



# Building the Future

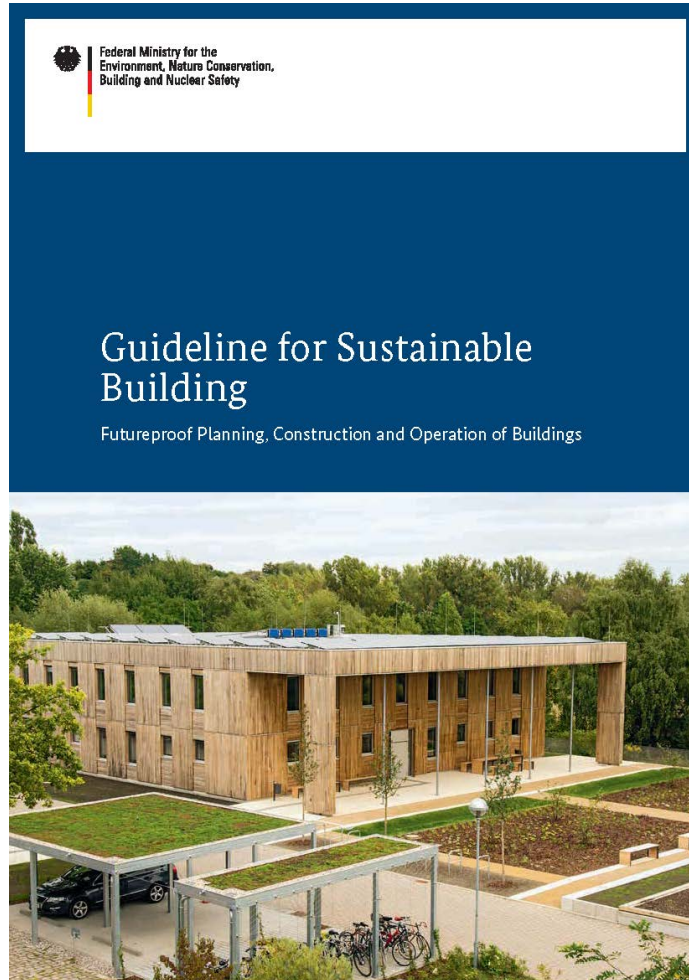
# ZUKUNFT BAU

FÖRDERN FORSCHEN ENTWICKELN

## Assessment Systems and Tools for Sustainable Building



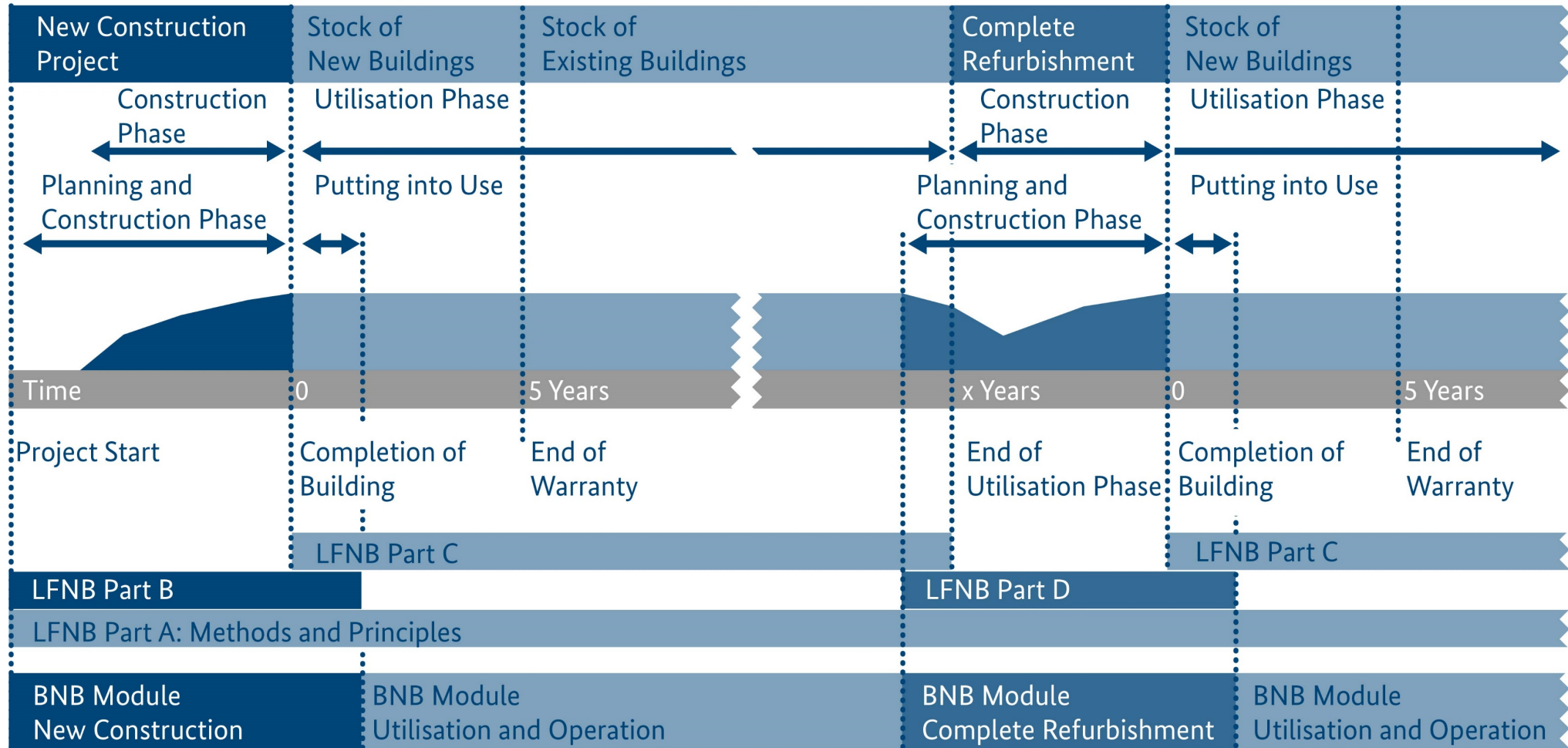
# Guideline for Sustainable Building



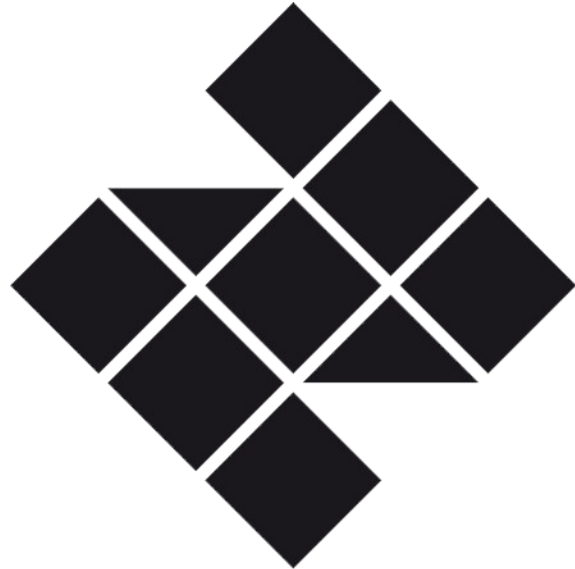
Introduced in 2001 the Guideline for Sustainable Building is continually being under further development with regard to the Assessment System for Sustainable Building for Federal Buildings (BNB). The Guideline provides general principles and methods of sustainable design. It offers a specific practical 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 criterion1						
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 %

Total degree of fulfilment of the building

100 %

95 %

90 %

85 %

80 %

75 %

70 %

65 %

60 %

55 %

50 %

1.0

1.5

2.0

3.0

Nachhaltiges Bauen

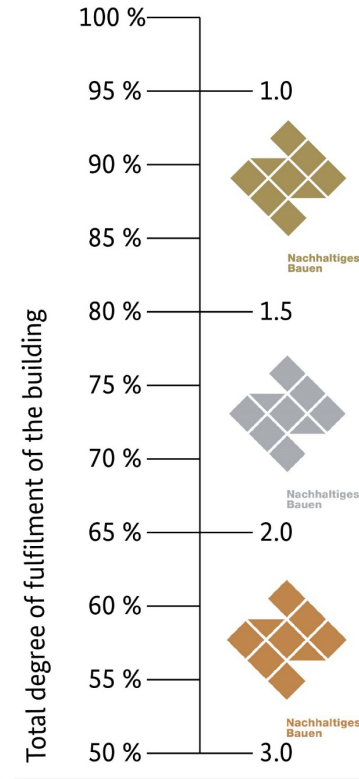
Nachhaltiges Bauen

Nachhaltiges Bauen

Nachhaltiges Bauen

Degree of Fulfilment

Location Profile (informative)



Degree of Fulfilment  
Location Profile (informative)

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.

