



Federal Ministry  
for Economic Affairs  
and Energy



MITTELSTAND  
**GLOBAL**  
ENERGY SOLUTIONS  
MADE IN GERMANY

# Energy Efficiency and Healthy Indoor Climate - Experiences and Trends from Germany

Josef Spritzendorfer, EGGBI

06.11.2019, Mannheim

Information event

"Energy efficiency in non-residential  
buildings in Bulgaria"



# Introduction



Josef Spritzendorfer

Author of textbooks, journalist and expert for building materials with a focus on residential health, until 2004 more than 10 years active as national product manager and trainer of an international construction materials company (area of responsibility: "sustainable building material assortment").

2006 co-founder of the Sentinel- house Institut Freiburg  
(Research project "Building of healthy wooden houses" with the Federal Environmental Foundation)  
Co-Managing Director until 2010

Current:

Since July 2017: Online editor of the "European Association for Healthy Construction and Indoor Hygiene EGGBI"

a privately run voluntary information and research platform  
to promote "healthy buildings" with a focus on

- health assessment of construction products
- public relations (publications, lectures)
- teaching (guest lectures at universities)
- international project support and research
- consumer advice (free service hotline) for allergy sufferers and  
chemical-sensitive builders, families with increased demands for healthy living
- support for parents, teachers and authorities in the event of pollutant problems in  
schools and day-care centers

# „The Internet platform for healthy building and indoor air quality"

has given himself the aim

- to „collect“ new insights on the subject of healthy living
- to sensitize and to raise awareness among stakeholders of the construction industry by giving lectures at universities and support of graduate work in the area of training, lectures, guest lectures on healthy living and support (examples: Master's degree transition timber for architects FH Rosenheim, Master Course WINGS , University of Wismar, FNR)
- to offer environmentally sensitive clients a free initial consultation to residential health (free hotline)
- „Protection of consumers in matters of healthy living - providing technical assistance to consumers at "damage cases“
- Support of parents and teachers in pollutant problems in schools
- to discuss open scientific questions by coordinating research projects in cooperation with construction companies, building material manufacturers, planners, medicine and scientific institutions / to clarify if possible, participation in research projects

# Energy state of buildings - fact

We have extremely positive developments in terms of CO<sub>2</sub> savings in the last years through energy-efficient construction and renovation (f.i. „Passive House“, "zero energy- house, energy plus house)

but there are also "health-related risks" by increased concentrations of pollutants in the buildings

## Solution:

- careful planning,
- responsibly product selection and
- professional structural implementation

