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# Fostering the Integration of Circular Economy Aspects into the Construction and Real Estate Industry

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**Abstract.** The conscious use of natural resources has always been a key concern of the German Sustainable Building Council (DGNB) since its foundation in 2007. In order to further drive forward this topic and to foster a more circular resource use within the construction and real estate industry, the DGNB has integrated circular economy bonuses into the current version 2018 of the DGNB System, providing a positive impact on the overall certification outcome. The DGNB System is thus the first of its kind to make circular economy principles an assessable and measurable aspect of buildings. The circular economy bonuses range from the reduction of the material input and the avoidance of waste through the reuse and recycling of building components up to the implementation of sharing models leading to an increased usage intensity of the buildings. In close cooperation with its members, the DGNB has developed a guideline on the integration of circular economy aspects into the construction and real estate industry. The guideline published in January 2019 provides examples of putting these aspects into practice and encourages planners to integrate innovative and circular building solutions into the planning of sustainable buildings.

## 1. Introduction

The German Sustainable Building Council (DGNB) was founded in 2007 and has since then turned into the German and international knowledge platform for sustainable building. With more than 3,000 pre-certified and certified projects worldwide, the DGNB Certification System is considered as a global benchmark for sustainability. Given its experience and its broad network representing the entire value chain of the construction and real-estate sectors, the DGNB sees it as its duty to go one step further and to assume a leading role in fostering the transformation towards a circular built environment.

As a first step, the DGNB has introduced Circular Economy bonuses into the current version of its certification system, awarding bonus points for integrating Circular Economy aspects into building projects. As a further step, the DGNB has published a guideline on the integration of Circular Economy aspects into the construction and real estate industry in order to highlight the potential of this economic model for the built environment and in order to promote its actual implementation into the building practice[1]. Addressing manufacturers and planners in particular, the guideline gives a detailed introduction on the relevance of the Circular Economy and provides a toolbox with pragmatic recommendations for action while displaying examples and case studies of circular solutions that have already been realized in the built environment.



### 1.1. The sustainability concept of the DGNB

Since the foundation of the DGNB, a holistic approach based on the entire life cycle of a building has been the foundation of its sustainability concept, assessing the overall performance instead of individual measures. Within this approach, ecological criteria are given as much importance as economic criteria as well as sociocultural and functional aspects. Going beyond the traditional three pillar sustainability concept, it furthermore includes the assessment of the technical, process and site quality of a building.



**Figure 1.** The sustainability concept of the DGNB.

### 1.2. Relevance of the Circular Economy

Taking into account the enormous impact of the construction and real estate industry with regard to resource consumption and waste generation on one hand and the limited availability of natural resources on the other hand, the current linear economy which is based on the infinite continuation of resource consumption and waste generation, can no longer be aspired to. Instead, the promotion of a more responsible resource use – as pursued by the circular model – is crucial for a future-proof built environment.

The concept of the circular economy is based on the “cradle-to-cradle” school of thought [2]. The objective is not only to minimize the negative impact or negative environmental footprint, but to make a positive contribution. Waste generation is avoided by leading raw materials in cycles and use them in order to create new materials or products. The concept differentiates between a biological cycle, where resources are compostable and compatible with health and continuously renew, and the technical cycle, where resources are repaired through human influence. [2]

Based on this concept, the Ellen MacArthur Foundation defines the following three characteristic principles of the Circular Economy: [3]

- Limiting and controlling the use of finite resources,
- closing material, component and product cycles through reuse and recycling
- and consequently internalizing external effects.

Within this economic model, resource consumption is substantially reduced in the first place. Once resources have been integrated into the cycle, they are used and reused at the highest possible quality level as long as possible, before they are finally being recycled, again at the highest possible quality level. In following these principles and implementing the Circular Economy, waste generation is largely avoided.

