

# DEVELOPMENT OF SCIENTIFIC REQUIREMENTS FOR CLIMATE-NEUTRAL BUILDINGS AND SUSTAINABLE FUNDING SCHEMES IN GERMANY

SYLVI ECKART\*, JULIANE JÄGER, NICOLAS KERZ, ANDREAS RIETZ

*Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR), Division Sustainable Building, Straße des 17. Juni 112, 10623 Berlin, Germany*

\* corresponding author: [sylvi.eckart@bbr.bund.de](mailto:sylvi.eckart@bbr.bund.de)

**ABSTRACT.** The German Climate Protection Plan 2050 describes interim targets and measures for the implementation of the Paris Climate Agreement, including the building sector. With the “New European Bauhaus”, the EU Commission has currently initiated an ambitious process. While new construction has been in the foreground up to now, the existing building stock must make a significant contribution to achieving the climate protection goals in the future. Robust building technology and a high degree of adaptability lead to a longer useful life and are thus more sustainable, both economically and in terms of ecological balance. Resilience to the consequences of climate change is gaining in importance.

The main goal of this contribution is to inform about the latest developments in governmental policies and subsidy schemes. As part of the National Climate Protection Programme 2030, the new “Federal Funding for Efficient Buildings (BEG)” was introduced in 2021. Research projects investigated how, with the introduction of efficiency house classes, funding can take greater account of the life cycle approach and other aspects of sustainability. At the same time, general and special requirements for the ecological, socio-cultural and economic quality were developed as a supplement to the existing certification systems and introduced by the Federal Building Ministry as “Quality Seal for Sustainable Buildings” (QNG).

**KEYWORDS:** Sustainable building, New European Bauhaus, sustainability assessment, climate protection plan, federal funding.

## 1. INTRODUCTION

Climate change creates new challenges for building. In terms of sustainable building, environmentally sound and energy-efficient construction as well as climate-friendly adaptation of buildings must be seen as a holistic task. The overarching guiding principle of sustainable development – based on the three dimensions: Ecology, Economy and Socioculture represents the basis for the development of the principles for sustainable building in Germany. This approach goes back to the “Our Common Future” report published in 1987, in which the UN Brundtland Commission outlined the guiding principle of sustainable development for the first time.

With the 2030 Agenda adopted in 2015, the United Nations defines sustainable development via 17 Sustainable Development Goals (SDGs) into global goals, subdivided into approximately 169 sub-goals. The revision of the national sustainability strategy and its adoption in January 2017 form the essential framework for national implementation.

Under the auspices of the Federal Ministry of Building, a start was made as early as the late 1990s on defining sustainability for the building sector and implementing it in a practical manner. Building on the recommendations of the Enquete Commission

“Protecting People and the Environment – Goals and Framework Conditions for Sustainable Development” and the experiences of the Federal Energy Commissioner in the context of the government relocation, frameworks for sustainable building were derived. As early as December 2001, the former Federal Ministry of Building and Urban Affairs set up the “Round Table on Sustainable Building” as a body to support its implementation. In the same year, in the spirit of setting an example, the first Guideline for Sustainable Building [2] was introduced as a mandatory planning aid for federal building. Due to the systematic nature of the requirements for the technical, functional, ecological, economic and social performance of buildings, the relevant sub-goals of the SDGs are now addressed and covered in the current version of the guideline.

In a two-year cooperation between the Federal Ministry of Building and the German Sustainable Building Council (DGNB), the development of a national assessment system was advanced in Germany in 2007/08, based on the national framework conditions, bodies of law, standards, etc. and designed for building in Germany. In January 2009, a first set of national sustainability criteria including a calculation and evaluation methodology was presented to the professional public. This methodology follows a holistic assessment approach taking into account the life cycle of a build-



FIGURE 1. Scheme of the United Nations Sustainable Development Goals [1].

ing as well as a comprehensive quantification. For the regulatory area of federal building, the Assessment System for Sustainable Building (BNB) was derived from this in 2010.

