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Environment, Nature Conservation,
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Assessment System for Sustainable Building

Administration Buildings

Imprint

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General

Description of the Criteria

Awarded Buildings

Milestones of Sustainability

„He who husbands a forest must take care to ensure that he does not cut down more wood than will grow back.“

cf. Carl von Carlowitz (*1645 - 1714), Sylvicultura oeconomica

The Federal Republic of Germany looks back on a long tradition of thinking about sustainability. The German term „Nachhaltigkeit“ (Sustainability) dates back to forest management in the early 18th century 1. Since then, the term has undergone far-reaching development, both nationally and internationally.

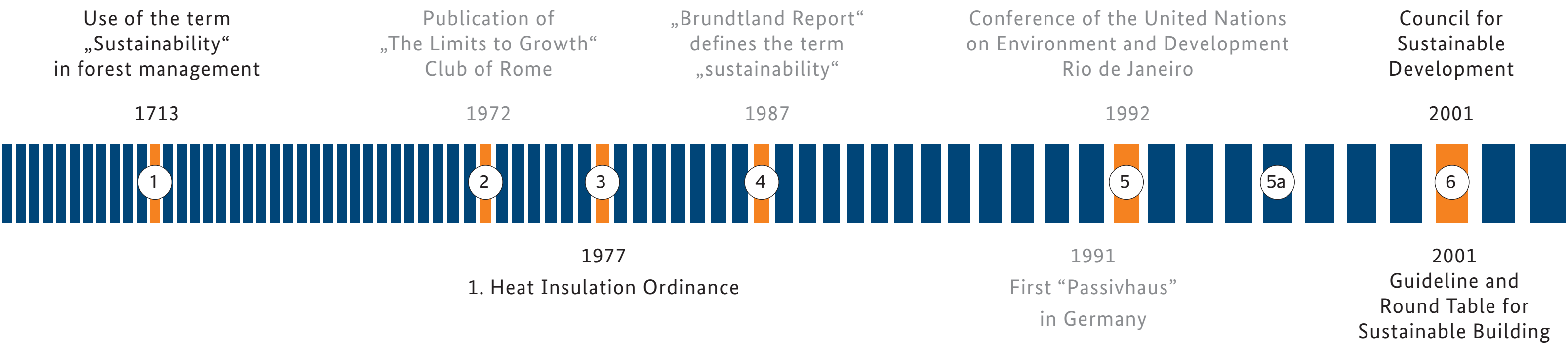
The study entitled „The Limits to Growth“ pushed the problem of limited resources into the consciousness of politicians and society 2. At the same time, the first oil crisis made clear the dependency on fossil fuels. It was under the impression of these events that the first German Heat Insulation Ordinance was passed in 1977 – with the objective of using construction measures to reduce the energy consumption of buildings. 3.

„Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.“

Brundtland Report(1987)

The world-wide discussion of sustainable development received a decisive impetus with the Brundtland Report, in which the term „sustainability“ was redefined 4. The „Montreal Protocol“ was also ratified internationally around the same time and is, as the first wide-ranging treaty under international law on the subject of environmental protection, a milestone in the history of sustainable development. In the private sector, enhanced awareness of the problem of the consumption of limited resources in Germany led to the development of the first “Passivhaus”, in which thermal comfort was achieved primarily by means of construction measures and without resorting to a classical heating system.

At the Conference of the United Nations on Environment and Development in Rio de Janeiro, international agreements with wide-ranging consequences were made, included among them the Framework Convention on Climate Change 5. The Kyoto Protocol of 1997 made the measures which were to be undertaken by the community of states for the protection of the climate concrete. Germany committed itself at the time to reducing its expected greenhouse gas emissions enough so that its levels in 2012 were 23,8% less than those of 1990. 5a.



Development in the new millennium accelerated rapidly. The idea of sustainability established itself in society and increasingly became a basis for political action in Germany.

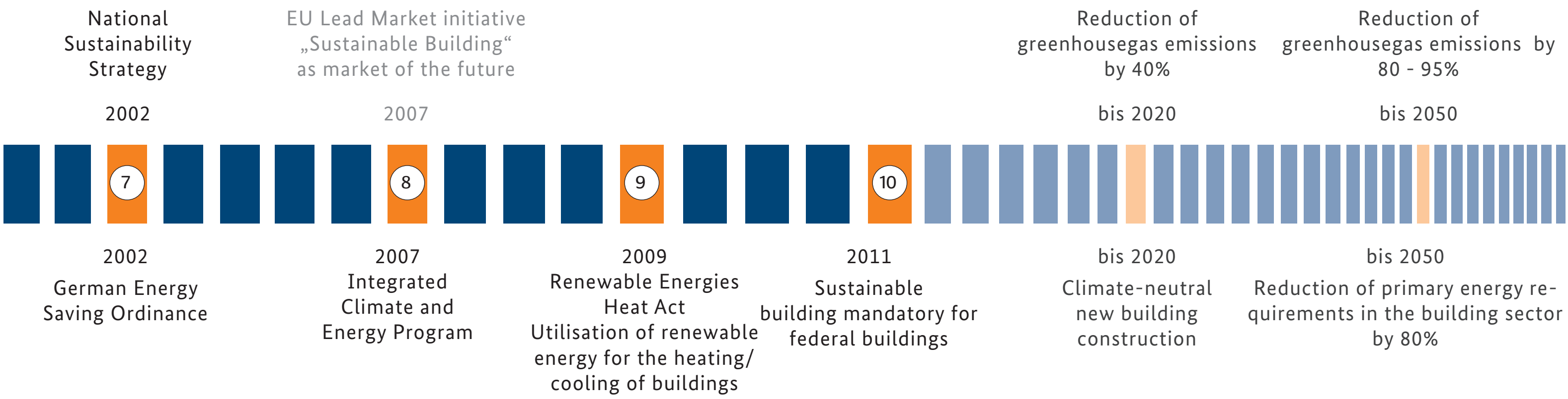
In 2001, the federal government convened the Council for Sustainable Development. In the same year, the Guideline for Sustainable Building was also published and the Round Table for Sustainable Building was founded 6. In 2002, the national sustainability strategy, „Perspectives for Germany", was enacted. At the same time, the first German Energy Saving Ordinance (EnEV) for buildings went into effect 7.

In 2007, Sustainable Building was named one of the six lead markets in the EU Lead Market initiative. At the same time, climate protection goals for the year 2020 were defined in the German government's „Integrated Climate and Energy Program", including among them a reduction of greenhouse gas emissions by 40% with respect to the levels of the reference year 1990 and an increase in the share of renewable energy in the heat supply to 14% 8. The Energy Concept 2050 provides a reduction in greenhouse gas emissions between 80-95% in the coming decades and carbon-neutral building construction by 2050.

The building sector is already contributing a significant share to the realisation of this ambitious goal. In addition to statutory specifications, e.g. the „Renewable Energies Heat Act" 9, and the promotion of voluntary measures, the Assessment System for Sustainable Building – in its first stage for the new construction of office and administrative buildings – was also developed. In order to uphold the role model function of the federal government as a public building owner, utilisation of the Assessment System for Sustainable Building has been a binding stipulation for the new construction of federal buildings since the beginning of 2011 10. The Guideline for Sustainable Building specifies minimum degrees of performance.

„The national sustainability strategy will set priorities for the coming years, identify objectives and measures and implement the core ideas of a sustainable development. It is intended to act as the basis for further political reforms as well as for changes in behaviour on the parts of companies and consumers."

Perspectives for Germany (2002)



Structure and Methodology

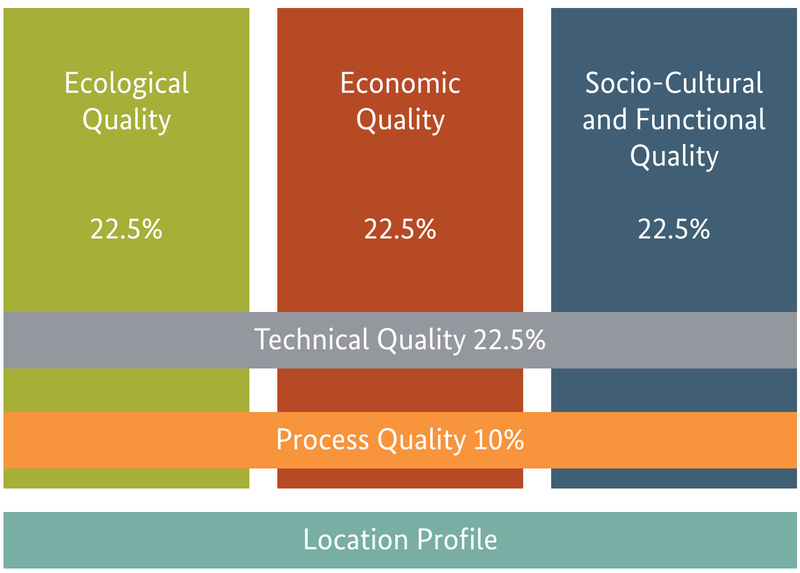
Nachhaltiges
Bauen

The „Nachhaltigkeits-N“
Logo of the Assessment System for Sustainable Building for Federal Buildings (BNB)

As a temporary milestone in the development of a comprehensive system for the evaluation of sustainable building in Germany, an initial criteria checklist for the comprehensive assessment of sustainability aspects for building was developed by the Federal Ministry for Building in a two-year collaboration with the German Sustainable Building Council e.V. (DGNB e.V.). As a first step, evaluations are performed in newly constructed office and administrative buildings.

The objective of sustainable building is the protection of common commodities, e.g. environment, resources, health, culture and capital. From these are derived the classical three dimensions of sustainability – ecology, economy and socio-cultural aspects – in terms of which the quality of a building must also be measured. Furthermore, in their function as cross-section qualities, technical qualities and process quality exercise an influence over all subordinate aspects of sustainability. Site characteristics are subjected to a separate scrutiny, but not taken into account in the overall assessment of the building.

No individual measures are evaluated in the results-oriented system, but rather their documentable effect on the overall concept of the building. Its application takes place throughout the construction planning stages, which means that it contributes not only to the optimisation of the building but also and at the same time to quality assurance.



The structure of the Assessment System for Sustainable Building for Federal Buildings (BNB)

The assessment system is characterised by a scrutinising of the buildings which is as comprehensive as possible. The principle of sustainability in the meantime enjoys broad support in society and has become a guideline in public policy. It is for that reason that there are binding standards and statutory requirements in Germany governing many subordinate areas. The requirements of these regulations go far beyond the statutes upon which they are based. On the one hand, a sensible exceeding of statutory stipulations is assigned a positive evaluation, e.g. a greater degree of energy efficiency. Furthermore, requirements regarding sustainable building also exist which are not bindingly regulated. These, too, are defined and taken into account in the Assessment System for Sustainable Building, e.g. Life Cycle Assessment.

In addition, a comprehensive scrutiny of the total life cycle of buildings is carried out. Not only energy requirements during the utilisation phase of a building, but also the amount of energy required for the manufacture of building materials is included in the assessment of the resource requirements of a building, for example.

The Assessment System is organised into three different levels. The actual definition of the qualities takes place on the Criteria level. These are described in detail in 46 criteria profiles on the basis of a total of around 150 indicators. The criteria profiles are grouped thematically in 11 criteria groups and 6 main criteria groups, thus making it possible to identify special qualities on each level.

Main Criteria Group:	3. Socio-Cultural and Functional Quality
Criteria Group:	3. 1. Health, Comfort and User Satisfaction
Criterion:	3.1.5 Visual Comfort
Indicator 1 - n:	Daylight availability, entire building
	Daylight availability, stationary workplaces
	Line of sight towards the exterior
	Nonglaring Daylight
	Nonglaring artificial light
	Light distribution
	Colour rendering

Levels of the Assessment System for Sustainable Building for Federal Buildings (BNB), from the main criteria groups to the indicators

Structure of the Criteria Profiles

The Criteria Profiles form the basis of the Assessment System. They contain a systematic and comprehensive description of the Criterion, the Sub-Criteria and Indicators.

