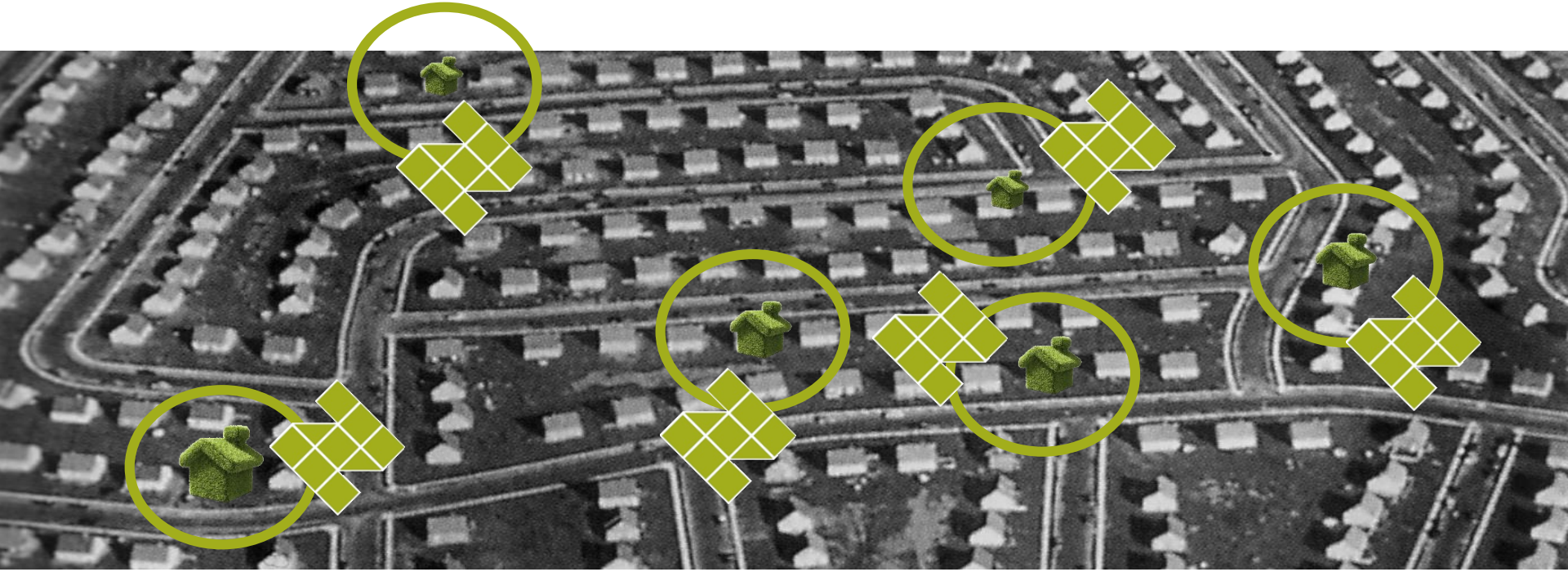

Assessment Tools for the Sustainability Performance of Buildings - Development of a Sustainability Assessment Method for Small Residential Buildings

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

HOCHSCHULE FÜR ANGEWANDTE WISSENSCHAFTEN MÜNCHEN

BiRN

Research Team

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

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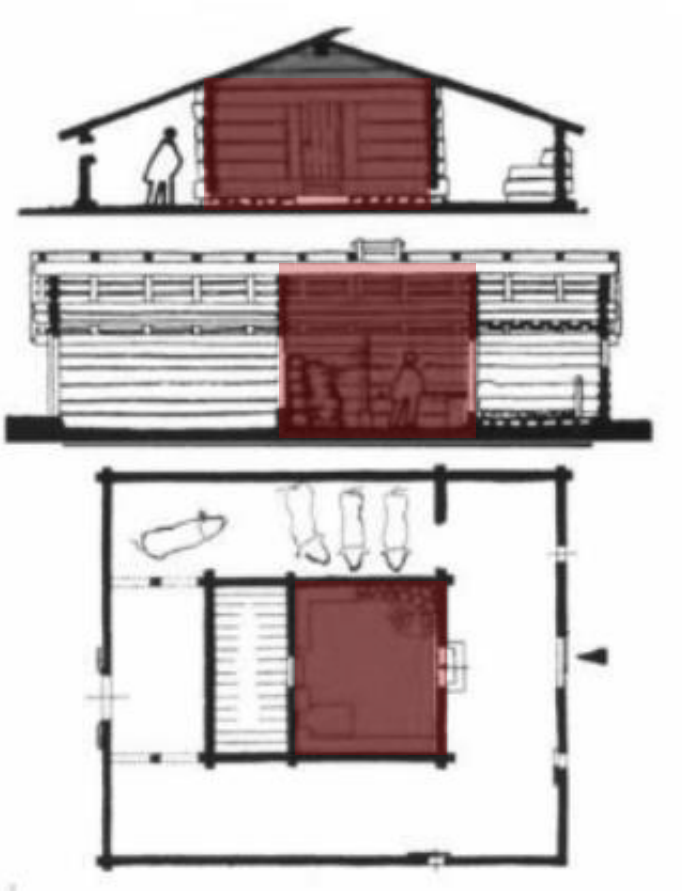
Civil Engineer