## 2. THE CLIMATE PROTECTION PLAN 2050

With the “New European Building”, the EU Commission has currently initiated an ambitious and far-reaching process. With regard to climate neutrality, SDG 13 “Climate Action” plays a central role. It essentially refers to the goals of the Paris Agreement by listing measures for greenhouse gas reduction and adaptation to impacts as well as financing and capacity-building instruments. The Climate Protection Plan 2050 adopted by the Federal Cabinet describes interim targets and measures for implementing the Paris Climate Agreement. It defines “nearly climate-neutral buildings” in such a way that these buildings have a very low energy demand, the remaining energy demand is covered by renewable energies and further greenhouse gas emissions are avoided. In the brochure “Energy Efficiency Strategy for Buildings”, the Federal Ministry for Economic Affairs and Energy (BMWi) calls for primary energy demand to be reduced by a combination of energy savings and the use of renewable energies in the order of 80 percent by 2050 compared to 2008.

In addition to considering the energy demand of buildings for heating/cooling and electricity, the Federal Ministry of Building focuses on the entire life cycle. In addition to the operation of buildings, emissions are primarily caused by the consumption of resources for materials, constructions, construction site equipment and processes, as well as during the deconstruction of buildings. Only if we succeed in significantly reducing resource consumption will there also be a chance to achieve the energy transition away from fossil fuels and towards renewable energies and to sustainably

and permanently reduce CO<sub>2</sub> emissions. Only if we succeed in significantly reducing resource consumption will we have a chance to achieve the energy transition away from fossil fuels and towards renewable energies and to reduce CO<sub>2</sub> emissions sustainably and permanently.

So far, energy- and CO<sub>2</sub>-reducing concepts and normative ideas have been developed primarily in relation to new construction. However, the focus of attention is on existing buildings. A socio-culturally and economically careful development of the building stock, taking into account the ecological framework conditions, will have to make a significant contribution to achieving the climate protection goals.

Robust building technology and a high degree of adaptability generally lead to a longer useful life and are thus more sustainable, both in economic terms, in terms of resource consumption and in terms of life cycle assessment. In this context, keywords such as “simplicity” and “low tech” play an important role. At the same time, resilience to the consequences of climate change (e.g. weather events, periods of heat) is important in climate-adapted construction.

## 3. FEDERAL SUSTAINABLE BUILDING ASSESSMENT SYSTEM (BNB)

This results in the obligation to develop and implement each planning task as an integrated overall concept in terms of sustainability. The guiding principle of the German assessment system based on the equal consideration of economic, ecological and socio-cultural qualities. In the Federal Assessment System for Sustainable Building (BNB), which based on European standardisation, technical quality and process quality been introduced as cross-sectional qualities in addition to the classic pillars of sustainability described above. On the one hand, this is intended to represent the high technical standard of buildings customary in Germany on the basis of the existing set of rules,



FIGURE 2. German Environment Agency House 2019 in Berlin [3].

and on the other hand, it is also intended to document the necessity of integral planning and quality assurance during construction as a basis for achieving the sustainability goals. The site characteristics are not included in the actual building rating, but been shown separately in the certificate. The BNB system is continuously revised and adapted to legal changes; at the same time, criteria that take into account the consequences of climate change have currently been included, e.g. the criteria profile “Resistance to natural hazards”.

With the Guideline for Sustainable Building, the “silver level” is required nationwide as a minimum standard for new construction and refurbishment in the area of civilian federal properties, and the gold standard is targeted for selected buildings. For example, an office building (House 2019) of the Federal Environment Agency in Berlin-Marienfelde was planned as a zero-energy building with the aim of actively conserving resources. With the two-storey building in timber construction, a design as compact as possible was chosen for reasons of energy efficiency, whereby the elongated canopy roof created a lounge zone in front of the building and enabled shading and thermal protection of the conference rooms on the first floor. In addition to the ecological balancing function, the green roof achieves a synergy effect with the photovoltaic system installed there. As a result of extensive monitoring, the zero energy level of the building was confirmed in the annual balance sheet and a clear surplus of electrical energy could be shown overall, which benefits the property as a whole.

