
Prof. Dr. Natalie Essig (Architect)
WSBE17 Hongkong, June 5-7 2017
Contact: natalie.essig@hm.edu
Research Team

MUAS - Faculty of Architecture, Institute for Structural Design and Building Climatology

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Urban Planner
Ancient Time: Sustainable Buildings?

Mountain Chalet

Materials: Regional Materials?
Energy: Heating Zone?
Visual Comfort: Windows?
Indoor Air Quality?
Today: Sustainable Buildings?

BNK Assessment System for Small Residential Buildings (1 to 5 Units)
Sustainability Assessment Methods for Buildings

International

LEED Canada

LEED Emirates

BREEAM

MINERGIE®

SBTool

GROUNDING COUNCIL BRASIL

GREEN BUILDING COUNCIL OF SOUTH AFRICA

GREEN BUILDING COUNCIL OF SOUTH EAST ASIA

GREEN BUILDING COUNCIL OF WEST ASIA

LEED - INDIA

LEED Association

DGNB

NaWoh

BNB/BNK

CASBEE

BEAM Society

Green Star

NABERS

Source Essig Natalie, 2017
Sustainability Assessments of Buildings

Certification: ZUB Kassel
Certification: BMG Bonn
Pre-Certification: BfS Bonn

Certification: Funky Munich
Certification: Tongji Xixian Shanghai
Consultation: Oskar-von-Miller-Forum Munich

Pre-Assessment: Sky-Zentrale München
Certification: Sports Hall, Munich
Certification: Allianz Campus Munich
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Facts and Figures: Residential Buildings

- 18.3 million residential buildings in Germany, around 75 percent are detached or semi-detached houses (2011)
- Forecasts by BBSR: 2.9 million further dwellings will be needed in 2025
- Approval of 235,500 new residential building in 2013: 11.5% more than in 2012
- Construction of detached and semi-detached houses in 2013: 110,000 buildings
- Detached and semi-detached houses: 88 percent owner-occupied, 12 percent rented

Source:
Sapper, T.; Neumann, P.; 2014
BBSR: Neubaunachfrage in Deutschland bis 2025; 2011; vgl. www.bbsr.bund.de from August 10th, 2016
**BREEAM Code for Sustainable Homes**
462,460 Certifications (dwelling units)
www.breeam.org

**Leed: Leed Homes**
14,873 Certifications (dwelling units)
74 Certifications (detached houses)
www.usgbc.org

**DGNB: Kleine Wohngebäude (< 6 units)**
683 Certifications (total)
4 Certifications (detached houses)
www.dgnb.org

**Minergie: Wohnen EFH**
333,521 Certifications (total)
17,806 Certifications (detached houses)
www.minergie.ch

**NaWoh: Wohngebäude (> 6 units)**
12 Certifications (appartment buildings)
www.nawoh.de

Sustainability Assessment for Residential Buildings

Sources: BREEAM, LEED, DGNB, MINERGIE, NaWoh; Data 2015
Funder: Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety, Germany (BMUB)

Research project I: Development of a sustainability assessment method for small residential buildings in Germany (new construction) – BNK System

Research project II: Implementation of a pilot phase - BNK System

Project Team: Ingenieurbüro Prof. Dr. Hauser GmbH, Prof. Dr. Thomas Lützkendorf and Munich University of Applied Sciences (MUAS), Prof. Dr. Natalie Essig

Pilot Projects: First certificates were given over at the fair Bau 2015 (Munich) for 19 buildings
BNK-System (1 to 5 Units)

Structure of the Assessment System for Small Residential Buildings

Topics to Protect:
- Health
- Social and Cultural Assets
- Economic Assets
- Natural Environment and Resources

Goals to Protect:
- Safeguard Health/ Comfort in Buildings
- Person-centred Environment (Accessibility/ Safety & Security)
- Reduce of Life Cycle Costs
- Safeguard Economic Assets in the Long Term
- Protect the Environment
- Protect Natural Resources

Assessment:
- Sociocultural and Functional Quality: 25%
- Economical Quality: 25%
- Ecological Quality: 25%

Source of Indicators: www.nachhaltigesbauen.de
Structure: Assessment System for Small Residential Buildings

1st Level: Categories

- Category 1
  - Criteria 1.1
    - Indicator 1.1.1
    - Indicator 1.1.2
    - Indicator 1.1.3
  - Criteria 1.2
    - Indicator 1.2.1
    - Indicator 1.2.2
  - Criteria 1.3
    - Indicator 1.3.1

- Category 2
  - Criteria 2.1
    - Indicator ...
  - Criteria ...