# Denser building = reduction of indoor air quality?

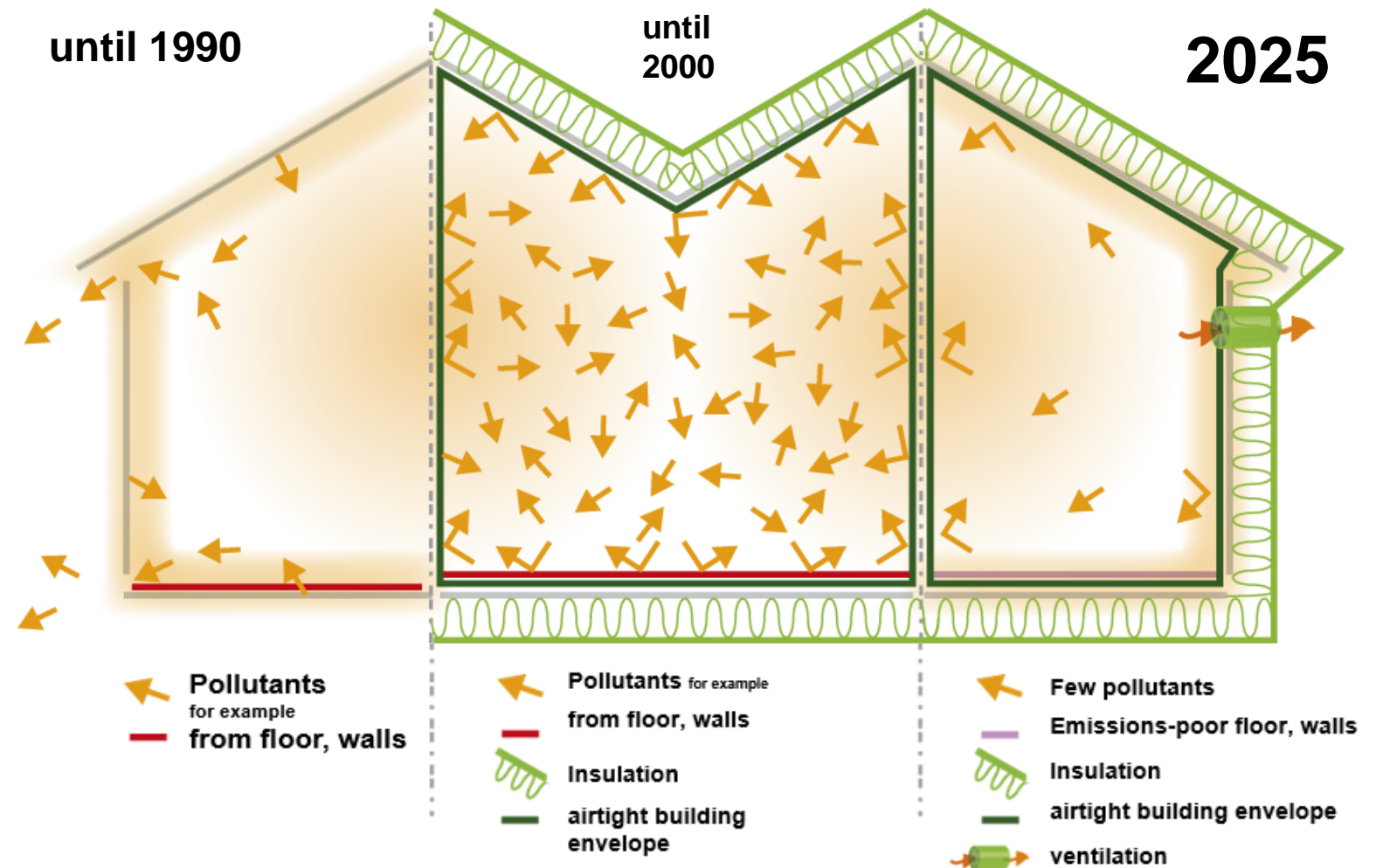
More and more dense buildings cause normally lower air exchange rates. That can only be compensated by appropriate ventilation planning.

So CO<sub>2</sub> concentrations are perfectly balanced by qualitative high-quality ventilation systems (without loss of energy, thanks to special heat recovery).

But not all emissions from building products, furniture, home furnishings, floor coverings, however, can be removed by means of ventilation systems - (Example: Liwoteststudie, Switzerland: increased TVOC loads despite switched comfort ventilation systems in many buildings of a research project)

In energetically optimized quality buildings therefore we need a conscientious selection of building materials with regard to avoidance of harmful solvents, plasticizers, flame retardants, but also non-toxic, but "only" allergy-causing emissions and odors indispensable.

