

Building the Future

ZUKUNFT BAU Fördern Forschen Entwickeln







Building the Future

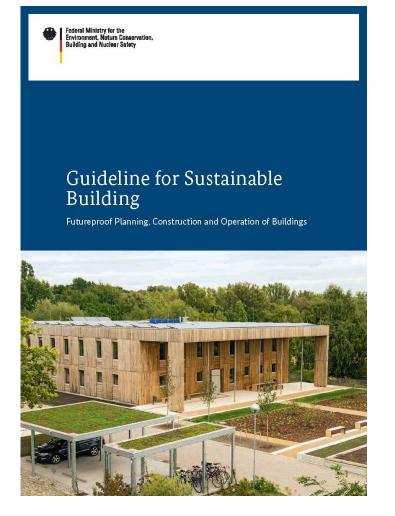
Assessment Systems and Tools for Sustainable Building







Guideline for Sustainable Building



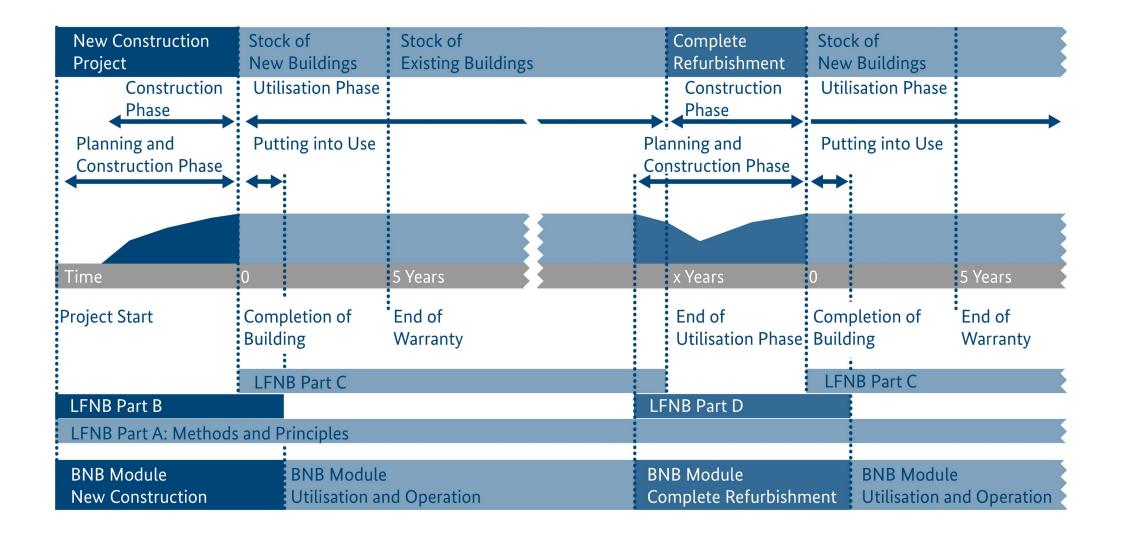
Introduced in 2001 the Guideline for Sustainable Building is continually being under further development with regard to the Assessment System for Sustainable Building for Federal Buildings (BNB). The Guideline provides general principles and methods of sustainable design. It offers a specific practical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





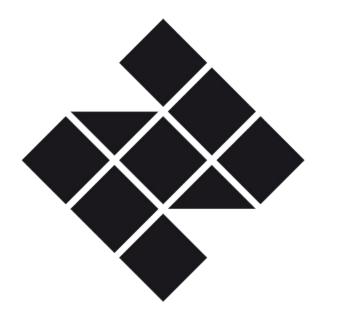
and Community





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Assessment System for Sustainable Building (BNB)



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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.