Relevance and objectives

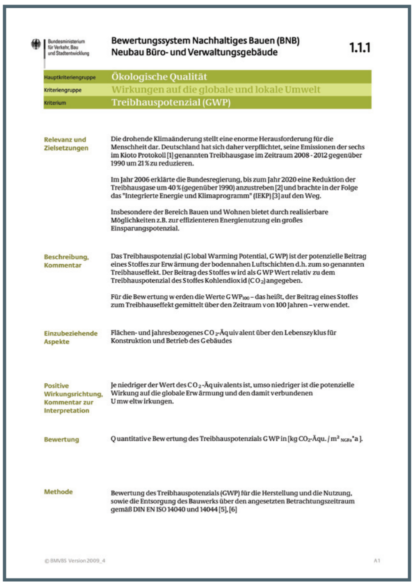
Description

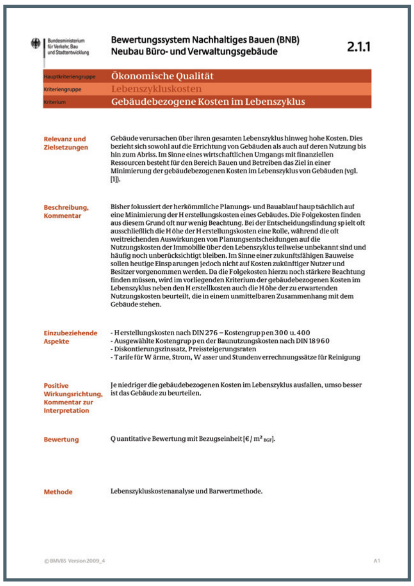
In a first section, the Criterion is described and its basic importance and relevance is identified. The relationship to existing problems is outlined, e.g. between greenhouse effect and climate change, and the terms are defined. Individual aspects which must be taken into account are described. For example, it is not only carbon dioxide which has an effect as a greenhouse gas, but also methane and nitrous oxide, which can be converted with appropriate factors to arrive at CO_2 equivalents for the purpose of aggregation. The lower the total amount of the greenhouse gas equivalent, the better the appraisal.

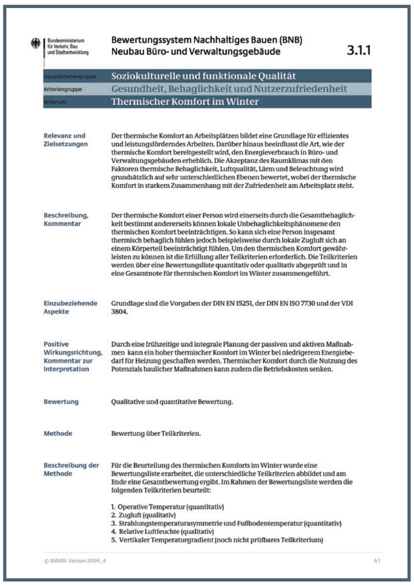
Assessment

Method

The assessment is described in a second section. This is quantitative as a rule. Because of the fact that not every quality can be reduced to a number, qualitative assessments are also used, as are a mixture of quantitatively and qualitatively assessable aspects. The range of evaluation methods includes calculations, checklists and defined quality levels which must be complied with.







Authoritative codes of practise

Professional information and application aids

In view of the fact that sustainability is characterised in particular by the linking of different requirements, a section is also devoted to this topic. In addition to the references to statutory or normative bases, databases, professional information and application aids required for the calculation are also presented.

Interactions with additional criteria

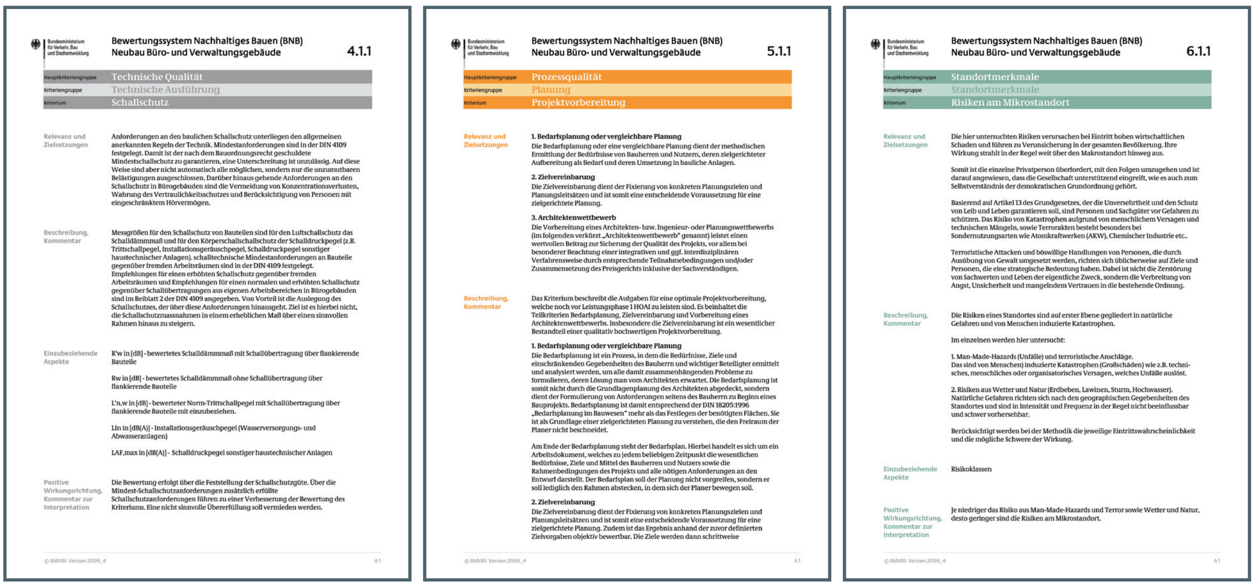
The relationships between the different Criteria are varied. The optimisation of individual aspects may result in either positive or negative effects on other Criteria. In order to be able to maintain one's overview in a system of this complexity, reference is made in each Criterion to its interactions with other Criteria.

Documents required for the assessment

Notes on the assessment process

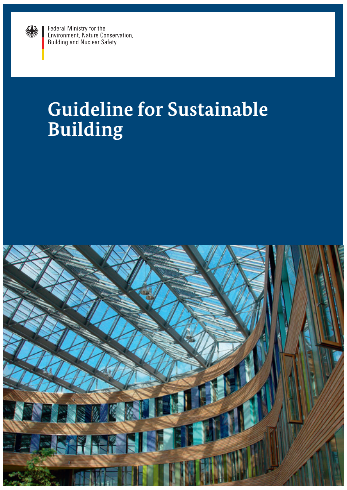
Standard for assessment

The precise description of the documents and evidence of conformity to be submitted enables comprehensible and comparable assessment results. The standard for assessment makes it possible to organise the results into a higher-level connection. Target, partial target, reference and limit values against which the building quality is measured are defined for the assessment. Assessment points are assigned to the result of the assessment – to the numerical value from the calculation, to the checklist points or to the stage of activity which has been reached.



Extract from the criteria profiles of the Assessment System for Sustainable Building for Federal Buildings (BNB)

Assessment and Award



In the Guideline for Sustainable Building, the federal government has set itself the binding objective of achieving a minimum degree of fulfilment for federal buildings of 65% in the Assessment System for Sustainable Building for Federal Buildings (BNB), which corresponds to the quality level „Silver".

The assessment of the individual qualities takes place on the Criteria level. The specific qualities of the building are recorded in a first step using the method described in the respective profile. On the basis of the standard of assessment specified, assessment points are assigned to the achieved result. Overall, a maximum assessment with 100 points can be achieved in each Criterion in accordance with the individual calculation rule, whereby the value 100 always corresponds to the target value definition. Parallel to the target value, a reference value of 50 points is defined along with a threshold value of 10 points as the minimum requirement. Compliance with the threshold value must always be documented as part of the process.

The assessment of the Criteria is summarised in the main Criteria groups. In view of the fact that Criteria of varying relevance to the objectives worthy of protection are grouped together, the assessment points achieved are weighted with a significance factor of 1 to 3 (minor to great importance). This is defined for each individual Criteria Profile.

1. Main Criteria Group: Ecological Quality

1. 1. Criteria Group: Effects on Global and Local Environment

1. 1. 1. Criterion 1. 1. 2. Criterion ...	Assessment methodology Calculation, quality level, checklist	Qualities and characteristic values of the project E.g. quality level 2	Conversion into checklist points Defined target, reference, limit values	Weighting by means of significance factor Defined from 1 – 3

1. 2. Criteria Group

...

2. Main Criteria Group: Economic Quality

3. Main Criteria Group: Socio-Cultural and Functional Quality

4. Main Criteria Group: Technical Quality

5. Main Criteria Group: Process Quality

6. Location Profile

The degree of fulfilment in the main Criteria group is calculated from the relationship between the maximum achievable numbers of points and the numbers actually reached. This result is incorporated along with the stipulated weighting into the overall result.

On the basis of this degree of fulfilment, a score is assigned to the quality levels – Gold, Silver or Bronze. The results are presented in greater detail on a certificate next to a „plaque" representing the respective quality level. Additional information regarding the building is contained therein. The site characteristics are evaluated separately from the qualities of the object, because they can be influenced to only a very limited extent by the planning, the planning process and the building itself. The assessment of the site is not included in the total score assigned, but is instead noted separately on the certificate.

The modular structure of the system enables a differentiated presentation of the results; particular attention can thus be drawn to exceptional qualities in one or more subordinate areas of the assessed building.


Bundesministerium für Verkehr, Bau und Stadtentwicklung

Zertifikat

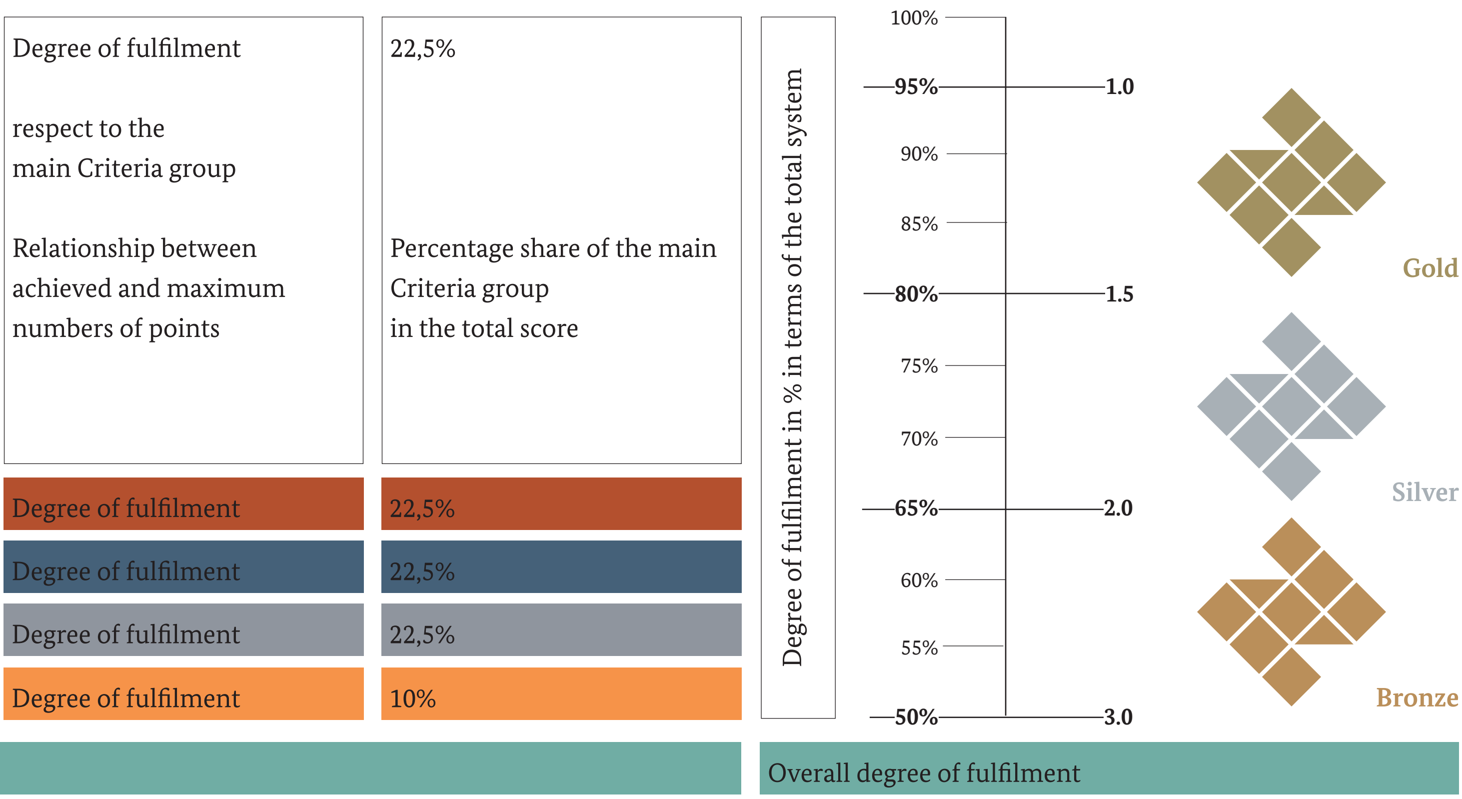
SILBER

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

Certificate for building assessment pursuant to BNB



Systematic assessment for the Assessment System for Sustainable Building for Federal Buildings (BNB)

