

# HEALTH CRITERIAS IN THE MINERGIE-ECO STANDARD



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# **INDEX**

ABSTRACT	2
<b>INTRODUCTION</b> General personal introduction The neglected aspect of health in the building sector	<b>3</b> 3 3
MINERGIE-ECO Brief introduction to the standard History of Minergie and its annex ECO Expansion strategy of Minergie	<b>4</b> 4 4
ANALYSE OF THE HEALTH CRITERIA IN THE MINERGIE-ECO STANDARD Definition of health criteria Assessment methodology Health requirements of Minergie-ECO Not considered health aspects in the certification system	<b>6</b> 7 7 12
CONCLUSIONS	14
<b>ANNEX</b> Specification catalogue of Minergie-ECO criteria for residential buildings	<b>15</b> 15
BIBLIOGRAPHY	20
IMAGE REFERENCES	20

# ABSTRACT

The construction market is currently undergoing a major transformation. Energy efficiency is now the legal standard, the grey energy of buildings will soon be, but health aspects are still largely neglected. Although various studies have shown the harmful effects that today's buildings can have on health. Sustainability standards are usually one step ahead of legislation, and can therefore give the real estate investor a guarantee about the measures taken. This is relevant because it must be assumed that not all professionals in the building sector have sufficient knowledge in the field of health, and the criteria catalogue of a certification system can offer good help.

This paper aims to analyse the health aspects in the voluntary Swiss certification system Minergie-ECO, to check the completeness of the health theme, to evaluate whether Minergie-ECO could be an interesting support for builders and architects who are particularly sensitive to health aspects in projects. Minergie started in the 90s as a low-energy building standard. However, thanks to the cooperation with the Eco-Bau association, it has become a sustainability label with the addition of ECO since 2006. The annex ECO considers environmental impact and health-relatet aspects, and is focused on the building itself, not including environment nor emplacement. The certificate with the Eco suffix is currently only available in Switzerland, but this could soon change thanks to Minergie's expansion strategy. The label could also become an attractive alternative on the local market, thanks to the practice-oriented systems and the relatively low certification costs.

In summary, it can be said that a large part of today's knowledge about health aspects in buildings is included in the catalogue of criteria. The flexibility of meeting two-thirds of all criteria makes the standard market-friendly, but takes away some of the bite. However, obtaining the certificate in the current construction market requires a considerable effort.



Figure 1: Factors affecting health according to Professor François van der Linde.

# INTRODUCTION

#### GENERAL PERSONAL INTRODUCTION

With experience, we use to change focuses and to amplify our knowledge. Since now my work is marked by interest for sustainability and especially by energy-efficient buildings. Even though I was always trying to respect building ecology and health aspects in my projects, now was the moment to profundize the knowledge and the postgrade Architecture and Health by Escola Sert was a very good opportunity to do so. Even though there is still a lot to learn, as it is a complex and wide area, the postgrade studies gave me a great overview of health aspects in the building sector. On the other hand, since many years I'm working with the standards Minergie and Passivhaus and I use to apply the criteria of Minergie-ECO in my projects, despite it can't be certified abroad Switzerland. My focus until now was more on environmental impact of the building materials, than on health-aspects. I consider it a good moment to enter more in the health part of the certification system. The aim of this work is to analyse the health aspects included in the Minergie-ECO to check the completeness and make a proposal of supplementing the standard.

# THE NEGLECTED ASPECT OF HEALTH IN THE BUILDING SECTOR

The construction sector is on the way to be transformed in an extended way. In the 70s to the 90s, European countries started to hear laws in order to reduce energy consumption during the phase of use of the new buildings. Up from 2020 following the Directive 2010/31/EU all new building should be a NZEB. Meanwhile, consciousness started about the impact of the construction itself, and certain initiatives started to improve the sustainable aspects. Construction materials started to get in the focus, the embodied energy of the construction materiales started to be evaluated. The European Energy Performance of Buildings Directive, EPBD, from 2021 is dealing these assets in order to include the impact of the building itself in the new building codes. At the same time, but less considered, the health of interior spaces started to be a theme, especially pushed by the confinement provoked by the Covid-19 pandemic. There are still almost no legal requirements, but this seems to be the next big step on the transformation of the building sector. Even though it's a brand spectrum of criteria, and some might not clearly to be proofed as harmful, and other aspects are considered to affect few the users, because knowledge about new findings is missing in between techniques and occupants. There are certification systems that consider health criteria's, but normally only partly. As it took several decades from first energy efficient pioneers (example Passivhaus 1990-2020) to be a respected subject, probably integrating health in standard buildings will take its time as well. Especially as measures may increase the cost of construction.