The extension of the office building of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) in Berlin-Mitte is a lighthouse project for implementing the goals of climate protection and sustainable building in Germany in an exemplary manner. As early as the competition stage, the scope and depth of the preliminary assessment of the competition entries were oriented towards the

implementation of the BNB Standard in Gold. The results of the preliminary assessment were graphically prepared for the jury and presented during the jury meeting, in order to illustrate both, the distance from the respective target corridor and, above all, the comparability of the competition entries with regard to key sustainability aspects.

Thus, based on the BNB system, among other things, the quantitative determination of the environmental footprint (greenhouse potential), supported by life cycle assessment modelling, was assessed.

The preliminary assessment estimated the overall sustainability potential of the entries based on derived pre-design-relevant individual indicators from 17 sustainability criteria of the BNB system. In order to accentuate the specificity of the competition – which relies on a decidedly low-tech strategy in terms of sustainability – three topics were prioritised in addition to the overall assessment: the quantitative determination of the environmental footprint, expressed in greenhouse potential based on life cycle assessment modelling, indoor air hygiene and daylight availability.

#### 4. INTRODUCTION OF THE FEDERAL SUBSIDY EFFICIENT BUILDINGS

In the context of sustainable planning and construction, the Federal Government is focusing on the further reduction of greenhouse gas emissions in the life cycle of buildings. This is intended to make an active contribution to climate protection and the achievement of political goals.

Energy-efficient building has a long tradition in Germany. On 16 November 2001, the “Ordinance on Energy-Saving Thermal Insulation and Energy-Saving Systems Technology in Buildings (EnEV)” was enacted for the first time and came into force on 1 February 2002. It replaced the previously valid 1995 Thermal Insulation Ordinance and 1998 Heating Installations Ordinance. With the new Building Energy



FIGURE 3. Model 1st Prize – Competition Federal Ministry for the Environment, Nature Conservation and Nuclear Safety – Extension, C.F. Møller Architects [4].

Act (GEG) passed by the Bundestag on 18 June 2020, the EnEV, the Energy Conservation Act (EnEG) and the Renewable Energies Heat Act (EEWärmeG) were merged into one modern law.

In a further step, it is planned to further develop and specify requirements for sustainable planning and building in the context of climate protection. Against the background that the climate neutrality of the building stock is to be achieved by 2045, a minimum KfW 55 standard was assumed for the eligibility and/or sustainability assessment of newly constructed residential buildings. The report initially proposes benchmarks for buildings with the Efficiency House 55 (EH 55) and Efficiency House 40 (EH 40) standards.

Within the framework of the National Climate Protection Programme 2030, new approaches for government funding programmes were developed and the new “Federal Funding for Efficient Buildings (BEG)” was introduced in 2021. The existing programmes to promote energy efficiency and renewable energies in the building sector will be bundled in a modernised, simplified and further developed funding offer. In this context, the Federal Government will promote sustainability aspects for the first time within the framework of the BEG from 1 July 2021 through a separate “NH class”. The required proof for the funding is provided by awarding the building-related QNG.

With the BEG, the promotion of energy efficiency and renewable energies will be brought together under one roof for the first time. For new buildings and complete renovations, the use of renewable energies will be rewarded even more. At the same time, there are new, attractive funding offers for particularly ambitious renovations and new buildings.

An efficiency house/building eligible for funding in BEG additionally achieves the “Efficiency House NH” class or “Efficiency Building NH” class if it has been awarded a “Quality Seal Sustainable Building Plus (QNG-PLUS)” or “Quality Seal Sustainable Building Premium (QNG-PREMIUM)” on the basis of certification of the building in accordance with the guarantee market statutes and the seal documents.

Proof of the successful award of the “Sustainable Building Quality Label” certificate after completion of the building project must be submitted with the proof of use. The energy efficiency experts confirm that the “Efficiency House NH” class was achieved with the award of the quality seal. Proof of the certificate must be provided upon request.

