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Experiences from the Implementation of the Assessment System for Sustainable Building (BNB) in Germany

A Rietz¹, N Kerz¹ and M Welsch¹

¹ Division Sustainable Building, Federal Institute for Research on Building, Urban Affairs and Spatial Development, Straße des 17. Juni 112; 10623 Berlin, Germany

andreas.rietz@bbr.bund.de

Abstract. Sustainability is one of the most important challenges for the future. Sustainable building is therefore an important component of the national sustainability strategy in Germany. The Federal Ministry of Building has developed instruments to implement its ambitious goals with the Guideline and the Assessment System for Sustainable Building (BNB). The aim was, to implement federal building on a sustainable basis and to assume an exemplary role for other public clients. This strategy has been successful to date. The combination of mandatory introduction and exemplary effect has motivated some federal states already introducing sustainability assessment with the BNB in their area of responsibility, while others are testing this approach at least with the launch of pilot projects. In order to support implementation, instruments and tools for the application of the BNB were developed as part of the national "Future Building" research initiative. An important step is the introduction of the Electronic Assessment System for Sustainable Building (eBNB). It enables the recording and control of all parameters necessary for the effective implementation of the requirements of sustainable building. As part of an ongoing scientific monitoring, the implementation will be evaluated on the basis of the federal buildings currently completed and certified by the BNB. So far, the BNB certifications show that even high sustainability requirements can be economically implemented.

1. Introduction

The overarching guiding principle of sustainable development – based on the three dimensions of sustainability: ecology, economy and socio-culture – forms the basis for the development of the principles and evaluation bases for sustainable federal building.

The national sustainability strategy was fundamentally revised in 2016 to implement the "Agenda 2030 for Sustainable Development of the United Nations" adopted in 2015 and the global sustainability goals anchored here, the "Sustainable Development Goals – SDG". The current "German Sustainability Strategy" was adopted by the Federal Cabinet in January 2017 [1].

Since the new edition in 2016, the "German Sustainability Strategy" has been structured according to the 17 global goals for sustainable development. Monitoring has been expanded accordingly. In the 2009 coalition agreement, the guiding principle of sustainable development was also updated and enshrined in binding form. According to this, the federal government should "continue to live up to its role model function for building culture and sustainability in its construction measures", particularly in the construction sector.



The State Secretary Committee for Sustainable Development is the central steering element of the German government's sustainability policy. Its task is to implement the national sustainability strategy, further develop its content and regularly review its implementation. The Committee of State Secretaries is also the contact for the Parliamentary Advisory Council on Sustainable Development, the Federal States and the central municipal associations. With the first "sustainability program of measures" adopted on 6 December 2010, "Implementing sustainability concretely in administrative action", and its update on 30 March 2015 [2], the State Secretary Committee sets out how the national sustainability strategy is to be implemented in the federal administrations. As an important submeasure, the program of measures calls for federal buildings to be aligned with the requirements of the Sustainable Building Assessment System (BNB) [3], which was developed in 2010 and introduced in 2013. The assessment shall be based on scientifically approved methods.

In accordance with the federal government's sustainability strategy, the definition of sustainability for the construction industry and its practical implementation was begun at the end of the 1990s under the auspices of the Federal Ministry of Building and Urban Affairs. In 2001, the Federal Ministry of Building published for the first time a guideline on sustainable building as a working aid for the planning, construction, maintenance, operation and use of real estate and buildings and made it mandatory for federal construction.

The Guideline for Sustainable Building [4] was comprehensively revised editorially and adapted to legal and scientific developments. The 2nd updated edition in German and English was published in February 2016 by the Federal Ministry of Building and forms the basis for the sustainable building within the federal building administration. In principle, it is to be used for the new construction, renovation, use and operation of federal buildings. The guideline defines general principles and methods, serves as a working aid for implementation and defines concrete requirements for federal building measures. As a framework document, the application of the guideline for federal buildings is mandatory – but it is also suitable for use by other public clients such as federal states and municipalities as well as for the private sector. The objectives and requirements formulated in this report have had an impact far beyond their regulatory scope.

2. Implementation support bodies

2.1. The Round Table for Sustainable Building

The Round Table for Sustainable Building was established in 2001 with the introduction of the Sustainable Building Guideline as an advisory body to the Federal Ministry of the Interior, Building and Community. Since then, it has accompanied the development of sustainable building at the federal level and, in particular, the sustainable building evaluation system. It is composed of representatives from the construction and housing industry, the construction and building materials industry, the national professional associations and chambers of architects and engineers, the BImA, the federal, state and local building authorities and the scientific community. The various working groups of the Round Table played a major role in the systematic and substantive development of a uniform national evaluation system in Germany. Current developments as well as important relevant research results are presented and discussed with the approximately 80–100 participants at the roundtable meetings, which are held twice a year on a regular basis. The findings gained in this way have been incorporated, for example, in the updating of the guideline and in the updating of the Sustainable Building Assessment System (BNB). With the ongoing involvement of relevant groups at the Round Table on Sustainable Building, the further development of sustainable building in accordance with and with a high level of acceptance should also be ensured in the future. The organisation of the Round Table is the responsibility of the Sustainable Building Secretariat within the Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR).