# 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 - Erweiterungsbau  
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%	
<b>Wirkungen auf die globale Umwelt</b>		1,2
1 Treibhauspotenzial (GWP)	100%	
2 Ozonabbauauspotenzial (ODP)	100%	
3 Ozonbildungspotenzial (POCP)	100%	
4 Versauerungspotenzial (AP)	80%	
5 Überdüngungspotenzial (EP)	75%	
6 Risiken für die lokale Umwelt	50%	
8 Sonstige Wirkungen auf die globale Umwelt	100%	
9 Mikroklimate	100%	
<b>Ressourcenumschneidung</b>		
10 Primärenergiebedarf nicht erneuerbar (PE <sub>nd</sub> )	100%	
11 Gesamtprimärenergiebedarf und Anteil erneuerbare Primärenergie (PE <sub>g</sub> )	85%	
14 Trinkwasserbedarf und Abwasseranforderungen	77%	
15 Flächenumschneidung	100%	
<b>Ökonomische Qualität</b>	91%	
<b>Lebenszykluskosten</b>		1,1
16 Gebäudebezogene Kosten im Lebenszyklus	95%	
17 Wertebildung	85%	
<b>Soziokulturelle und funktionale Qualität</b>	39%	
<b>Gesundheit, Behaglichkeit und Nutzerzufriedenheit</b>		3,7
18 Thermischer Komfort im Winter	10%	
19 Thermischer Komfort im Sommer	10%	
20 Innenraumklima	50%	
21 Akustischer Komfort	0%	
22 Visueller Komfort	62%	
23 Einflussnahme des Nutzers	50%	
24 Dachgestaltung	100%	
25 Sicherheit und Mischbelastungen	62%	
<b>Funktionalität</b>		
26 Barrierefreiheit	75%	
27 Flächeneffizienz	26%	
28 Unmutarungsfähigkeit	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%	
<b>Qualität der technischen Ausführung</b>		1,9
33 Brandschutz	75%	
34 Schallschutz	70%	
35 Energieeffizienz und bautechnische Qualität der Gebäudehülle	59%	
40 Reinigung und Instandhaltung	79%	
42 Rückbauvermögen, Recyclingfreundlichkeit, Demontagefreundlichkeit	57%	
<b>Prozessqualität</b>	35%	
<b>Qualität der Planung</b>		4,0
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%	
<b>Standortmerkmale</b>		1,7
56 Risiken am Mikrostandort	71%	
57 Verhältnisse am Mikrostandort	33%	
58 Lage und Zustand von Standort und Quartier	38%	
59 Verkehrsanbindung	97%	
60 Nähe zu nutzungrelevanten 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**

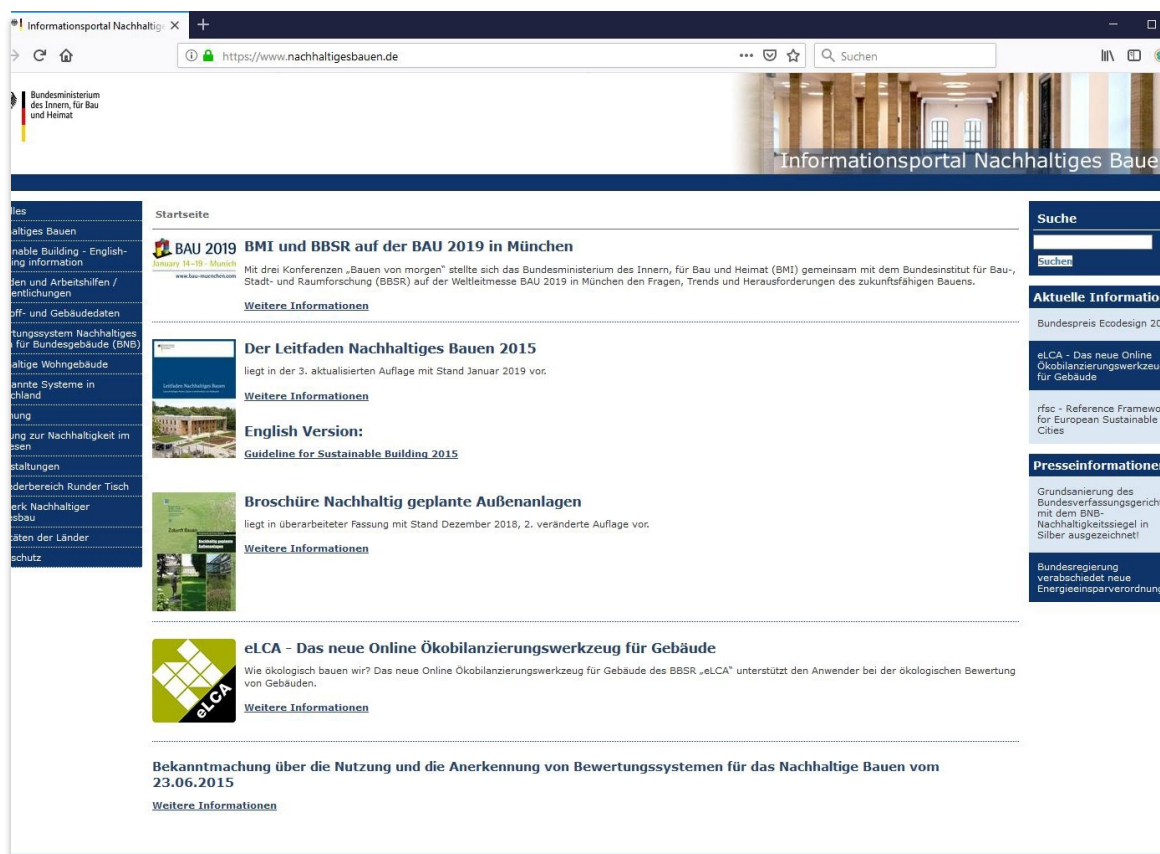
Hauptkriteriengruppen	Erfüllungsgrad	Anteil gesamt
Ökologische Qualität	89 %	22,5 %
Ökonomie	91 %	22,5 %
Soziokulturelle und funktionale Qualität	39 %	22,5 %
Technische Qualität	68 %	22,5 %
Prozessqualität	35 %	10,0 %

HZA Anlage 3

...and the fulfillment of the main criteria groups



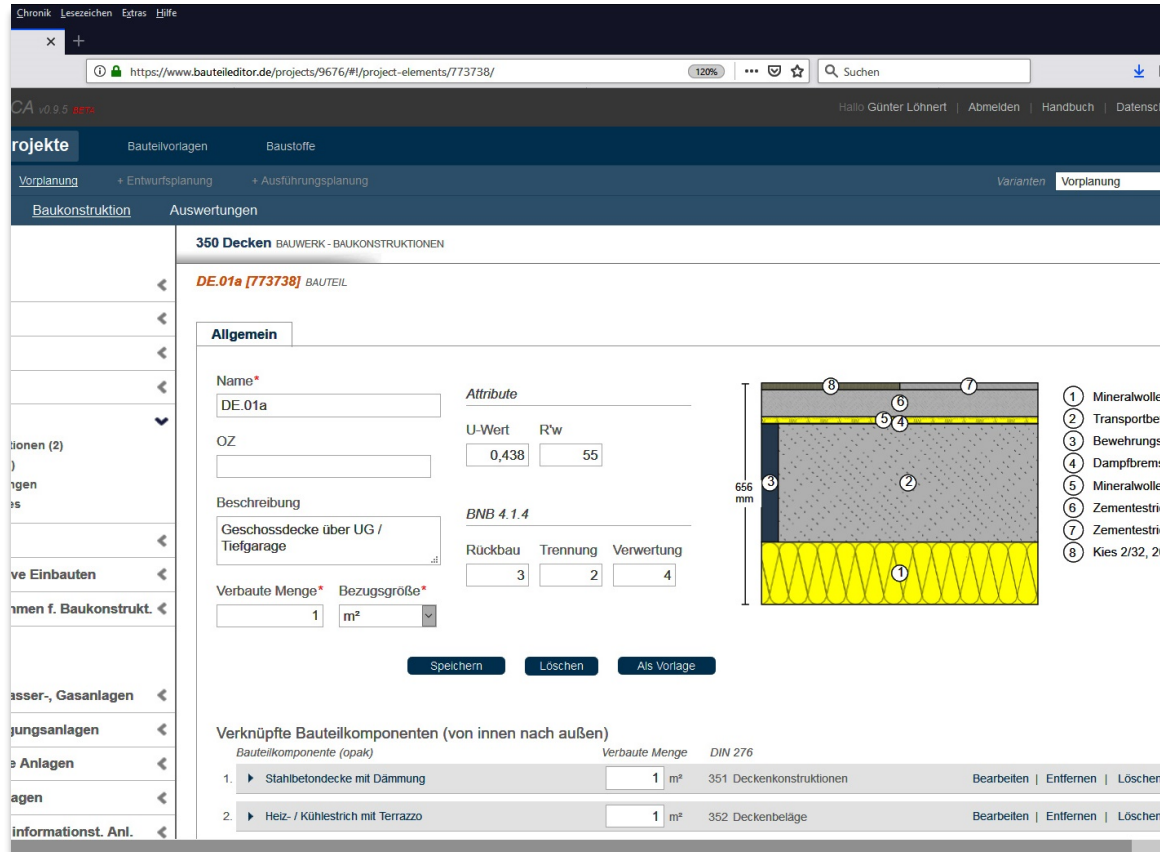
# Tools for Sustainable Building



## 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

LAYOUT

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	▼	-11,61

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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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
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1.2.2		Gesamtprimärenergiebedarf (PEges) und Anteil erneuerbarer Primärenergie (PEe)	2,25 %	75,0	100,0	100,0	▲	0,0
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2		Ökonomische Qualität	22,5 %					79,592 %
2.1		Lebenszykluskosten	13,5 %					
2.1.1		Gebäudebezogene Kosten im Lebenszyklus	13,5 %	65,0	100,0	75,0	▲	25,0
2.2		Wertentwicklung	9,0 %					
2.2.1		Drittverwendungsfähigkeit	9,0 %	65,0	48,98	75,0	▼	-26,02
3		Soziokulturelle und funktionale Qualität	22,5 %					65,611 %
3.1		Gesundheit, Behaglichkeit und Benutzerzufriedenheit	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
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3.2		Funktionalität	6,429 %					
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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