Paul Mittermeier
Environmental Engineer

Johannes P. Steidl
Urban Planner

Ancient Time: Sustainable Buildings?

Mountain Chalet



Today: Sustainable Buildings?

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

International

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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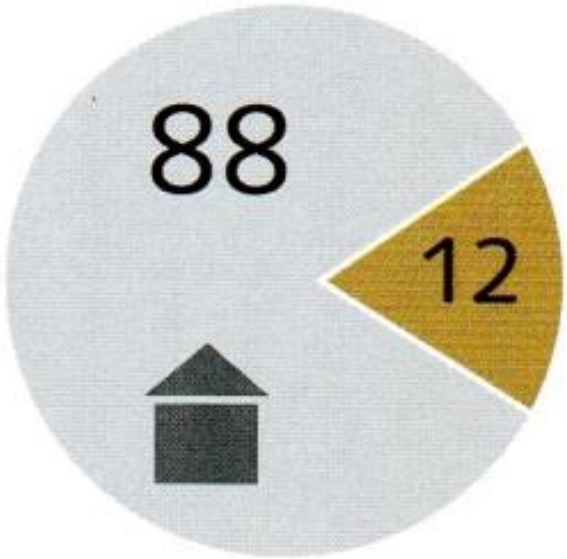
Certification: Sports Hall, Munich

Certification: Allianz Campus Munich

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
Statistisches Bundesamt: Bautätigkeit und Wohnungen, Bestand an Wohnungen; 2011; vgl. www.destatis.de from June 25th,.2016
BBSR: Neubaunachfrage in Deutschland bis 2025; 2011; vgl. www.bbsr.bund.de from August 10th, 2016

Sustainability Assessment for Residential Buildings

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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