# The problem- the solution





# Entry sources of "external" pollutants

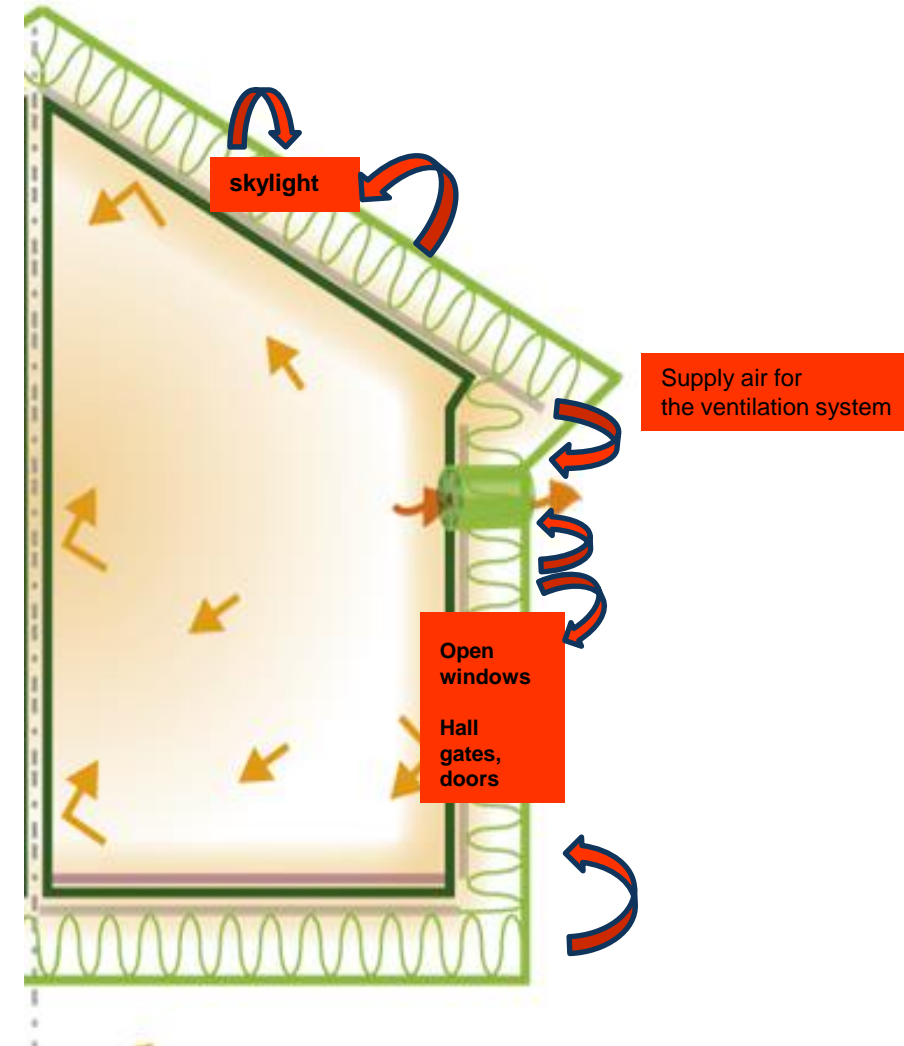
Increased emission levels, in particular due to summer heating of the roof and façade, can lead to detectable loads in the interior.

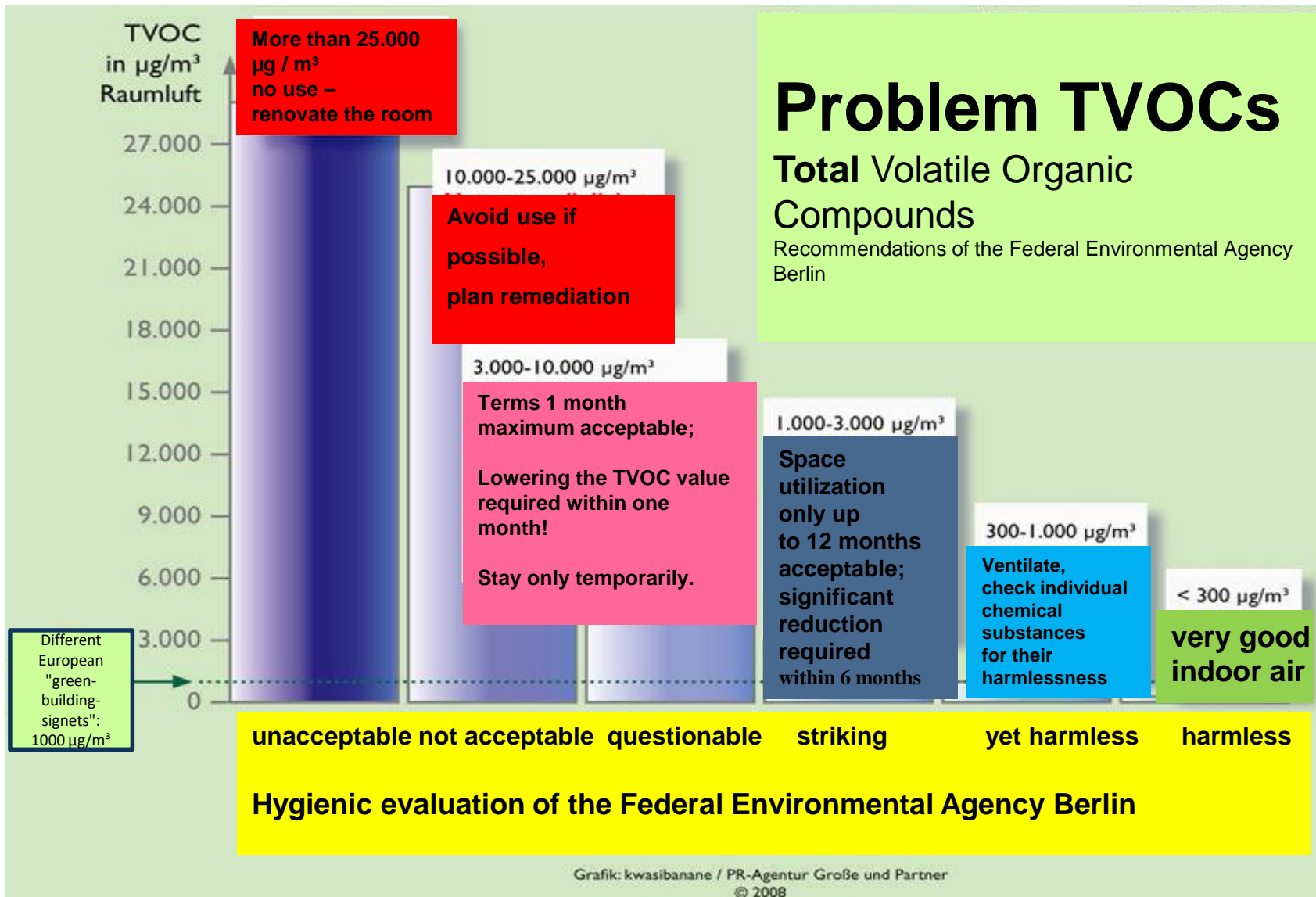
## Pollution sources:

- Paints, wood stains (VOC, glycols, preservatives, butanone oxime, Formaldehyde, plasticizer .....
- Cleaning (VOC, plasticizer ...)
- Insulating materials (styrene, flame retardants, formaldehyde, lubricants, VOCs ....)
- Sealing compounds (butanone oxime, VOCS, flame retardants ....)
- Sealing films (VOCs, plasticizers, bitumen, PAK ...)

## "sources of entry"

skylight  
window  
Hall gates, doors  
Supply air of the ventilation system





State recommendations in terms of pollution in buildings in Germany (TVOC)

There is also a guideline for formaldehyde in Germany:

Indoor air maximum

100 µg / m³

Construction products max.

0.1 ppm =

120 µg/m³

In addition, there are much stricter limits of voluntary labels and certifications



## health aspects



Increase of the Sick Building syndromes

> 25% of adults in Germany are allergy

> 30% of children

Mold problem in 40% (also) the (often wrong) modernized buildings



<http://www.eggbi.eu/beratung/bauen-fuer-allergiker/>

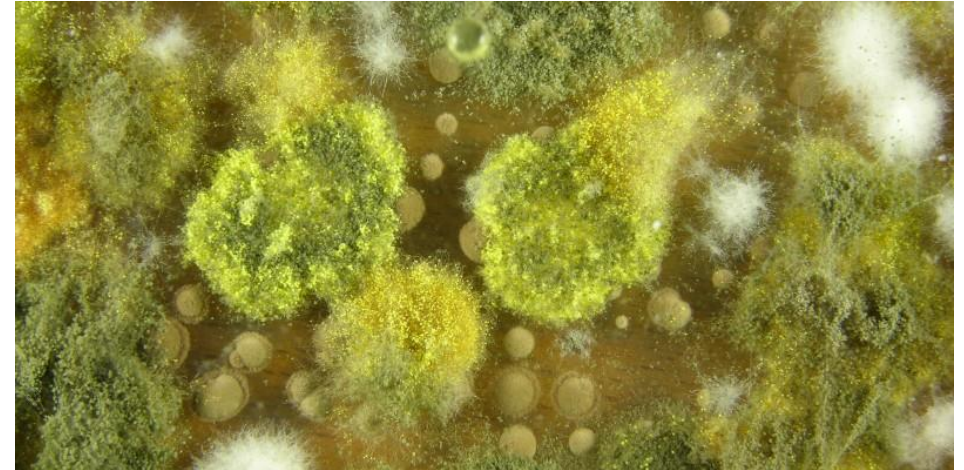
# Problem „MOLD“

**Especially with energy-saving renovation,**  
caused by  
deficient planning  
(for renovations there should always be considered all  
components: walls / roof / windows / doors together)  
and / or  
unqualified structural implementation

it can come to thermal bridges, which almost always result  
in the consequence to structural damage with mold.