## 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).

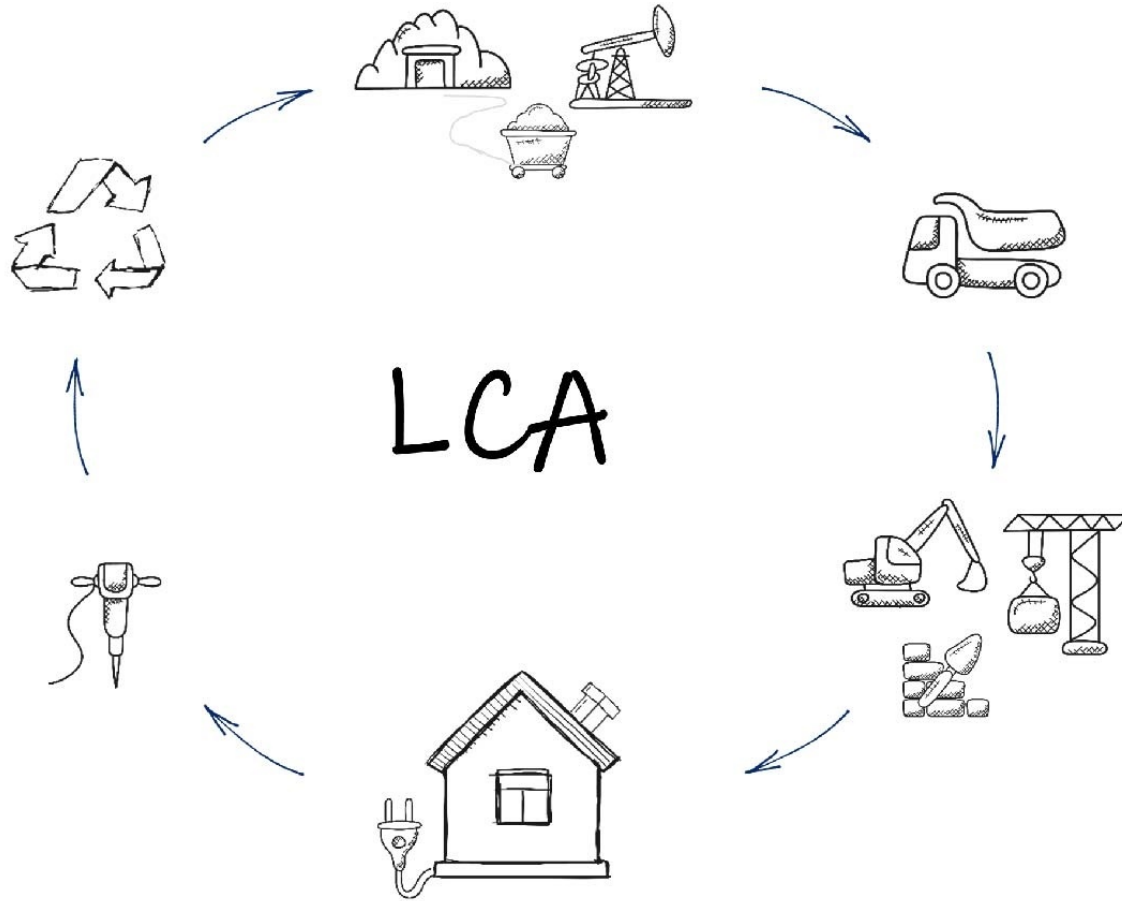


## Added Value

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

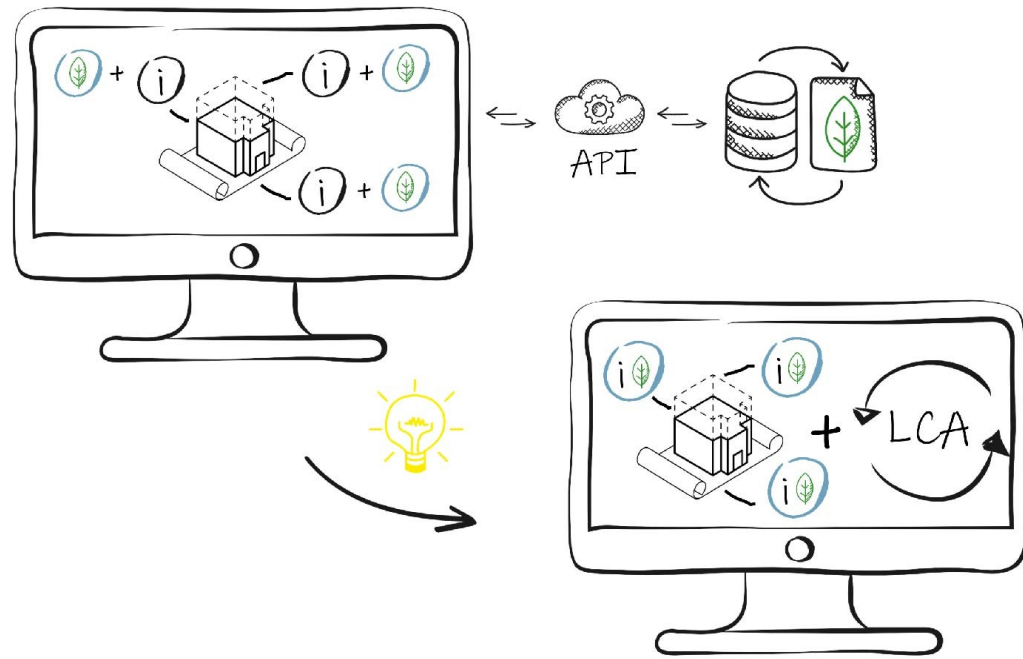


## The Use of BIM to Simplify Whole Building LCA

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



© Glass Kramer Löbbert Architekten

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

## 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

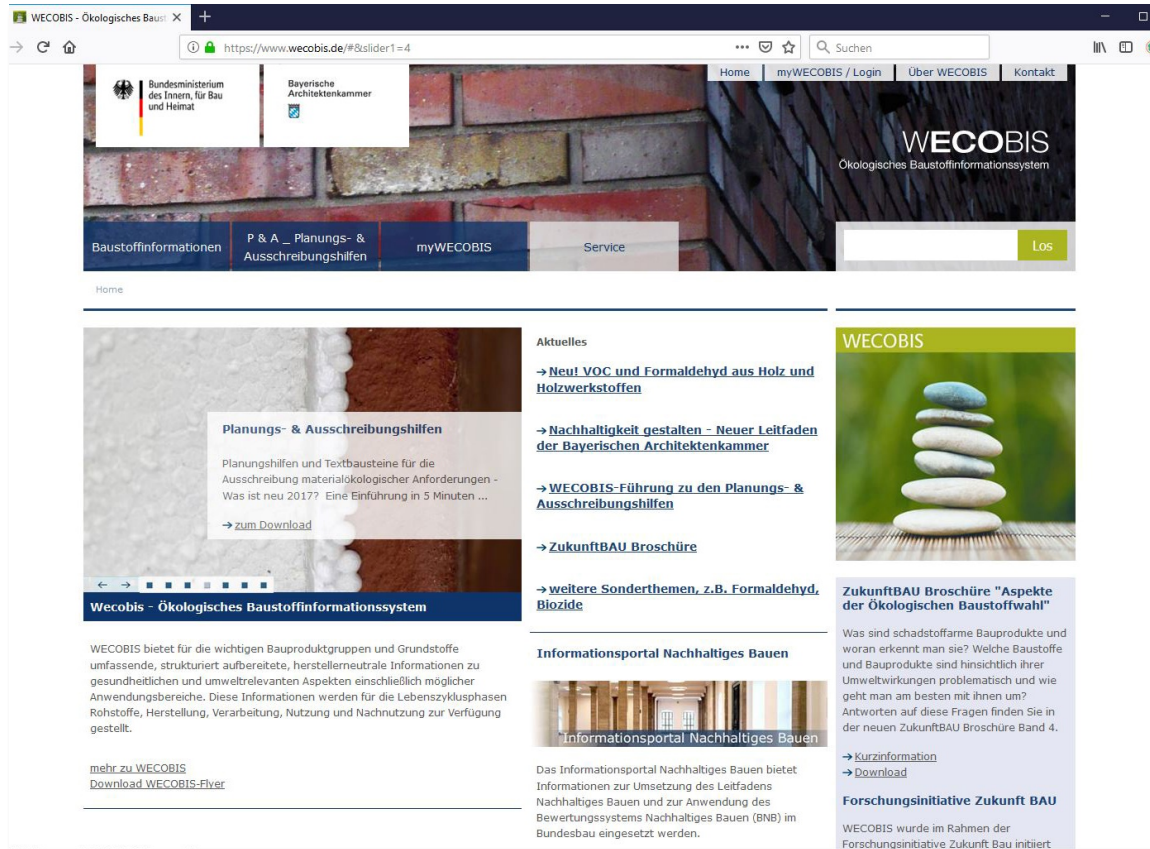
The extension of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety office building in Berlin-Mitte is a current lighthouse project to implement the goals of climate protection and sustainable construction in Germany in an exemplary manner.