# **MINERGIE-ECO**

### BRIEF INTRODUCTION TO THE STANDARD

Minergie is a Swiss-based standard for sustainable construction and building operation, aimed at promoting energy-efficient and environmentally friendly buildings. While the primary focus of Minergie is on energy efficiency, the annex ECO takes health and building ecology aspects into consideration to create healthier living and working environments for occupants and guarantee a lower environmental impact. It is possible to certify a building only Minergie, but not only ECO, so the energy efficiency always has to be fulfilled. There are more options of the energy aspects, as the variants Minergie-A and Minergie-P, but there are not considered in this document. This thesis is focused on Minergie-ECO.

The topics on health-related subjects are subdivided into daylight, sound insulation and indoor wellbeing. In the next chapter, you can find a brief analysis of the integrated and non-integrated health aspects of the certification scheme. The issues of environmental impact are structured in building concept, materials and building process and embodied energy, but it is not part of the investigation of this work.

# HISTORY OF MINERGIE AND ITS ANNEX ECO

In 1998, the Minergie Association was founded in Switzerland to promote low-energy-consumption building standards and sustainable construction practices. 2006 Minergie-ECO was introduced as an extension of the Minergie Standard, emphasizing not only energy efficiency but also ecological and health aspects in building construction. It has been a result of a collaboration of Minergie and the Swiss Association Eco-Bau. The association Eco-Bau has a strong position in Switzerland, within the members are the federal and many cantonal building authorities, the aim is to promote the ecological and healthy building. The focus of the association's activities is the development and dissemination of planning tools that support planners and architects in all construction phases. Today, 15%-20% of all new buildings in Switzerland are Minergie certified, but only a relatively small proportion around 2% of renovations. In total, there are more than 50,000 certified buildings in Switzerland, and about 700 abroad. And there are more than 2,200 certified buildings with the annex -ECO in Switzerland, ranging from small detached houses to hospital buildings as the Inselspital Bern with over 67,000m2. "At the same time, MINERGIE-ECO influenced the building material market. The availability of recycled concrete improved significantly and the number of solvent-free products significantly increased." [1]

"With its approach to healthy and ecological building, Minergie-Eco covers a large part of the aspects of sustainable building (society, economy and environment). Not assessed are, for example, the influences on the community, design, use, development and investment costs." [2]

#### EXPANSION STRATEGY OF MINERGIE

Throughout its evolution, Minergie has gained widespread recognition and acceptance in Switzerland and beyond. It has become a well-known and respected standard for energy-efficient and sustainable construction, contributing significantly to reducing the carbon footprint of buildings and promoting healthier living and working environments for occupants.

The first Minergie buildings in Spain have been certified in between 2011 and 2015, and actually there are only 3 buildings in Spain. This is partly caused by the close connection to the Swiss building regulation, but as well by a missing expansion strategy of Minergie itself. At these moments the situation is about to change, Minergie just started to be present in Mexico and Chile, and is preparing to be established in certain countries in Europe.

What can Minergie offer, that other local or international standards can't provide? The basic Minergie standard would not give an interesting novelty. But Minergie-ECO could be a good alternative for a sustainable standard, especially for cost conscious real estate investors and for private investors. As the cost of the certification is scaled according to the size of the project, and in general the cost is affordable. In the following graph, you can find some examples of certification costs.

size of the building	Minergie	ECO	Minergie-ECO
≤ 250 m2 *	1.200	1.900	3.100
≤ 250 m2 **	1.500	5.000	6.500
> 500 ≤ 1.000 m2 *	1.700	5.000	6.700
> 500 ≤ 1.000 m2 **	2.100	5.000	7.100
> 5.000 ≤ 10.000 m2 *	8.500	11.000	19.500
> 5.000 ≤ 10.000 m2 **	10.000	11.000	21.000
> 10.000 m2 */**	specific offer	specific offer	specific offer

Figure 2: Certification costs of Minergie-ECO.

