

## **BUILDING CERTIFICATIONS – TOOLKITS FOR IMPROVEMENT AND LESSONS LEARNT**

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### **Summary**

Certificates that address the sustainability of buildings are applied more and more in Europe. These certificates – e.g. according to DGNB – are based on a set of sustainability indicators for which evaluation methodologies are defined. These indicators give guideline on the selection of relevant sustainability impacts and on how to address expected impacts in the planning and execution phases of a building's development. The authors discuss the factors for when certification leads to improved building sustainability performance. One focus will be on the coherent use of assessment tools during the development phases, e.g. for building life cycle assessment.

**Keywords:** Certification, DGNB, LCA

### **1 Introduction**

In 2007 in Germany the German Green building council (DGNB – Deutsche Gesellschaft für Nachhaltiges Bauen) was founded. In an interdisciplinary process a holistic building rating scheme was established [1]. From this first generation rating schemes experiences could be collected, existing gaps could be identified and out of that learning process a performance oriented second generation rating system could be developed. The system is mainly targeting on the creation of sustainable buildings. Additionally the consistency with European and international standardisation and legislation was an important issue. The system allows permanent development of each criterion according to state of the art and legislation. This enables continuously integration of new research results, extension with new criteria, and the adaptation of benchmarks according to higher standards and legislation. Six groups of criteria have been identified. Beside the three classical columns of sustainability which are ecological quality, economical quality, and socio-cultural and functional quality, technical quality and process quality have been considered as important criteria groups. Additionally the quality of the site is assessed. The system allows an overall evaluation of buildings and also provides a bundle of tools (Life Cycle Assessment, Life Cycle Costing, various simulations regarding thermal, acoustic and visual behaviour, etc) which can be used in the integral planning process to ensure high quality of the building by providing measurable indicators which support an optimisation of the building during the planning process. For quantification of the rating system around 50 characteristics have been elaborated, which are evaluated by indicators, target values, bench marks, and criteria.

This results in a rating system which allows independent from operational implementation and management the measurement and controlling of the building performance with a life cycle perspective. Using the system in this way the tool becomes a guideline from developing the idea of a building until final disposal. Therefore the DGNB system offers the important added value of building optimisation and quality control over the whole life cycle of the building.

## **2 Description of the building rating scheme**

The rating scheme is based on the main target of protection of mankind. Based on that areas of protection can be identified which are health, natural environment, natural resources, economical aspects and socio-cultural aspects. The building sector is important in the field of ecology because of high consumption of resources; in the field of economy because of costs for construction and operation of buildings; in the socio-cultural field. To fulfil all this requirements a building needs to have high technical quality. A precondition to reach all this targets is a high process quality in a life cycle perspective from initial planning phase until final disposal or recycling of the building and its components including the occupied land. Because all this categories have the same importance under the aspect of sustainability they all have the same weight in the rating scheme. Therefore environmental quality, economical quality, socio-cultural and functional quality as well as technical quality are weighted with 22,5 % each.

## **3 Criteria Groups and their interdependencies**

The building rating describing the building performance is structured within five criteria groups with the weighting described above. Between this criteria groups interdependencies are existing, for instance higher comfort and ecological quality may result in higher construction costs but possibly lower operation costs. To have a basis for decision in an early planning phase first evaluations and simulations shall be done as early as possible. So a quality standard of the building can be set up in an early stage and controlled over the whole life cycle. It is logic that only in the planning stage changes can be made easily without causing high costs.

### **3.1 The ecological quality**

Main point of ecological quality is the Life Cycle Assessment for the whole building. LCA includes all processes from gathering raw materials to final disposal for all materials and for energy demand of a building. In the DGNB system the environmental impact categories Global Warming Potential (GWP), Acidification Potential (AP), Eutrophication Potential (EP), Ozone Depletion Potential (ODP), and Photochemical Ozone Creation Potential (POCP) are considered. Additionally from Life Cycle Inventory Primary Energy demand renewable and Primary Energy demand non renewable are assessed. LCA shows the contributions of all life cycle phases of the building.

