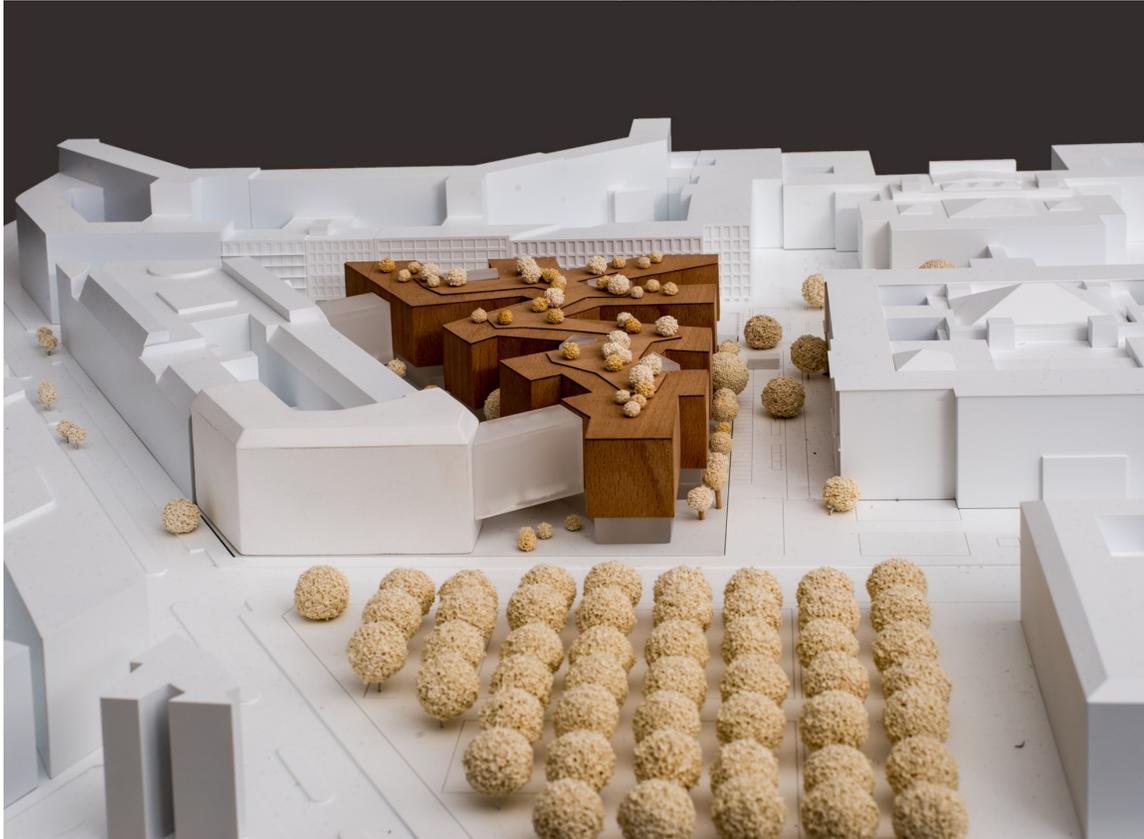
Theme	No.	Criteria
functionality	01	infrastructure
	02	public accessibility
	03	accessibility
	04	safeness
	05	communication
comfort und cosiness	06	sound insulation
	07	daylight
	08	indoor climate
economics	09	space efficiency
	10	flexibility of use
	11	life cycle costs
resources and energy	12	land take
	13	building materials
	14	energy demand
	15	energy demand coverage

© eeconcept

## Themes and Criteria

The 15 pre-design criteria (see table) provide essential guidance. These are defined on the basis of the BNB system, to which further indicators, planning aspects and benchmarks are assigned to. Accordingly, the requirements are formulated in the outline of the competition, evaluated in the preliminary examination and finally explained by the jury by analysing main design characteristics of all submissions.

# SNAP: Application in Architectural Competitions



source: BBR/photographer: Winfried Mateyka

*1st prize - model view of the extension building  
design: C. F. Møller Architects, Aarhus and C. F. Møller Landscape Architects, Aarhus*