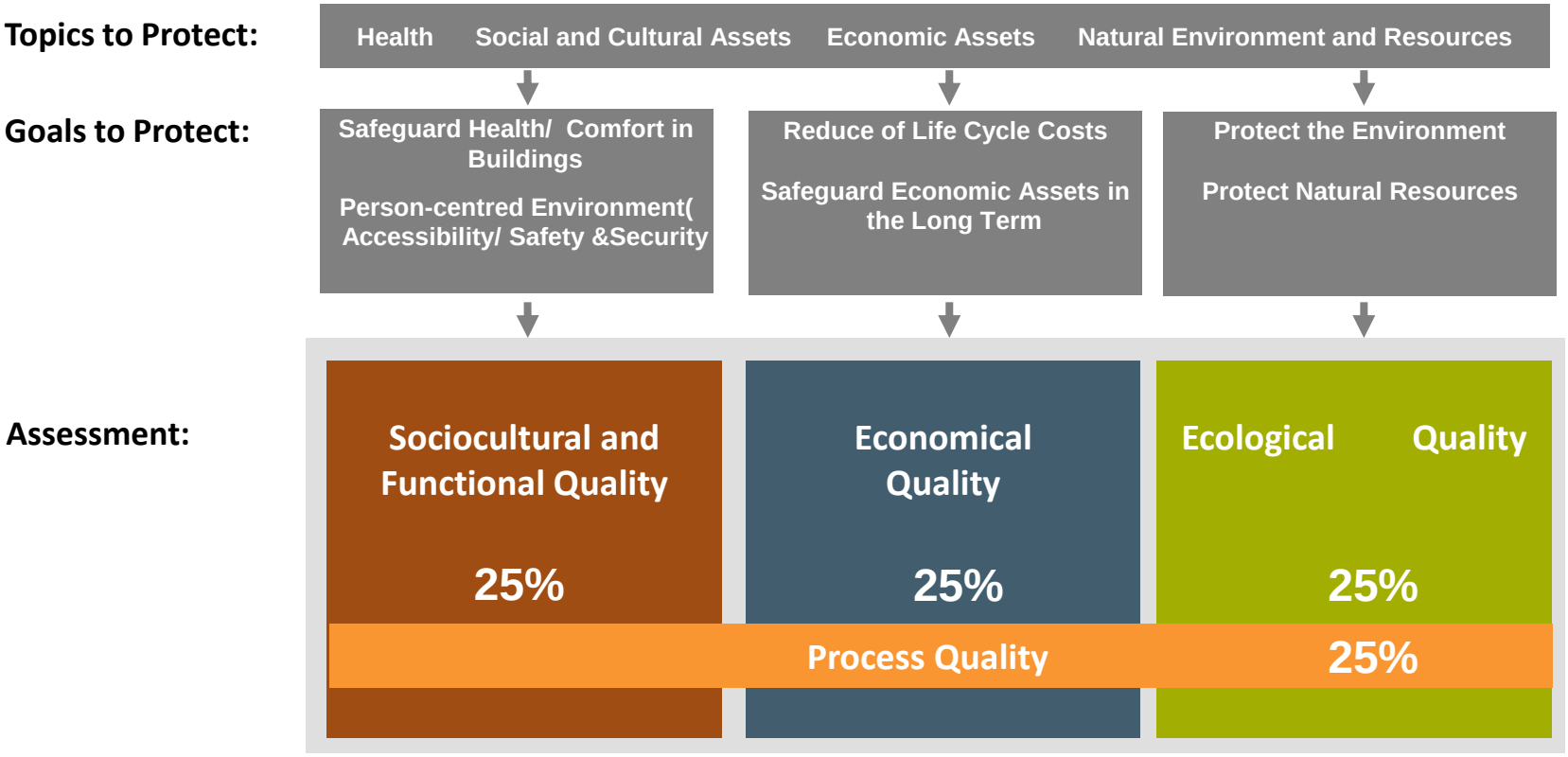
Sources: BREEAM, LEED, DGNB, MINERGIE, NaWoh; Data 2015