## 5. QUALITY SEAL SUSTAINABLE BUILDING

The “Quality Seal Sustainable Building (QNG)” is a German national quality seal for buildings. The prerequisite for the award of the Quality Seal is proof of fulfilment of general and special requirements for the ecological, socio-cultural and economic quality of buildings.

The fulfilment of the requirements is to be proven by an independent audit after completion of construction on the basis of the completed planning and construction processes and on the basis of the review of selected realised qualities. At the start of the quality seal in July 2021, seal variants will initially be offered for the new construction of residential buildings. When applying, accredited energy efficiency experts confirm that the measure fulfils the minimum requirements

of the efficiency house level and that a certification “Quality Seal Sustainable Building” is planned.

An efficiency building achieves the “Efficiency Building NH” class if it has been awarded a quality seal by an accredited certification body on the basis of a certification of the building. Whether the “Plus Label” or “Premium Label” has been achieved has no influence on eligibility for funding or the type and scope of funding. Buildings awarded the Quality Seal make a special contribution to sustainable development. The requirement levels make the fulfilment of above-average requirements (QNG-PLUS) and clearly above-average requirements (QNG-PREMIUM) for sustainability-relevant features and characteristics recognisable at a glance.

Certification bodies are the testing and awarding bodies for the “Sustainable Building Quality Label” and are responsible for the technical-operational processing of the testing of the requirements for the award of the quality label and its awarding. They are commissioned by the applicants, for example the building owners. In principle, only certification bodies that demonstrate and maintain accreditation within the meaning of Regulation (EC) 765/2008 in accordance with ISO/IEC 17065 may be active in the area of awarding the Quality Seal. The Sustainable Building Office at the BBSR maintains a publicly accessible list of accredited certification bodies.

All information on the “Quality Seal for Sustainable Buildings”, including a list of the certification bodies that may act as testing and awarding bodies for the QNG, as well as the assessment systems that may be used as a basis for the QNG, are published on the Sustainable Building Information Portal [5].

The quality seal is further developed on the basis of research projects of the Building Innovation Programme for the Future. Representatives of industry, associations, administration, politics and science will be involved in the further development via the Round Table on Sustainable Building of the Federal Ministry of Building.

In various research projects commissioned by the BBSR, it was investigated how, with the introduction of efficiency house classes, funding can in future take greater account of the life cycle approach as well as other aspects of sustainable building, such as biodiversity or accessibility.

The QNG-PLUS and QNG-PREMIUM quality seals of the federal government are a state seal of quality for buildings. A prerequisite for the award of the quality seals is the fulfilment of the special requirements for the contribution of buildings to sustainable development. The building requirements formulated by the seal issuer are described with evaluation criteria and assessment standards in Annex 3 to the Quality Seal Manual.

The following chapters describe the currently applicable building requirements.

### 5.1. GREENHOUSE GAS AND PRIMARY ENERGY

The building may only be awarded QNG-PLUS if the greenhouse gas emissions determined in accordance with the methodology of the Appendix “LCA balancing rules of the QNG for residential buildings” are a maximum of 28 kg CO<sub>2</sub>eq/m<sup>2</sup>a and the calculated primary energy demand non-renewable is a maximum of 96 kWh/m<sup>2</sup>a in the building life cycle. For QNG-PREMIUM, the greenhouse gas emissions in the building life cycle must not exceed 20 kg CO<sub>2</sub>eq/m<sup>2</sup>a and the calculated non-renewable primary energy demand in the building life cycle must not exceed 64 kWh/m<sup>2</sup>a.

The aforementioned minimum requirements for limiting the global warming potential GWP100 and the primary energy demand were determined on a suitable data basis in the research project “Development of LCA benchmarks for residential buildings” [6]. The calculations were carried out using the calculation tool “eLCA”, which was provided by the BBSR. On the basis of the calculations carried out, evaluations are made in order to be able to propose suitable values (benchmarks) for the questions raised. The calculation results were transferred in an editable data format (eLCA exchange format).