2.2. Sustainable Federal Construction Network

The Sustainable Federal Construction Network consists of the trained BNB sustainability coordinators of the federal building authorities as well as representatives of the BMI, the BBSR, the Institute for Federal Real Estate (BImA) and the state building authorities. The network has at its disposal an Internet-based information and exchange platform as well as a discussion forum for the further development of the BNB as a protected area in the Sustainable Building Information Portal for the practical application of the NBB. The annual BNB user meetings organised by the Sustainable Building Office are a key component of the network. There, the sustainability coordinators are given the opportunity to regularly exchange experiences on the implementation of the guidelines and the BNB in the respective building authorities.

3. Application of the Assessment System for Sustainable Building in Practice

3.1. Pilot Phase and Development of the Assessment System for Sustainable Building (BNB)

The federal government's sustainable construction, with the requirements of the Guideline for Sustainable Building and the Assessment System for Sustainable Building (BNB) that it contains, forms one of the cornerstones for the exemplary role of federal construction and a concrete yardstick for federal construction quality. The "silver level" of the BNB must be observed as the minimum standard for civil federal buildings. For new construction measures in the area of responsibility of the Federal Ministry of the Interior, Building and Community (BMI), the principle of economic efficiency is to be taken into account and the "gold standard" generally implemented. The BMI thus assumes an exemplary role for the entire federal construction sector.

Already in the first pilot phase of the evaluation methodology developed jointly with the German Sustainable Building Council (DGNB e.V.), in January 2009 the new building of the Federal Environment Agency Dessau, which was built after the 1998 competition from 2001 to 2005, achieved a property certification with the Gold Standard. This was due, among other things, to the consistent consideration of the Guideline for Sustainable Building in the planning phase, the high energy requirements, the detailed life cycle assessment studies and material declarations as well as the accompanying monitoring. In addition, innovative ideas from planners and users that went beyond the guidelines were implemented. The building is characterised by the combination of compact form and high external wall insulation with intelligent building technology and the use of renewable energies. All measures were taken into account in the sustainability assessment.



Figure 1. New building Federal Environment Agency Dessau – Atrium (Karsten Prior, BBSR)

With the decision to use the Assessment System for Sustainable Building (BNB) for the federal buildings, an office and laboratory building for the Federal Office for Radiation Protection in Berlin, the new building of the Federal Ministry of Health in Bonn and the extension to the main customs office in Rosenheim were certified at the end of the second pilot phase in February 2010.

3.2. Regular application of the BNB for federal buildings

Since 2012, around 20 further completed projects have been awarded a BNB certificate. In addition to the projects already certified in accordance with the BNB, a large number of other projects are now being completed year after year which conclude with a BNB certificate or which are being implemented analogously and thus do not undergo certification. In principle, the federal government's buildings are to achieve a silver standard in accordance with the BNB; the gold standard is to be striven for selected construction projects, such as the new construction of the United Nations Campus in Bonn and an extension for the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety in Berlin.

The results of the detailed monitoring provided indications for necessary readjustments in plant operation and user behaviour, but also show that the building can achieve a balanced energy balance in the future even under real conditions. Thus, the Federal Building Ministry is consistently pursuing the path towards energy-efficient and sustainable construction that it embarked upon with the binding introduction of the updated Guideline for Sustainable Building in July 2013.

Table 1. BNB-Certifications (Federal building administration, selected)

Building	BNB-Module	Standard	Year of certification
Main Customs Office, Rosenheim	Administration	silver	2011
Main Customs Office, Hamburg	Administration	gold	2012
Administration Building UBA 2019	Administration	gold	2015
Federal Constitutional Court	Administration	silver	2015
Experimental Research Center	Laboratory	bronze	2015
Federal Ministry of Education and Research	Administration	gold	2015
Max-Planck-Institut, Köln	Laboratory	silver	2015
Center for Preclinical Research	Laboratory	silver	2016
Air Measuring Station, Zingst	Laboratory	silver	2017
Robotics and Mechatronics Centre	Administration	silver	2017
German Centre for Neurodegenerative Diseases	Laboratory	gold	2018
Daycare Center Army Hospital, Ulm	Education	silver	2018