This overview represents only certification costs, it does not include possible increment of the construction price, nor consulting experts. The prices are defined for Switzerland, abroad costs may vary.

\* Residential buildings

\*\*Administration, sales, restaurants, assembly halls

- Schools, sports facilities, hospitals, industry, warehouses, indoor swimming pools, are not included in the cost graph, being cheaper schools and sports facilities, and more expensive the others.

"The MINERGIE-ECO evaluation procedure has proven to be very flexible because it provides the applicant with several alternatives that are to be implemented only in some parts. In addition, there is no requirement to rely on the services of a sustainability expert because specifications are practice-oriented. The simple procedure not only diminishes certification costs but also expenditures for the overall certification process." [1]

# ANALYSE OF THE HEALTH CRITERIA IN THE MINERGIE-ECO STANDARD

# DEFINITION OF HEALTH CRITERIA

The base for this study is the sustainable standard, Minergie-ECO, that has briefly been presented earlier. Anyhow, the aim is to focus only on the health aspects of this standard. Many impacts can influence our health, the health of fauna and flora, or even of the planet. Some more immediately, others in the future. The analysis only respects impacts on the health of the user of the building, only direct and immediate impacts. To verify the completeness of the criteria, the comparison is based on health criteria treated in the postgrade studies of Architecture and Health.

		<b>v</b>	
alth	Minergie	ECO	
Life quality and hea	Comfort • Hight thermal comfort	<ul><li>Health</li><li>Ideal daylight conditions</li></ul>	Daylight
	<ul> <li>Summer heat protection</li> <li>Systematic air renovation</li> </ul>	<ul> <li>Low noise immissions</li> <li>Low burden with pollutant, germs and radiation</li> </ul>	Soundproofing
			Indoor well-being
Low environmental impact	<ul><li>Energy efficiency</li><li>Global energy consumption at 20%</li></ul>	<ul><li>Building ecology</li><li>Long life cycle, flexibility of use, dis-</li></ul>	Building concept
	<ul> <li>Iower than average standard</li> <li>Fossil energy consumption approximately 50% lower than average stand-</li> </ul>	<ul> <li>mantling capability</li> <li>Use of recycled building materials, labelled products, soil protection</li> <li>Low embodied energy of the sum of all building materials used</li> </ul>	Materials and building processes
	ard		Embodied energy of building materials

# Minergie-ECO

Figure 3: The criteria of Minergie-Eco. On the left the criteria of Minergie (Minergie-P and Minergie-A), on the right the criteria of the Eco addition.

#### ASSESSMENT METHODOLOGY

Minergie-ECO is divided into 6 areas and the exclusion criteria. Three areas are dedicated to health, the other three to building ecology. The exclusion criteria are from both sectors, with health criteria having more weight.

The assessment methodology is carried out in two ways. There are chapters that are evaluated with a procedure based on a catalogue of specifications, others with a calculation, such as the daylight level and the compliance with the maximum grey energy (the latter not a health criterion). In the case of the catalogue of specifications, the answer is yes or no, or no information if the criterion does not exist for the building. To clarify the scoring, I quote from the document "Vorgabenkatalog Minergie-ECO Neubau MFH, Stand 30. Mai 2023": "Exclusion criteria are those requirements that must be met absolutely and without gaps in order for a building to be certified. This ensures a minimum quality standard. Points are awarded for the fulfilment of the remaining requirements. As a minimum degree of fulfilment, 50% of the maximum achievable points, which result from the number of specifications applicable to the concrete project, must be achieved in each criterion. Below 50% (grey energy: above upper limit GW2) the traffic light is red, between 50% and 70% (grey energy: between GW1 and GW2) it is yellow and above 70% (grey energy: below GW1) it is green. The partial results are combined by means of a traffic light system. Overall, the following results must be achieved for certification: Minergie standard achieved, all exclusion criteria fulfilled, no traffic lights on red and at least two traffic lights on green in the area of health or building ecology." [5]

To guarantee the feasibility of Minergie-ECO projects, there is an 80% rule. To explain it, here is a quote from the same document as the previous one: "In order to fulfil a specification, only 80% of the affected components must comply with it. The percentage refers in each case to a sensible scale for assessment. The aim of this rule is the practical handling of the requirements. However, this 80% rule does not apply to exclusion criteria; in this case, 100% of the affected components must comply with the specification." [3]

The fact that only two thirds of the questions have to be answered with yes and the existence of the 80% rule could lead to the assumption that it is an easy standard to fulfil. However, experience with Minergie-ECO buildings shows that it is a great challenge to obtain certification, and the measurement of indoor air quality and non-ionising radiation as acceptance criteria naturally contribute to this.

