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THE CHALLENGES OF MODERN CONSTRUCTION

RESPONDING TO RAPIDLY CHANGING TIMES

For some time now, hardly any other subject has been the focus of greater public and professional discussion than sustainability.

Green building is becoming increasingly important at a national and international level and is also highlighting climate change problems caused by global warming and the associated rise in the concentration of CO_2. The situation in terms of the transformation of population lifestyles and the higher demands and requirements placed on living and working environments is also changing. In order to ensure that sustainability remains a viable subject in future, environmental aspects must be considered to the same degree as social and commercial aspects. The focal point is a sound ecological, social and economic objective.

In this respect, resources need to be conserved to the greatest extent possible and a high degree of energy efficiency and reduction of CO_2 emissions ensured through the use of renewable energies. The focus in terms of green building is on the minimization of energy and resource consumption. As such, balanced consideration of economic, ecological and social aspects in all phases of a building's life cycle is required.

Compliance with green building requirements needs to be verified by way of certification, be it LEED, BREEAM or DGNB. Building certification systems define and illustrate green building requirement criteria and objectives in a comprehensible form and are a significant aid to those responsible within the planning process. However, certification also offers other positive aspects. The reduction of environmental pollution thanks to green buildings, low life cycle costs, improved ascertainability during the planning process and easier access to information for users and operators are all important benefits of certification. These facilitate a comparison of quality issues and consequently also enable an early assessment by project building owners and planners.

INTERNATIONAL CERTIFICATION SYSTEMS

Throughout the world, numerous different certification systems have been developed in recent years that are now becoming increasingly homogeneous as a result of being updated on the basis of experience gained. Certification is consequently developing into a global standard.

The map shows a selection of the prevailing international systems.


DGNB
TQ
MINERGIE-ECO
CASBEE
EEWH
LEED VAE
LEED IN
GREEN STAR
GREEN STAR NZ

INTERNATIONAL CERTIFICATION SYSTEMS

DGNB, BREEAM AND LEED

DGNB certification system

Compared to the American LEED and British BREEAM systems, the DGNB certificate is relatively new to the building sustainability assessment market. The system was first developed in 2007, around 15 years after LEED and BREEAM. Following a pilot phase in 2008, the first 'New office and administrative buildings' occupancy profile was introduced onto the market. The DGNB certificate has since become increasingly prevalent on a national level. According to a press statement published on June 20, 2012 on the German Sustainable Building Council (DGNB) website, more than 750 projects throughout the world have already been granted a DGNB certificate or have applied for certification. The number of members has also steadily increased since its foundation and now totals more than 1,100.

BREEAM certification system

The first system for assessing the sustainability of buildings was developed in the late1980s in the United Kingdom under the name 'BREEAM', which stands for Building Research Establishment Environmental Assessment Method. This so-called ur-version of all building sustainability assessment certification systems was launched in 1990 and has since become one of the most internationally widespread and recognized systems of assessment. Around 200,000 properties worldwide have already been certified (as of 2011). Most of the buildings, in particular the residential properties, have been certified in the United Kingdom itself; however, numerous buildings outside of the UK have also been certified using the BREEAM method.

LEED certification system

The American certification system is called LEED (Leadership in Energy & Environmental Design) and assesses the ecological, economic and social aspects of a building. Development began in the 1990s with the aim of designing an assessment system with the capability of quantifying and comparing the sustainability of buildings over their entire life cycle (planning, construction, operation and demolition). The aim was not only to raise awareness and promote the further development of sustainability in the commercial environment, but also within the private community.
Globally, the American certification system has developed into one of the "most important voluntary quality audits in sustainable, environmentally-friendly, low-pollution and low-emission construction." (http://www.eco-institut.de)
As of 2011, around 30,000 commercial and office buildings had already applied for certification. Almost 11.000 of these have now received a certificate. After initial teething problems, the number of registrations and members steadily rose. A clear trend towards building certification is evident above all in the USA, which has the largest volume of registered buildings, primarily due to contributing factors such as authority standards, driving forces and the market system itself, which have all recognized the benefits of certification.

** source: ww.eco-institut.de*

INTERNATIONAL CERTIFICATION SYSTEMS
DIFFERENCES BETWEEN DGNB, BREEAM AND LEED

The difference between the labels

The three most widespread and established certification systems, BREEAM, LEED and DGNB, currently differ both structurally and in terms of context. Each assessment system stipulates different requirements for implementing the assessment process. In the case of BREEAM and DGNB, assessment can only be carried out by experts that have completed specialist training at the respective certification organization. In contrast, LEED does not stringently require an 'LEED accredited professional' (AP) to participate in the assessment process; although the inclusion of an AP within the project team does generate an assessment point in the Innovation category.

Certification is implemented in a two-step process in all of the systems. This involves (voluntary) pre-certification during the planning phase and definitive certification when the building is finished. Pre-certification in the case of BREEAM and DGNB is based on draft values and final certification on the basis of values and workmanship actually measured. In many cases, for final verification BREEAM also necessitates an inspection of the building by a BREEAM expert as well as photographic documentation to check whether the draft has indeed been implemented. Contrastingly, LEED differentiates between criteria that are only taken into consideration in the planning phase (design credits) and criteria evaluated during or after construction (construction credits). An on-site inspection is only required by LEED for the approval of energy-related building technology.

Assessment ratings and mandatory criteria

The certification systems apply different assessment ratings and certifications. Results are presented in percentages or points and are dependent on the overall level of compliance. The lowest rating represents the current minimum requirements at national level for green building. Due to the different building standards in the individual countries a comparison of the assessment results is practically impossible. To guarantee the quality of certification, LEED, BREEAM and DGNB require compliance with a selection of mandatory criteria. In the case of LEED, compliance with these so-called 'prerequisites' is a basic requirement for certification, while BREEAM requires the achievement of specific 'minimum BREEAM standards' that depend on which assessment rating is targeted. DGNB prescribes 'minimum qualities' for individual assessment ratings; in other words, a building with, for example, silver certification must achieve at least bronze level in all categories.

Sustainability and life cycle coverage

From a contextual perspective, the systems differ above all in relation to the coverage of sustainability requirements. DGNB follows a holistic approach that encompasses ecological, economic and sociocultural criteria over the entire life cycle. This approach is also known as the 'second-generation' assessment method. Contrastingly, 'first-generation' systems such as LEED and BREEAM focus mainly on energy and environmental aspects. Focal areas of the respective systems are also reflected in the weighting of the assessment criteria and categories. In the case of LEED and BREEAM, weighting is primarily on energy (BREEAM: 19%, LEED: 35 out of 100 or 110 points). The DGNB system weights each of the individual sustainability categories with 22.5%. Within the Environmental quality category the energy share constitutes 5.6%. In addition, 'Technical quality' is weighted with 22.5% and 'Process quality' with 10% (Fig. 4, p.10). DGNB assesses 'Locational quality' separately, not least because the sustainability quality of the building is designated rateable and in contrast to BREEAM and LEED is not included in the overall scoring.

Outside of DGNB, the life cycle has until now either not been taken into account at all or only to a partial extent during certification. The focus has previously been on the operational phase, supplemented by the building phase. However, this is changing and analysis of the entire life cycle of a building is increasingly being integrated into new system versions. For example, BREEAM UK 2011 now includes the criterion 'Life cycle impacts' in the 'Materials' category; while LEED is testing the pilot criterion 'Life cycle assessment of building assemblies and materials'.

THE DGNB CERTIFICATION SYSTEM

NEW OFFICE AND ADMINISTRATIVE BUILDINGS

To achieve its primary aims, DGNB has developed building- and utilization-specific catalogues of criteria to facilitate precise description and assessment of a building or urban area within the quality groups specified opposite. Particularly important are the criteria life cycle assessment and life cycle costs.

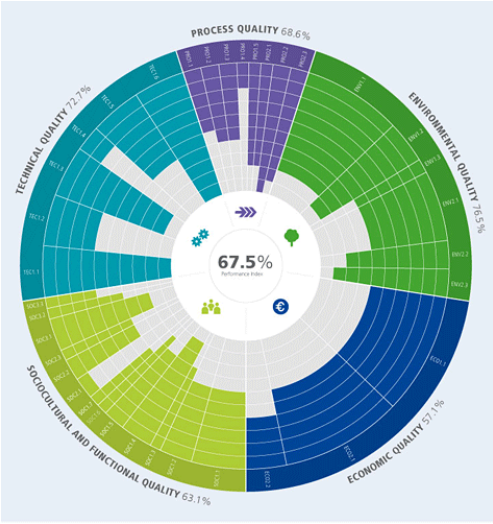
DGNB assessment method:

The differentiated assessment method regards each individual criterion as an important component for successful certification. Depending on the level of compliance with prescribed requirements, a gold, silver or bronze DGNB certificate is awarded. The level of compliance is detailed in the form of percentages and ratings.

To promote a uniform high standard of building quality, the score in each category must reach a specific basic level to receive the respective certification. Gold, for example, requires a score of at least 65% in all five categories
.

The assessment diagram shows the weighting of specific criteria within the individual quality areas (called 'categories' in the following) and the assessment of an office and administrative building.

Total score	Minimum score	Certification
50 % and above	35 %	Bronze
65 % and above	50 %	Silver
80 % and above	65 %	Gold



ACCURATE AND CLEAR. THE ASSESSMENT MATRIX OF THE DGNB CERTIFICATE.