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

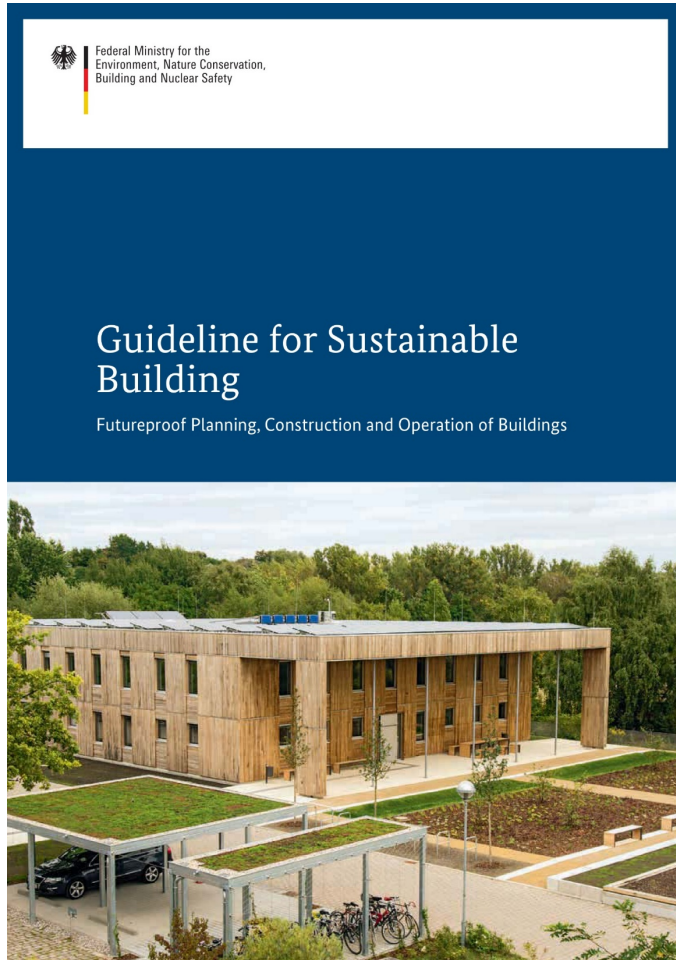


## Wecobis

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





# Assessment System: System Variants and Module Applications



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

© Joern Lehmann

## 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



© quats.tv GmbH & Co.KG

*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).

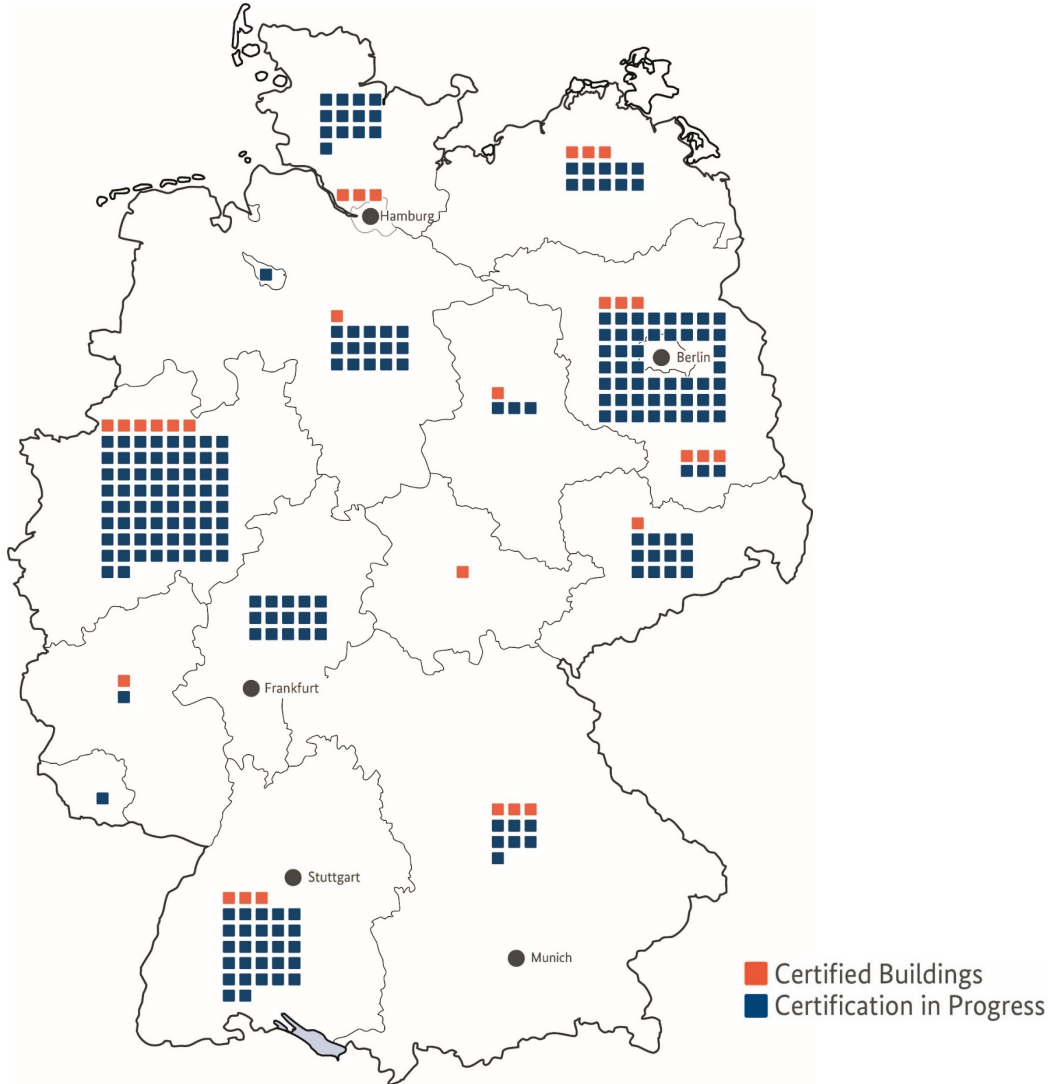
Primarily single-family and two-family houses of private builders are evaluated. The system is based on the BNB system and has been adapted to the specific requirements.



## Application of the Assessment System BNB



# Application of the Assessment System BNB



The adjacent map shows BNB-certified projects - both finished and still in progress. The projects are distributed all over the federal states of Germany. There are 29 certified projects so far, but more than 200 projects are in the process of implementation.

Most projects are federal properties, but there is also a growing number of municipal and private buildings implementing the certification with the BNB-System.