Terminology and Symbols

A multitude of criteria is required for handling the complex task of building evaluation. These are described in brief in the following pages.
The symbols presented here reproduce relevant aspects of the individual profiles at a glance:

Life Cycle of the Building

Total life cycle

Consideration of a mostly complete life cycle of a building is an important aspect of building assessment. The effects of the building on the environment are recorded comprehensively with the aid of the life cycle analysis. In the same way, the determination of the life cycle costs is not only in reference to the original investment but also with respect to follow-up costs over the life cycle of the building being studied. The first 50 years of the utilisation of the building are scrutinised in each case. In addition, Criteria such as surface efficiency exist which have an effect on the total life cycle of a building.

Realisation

Utilisation

Dismantling

The relevance of certain Criteria is however also quite clearly restricted to individual life phases of the building, e.g. erection, utilisation and dismantling. At the same time, the erection period of the building includes the entire process from project development to the handing over of the building to the user. The utilisation phase also includes maintenance activities, while dismantling extends as far as the qualitative scrutiny of the disposal and recycling of the building products.

Assessment

Linear assessment

Quality level

Checklists

Different methods of assessment are to be found within the assessment system. Calculation regulations are described for quantifiable Criteria; the interpolation of the results is as a rule linear within the defined limit, reference and target values. This assessment is however not practical for all Criteria. Thus, for example, it is primarily qualitative assessments which are also performed on the basis of quality levels and checklists. Whereas it is the case that all conditions must be fulfilled when making assessments in accordance with stages of activity in order that there can be documented evidence of conformity with a higher quality level, individual points are added together and evaluated when assessment is made in accordance with checklists.

Responsible Individuals

As a rule, the compilation of documents of conformity requires interdisciplinary collaboration on the parts of the actors involved. Nonetheless, main responsibility for individual Criteria Profiles can be assigned to particular individuals who have primary possession of the relevant information and/or who are responsible for its preparation. In addition to building owner and planner, these could also be external specialists, e.g. for the creation of the environmental life cycle assessment or for the performance of measurements for quality control.

C Client

P (specialist) Planners

E External

Verification Management

The Assessment System for Sustainable Building is primarily a planning-based system. This means that it also simultaneously assumes the function of quality assurance during the planning stages and erection of a building.

The documentations of conformity required for the building assessment are compiled in tandem with the policy-making decisions made during the individual planning stages. The final relevant documentations of conformity are measurements made at the beginning of the utilisation phase. These are used for verifying the qualities achieved which cannot be documented solely on the basis of the planning, in view of the fact that they mainly depend in their essentials on the type and quality of the building construction carried out.

PD Project development

DE Design

TP Tender and placing

RE Realisation

HU Hand-over and utilisation

Additional Accomplishments

The Assessment System for Sustainable Building is oriented to the conventional sequence of building construction. A majority of the documentations of conformity are as a rule available or can be compiled with a small amount of additional effort. Certain qualities can be implemented with practically no effect on costs by taking into account the respective objectives as early as the project preparation stage and through integrated planning. Nonetheless, in certain subordinate areas, there is still a certain amount of increased expense – in comparison with a conventional building – involved in planning and building execution which is to be credited primarily to the higher quality of the building.

Overview of Criteria

		Relevant life phase	Assessment method	Verification management	Time of documentation	Factor of relevance	Percentage share of overall result	
1.	Ecological Quality							22.5%
1.1	Effects on Global and Local Environment							
1.1.1	Global Warming Potential			E	DE	3	3.375%	
1.1.2	Ozone Depletion Potential			E	DE	1	1.125%	
1.1.3	Photochemical Ozone Creation Potential			E	DE	1	1.125%	
1.1.4	Acidification Potential			E	DE	1	1.125%	
1.1.5	Eutrophication Potential			E	DE	1	1.125%	
1.1.6	Risks to the Local Environment			P	TP	3	3.375%	
1.1.7	Sustainable Logging / Wood			P	TP	1	1.125%	
1.2	Demand of Resources							
1.2.1	Primary Energy Demand Not Renewable (PE_{nre})			E	DE	3	3.375%	
1.2.2	Total Primary Demand (PE_{tot}) and Amount of PE_{re}			E	DE	2	2.250%	
1.2.3	Fresh Water Demand and Quantity of Wastewater			P	DE	2	2.250%	
1.2.4	Demand of Space			C	PD	2	2.250%	
2.	Economic Quality							22.5%
2.1	Life Cycle Costs							
2.1.1	Building-related Life Cycle Costs			E	DE	3	13.50%	
2.2	Performance							
2.2.1	Value Stability			P	DE	2	9.00%	
3.	Socio-Cultural and Functional Quality							22.5%
3.1	Health, Comfort and User Satisfaction							
3.1.1	Thermal Comfort in Winter			P	DE	2	1.607%	
3.1.2	Thermal Comfort in Summer			P	DE	3	2.411%	
3.1.3	Indoor Air Quality			E	HU	3	2.411%	
3.1.4	Acoustic Comfort			P	DE	1	0.804%	
3.1.5	Visual Comfort			P	DE	3	2.411%	
3.1.6	Influence of the User			P	DE	2	1.607%	
3.1.7	Outdoor Qualities			P	DE	1	0.804%	
3.1.8	Safety and Incident Risks			P	DE	1	0.804%	
3.2	Functionality							
3.2.1	Barrier-free Building			P	DE	2	1.607%	
3.2.2	Space Efficiency			P	DE	1	0.804%	
3.2.3	Capability of Conversion			P	DE	2	1.607%	
3.2.4	Public Accessibility			P	DE	2	1.607%	
3.2.5	Bicycle Comfort			P	DE	1	0.804%	

		Relevant life phase	Assessment method	Verification management	Time of documentation	Factor of relevance	Percentage share of overall result	
3.3	Ensuring Design Quality							
3.3.1	Design and Urban Quality	Realisation	Checklists	C	DE	3	2.411%	
3.3.2	Art in Architecture	Realisation	Checklists	C	DE	1	0.804%	
4.	Technical Quality							22.5%
4.1	Technical Execution							
4.1.1	Sound Insulation	Utilisation	Quality level	P	DE	2	5.625%	
4.1.2	Heat Insulation and Protection against Condensate	Utilisation	Checklists	P	DE	2	5.625%	
4.1.3	Cleaning and Maintenance	Utilisation	Checklists	P	DE	2	5.625%	
4.1.4	Dismantling, Separation and Utilisation	Dismantling	Linear assessment	P	DE	2	5.625%	
5.	Process Quality							10%
5.1	Management and Design							
5.1.1	Project Preparation	Realisation	Quality level	C	PD	3	1.429%	
5.1.2	Integrated Design	Realisation	Quality level	P	DE	3	1.429%	
5.1.3	Optimisation and Complexity of Planning	Realisation	Checklists	P	DE	3	1.429%	
5.1.4	Sustainability Issues in Tender and Placing	Realisation	Checklists	P	TP	2	0.952%	
5.1.5	Requirements for an Optimal Utilisation and Management	Realisation	Checklists	P	RE	2	0.952%	
5.2	Building Construction							
5.2.1	Building Site / Building Process	Realisation	Checklists	P	RE	2	0.952%	
5.2.3	Quality Assurance of the Building Construction	Realisation	Checklists	E	RE	3	1.429%	
5.2.4	Controlled Commissioning	Realisation	Quality level	P	HU	3	1.429%	
6.	Location Profile							-
6.1	Location Profile							
6.1.1	Risks at the Micro-Site	Total life cycle	Checklists	C	PD	2	–	
6.1.2	Conditions at the Micro-Site	Utilisation	Checklists	C	PD	2	–	
6.1.3	Image and Character of Location and Quarter	Utilisation	Checklists	C	PD	2	–	
6.1.4	Public Transport Connections	Utilisation	Checklists	C	PD	3	–	
6.1.5	Vicinity to Use-Specific Services	Utilisation	Checklists	C	PD	2	–	
6.1.6	Supply Lines / Site Development	Utilisation	Checklists	C	PD	2	–	

Relevant life phase

- Total life cycle
- Realisation
- Utilisation
- Dismantling

Assessment method

- Linear assessment
- Quality level
- Checklists

Verification management

- C Client
- P (specialist) Planners
- E External

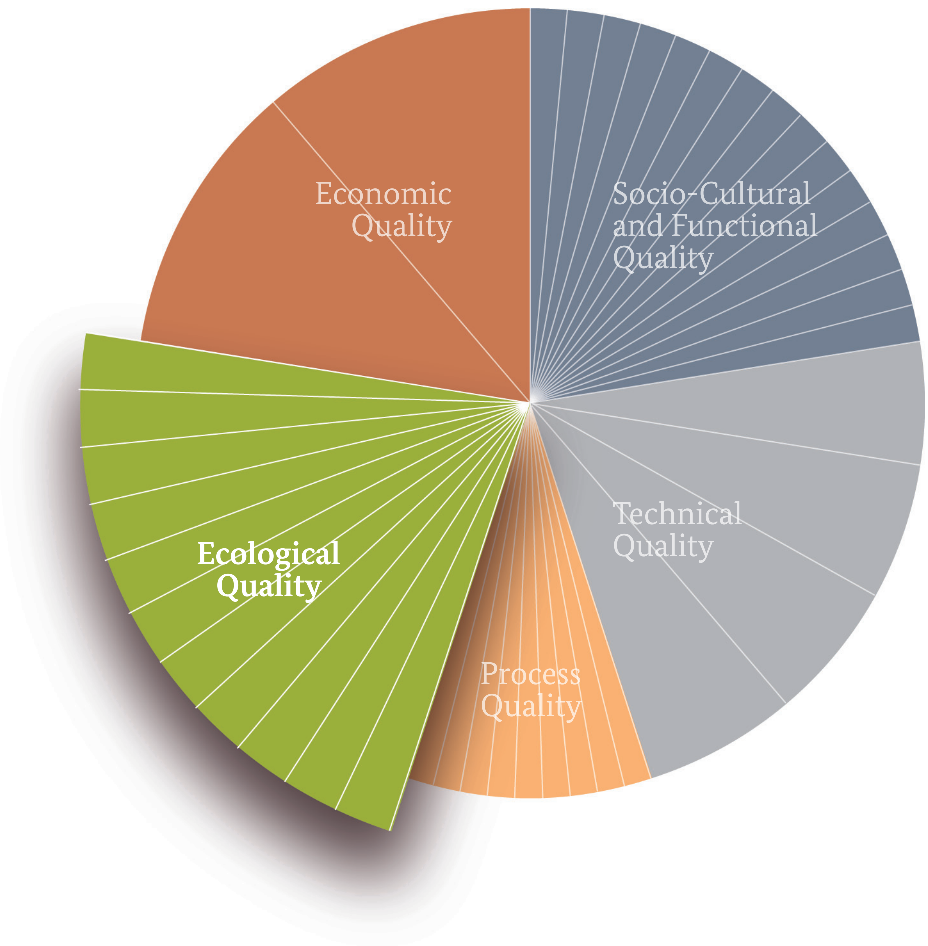
Time of documentation

- PD Project development
- DE Design
- TP Tender and placing
- RE Realisation
- HU Hand-over and utilisation

1. Ecological Quality

The ecological quality resource worthy of protection is the natural environment. Sustainable building is distinguished by the protection of resources and the minimisation of effects on the global and local environment.