EVALUATION AREA	CRITERIA GROUP	CRITERIA	CRITERIA POINTS **ACHIEVED**	CRITERIA POINTS **MAX. POSSIBLE**	WEIGHTING FACTOR	WEIGHTED POINTS **ACHIEVED**	WEIGHTED POINTS **MAX. POSSIBLE**	GROUP POINTS **ACHIEVED**	GROUP POINTS **MAX. POSSIBLE**	GROUP PERFORMANCE INDEX	GROUP WEIGHT	TOTAL PERFORMANCE INDEX
ENVIRONMENTAL QUALITY	LIFE CYCLE ANALYSIS	Global Warming Potential	10.0	10.0	3	30.0	30.0	178.5	200.0	89.3%	22.5%	DGNB 86.3% (Gold)
		Ozone Depletion Potential	10.0	10.0	1	10.0	10.0					
		Photochemical Ozone Creation Potential	10.0	10.0	1	10.0	10.0					
		Acidification Potential	10.0	10.0	1	10.0	10.0					
		Eutrophication Potential	7.1	10.0	1	7.1	10.0					
	GLOBAL AND LOCAL ENVIRONMENTAL IMPACT	Local Environmental Impact	8.2	10.0	3	24.6	30.0					
		Sustainable Use of Resources / Wood	10.0	10.0	1	10.0	10.0					
	RESSOURCE CONSUMPTION AND WASTE GENERATION	Nonrenewable Primary Energy Demand	10.0	10.0	3	30.0	30.0					
		Total Primary Energy Demand and Proportion of Renewable Primary Energy	8.4	10.0	2	16.8	20.0					
		Drinking Water Demand and Volume of Waste Water	5.0	10.0	2	10.0	20.0					
		Land Use	10.0	10.0	2	20.0	20.0					
ECONOMIC QUALITY	LIFE CYCLE COSTS	Building-Related Life Cycle Costs	9.0	10.0	3	27.0	30.0	47.0	50.0	94.0%	22.5%	
	ECONOMIC PERFORMANCE	Suitability for Thiry-Party Use	10.0	10.0	2	20.0	20.0					
SOCIOCULTURAL AND FUNCTIONAL QUALITY	HEALTH, COMFORT AND USER FRIENDLINESS	Thermal Comfort in Winter	10.0	10.0	2	20.0	20.0	251.1	280.0	89.7%	22.5%	
		Thermal Comfort in Summer	10.0	10.0	3	30.0	30.0					
		Indoor Air Quality	10.0	10.0	3	30.0	30.0					
		Acoustic Comfort	10.0	10.0	1	10.0	10.0					
		Visual Comfort	8.5	10.0	3	25.5	30.0					
		User Influence on Building Operation	6.7	10.0	2	13.4	20.0					
		Quality of Outdoor Spaces	9.0	10.0	1	9.0	10.0					
		Safety and Security	8.0	10.0	1	8.0	10.0					
	FUNCTIONALITY	Accessibility	8.0	10.0	2	16.0	20.0					
		Efficient Use of Floor Area	5.0	10.0	1	5.0	10.0					
		Suitability for Conversion	7.1	10.0	2	14.2	20.0					
		Public Access	10.0	10.0	2	20.0	20.0					
		Cycling Convenience	10.0	10.0	1	10.0	10.0					
	AESTHETIC QUALITY	Design and Urban Planning Quality through Competition	10.0	10.0	3	30.0	30.0					
		Integration of Public Art	10.0	10.0	1	10.0	10.0					
TECHNICAL QUALITY	TECHNICAL QUALITY OF BUILDING DESIGN AND SYSTEMS	Fire Prevention	8.0	10.0	2	16.0	20.0	74.0	100.0	74.0%	22.5%	
		Indoor Acoustics and Sound Insulation	5.0	10.0	2	10.0	20.0					
		Building Envelope Quality	7.7	10.0	2	15.4	20.0					
		Ease of Cleaning and Maintenance	7.1	10.0	2	14.2	20.0					
		Ease of Dismantling and Recycling	9.2	10.0	2	18.4	20.0					
PROCESS QUALITY	QUALITY OF THE PLANNING PROCESS	Comprehensive Project Definition	8.3	10.0	3	24.9	30.0	188.6	230.0	82.0%	10.0%	
		Integrated Planning	10.0	10.0	3	30.0	30.0					
		Comprehensive Building Design	8.6	10.0	3	25.8	30.0					
		Sustainable Aspects in Tender Phase	10.0	10.0	2	20.0	20.0					
		Documentation for Facility Management	5.0	10.0	2	10.0	20.0					
		Environmental Impact of Construction Site / Construction Process	7.7	10.0	2	15.4	20.0					
		Prequalification of Contractors	5.0	10.0	2	10.0	20.0					
	CONSTRUCTION QUALITY	Construction Quality Assurance	10.0	10.0	3	30.0	30.0					
		Systematic Commissioning	7.5	10.0	3	22.5	30.0					
SITE QUALITY	SITE QUALITY	Site Location Risks	7.0	10.0	2	14.0	20.0	93.3	130.0	71.8%		
		Site Location Conditions	7.1	10.0	2	14.2	20.0					
		Public Image and Social Conditions	1.0	10.0	2	2.0	20.0					
		Access to Transportation	8.3	10.0	3	24.9	30.0					
		Access to Specific Use Facilities	9.7	10.0	2	19.4	20.0					
		Connection to Utilities	9.4	10.0	2	18.8	20.0					

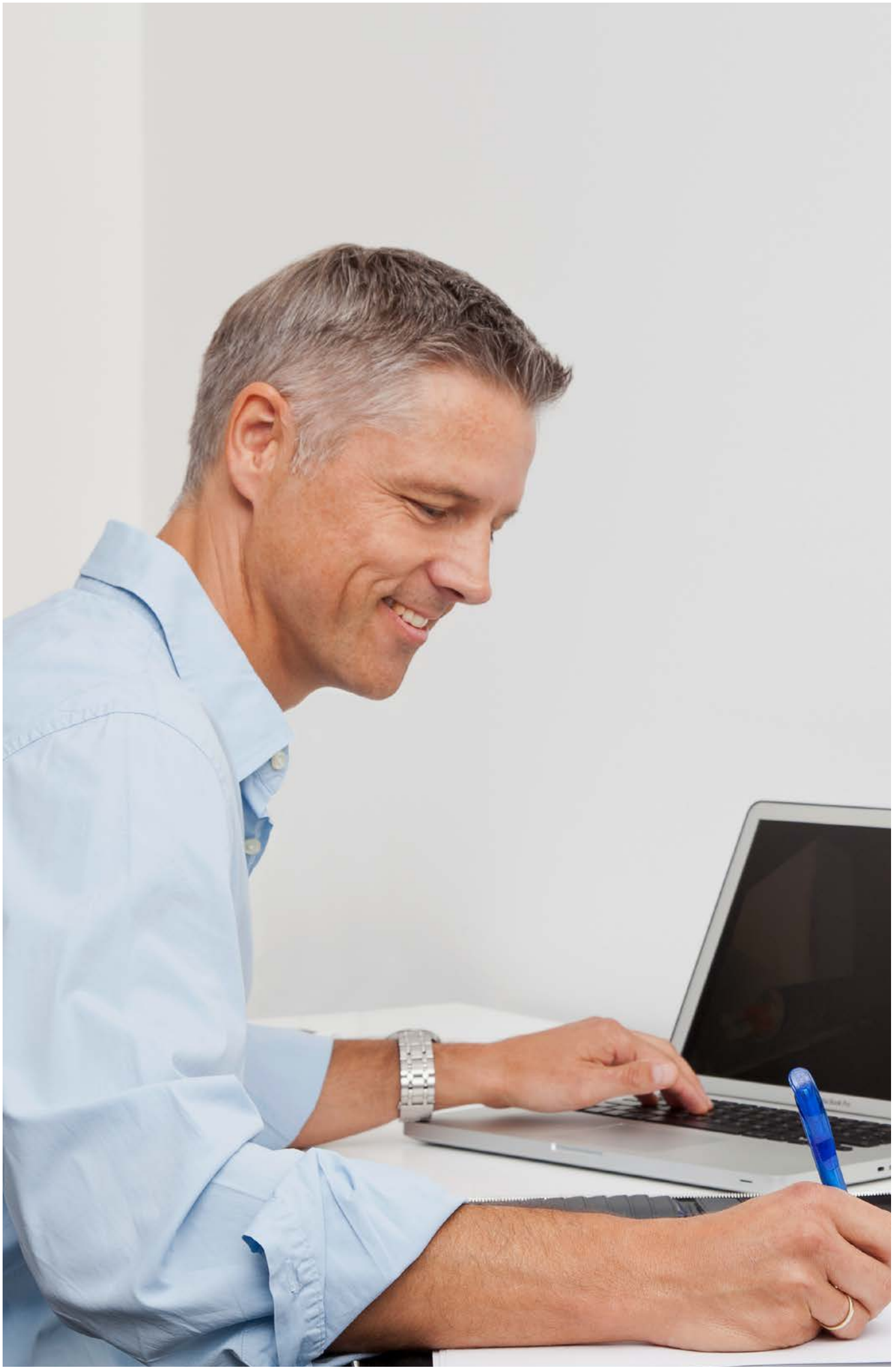
Example of an assessment matrix of a DGNB gold certified building,
occupancy profile "New Office and Administrative Buildings, version 2009"

INFLUENCE OF THE REHAU SYSTEMS

THE DGNB CERTIFICATION SYSTEM

NEW OFFICE- AND ADMINISTRATIVE BUILDINGS

REHAU system	Criteria description	Criteria number	Share of total score
Geothermal	Life cycle assessment – emission-related environmental impact	ENV 1.1	7,9 %
	Life cycle assessment – primary energy	ENV 2.1	5,6 %
	Building-related costs within the life cycle	ECO 1.1	9,6 %
Stormwater utilization	Drinking water demand and wastewater volume	ENV 2.2	2,3 %
	Building-related costs within the life cycle	ECO 1.1	9,6 %
Ground-air heat exchanger	Life cycle assessment – emission-related environmental impact	ENV 1.1	7,9 %
	Life cycle assessment – primary energy	ENV 2.1	5,6 %
	Building-related costs within the life cycle Indoor air quality	ECO 1.1	9,6 %
	Indoor air quality	SOC 1,2	2,6 %
Local and district heating	Life cycle assessment – primary energy	ENV 2.1	5,6 %
	Risks to the local environment	ENV 1.2	3,4 %
	Building-related costs within the life cycle	ECO 1.1	9,6 %
Acoustic solutions	Acoustic comfort	SOC 1.3	0,9 %
	Noise protection	TEC 1.2	4,1 %
Subsurface heating/cooling	User influence	SOC 1.5	1,7 %
	Thermal comfort	SOC 1.1	4,3 %
	Life cycle assessment – primary energy	ENV 2.1	5,6 %
	Ease of building cleaning and maintenance	TEC 1.5	4,1 %
	Building-related costs within the life cycle	ECO 1.1	9,6 %
	Flexibility and suitability for conversion	ECO 2.1	9,6 %
Concrete core tempering	Life cycle assessment – primary energy	ENV 2.1	5,6 %
	Thermal comfort	SOC 1.1	4,3 %
	Ease of building cleaning and maintenance	TEC 1.5	4,1 %
	Building-related costs within the life cycle	ECO 1.1	9,6 %
	Flexibility and suitability for conversion	ECO 2.1	9,6 %
Domestic installation systems	Noise protection	TEC 1.2	4,1 %
	Ease of demolition and deconstruction	TEC 1.6	4,1 %
	Building-related costs within the life cycle	ECO 1.1	9,6 %
	Flexibility and suitability for conversion	ECO 2.1	9,6 %
Electrical installation systems	Ease of demolition and deconstruction	TEC 1.6	4,1 %
	Safety and risk of hazardous incidents	SOC 1.7	0,9 %
Window, door and curtain walling systems	Life cycle assessment – primary energy	ENV 2.1	5,6 %
	Building-related costs within the life cycle	ECO 1.1	9,6 %
	Noise protection	TEC 1.2	4,1 %
	Technical quality of building envelope in terms of heat and humidity	TEC 1.3	4,1 %
	Ease of demolition and deconstruction	TEC 1.6	4,1 %
	Risiks to the local environment	ENV 1.2	3,4 %
	Thermal comfort	SOC 1.1	4,3 %
	Visual comfort	SOC 1.4	2,6 %
	Barrier-free accessability	SOC 2.1	1,7 %
REHAU Service Center	Project preparation quality	PRO 1.1	1,4 %
	Integral planning	PRO 1.2	1,4 %
	Evidence of optimization and complexity of the planning method	PRO 1.3	1,4 %
	Establishment of sustainability aspects in calling for and placing tenders	PRO 1.4	1,0 %
	Establishment of optimal use and management conditions	PRO 1.5	1,0 %
	Building construction quality assurance	PRO 2.2	1,4 %



Environmental quality

ENV1.1
Life cycle assessment – emission-related environmental impact

Buildings produce emissions in all phases of their life cycles: from construction, throughout their use, right through to the end of their service life. These emissions are transferred to the air, water and land and cause numerous environmental problems. Such problems include global warming, destruction of the stratospheric ozone layer, summer smog, the decline of forest and fish stock and overfertilization of bodies of water and the soil. As a consequence, the aim is to reduce building emissions to the greatest possible extent throughout the entire life cycle.