With the new building of the Federal Ministry of Education and Research (BMBF) and the House 2019, an office building of the Federal Environment Agency (UBA), two buildings could be realised in Berlin, both of which have received BNB certification in the gold standard as office and administration buildings. With the "UBA 2019", handed over in August 2013, the Federal Government, as the largest public building owner, shows that it takes its role as an example seriously and successfully implements its own requirements for sustainable construction in practice. The new construction of an office building for around 30 employees on the research campus of the UBA in Berlin-Marienfelde was thus the first building to be accompanied by the Federal Assessment System for Sustainable Building (BNB) throughout all phases, from the start of planning to handover. In addition to the high sustainability standard in the form of a BNB certificate in gold, the design of the building as a net zero energy building has already met the requirements that the European Union will not impose on all new public buildings until 2019.

When modernising existing buildings, the aim is also to achieve at least the silver standard. The Federal Constitutional Court in Karlsruhe was in 2015 the first federal building project with the BNB module Office and Administration Building, Complete Modernization to be re-evaluated and achieved the silver standard. This was a pilot project for the application of the evaluation system in the area of existing buildings with monument properties. The sustainable complete modernization of a listed building posed a considerable challenge. In particular, it consisted of preserving the transparent architectural language as an expression of democratic jurisdiction and at the same time creating a contemporary, energy-efficient and comfortable building for the next life cycle.

The "Administration Building Bismarckplatz", a project for the UBA in Berlin, aims to achieve the Gold Standard for outstanding modernizations.



Figure 2. New Office building UBA 2019 in Berlin-Marienfelde (Andreas Meichsner photography)



Figure 3. Federal Constitutional Court, Karlsruhe (bild_raum, Stephan Baumann, Karlsruhe)



Figure 4. German Centre for Neurodegenerative Diseases, Bonn (Archigraphie Steffen Vogt)

The German Centre for Neurodegenerative Diseases (DZNE), the first laboratory building to receive BNB certification in gold, is currently being awarded. The new building is located on the campus of Bonn University Hospital and is not only equipped with state-of-the-art laboratories but is also operated in an environmentally friendly manner.



Figure 5. Daycare center at the Hospital of the German Armed Forces, Ulm (Martin Duckek)

The new daycare center at the Hospital of the German Armed Forces Ulm, also certified in 2018, achieves the silver standard. It was evaluated as one of the first construction projects of the Federal Ministry of Defense with the BNB module "Educational Buildings".

4. Evaluation of the Assessment System for Sustainable Building

In total, the databases of the Federal Building Ministry and the business area currently contain 688 major civil building projects with different construction stages, for which the Federal Ministry of the Interior, Building and Community (BMI) performs the function of Supreme Technical Authority. According to a survey in the field of federal construction as of January 2019, 91 projects with the goal of certification in silver and 11 projects with the goal of certification in gold are currently in progress. Postponements are possible in the course of project work if other allocations are made or projects withdrawn in the course of coordination with the Conformity Assessment Bodies, e.g. because funding bodies do not require certification. In addition, around 350 measures are being processed in analogous application, of which approx. 40 percent are in the military sector. This includes both building construction measures and outdoor facilities on federal properties.

In order to carry out an overall evaluation, the BBSR will evaluate federal construction projects that have been completed and certified by the BNB. Recommendations are to be drawn up on this basis as to whether and what need exists for streamlining, supplementing or reweighting the BNB. In particular, it is important to address the question of how effective the BNB is in relation to the objectives of Agenda 2030 and the Climate Protection Plan 2050 (almost climate-neutral building stock) at present and whether this needs to be strengthened if necessary.

The holistic approach of sustainable building is also examined with regard to the need to update newly gained knowledge from separate cross-sectional considerations. This concerns among other things strategies for the increase of the variety of species at the location of the building measure or defaults for the optimization of the resource efficiency regarding the recycling right constructing. However, new findings from the field of building data modelling (BIM) must also be examined with regard to transferability and practicability for BNB application.

However, experience with the projects completed to date has already shown that the more demanding planning processes achieve better results in terms of implementing the Guideline for Sustainable Building.

5. Implementation in the federal states, municipal and private sectors

In contrast to the application of the evaluation system by the Federal Building Administration, this is voluntary for other users, e.g. at local level. The necessary tools and instruments are made available free of charge in the Sustainable Building Information Portal.