In order to achieve these objectives, the flows of material and energy need to be optimised for the total life cycle of the building. The most important instrument for this observation is the Life Cycle Assessment (LCA).



1.1 Effects on Global and Local Environment

The regenerative capacity of the natural environment is the basis for a functioning ecosystem. Only limited amounts of hazardous substances are permitted to be carried into the environment if these mechanisms are to be maintained. The assessment of this aspect therefore represents an important Criterion of ecological quality.

Building constructions exercise both direct and indirect influences on our environment, which affect not only flora and fauna, but also humans themselves. Scrutinised here are not only the global effects on the environment which arise throughout the entire life cycle of a building, but also local risks which could be connected with the erection and/or operation of a building.

- 1.1.1 Global Warming Potential
- 1.1.2 Ozone Depletion Potential
- 1.1.3 Photochemical Ozone Creation Potential
- 1.1.4 Acidification Potential
- 1.1.5 Eutrophicatin Potential
- 1.1.6 Risks to the Local Environment
- 1.1.7 Sustainable Logging / Wood

1.2 Demand of Resources

The continuously increasing world population is causing an ever further increasing consumption of resources. A sparing use of both resources and area, as will an increasing utilisation efficiency are therefore of urgent necessity. Assessment is made of the demand for resources throughout the entire life cycle of the building.

- 1.2.1 Primary Energy Demand Non Renewable (PE_{nre})
- 1.2.2 Total Primary Energy Demand (PE_{tot}) and Amount of Renewable Energy (PE_{re})
- 1.2.3 Fresh Water Demand and Quantity of Wastewater
- 1.2.4 Demand of Space

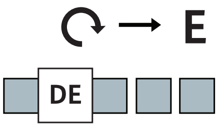
Life Cycle Assessment (LCA)

Compilation is made of the expenditures in energy – SB 1.2.1 and 1.2.2 – and of the effects on the environment during the building life cycle – SB 1.1.1 - 1.1.5 – not only for the operation of the building but also for the manufacture and disposal of the construction materials. The influence of manufacture and disposal in relation to the effects of the utilisation period becomes increasingly less, the longer the observation period is – i.e. the assumed period of utilisation. A utilisation period for the structure of 50 years is observed for the assessment of the building. The effects on the environment are balanced against a point in time 100 years in the future.

A comprehensive components list of the materials and products used in the building is compiled for the Life Cycle Analysis. This is also the basis for Criterion 1.1.7 Sustainable material utilisation and 4.1.4 Dismantling, separation and recycling. The Life Cycle Costs (LCC) – SB 2.1.1 – are also balanced in a fashion analogous to that with the LCA.

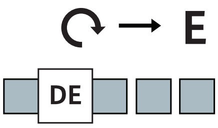
1.1 Effects on Global and Local Environment

1.1.1 Global Warming Potential



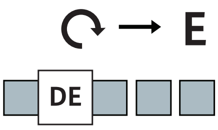
Anthropogenic climate change was and is being caused by the emission of greenhouse gases. This not only represents a threat to the variety of species, it also confronts humanity with major challenges. Particularly in the building sector, great savings are possible and economically feasible through the efficient usage of energy. In addition to the release of greenhouse gases during the operating stage, the manufacture and disposal scenarios of the construction materials used are also taken into account.

1.1.2 Ozone Depletion Potential



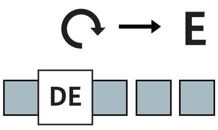
Ozone, only a slight concentration of which is present in the atmosphere, is in the stratosphere of great importance for life on Earth. The ozone layer shields the Earth from a large portion of UV radiation and thus protects our habitat from the negative effects of excessively high radiation intensity. The accumulation of R11 equivalent in the atmosphere contributes to the destruction of the ozone layer.

1.1.3 Photochemical Ozone Creation Potential



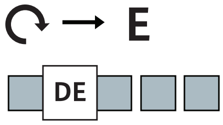
Whereas ozone in the stratosphere protects against excessive UV radiation, ozone which is formed from trace gases (e.g. nitrogen oxides and hydrocarbons) close to the ground (summer smog) causes damage to the respiratory organs of both humans and animals. This formation must therefore be limited with appropriate measures.

1.1.4 Acidification Potential



Sulphur and nitrogen compounds from emissions of anthropogenic origin react in the atmosphere to form sulphuric and nitric acid, respectively, which fall to earth as „acid rain“ and damage soils, waters, organisms and buildings. The entry of sulphuric and nitrogen compounds into the atmosphere is therefore to be reduced to a minimum.

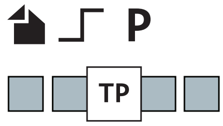
1.1.5 Eutrophicatin Potential



Overfertilisation (eutrophication) refers to the transition of waters and soils from a nutrient-poor (oligotrophic) to a nutrient-rich (eutrophic) state. It is caused by the addition of nutrients, in particular by phosphorous and nitrogen compounds.

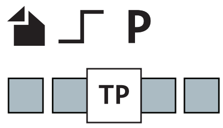
These arise during the generation of biofuels, among other things, but can also enter the environment through building products manufacturing and combustion emissions. The uncontrolled entry of nutrients into soils and waters can have undesirable effects on plants and animals at the site. Thus, for example, the change of the nutrients available in waters can lead to increased algae growth and result in the death of the fish.

1.1.6 Risks to the Local Environment



The Criterion promotes a targeted selection of products and materials which could come into contact with the local environment during erection and operation. Negative effects on waters, soils and air should be avoided thereby. The environmental compability of the products must be documented by means of various environmental categories and certifications such as GisCode, RAL environmental labels, manufacturer‘s declarations such as GUT and EMICODE, etc. Environmental Product Declarations (EPD) may also serve as suitable documentations of conformity.

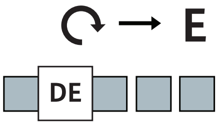
1.1.7 Sustainable Logging / Wood



The sustainable utilisation of forests is of high significance, not only for the global environment through the bonding of carbon and water but also for the variety of local flora and fauna. It is for that reason that woods and wood materials from sustainable forest management should also be used for the construction of buildings. These are identified by such certificates as the PEFC or FSC seal.

1.2 Demand of Resources

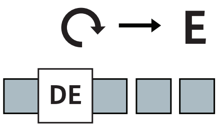
1.2.1 Primary Energy Demand Not Renewable (PE_{nre})



The Criterion is used to evaluate the resource consumption of fossil energy carriers. The objective is the minimisation of the consumption of finite resources. In order to achieve this objective, the demand for primary energy in terms of surface and year must be optimised throughout the life cycle.

The proportion of total primary energy demand for building conditioning is estimated to be approximately 50%. Energy efficiency is therefore the most important objective in new construction.

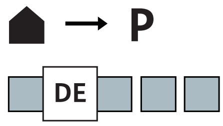
1.2.2 Total Primary Energy Demand (PE_{tot}) and Amount of Renewable Energie (PE_{re})



In addition to the lowering of the total primary energy demand, the objective of the German federal government is, in the spirit of sustainable development, to increase the share of renewable energies in total primary energy requirements and thus at the same time to lower the demand for non-renewable energy carriers. This objective can be achieved through high energy efficiency and an increased utilisation of renewable energy.

The entire building life cycle is included in the assessment. In addition to the energy requirement during the utilisation phase, the energy used for the construction product manufacturing and disposal scenarios are also taken into account.

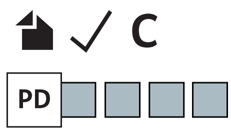
1.2.3 Fresh Water Demand and Quantity of Wastewater



Despite the generous amount of water available in Germany, the necessity still exists of handling drinking water sparingly. Water is tapped from the natural circulation systems, processed as drinking water, used and then subjected to elaborate clarification in order to be introduced back into flowing water. The objective here is counter this great expenditure with a reduction of drinking water consumption and largely to avoid disrupting the natural circulation of water.

Savings with respect to drinking water and waste water used for irrigation, cleaning and the water requirements of the users are evaluated for that reason under this Criterion. The documentation of conformity ensues on the basis of product information and manufacturer‘s statements with respect to the sanitation equipment, or of the layout of the systems for utilisation of rain water or service water or on the basis of rain water seepage and service water purification, as appropriate.

1.2.4 Demand of Space

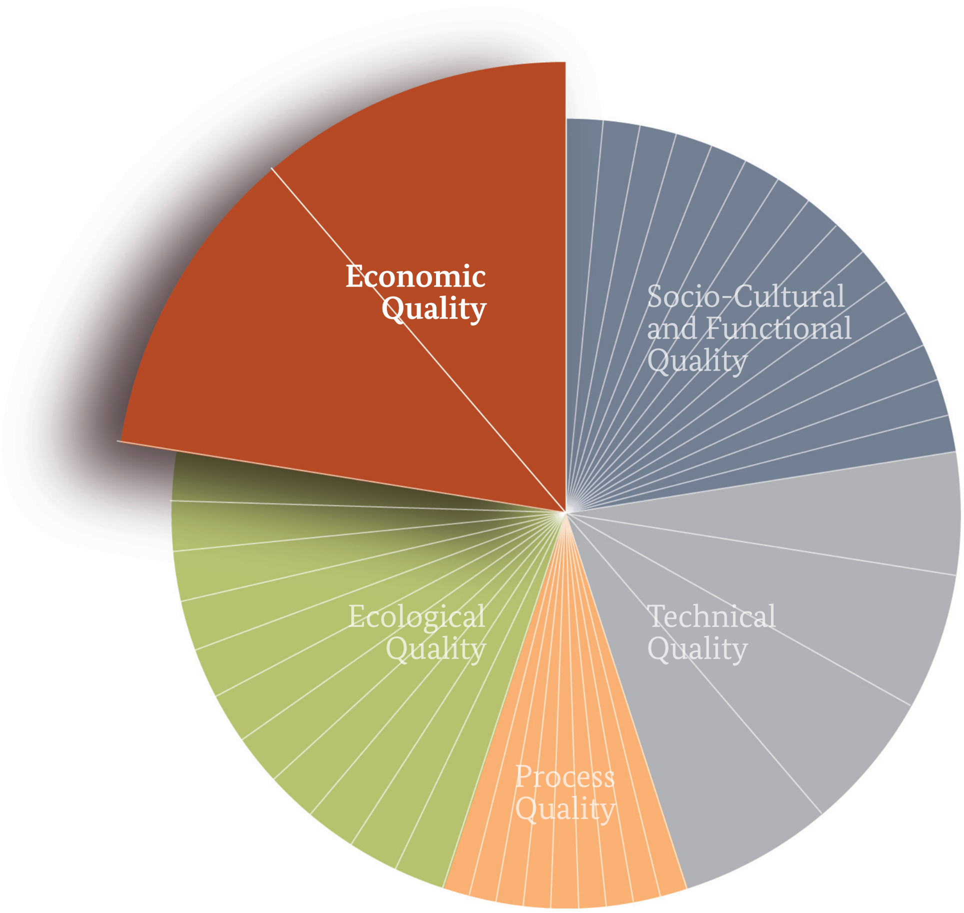


The essential aspects of the ecological dimension in the building and residential sector are the reduction of surface area consumption, the end of uncontrolled settlement of open country and the minimisation of additional sealing of the soil surface and the exploitation of potentials for unsealing soil.