ENV1.2
Risks to the local environment

Certain materials, building products and formulations are hazardous to the soil, air, groundwater, surface water and the health of humans, flora and fauna. To minimize the risk to people and the local environment, materials, (building) products and formulations that are hazardous to groundwater, surface water, soil or air because of their material characteristics or formulation components need to be reduced, avoided or substituted. Specifically materials, (building) products and formulations that are harmful or cause short-, medium- or long-term damage to the health of humans, flora and fauna are to be reduced, avoided or substituted. This applies to their entire life cycle – from production, processing on the building site and utilization in the building stock, right through to their disposal (demolition, recycling or dumping). The local risks are assessed in relation to materials and products. Ecological and human toxicological impact categories within life cycle assessment cannot yet be applied due to the lack of ascertainment and assessment procedures.

ENV2.1
Life cycle assessment – primary energy

This criterion assesses the entire primary energy requirement of a building. Particular value is placed on the reduction of overall primary energy consumption and maximization of renewable energy utilization. The aim here is to exceed statutory requirements to benefit global climate and resource protection.

ENV2.2
Drinking water demand and wastewater volume

To obtain high-quality drinking water, water is tapped from the natural hydrological cycle on a daily basis and thoroughly treated before then being used. The resulting wastewater must then be treated to remove contaminants and pollutants before ultimately being reintroduced into the natural hydrological cycle. Green building therefore endeavors to minimize the requirement for drinking water and the volume of wastewater in order to reduce the burden on the natural circulation of water to the greatest possible extent.

Economic quality

ECO1.1
Building-related costs within the life cycle

Buildings generate high costs over their entire life cycle, from construction and utilization right through to the demolition phase. To promote economical handling of financial resources, construction and utilization needs to minimize the overall life cycle costs of buildings.
Ascertainments made within the scope of certification serve primarily to compare different buildings within a given type-of-use. As a consequence, clearly defined rules are prescribed for ascertainment and documentation in relation to any such application. The results are assessed using benchmarks.
The rules strive to establish a comparable and strictly project-related procedure that is able to compare different buildings within a given type-of-use based on predetermined parameters. Selected production and utilization costs are incorporated into the process to avoid unnecessary expenditure. The scope of the review is limited to specific cost groups to maintain a focus on building-related life cycle costs. The life cycle costs are determined over a fixed review period.

ECO2.1
Flexibility and suitability for conversion

The easier a building can be adapted to meet a change in requirements, the more favorable impact it has on user acceptance, its life cycle and the life cycle costs. Good suitability for conversion and flexibility therefore reduce the risk of vacancy and contribute to the commercial success of the real estate in the long-term. The goal is therefore to design the building to be as flexible as possible and to plan in the broadest possible conversion capability.

Sociocultural and functional quality

SOC1.2
Indoor air quality

The indoor air quality criterion is an exclusion criterion within the DGNB certification system. A building that does not meet the minimum requirements for indoor air quality cannot be certified. The aim of the criterion is to ensure that the air quality indoors is not detrimental to the well-being and health of those inside the building. In this respect, important factors include maintaining hygiene and avoiding pollutant concentrations and olfactory perceptions that may be deemed unpleasant. A TVOC concentration greater than 3,000 µg/m^3, formaldehyde concentration greater than 120 µg/m^3 or exceeding the RW-II values would be classed as hygienically questionable. Consequently any buildings with such high pollution levels would be excluded from certification.

SOC1.3
Acoustic comfort

The aim is to provide suitable architectural acoustic quality that is commensurate with the respective use of the rooms. Architectural acoustic quality determines the acoustic ambience and has a significant impact on workplace performance. In most office and administration building types-of-use, verbal communication is a primary factor. As such, a good level of speech intelligibility in conference rooms, seminar rooms, individual offices etc. and a sufficiently low ambient noise level are important prerequisites for room use. In contrast, attempts should be made to reduce undesirable inter-workspace speech intelligibility in open-plan office areas. One thing all types of use require is the acoustic damping of rooms through a minimum use-dependent level of noise absorbing wall areas.

Good acoustic conditions are an important prerequisite for positive user performance and well-being. As such, the objective of the criterion is to create architecturally acoustic conditions that are in line with the proposed use and that ensure a suitable level of user comfort.

SOC1.4
Visual comfort

User satisfaction is closely associated with the user's perception of comfort. A particularly important factor in this respect is the provision of daylight inside the building. Natural light has a positive impact on the psychological and physical health of a person. As a consequence, sufficient and unimpeded provision of daylight and artificial light must be ensured in all rooms that are in constant use.

SOC1.5
User influence

User performance and satisfaction as well as energy consumption in a building are closely linked to the possibility a user has to independently determine the room climate. Significant factors to help achieve the highest possible acceptance level in terms of room climate are thermal comfort, indoor air quality, noise level and lighting. The aim of this criteria is therefore to provide the user with the best possible opportunity to influence ventilation, sun protection, glare protection, temperature (inside and outside the heating periods) and the provision of daylight and artificial light.

SOC1.7
Safety and risk of hazardous incidents

A high perceived level of safety is fundamental to a person's comfort level. Contrastingly, insecurity and fear limit freedom of action. Measures that increase a feeling of security are also generally suitable for reducing the risk of encroachment by others. The objective is to avoid hazardous situations where possible and to reduce to the greatest possible extent the impact of unavoidable damage caused by force majeure.

SOC2.1
Barrier-free accessibility

The barrier-free accessibility criterion is deemed an exclusion criterion within the DGNB certification system. A building that does not meet the minimum requirements for barrier-free accessibility is excluded from certification. The highest possible level of barrier-free accessibility both inside and in adjacent areas outside the building is a decisive criterion in terms of building usability. Barrier-free accessibility is a significant component of forward-looking and sustainable development within the construction industry. The aim is to enable everyone to gain easy access to all the urban surroundings without the need for help from others. This enables people with disabilities to lead an independent lifestyle and participate fully in all areas of life. Consequently, public areas must be barrier-free and the same should apply for utilization-specific areas.

Technical quality

TEC1.2
Noise protection

In office and administration buildings, it is immaterial whether noise-related encroachment and interferences stem from user areas or third-party areas. As such, in contrast to DIN 4109 provisions, the following requirements apply – regardless of whether they concern user-related or third-party sections of the building. Ensuring a minimum quality standard in terms of acoustics is an essential requirement for using a building in line with regulations. The sound-related quality of a room is a key factor in determining user acoustic comfort and satisfaction. DIN 4109 stipulates the minimum architectural noise protection standards introduced through building regulations. New buildings and modernization measures that impact on the building structure are not permitted to deviate from these regulations. These requirements do not, however, rule out all disturbances, only unreasonable ones. Accordingly, noise protection in office buildings should be planned in such a manner that the user's ability to concentrate is maintained, confidentiality is guaranteed and persons with limited hearing are not disadvantaged. In the case of hotels, this particularly means creating adequate conditions for guests to ensure they have peace and quiet and their legitimate expectations are fulfilled.
In residential buildings, in order to provide the standard residential comforts, the aim should be to strive for higher values than those stipulated in DIN 4109. Recommendations for a higher level of noise protection to protect against noise from neighboring areas are detailed in Supplementary sheet 2 of DIN 4109, VDI Directive 4100 and in DEGA recommendation 103. Noise protection levels that exceed these recommendations are advisable for high-quality buildings. The aim here is not to considerably expand noise protection measures to an extent that goes beyond what is deemed practical.

TEC1.3
Technical quality of building envelope in terms of heat and humidity

The aim of this criterion is to minimize the heat requirement for building room conditioning and at the same time ensure a high level of thermal ambience and effectively avoid structural damage.

TEC1.5
Ease of building cleaning and maintenance

The question of how a building can be cleaned and maintained has a considerable effect on the costs and environmental impact of a building during utilization. Building components that are optimally maintained have a longer service life. Surfaces that are easy to clean require less cleaning agents and therefore generate less cleaning costs. As such, the objective is to keep operating expenditure for cleaning and maintenance as low as possible and simultaneously promote a long service life in terms of the materials used.

TEC1.6
Ease of demolition and deconstruction

The construction industry is one of the largest causal agents of material flows in Germany. Material, energy-related and financial impacts, which are subject to an increasing level of attention, are closely associated with the volumes of waste generated. This is evident in the fact that almost 50% of waste volume in Germany is produced by the construction industry. Green building is facing the challenge of reducing the material quantity generated and directing it into a materials cycle.

Process quality

Pro1.1
Project preparation quality

The purpose of this criterion is to optimize planning results through early requirements planning and a commensurate target agreement. Building owner and user requirements placed on a building are ascertained in a requirements plan and documented in a target agreement. This enables planned targets to be clearly formulated and allows for a subsequent check of their implementation. Such project preparation has a considerable impact on the subsequent quality of the building.

Pro1.2
Integral planning

Integral planning forms the basis for the planning and project realization of a green building. Coordination of all the various project participants at an early stage significantly improves the planning process and end result.

Pro1.3
Evidence of optimization and complexity of the planning method

No standard solution exists for constructing a green building. Consequently, new solutions have to be constantly worked out for the various areas of each respective project. In order for these to be interwoven into an optimized overall solution, they should be worked out at an early stage by an interdisciplinary planning team within the scope of integral planning. Concepts and variation studies are therefore an essential part of targeted planning and contribute greatly to improving building quality.

Pro1.4
Establishment of sustainability aspects in calling for and placing tenders

Ecological and social building quality is increased if sustainability aspects are integrated into tenders. Product quality decisions would consequently then no longer be made exclusively on the basis of economic aspects. Integration of sustainability aspects during the selection of companies pursues the same objective.

