Implementation of the DGNB Framework for Carbon Neutral Buildings and Sites

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Abstract. With more than 30% of the total global greenhouse gas emissions generated from the constructions sector, fostering sustainable buildings is one of the key levers in order to address the highly urgent topic of climate change. The German Sustainable Building Council (DGNB) is striving to make a significant contribution to the achievement of the national targets defined in the Paris Agreement in order to limit global warming to well below 2°C. The key to achieving these targets for the building sector lies in fostering climate neutral operation of new construction and, even more challenging, in realizing a carbon neutral building stock by 2050. With the discussion paper for a new format of the German Energy Code “GEG 2050” claiming the introduction of a „Building Emissions Law 2050“, DGNB has started a much-needed debate on shifting the focus of performance metrics from “primary energy demand” to “CO₂-emissions”. In order to translate the requirements into building practice and to make their implementation assessable and measurable, the DGNB has developed a “Framework for Carbon Neutral Buildings and Sites”, which includes three main parts: 1. Carbon Accounting Rules defining consistent calculation rules for buildings and sites, 2. Carbon Disclosure Rules with specific rules regarding the type and the content of the communication towards the customer and 3. Carbon Management Rules establishing a roadmap to carbon neutral building operation (“Klimaschutzfahrplan”) that demonstrates a net zero carbon balance by latest 2050, using a linear trajectory to zero from today onwards. The Framework has been published as a preview version in May 2018 and now is currently being revised within a pilot phase.

1. Introduction

As German and international knowledge platform for sustainable building and provider of one of the leading certification systems worldwide, DGNB can look back on ten years of experience and more than 3,000 pre-certified and certified projects worldwide. Climate protection is an essential topic to be considered regarding the certification of sustainable interiors, buildings and districts. Therefore, the ambitious assessments of the DGNB System have always been based on the entire lifecycle of a building, including both embodied and operational carbon emissions. In May 2018 DGNB has published the Framework for Carbon Neutral Buildings and Sites in order to make a significant contribution to achieving carbon neutral building operation for new construction by latest 2030 and 2050 for the remaining building stock.
2. Objectives and Target Groups of the Framework

The intention of developing a Framework for Carbon Neutral Buildings and Sites was, to translate the commitments of the Paris Agreement from 2015 into specific actions of the building industry and to make these actions measurable by using actual projects as a basis. Recent studies, such as the study “Klimapfade für Deutschland” [1] which describes a nearly zero-emission building stock as a possible scenario, and the study “Szenarien für eine marktwirtschaftliche Klima- und Ressourcenschutzpolitik 2050 im Gebäudesektor” [2], which suggests transition paths to make a massive reduction of carbon emissions actually achievable, strengthened the development of the framework. It is intended to provide a reliable basis for political and financial decision-makers and reveals so far unused potentials regarding the achievement of carbon neutrality. The goal is to motivate stakeholders involved in construction and operation to massively accelerate the current renovation rate, to activate all measures for a continuous improvement process in facility management and to encourage building users to actively support the reduction of carbon emissions in their own building. A holistic approach is required as illustrated in “Kein ja aber mehr“[3].

3. Application of the Framework

There are six key applications identified to apply the framework:

3.1. CO\textsubscript{2} management and benchmarking

The framework allows to identify the impact of building performance on CO\textsubscript{2}-emissions and to compare among its peers. For both calculated and measured performance a strongly needed holistic definition for the boundary of energy-related CO\textsubscript{2}-assessments is established: Boundary is the site and thus including plug-loads. It is important to point this out as current standard practice and code requirements omit user-related energy use and thus missing a major portion of potential CO\textsubscript{2}-emissions. The framework describes rules for calculating a building's current and future CO\textsubscript{2}-emissions and allows consistent CO\textsubscript{2}-intensity benchmarking in relation to other buildings. Project-specific CO\textsubscript{2} maximum values per year, up to the year 2050, enable investments to be planned in the long term.