1. Main Criteria	Group: Ecolo	gical Quality			Degree of Fulfilment	Weighting 22.5 %		100 %	
1. 1. Criteria Gro	oup: Effects o	n Global and l	.ocal Environm	nent	Based on the main criteria group as the	Fixed weighting of the result of the		95 % ——	1.0
1. 1. 1 Criterion	Assessment methodology:	Qualities:	Conversion in assessment	Weighting by means of significance	ratio of the achieved and the maximum possible score	main criteria group for the overall score		90 % ——	
partial criterion1	Calculation, quality level	quality level 2	scale: Defined target, reference, and	factor:				85 % ——	Nachhaltiges Bauen
			limit values	1 to 3			ding	80 % ——	—— 1.5
1. 1. 2 Criterion							Total degree of fulfilment of the building	75 %	
							nt of t	70 %	Nachhaltiges
2. Main Criteria	Group: Econ	omic Quality			Degree of Fulfilment	Weighting 22.5 %	Ifilme	65 % ——	
3. Main Criteria	3. Main Criteria Group: Sociocultural and Functional Quality					Weighting 22.5 %	ee of fu	60 % ——	
4. Main Criteria	4. Main Criteria Group: Technical Quality					Weighting 22.5 %	l degre	55 % ——	
5. Main Criteria	Group: Proce	ess Quality			Degree of Fulfilment	Weighting 10.0 %	Tota	50 % ——	Nachhaltiges Bauen 3.0
Location Profile	Location Profile					Weighting 0 %		ree of Fulfilr Ition Profile	ment (informative)

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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.

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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



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The front page of the Certificate shows the overall result

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61 Anliegende Medien / Erschließung 88%		Anliegende Medien / Erschließung		

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

*	Bundesministerium für Verkehr, Bau und Stadtentwicklung Bewertungsgrafik der Hauptkriterieng	ruppen	¢
	Hauptkriteriengruppen	Erfüllungsgrad	Anteil gesamt
	Ökologische Qualität Ökonomie Qualität	89% 91%	22,5%
	Soziokulturelle und funktionale Qualität	39 %	22,5 % 22,5 %
	Technische Qualität Prozessqualität	68 % 35 %	22,5 % 10,0 %
	нга		Anlage 3

...and the fulfillment of the main criteria groups

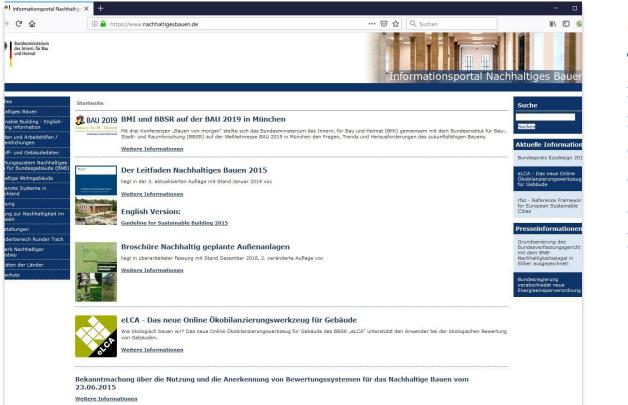
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Tools for Sustainable Building



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

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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.