The Criterion “Demand of Space” evaluates to what extent the type of land utilisation is altered by the building project. A positive assessment is issued when no additional natural area is converted to building areas and/or when the surface is obtained by land recycling. Previous utilisation and hazardous waste sites which may be present are determined on the basis of excerpts from the land register and development plans.

2. Economic Quality

In terms of economics, the quality worthy of protection is capital. Here it is not primarily the investment expenditure which is to be considered; the objective here is far more the optimisation of costs over the total life cycle of a building. As a result, it is not only the follow-up costs of an investment, but also the aspects of economic efficiency and value stability which become the focus of scrutiny.



2.1 Life Cycle Costs

Not only the erection but also the utilisation and the dismantling of buildings are causes of high costs. This means that, as a rule, the building utilisation costs – depending on the building category and the observation period – wind up being several times as great as the manufacturing costs. The objective is therefore not only a minimisation of manufacturing costs but also a reduction and optimisation of costs throughout the entire life cycle.

2.1.1 Building-related Life Cycle Costs

Selected cost types for erection and operation are determined for the assessment of the Life Cycle Costs, taking into account the discount rate and the rate of inflation. In view of the fact that very little usable data are available for the areas of dismantling and disposal, these costs cannot be included in the calculations.

The total costs are calculated for the reference time period of 50 years and shown as net amount per square metre (€/m²BGFa). The cost types 300 and 400 are taken into account for the erection. For the building utilisation costs, operating costs and the costs of maintenance are determined by means of the present value method.

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Included are the costs for:

- Water supply and disposal analogous to Criterion 1.2.3
- Energy requirements pursuant to DIN V 18599
- Cleaning and upkeep of the building
- Operation, inspection and service of building construction and technical building equipment
- maintenance of building construction and technical building equipment

2.2 Performance

Buildings always represent a long-term investment. Positive value de velopment is therefore an important characteristic of economic quality.

2.2.1 Value Stability

A long-term utilisation duration of buildings makes a decisive contribution to sustainability through the avoidance of resource consumption and emissions. In the event of different user requirements or a change of user, a building must lend itself to flexible and simple adjustment to new requirements in order that it can continue to be used following an economically feasible conversion. The results of Criteria 3.2.2 Surface efficiency and 3.2.3 Reutilisation capability are applied for the assessment.

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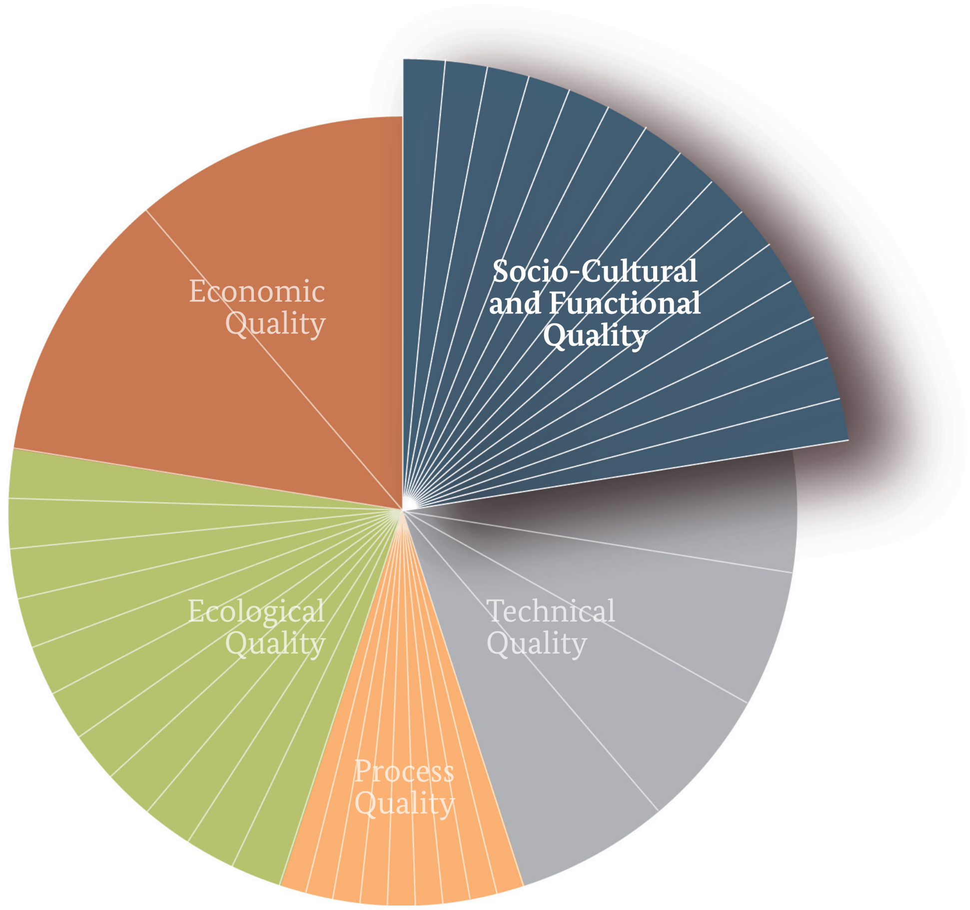
3. Socio-Cultural and Functional Quality

The building users and their needs are the centre of attention for assessing socio-cultural and functional quality. Accordingly, the objectives worthy of protection here are the health, safety and comfort of the users and the quality of design.

These aspects have a decisive influence on identification with the constructed environment and correspond to the requirements the user has of a building and to the quality of utilisation which goes with them.



3.1 Health, Comfort and User Satisfaction

Humans spend the majority of their lives in enclosed rooms. As a result, the quality of the rooms and buildings has a decisive effect on the feeling of well-being of the users. In addition to the avoidance of harmful effects on health, the comfort and satisfaction of the building users are also to be secured. A large number of aspects must be taken into account in order to accomplish this.

- 3.1.1 Thermal Comfort in Winter
- 3.1.2 Thermal Comfort in Summer
- 3.1.3 Indoor Air Quality
- 3.1.4 Acoustic Comfort
- 3.1.5 Visual Comfort
- 3.1.6 Influence of the User
- 3.1.7 Building-related Outdoor Qualities
- 3.1.8 Safety and Incident Risks

3.2 Functionality

The functionality of buildings involves, on the one hand, comprehensive utilisation capability for different groups of users. On the other hand, this ensures the prerequisites needed in order for the life of the building to be able to be prolonged in economic terms even beyond a normal utilisation period.

- 3.2.1 Barrier-free Building
- 3.2.2 Space Efficiency
- 3.2.3 Capability of Conversion
- 3.2.4 Public Accessibility
- 3.2.5 Bicycle Comfort

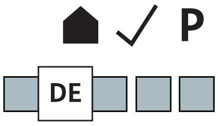
3.3 Ensuring Design Quality

Buildings determine the appearance of our everyday environment. A high aesthetic quality in the building environment is indispensable for a sense of well-being. At the same time, a high level of design quality – as the result of the identification of the user with the building – contributes to the enhancement of the utilisation period of the building.

- 3.3.1 Design and urban Quality
- 3.3.2 Art in Architecture

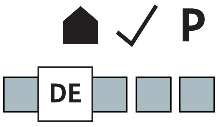
3.1 Health, Comfort and User Satisfaction

3.1.1 Thermal Comfort in Winter



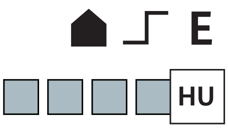
The thermal comfort and the room temperature at the workplace form a basis for efficient and performance-promoting work. In addition, the method by which the thermal comfort is provided exercises a considerable influence on energy consumption in office and administrative buildings. Integrated planning of the heating system, the ventilation concept and the enveloping surfaces is necessary for fulfilling requirements.

3.1.2 Thermal Comfort in Summer



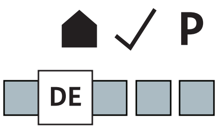
Building thermal insulation is of special importance with respect to the relevance of room temperature and and thermal comfort, not only to the extent they affect the pleasantness of the workplace in the summer but also in connection with high energy consumption levels for building cooling. In addition, suitable measures must be implemented to channel away interior thermal loads.

3.1.3 Indoor Air Quality



The objectives are to protect the users against hazardous substances, to increase comfort and to ensure an air quality which is felt to be good. Evaluation is made of the concentration of volatile organic substances, formaldehyde and of the individual-specific rate of ventilation. It is imperative that the use of low-emission and low-odour materials be taken into account as part of planning and tendering. By metering the indoor air concentration of volatile organic compounds and formaldehyde after completion, the success of the careful selectition of building products is reviewed and assessed.

3.1.4 Acoustic Comfort



The assessment of the acoustic comfort follows the DIN 18041 “Acoustic quality in small to medium-sized rooms“. The rule presets requirements for reverberation time for different areas of use. The ascertained results from metering or calculating the particular room types are included spatially-weighted in the overall evaluation.

3.1.5 Visual Comfort

Early and integral daylight and artificial lighting planning can provide a high quality of illumination coupled with low energy requirements for illumination and a reduction in the interior thermal load. Furthermore, it has been shown that a high degree of daylight utilisation can enhance performance capability and health at the workplace while at the same time reducing operating costs. Assessment is made of daylight availability, line of sight towards the exterior, nonglaring light, light distribution and colour rendering.

3.1.6 Influence of the User

The possibility of modifying the conditions at the workplace in accordance with individual requirements enhances comfort and satisfaction in the work environment. Assessment is made of the possibility of the user to exercise influence over the areas of ventilation, protection against sunlight, protection against glare, temperature (both during and outside of the heating period) and the control of daylight and artificial light at the workplace.

3.1.7 Outdoor Qualities

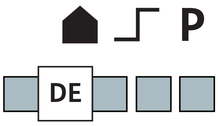
The development of different qualities in open spaces provides individual opportunities for communication, manoeuvring and retreat for various user groups and requirements. Evaluation is made of the array of variation between areas where people gather and the quality of furnishings. Interior open areas, e.g. atriums, are included in the assessment.

3.1.8 Safety and Incident Risks

The enhancement of the subjective feeling of security, the avoidance of hazards and extensive safety even in the event of accidents and catastrophes contributes essentially towards the feeling of comfort. The aspects to be evaluated are for example the adequate lighting of pathways, the presence of evacuation plans and minimizing the risk of fire gases.

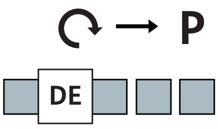
3.2 Functionality

3.2.1 Barrier-free Building



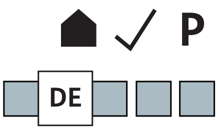
The objective is to provide all of the people with similar opportunities for utilising the building environment. The absence of barriers enhances the value and the attractiveness of the building environment for segments of the population; unlimited accessibility is particularly important to people with motor or sensory handicaps. As a result of demographic changes, their percentage of the general population will increase in the future. Sustainable building must take this development into account.

3.2.2 Space Efficiency



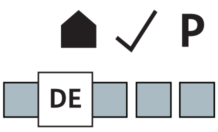
The objective of the national sustainability strategy of the federal government is, in addition to the general restriction of the development of new land areas, also the enhancement of the efficient utilisation of space which is already sealed. In the interiors of buildings, the implementation of this objective requires an increase in space efficiency.

3.2.3 Capability of Conversion



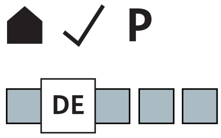
A high capacity for conversion is the prerequisite for a prolongation of the utilisation period beyond the originally planned utilisation. This obtains when a building can be converted with a low level of resource utilisation. The indicators modularity, spatial structure, electrical and media supply and air-conditioning, among others, are investigated on the basis of the checklist.

3.2.4 Public Accessibility



Added value is created through public accessibility which increases the acceptance and integration of buildings within an area. This can be implemented by means of such things as the public utilisation of open-air enclosures, cafeterias and the subletting of office units or conference rooms to third parties.