# Ministry of Education and Research, Berlin



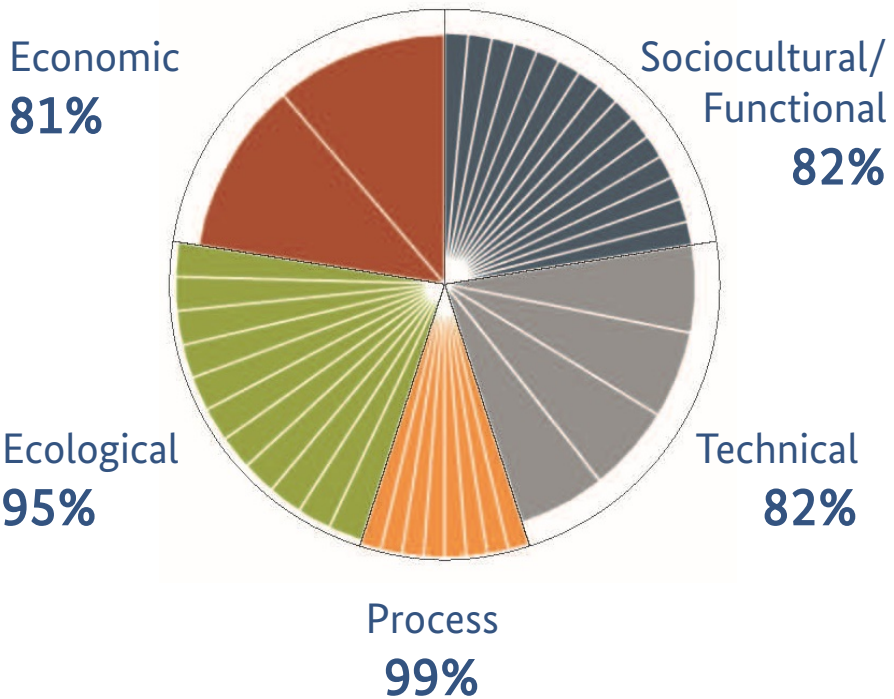
## Office and Administration New Construction | Grade 1.3 | GOLD

The new building of the Federal Ministry of Education and Research (BMBF) in Berlin is the first civilian building project implemented by the Federal Government in the context of a Public Private Partnership (PPP), and is also the first project of this size and type awarded with a BNB Gold certificate.



Nachhaltiges  
Bauen

## Weighting of Assessment Quality 86.2 %



Office Building (New Construction)	Gold according to BNB_BN 2011
Client	Institute for Federal Real Estate
Architect / Planner	Christian Pelzeter, Heinle, Wischer und Partner
Auditor	Thomas Thümmeler, WS GreenTechnologies GmbH
Completion	August 2014
Gross Floor Area (GFA)	58,273 m²
Gross Construction Costs	€ 114.5 million
Construction Costs (KG 300, 400)	1,151 €/m² <sub>GFA</sub> (net)
Operation Costs	772 €/m² <sub>GFA</sub> (net)
Life Cycle Costs	1,922 €/m² <sub>GFA</sub> (net)
Primary Energy Demand total (LCA)	101 kWh/(m²NFA <sub>a</sub> a)
Global Warming Potential (LCA)	21.86 kg CO <sub>2</sub> eqv./ (m²NFA <sub>a</sub> a)



# Federal Constitutional Court, Karlsruhe



© Stephan Baumann, bild\_raum, Karlsruhe

## Office and Administration | Complete Refurbishment Grade 1.7 | SILVER

The Federal Constitutional Court is in the city centre of Karlsruhe, close to the public park of Schlossplatz and a Botanical Garden.

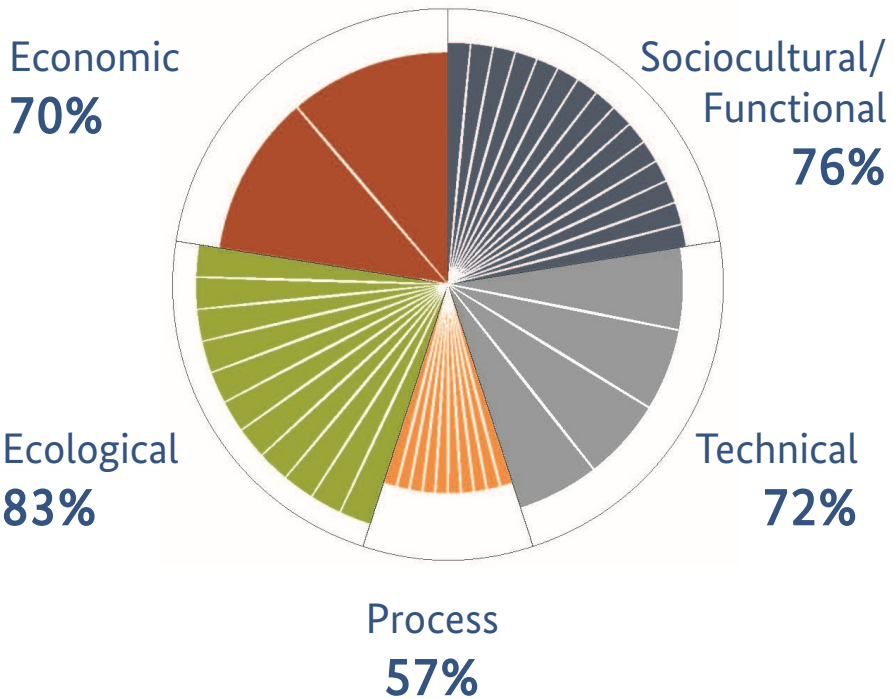
The challenge was to preserve the distinctive, transparent architectural language as an expression of a representative and broad understanding of democratic jurisdiction. However, at the same time a contemporary, energy-efficient building that provides a comfortable indoor climate for the next life cycle should be realised.



Nachhaltiges  
Bauen

# Federal Constitutional Court, Karlsruhe

## Weighting of Assessment Quality 73.3 %



Office Building (Refurbishment)	Silver according to BNB_BN 2011
Client	Institute for Federal Real Estate
Architect / Planner	Christian Pelzeter, Heinle, Wischer und Partner
Auditor	Thomas Thümmeler, WS GreenTechnologies GmbH
Completion	August 2014
Gross Floor Area (GFA)	58,273 m²
Gross Construction Costs	€ 114.5 million
Construction Costs (KG 300, 400)	1,151 €/m² <sub>GFA</sub> (net)
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Global Warming Potential (LCA)	21.86 kg CO <sub>2</sub> eqv./ (m²NFA <sub>a</sub> a)



# Center for Neurodegenerative Disease, Bonn



© Steffen Vogt für wulf architekten

## Laboratory | New Construction Grade 1.4 | GOLD

The building is located on the campus of the University Hospital Bonn, as part of the German Center for Neurodegenerative Diseases (DZNE).

Three organically shaped buildings are connected by circulation areas, where spacious seating offers meeting points.

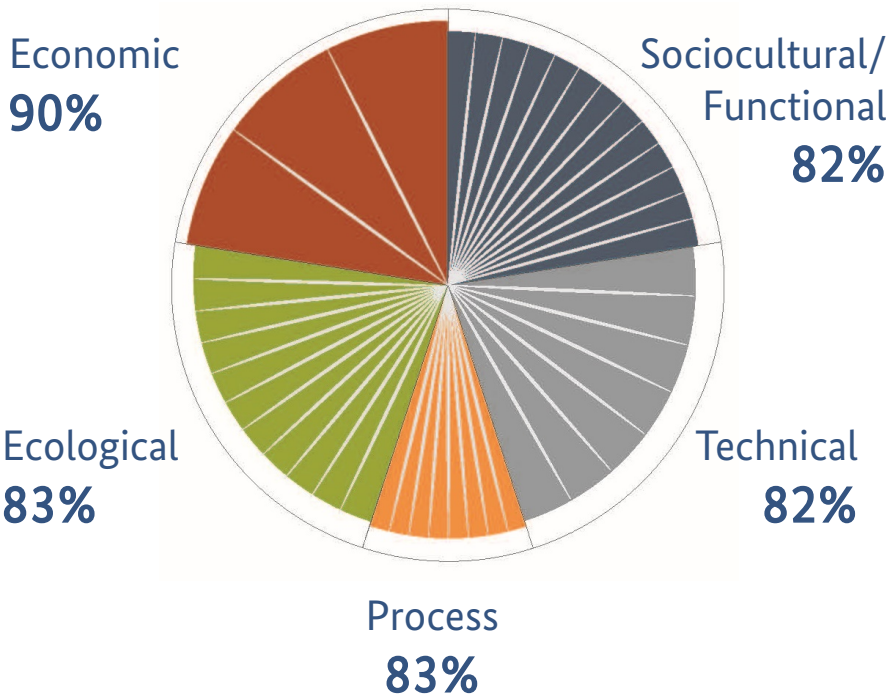
They consist of a main building including the entire general facilities, entrance hall, cafeteria, lecture hall, library, clinical research, MRI and administration representing a central research building providing all laboratory facilities and offices, and the preclinical institute.



Nachhaltiges  
Bauen

# Center for Neurodegenerative Disease

## Weighting of Assessment Quality 84.1 %



Laboratory Building (New Construction)	Gold according to BNB_LN 2014
Client	DZNE e. V., Bonn
Architect / Planner	wulf architekten gmbh, Stuttgart
Auditor	Johannes Hopf, DS-Plan GmbH, Stuttgart
Completion	April 2017
Gross Floor Area (GFA)	35,938 m²
Gross Construction Costs	€ 127 million
Construction Costs (KG 300, 400)	2,296 €/m² <sub>GFA</sub> (net)
Operation Costs	1,588 €/m² <sub>GFA</sub> (net)
Life Cycle Costs	4,579 €/m² <sub>GFA</sub> (net)
Primary Energy Demand total (LCA)	343 kWh/(m²NFA <sub>a</sub> a)
Global Warming Potential (LCA)	67.6 kg CO <sub>2</sub> eqv./ (m²NFA <sub>a</sub> a)



# Day Care Centre, Ulm



© Staatliches Hochbauamt Ulm/Botzenhardt Fotografie

## Educational Building| New Construction Grade 1.6 | SILVER

The building is designed on a regular grid in timber frame construction and thus offers maximum flexible indoor use. The project has been realized as a highly efficient building based on the passive house standard with a high proportion of renewable raw materials.