- Category ...

2nd Level: Criteria

3rd Level: Indicator

4th Level: Assessment Factor

5th Level: Weighting [%]

6th Level: Result
Result of the BNK-System

Example

67.2%
<table>
<thead>
<tr>
<th>Category</th>
<th>No.</th>
<th>Criterion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Sociocultural and functional quality</td>
<td>1.1.1</td>
<td>Healthy housing: Interior hygiene</td>
</tr>
<tr>
<td></td>
<td>1.1.2</td>
<td>Healthy housing: Healthy drinking water</td>
</tr>
<tr>
<td></td>
<td>1.2.1</td>
<td>Thermal insulation in summer</td>
</tr>
<tr>
<td></td>
<td>1.3.1</td>
<td>Available daylight</td>
</tr>
<tr>
<td></td>
<td>1.4.1</td>
<td>Sound insulation</td>
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<td></td>
<td>1.5.1</td>
<td>Controlling building services: User-friendliness and informativeness of controls</td>
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<td></td>
<td>1.6.1</td>
<td>Safety and security: Anti-intruder measures</td>
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<td>Safety and security: Fire alarms and firefighting</td>
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<td>Life cycle assessment - primary energy demand</td>
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<td>Building dossier including user manual</td>
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## BNK System (19 Criteria)

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Criteria 1.1.1: Healthy Housing – Indoor Hygiene

Outdoor:
Do you like jogging on the street?

Indoor:
Which building materials are used?
Contaminants?
Healthy Materials?
Environmental friendly materials?
Criteria 1.1.1: Healthy Housing – Indoor Hygiene

Environmental Produkt Deklarations (EPDs)
Criteria 1.1.1: Healthy Housing – Indoor Hygiene

Measurement of TVOCs (Total Volatile Organic Compounds)

<table>
<thead>
<tr>
<th></th>
<th>TVOC MS identifiziert</th>
<th>VOC nicht identifiziert</th>
<th>T VOC MS erreichte DGNB-Vorgabe</th>
<th>Formaldehyd erreichte DGNB-Vorgabe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open Space NF 03.201 153634/35</td>
<td>65 ( \mu g/m^2 )</td>
<td>(&lt; 30 \mu g/m^2 )</td>
<td>(&lt; 500 \mu g/m^2 )</td>
<td>11</td>
</tr>
<tr>
<td>Open Space ND 02.101 153636/37</td>
<td>476 ( \mu g/m^2 )</td>
<td>(&lt; 30 \mu g/m^2 )</td>
<td>(&lt; 500 \mu g/m^2 )</td>
<td>11</td>
</tr>
<tr>
<td>Open Space NG 04.102 153638/39</td>
<td>388 ( \mu g/m^2 )</td>
<td>(&lt; 70 \mu g/m^2 )</td>
<td>(&lt; 500 \mu g/m^2 )</td>
<td>40</td>
</tr>
<tr>
<td>Büro Leitung NH 03.218 153840/41</td>
<td>444 ( \mu g/m^2 )</td>
<td>(&lt; 70 \mu g/m^2 )</td>
<td>(&lt; 500 \mu g/m^2 )</td>
<td>192</td>
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<tr>
<td>Besprechung NF 02.106 153678/70</td>
<td>232 ( \mu g/m^2 )</td>
<td>( &lt; 70 \mu g/m^2 )</td>
<td>(&lt; 500 \mu g/m^2 )</td>
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<tr>
<td>Besprechung NH 03.241 153682/83</td>
<td>293 ( \mu g/m^2 )</td>
<td>( &lt; 70 \mu g/m^2 )</td>
<td>(&lt; 500 \mu g/m^2 )</td>
<td>14</td>
</tr>
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BNK-System: What’s going on?

BiRN: Green Building Council for the BNK-System

- Approval of the BNK-system as national assessment system for small residential buildings (1 to 5 units) by the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety, Germany (BMUB) in 2015
- Foundation of the Green Building Council BiRN (Bau-Institut für Ressourceneffizientes und Nachhaltiges Bauen) in 2016
- Funding of 50% of the certification costs by national funds, like the kfW Bank
- More than 40 certificates since 2016
FertighausWelt Günzburg
Sustainable Model Home Village (BNK Certification)