## 2. Circular Economy and the DGNB

### 2.1. Circular Economy aspects within the DGNB system

In the current discourse on Circular Economy, circular principles often seem to be absolutely new and innovative. However, the concept is rather based on a holistic approach which is why many of these aspects have been fundamental concerns of the DGNB system since its very beginning. For the current version of the certification system, however, this topic has systematically been developed and established more firmly in the system by introducing Circular Economy bonuses. These bonuses allow circular solutions at building level to be assessed and measured, rewarding their implementation with a positive effect on certification results. A Circular Economy bonus is granted in the form of bonus points which are added to the regular points obtainable within one criterion (for a majority of the DGNB criteria, 100 points are achievable). The twelve available Circular Economy bonuses are displayed in the table below.

**Table 1.** Circular Economy bonuses within the DGNB Certification System [4].

Criterion Name	Contribution To A Circular Economy	Score
Land use	Brownfield redevelopment: Land that is subject to low-level or significant contamination is considerably improved by <b>properly disposing of the soil and sediment</b> on the land.	CE bonus: +5 points (low-level contamination), +10 points (significant contamination)
Life cycle cost	Reuse: It can be demonstrated that a significant proportion of <b>building components have been reused</b> in the building or used in line with business models based on the idea of a circular economy (e.g. performance contracting with a strategy for recycling or reuse).	Maximum CE bonus: +10 points, plus 5 bonus points for every circular economy solution implemented.
Flexibility and adaptability	High intensity of use: For at least 50% of the building's usable area, area usage concepts that allow for a <b>higher intensity of use</b> (in the form of a higher number of users or different usage times) have been implemented.	CE bonus: +10 points
Commercial viability	Circular economy users, tenants or hirers: At least one company/party actively contributes to a circular economy as <b>users/tenants/hirers</b> of the building. This occurs in the building itself or at the site by means of joint <b>material flow management</b> or similar forms of collaboration with another company/party within the near vicinity of the building.	CE bonus: +10 points
Use and integration of building technology	District-level solution for renewable energy: To cover the energy demand in the building that arises from the running of the building and from user actions, energy that is generated in the surrounding <b>district</b> /in the immediate vicinity from <b>renewable</b> energy sources (at least 10% of the energy demand arising from the running of the building) is always used. Alternatively, energy that is generated in the building or on its land from renewable energy sources is fed to the district/the area in the immediate vicinity (at least 10% more than the energy requirements arising from the running of the building).	CE bonus: +10 points

Criterion Name	Contribution To A Circular Economy	Score
Use and integration of building technology	Energy system that provides ancillary services to the electrical grid: The building provides significant <b>storage capacity</b> (based on approx. 10% of the building's total energy requirements) for the purpose of <b>grid compatibility</b> or uses integrated energy and load management.	CE bonus: +10 points
Deconstruction and recycling	Reuse or material recycling: <b>Building components are reused</b> in the building or building components are used for which there is documentary evidence to show that <b>the materials from which they are made are currently recycled</b> into comparable products.	Maximum CE bonus: +20 points (1 point per building component)
Deconstruction and recycling	Eliminating building components: The building is designed so as to <b>completely eliminate building components</b> that are usually installed for this purpose. The solution presented is a feasible one that significantly and demonstrably eliminates the need to use raw or secondary materials.	Maximum CE bonus: +10 points (1 point per building component)
Mobility infrastructure	Mobility sharing: The building has designated <b>mobility-sharing</b> parking spaces that are easily accessible or very near the building's entrance. Alternatively, the building is located within an area in which a free-floating car-share service operates.	CE bonus: +10 points
Sustainability aspects in tender phase	Recycling materials: The <b>invitations to tender</b> do not specifically forbid the use of mineral <b>recycling materials</b> ; with regard to the building products, the reuse or use of secondary materials is explicitly recommended or required by the invitations to tender.	CE bonus: +10 points
Construction site/construction process	Waste prevention on the construction site: Innovative concepts, construction methods or technologies that significantly <b>reduce the amount of waste generated</b> are used on the <b>construction site</b> .	CE bonus: +10 points
Access to amenities	Facilities that cater for people's day-to-day needs and provide meeting points for interaction: In or near the building, innovative <b>amenities or provisions</b> for the building's users or other people are built or provided, such as allotment gardens and beehives (urban farming), or spaces are provided on a permanent or regular basis for <b>trading skills or services with others in the community</b> , e.g. temporary trading spaces/pop-up shop premises, repair caf��s, community meeting places.	CE bonus: +10 points