3.2. Communication of CO\textsubscript{2} footprint, enhanced building performance and “Paris-proof” building operation

The framework’s clear calculation specifications assist in communicating the achieved and planned carbon-related contribution towards climate protection, comparing target and actual values in a transparent way. In addition, the framework provides the background to set up a roadmap to carbon neutral building operation of buildings and sites (check compliance with the Paris Agreement) by reducing CO\textsubscript{2}-emissions by 2050.

3.3. Approval as part of DGNB certification

Incentives offered in version 2018 of the DGNB System already provide “bonus points” for “carbon-neutral buildings”. The associated criteria will also be gradually adapted for other system applications and the goal is establish the framework in a standardised way in all future DGNB system applications and schemes within the DGNB System.

3.4. Influencing supply chains and gearing procurement towards climate protection

Because climate protection measures must always be considered and assessed as a whole, corresponding realistic emission factors must be used for CO\textsubscript{2} accounting. When choosing construction materials for renovated and new buildings, the use of environmental protection as a decision-making criterion must be a crucial aspect. The application of Environmental product declarations (EPD) for construction products in accordance with DIN EN 15804 aids with evaluating supply chains with regard to waste prevention, reprocessing, reuse and recycling.
3.5. Green bonds and tax advantages
The framework can be used as neutral and transparent decision-making tool for performance evaluation of projects to be financed. Based on monitored performance data the effective implementation and extent of contribution made towards CO₂ reduction can be rated.

3.6. Basis for regulatory instruments
Elements of the framework have been incorporated into a political discussion proposal, published in February 2018. This DGNB Statement, relating to a “Building Emissions Law 2050” (GEG 2050), clearly illustrates the contents a law consistently focusing on climate protection should include. In order to provide political decision-makers with a realistic tool for advocating this type of legislative proposal, DGNB will use this framework for carbon-neutral buildings and sites to demonstrate that the approach is effective and results in buildings that are necessary for climate protection reasons.

4. Structure of the Framework
The framework is organized in three parts:
- Part 1: Carbon Accounting Rules
- Part 2: Carbon Disclosure Rules
- Part 3: Carbon Management Rules

These parts can be applied separately and reflect the interests and challenges of the different stakeholders. Part 1 addresses energy and specialized planners and describes how to calculate the carbon balance. Part 2 describes key metrics to report and communicate the energy and carbon balance on site. In part 3, a building-specific roadmap to carbon neutral building operation is set up showing the building’s expected future carbon performance and its path towards a carbon neutral annual balance. The essential elements of each part will be described subsequently. The entire framework is available on the DGNB website [4].

Figure 1. The structure of the DGNB framework is organized in three parts.
4.1. Carbon accounting rules
For the accounting of a building’s carbon performance, two different accounting levels can be applied. Within “Accounting level 1”, the balance framework only comprises the CO$_2$ emissions of the building operation. Within “Accounting level 2”, apart from the operational CO$_2$ emissions, the balance framework includes the embodied CO$_2$ emissions resulting from production, maintenance, dismantling or recycling processes.

4.2. Carbon disclosure rules
The “Emission Report” is an essential element of the second part of the framework. It will be displayed directly at the building or site and be visible, understandable and presented to everyone interested. The “Emission Report” provides transparency for calculated versus actual carbon performance, as well as further relevant CO$_2$ and energy related parameters (e.g. per person / per floor area, final energy, share of renewables, etc.). With this instrument occupants and visitors are continuously informed about the current carbon performance and its expected development.

4.3. Carbon management rules
The essential element of the third part of the framework is the roadmap for carbon neutral building operation which will be set up for each building individually. The roadmap demonstrates that the buildings on site will a net zero carbon balance, using a linear trajectory of current emissions to zero by latest 2050. In order to set up the roadmap, the building’s current CO$_2$ emission level is to be measured serving as a building-specific starting point. As a next step, a straight line is drawn from this starting point to the zero-emission target in the year 2050, defining the building’s individual CO$_2$ limit values for each year (see orange line in the illustration below). For all buildings and sites with a climate protection roadmap according to the definition above, annual planning values will thus always remain below the building-specific emission limit values.

