Investigation of the BNB Building Certification for the Further Development of the Energy Performance Certificate

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Abstract

In this study, a life cycle oriented planning of buildings is proposed to support future building developers and planners in making environmentally sound decisions on the basis of comprehensive information. The study, in which the building certification BNB (Bewertungssystem Nachhaltiges Bauen, or “Assessment System for Sustainable Building”) is carried out on the example of an office building, is applicable to German-speaking countries. In addition to meeting the requirements of the 2020 German Energy Act for Buildings (GebäudeEnergieGesetz, GEG), the aim is to optimize the building with regard to sustainability criteria of the BNB by revising and expanding the existing planning so that the “gold” quality label can eventually be achieved. The biggest influence on this optimization process is, among other things, the life cycle costs, the adaptability of the building, the primary energy demand as well as the technical quality. Based on these findings, this research paper details the further development of the energy performance certificate, before in a final step the building assessment can be graphically presented with regard to both aspects – energy efficiency (final energy) and sustainability (in terms of ecological, economic, socio-cultural, functional and technical quality, process quality and location characteristics) – from the production phase through the usage phase up to the disposal phase.

1. BNB System Building Certification

In today’s construction industry, the topic of sustainability is becoming an increasingly significant basic principle, which is leading to a steady increase in environmental awareness in this sector. The objective of the various certification systems is to allow an assessment of the sustainable quality of “green buildings”. Across all life cycle phases, environmentally friendly buildings are certified in their planning, construction and operation phases based on pre-defined benchmarks.

The BNB certification system is an instrument that provides measurable and verifiable criteria for the assessment of construction measures. The sustainability criteria are assessed in six distinct sections (ecological quality, economic quality, socio-cultural and functional quality, technical quality, process quality and location characteristics).

Criteria have been developed and established for office buildings, classroom buildings, laboratory buildings and outdoor facilities. Internationally, there are many certification systems that share the same objective, despite their different approaches. The BNB system can be used to lay the groundwork for the further development of the energy performance certificate, so that in the future this knowledge can also be transferred and adapted internationally.
2. Investigation of the planned office building

To facilitate a better understanding, this figure shows the examined 3-storey office building in Brandenburg (Germany), which is planned as a new building construction with a ground floor, upper floor and attic floor. It is fitted with a gas condensing boiler for heating and hot water supply, as well as with a south-facing photovoltaic system. The building shell is planned as an External Thermal Insulation Composite System (ETICS) and does not have a cellar.

On 1 November 2020, the new German Energy Act for Buildings (Gebäudeenergiegesetz, GEG) entered in force, replacing the previously applicable Energy Conservation Act (Energieeinsparungsgesetz, EnEG), Energy Saving Ordinance (Energieeinsparverordnung, EnEV) and the Renewable Energies Heat Act (Erneuerbare-Energien-Wärmegesetz, EEWärmeG).

After carrying out the energy assessment according to the GEG, and meeting the specifications contained therein for the energy-related building quality, for issuing and using energy performance certificates and for using renewable energies in buildings, the resulting primary energy demand on the energy performance certificate is well within the green range.

However, because other sub-categories of certification only achieve a mediocre score, the office building receives only the quality seal “bronze”. Other factors, including technical quality, adaptability, life cycle costs and the primary energy demand, have a significant influence on the awarding of the quality seal. This research paper shows how these key factors to be used to gradually achieve better results for the building based on different variants, thus helping to attain the “gold” quality seal.

2.1. Steps toward the “gold” quality seal

The first variant pertains to the area of building technology. The installed gas condensing boiler generates its energy from fossil fuels, i.e. non-renewable energy sources. In order to reduce the impact on the global and local environment and minimize resource consumption, an improved heating technology is used, for example a heating system based on heat pump technology. This results in a reduction in energy consumption and lower associated heating costs.

Another important factor is the building envelope. In order to create an ecologically high-quality building, the construction materials must in the long run show a positive ecological balance for the local environment across all life cycle phases, from production of the construction material to its disposal. This is why hazardous construction materials were replaced with products that are more ecologically sound. Additional small adjustments were made, taking into consideration such aspects as adaptability, technical execution or dismantling, materials separation and recycling.
3. Further development of the current energy performance certificate

The energy performance certificate has been gradually introduced since 2002 to facilitate the comparison of real estate properties. A distinction is made between demand and consumption certificates. The demand certificate is mandatory for new buildings. In this case, the “theoretical” energy consumption is determined, which is independent of the usage behavior of a resident. The primary energy and energy values calculated are depicted as follows:

This color-coded classification system allows interested parties, in particular those with limited technical background, to gain an overview of the energy budget of a real estate property.

While the energy savings regulations and laws have been steadily adjusted over the past 20 years, the energy performance certificate as a graphic representation has remained the same, with no progress made to renew or update it. Despite the fact that it is now mandatory to provide the energy performance certificate when real estate is sold or leased, and that failure to issue one can lead to fines being imposed, the energy performance certificate has not established itself to a sufficient degree. Currently, the energy performance certificate only depicts the usage phase of a building, which essentially means that only the annual energy values of the building’s technical systems of heating, hot water, ventilation, cooling or, in the case of non-residential buildings, also of the lighting, are taken into consideration. The construction elements play an indirect role, since these are also dependent on the building envelope, but the production and disposal of these elements is not taken into account. The 2020 German Energy Act for Buildings (GEG), at least, introduced the CO2 equivalent as a sustainable aspect – although naturally only for the usage phase.

Based on the reasons stated above, this research paper aims to expand or adjust the current energy performance certificate through a holistic view across all life cycle phases of a real estate property. This will ensure that in the future, buildings are not only comparable in their usage phase, but throughout all life cycle phases, from production to use, dismantling and recycling. In addition to the building envelope, the assessment also takes the building’s technical fittings into account. The assessment of the building envelope entails the ecological quality of the building materials used, from production phase to the dismantling of the materials. The depiction of selected and important aspects of technical quality such as sound insulation, moisture protection or also indoor air hygiene and thermal comfort, is meant to round off the assessment of a building and add the consideration of energy consumption and CO2 equivalent levels to the assessment. Since the cost aspect also plays a growing role for the operator of a building, the life cycle costs should also be included in the assessment.

This expanded range of information about a building, in addition to the standard information about energy consumption, can help buyers, renters or operators of the respective real estate property make necessary decisions.

References

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