The result is a single-storey building in timber frame construction including an extensively greened flat roof. The facade is designed as a rough-cut timber formwork.

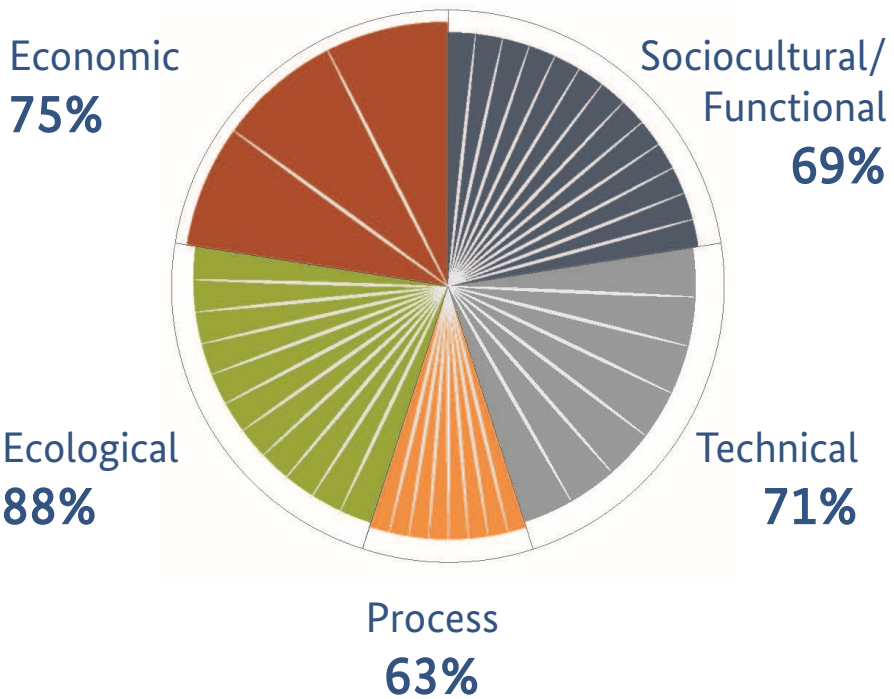


Nachhaltiges  
Bauen



# Day Care Centre, Ulm

## Weighting of Assessment Quality 76.4 %



Laboratory Building (New Construction)	Silver according to BNB_UN 2013
Client	Ministry of Defense
Architect / Planner	Günter Hermann Architekten Stuttgart
Auditor	Iris Schaaf, Staatliches Hochbauamt Ulm
Completion	September 2015
Gross Floor Area (GFA)	1,120 m²
Gross Construction Costs	€ 39 million
Construction Costs (KG 300, 400)	1,695 €/m² <sub>GFA</sub> (net)
Operation Costs	806 €/m² <sub>GFA</sub> (net)
Life Cycle Costs	2,886 €/m² <sub>GFA</sub> (net)
Primary Energy Demand total (LCA)	265 kWh/(m²NFA <sub>a</sub> a)
Global Warming Potential (LCA)	34,8 kg CO₂ eqv./ (m²NFA <sub>a</sub> a)



# More Sustainable Buildings in Germany



© Henning Koepke München

*German Aerospace Center e.V. (DLR)  
BNB: Office and Administration / New Construction / Silver  
Design: Birk Heilmeyer und Frenzel  
Audit: Landesbaudirektion Bayern*



# More Sustainable Buildings in Germany



© Dr. Günter Löhnert

*Primary School Niederheide  
BNB: Educational Building | New Construction | Gold  
Design: IBUS Architekten und Ingenieure GbR  
Audit: Dr. Günter Löhnert, sol-id-ar planungswerkstatt*



# More Sustainable Buildings in Germany



© quatsi.tv GmbH & Co.KG

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



# More Sustainable Buildings in Germany



© Andreas Süß

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



# More Sustainable Buildings in Germany



© Ferdinand Heide Architekt

*University of Regensburg –  
Auditorium and Disposal Building  
BNB: Educational Building | New Construction | Silver  
Design: Ferdinand Heide  
Audit: Oberste Baubehörde Bayern*



# More Sustainable Buildings in Germany



© Jürgen Landes

*University of Applied Sciences Erfurt –  
lecture hall and laboratory building  
BNB: Educational Building | New Construction | Silver  
Design: Gerber Architekten  
Audit: Jürgen Norwig, TMBLV*



# More Sustainable Buildings in Germany



© Jürgen Landes

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



# More Sustainable Buildings in Germany



© Sprinkenhof AG

*Department of Urban Development and Environment, Hamburg  
DGNB: Office and Administration / New Construction / Platinum  
Design: Sauerbruch Hutton  
Audit: Dr. Günter Löhnert, sol-id-ar planungswerkstatt*



# More Sustainable Buildings in Germany



© Hager Partner AG

*Bundestag, Inner Courtyard  
BNB: Outdoor Facilities / Bronze  
Design: Hager Partner AG  
Audit: LA.BAR Landschaftsarchitekten bdla*





# More Sustainable Buildings in Germany



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



# More Sustainable Buildings in Germany



© GAP Architekten

*Paul-Wunderlich-Haus, Eberswalde  
DGNB New Building: Platinum /  
DGNB Existing Building: Platinum /  
BNB Use and Operation: Award  
Design: GAP Architekten  
Audit: Dr. Günter Löhnert, sol-id-ar planungswerkstatt*



# Building the Future

## Further Research Projects



# SDGs in Germany: Multi-Level Analysis and Monitoring



## SUSTAINABLE DEVELOPMENT GOALS

### Activities Serving the SDGs

The SDGs are involved into various activities in the context of cities, urban neighbourhoods and buildings as well as the individual behaviour of citizens. BBSR's Global Urban Transformation Project shows that all these activities are part of integrated and interdisciplinary local transformation paths in cities of different sizes, e.g. in

- Hamburg (1.800.000 people)  
Green, Fair and Growing City on the Waterfront
- Leipzig (560.000 people)  
Integrated Urban Development Leipzig 2030 Concept
- Jena (110.000 people)  
Jena 2030 Mobility Concept
- Finsterwalde (18.000 people)  
Future City in a predominantly rural area

# SDGs in Germany: Multi-Level Analysis and Monitoring

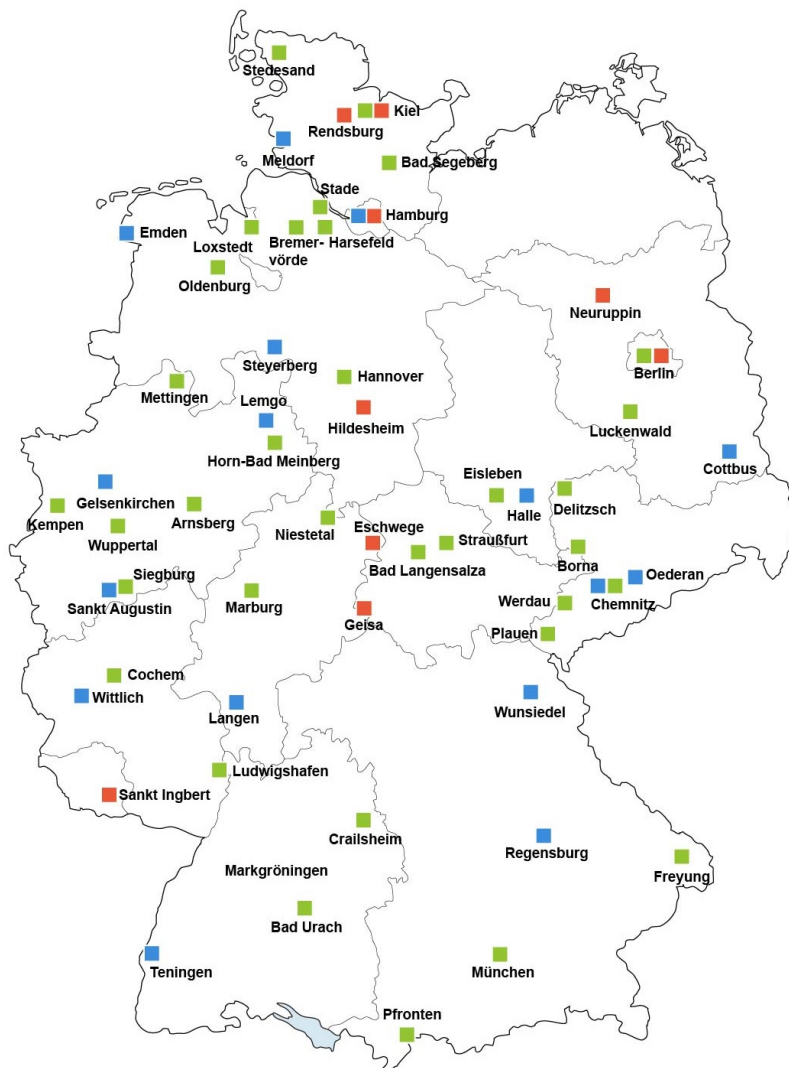


## SDG Indicator Set for Municipalities

In a joint initiative in Germany institutions developed the SDG Indicator Set for Municipalities as a set of specific indicators, which is compatible with the Sustainability Strategy of Germany and may be aggregated across levels:

- Association of German Cities (DST)
- German Association of Towns and Municipalities (DStGB)
- German Association of Counties (DLT)
- German Institute of Urban Affairs (DIFU)
- Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR)
- Bertelsmann Stiftung
- Service Agency Communities in One World (SKEW)

# Energy-Efficient Urban Redevelopment programme



## Programme-Related Research of KfW 432 Implementations

Since its establishment in 2011, the Energy-Efficient Urban Redevelopment programme (EnSanQ KfW) has been making important contributions to the localized realization of goals towards energy-transformation in Germany. Experiences with the implementation of KfW programmes 432 have been analyzed through supporting research since mid-2013.