The Federal Ministry of the Interior, Building and Community (BMI) and the BBSR inform and advise the federal states and local authorities on the implementation of the guideline on sustainable construction via the Round Table on Sustainable Construction and the BBSR. Furthermore, the implementation of the sustainability assessment at state and municipal level is to be strengthened within this framework. In addition to the technical exchange at the Round Table on Sustainable Building (Head: BMI), the Federal Government has continued its intensive cooperation with the Federal States via the Sustainable Building Secretariat in the BBSR in the project group Building for the Future/Sustainable Building in the Committee for State Building Construction of the Conference of Ministers of Construction.

With Baden-Württemberg and Schleswig-Holstein (limited for selected pilot projects), the first regional planning authorities have introduced the use of the BNB evaluation system for their own regional construction measures. In addition, the state of Berlin has also introduced the BNB evaluation system for new construction and complete modernisation of state construction measures with an investment volume of 10 million euros or more with new environmental protection requirements within the framework of the administrative regulation on procurement and the environment. In cooperation with the BBSR, Berlin is already testing the BNB system variant for teaching buildings on

three new school buildings owned by the state, which are to be certified after completion of the construction measures. A total of 83 projects aimed at BNB certification have been notified to the office of the state building authorities.

Table 2. BNB-Certifications (Federal states / communities, selected)

Building	BNB-Module	Standard	Year of certification
Primary School, Hohen Neuendorf	Education	gold	2013
Customs Office, Garmisch-Partenkirchen	Administration	silver	2014
Ludwig-Bölkow-Haus, Schwerin	Administration	silver	2015
Daycare Center Wildblume, Stralsund	Education	gold	2016

Pilot applications of the BNB are also reported from Rhineland-Palatinate, Mecklenburg-Western Pomerania, Bavaria and Schleswig-Holstein. In Bavaria, a state construction project in the form of a new office and administration building has already been certified with silver in the Garmisch-Partenkirchen tax office system. Other important measures in the federal states were the training of BNB coordinators for state construction and the integration of sustainability assessment in funding measures. In order to promote and support the broad application of the BNB system at state and municipal level for the important task of school and university construction, a nationwide network for sustainable teaching buildings is to be set up in future. The network serves the exchange of information and experience as well as the strengthening of sustainability processes and strategies to ensure sustainable construction.

In some federal states there are still concerns in the building authorities regarding additional expenditure in the building projects with a regular application of the sustainability assessment. In addition, the building authorities must first build up the technical competencies and personnel capacities for certification with the BNB.

The support of the federal states and municipalities in the further implementation of the sustainability assessment in their own building administrations is to be continued in the future depending on the personnel capacities and organisational structures in the Sustainable Building Office.

The German Sustainable Building Council (DGNB) was able to establish its national rating system for the sustainability rating in the private sector, which is a continuation of the joint development with the Federal Ministry of Building. In contrast to other international systems on the German market, the DGNB system is based on the same methodology as the BNB, uses its data and tools and offers a holistic valuation approach that takes economic criteria into account.

With the recognition of system providers for the rating system Sustainable Small Residential Building (BNK) and the quality seal Sustainable Residential Building (NaWoh) for multi-family houses and the DGNB usage profile "New Construction of Small Residential Buildings", a clear step towards the implementation of sustainability aspects in the area of private-sector housing construction was achieved.

6. Conclusion

The introduction of the Sustainable Building Rating System (BNB) had to take a large number of requirements into account. In addition to establishing the necessary conformity testing bodies at the technical supervisory levels in the Federal States and in the Federal Office for Building and Regional Planning (BBR), the employees of the Federal Building Administration had to be prepared for the application of the BNB assessment system by means of a training program with competence-specific knowledge. Furthermore, it was necessary to establish a sustainability-oriented project management in accordance with the requirements of the BNB and RBBau (Guidelines for the Implementation of Federal Construction Tasks).

In the course of the ongoing system development, starting with the system variant for the new construction of office and administration buildings, the introduction and thus obligatory application of the Assessment System BNB in federal construction could only be carried out step by step. All decrees since 2011 contained a key date regulation with which it was achieved that the respective application obligations only applied to newly started and future construction measures. Many construction measures currently underway were already too far advanced in the planning stages at the respective times, so that neither the BNB is applied with the aim of certification nor is the BNB applied analogously.

As part of ongoing scientific monitoring, the implementation is being evaluated on the basis of currently completed and BNB-certified federal buildings. So far the BNB-certifications show that even high sustainability requirements can be realized economically.

The exemplary effect that the Federal Government is setting with the obligatory implementation of the BNB in the Federal Construction Administration is also having an effect at the other levels of government. This is shown by the introduction or testing of the BNB in various federal states. Some municipalities also use a sustainability assessment based on the NBB system in selected building projects. The political approach chosen in Germany, not to rely on binding regulations but on voluntary action, seems to be successful, at least in the area of public clients.

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