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			Zertifizierungsziel: Gold (80% - 85%)							79,70
		1	Ökologische Qualität		22,5 %					86,26
		1.1	Wirkung auf die globale Umwelt		12,375 %					
+		1.1.1	Treibhauspotenzial (GWP)		3,375 %	80,0	100,0	99,0	A	1,0
+		1.1.2	Ozonschichtabbaupotenzial (ODP)		1,125 %	80,0	100,0			1,0
+		1.1.3			1,125 %	80,0	100,0			0,0
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+			Überdüngungspotenzial (EP)		1,125 %	80,0	100,0			0,0
+			Risiken für die lokale Umwelt		3,375 %	50,0	75,0			5,0
+			Nachhaltige Materialgewinnung Holz		1,125 %	80,0	80,0	100,0	-2	0,0
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+	+		Flächeninanspruchnahme		2,25 %	50,0	40,19			0,0
-	-		Ökonomische Qualität		2,25 %	30,0	70,0	70,0	-	79,592
-	-		Lebenszykluskosten		13,5 %					19,390
+	-		Gebäudebezogene Kosten im Lebenszyklus		13,5 %	65,0	100,0	75,0	2	5,0
			Wertentwicklung		9,0 %	03,0	100,0	13,0		,,o
+	Т	2.2.1			9.0 %	65,0	48,98	75,0	-26	02
	1		Soziokulturelle und funktionale Qualität		22.5 %					65.611
-			Gesundheit, Behaglichkeit und Benutzerzufriedenheit		12,857 %					
+		3.1.1	Thermischer Komfort im Winter		1,607 %	70,0	100,0	100,0	A	0,0
+		3.1.2	Thermischer Komfort im Sommer		2,411 %	85,0	100,0	100,0	A	0,0
+		3.1.3	Innenraumhygiene		2,411 %	60,0	85,0	100,0	−1	5,0
+		3.1.4	Akustischer Komfort		0,804 %	0,0	25,628	0,0	A 25,6	28
+	⚠	3.1.5	Visueller Komfort		2,411 %	35,0	55,0	75,0	-2	0,0
+			Einflussnahme des Nutzers		1,607 %	48,0	100,0			0,0
+			Aufenthaltsmerkmale im Außenraum		0,804 %	35,0	100,0			0,0
+	_		Sicherheit und Störfallrisiken		0,804 %	35,0	85,0	85,0	A	0,0
			Funktionalität		6,429 %					
+			Barrierefreiheit		1,607 %	10,0				5,0
+			Flächeneffizienz		0,804 %	30,0	45,7	70,0	-2	4,3

Federal Ministry

and Community

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.

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			Zertifizierungsziel: Gold (80% - 85%)							79,70
		1	Ökologische Qualität		22,5 %					86,26
		1.1	Wirkung auf die globale Umwelt		12,375 %					
+		1.1.1	Treibhauspotenzial (GWP)		3,375 %	80,0	100,0	99,0		
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+			Risiken für die lokale Umwelt		3,375 %	50,0	75,0	100,0		
+	⚠		Nachhaltige Materialgewinnung Holz		1,125 %	80,0	80,0	100,0	-20,0	
			Ressourceninanspruchnahme		10,125 %	00.0	100.0	100.0		
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+			Flächeninanspruchnahme		2,25 %	50,0	70,0	70,0		-
+			Ökonomische Qualität		22,5 %	50,0	70,0	70,0		79,59
			Lebenszykluskosten		13,5 %					15,55
+			Gebäudebezogene Kosten im Lebenszyklus		13,5 %	65,0	100,0	75,0	A 25,0	
			Wertentwicklung		9.0 %					
+	1		Drittverwendungsfähigkeit		9,0 %	65,0	48,98	75,0	-26,02	
		3	Soziokulturelle und funktionale Qualität		22,5 %					65,61
		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			2,411 %	60,0	85,0	100,0	-15,0	
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			Funktionalität		6,429 %					
+			Barrierefreiheit		1,607 %	10,0	100,0	75,0		
+	\triangle		Flächeneffizienz		0,804 %	30,0	45,7	70,0		

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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).

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eBNB: Electronic Rating System for Sustainable Building

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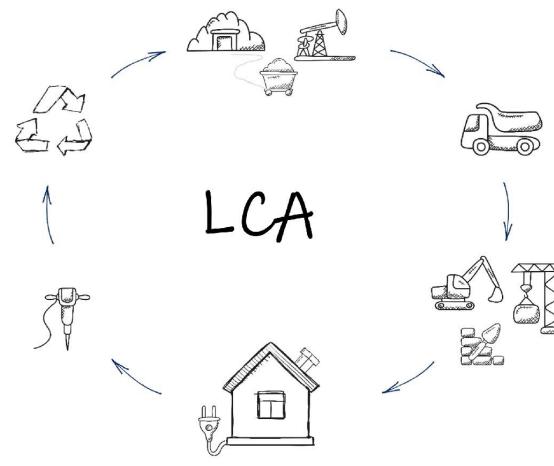
Added Value

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.