For instance it is possible to track the contribution of each single material and all the energy demanding system components. So LCA supports the design of the building regarding energy performance (change of house technical systems, of energy carriers, influence of solar systems etc.) as well as the selection building materials, how they are

connected and how they are treated in the End of Life processes. All these calculations and simulations shall be done in an early planning stage to be able to do efficient optimisation of the building and its performance. Life Cycle Assessment shall be combined with Life Cycle Costing in order to have also information about costs over the whole life cycle. This is very useful for comparison of various energy providing systems in order to recognise the economic payback period of new innovative systems.

Another important ecologic criterion in addition to LCA is the toxic and chemical evaluation of materials used. Materials are classified according to their emissions (e.g. VOC, formaldehyde, etc.) or content of problematic substances (heavy metals, halogenated blowing agents, pesticides, etc.) aiming in protection of workmen and for protection of the health of inhabitants. If zero or at least low emission materials are used high indoor air quality can be expected. Additionally in further criteria the legal and sustainable origination of materials, the water consumption, the land use (quality and quantity), and, the influence on the micro climate is evaluated.

### **3.2 The economical quality**

The Calculation of Life Cycle Costs (LCC) includes the costs of construction and the costs for operation (Energy, water supply and disposal, cleaning, energy used and probably produced, maintenance and renewing of the building and technical equipment itself). Applied calculation methodology is the cash method. So payments in future are discounted according to expected inflation rate. Variations in discount rates and their influence can be checked easily. The considered temporal system boundary is like in LCA 50 years for office buildings. There is a close connection of Life Cycle Costing and Life Cycle Assessment. An additional criterion is the stability of the economic value of the building over the time. The buildings space efficiency is checked, also aspects of flexibility and possibilities for the change of use of a building is checked.

### **3.3 The Socio-Cultural and Functional quality**

Health, comfort, and user satisfaction covers aspects of indoor air quality and comfort as well as user-friendly equipment. It also considers the connection between interior space and outdoor space respectively quality. Functionality covers the aspects of fulfilling the necessary functions of the building, accessibility, barrier free design, area efficiency, possibility of change of use, flexibility. High quality planning performance is a pre condition to fulfil these criteria and these aspects are important for rent ability and productivity in the case of a commercial used building like an office building or trade building.

### **3.4 The Technical quality**

The quality of technical realisation is a precondition for high functional and socio-cultural quality (e.g. subsonic and airborne noise insulation, thermal insulation, protection from humidity, avoidance of thermal bridges, etc.) and has influence on costs (possibly increase construction costs and decrease costs for operation and maintenance). This also influences the materials selection and the energy demand, which is evaluated with LCA. There is also a connection to recyclability, which is also a component of the technical quality.

### **3.5 The Process quality**

High quality planning and realisation of a building is a precondition for the creation of a sustainable building. The system differentiates between planning processes and realisation processes. The planning process is the key process over the whole life cycle; therefore the system puts a special focus on process quality. The evaluation of the quality of the planning process already starts with first steps of preparation of the development of the building. This is before any design processes itself are starting. Important is to have an interdisciplinary organised integral planning process from the beginning. All planning experts have to join the planning process from the beginning and bring their expertise into the project. In this stage the DGNB system can be used as a comprehensive guideline used as a planning tool coordinated by the sustainability consultant. If no certification will be done at the end the DGNB system at least serves as a quality control tool and when the building is finished a comprehensive documentation of the whole building is available what is useful for the sales process and for operation of the building.

## **4 Criteria Groups and their interdependencies**

If the DGNB system is used only as a planning tool the result besides planning guideline and quality control is a comprehensive documentation for operation of the building. This is also the added value of the DGNB system: it is more than only the certification of a building. If the building shall be certified the documentation has to be handed over to an independent reviewer in order to do a critical review of the documentation. According to the performance of the building for each criteria points are calculated which finally results in a percentage value.

## **5 Conclusion**

The DGNB and other certification schemes system provide on the one hand side a planning tool and guidelines for all processes over the whole life cycle of the building and on the other hand side provides general information about the quality of the building for each criteria in a transparent way which may support the owner of a building in many issues.

## **Literature**

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