Research and Pilot Project

- **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

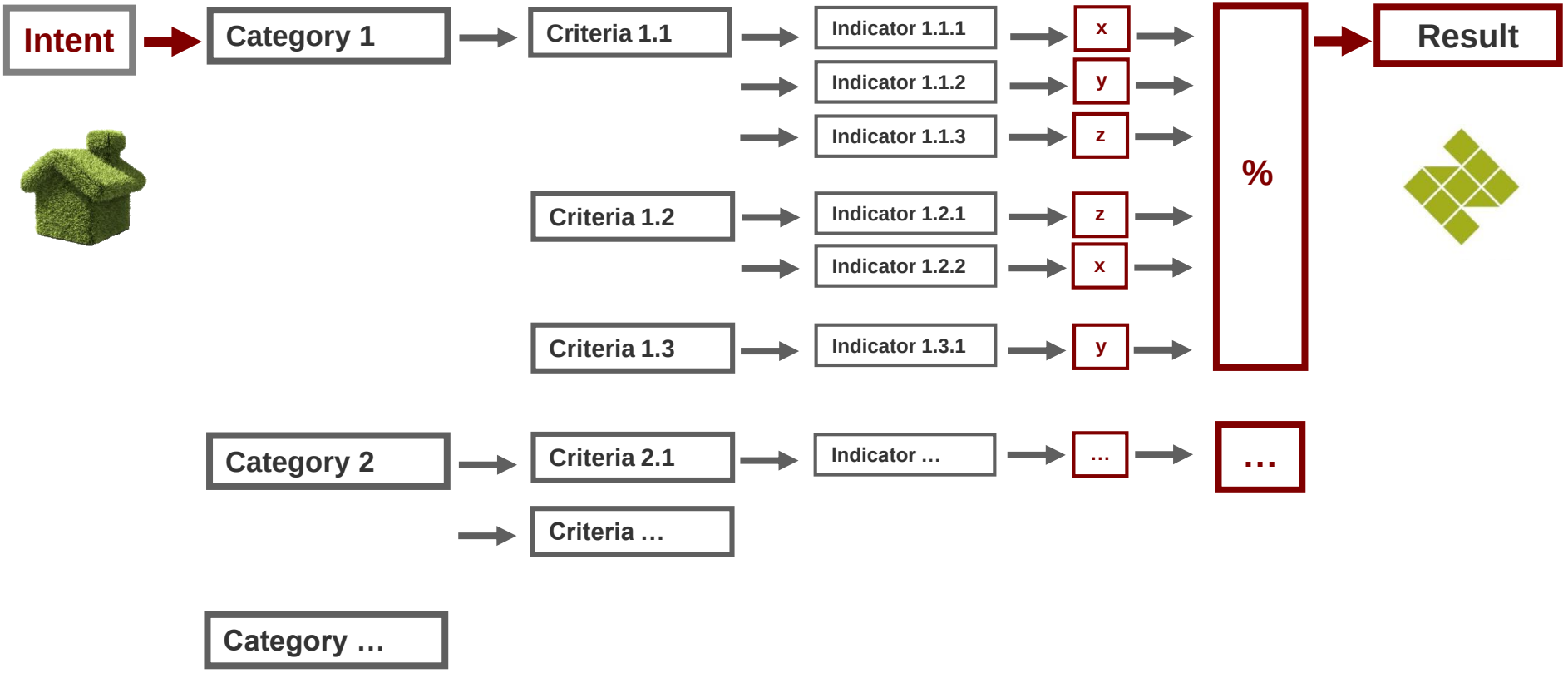


Source of Indicators: www.nachhaltigesbauen.de

Structure: Assessment System for Small Residential Buildings

HOCHSCHULE FÜR ANGEWANDTE WISSENSCHAFTEN MÜNCHEN

1st Level:	2nd Level:	3rd Level:	4th Level:	5th Level:	6th Level:
	Categories	Criteria	Indicator	Assessment Factor	Wheighting



Result of the BNK-System

Example

67,2%

100 %
95 %
90 % excellent
85 %
80 % 1,5
75 %
very good
70 %
65 % 2,0
60 %
good
55 %
50 % 3,0

Nachhaltiges Bauen

sehr gut (1,9)

BNK System (19 Criteria)

HOCHSCHULE FÜR ANGEWANDTE WISSENSCHAFTEN MÜNCHEN

Category	No.	Criterion
1. Sociocultural and functional quality	1.1.1	Healthy housing: Interior hygiene
	1.1.2	Healthy housing: Healthy drinking water
	1.2.1	Thermal insulation in summer
	1.3.1	Available daylight
	1.4.1	Sound insulation
	1.5.1	Controlling building services: User-friendliness and informativeness of controls
	1.6.1	Safety and security: Anti-intruder measures
	1.6.2	Safety and security: Fire alarms and firefighting
	1.7.1	Accessibility
2. Economic quality	2.1.1	Selected life cycle costs
3. Environmental quality	3.1.1	Life cycle assessment - Global Warming Potential and other environmental impacts
	3.1.2	Life cycle assessment - primary energy demand
	3.2.1	Decentralised enegry generation
	3.3.1	Use of local / certified wood
	3.4.1	Use of water-saving taps and mixers
	3.5.1	Efficient use of available space
4. Process quality	4.1.1	Consultation and agreeing objectives
	4.2.1	Building dossier including user manual
	4.3.1	Quality assurance

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:

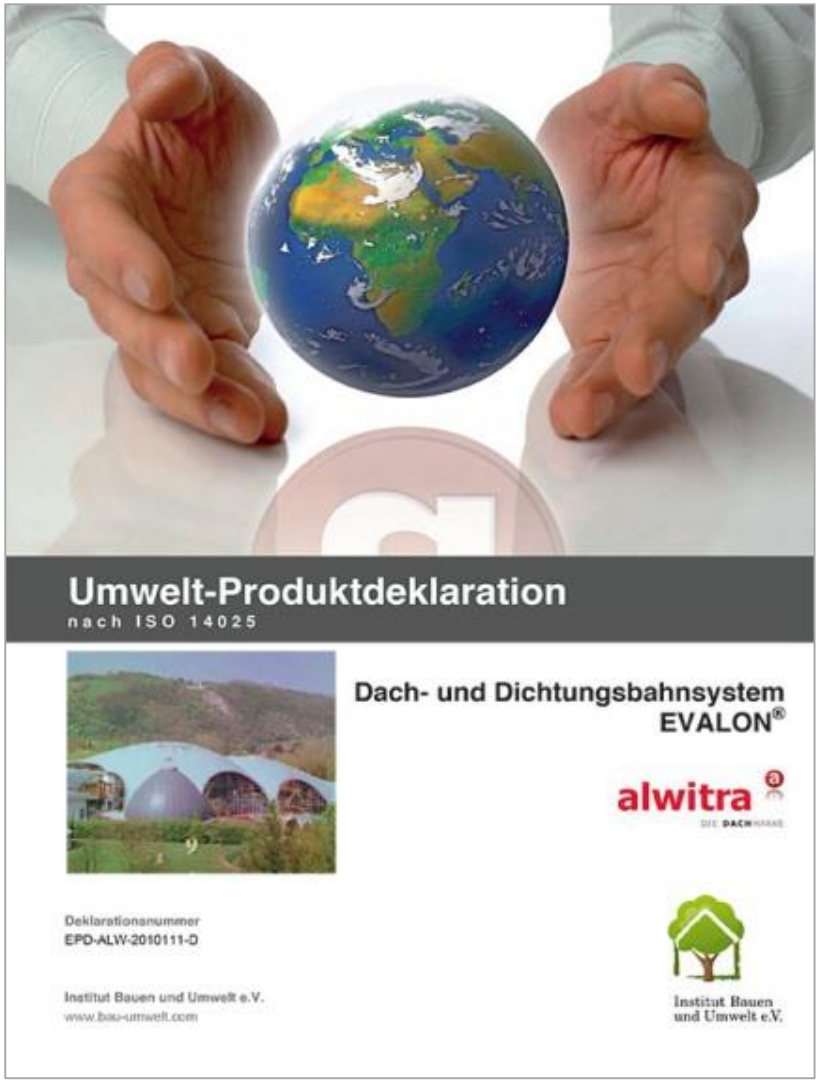
Which building materials are used?

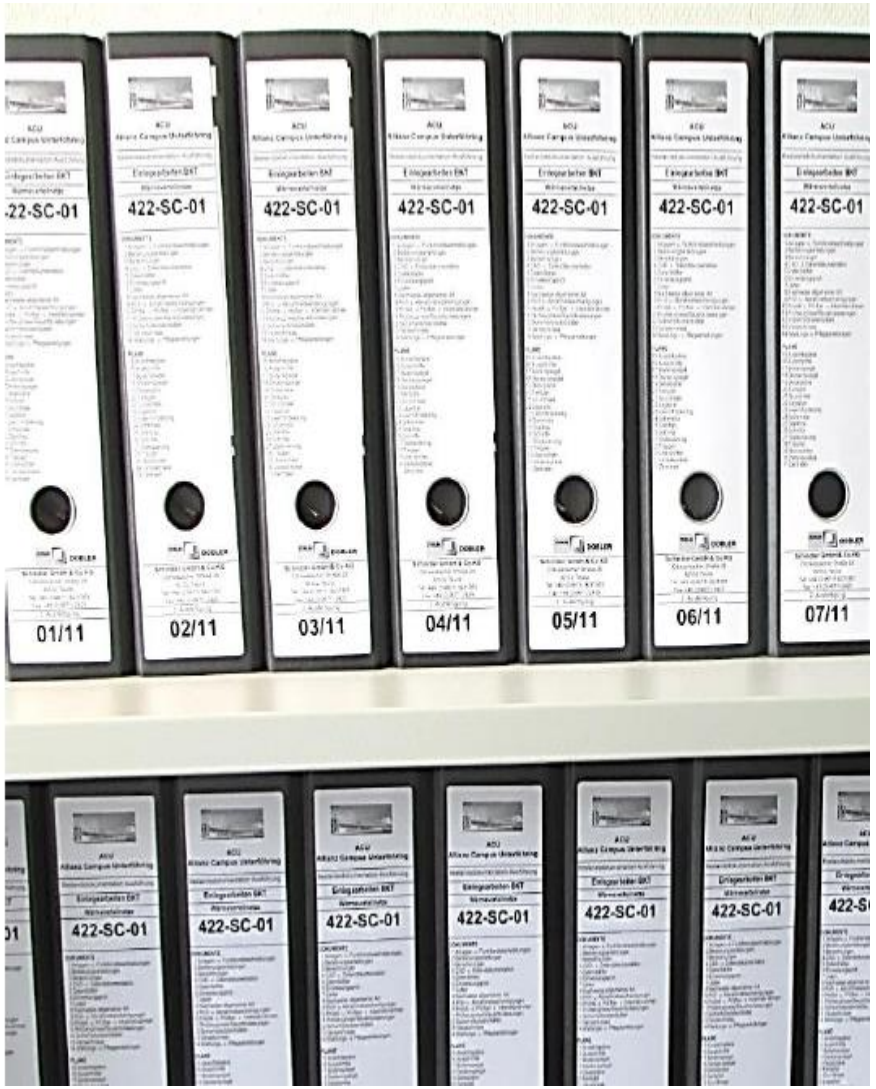
Contaminants?

