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Development of sustainability requirements for public housing construction in Germany in the sense of a model effect of the federal government

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Development of sustainability requirements for public housing construction in Germany in the sense of a model effect of the federal government

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Abstract. The scarcity of affordable housing in many German cities and agglomerations is currently one of the most pressing challenges facing politics. The challenge now is to create affordable and sustainable housing for all, because this is one of the main indicators of SDG 11 Sustainable Cities and Communities. On the basis of the Guideline for Sustainable Building, requirements for federally owned residential buildings are to be developed. In addition to the principles of modern and affordable housing, the objectives of the Climate Protection Plan 2050 and requirements of sustainability have been taken into account. As a result, proposals for the updating and optimization of existing regulations have been developed to ensure sustainable construction of public housing. The criteria already address large parts of the sustainability and climate protection goals. Some aspects such as biodiversity at the site or the consideration of neighbourhoods have been included. Subsequently, it was examined how these different systems could be brought together in an updated evaluation system for new housing construction. Newly added aspects such as biodiversity at the location or the consideration of neighbourhoods were included. The results will be discussed with the stakeholders in order to achieve a broad application. Furthermore, new support programmes for public housing are to be developed.

1. Introduction

The scarcity of affordable housing in many German cities and agglomerations is currently one of the most pressing challenges facing politics and business. Since March 2018, the German government has initiated a number of measures to intensify housing construction and ensure affordable housing. In order to reduce the lack of affordable housing in many large German cities and conurbations, the German federal government has introduced a large number of measures since March 2018. The aim is to intensify housing construction and ensure the affordability of housing. These measures were coordinated with the federal states and municipalities and a housing offensive was launched to build 1.5 million new apartments.

Since the newly built apartments will leave their mark on cities for many years to come, affordable but sustainable construction is of great importance. Within the framework of a research project, corresponding requirements for the sustainable planning and construction of residential buildings are therefore to be developed, with the focus on federal housing construction. The aim of the research project is to define requirements for sustainable housing construction and to transfer them into an evaluation that can be implemented in an economically justifiable way and at the same time are future-proof. The

present results are to be discussed with interested actors in order to arrive at consensual recommendations for action.

Affordable housing for all is one of the main indicators of SDG 11 Sustainable Cities and Communities. The new buildings will not only shape our cities for many years, they will also influence the environment and climate for decades to come. The challenge now is to develop affordable housing for broad sections of society and to implement it in a sustainable way that also meets future environmental and climate protection requirements.

For many years, the Federal Government in Germany has made sustainability a basic principle of its policy and has played with its own buildings a model role in the field of sustainable building. The main instruments of implementation are the Guideline for Sustainable Building [1] and the Assessment System for Sustainable Building (BNB) [2] based on them, which have been made mandatory for federal construction. The principles and requirements set out in these guidelines are also to be applied to federal housing construction and federal support programmes in order to set an example. For its own construction measures, the federal government is pursuing a number of construction policy objectives which are to be reflected in the federal buildings [3]:

- Functional justice
- Security
- Economic efficiency
- Quality
- The creative power of architecture
- Sustainable and energy-efficient building
- Use of innovative building materials, techniques and processes
- Protection of historical monuments
- Urban planning integration at the location
- Art on building

2. Research approach

On the basis of the Guideline for Sustainable Building, requirements for federally owned residential buildings are to be developed. The criteria of the BNB-System were originally drawn up with regard to the assessment of non-residential buildings. Consequently, almost all sustainability criteria have to be adapted with regard to the requirements for residential buildings. In addition to the principles of modern and affordable housing, the objectives of the Climate Protection Plan 2050 and sustainable construction - e.g. resource efficiency, accessibility, etc. – have been taken into account. Requirements for the building envelope or the use of renewable energies are already anchored in the national regulations and are to be further developed into a “lowest-energy” or a “climate-neutral” new building standard.

2.1. Methodical procedure

Work packages were defined for the implementation of the research project. The coordinated work steps were transferred into a structured project schedule and recorded in a written implementation concept. The results of the individual work packages are recorded in interim reports. A Body of Experts was set up to monitor the content of the research project. It consists of representatives of the Federal Ministry of Building, the Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR), the Institute for Federal Real Estate (BImA), the housing industry and other scientific institutions. The interim results were discussed with this body of experts in several workshops or in individual agreements with selected actors. On the basis of the available results, it will be discussed which concrete requirements can be used as a basis for public funding of housing construction.