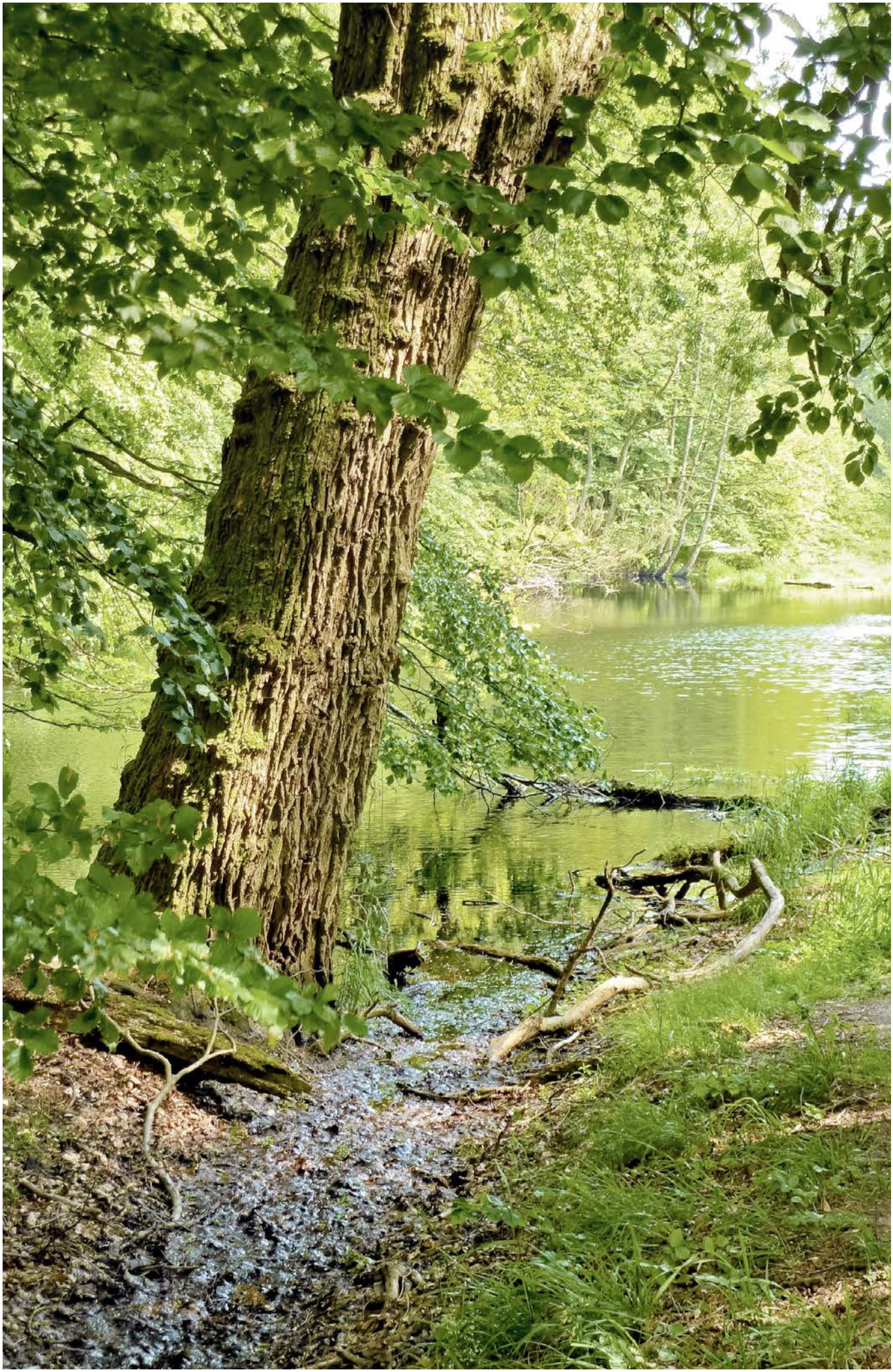
Pro1.5
Establishment of optimal use and management conditions

The aim is to support future operation of the building with comprehensive building documentation. This especially involves information on parts of the building that are relevant to its daily operation, such as the maintenance of surfaces and building installations. In addition, with buildings becoming ever more complex and technical, it is important to provide recommendations for action in relation to building use. In the form of user or tenant manuals and guidelines, important information on the building can be prepared and forwarded to those who need it.

Pro2.2
Building construction quality assurance

This criterion serves to describe and assess building construction. The aim is to eliminate defects during the construction phase to the greatest possible extent and to document the quality achieved by way of adequate building documentation and quality controls. Furthermore, later conversion or demolition measures should be facilitated and optimized in terms of sustainability.

Sources: *Deutsche Gesellschaft für Nachhaltiges Bauen – DGNB e.V. (publisher): Neubau Büro- und Verwaltungsgebäude; in DGNB Handbuch für nachhaltiges Bauen, Stuttgart 2012*



REHAU CORE EXPERTISE CONSTRUCTION

SYSTEM SOLUTIONS FOR GLOBAL TRENDS

Expertise and a flair for innovation have made REHAU the leading system and service provider of polymer-based solutions within the construction, automotive and industry sectors.

Around 17,000 employees in over 170 locations in 54 countries are continually working on the development of complete systems specifically tailored to both the needs of our customers and preservation of the environment. The quality of our innovations, sophisticated technology of our production systems, flexibility of our logistics and close proximity to our customers have shaped our independent privately-owned company into a reliable, progressive and established partner.
Since the foundation of the company in 1948, REHAU has independently grown into a globally operative group. After initially establishing itself in Germany and the surrounding western countries, REHAU then pursued a successful course of further development in Europe and founded locations in North America, Asia and Australia. The corporate group has also been well represented in Eastern Europe for more than ten years.

Innovation fuelled by research and development

The exceptional potential of the polymers provides the premise for the continual improvement of numerous everyday products in terms of convenience, safety, design, environmental compatibility and efficiency. Our longstanding experience, process engineering know-how and material and tooling expertise enable us to create new opportunities for our customers without losing sight of the fundamental principle of premium quality.

Quality as a basic principle

Quality is an essential fundament of our success. We contribute significantly to the satisfaction of our customers by fulfilling their quality needs and requirements. At each and every REHAU location we work according to globally applicable quality standards and guidelines.

Construction Division

The Construction Division concentrates on innovative system solutions in the fields of energy efficiency, water management, infrastructure and renewable energies, whereby we constantly strive to raise the bar in terms of ecology, economy, design, functionality, safety and convenience. REHAU is the epitome of sustainable building and modernization – in relation to both commercial and private construction projects. We are already contributing significantly to optimizing energy use with a whole host of products; including windows and doors made from REHAU profiles that decisively minimize energy losses, innovative REHAU subsurface heating/cooling systems and concrete core tempering.

WHY REHAU?
SUSTAINABILITY

Sustainability is not an empty cliché for us, but rather is firmly anchored within our corporate values and consequently shapes our entrepreneurial thinking and action. In essence, our mission statement embraces four core elements:

LONG-TERM CORPORATE STRATEGY

We take an earnest view of our responsibility as a global company and base our actions on the concept of sustainability. As a privately held company, REHAU is consciously diversifying by business divisions and industry sectors as well as regions and countries. This diversification provides stability and strengthens the company's economic performance.

RESOURCE EFFICIENCY

As a manufacturing company we are aware of the impact of our business on our climate and environment. As a result, all REHAU sites implement, control and assess measures for resource conservation and energy efficiency. Through optimized production technologies and processes, we aim to use natural resources responsibly, thereby reducing emissions and minimizing the negative impact on people and the environment as much as possible.

ENVIRONMENTALLY FRIENDLY AND ENERGY EFFICIENT PRODUCTS

We help our customers become more sustainable. Our innovative drive means we create holistic products and solutions based on customer needs; we enable our customers to increase their energy efficiency, reduce costs and ensure quality of life.

EMPLOYEE SATISFACTION

Our employees are the foundation of our success. We want to increase employee satisfaction and guarantee equal opportunities. Training and advanced training, health and safety as well as the reconciliation of work and family life are designed to give our employees long-term perspectives, motivation and encouragement. In addition, we want to play an active role in the communities in which we operate.

Further information available at:
www.rehau.com/sustainability

PRODUCT LIFE CYCLE

WHY USE POLYMERS FOR BUILDING PRODUCTS?

Durability:
30 - 50 years, even up to 100 years in certain application areas

Recyclability:
100 %

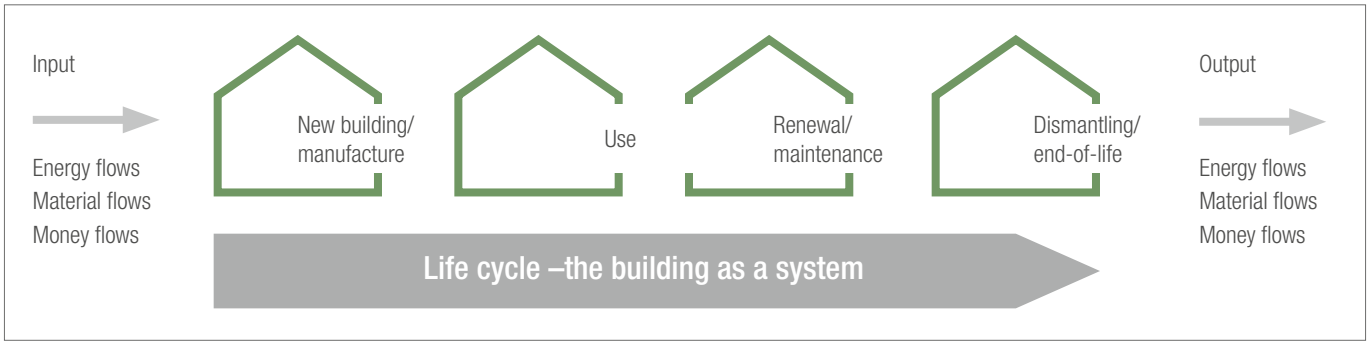
Low energy consumption in terms of forming and processing:

PVC:	180 °C
PE:	200 °C
Steel:	1.600 °C
Aluminum:	2.000 °C

Material characteristics/ thermal conductivity:

PVC:	0,17 W/m*K
Aluminum:	160 W/m*K
Steel:	50 W/m*K

Sensible use of raw material: the use of PVC sustainably helps to reduce oil and gas consumption; in other words, optimal saving of thermal energy throughout the respective life cycle (up to 50 years). Forming the benchmark are the excellent Uf-values of PVC windows.



MATERIAL CHARACTERISTICS

WHY ARE THEY SIGNIFICANT FOR THE CONSTRUCTION SECTOR?

PVC characteristics in terms of window construction
High resistance to environmental influences and chemicals such as acids and lye
Longstanding resistance to weathering (light and weather resistance) and ageing
Easy to service and maintain
Energy-saving thanks to excellent thermal insulation/low thermal conductivity
Straightforward machinability during manufacture and secure assembly
Versatile window design due to excellent formability and welding properties
Surface finishing with lamination and painting
Can be matched to any style by way of shape, color and using accessories such as mullions or decorative profiles
Recyclable

PE-Xa characteristics for heating and drinking water supply
Long service life and highly suitable for such installations
No tendency for deposit build-ups or incrustation
Complies with all current standards, laws and guidelines
Corrosion-resistant (no pitting), good abrasion resistance and high impact strength of RAU-PE-Xa material
Quick and easy to install using REHAU compression sleeve technology
Notch insensitivity/insensitivity to point loading
Can be used with constant temperatures of up to 95°C
Excellent resilience (memory effect)
Reusable

PP characteristics for drainage technology
Economical and easy to maintain
Resistant to thermal shock, ideal balance between good rigidity and impact strength, break-resistant
Resistant to aggressive substances, yet also ecologically and physiologically safe
Easy to install without additional work, minimal overlap
Long depreciation periods
Filler-free polypropylene in accordance with DIN EN 1852
Permanent impermeability for ground-water installations
Safety-lock sealing system
Infiltration-water-proofness in accordance with Institute for Underground Infrastructure (IKT) test seal
100% recyclable

NEW OFFICE AND ADMINISTRATIVE BUILDINGS

INFLUENCE OF THE REHAU SYSTEM SOLUTIONS

REHAU develops intelligent and forward-thinking complete solutions that combine ecology and economy, design and functionality, safety and comfort, and set new trends within the construction industry.

The following pages present in detail the proportion of respective REHAU system solutions applied during DGNB certification for 'New office and administrative buildings':

- Geothermal
- Stormwater management
- Ground-air heat exchangers
- Local and district heating systems
- Acoustic solutions
- Subsurface heating/cooling
- Concrete core tempering
- Domestic installation systems
- Electrical installation systems
- Window, door and curtain walling systems
- REHAU service center

GEOTHERMAL
EXPLOITING THE EARTH'S HEAT

The earth's (geothermal) heat is energy stored in the soil that is constantly regenerated by solar radiation and geothermal heat flows. The energy stored in the soil can be used regardless of the type of weather and time of year.