Healthy Materials?

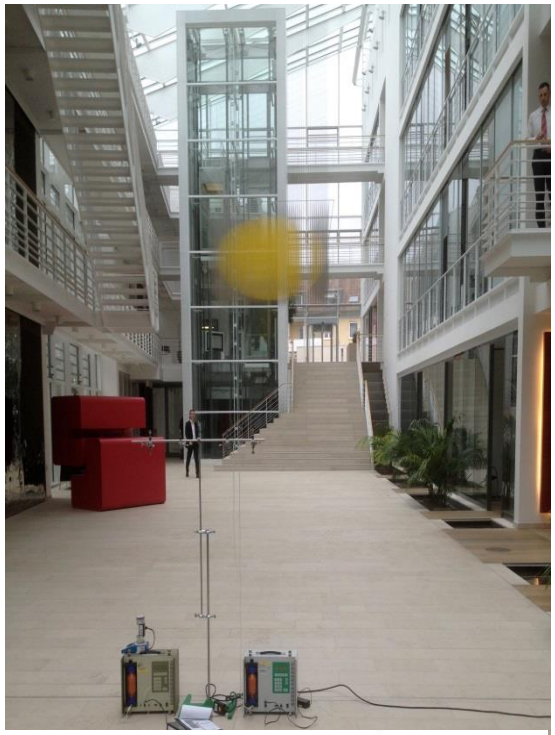
Environmental friendly materials??

Environmental Produkt Deklarations (EPDs)





Measurement of TVOCs (Total Volatile Organic Compounds)



TVOC-/Formaldehyd-Konzentration

	Open Space NF.03.201 153634/35	Open Space ND.02.101 153636/37	Open Space NG.04.102 153638/39	Büro Leitung NH.03.218 153640/41	Besprechung NF.02.106 153678/79	Besprechung NB.03.246 153682/83
	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
VOC $_{MS}$ identifiziert	65	476	388	444	192	293
VOC nicht identifiziert als Toluoläquivalente	< 30	< 30	62	< 30	40	< 30
Σ TVOC $_{MS}$	**65**	**476**	**450**	**444**	**232**	**293**
erreichte DGNB-Vorgabe	< 500	< 500	< 500	< 500	< 500	< 500
Formaldehyd	**11**	**11**	**25**	**11**	**26**	**14**
erreichte DGNB-Vorgabe	< 60	< 60	< 60	< 60	< 60	< 60

BNK-System: What‘ going on?

PILOTPROJEKT
Musterhaus Bau-Fritz „Hochhinaus“

Gesamterfüllungsgrad	82,34 Prozent
Soziokulturelle und funktionale Qualität	74 Prozent
Ökonomische Qualität	94 Prozent
Ökologische Qualität	61 Prozent
Prozessqualität	100 Prozent
Exzellent	Note 1,4

PILOTPROJEKT
Bien-Zenker Musterhaus Pfullingen

Gesamterfüllungsgrad	85,12 Prozent
Soziokulturelle und funktionale Qualität	87 Prozent
Ökonomische Qualität	70 Prozent
Ökologische Qualität	84 Prozent
Prozessqualität	100 Prozent
Exzellent	Note 1,3

BiRN
BAU-iNSTiTUT
Ressourceneffizienz und Nachhaltigkeit

HOCHSCHULE FÜR ANGEWANDTE WISSENSCHAFTEN MÜNCHEN

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
- Approval of BiRN as offical Green Building Council for the BNK-System by the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety, Germany (BMUB) 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)