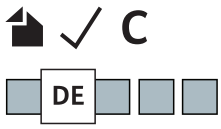
3.2.5 Bicycle Comfort



The shifting of individual transportation to bicycle traffic can be an essential contribution to the formation of an environmentally appropriate and energy-efficient mobility. For this it is not mainly the quantitative but rather the qualitative aspects which are decisive for user acceptance. One important module on the way to sustainable mobility is therefore the expansion of infrastructure offerings for bicyclists. In addition to the presence of a sufficient number of bicycle parking spaces and the quality of their fittings, e.g. protection against weather and theft, changing rooms and shower facilities in office and administration buildings are also to be mentioned here.

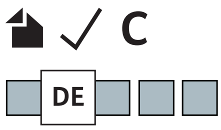
3.3 Ensuring Design Quality

3.3.1 Design and Urban Quality



Buildings give structure to public spaces and are an important part and reflection of the ongoing cultural development of the society. With targeted planning and development is applied to buildings, attractive habitats can be created, not only for humans but also for flora and fauna. City planning and architectural quality is ensured through competitions and selection by a qualified jury. The execution, the procedure and the commissioning of the planning team, among other things, are investigated during the course of the jury‘s deliberations. Alternately, buildings receive recognition for their high quality in terms of design.

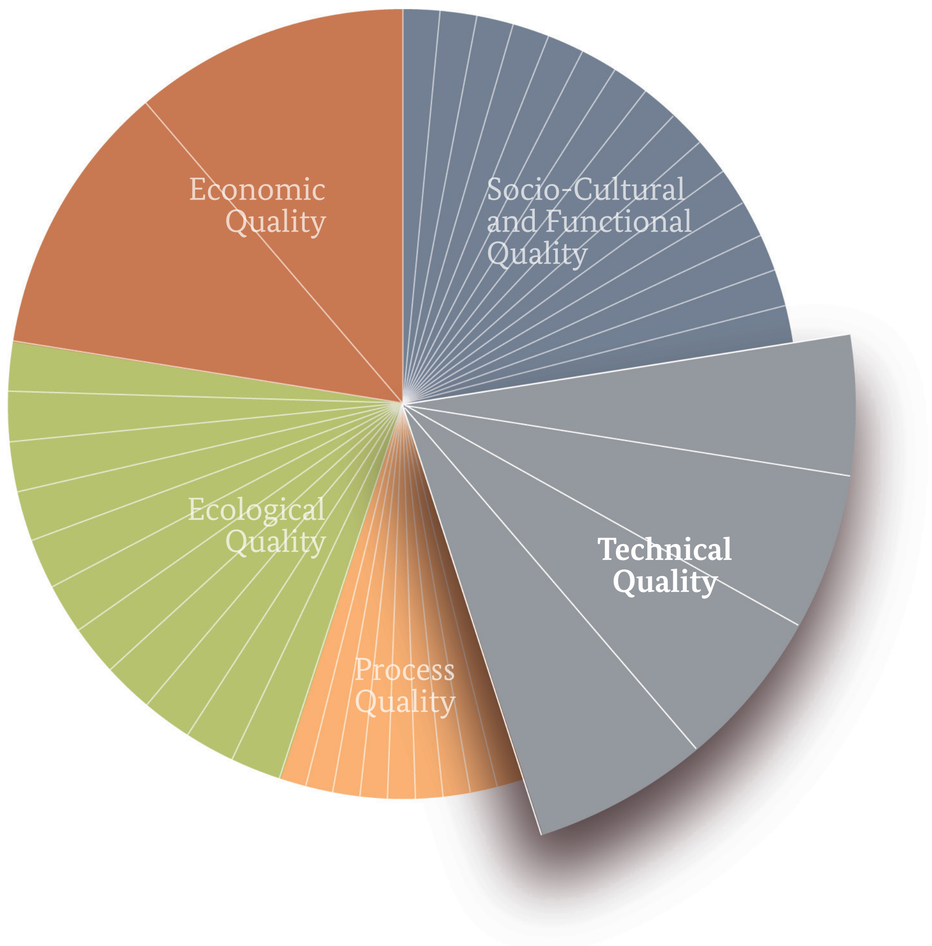
3.3.2 Art in Architecture



Art in Architecture is an element of building structure which also contributes to its quality and expressiveness. It is therefore an integral component of the building task and is the responsibility of the owner. Art in Architecture contributes to enhancing the acceptance and identification of the user with the building. The selection process and the requirements should thereby be in compliance with the guideline for Art in Architecture.

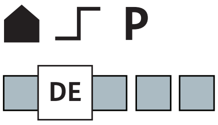
4. Technical Quality

The technical quality focuses on the quality of the technical execution of a building and its systems. As a cross-section quality, it exercises influence on all areas of sustainability.



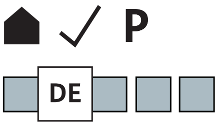
4.1 Technical Execution

4.1.1 Sound Insulation



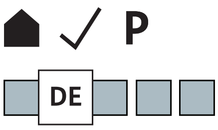
High quality sound insulation supports the concentrativeness and confidentiality. The assessment takes place through the determination of sound insulation qualities. The fulfilment of requirements which exceed the specifications of minimum acoustic protection result in an improvement of the assessment.

4.1.2 Heat Insulation and Protection against Condensate



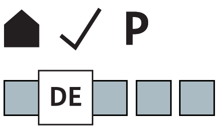
In this Criterion, it is primarily the quality of the external envelope which is investigated. A high degree of thermal comfort and the avoidance of construction damage should at the same time be ensured. The assessment is made on the basis of individual requirements with respect to components in the building envelope and to the building itself as a whole. This includes the heat transmission coefficients of the components, the air tightness of the building envelope, the sunlight transmission parameter and the avoidance of thermal bridges and condensate in the construction.

4.1.3 Cleaning and Maintenanc



Targeted cleaning and maintenance can ensure that the materials utilised will be available for use through to the end of their maximum possible service life. The buildings are divided up into three construction types for the assessment. A checklist is used, e.g. to determine the accessibility and cleaning-friendliness of parts of the building. The documentation of conformity is accomplished by plans and documentary proofs of the type and design of the floor covering.

4.1.4 Dismantling, Separation and Utilisation

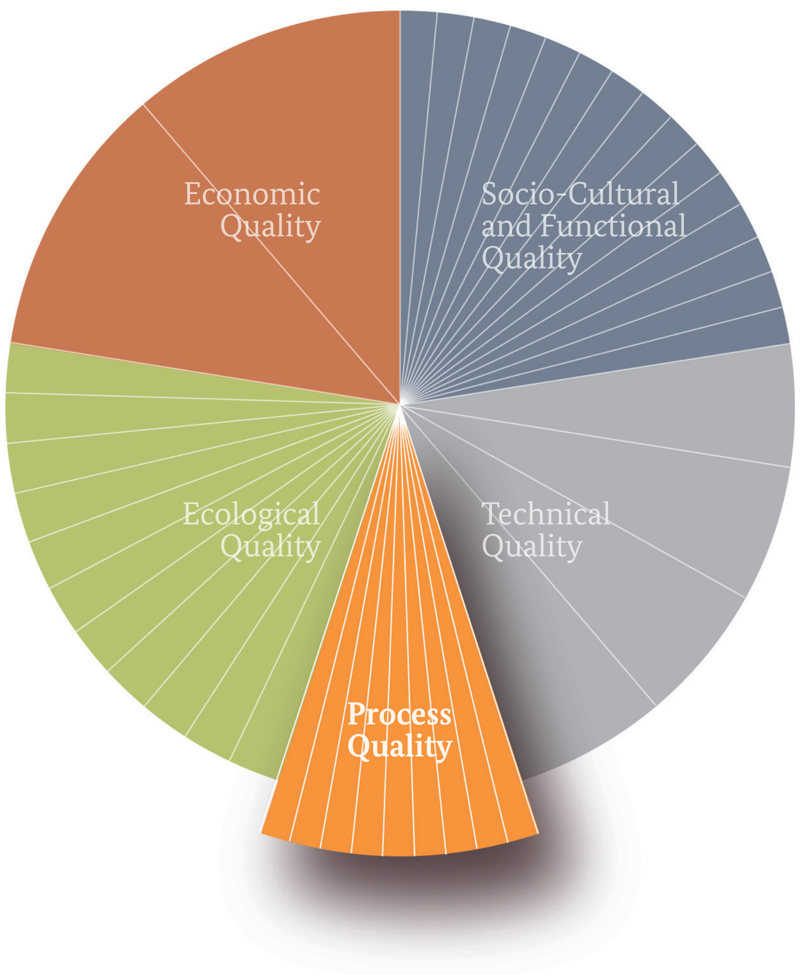


Construction waste is future raw materials. This applies only if the materials used are available for new utilisations without any diminishments of quality after they have been used as a construction material. Positive assessments are given for the utilisation of materials and building products which can be readily reclaimed as high-quality resources and then recycled. The design should in addition enable a clean segregation of the construction materials.

5. Process Quality

A high process quality in the erection stage of a building structure is a prerequisite for the optimisation of the total life cycle.

In this context, it is particularly the aspects of the quality of the planning process, of the building execution and of the preparation for building operations which merit the greatest scrutiny.



5.1 Management and Design

It is in the planning that the prerequisites are established for sustainable erection, operation and even dismantling. In light of the fact that the decisions made in early planning stages already exercise great influence on the quality of the building, a special significance is given to planning quality. It is for this reason that all phases and aspects of the planning process are scrutinised in the Criteria group.

- ▸ 5.1.1 Project Preparation
- ▸ 5.1.2 Integrated Design
- ▸ 5.1.3 Optimisation and Complexity of Planning
- ▸ 5.1.4 Sustainablity Issues in Tender and Placing
- ▸ 5.1.5 Requirements for an Optimal Utilisation and Management

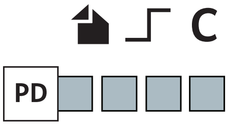
5.2 Building Construction

An adequate implementation of the planning and the quality of the execution of the building make a major contribution to the realisation of the project objectives. Quality assurance and monitoring during the execution and a systematic hand-over of the building are of decisive importance in this connection. Together with qualified monitoring in the initial utilisation phase, these form the foundation for monitoring success and the prerequisite for operations optimisation.

- ▸ 5.2.1 Building Site / Building Process
- ▸ 5.2.2 Quality Assurance of the Building Construction
- ▸ 5.2.3 Controlled Commissioning

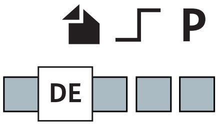
5.1 Management and Design

5.1.1 Project Preparation



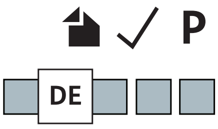
Optimum project preparation is the foundation for all further planning steps and is also to be contributed prior to work phase 1 pursuant to HOAI. The Criteria are the requirements planning, the target agreement and the preparation of a planning competition.

5.1.2 Integrated Design



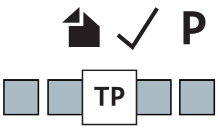
Integral planning enables a comprehensive scrutiny of the complex requirements demanded of a building construction and the iterative further development of individual aspects in the overall context. The early establishment of a qualified, interdisciplinary planning team and the integration of the sustainability Criteria as a catalogue of objectives for the individual planning steps are indispensable for sustainable planning and must already be defined at the start of the planning.

5.1.3 Optimisation and Complexity of Planning



The optimisation of complex planning connections by means of the compilation of detailed concepts and comparisons of different versions with respect to individual subject areas is a decisive quality characteristic of sustainable planning. Conflicts between different technical, organisational and logistical objectives can be identified at an early stage and transferred systematically into approaches for solutions.

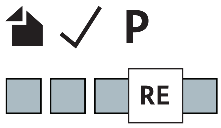
5.1.4 Sustainability Issues in Tender and Placing



The integration of sustainability aspects in the call for tender and when companies are selected serves the purpose of enhancing the building quality to be anticipated. Decisions regarding product quality are thus, from the point of view of sustainability, not made solely on the basis of economic considerations; ecological and (where pertinent) social aspects can also be taken into account in the decision.