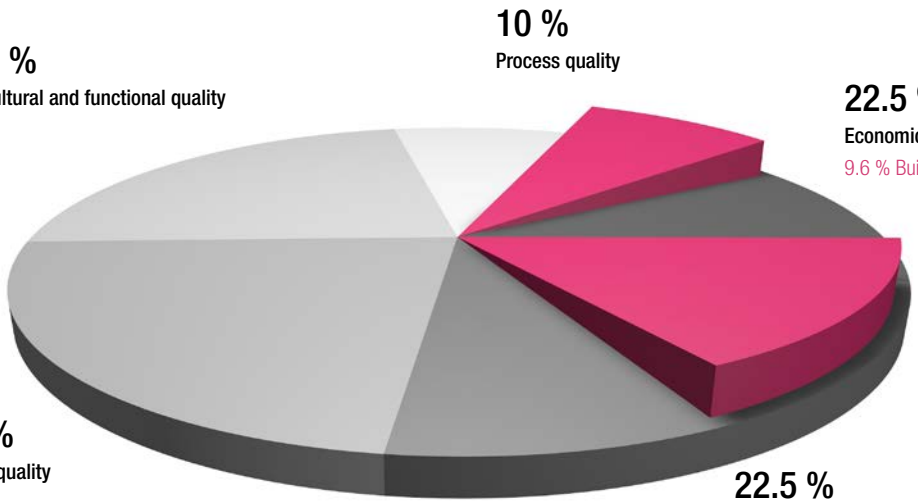
In Germany, this energy is already economically usable at a depth of around 1.5 meters. At a depth of around 10 meters, the temperature is largely constant at approx. 8 - 12 °C the whole year round.

In the form of its RAUGEO program, REHAU offers versatile and high-quality system solutions to enable exploitation of geothermal heat for heating and cooling in conjunction with thermal pumps. The combination of low temperature systems, such as subsurface heating or concrete core tempering, is particularly economical in this respect.

REHAU system solutions:
- Horizontally-installed flat collectors RAUGEO collect (up to 1.5 m)
- RAUGEO Helix probes (2 to 5 m)
- RAUGEO geothermal probes (80 to 300 m)
- RAUGEO high-pressure deep probes (up to 800 m)
- Layout and sizing supportfrom our planning centers

Further information available at:
www.rehau.com/geothermal

23.1% of the DGNB criteria points are influenced by geothermal systems.



STORMWATER MANAGEMENT

USING THE NATURAL HYDROLOGICAL CYCLE AS A MODEL

Modern stormwater management means ecological and economic handling of water and is therefore becoming increasingly important. Conserving groundwater reserves and reducing sealing taxes are only a few examples.

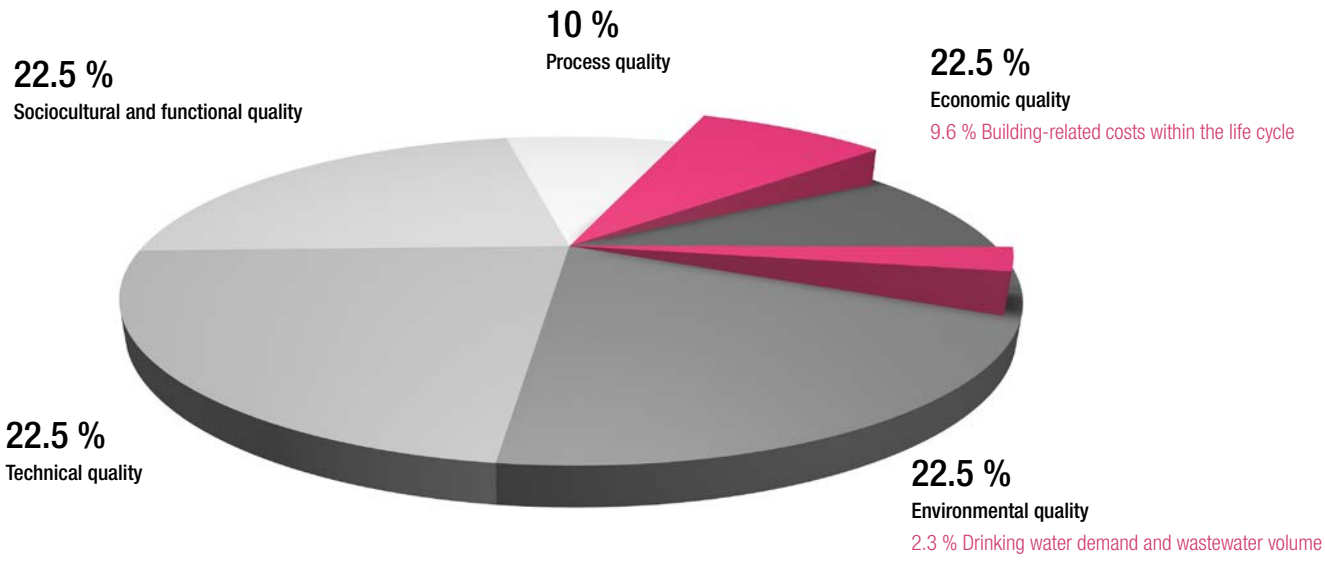
Further information available at:
www.rehau.com/stormwater

REHAU offers optimally coordinated, state-of-the-art system solutions for stormwater management to ensure that the increasingly stringent requirements can also be met in the future.

REHAU system solutions:

- RAUSIKKO stormwater seepage and storage systems
- RAUSIKKO stormwater treatment systems
- Stormwater utilization systems
- Calculation software for RAUSIKKO systems

11.9 % of the DGNB criteria points are influenced by stormwater management systems.



GROUND-AIR HEAT EXCHANGERS

FRESH AIR WITH ENERGY-RELATED VALUE ADDED

In office and administration buildings, economically viable solutions are increasingly being sought, in particular to support cooling loads that may arise. Using upstream ground-air heat exchanger (L-EWT) systems can reduce the demand for conventional cooling units or even completely replace them.

The use of an LEWT system reduces operating costs and significantly reduces CO_2 emissions.

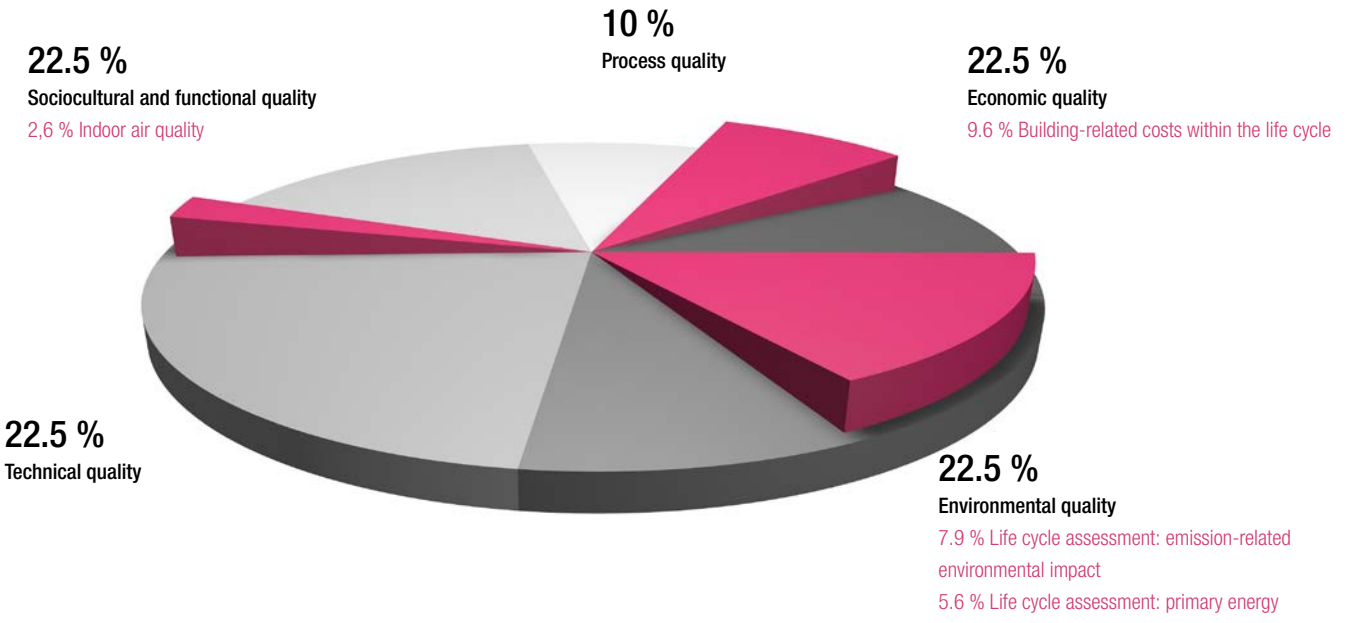
Early incorporation of a REHAU LEWT system into the ventilation concept is a significant prerequisite for contributing directly to increasing the efficiency of the fresh air supply.

REHAU system solutions:

- Ground-air exchanger systems with anti-microbial inner coating
- Implementation of various layout concepts possible
- Usable in a variety of different soil categories

WWW Further information available at:
www.rehau.com/awadukthermo

25.7 % the DGNB criteria points are influenced by ground-air heat exchangers.



LOCAL AND DISTRICT HEATING

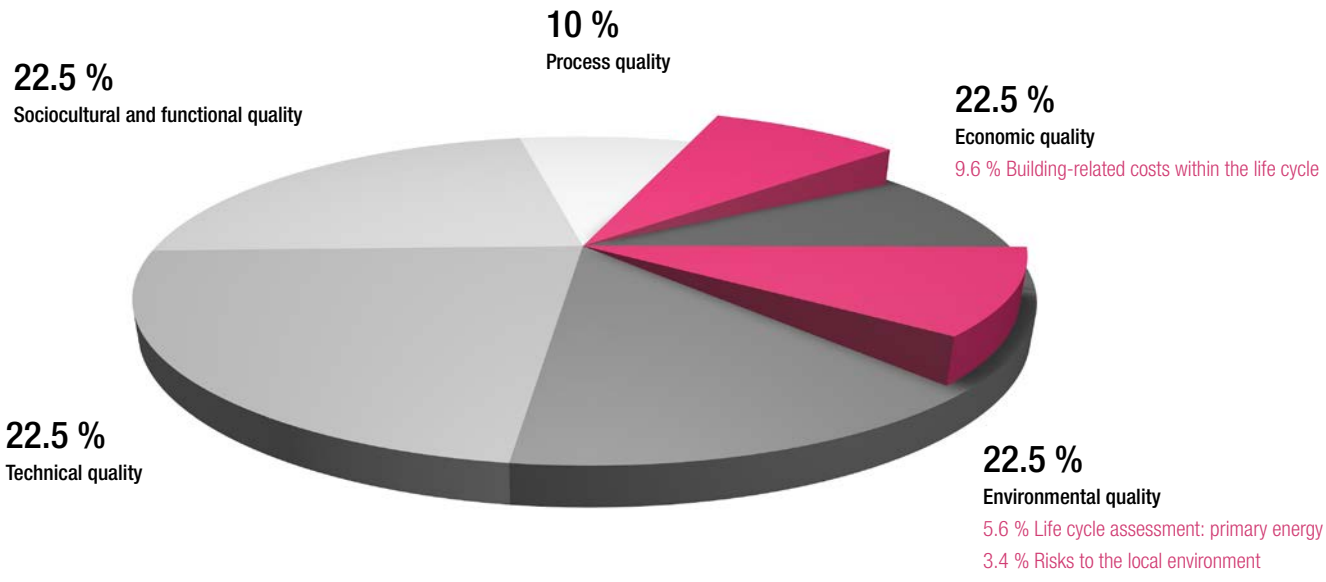
ENERGY TRANSPORT VIA HIGHLY EFFICIENT SYSTEMS

The primary aim of planning and realizing local and district heating networks is the reduction of heat and, consequently, energy loss. This applies to communal energy networks and also the operation of biogas facilities and power plants.