© Sebastian Theißen, Jannick Höper, Reinhard Wimmer, Anica Meins-Becker, Michaela Lambertz

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The Use of BIM to Simplify Whole Building LCA

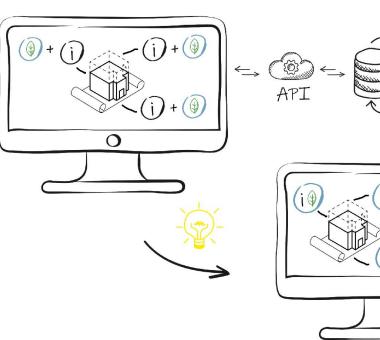
Digital building models offer a great potential to link external LCA and material databases for sustainable assessments and their live visualization. This contributes to achieving climate targets. The construction and operation of buildings is the largest emitter of CO_2 in the world, consumes a large 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

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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 programmeming 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.







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

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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.

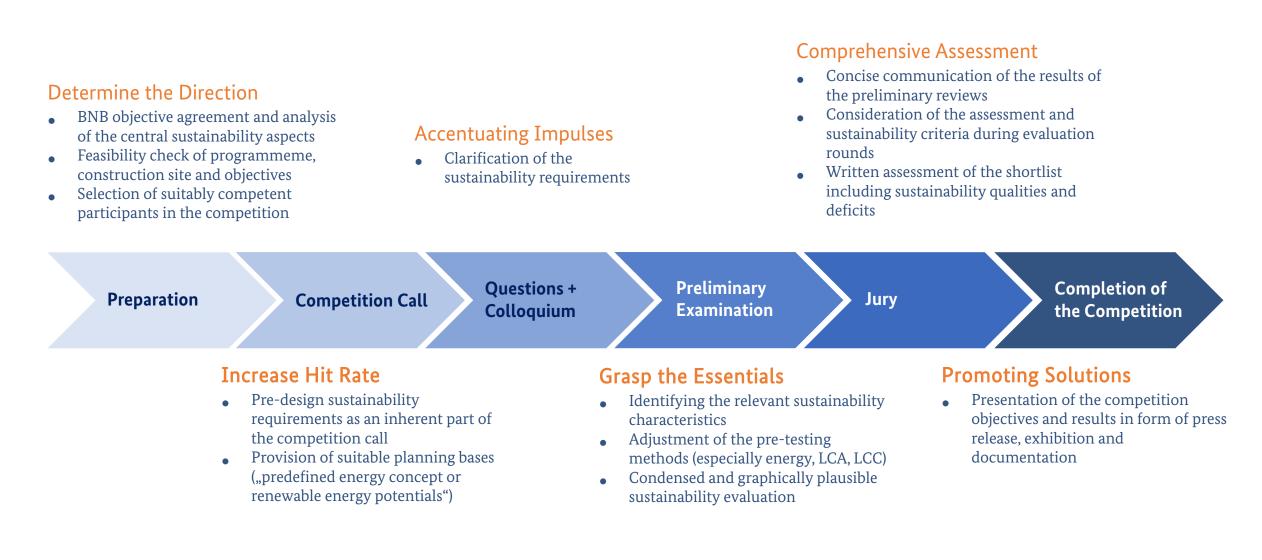
Accordingly the ongoing research project collects and evaluates the practical experience that has been gained in the meantime and is still developing the SNAP methodology.

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





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FÖRDERN FORSCHEN ENTWICKELN

SNAP: Sustainability Requirements in Architectural Planning Competitions

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

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



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

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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.