5.1.5 Requirements for an Optimal Utilisation and Management

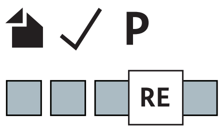
A great deal of information can be collected relatively simply during the planning and building execution which is then of great value during later operations. A comprehensive object documentation is therefore to be compiled. This includes the updated plans and notes regarding, upkeep and maintenance of the building and of the technical systems.



5.2 Building Construction

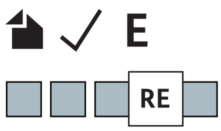
5.2.1 Building Site / Building Process

The objective is to ensure a construction site low on waste, noise and dust and to protect the ground against compacting and chemical leakage. This will safeguard both the health of all involved and also minimise the influence on the local environment.



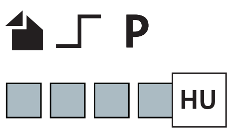
5.2.3 Quality Assurance of the Building Construction

In this criterion, quality assurance is evaluated by means of comprehensive documentation of the building execution. A more detailed building documentation ensures a uniform information basis and makes a decisive contribution to being able to implement future work on the building safely and economically. At the same time, the performance of measurements for the purpose of quality control is assessed in this Criterion. The basis for the assessment is the documentation of the material utilised, including product and safety data sheets, measurements carried out and acceptance protocols.



5.2.4 Controlled Commissioning

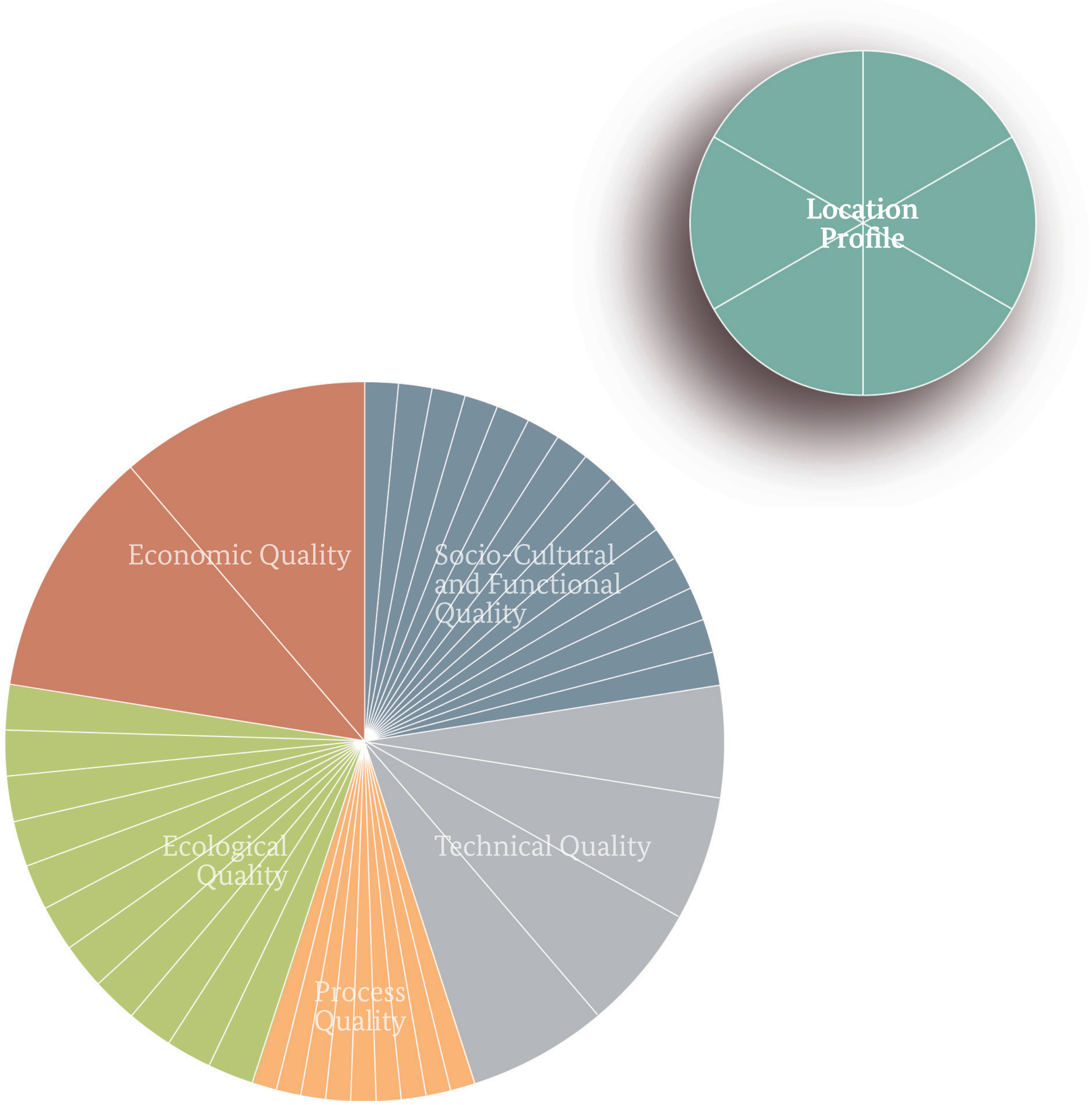
An important contribution to the function optimisation of the domestic service facilities is made by carrying out a systematic commissioning. Assessment is made of the conceptual and contractual preparation and implementation, from the acceptance of the building utility systems to their adjustment in utilisation phase.



6. Location Profile

The qualities of a site can be influenced only to a limited extent by the erection of a building. The qualities of the site, on the other hand, influence to a uniform extent all of the objectives of sustainable building.

It is therefore not only political and strategic considerations which need to be taken into account when selecting a building site, but also the risks and relationships at the micro-location, the district characteristics and the embedding in the local infrastructure.



6.1.1 Risks at the Micro-Site

Risks arise from the likelihood of occurrence and the potential for damage resulting from an event, e.g. flooding. The awareness of risks at the micro-location is a decisive Criterion for the selection of the site; appropriate reactions to know risks can at the same time be included in the design.

6.1.2 Conditions at the Micro-Site

The Criterion evaluates the relationships at the micro-location which have direct effects on the building users. These include not only burdens arising from noise, electric smog, radon, outside air and the foundation soil, but also positive aspects such as high-quality lines of sight.

6.1.3 Image and Character of Location and Quarter

Decisive for the selection of a site are often factors such as the image of the area, social synergy and conflict potentials in the neighbourhood and the state of upkeep and preservation in the natural and building surroundings.

6.1.4 Public Transport Connections

The paramount objective is to reduce private motorised transport by means a good connection with the local public transport system and bicycle paths. At the same time, the small-scale networking of the public transport system is to be promoted.

6.1.5 Vicinity to Use-Specific Services

In order to satisfy the needs of the users of office buildings, the surroundings must offer such things as opportunities for recreation and proximity to educational facilities. In addition to this, supply facilities must be available for both short-term and middle-term needs.

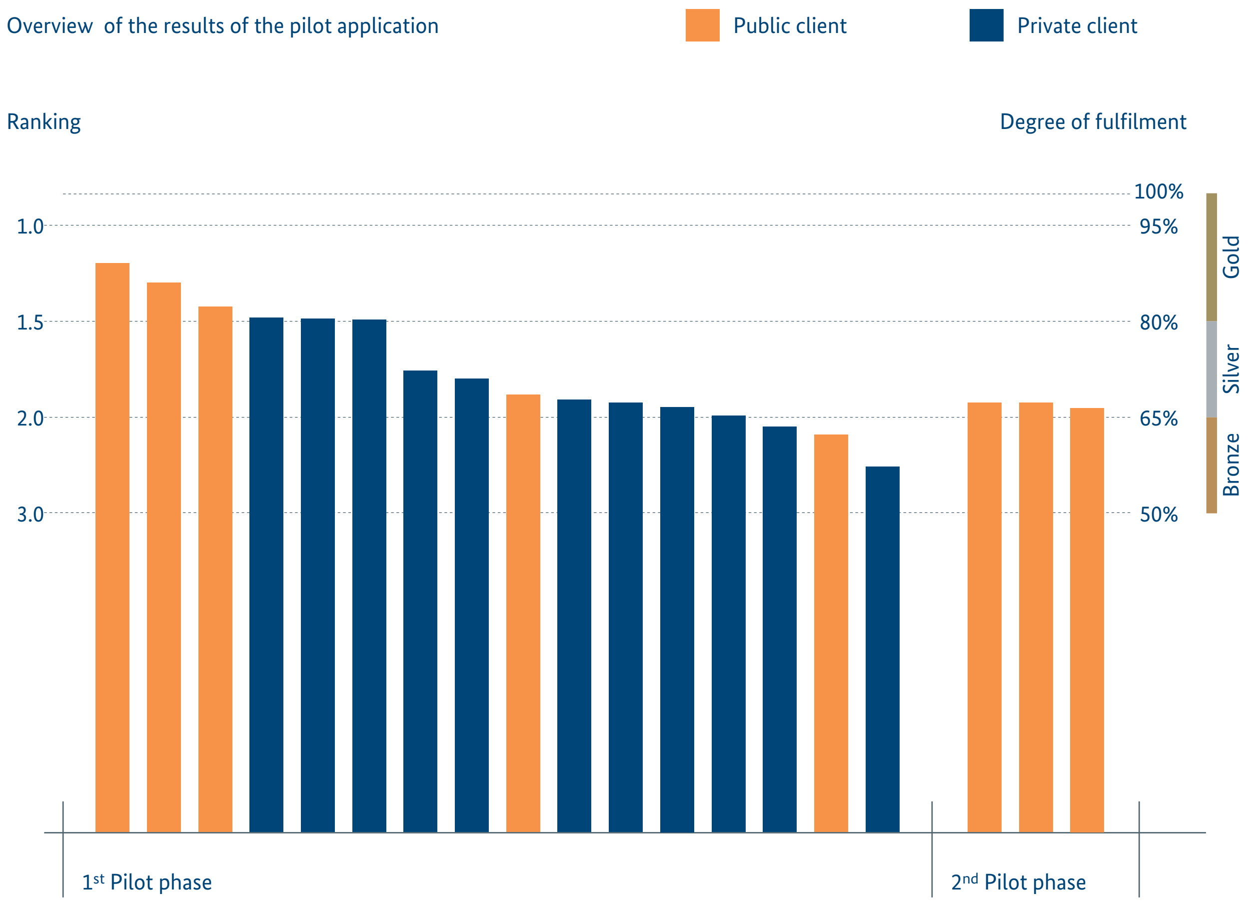
6.1.6 Supply Lines / Site Development

The offerings with respect to energy provided by cable, the opportunity of implementing drainage or solar systems, and access to modern media must all be numbered among the quality characteristics of trendsetting building locations.

Application of the Assessment System

The draft of the Assessment System for Sustainable Building was put to the test in an initial pilot phase with the 2008 test version on 16 existing office and administration buildings – five of them in the public domain. In the second pilot phase, three additional recently completed federal buildings were evaluated and certified with the consolidated version of 2008.

The system was optimised by the knowledge gained from pilot phases and research projects. With the update of the Guideline for Sustainable Building in 2013 the assessment is mandatory for all federal office and administration buildings. Currently, not less than 30 federal buildings are planned and erected according to the requirements of BNB. In addition to this, applications are underway in the Federal States and at communal level.



A wide cross-section of 16 buildings was assessed in the first pilot phase. None of the buildings was completed more than five years before. The buildings were planned and built to a certain extent with very high requirements. It was thereby revealed that buildings with an outstanding quality of construction and a high energy standard exhibited outstanding results in many subordinate areas with respect to sustainability, even when they were not explicitly planned in accordance with the Criteria of the sustainable building. Two public buildings with the usual planning requirements – i.e. primarily requirements with respect to economy and the sequence of planning and building processes – were also evaluated during the pilot phase. Their performance was, as was to be expected, poorer, although they still earned awards in silver and bronze, respectively.