### 5.2. SUSTAINABLE MATERIAL EXTRACTION

The building may only be awarded QNG-PLUS if at least 50 % of the timber, timber products and/or timber materials used can be proven to originate from sustainable forestry. For QNG-PREMIUM, a limit of 80 % applies here. The condition applies that the regulated, sustainable management of the forest of origin is proven by presentation of a certificate. The following certificates are recognised for certificates are recognised for verification purposes:

- PEFC (Programme for the Endorsement of Forest Certification Schemes)
- FSC (Forest Stewardship Council)

### 5.3. POLLUTANT AVOIDANCE IN BUILDING MATERIALS

The building may only be awarded the QNG-PLUS if the client has contractually obligated all companies carrying out the construction to comply with the QNG quality requirements for the avoidance of pollutants and the companies declare their compliance after completion of their services. For QNG-PREMIUM, compliance with the QNG quality requirements for pollution prevention must be demonstrated for all materials and products used. The specific requirements are described in detail in a separate document.

### 5.4. ACCESSIBILITY

The building may only be awarded QNG-PLUS if at least 80 % of the residential units and the common areas of the building are shown to meet 7 of the specified 8 requirements of the “ready for visitors” standard. For QNG-PREMIUM, compliance with 7

of the specified 8 requirements of the “ready plus” standard must be demonstrated. These requirements are listed in detail in the profile.

## 6. CONCLUSIONS

With the introduction of the new “Federal Promotion for Efficient Buildings (BEG)”, the previous programmes for the promotion of energy efficiency and renewable energies in the building sector will be merged into a unified funding offer. The aim is to achieve a significantly greater reach and thus a broadly effective implementation of sustainable building in Germany. In this way, the Federal Government is implementing an important political goal within the framework of climate protection. The Quality Seal for Sustainable Buildings implements quality control in the promotion of sustainability. The regulations anchored in it are the result of various research projects within the framework of the Federal Ministry of Building’s departmental research programme Zukunft Bau.

### LIST OF SYMBOLS

BBSR Federal Institute for Research on Building, Urban Affairs and Spatial Development  
 BEG Federal Funding for Efficient Buildings  
 BMI Federal Ministry of the Interior, Building and Community  
 BMU Federal Ministry for the Environment, Nature Conservation and Nuclear Safety  
 BMWi Federal Ministry for Economic Affairs and Energy  
 BNB Assessment System for Sustainable Building  
 DGNB German Sustainable Building Council

EEWärmeG Renewable Energies Heat Act  
 EnEG Energy Conservation Act  
 EnEV Ordinance on Energy-Saving Thermal Insulation and Energy-Saving Systems Technology in Buildings  
 GEG Building Energy Act  
 GWP Global Warming Potential  
 LCA Life Cycle Assessment  
 SDG Sustainable Development Goal  
 QNG Sustainable Building Quality Label  
 UN United Nations

### REFERENCES

- [1] UNDP (United Nations Development Programme). The sustainable development goals, adopted on 25 september 2015 as a part of the 2030 agenda. [2022-06-10]. <https://unric.org/en/united-nations-sustainable-development-goals/>
- [2] Federal Ministry of the Interior, Building and Community. Guideline for sustainable building, 3rd updated edition, Berlin, 2019.
- [3] Qatsi.tv GmbH & Co.KG, German Environment Agency House 2019 in Berlin.
- [4] W. Mateyka. Model 1st prize, Competition Federal Ministry for the Environment, Nature Conservation and Nuclear Safety – Extension, C.F. Moller Architects.
- [5] Federal Ministry of the Interior, Building and Community. Sustainable building information portal. [2022-06-10]. <https://www.nachhaltigesbauen.de/>
- [6] H. König, A. Hafner. Teilprojekt: Entwicklung von LCA-Benchmarks bei Wohngebäuden Projekt: RV Handlungsplan Nachhaltiges Bauen, 2021. Aktenzeichen: 10.08.17.7-19.13.