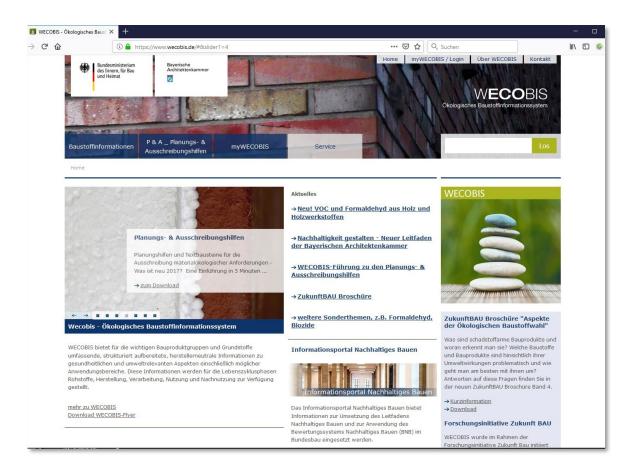
The sustainability potential was assessed in the architectural competition procedure in 2019 / 2020 in order to support the jury and to be able to ensure the desired implementation of the BNB standard in gold at an early stage. In order to accentuate the specific nature of the competition – which focuses 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

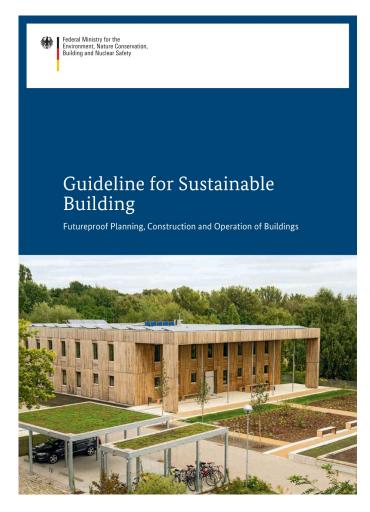
The web-based ecological building material information system (wecobis) provides qualitative information to healthrelated and environmental issues of building material.

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







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Assessment System: System Variants and Module Applications



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





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

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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.

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Nachhaltiges Bauen





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

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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.







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

Federal Ministry of the Interior, Building

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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 costeffective 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.

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

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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.

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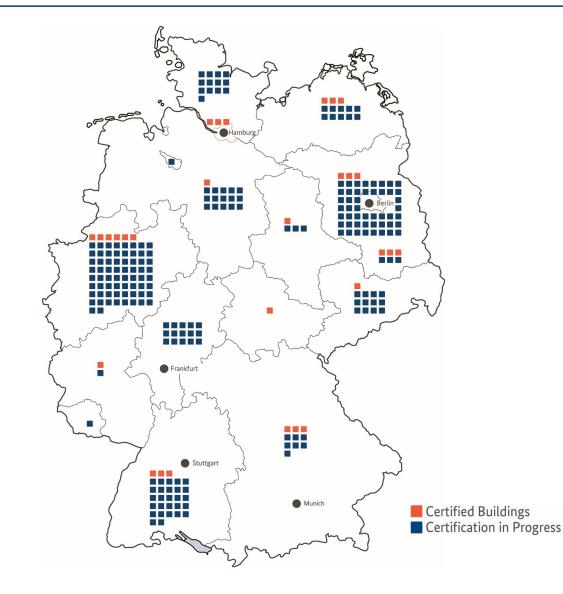
Building the Future

Application of the Assessment System BNB





Application of the Assessment System BNB



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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.

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Ministry of Education and Research, Berlin



Federal Ministry of the Interior, Building

and Community

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.







Ministry of Education and Research, Berlin

Economic Sociocultural/ Functional 81% 82% Ecological Technical 95% 82% Process 99%

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 Thümmler, WS GreenTechnologies GmbH
Completion	August 2014
Gross Floor Area (GFA)	58,273 m ²
Gross Construction Costs	€ 114.5 million
Construction Costs (KG 300, 400)	1,151 €/m ² _{GFA} (net)
Operation Costs	772 €/m ² _{GFA} (net)
Life Cycle Costs	1,922 €/m² _{GFA} (net)
Primary Energy Demand total (LCA)	101 kWh/(m²NFA _a a)
Global Warming Potential (LCA)	21.86 kg CO ₂ eqv./(m ² NFA _a a)



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Federal Ministry of the Interior. Building

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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

same time a contemporary, energy-efficient building that provides a comfortable indoor climate for the next life cycle should be realised.