2.2. Content-related issues

Existing sustainability assessment criteria and the building regulations for federally owned or federally funded housing were evaluated and updated with regard to current housing standards, concepts for affordable housing construction, such as modular and serial construction, and supplemented. The aim

was to examine which measures could be taken to ensure that the objectives of the German government's Climate Protection Plan 2050 [4] (almost climate-neutral building stock) are met at the same time. The scope of the sustainability requirements to be implemented should be based both on practical considerations and on the basic principles of the German government's sustainability strategy. To this end, in addition to the Assessment System for Sustainable Building (BNB) [2], the criteria of the Quality Seal for Sustainable Housing (NaWoh) [5] will be examined to determine which requirements can be usefully adopted or adapted and which ones need to be newly developed.

In addition to the "set of rules", procedures and implementation options are also developed, in which, for example, procedures, evaluation criteria and working aids are presented. The assessment standards and benchmarks are to serve, among other things, as a basis for evaluating sustainability in federal housing construction.

3. Results

As a result, proposals for the updating and optimization of existing regulations have been developed with the aim of introducing minimum requirements to ensure sustainable construction within the framework of public housing construction programs. The results will be transformed into a systematic sustainability assessment for new residential construction, the nature and scope of which will be based both on practical considerations and on the basic principles of the national sustainability strategy. As a result, methods and minimum requirements for the implementation of sustainable construction should be available for public housing that ensures a comparable sustainability standard as for other federal buildings.).

3.1. Sustainability and climate protection goals

The "Climate Protection Plan 2050" [4] adopted by the Federal Cabinet describes interim targets and measures to implement the Paris Climate Protection Agreement. The objectives of the climate protection plan 2050 include in particular that

- the building stock becomes almost climate-neutral,
- settlement structures are designed to be energy-saving and compact,
- highly efficient heating networks are used,
- green buildings (roof, facade) can be implemented,
- building materials/building materials are selected in consideration of the life cycle assessment,
- modular, serial construction methods can be implemented,
- comfortable and age-appropriate apartments are provided,
- a pedestrian, barrier-free/poor accessibility and an environmentally friendly choice of means of transport are possible
- green areas and social meeting places are planned.

"Nearly climate-neutral buildings" are defined in the Climate Protection Plan 2050 in such a way that these buildings have a very low energy requirement, the remaining energy requirement is covered by renewable energies and other greenhouse gas emissions are avoided. In addition to "climate-neutral buildings", the Federal Ministry for Economic Affairs and Energy (BMWi) defines within the brochure "Energy Efficiency Strategy for Buildings" [6] that the primary energy requirement is to be reduced by a combination of energy saving and the use of renewable energies in the order of 80 percent by 2050 compared to 2008. The Federal Building Ministry, in addition to considering the energy requirements of buildings for heating / cooling and electricity, also wants a focus on building materials. These are not considered in the strategy of the BMWi, as they are assigned to a different sector.

The existing criteria from the evaluation systems under consideration were assigned to the respective objectives.

Laws, ordinances and standards already partially prescribe the implementation of the above-mentioned requirements. However, these regulations need to be further specified and tightened for the building stock in view of the implementation of the Climate Protection plan 2050.

3.2. Principles of the German evaluation methodology

During the development of the Sustainable Building Assessment System (BNB) [2] by the Federal Ministry of Construction in cooperation with the German Sustainable Building Council (DGNB) in the period 2007 to 2009, specifications were also made on the basic approach to the assessment of buildings.

These include:

- Holistic assessment
- Life cycle assessment
- Performance orientation

The holistic assessment of buildings (simultaneous and equal consideration of the different areas of sustainability: ecology, economy and socio-cultural aspects, supplemented by technical properties and processes) was derived from definitions already established, e.g. Brundtland Report [7].

The effects in the life cycle of the building through various specifications from the energy concept, through the selection of building materials or, for example, through the size and arrangement of window areas should be investigated and evaluated during the planning phase. In this way, optimisation possibilities can be identified and implemented, for example with regard to environmental impact and life cycle costs.