## HEALTH REQUIREMENTS OF MINERGIE-ECO

The Minergie-ECO health criteria are divided into three areas. Optimal use of daylight, improved sound insulation and a healthy indoor well-being. The first two areas are not analysed in depth in this paper, as they are largely self-explanatory and are recognised as generally valid. As mentioned before, the daylight verification is verified with a calculation programme, the sound insulation with a list of questions. But now to the interesting part, which is summarised under the term healthy indoor well-being and in the exclusion criteria.

Let's start with the exclusion criteria, after all these are the only criteria whose non-fulfilment makes certification impossible. Enclosed is a list of the exclusion criteria relevant to health. The item "MNA2.010 Installation and sealing work" only partially fulfils the aspects specified in the chapter "Definition of health criteria", as it can affect the health of the construction workers and not of the occupants.

EXCLUSION CRITERIA (selection of the ones related with health) [3] MNA1.010 Pollutants in buildings MNA1.030 Biocides and wood preservatives indoors MNA1.040 Formaldehyde emissions from building materials MNA1.050 Solvent emissions from construction and auxiliary materials MNA2.010 Assembly and sealing work MNA9.010 Indoor air measurements: Formaldehyde MNA9.020 Indoor air measurements: TVOC

#### MNA1.010 Pollutants in buildings

In buildings built before 1990 or where substances hazardous to the environment and health are to be expected, a building pollutant assessment (ecobau building check) is carried out by a suitable specialist before the conversion or deconstruction measures.

All materials containing pollutants identified in the building check are professionally remediated or removed, recycled or disposed of.

Very briefly summarised without any claim to completeness, existing buildings are checked for the following products: "Asbestos, Polychlorinated biphenyls (PCB) and chlorinated paraffins (CP), Polycyclic aromatic hydrocarbons (PAH), Heavy metals, Wood preservatives, Moulds, Formaldehyde, Radon, Other pollutants." [4] The following link leads to the document Building Check ecobau. https://www.ecobau.ch/de/instrumente/ecobkp

MNA1.030 Biocides and wood preservatives indoors

Excluded: Use of biocides or biocide-treated paints (film preservation) and chemical wood preservatives in heated interiors.

MNA1.040 Formaldehyde emissions from building materials

Excluded: Use of wood-based materials in heated interiors which either do not comply with applications 1 or 2 of the Lignum product list of suitable wood-based materials for indoor use or the respective product and application recommendations or use of wood-based materials in heated interiors which are not provided with a suitable coating or covering on all sides and use of other building materials in heated interiors (on the room side of the airtight layer) that can release formaldehyde in relevant quantities. https://www.lignum.ch/holz\_a\_z/raumluftqualitaet/ (at the very end of the webpage, only available in German or French).

MNA1.050 Solvent emissions from construction and auxiliary materials Excluded: Processing of solvent-dilutable products (paints, impregnations, sealants, oils/waxes, adhesives, fillers, cleaning agents, etc.) in heated interior rooms.

MNA2.010 Assembly and sealing work

Excluded: Assembly, sealing or filling of cavities by means of assembly or filling foams.

MNA9.010 Indoor air measurements: Formaldehyde

Excluded: Measured values of the formaldehyde concentration in the investigated above 60  $\mu$ g/m3 (active measurement) or above 30  $\mu$ g/m3 (passive measurement).

MNA9.020 Indoor air measurements: TVOC

Excluded: Measured values of the TVOC concentration in the examined rooms above 1000  $\mu$ g/m3 (active measurement) or above 500  $\mu$ g/m3 (passive measurement).

The non-health-specific exclusion criteria are not listed here; they can be consulted in Annex I "Specification catalog Minergie-ECO new residential building".