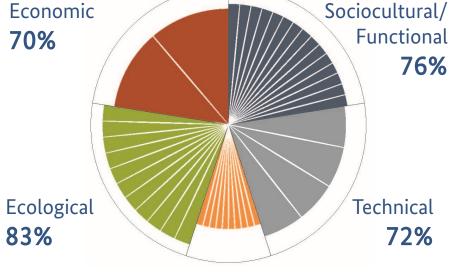


Bauen



Federal Constitutional Court, Karlsruhe

Weighting of Assessment Quality 73.3 % Economic 70%



Process 57%

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 Thümmler, WS GreenTechnologies GmbH
Completion	August 2014
Gross Floor Area (GFA)	58,273 m ²
Gross Construction Costs	€ 114.5 million
Construction Costs (KG 300, 400)	1,151 €/m ² _{GFA} (net)
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Life Cycle Costs	1,922 €/m ² _{GFA} (net)
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Global Warming Potential (LCA)	21.86 kg CO ₂ eqv./(m ² NFA _a a)



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Center for Neurodegenerative Disease, Bonn



Federal Ministry

and Community

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.

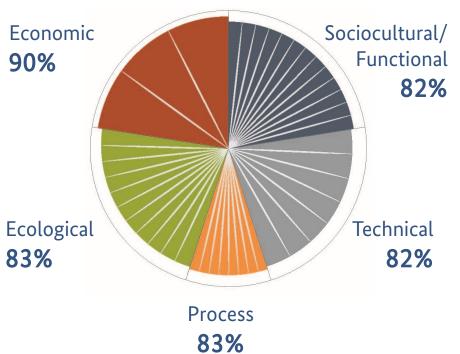
Nachhaltiges Bauen





Center for Neurodegenerative Disease

Weighting of Assessment Quality 84.1 %



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 m ²
_	Gross Construction Costs	€ 127 million
-	Construction Costs (KG 300, 400)	2,296 €/m ² _{GFA} (net)
-	Operation Costs	1,588 €/m ² _{GFA} (net)
-	Life Cycle Costs	4,579 €/m ² _{GFA} (net)
-	Primary Energy Demand total (LCA)	343 kWh/(m²NFA _a a)
-	Global Warming Potential (LCA)	67.6 kg CO ₂ eqv./(m ² NFA _a a)

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Day Care Centre, Ulm



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.

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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.



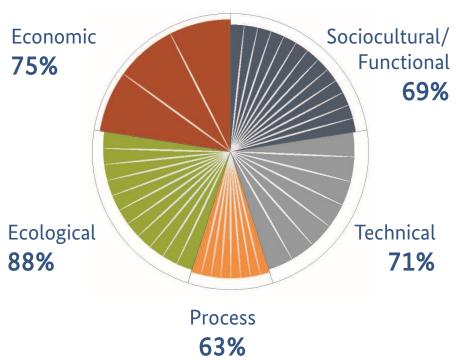
Nachhaltiges Bauen





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 m ²
Gross Construction Costs	€ 39 million
Construction Costs (KG 300, 400)	1,695 €/m² _{GFA} (net)
Operation Costs	806 €/m² _{GFA} (net)
Life Cycle Costs	2,886 €/m ² _{GFA} (net)
Primary Energy Demand total (LCA)	265 kWh/(m²NFA _a a)
Global Warming Potential (LCA)	34,8 kg CO ₂ eqv./(m ² NFA _a a)

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More Sustainable Buildings in Germany



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



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







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

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



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

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

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



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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







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

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



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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

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Building the Future

Further Research Projects









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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



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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)

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Energy-Efficient Urban Redevelopment programme



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Programme-Related Research of KfW 432 Implementations