The "performance" of buildings is determined on the basis of criteria (for which evaluation standards with characteristic values have been defined) - and thus enables the comparison of different buildings of the same use. For the assessment according to the BNB, compliance with legal requirements is generally assumed. By means of calculations, measurements and the designation of certain properties (e.g. proportion of barrier-free accessible areas, results of indoor air measurements), the characteristic values of the building are determined and compared with specified requirement values. Where possible, established standards and guidelines are used for this purpose. In some cases, the company has developed its own calculation methods for evaluation and has determined and specified the benchmarks on the basis of studies of sample buildings. A distinction is made between quantitative criteria (e.g. number of bicycle parking spaces) and qualitative criteria. In the case of the qualitative criteria, the requirements are described as "selection catalogues" with possible measures, for example the equipment of the bicycle parking spaces with roofing and lighting.

The BNB thus also serves as a quality assurance instrument and to create transparency: measurable or verifiable characteristics of buildings can be defined at the beginning of the project (can be "ordered" by the client). The gradation of objectives / requirements between a limit value via a reference value to the target value is intended to describe realistic and achievable properties, but also to indicate possibilities for improvement (ambitious objectives). The implemented sustainability qualities can then also be checked for completion and the building can be awarded a certificate. Supplementary minimum requirements and award levels have been defined for certification.

Similar considerations were also the basis for the development of the Quality Seal for Sustainable Housing (NaWoh) [5]. Here the focus was placed on a quality seal. In order to better communicate the qualities of multi-family houses to builders and users, the order and designations of main criteria groups were changed in comparison to the BNB (e.g. "housing quality" as the first instead of "socio-cultural and functional quality" as the third main criteria group in the BNB). Therefore, characteristics such as floor plans and equipment of the dwellings and associated open spaces are shown first, followed by characteristics such as results of indoor air measurements. Aspects of the technical quality of the buildings are followed by more detailed calculations of the life cycle assessment and life cycle costs.

In NaWoh, building characteristics and measures are shown on the basis of three evaluation levels or as characteristics to be described. The evaluation philosophy of the Quality Seal NaWoh is characterised by the system carrier as follows [8]:

- Orientation towards the requirements of portfolio holders
- Approach Quality Seal (similar to Blue Angel or TÜV)

- Combination of seal and strengths profile
- Not part of the BNB system family
- Signal for sustainability, quality and transparency
- Complete processing of all topics
- Compliance with all minimum requirements
- Voluntary process
- Concentration on new construction measures
- Orientation towards standards, regulations and laws
- Avoidance of additional normative specifications
- High proportion of descriptive elements

In order to improve transparency, the results of the description and evaluation are given in detail and summarised in a strength profile. Compliance with the description criteria and quality requirements is subjected to a completeness and conformity check and confirmed with a certificate.

3.3. Modification and addition of criteria for the evaluation of new residential buildings

For the evaluation of new residential buildings, it should be possible to identify the overall quality achieved. The basic approach of the BNB and NaWoh should also be applied to the future valuation of residential buildings.

The described partial aspects from the climate protection plan 2050 were compared to the already existing evaluation systems. The evaluation systems cite, for example, the life cycle assessment and systematic commissioning as measures whose implementation will enable the achievement of an almost climate-neutral building stock.

For the upcoming update and addition of a sustainability assessment for new residential buildings based on current requirements, the assessment criteria can be designed according to these three methods:

- Performance-oriented
  (Effect- and result-oriented: primarily specification of characteristic values to be achieved such as kg/CO2 equivalent or transmission heat loss, etc.)
- Interaction-oriented
  (Consideration of specifics of the location, general conditions, conflicting goals, etc., among others via concepts)
- Rating Tool/Strength Profile
  (Checklists for evaluation, with measures for selection, catalogue of possibilities, etc.)

All three methods are used in the BNB and NaWoh evaluation systems, as it is not possible to define characteristic values for all aspects of sustainability. This is due, for example, to the different framework conditions of construction projects (example: minimum amount of electricity that can be generated on the building depending on location, orientation, shading, roof/outer wall surface, admissibility of PV systems, etc.). Via the criteria of process quality, steps for implementing the sustainability criteria and dealing with interactions between the individual requirements are included.