Quote University of Ulm:

**Dampness and mold are more  
than dust mites, the main triggers of asthmatic diseases.**



# Algae and mold problems on facades

## solutions

**Use of biocides** (algicides, fungicides)

Result: **environmental pollution by washing out of the biocides**

### Alternative:

Environmentally conscious product selection  
(**mineral** wall-plasters and facade paints)



# Pollution problems caused by the use of "Unsustainable insulation"

Really sustainable, healthy living buildings should be built with sustainable insulation materials:

- sustainable (unlimited available or renewable resources)
- no **harmful** ingredients (**toxic** flame retardants, emissions, respirable fibers ...)
- no extremely toxic gases in case of fire (Dioxine. ..)
- no disposal problems after the later demolition of buildings





# Sheep wool insulation producer "Isolena" built „woolen center“ of excellence in Waizenkirchen

The company Isolena (Natureplus tested sheep wool Insulation) has built a competence center for wool in Waizenkirchen (Austria)

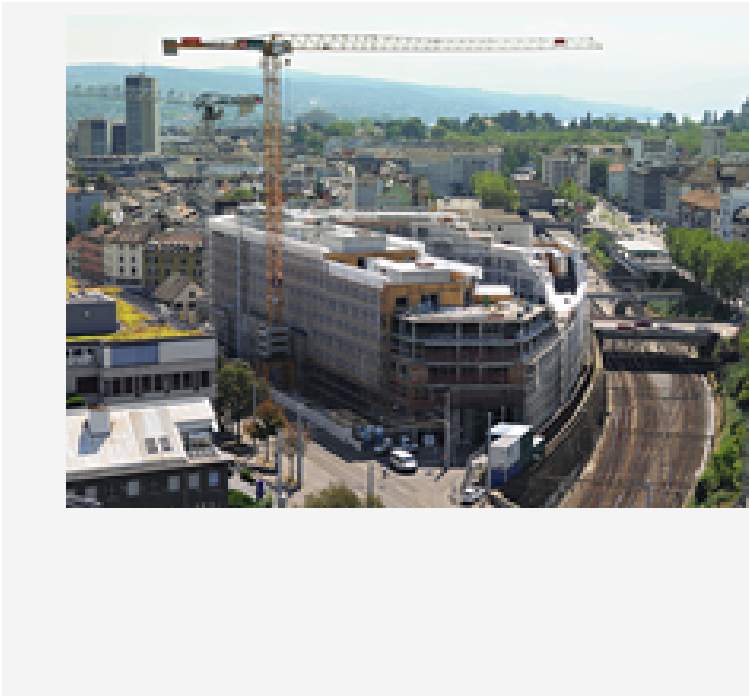
In this center mainly planners, architects, craftsmen and building material suppliers will be fully informed about sheep's wool.

The complete former factory building got a full thermal insulation with wool and wood fiber.



# Wood fiber insulation of facades

Not only for  
private houses, also for  
major projects



## Residential and commercial building Kalkbreite, Zürich

Fast, economical and also highly environmentally after Swiss Minergie-P-ECO standard build a seven-storey house with jointless facade.

How to do this is, is documented with the new residential and commercial building Kalkbreite in downtown Zurich. The pioneering object was built as a hybrid construction with concrete frame and prefabricated facade modules.

The outer insulation is made of PAVATEX DIFFUTHERM wood fiber insulation boards.

They carrier boards allow not only the seamless facade, but also ensure a high degree of energy efficiency, ecology and comfort.



2009 POROTON-WDF

## Later insulation - Inside and outside with the perlite-filled brick poroton



Old building renovations with usual heat composite systems often lead to algae growth, mechanical damage (f.i. woodpecker) and elaborate fire protection solutions.