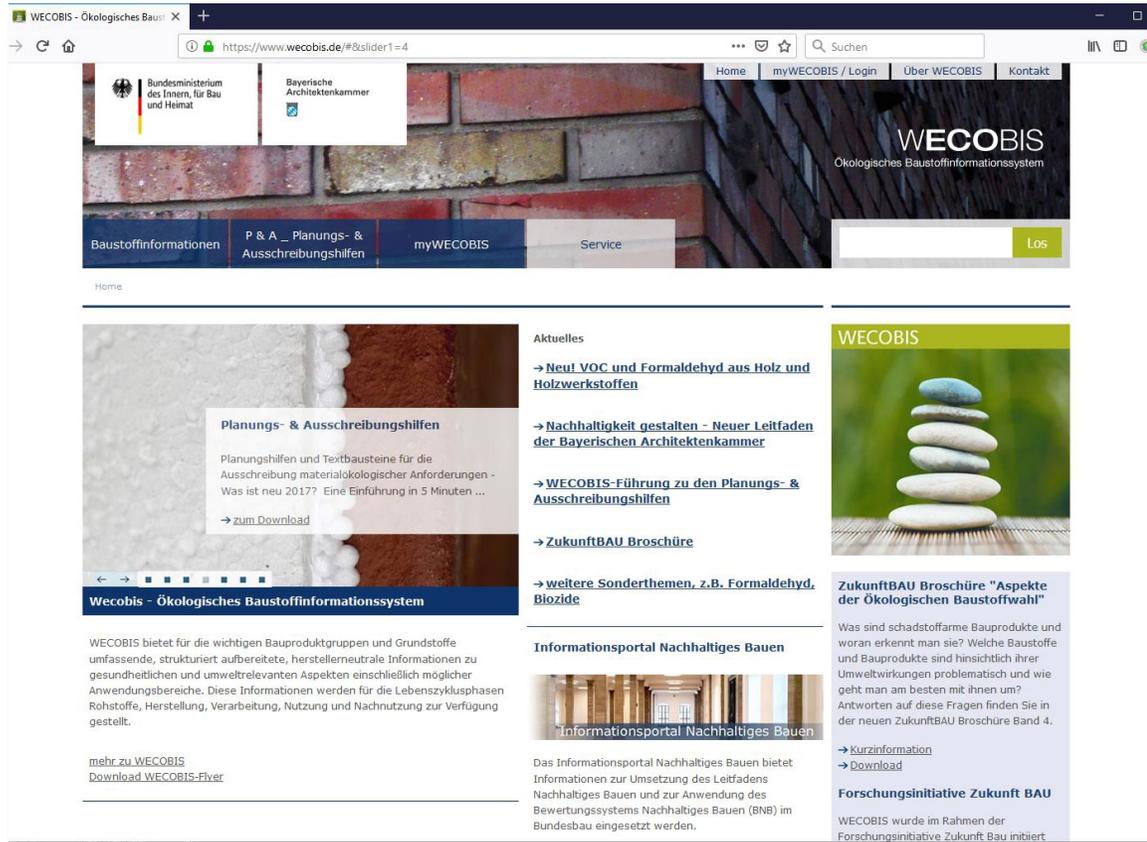
## Practical Application

The extension of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety office building in Berlin-Mitte is a current lighthouse project to implement the goals of climate protection and sustainable construction in Germany in an exemplary manner.

The sustainability potential was assessed in the architectural competition procedure in 2019 / 2020 in order to support the jury and to be able to ensure the desired implementation of the BNB standard in gold at an early stage. In order to accentuate the specific nature of the competition – which focuses on a distinctly low-tech strategy – three topics were given priority in addition to the overall consideration:

- the global warming potential
- the indoor air hygiene
- the daylight availability

# Tools for Sustainable Building



## Wecobis

The web-based ecological building material information system (wecobis) provides qualitative information to health-related and environmental issues of building material.

The focus is on the avoidance of pollutants and risk substances. The requirements of the BNB system are explicitly taken into account with concrete practical information and tender aids.

# Guidelines and Working Aids

 Federal Ministry for the  
Environment, Nature Conservation,  
Building and Nuclear Safety

## Guideline for Sustainable Building

Futureproof Planning, Construction and Operation of Buildings



 Bundesinstitut  
für Bau-, Stadt- und  
Raumforschung  
Im Bundesamt für Bauwesen  
und Raumordnung

## Zukunft Bauen

Forschung für die Praxis | Band 08

### Nachhaltiges Bauen des Bundes

Grundlagen – Methoden – Werkzeuge



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## Zukunft Bauen

Forschung für die Praxis | Band 16

### Nachhaltig geplante Außenanlagen



# Assessment System: System Variants and Module Applications



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*Max-Planck-Institut, Köln  
BNB: Laboratory Building | New Construction | Silver  
Design: hammeskrause architekten | Audit: ee concept GmbH*

## System Variants for Different Building Types

System variants consider the special requirements of different building categories. The following variants are available:

- Office and Administration Building
- Educational Building
- Laboratory Building
- Outdoor Facility

## Modules and their Application

The BNB modules reflect the cases planning and erecting new buildings, using and operating buildings, as well as planning and performing refurbishment and conversion projects. The following modules are available:

- New Construction
- Use and Operation
- Complete Refurbishment

# Assessment Systems in Germany



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*Federal Environment Agency, Berlin-Marienfelde  
BNB: Office and Administration | New Construction | Gold  
Design: Braun-Kerbl-Löffler | Audit: Nicolas Kerz, BBSR*

## BNB-System

The Assessment System for Sustainable Building for Federal Buildings (BNB-System) was developed primarily for use of the German Federal Government.

There is also an interdependence with the requirements for federal construction measures and the Guideline for Sustainable Building.



# Assessment Systems in Germany



*Department of Urban Development and Environment, Hamburg  
DGNB: Office and Administration | New Construction | Platin  
Design: Sauerbruch Hutton | Audit: solidar planungswerkstatt*

## DGNB-System

The German Sustainable Building Council (DGNB) provides certification systems for many different building categories from office and administration via residential and educational buildings to hotels and industrial buildings.

There is also the possibility to certify urban quarters and perform serial certifications. In addition, there are offers for training and further education, topic-related events and further information, such as DGNB Navigator for construction products.



# Assessment Systems in Germany



© Andreas Süß

*HOWOGE Treskow-Höfe, Berlin  
NaWoh: Seal of Quality  
Design: Ligne Architekten | Audit: HOCHTIEF Building GmbH*

## NaWoh-System

The Assessment System for Sustainable Housing (NaWoh) was developed jointly by the German Housing Association (GdW) and the German Federal Government.

The focus addresses the requirements for sustainable and cost-effective housing. The results are awarded a seal of quality that documents compliance with defined requirements. Special features of the projects are presented in a distinguishing strength-profile.



# Assessment Systems in Germany



© Fischerhaus GmbH & Co. KG

*Fischerhaus Musterhaus, Günzburg  
BNK: Very Good  
Design: Fischerhaus GmbH & Co. KG | Audit: Rainer Limbrunner*

## BNK-System

The building institute BiRN provides the Assessment System for Sustainable Building of small residential buildings (BNK).

Primarily single-family and two-family houses of private builders are evaluated. The system is based on the BNB system and has been adapted to the specific requirements.



# Building the Future

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