The projects vary in terms of neighborhood size, ownership structures, and types of housing markets.



# Energy-Efficient Urban Redevelopment programme



## Programme-Related Research of KfW 432 Implementations

The projects are supported and analyzed based on their varying goal sets, and may be categorized as follows:

- **Reference projects:** which illustrate differentiation in local conditions depending on the municipality as well as diverse possibilities for the application of the programme.
- **Representative projects:** which provide examples for successful implementation of integrated development methods.
- **Focus projects:** which are of interest for “Energy-Efficient Urban Redevelopment” insofar as specific aspects, such as incorporation into the entire city development strategy, citizen participation, of building culture, may be thoroughly examined and provide practical knowledge.

# Efficiency House Plus



© Ulrich Schwarz

*Office and Administration building: Zero-Energy-Building Berlin  
Client: Federal Republic of Germany  
Design: Werner Sobek Stuttgart*

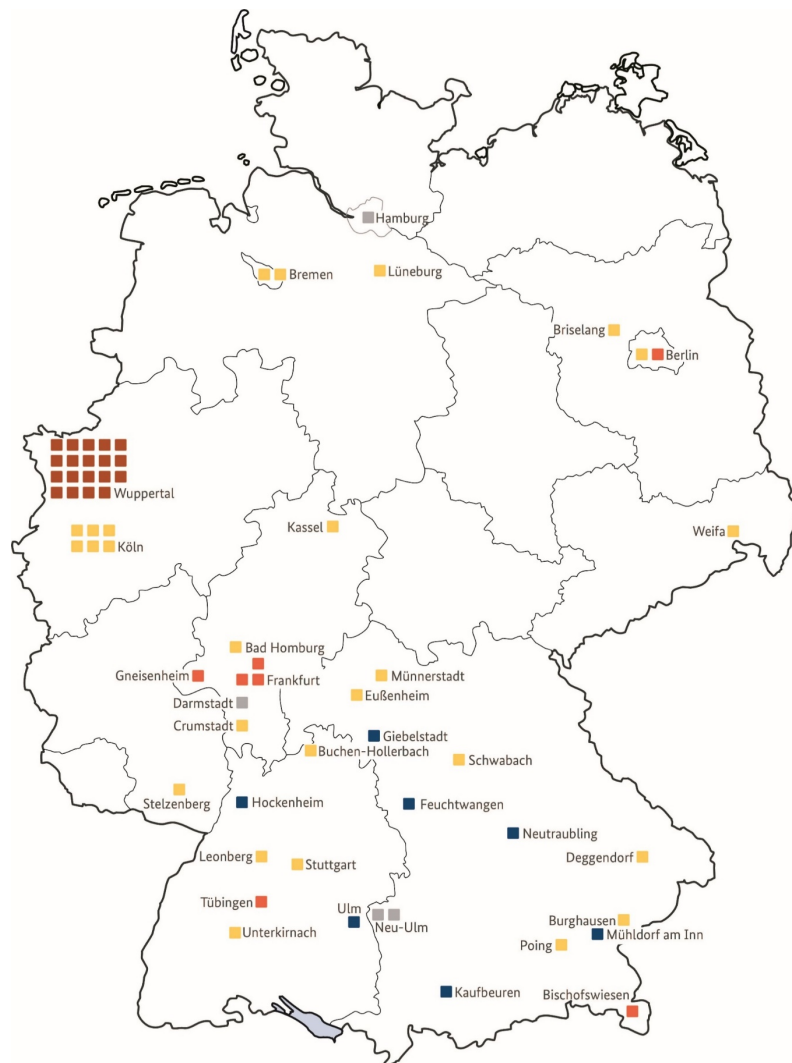
## Support programme for Housing and Educational Facilities

The German Federal Ministry of Building launched a first support programme in 2012 for a housing prototype that fulfils the Efficiency House Plus Standard.

The Efficiency House Plus Standard is true if a building provides:



- Negative annual primary energy demand:  $\sum Q_p < 0 \text{ kWh/m}^2\text{a}$
- Negative annual final energy demand:  $\sum Q_e < 0 \text{ kWh/m}^2\text{a}$

# Efficiency House Plus



## Network and Built Projects

The map gives an overview of the buildings in the network Efficiency House Plus. All buildings have either been extensively evaluated already or will be monitored in the near future. The researchers also evaluate the extent to which the Efficiency House Plus Standard relieves the environment of greenhouse gas emissions. Overall, the projects of the network can thus save approximately 1,000 t CO<sub>2</sub>eq annually in Germany. The Efficiency House Plus standard can thus make a significant contribution to climate protection.

 Residential Buildings  
 Apartment Blocks  
 Refurbishment

 Educational Buildings  
 District: Fertighauswelt Wuppertal



# Efficiency House Plus



© HO Immobilien + Baukonzepte GmbH

*Residential Building: Effizienzhaus Plus HO Immobilien & Baukonzepte  
Client: Brigitte von Engelbrechten, Holger Osterloh  
Design: Gruppe GME, HO Immobilien + Baukonzepte GmbH*

## Detached and Semi-detached Houses

The Federal Ministry of Building supported 26 small residential buildings in the Efficiency House Plus Standard. The buildings provide a compact design and a very low heat and electricity consumption.

The majority of energy needs are covered by environmental heat and photovoltaics. This generates more energy than is consumed.

# Efficiency House Plus



© Constantin Meyer Photographie

*Apartment Block: Aktiv-Stadthaus Frankfurt am Main  
Client: ABG Frankfurt Holding Wohnungsbau- und Beteiligungsgesellschaft mbH  
Design: HHS Planer + Architekten AG, Kassel | Energy Design: EGS-Plan*

## Apartment Blocks

During the first phase of the support programme the implementation of the concept concentrated on detached houses. Over the years the possibility of transferring the design method to apartment blocks emerged. For this purpose, a number of large housing complexes was built in Berlin and Frankfurt as Efficiency House Plus.



# Efficiency House Plus



*Refurbishment of Residential Buildings: Pfuhler Straße 12 -14  
Client: NUWOG Wohnungsgesellschaft der Stadt Neu-Ulm  
Design: o5 architekten bda*

## Refurbishment of Residential Buildings

A great challenge in Germany is the refurbishment of the existing building stock, particularly in the sector of small private residences.

A semi-detached house located in Mühlthal, which had originally been built during the 1970ies, was one of the first existing buildings to be transformed into an Efficiency House Plus in 2013.

As a next step, an architectural competition was held with the task of refurbishing two identical rows of houses towards a positive carbon footprint. The two winning concepts have been put into practice in Neu-Ulm between 2013 and 2016.

© Eibe Sönneken



# Efficiency House Plus



© Dorothea Burkhardt

*Educational Building: Louise-Otto-Peters-Schule Hockenheim, 2017  
Client: Eigenbetrieb Bau und Vermögen Rhein-Neckar-Kreis, Neckargemünd  
Design: Roth Architekten, Schwetzingen | Energy Design: Ing.-Büro Wilhaug GmbH*

## Educational Buildings

After successfully introducing the Efficiency House Plus approach for residential buildings, the next step was to apply it to non-residential structures. Therefore, in 2015 the German Federal Ministry of Building launched a support programme for the construction of Efficiency House Plus educational buildings.

Educational buildings are especially suited for the concept of using on-site generated renewable energy that is produced by solar cells, since these buildings consume most of their energy-demand during daytime. The support programme was open for all kinds of schools, for kindergartens, universities and other research institutions.