Further information available at:
www.rehau.com/biomass

REHAU offers efficient solutions for modern local and district heating supplies. REHAU also has sector-specific solutions and develops customized complete solutions for increasingly standardized biogas facility systems.

18.6 % of the DGNB criteria points are influenced by local and district heating systems.



ACOUSTIC SOLUTIONS

NOISE PROTECTION SOLUTIONS FOR WORKING ENVIRONMENTS

The current trend in office architecture is increasingly moving towards large open spaces. Accordingly, new technical solutions need to be applied to maintain the accord between modern architecture and good room acoustics.

REHAU offers versatile solutions for optimal room acoustics. These include flexible partitioning systems, room segmentation elements and specific acoustically effective surfaces. Functional application of ceilings using the REHAU acoustic chilled ceiling also affords architects total freedom to individually design rooms.

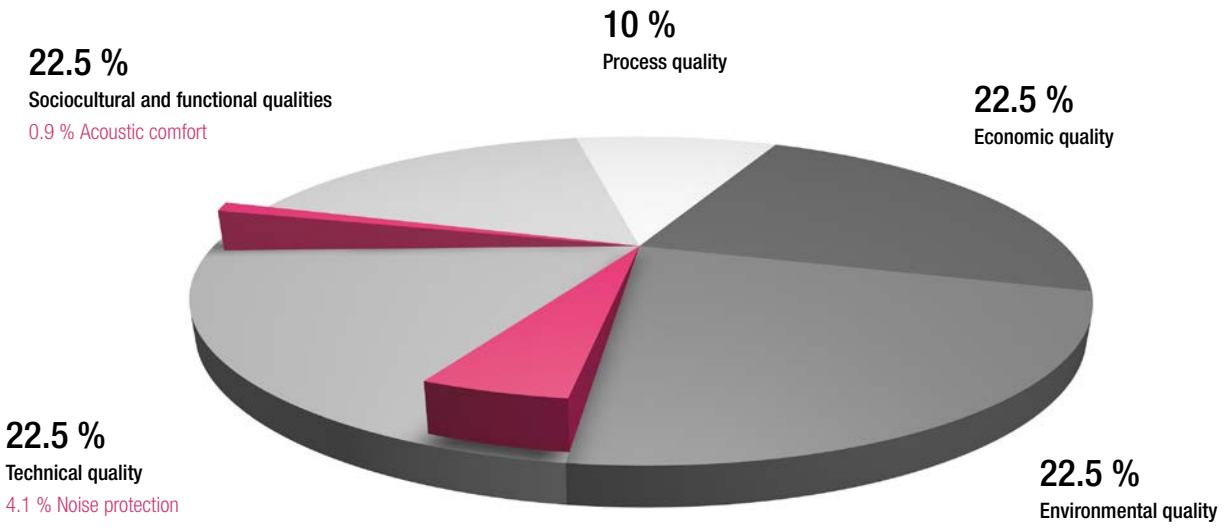
REHAU system solutions:

For an optimal, basic acoustic conditioning of the room:

- Acoustic chilled ceiling for standard heating and cooling performance requirements
- High-performance acoustic chilled ceiling for areas with increased cooling and heating performance requirements
- RAUVOLET acoustic-line tambour door system
- RAUWORKS front lift door module for carcass furniture
- RAUWORKS screen element

Further information available at:
www.rehau.com/acoustic

5.0 % of the DGNB criteria points are influenced by acoustics and noise protection systems.



SUBSUFRACE HEATING/COOLING

HOMOGENEOUS, ENERGY-EFFICIENT HEAT DISTRIBUTION

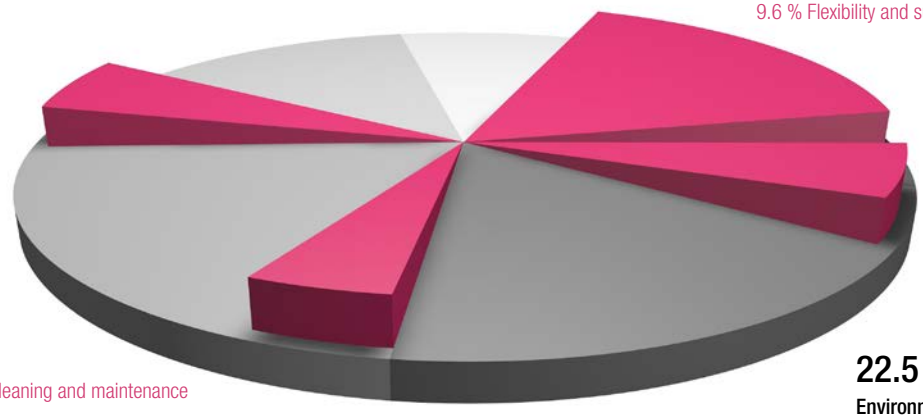
Modern architecture, climatic influences and a growing demand for comfort are placing additional requirements on today's building technology. A minimum space requirement, lower supply temperatures and greater flexibility in architectural design are the main arguments for using a subsurface heating or cooling system.

Further information available at:
www.rehau.com/heatingandcooling

REHAU offers complete system solutions for all applications in office and administration buildings, industrial and commercial real estate and public buildings. All the systems are designed to cope with the tough, everyday on-site conditions, are rapidly and easily installed, and offer an exceptional degree of safety and quality.

REHAU system solutions:
- Underfloor heating/cooling
- Radiant heating/cooling ceiling
- Wall heating/cooling
- Heating/cooling control technology
- Outdoor facility heating for keeping areas free of snow and ice
- Special solutions for sports venues
- Design and sizing support from our planning centers

34.9 % of the DGNB criteria points are influenced by subsurface heating/cooling systems.



22.5 %
Sociocultural and functional qualities
4.3 % Thermal comfort
1.7 % User influence

10 %
Process quality

22.5 %
Economic quality
9.6 % Building-related costs within the life cycle
9.6 % Flexibility and suitability for conversion

22.5 %
Technical quality
4.1 % Ease of building cleaning and maintenance

22.5 %
Environmental quality
5.6 % Life cycle assessment: primary energy

CONCRETE CORE TEMPERING

BUILDING TEMPERATURE CONTROL VIA PRIMARY STRUCTURES

The increased demand for comfort has placed additional requirements on innovative building technology today. A forward-looking cooling and heating system that meets these additional requirements is concrete core tempering. Due to its high level of efficiency, concrete core tempering is an established component of sustainably planned buildings.

The principle of concrete core tempering is based on utilization of the storage potential of building components. Concrete core tempering supports the storage potential of solid concrete components with heating and cooling water running through pipes. This effectively creates an 'endless' storage capability.

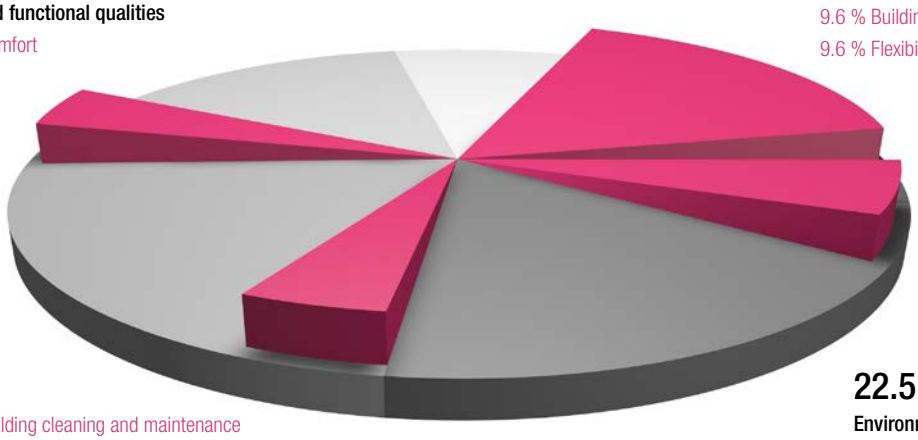
REHAU offers two solutions for the comfortable and environmentally conscious temperature control of buildings. Depending on the requirement, a choice of normal or near-surface concrete core tempering is available.

REHAU system solutions:

- Concrete core tempering for base load coverage
- Near-surface concrete core tempering with higher and quicker performance adjustment
- Different installation methods: on-site installation; installation in modules; prefabricated installation at plant
- Design and sizing support from our planning centers

Further information available at:
www.rehau.com/concretecoretempering

33.2 % of the DGNB criteria points are influenced by concrete core tempering systems.



22.5 %
Sociocultural and functional qualities
4.3 % Thermal comfort

10 %
Process quality

22.5 %
Economic quality
9.6 % Building-related costs within the life cycle
9.6 % Flexibility and suitability for conversion

22.5 %
Technical quality
4.1 % Ease of building cleaning and maintenance

22.5 %
Environmental quality
5.6 % Life cycle assessment: primary energy

DOMESTIC INSTALLATION SYSTEMS
GUARANTEEING RELIABILTY, HYGIENE AND COMFORT

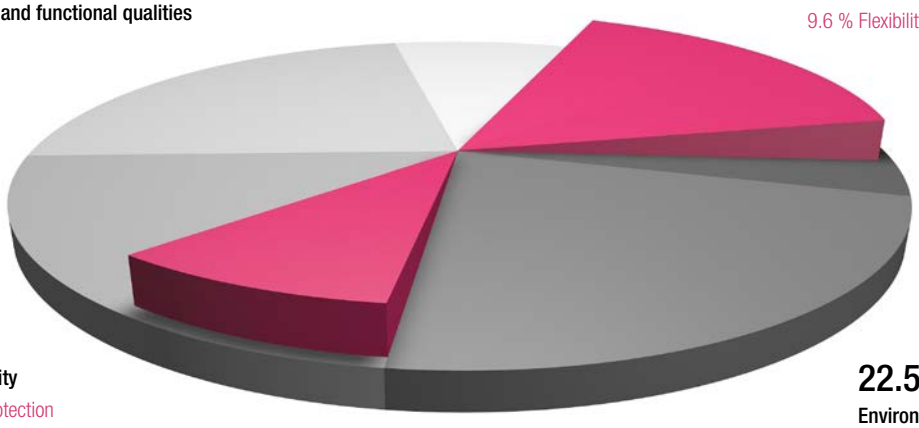
To date, sanitary installations in buildings have needed to ensure long-term reliability above all else. In addition to a constantly clean water quality, throughout the entire life cycle of a building the focus also lies in other areas, such as noise protection and flexibility in relation to changes of use.

Further information available at:
www.rehau.com/raupiano
www.rehau.com/rautitan

In the form of the RAUTITAN installation system and the unique compression sleeve jointing technique, REHAU offers a polymeric system for drinking water that has been tried and tested for decades and boasts exclusive hygiene and future proof characteristics. For building drainage, REHAU provides the efficient domestic waste water system RAUPIANO PLUS, which is notable for its minimal noise level.