It should also be noted that the measures/evaluation criteria are also to be considered under the aspects of economic efficiency and technology openness must be defined. This is taken into account in the evaluation systems by, among other things, specifying requirement values which have been tested on pilot projects and which can be achieved by various measures.

With regard to the requirements for comfortable and age-appropriate housing or pedestrian, barrier-free/low accessibility and environmentally friendly choice of transport, the evaluation systems already focus on user comfort (thermal, visual), the quality of indoor and outdoor living, accessibility and safety. It is recommended that not only the individual building is evaluated, but that the direct surroundings or

the urban district are also included in the analysis. The system boundary still needs to be checked when the individual sustainability criteria for new residential buildings are defined.

Proposals for adoption of criteria (BNB / NaWoh) for new residential buildings:

- Life cycle assessment (incl. global warming potential, primary energy demand and generation of renewable energy)
- Risks for the local environment / avoidance of pollutants
- Sustainable material extraction / use of certified wood
- land use and sealing
- Building-related costs in the life cycle
- Space efficiency, adaptability/space ratios, functional quality of the dwellings
- Thermal comfort
- Indoor air hygiene, indoor air quality
- Lounge qualities / Outdoor seating, Outdoor space, Open spaces
- Accessibility
- Mobility infrastructure / parking spaces
- Design and urban development quality
- Heat and condensation protection / Energy quality, airtightness of the building envelope
- Dismantling, separation and recycling / Dismantling and recycling friendliness of the building structure
- Resistance to natural hazards / reaction to site-specific conditions / durability
- Ease of maintenance / retrofitting of the TGA
- Quality of project preparation
- Conditions for optimal management
- Quality assurance of construction / measurements
- Systematic commissioning / start-up, adjustment

Proposals for additions and adjustments to the criteria for new housing (Building):

- Implementation of possibilities to avoid the cooling of buildings (including avoidance of the use of halogenated refrigerants)
- Measures to reduce effects on the microclimate
- Measures to promote biodiversity through building measures
- Use of resource-saving and reusable building materials
- Measures for climate impact adaptation (e.g. heavy rainfall events)

Extension of consideration to surroundings / neighbourhood:

- Energy supply concepts at neighbourhood level (e.g. decentralised heating networks), incl. sector linkage (e.g. e-mobility)

3.4. Adaptation of public support programmes for sustainable housing

At present, state funding is provided under the known funding programmes as Grant (with a fixed amount or a fixed maximum amount) or by subsidised loans (to finance mostly technical measures). The grants can be used for the following measures:

- Use of consultancy services (e.g. as a quality assurance measure)
- Implementation of individual measures (e.g. for the use of sustainable building materials)
- Implementation of a building certification

Based on the requirements for sustainable new housing developed in the current project, the next step will be to develop proposals for subsidy topics for new housing that can be included in existing or new subsidy programmes in the future. Here it is still open, in which form the topics will be integrated into

the promotion programs. It is to be investigated whether these should be treated as a separate funding topic or whether they should be integrated as building blocks in existing funding programmes.

4. Conclusion

In order to reduce the lack of affordable housing in many large German cities and conurbations, the aim is to promote housing construction that is affordable for broad sections of the population. The principles and requirements laid down in the national guideline on sustainable construction are to be applied to housing construction, taking into account economic and social framework conditions, in order to achieve the climate protection targets adopted by the Federal Government and thus make a significant contribution to sustainable cities and municipalities.

This research project has shown that large parts of the sustainability and climate protection goals can already be covered by updating and supplementing existing sustainability requirements. To this end, existing sustainability assessment systems such as the Sustainable Building Assessment System (BNB) or the Sustainable Housing Quality Seal (NaWoh) were evaluated. In a first step, these were used to develop generally applicable requirements for sustainable new housing construction which can also ensure that the federal government sets an example for housing construction. Since the more comprehensive BNB system was developed for non-residential buildings, the individual criteria had to be analysed with regard to their applicability to housing construction. Subsequently, it was examined how these different systems could be brought together in an updated evaluation system for new housing construction. Newly added aspects such as biodiversity at the location or the consideration of neighbourhoods were included.

In a further step, the results of this project will be discussed with the stakeholders in order to achieve a broad application. Furthermore, new support programmes for public housing construction are to be developed.

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