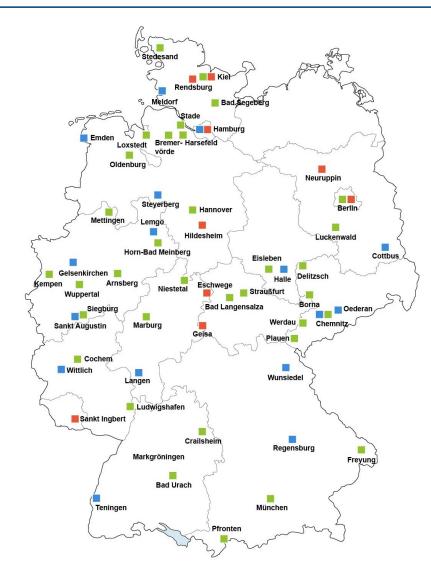
Since its establishment in 2011, the Energy-Efficient Urban Redevelopment programme (EnSanQ KfW) has been making important contributions to the localized realization of goals towards energy-transformation in Germany. Experiences with the implementation of KfW programmes 432 have been analyzed through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

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

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Energy-Efficient Urban Redevelopment programme



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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.

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

Support programme for Housing and Educational Facilities

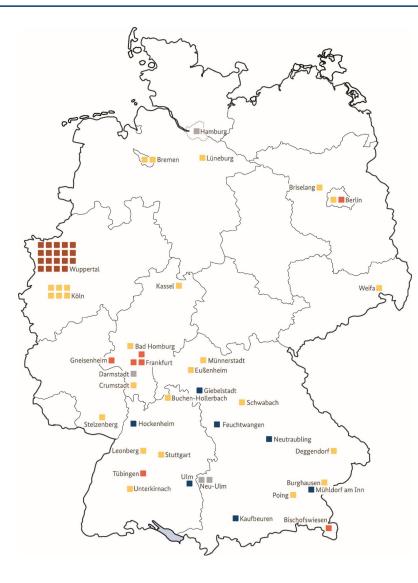
The German Federal Ministry of Building launched a first support programme in 2012 for a housing prototype that fulfils the Efficiency House Plus Standard.

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

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







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 CO2eq annually in Germany. The Efficiency House Plus standard can thus make a significant contribution to climate protection.

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Residential Buildings Apartment Blocks Refurbishment Educational Buildings
 District: Fertighauswelt Wuppertal







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.







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.







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 Mühltal, 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.







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 energydemand during daytime. The support programme was open for all kinds of schools, for kindergartens, universities and other research institutions.





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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













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 m³ were assembled within 10 working days. The material for interior fittings was delivered directly to the construction site, included in the respective space modules.













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 $1,775 \notin /m^2$ living area and were thus significantly lower than the costs for a comparable new building.







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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 barrierfree 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.









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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.







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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 $5m^2$ 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.



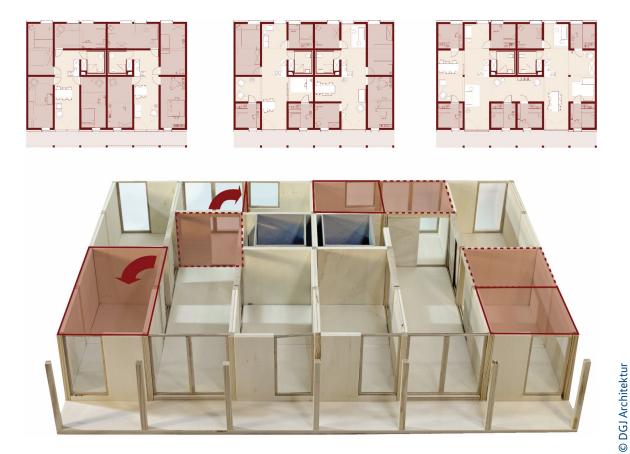




Hochschule für Tecl und Wirtschaft Ber



Vario Apartments: Collegium Academicum



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.



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' Architektur



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