## 2.2. DGNB guideline to foster the integration of Circular Economy aspects into the construction and real estate industry

The above described bonuses serve as incentives for the implementation of circular aspects in actual building projects. Breaking down the rather abstract model of Circular Economy into achievable and assessable measures to implement in the construction sector is a first step in order to establish them in the building practice. However, the transformation towards a Circular Economy must be accompanied by comprehensive information for all stakeholders of the construction and real estate sector in order to raise awareness and foster a broad understanding of the topic's relevance. The DGNB therefore published a guideline providing further instructions and guidance on how to actually bring these aspects into practice.

**2.2.1. Objective and added value of the guideline.** The guideline aims at providing all stakeholders of the construction and real estate sector with a comprehensive overview of what the Circular Economy is and why its implementation is especially important within the built environment. Stakeholders are given practical tools for their daily work by means of a toolbox which consists of the following three elements:

- **Strategic action areas:**  
Several strategic action areas are displayed along with the associated challenges and necessary steps for the individual stakeholder groups involved in the construction process (e.g. planners, manufacturers, public domain and further).
- **Impulses and examples for practical implementation in design:**  
Suggestions and ideas on how to integrate Circular Economy aspects into actual construction projects are shown in the form of practical examples realized in the built environment in order to encourage planners and manufacturers to find new solutions and try out new approaches – from a flexible building structure up to innovative materials.
- **Checklist for individual projects:**  
In order to support planners and manufacturers to take into account Circular Economy in each phase of a construction project, they are provided with a checklist addressing possible measures to be implemented according to the individual stages of a project. The checklist, which can be used separately and be considered for each project, is meant to provide guidance and set incentives for designers to make circularity an essential element of the design and construction process.

**2.2.2. Target groups of the guideline.** While serving as a basis of information for any stakeholder involved in the construction process who is interested in the Circular Economy, the guideline addresses manufacturers of construction products and planners in particular. Manufacturers are given a broad overview of the future developments regarding the Circular Economy as the guideline identifies the challenges, but more importantly the opportunities this economic model brings along with respect to innovative business models and future market opportunities. Furthermore, the guideline provides planners with tangible and pragmatic solutions for realizing circular aspects on building, component and material level, displaying the relevant parameters of a circular building.

**2.2.3. Focus topic of the guideline.** One important lever for a more circular built environment is the consistent consideration of a building's eventual deconstruction already during the planning stage. In order to successfully implement the constant circulation of resources, it is crucial to ensure that those materials that are brought into the "urban mine" today, can be disassembled and separated by type at the end of the building's lifecycle. The ease of recovery and the actual material separation represent a fundamental prerequisite for a high-quality reuse of building components and recycling of building materials. In order to prepare a future disassembly adequately, it is furthermore important to document the substances contained in the built-in components as well as suitable reuse possibilities and recycling paths. Even though the disassembly and deconstruction of buildings represents, the main topic of the guideline, the above described individual tools of the toolbox are also provided for the topic of Spacesharing / Multi-use of areas.

### 2.3. Outlook.

Building on the described activities, the DGNB will follow up the topic of Circular Economy in the coming years more intensively, build up knowledge and disseminate it. In order to do so, the DGNB Toolbox will be developed as an online platform which will be continuously extended and complemented with further examples and focus topics. As a next step, the DGNB is currently developing a new certificate for the disassembly and recovery of buildings and districts in close cooperation with its members.

### 3. Conclusion

In order to ensure a conscious resource use and limit waste generation in the built environment, the implementation of a Circular Economy model in the construction and real estate industry is crucial. With the integration of Circular Economy bonuses into its certification system and thus the introduction of measurable incentives, the DGNB has taken an important step towards a more circular built environment. The DGNB as a central knowledge platform for sustainable building strives to take over a leading role in order to further promote this transformation. A guideline on Circular Economy published in January 2019 provides stakeholders involved in the construction process with pragmatic recommendations for action and feasible solutions for integrating circular aspects into the design process of future-proof buildings.

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