REHAU system solutions:
- RAUTITAN universal system for drinking water and heating
- The millionfold proven compression sleeve jointing technique
- RAUPIANO PLUS for noiseless building drainage
- RAUCAD/RAUWIN planning software

27.4 % of the DGNB criteria points are influenced by domestic installation systems.



ELECTRICAL INSTALLATION SYSTEMS

HARMONIOUS FLEXIBILITY AND SAFETY

Modern working environments require flexibility, the potential for changing use and consequently a variable electrical installation. Systems are required that facilitate an uncomplicated, fast and safe installation. In addition to structural aspects, fire prevention standards also have to be met.

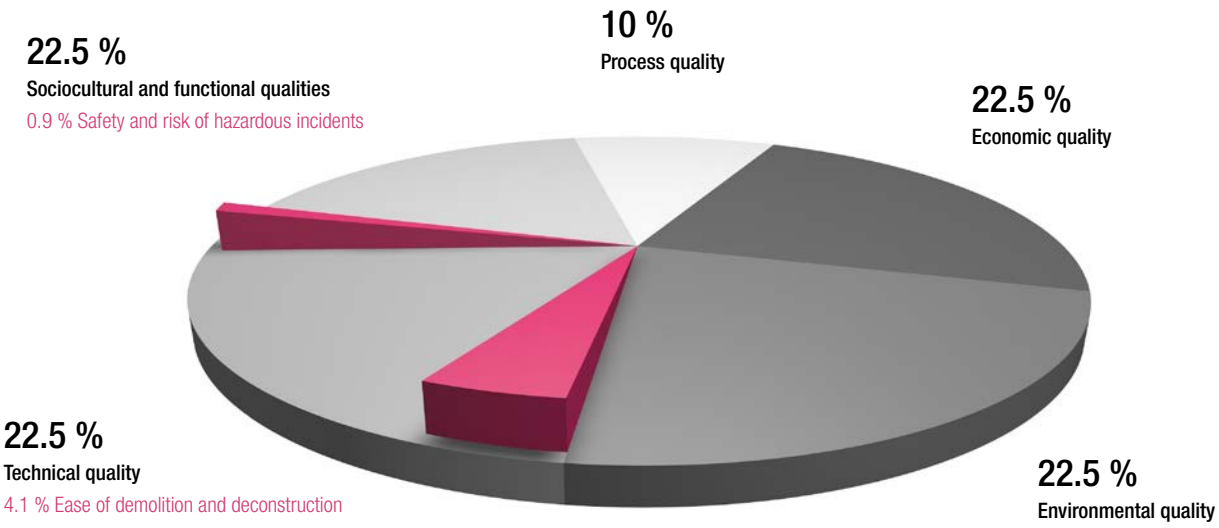
REHAU electrical installation systems offer maximum flexibility and optimal protection in the event of a fire. VDE-tested products with innovative technology and intelligent value added solutions for the working environment provide safety whatever the requirement.

REHAU system solutions:

- Dado trunking
- Routing trunking
- Wiring trunking
- Trunking socket outlets and supply stations
- Fire protection trunking
- LEH halogen-free routing trunking
- Cable ducts and microducts

Further information available at:
www.rehau.com/trunking

5.0 % of the DGNB criteria points are influenced by electrical installation systems.



WINDOW AND CURTAIN WALLING SYSTEMS

BUILDING ENVELOPE OPTIMIZATION THROUGH ITS TRANSPARENT BUILDING COMPONENTS

As transparent components in the building envelope, windows and facades determine the significant characteristics of a building and its utilization quality. The interplay of heat insulation, noise protection and light incidence needs to be optimally coordinated to meet the requirements of subsequent use.

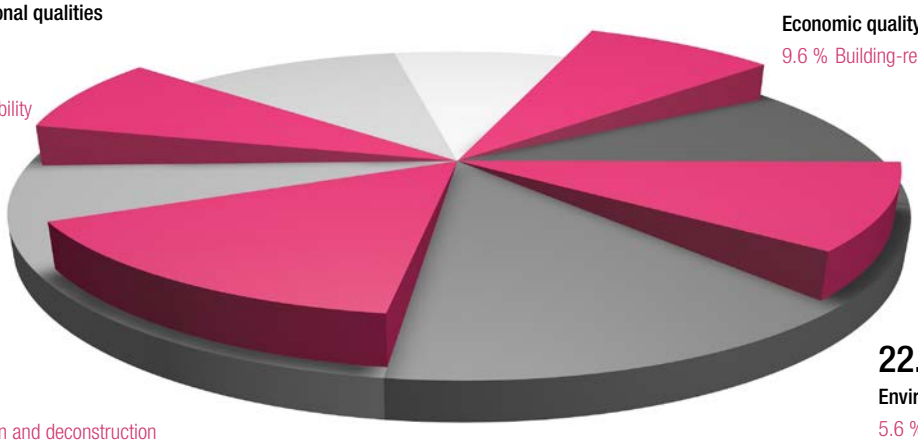
Further information available at:
www.rehau.com/windows

Polymer windows with REHAU profiles are notable for their excellent heat insulation properties and minimum requirements in terms of maintenance and servicing over their entire life cycle. By using modern insulation glass, the user concurrently benefits from the incidence of natural light. State-of-the-art privacy and sun screens accentuate this in a functional manner and simultaneously constitute a design element on the outside of the facade. The appropriate choice of high-insulation window system is an important element in achieving low energy consumption in a building.

REHAU system solutions:

- GENEO/GENEO PHZ: fiber-reinforced premium window system with 86 mm construction width (U_f to 0.86 W/m²K/ U_f to 0.79 W/m²K)
- Euro-Design 86 plus: PVC system with 86 mm construction width (U_f to 1.1 W/m²K)
- Brillant-Design: PVC system with 70 mm construction width (U_f to 1.2 W/m²K)
- Front door systems
- Lift-slide door systems
- Color design by way of foil lamination, lacquering and also aluminum casing
- Curtain walling systems
- Privacy and sun screen systems

39.5 % of the DGNB criteria points are influenced by polymer window systems.



22.5 %
Sociocultural and functional qualities
4.3 % Thermal comfort
2.6 % Visual comfort
1.7 % Barrier-free accessibility

10 %
Process quality

22.5 %
Economic quality
9.6 % Building-related costs within the life cycle

22.5 %
Technical quality
4.1 % Noise protection
4.1 % Ease of demolition and deconstruction
4.1 % Building envelope quality in terms of heat and humidity

22.5 %
Environmental quality
5.6 % Life cycle assessment: primary energy
3.4 % Risks to the local environment

REHAU SERVICE CENTER

TENDERING, DESIGN AND PLANNING SUPPORT

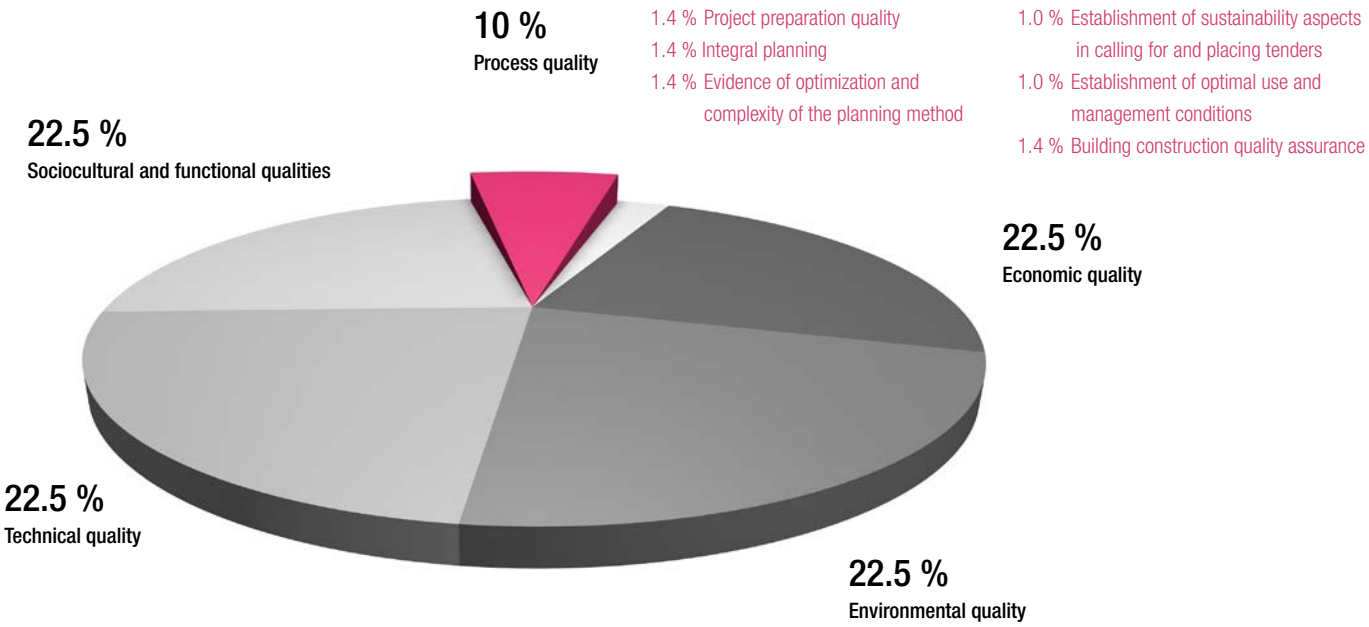
Large, modern day building projects stand and fall with advance planning. The more detailed and better the coordination of these aspects, the greater the success of completion of the building project within the targeted time and cost framework.

Our specialists in window and curtain walling technology, building technology and civil engineering/ infrastructure are on hand to help and advise you throughout every phase of your building project. The REHAU planning centers for the civil engineering and building technology segments, diverse professional software solutions, and the mediation of qualified companies specializing in the installation of REHAU systems are just a few examples of the comprehensive range of services that we offer.

In addition to the provision of products, systems and planning support, we also interpret service as meaning the provision of personal advice in relation to your property. Also a matter of course are the seminars at the REHAU Academy and provision of the commensurate documentation and technical information.

WWW Further information available at: www.rehau.com/services

7.6 % of the DGNB criteria points are influenced by planning and service provision.



THE DGNB NAVIGATOR

Many building products. One information platform.

During the planning and building of green buildings, the selection of suitable products is of utmost importance. However, information on issues regarding the environmental impact of products, life-cycle-relevant product features and other important sustainability factors for architects and planners is not always easy to find. The DGNB Navigator has all this information available in one place – just a click away. Moreover, the exceptional online platform provides manufacturers with information on what part of and in which form their product data is relevant for green building. As such, the DGNB Navigator is a key interface between the various stakeholders in the planning and building process and product manufacturers.

Informed planning. Making the right decision.

The DGNB Navigator supports architects, planners, building owners and all the operative stakeholders in one of the most important project phases – planning. Via an intelligent product search with defined filtering options, the tool delivers solid, meaningful results. You receive all the required information in detail with one click. Alternatively, you can also access the detailed page directly by entering the specific registration code. The page illustrates all product parameters relating to the DGNB categories. Additionally, the DGNB Navigator delivers supplementary information such as product catalogues, CAD drawings, and manufacturer contact information. Individually bookmarked lists of selected products can be created and stored for different projects, thereby providing a constant reference point for the various product features. Use is free of charge.