The thermal facade Poroton WDF, is a massive brick wall, filled with the natural insulation perlite (volcanic rock fumed). Environmentally friendly, high fire protection inclusive

2009 POROTON-T7



With the further improvement in thermal conductivity of 0.070 W (mk) Poroton T7 meets the strict requirements of the EnEV (Energy Saving Ordinance)

[www.poroton.de](http://www.poroton.de)

POROTON®-WDF®

Inside



- 1 Inventory wall
- 2 plaster for interior
- 3 backfill
- 4 Poroton WDF
- 5 plaster for interior
- 6 bottom panel - ceiling

POROTON®-WDF®

Outside



- 1 Inventory wall
- 2 Poroton WDF
- 3 lightweight plaster

# Exempel 1: (pollutant- tested) mineral composite thermal insulation system

## Interior Insulation

### iPor-Novo-Mineral insulation panel

Capillary-active, permeable, fibre-free, mineral, solid insulation panel made of calcium silicate hydrates, biologically harmless and fully recyclable. Incombustible A1 as per DIN EN 13501-1, officially approved.

**Panel size:** 600 x 390 mm

**Panel thickness:** 60/80/100/120/140/160/180/  
200 mm (220-300 mm on request)

Rated value of thermal conductivity: 0.042 W/mK

Compressive strength on average: at least 200 kPa

Density range from 85 to 95 kg/m<sup>3</sup>

**Panel thickness:** 50 mm

Rated value of thermal conductivity: 0.045 W/mK

Compressive strength on average: at least 300 kPa

Density range from 110 to 115 kg/m<sup>3</sup>



### Exterior Insulation with KEIM Multipor



# Exampel 2: (pollutant- tested) mineral composite thermal insulation system

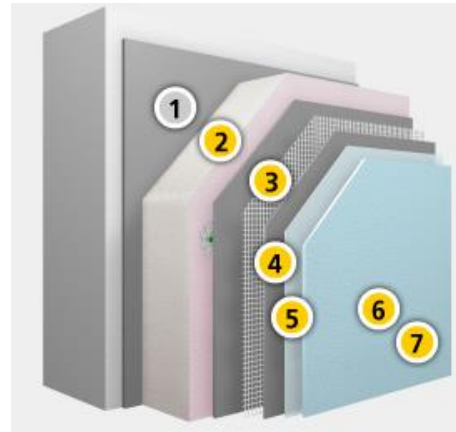
External Thermal Insulation Composite  
System with

Mineral foam insulation board  
StoTherm Cell

Mineral, non-combustible cladding system  
with mineral foam insulation



- 1 bonding
- 2 insulation
- 3 flush
- 4 Reinforcement
- 5 intermediate coating
- 6 final coat
- 7 Accessories, Supplements



# Economic aspect of the theme "healthy living"

High costs always arise in subsequent renovations by  
**mold problems**  
as well as by Indoor air pollution

*Negative marketing for  
architects and builders*

After renovation in old buildings:  
mold - **what happened?**

Actually, everything was supposed to be better, if the building envelope would be provided with a reasonable thermal insulation.

Lower heating costs, better living climate plus a real increase in property value. Well actually.

Often promised in the most dazzling colors in brochures, this can do not match with the reality in some cases.

Mold on interior walls,  
wet house corners, hardly an insulating effect  
are the fatal and costly consequences **of a faulty house insulation**

# Economic aspect of the theme "healthy living"

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as well as by **Indoor air pollution**

Formaldehyde after a energy refurbishment

*"In a school in the 70s, the windows are in the context of energy Restoration renewed. Above the false ceiling there is a permanent formwork chipboard. The new window of the natural air exchange falls into the Spaces, so that the formaldehyde content, thanks to the leaky window before still had not become noticeable, rises above the limit value and a reorganization of the school again begins, this time a contaminant remediation."*

*Negative marketing for architects and builders*

In addition, there is always a huge damage to the image of the planning and exporting companies, especially when the problems arise in public buildings (schools, kindergartens) with appropriate media interest.



# “Hammer of the week”

ZDF TV Report **09.07.2016**

Ecological newly built Kindergarten - energetically optimized - has far excessive pollution levels

## WALLERFANGEN

Newly built crib is not usable

After 13 months of ventilation and heating is certain: The replacement of the walls and ceilings is inevitable!

**2018 the building must be demolished - the architect is sued for damages**

What is measured, is the concentration of pollutants (aldehydes) from the exhalations of the built-up (OSB) timber. At the time of closing, the figures were around 13 000 µg/m<sup>3</sup>.

The new building costed around 1.5 million euros.

The costs for the measurements and appraisals now amount to a further 19,000 euros.