Figure 2. Building-specific roadmap for carbon neutral building operation by latest 2050.

5. Pathway Towards the Broad Market Launch
The next steps towards the broad national and international market launch are centred around the ongoing pilot phase and follow a clear path of seven work packages until end of June 2019:
5.1. Establish Group of Consultants
The expertise of a selected Group of Consultants is established to consult, guide and help implement required specialized in-depth knowledge during the pilot phase and the following assessment to build the official release version of the framework. The Group of Consultants will be extended as required and currently includes the following stakeholders: DGNB Expert Advisory Board, DGNB Scientific Advisory Board, DGNB Real Estate Advisory Board, Pilot Project Group, European Steering Group, Financial Steering Group.

5.2. Specific Consultant Meetings
Broad collaboration for the current version of the Framework identified crucial aspects to be addressed, discussed and clarified in practice during a pilot phase. Conclusions, requirements and recommendations will be implemented in the final release of the framework. The list of aspects includes the quality/future projection of energy related CO₂-emission factors, allowable options for green power and CO₂-compensation, trajectory to zero, framework for data access, calculation rules and tools, ongoing external scientific research, real estate and portfolio management issues and others. The overall goal is to share best practices and thorough insights to bring the Framework to the best possible level for a broad and highly accepted market launch.

5.3. Pilot Phase
The ongoing Pilot Phase is open to all building types (residential, office, shopping malls, …) and both new construction as well as existing buildings. During the pilot phase, the method of carbon accounting which is presented within the framework is further being developed and outstanding issues such as CO₂-emission factors, eventual allowance of compensation measures and green electricity are being discussed with the above stated group of Consultants. Feedback from the Group of Consultants will be directly implemented. A tool for accounting, disclosure and management (roadmap to zero) of carbon emissions is available to support and document the work of the participants and will be further optimized according to the needs.

5.4. Results and Conclusions
Results and conclusions from the Pilot Phase as well as further feedback from the Group of Consultants will be go through a process of balancing practicability, conflicts and opportunities. Results and conclusions will go through DGNB internal quality control and will be presented to the DGNB Expert Advisory Board.

5.5. Framework Revision and Official Release
The achievements of the previous work stages will be implemented in the Framework revision. DGNB internal quality control, DGNB Expert Advisory Board and DGNB Real Estate Advisory Board will approve the Framework before official release.

5.6. Full DGNB System Integration
The Framework will be fully integrated into the DGNB System.
Important note: The Framework is a stand-alone document open to the public that can be applied independent of a DGNB certification. All stakeholders as well as other national Green Building
Councils are welcome to adopt and apply the Framework for their own use – as already indicated by multiple international Green Building Councils.

Broad Market Launch

All stakeholders in the field of the Framework will be addressed and encouraged to apply it to both new construction as well as existing buildings. The goal is a broad acceptance in the real estate market to launch a strong framework for a carbon neutral building stock by 2050.

The Framework is currently in Pilot Phase (see chapter 5.3). Results and conclusions as well as the official release of the Framework will be the key element presented on CESB19 Conference in July 2019.

References

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[2] Deutsche Energie-Agentur GmbH (dena) [ed.] 2017 Gebäudestudie: Szenarien für eine marktwirtschaftliche Klima- und Ressourcenschutzpolitik 2050 im Gebäudesektor. Available online: https://shop.dena.de/sortiment/detail/produkt/szenarien-fuer-einemarktwirtschaftliche-klima-und-ressourcenschutzpolitik-2050-im-gebaeudesektor/

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[4] Deutsche Gesellschaft für Nachhaltiges Bauen – DGNB e.V. [ed.] 2018 Framework for carbon neutral buildings and sites. Available online: https://www.dgnb.de/en/news/reports/Frame work/

Please note: a previous version of this paper is being published in:

[1] Braune A 2018 Proc. 10th Int. Conf. Improving Energy Efficiency in Commercial Buildings and Smart Communities, ed P Bertoldi (Frankfurt: tbc)