Total transparency. Your benefits at a glance.

Access to a comprehensive green building information platform. Reliable orientation during product selection. A user-friendly data base with all the relevant details on sustainability aspects, visualizations and supplementary documentation on products, manufacturers and contact persons.

Source: *www.dgnb-navigator.de*

ENVIRONMENTAL PRODUCT DECLARATIONS

REHAU – EXPERTISE AND KNOW-HOW

In terms of building products, environmental product declarations are also a fundamental component of building sustainability assessment and certification. They essentially document a life cycle assessment of the greenhouse effect, acidification potential, ozone depletion potential, summer smog and eutrophication (introduction of nutrients into the environment) as well as an illustration of the fossil-fired and regenerative primary energy requirement over the entire product life cycle.

What is an EPD?

The findings of Full Life Cycle (LCA) Assessments are summarised in the form of Environmental Product Declarations (EPDs) which identify a product's overall environmental impact across a number of factors. An EPD is a certified environmental declaration, developed in accordance with the standard ISO 14025. This declaration is defined, in ISO 14025, as quantified environmental data for a product with pre-set categories of parameters based on the ISO 14040 and 14044 series of standards and any other relevant environmental information.

TEPPFA publicizes its LCA findings on the different types of plastic pipe systems in the form of a set of EPDs.

What is TEPPFA?

TEPPFA is the European Plastic Pipes and Fittings Association, a group of 15 European national associations and 11 direct company members across Europe. TEPPFA company members directly employ 40.000 people and produce 3 million tonnes of plastic pipes annually, representing an annual turnover of 12 billion euros. On behalf of its members, TEPPFA is actively involved in the promotion of plastic pipe systems for all applications.

REHAU creates and continuously updates the corresponding EPDs (Environmental Product Declarations) for its products and systems.

Current data sheets and EPDs for REHAU systems are available at:

www

www.rehau.com/certifiedconstruction

OFFICE/ADMINISTRATIVE BUILDINGS

NEW OFFICE FOR URBAN DEVELOPMENT AND ENVIRONMENT (BSU) BUILDING

New BSU building in Hamburg

In a Europe-wide architect's competition, Sauerbruch Hutton Architects and the planning company Reuter & Rührgartner GmbH impressed with high-quality architecture and an innovative, forward-looking energy concept. The focal points were the intelligent use of space, a friendly working environment and the combination of standard energy-efficient solutions such as **concrete core tempering with a geothermal solution**. To realize the latter, in the form of REHAU, Sprinkenhof AG brought on board not only an internationally recognized specialist, but also a full-service partner with whom they had already successfully implemented numerous projects.

DGNB Gold pre-certification
New office and administrative buildings, 2009 version

Building owner	Sprinkenhof AG
Architect	ARGE BSU: Sauerbruch Hutton / Reuter Rührgartner
Year of completion	2013
Year of pre-certification	2010
Gross floor space	49,602 m^2
Property assessment	81.40 %
- Ecological quality	79.50 %
- Economic quality	79.60 %
- Sociocultural and functional quality	84.10 %
- Technical quality	82.00 %
- Process quality	82.30 %
Locational assessment	66.30 %

NEW URBAN DISTRICT

EUROPAVIERTEL WEST

New construction of the 'Europaviertel' urban district in Frankfurt

A total of 71 high-quality luxury apartments with a broad range of penthouses with roof terraces and townhouse-style maisonettes combine comfort with tranquility in the center of the city. The installation of RAUPIANO PLUS wastewater pipes provides noise protection and living comfort for the residents..

DGNB Gold certification

New urban districts, version 2011

Urban planner	AS&P - Albert Speer & Partner GmbH AG
Year of certification	2012
Gross floor space	501,473 m^2
Property assessment	82.60 %
- Ecological quality	72.00 %
- Economic quality	83.00 %
- Sociocultural and functional quality	85.00 %
- Technical quality	88.00 %
- Process quality	87.00 %

RETAIL BUILDING

ARCADEN PASING II

New Pasing Arcades in Munich

In the Pasing Arcades, the second construction phase is also being furnished with reliable REHAU solutions. The shopping center expansion project is benefiting from tried and tested REHAU quality. Due to the (still) limited spatial conditions on the site, the high degree of efficiency presented by the **RAUSIKKO solution** was a key factor for the planners from Allmann, Sattler and Wappner Architects. However, other factors were also significant, including the long service life of installed components, a high stability level including under heavier loads, and the flexibility of planning and implementation. In addition to the stormwater seepage system, the second building phase's wastewater connection to the Munich sewage network is also being realized with REHAU solutions. The decision in this case fell to **AWASCHACHT and the AWADUKT PP heavy duty sewage pipe system** that, in addition to the IKT-certified infiltration sealing, also scored with its minimum 100-year service life.

DGNB Gold pre-certification
New retail building, version 2009

Building owner	mfi management für immobilien ag
Architect	ASW Allmann Sattler Wappner
Year of completion	2013
Year of pre-certification	2012
Gross floor space	36,700 m²
Property assessment total	83.40 %
- Ecological quality	89.00 %
- Economic quality	96.20 %
- Sociocultural and functional quality	84.70 %
- Technical quality	66.80 %
- Process quality	76.60 %
Locational assessment	**76.60 %**

OFFICE/ADMINISTRATIVE BUILDINGS

ART DECO PALAIS

Redevelopment of the Art Deco Palais in Munich

Built in 1924 as the main post administration office and located in the center of Munich, not far from the main railway station, the listed Art Deco Palais today offers a symbiosis of historical ambience and modern office space following its extensive refurbishment. The building structure allowed for development of a variety of different office sizes ranging from individual offices to open-plan solutions. Thermal activation of the ceilings encompassed the installation of **radiant cooling/heating ceilings, with RAUTHERM S pipes** integrated into the industrially pre-fabricated plasterboards.

DGNB Gold pre-certification

Modernization of an office and administrative building, version 2010

Building owner	Mike 1 GmbH & Co KG
Architect	WEP Effinger Partner Architekten BDA GbR
Year of completion	2009
Year of pre-certification	2011
Gross floor space	46,000 m²
Property assessment	82.60 %
- Ecological quality	84.90 %
- Economic quality	84.80 %
- Sociocultural and functional quality	81.10 %
- Technical quality	77.70 %
- Process quality	86.80 %
Locational assessment	86.70 %

NEW RESIDENTIAL BUILDING

WATERHOUSES - LIVING NEXT TO THE ISLAND PARK

New WaterHouses in Hamburg

Five buildings demonstrate how water zones can be used as residential locations in tandem with consideration of environmental issues and people's safety requirements.

The WaterHouses are built on piles in a 4,000-square-meter water basin integrated into the existing waterway network. Located in Wilhelmsburg Mitte, the basin is fed by stormwater. Built to passive house standards, the buildings feature numerous REHAU system solutions, such as **RAUGEO geothermal probes, concrete core tempering, RAUTITAN drinking water installations and the RAUPIANO PLUS domestic wastewater system**.

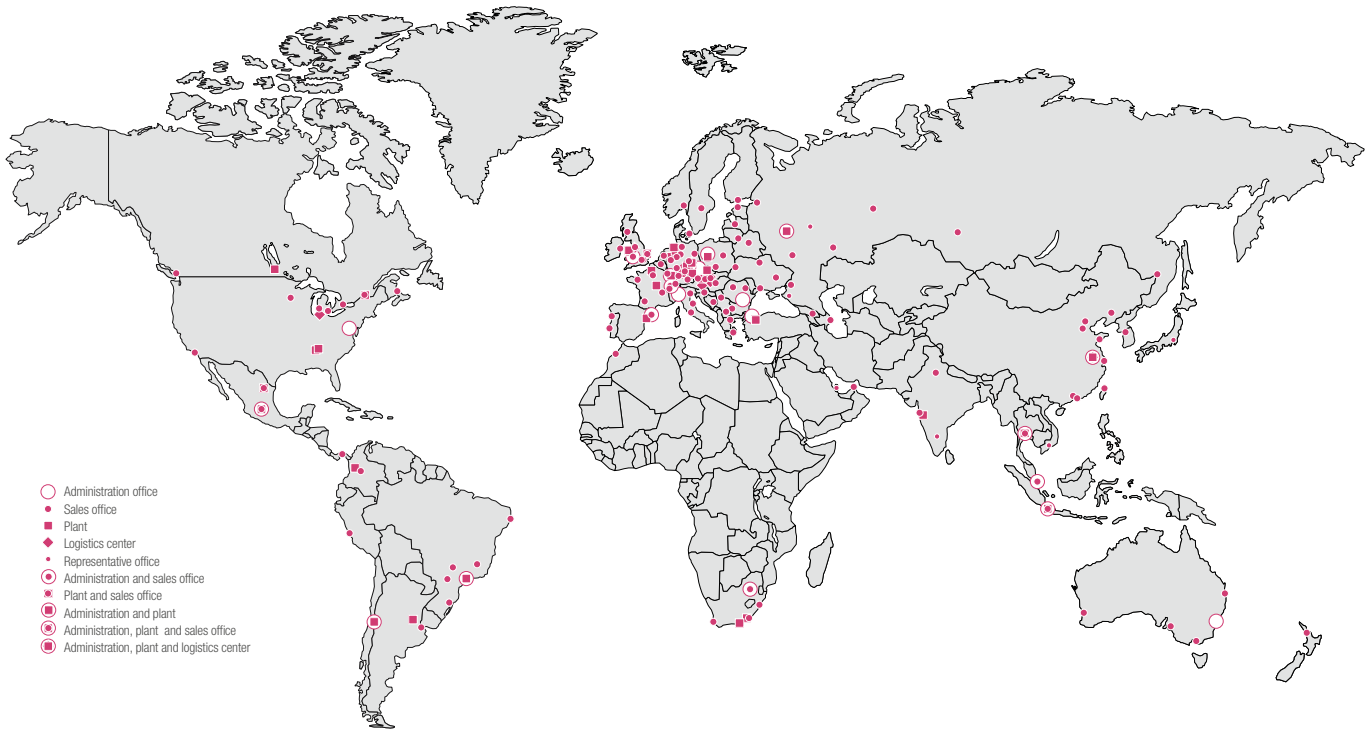
DGNB Gold pre-certification

New residential building, version 2011

Building owner	HOCHTIEF Solutions AG formart Hamburg
Architect	Schenk+Waiblinger Architekten
Year of completion	2013
Year of pre-certification	2011
Gross floor space	4,031 m²
Property assessment	84.10%
- Ecological quality	78.50 %
- Economic quality	85.90 %
- Sociocultural and functional quality	83.10 %
- Technical quality	83.20 %
- Process quality	96.90 %
Locational assessment	79.60 %

REHAU WORLDWIDE

GLOBAL PLAYER OFFERING LOCAL SERVICE



Around 17,000 employees all around the world are currently achieving growth and success for our group of companies. REHAU seeks close proximity to the market and its customers via more than 170 locations on five continents.

Since the company was established in 1948, REHAU has grown by virtue of its own strength to become a globally operative group. REHAU initially established itself in Germany and the surrounding countries to the west. Later, successful further development followed in Europe and the founding of locations in North America, Asia and Australia. The group has also been well represented in Eastern Europe for more than a decade.

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