**main cause:**

**OSB** (oriented strand board or oriented structural board)

[https://www.sr.de/sr/home/nachrichten/politik\\_wirtschaft/wallerfangen\\_kita\\_zuschuss\\_rueckzahlung100.html](https://www.sr.de/sr/home/nachrichten/politik_wirtschaft/wallerfangen_kita_zuschuss_rueckzahlung100.html)



# Positive economic aspect of the theme "healthy living"

**Example:**

**LOHAS = Lifestyles of Health and Sustainability**

More than a third of the population of western countries is counted among the LOHAS.

It is a new target group that will have a significant impact on trade, marketing and product design in the coming years.

**LOHAS want the 'AND':**

- **health AND pleasure, comfort**
- **lifestyle AND environmental**
- **individual welfare AND the fate of humanity**
- **family AND career**

*Positive marketing with low-emission buildings  
for living **and** for working*

**LOHA is a rapidly growing market, which is estimated at an annual turnover of around \$ 500 billion worldwide.**

Source: Future Institute

# Laws for „healthy“ buildings - example Germany

civil Code  
criminal code  
products Safety Act  
EU Construction Products Regulation  
sample management regulation MVV TB  
country building regulations  
liability of the architect



**Legal regulation for buildings:**

**Pursuant to § 3 and § 13 MBO1, physical structures must be arranged, constructed, modified and maintained in such a way that public safety and order, in particular life, health and natural resources are not endangered, and by plant and animal pests and others chemical, physical or biological influences do not cause any danger or unreasonable nuisance.**

In all these national and European regulations there are demands for protection of the health in terms of building products and buildings

# Add to that in Germany: “architects liability”

Quote:

*"Contractual agreements*

*When determining the basics, the architect has to research the interests of the client. He must therefore find out **even without a special order:***

- whether special energy-saving measures are desired,*
- whether the client wants to avoid certain allergenic substances,*
- whether he is particularly interested in a good indoor air quality and*
- whether it is due to the special nature of the use of certain ventilation systems - beyond the accepted rules of technology - and similar needs.*

***What the client is not already pretends himself, the architect must ask.***

***He is the administrator of the client interests."***

Source: “Deutsches Architektenblatt”, September 2015

## Careful product selection

Only products should be used in new buildings, but especially also in energy renovations,  
**for which credible, comprehensive emission reports are present.**

Do not orient yourself to questionable quality labels, who often give "complacency reports":

## Example - Test reports for wood-based materials with "zero" emissions!

### 2.3.1 Zusammenfassung Substanzlisten

Substanzliste nach Messdauer von 3 Tagen als Positivliste

Substanz	Stöckbereich	CAS-Nummer	Messwert in $\mu\text{g}$	Messwert in $\mu\text{g}/\text{m}^3$	NiK in $\mu\text{g}/\text{m}^3$	R <sub>i</sub>
Summenwert						

keine VOC oder SVOC feststellbar

[illegible]

keine VOC oder SVOC feststellbar

[illegible]

entfällt, da Abbruchkriterien erfüllt

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evaluated as helpful by "Ökotest"



important:

- Credibility of the audited institution
- the samples must be taken from the Institute or his agent from current production (**not sent by the manufacturer**)
- Circumference of the inspection order must be correct
- standard test conditions
- the values must be credible!

# Architects, contractors and consumers are confused by a myriad of quality labels and certificates

Already in 2014 we published with the magazine Ökotest a comparison of numerous "quality labels for construction products."