# Vario Apartments: Affordability Strategies and Goals



## Affordable Housing as a Challenge in Urban Spaces

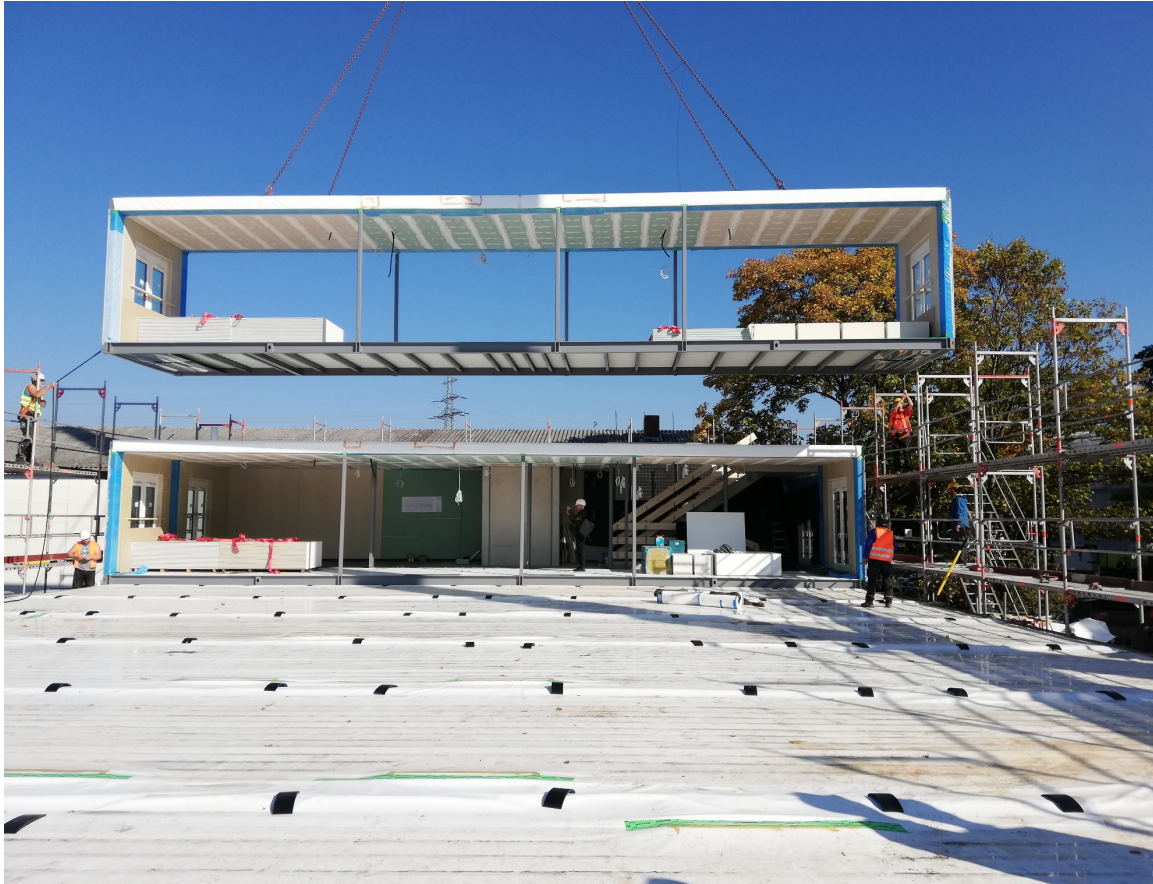
In recent years, the influx into cities has increased significantly, having an impact on real estate and rental prices. The funding programme „Model projects for the sustainable and affordable construction of vario apartments“ is a support and search for high-quality solutions concerning these challenges.

18 pilot projects, examine different strategies and their concepts are currently being tested, showing how affordable housing can be provided. The main issues on a glance:

- Reducing Construction Time
- Affordable Construction
- Adjustable Construction
- Quality of Use
- Sustainable Construction



# Vario Apartments: Affordability Strategies and Goals



© Technische Hochschule Ostwestfalen-Lippe

## Reducing Construction Time

With the use of prefabricated elements, components such as entire facades, sanitary cells or space modules, the construction process can be accelerated. This is an advantage, especially in inner-city locations. Restrictions on residents are kept low, and logistics are potentially simplified.

*For the Hamburg-Steilshoop model building project, entire room cells were prefabricated. 48 room units with a gross capacity of 8,400 m<sup>3</sup> were assembled within 10 working days. The material for interior fittings was delivered directly to the construction site, included in the respective space modules.*



# Vario Apartments: Affordability Strategies and Goals



© solidar planungswerkstatt | Dr. Günter Löhnert

## Affordable Construction

In order to reduce construction costs, the projects pursue various strategies, including simplified construction, standardized components, serial floor plan designs and reduced fit-out standards.

*After more than 20 years of vacancy, 247 dwellings have been created for students in the former dental clinic in Erfurt. The production costs amounted to 1,775 €/m<sup>2</sup> living area and were thus significantly lower than the costs for a comparable new building.*

# Vario Apartments: Affordability Strategies and Goals



© Technische Hochschule Ostwestfalen-Lippe

## Adjustable Construction

The model projects have different approaches towards adaptability. All of them are considered for elderly friendly living. Sufficient widths, movement areas and mostly barrier-free bathrooms allow the use even with handicaps. Targeted breakthroughs enable a precisely defined re-use at low costs. Skeleton constructions with large spans allow a very high flexibility of floor plans, though associated with higher manufacturing costs.

*In Chemnitz, due to pre-planned possible breakthroughs and non-load-bearing lightweight walls, a variety of floor plans is guaranteed in case of subsequent use at minimal cost.*



# Vario Apartments: Affordability Strategies and Goals



© solidar planungswerkstatt

## Sustainable Construction

All model projects have been subjected to a sustainability certification. Their ecological, economic, socio-cultural, technical and process qualities were considered.

The buildings' entire life cycle is considered through Life Cycle Assessment (LCA) and Life Cycle Costing (LCC).

*In Meschede, the former job center (left figure) was refurbished sustainably to a large extent after more than 16 years of vacancy. Here, the continued use of the embodied energy contained in the shell structure, the consistent supply of renewable energies and smart building technology is essential to the concept.*



# Vario Apartments: Affordability Strategies and Goals



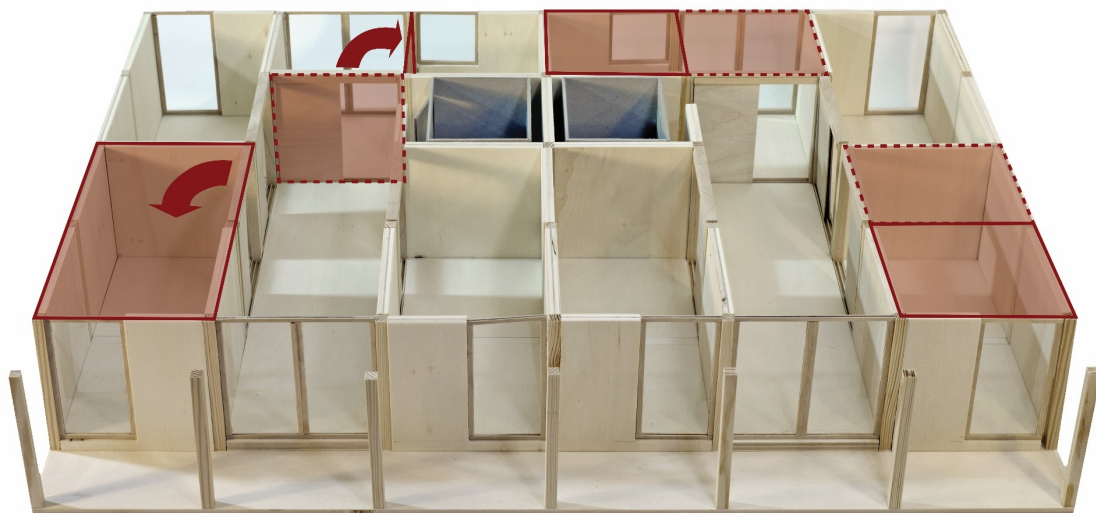
© Hochschule für Technik und Wirtschaft Berlin

## Quality of Use

An essential requirement in the funding programme is the creation of community spaces. These give room for informal meetings and enable activities which are not possible within the individual living units.

*In Berlin-Marzahn, more than 5m<sup>2</sup> of common area is available per resident. The common spaces are connected by an air space between two floors and have a high spatial quality. The furnishing allows a wide range of possible uses and the appropriation by the tenants.*

# Vario Apartments: Collegium Academicum



© DGJ Architektur

## Flexible Timber Structure for Student Housing

Since 2016 a group of students and 'DGJ Architektur' have been planing a self-managed student housing project 'Collegium Academicum' in Heidelberg. The project is not only a model project of 'Variowohnungen' but also project of the International Building Exhibition IBA Heidelberg.

*The constructional design approach for the building is to utilize the ecological benefits of wood, being a locally available and renewable resource, as much as possible.*

*To achieve this a newly developed timber construction system is applied as the main load bearing structure. Its skeleton frame design allows high levels of spacial flexibility as well as the use of modular elements easy to disassemble and recycle.*

# Building the Future

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