Whereas for the first pilot phase a relatively wide range of projects were represented with respect to quality, complexity and year of completion, in the second phase only recently finished federal buildings with individual requirements regarding ecological and socio-cultural quality were selected. The federal government's announced objective – a degree of fulfilment in excess of 65% – was able to be achieved for these buildings.

The consideration of sustainability Criteria as early as the initial planning phase will enable a high quality level of comprehensive sustainability in the future. In this context, the Assessment System for Sustainable Building is used not only as an instrument for quality assurance as part of planning and quality control at the construction site, but also in the monitoring of success in building operations.

A small selection of buildings from the two phases of the pilot application is presented in the following. In addition to a brief description, selected results from the evaluations are presented.

Following buildings took part in the pilot application of the Assessment System for Sustainable Building:

1st Pilot phase:

Gold:
1. Paul-Wunderlich-Haus, Eberswalde
2. Federal Environment Agency Dessau
3. New Regionshaus Hanover
4. Volkswagen Financial Services AG
5. Office Building OWP11, Stuttgart
6. etrium, Cologne

Silver:
7. Laim 290, Munich
8. ATMOS, Munich
9. Institute Building TU Darmstadt
10. ZUB, Kassel
11. Office Building Meerbusch
12. Vileda, Weinheim
13. Z-zwo, Stuttgart

Bronze:
14. SuperC RWTH Aachen
15. Judicial authority Chemnitz
16. Office Building Saegeling, Heidenau

2nd Pilot phase:

Silver:
1. Main Customs Office Rosenheim
2. Federal Office for Radiation Protection Berlin
3. Ministry of Health Bonn

The sequence corresponds to the ranking in the pilot application of the Assessment System for Sustainable Building.

Paul-Wunderlich-Haus Eberswalde

Parallel to the development of the Assessment System for Sustainable Building, the Paul-Wunderlich-Haus in Eberswalde was also used for the performance of an initial run-through and iterative optimisation of the system. It also participated as a community building in the subsequent initial pilot phase with the 2008 Test Version. During its planning, an important part of the task specification was low building and operating costs. Here it was demonstrated that even an inexpensive building can achieve outstanding qualities in the presence of intelligent planning. The commitment of the builders paid off – the building ensemble achieved the highest certification in the „Gold" category among all of the participating buildings.

The building ensemble comprised of four compact, three to four-storey blocks grouped around a shared interior courtyard, closes the gap in city planning left over from the war in the middle of the historical old town of Eberswalde, in proper scale and with great circumspection. In addition to the district administration and the headquarters of the county commissioner, it also houses businesses, service facilities and a small museum with works by Paul Wunderlich, after whom the project is named.

The objective of achieving high quality in terms of design and energy efficiency at a low cost was implemented primarily by means of an optimum coordination of building form and insulation, intelligent daylight utilisation and thermal masses within the building. The drilled piles necessary for the foundation are equipped with absorber registers and, by means of a heat pump, are used for both heating in winter and cooling in summer. The ventilation system is equipped with a heat recovery system. Innovative technologies, such as vacuum insulation panels (VIP) and phase change material (PCM), were also installed.

All of the specialist planners required for energy efficiency were included in the planning from an early stage onward. Simulations were carried out for the purpose of achieving an optimum building concept which goes beyond conventional planning efforts. As an EnOB project, extensive monitoring was carried out in the Paul-Wunderlich-Haus under the supervision of Brandenburg University of Technology Cottbus.

The „Paul-Wunderlich-Haus" Barnim Service and Administration Centre is part of the research and funding project „Energy-optimised Building" (EnOB)

Client:
District Administration Barnim

Architect:
Thomas Winkelbauer, GAP
Gesellschaft für Architektur &
Projektmanagement mbH Berlin

Auditors:
Dr. Günter Löhnert,
Holger König,
Prof. Thomas Lützkendorf

Gross Floor Area:	22,218 m²
Completion:	2007
Production Cost (300+400):	945 €/m^2_{GFA}
Occupancy Cost*:	893 €/m^2_{GFA}
PE_{tot}:	157 kWh/m^2_{NFA}a
PE_{re}:	27 kWh/m^2_{NFA}a
GWP:	25.6 kg CO_2-Äqu/m^2_{NFA}a

Building Assessment	**1.2**
Ecological Quality	1.1
Economic Quality	0.8
Socio-Cultural and Functional Quality	1.3
Technical Quality	1.4
Process Quality	1.6
Location Assessment	**1.6**

* for 50 years, determination with the aid of the present value method

Federal Environment Agency Dessau

The Federal Environment Agency in Dessau (UBA) is a showcase project for the federal government due to its high quality in all aspects of sustainable construction. This estimation was also confirmed in the initial pilot phase with the 2008 Test Version, during which the Federal UBA was awarded certification with Gold.

With its eye-catching architecture, the new UBA Building in Dessau sets the tone at the central site in the former industrial area. It is not only because of its shape, in the form of a colourful, rolling „ribbon“, but also and primarily because of its outstanding ecological concept that the Federal Environment Agency building is now attracting numerous interested visitors from home and abroad.

In addition to the conversion of a heavily contaminated industrial wasteland, special emphasis was also placed on energy efficiency and the utilisation of renewable energies. Thus, for example, levels at 50% of those specified by the Heat Insulation Ordinance valid at the time were achieved, the annual electricity energy demand was limited to 40 kWh/m²NGF and energy requirements were covered up to 15% by renewable sources. Measures used for achieving these ambitious goals included the conditioning of the supply air by means of an air-driven underground heat exchanger, heat recovery, the utilisation of solar energy for generating electricity and cooling by means of solar energy-supported cold production.

The implementation of the building project was preceded by a comprehensive planning process which was marked by extensive conceptual analyses and simulations for the implementation of the ecological goals. After commissioning, the Federal Environment Agency was subjected to intensive scientific monitoring.
It was also revealed at the time that energy-optimised buildings require an adjustment phase of at least one year in order to coordinate the plant systems with one another and to utilise the savings potential to the fullest.

The Environment Agency in Dessau arose as a pilot project for the implementation of the 2002 Guideline for Sustainable Building of the Federal Ministry for Building. In addition, its realisation is a part of the research and funding project „Energy-optimised Building“ (EnOB).

Client:
Federal Republic of Germany
represented by:
Federal Ministry for Building
represented by:
LBB Sachsen-Anhalt; Division Magdeburg

Architect:
Sauerbruch Hutton, Berlin

Auditors:
Dr. Günter Löhnert,
Holger König,
Prof. Thomas Lützkendorf,
Prof. Alexander Rudolphi

Gross Floor Area:	36,623 m²
Completion:	2005
Production Cost (300+400):	1,311€/m^2_{GFA}
Occupancy Cost*:	1,097€/m^2_{GFA}
PE_{tot}:	157 kWh/m^2_{NFA}a
PE_{re}:	21 kWh/m^2_{NFA}a
GWP:	27.6 kg CO_2-Äqu/m^2_{NFA}a

Building Assessment	**1.3**
Ecological Quality	1.2
Economic Quality	1.0
Socio-Cultural and Functional Quality	1.2
Technical Quality	1.7
Process Quality	1.4
Location Assessment	**1.8**

* for 50 years, determination with the aid of the present value method

Building Assessment	**1.9**
Ecological Quality	1.2
Economic Quality	1.1
Socio-Cultural and Functional Quality	3.7
Technical Quality	1.9
Process Quality	4.0
Location Assessment	**1.7**

Building Assessment	**1.9**
Ecological Quality	1.6
Economic Quality	1.5
Socio-Cultural and Functional Quality	3.6
Technical Quality	1.8
Process Quality	2.4
Location Assessment	**1.7**

Building Assessment	**1.9**
Ecological Quality	1.8
Economic Quality	1.1
Socio-Cultural and Functional Quality	3.3
Technical Quality	2.5
Process Quality	2.4
Location Assessment	**1.6**

Main Customs Office Rosenheim

In order to achieve a comfortable building climate, even in summer, the Main Customs Office in Rosenheim placed primary emphasis on passive measures such as night-time cooling and protection against sunlight. Rainwater is stored and used for toilet flushing. A high percentage of the heat requirement is covered by district heating powered by waste incineration. Spatial flexibility is supported by continuous ribbon glazing and cable ducts, as well as by lightweight partitions between the offices. The flat roof has been extensively covered with greenery.

Client: Federal Republic of Germany
Architect: Staatliches Bauamt Rosenheim
Auditor: Dipl.-Ing. Nicolas Kerz, BBSR

Gross Floor Area:	5,181 m²
Completion:	2007
Production Cost (300+400):	1,084 €/m^2_{GFA}
Occupancy Cost*:	918 €/m^2_{GFA}
PE_{tot}:	236 kWh/m^2_{NFA}a
PE_{re}:	121 kWh/m^2_{NFA}a
GWP:	21.3 kg CO_2-Äqu/m^2_{NFA}a

Federal Office for Radiation Protection Berlin

The principles of ecological and energy-saving building were given special emphasis for the new construction of the laboratory building of the Federal Office for Radiation Protection. The planning and execution process were supervised and monitored during the building by the Gesellschaft für ökologische Bautechnik, GfÖB. Only materials compatible with health and environment were used for the new building. The rain water which falls on the property is drained away aboveground, the ventilation systems are equipped with a heat recovery unit; the main roof is extensively covered with roof greenery.

Client: Federal Republic of Germany
Architect: Cosa Nova Architekten, BDA Berlin
Auditor: Prof. Ing. Alexander Rudolphi, GfÖB Berlin mbH

Gross Floor Area:	1,715 m²
Completion:	2009
Production Cost (300+400):	1,378 €/m^2_{GFA}
Occupancy Cost*:	1,242 €/m^2_{GFA}
PE_{tot}:	218 kWh/m^2_{NFA}a
PE_{re}:	18 kWh/m^2_{NFA}a
GWP:	47.2 kg CO_2-Äqu/m^2_{NFA}a

Ministry of Health Bonn

The Ministry of Health in Bonn is a successful example for achieving excellent comfort and lifestyle with less expenditure of technology, material and energy. The wind-shielded built-in ventilation wings permit the windows to be opened, even in the 13-storey high-rise, controllable ribs protect against excessive heat entry, the low cooling loads can be optimally discharged through activated components – i.e. heating and cooling elements – and through the natural ventilation. The variable-user building structures are an additional plus point for performance and sustainability.

Client: Federal Republic of Germany
Architect: Petzinka Pink Architekten, Düsseldorf
Auditors: Dipl.-Ing. Natalie Eßig, TU München
Dipl.-Ing. Thomas Rühle, Intep GmbH

Gross Floor Area:	17,202 m²
Completion:	2007
Production Cost (300+400):	1,093 €/m^2_{GFA}
Occupancy Cost*:	1,109 €/m^2_{GFA}
PE_{tot}:	317 kWh/m^2_{NFA}a
PE_{re}:	12 kWh/m^2_{NFA}a
GWP:	73.9 kg CO_2-Äqu/m^2_{NFA}a

* for 50 years, determination with the aid of the present value method

List of Abbreviations

BNB..Assessment System for Sustainable Building for Federal Buildings
PE_{re}..Primary Energy Demand Renewable
PE_{nre}..Primary Energy Demand Not Renewable
PE_{tot}..Total Primary Energy Demand
LCC..Life Cycle Costs
LCA..Life Cycle Assessment
GWP..Global Warming Potential
GFA..Gross Floor Area
NFA..Net Floor Area
EnOB..Research and funding project „Energy-optimised Building“

Further Information

www.nachhaltigesbauen.de........Internet Portal Sustainable Building
www.bundesregierung.de..........German Federal Government
www.bmub.bund.de..................Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety
www.bbr.bund.de......................Federal Office for Building and Regional Planning
www.bbsr.bund.de.....................Federal Institute for Research on Building, Urban Affairs and Spatial Development
www.nachhaltigkeitsrat.de.........Council for Sustainable Development
www.enob.info...........................Research and funding project „Energy-optimised Building“

www.bmub.bund.de/english