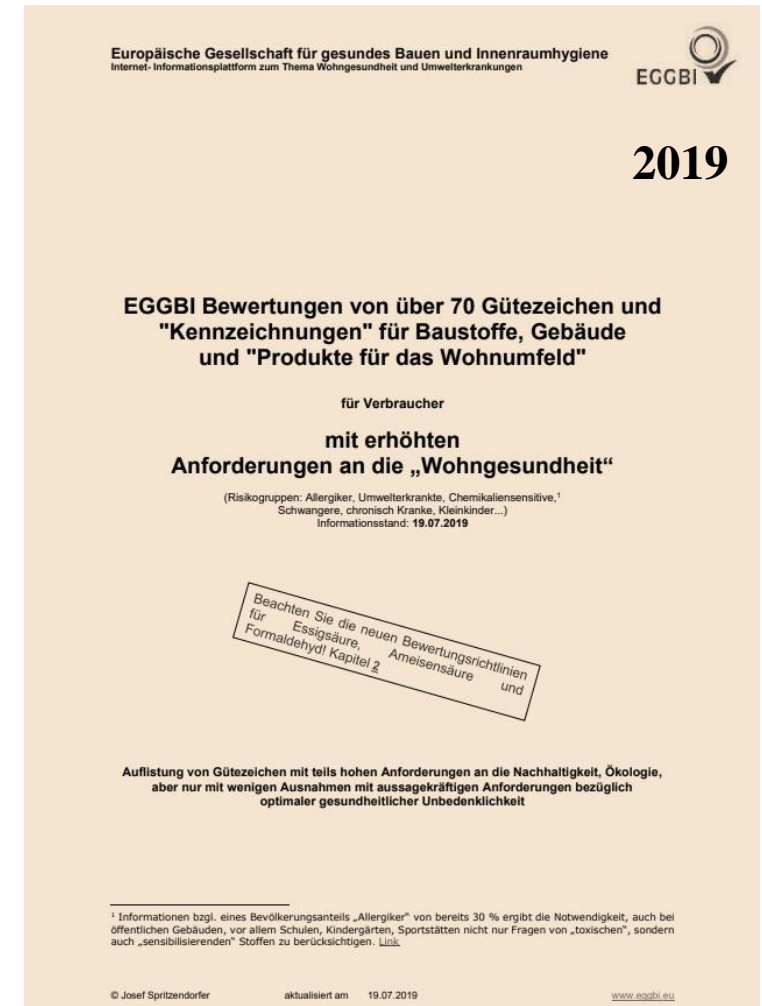


"rarely light in the jungle"

Currently we have listed over 70 quality labels for construction products and buildings,

of which only very few are a serious basis for a "health assessment" –rating.

Free download in the EGGBI publication series:



# Most important: Education“

**The topic of " sustainability - healthy living " is also increasingly part of the university and post-university education (architects, planners) in Germany**

example:

**DISTANCE EDUCATION Course  
MASTER ARCHITECTURE AND ENVIRONMENT**



The „Master distance course“ architecture and environment is a range of courses at „Hochschule Wismar“– university of Applied Sciences: Technology, Business and Design.

The aim of the inter-university „distance learning architecture and the environment“ is to convey the complexity and the necessary knowledge of the "ecological building". [http://www.wings.hs-wismar.de/de/fernstudium\\_master/architektur\\_und\\_umwelt](http://www.wings.hs-wismar.de/de/fernstudium_master/architektur_und_umwelt)

The course includes 3 lessons of healthy living „construction and use of practical examples" occupied by EGGBI

**We also support Training courses for architects, planners and craftsmen on issues of low-emission construction methods, materials and workmanship.**



# Urgently required: „Research projects“

Especially up to date:

Issues of health relevance of natural emissions from wood-based materials (terpenes, carboxylic acids...)

Research results in Germany and Austria lead to new "product reviews".

2018

- **carboxylic acids:**

New guideline for the detection of vinegar and formic acid

**VDI guideline 4301 sheet 7 (issue 10/2018)**

Here it is pointed out expressly, that it comes to under-detection with the previously practiced Tenax method! (Own experiences up to a factor of 2.5)

- **Formaldehyd:**

Even a new test standard - the **DIN EN 16516 (1/2018)** currently worries mainly wood-based panel manufacturers, since this results in completely new bases for the determination of formaldehyde emissions. Previous measurement results (formaldehyde values) according to EN 717-1 are therefore to be multiplied by a factor of 2 in the future.

<http://www.eggbi.eu/beratung/produktinformationen-guetezeichen/#c1567>

Current example:  
research project  
(with EGGBI participation)

**"gut dank Holz"**

"good because of using wood"

Toxicological evaluation:  
natural emissions  
made of wood and wood-based materials

Health:

Positive and negative effects

Institut für Umweltmedizin und  
Krankenhaushygiene



Final resume:

## **Main condition for "healthy living" energetic renovations of buildings**

- **Careful diagnosis of the actual technical and energetic building state**
- **Expertly competent overall renovation concept, taking questions of the future air exchange (ventilation planning) into account**
- **Use of only pollutant-tested products**
- **Careful execution of the construction work**

**Thank you for your attention**

# Contact us

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Publications: (free downloads)

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