These are the most highly rated health criteria in Minergie-ECO, as they are mandatory to fulfil in order to achieve a certificate. Of the previously mentioned chapters on daylight, sound insulation and indoor climate, we will now have a closer look at the latter. For this purpose, we will first provide a list of the criteria and then look at them in more detail.

INDOOR WELL-BEING

MNI1.010 Cleanability and protection of air-carrying components (ventilation and air- conditioning systems)

MNI1.020 Air conditioning of ventilation systems

MNI1.040 Initial hygiene inspection of ventilation systems

MNI2.010 Legionella

MNI2.020 Cooling towers or wet recoolers

MNI3.010 Measures to reduce radon contamination

MNI4.010 Non-ionising radiation (NIR zone plan, low frequency 50 Hz)

MNI4.020 Non-ionising radiation (main lines)

MNI4.030 Non-ionising radiation (laying of lines)

MNI4.040 Non-ionising radiation (antennas)

MNI5.020 Floor coverings

MNI5.030 Respirable mineral fibres

MNI5.040 Building product labels (paints and varnishes)

MNI5.050 Building product label (installation materials and joint sealants)

MNI5.060 Ventilation after completion (pollutant emissions)

MNI9.010 Indoor air measurements (CO2)

MNI9.020 Indoor air measurements (radon)

MNI9.030 Acceptance measurements (non-ionising radiation low frequency 50 Hz)

MNI1.010 Cleanability and protection of air-carrying components (ventilation and air- conditioning systems)

Surfaces of air-conducting components are designed and manufactured in such a way that dirt deposits are not encouraged and complete cleaning is possible in all parts. Planning and execution comply with the requirements of SWKI guideline VA104-1 "Hygiene requirements for ventilation and air-conditioning systems".

On the construction site, all air-conducting components are protected from dust and dirt deposits as well as moisture.

MNI1.020 Air conditioning of ventilation systems

The ventilation systems do not include air conditioning (dehumidification or humidification systems).

MNI1.040 Initial hygiene inspection of ventilation systems

Before the building is occupied, the entire ventilation system is subjected to an initial hygiene inspection in accordance with SWKI guideline VA104-01 by a suitable specialist who is independent of

the company carrying out the work. Any defects found will be rectified no later than 2 weeks after occupation.

#### MNI2.010 Legionella

The planning of the hot water supply complies with the hygienic requirements of SIA standard 385/1:2011.

#### MNI2.020 Cooling towers or wet recoolers

The air flows from adiabatic coolers or wet recoolers/cooling towers are not in contact with the room air. The distance to openable windows, doors or walkable outdoor areas is at least 10 metres.

## MNI3.010 Measures to reduce radon contamination

The building shall be constructed in such a way that the radon concentration in the main rooms does not exceed 100 Bq/m3. For this purpose, the measures of radon-safe construction (see section Remarks) are to be taken into account. If the risk of increased radon exposure according to the FOPH radon map is more than 10% or if not all measures (according to section Remarks) are implemented, additional measures are to be taken in consultation with a radon expert.

#### MNI4.010 Non-ionising radiation (NIR zone plan, low frequency 50 Hz)

A NIR zone plan with the spatial allocation according to use zones (A, B) and the zones in which the limit values for these use zones are exceeded was drawn up for the entire building and corrected (measures to prevent limit value exceedances). Use zones A are places where mainly users stay who are classified as particularly sensitive (e.g. crèches, nurseries, gardens and playgrounds, bedrooms). Use zones B are rooms in which people regularly stay for longer periods of time.

#### MNI4.020 Non-ionising radiation (main lines)

The routing of the main lines (incl. routes) and riser zones as well as the arrangement of distribution systems and racks for heavy current installations shall not take place in rooms of utilisation zones A or B.

#### MNI4.030 Non-ionising radiation (laying of lines)

Cables are laid in rooms in usage zones A and B in the form of round cables (no individual wires, no ribbon cables).

#### MNI4.040 Non-ionising radiation (antennas)

Fixed transmitting antennas for wireless in-house communication are not installed in rooms in use zones A or B. Or it is demonstrated that the antennas are arranged in such a way that the radiation exposure of the building occupants is minimised.

#### MNI5.020 Floor coverings

Smooth, low-joint and easy-to-clean coverings will be installed throughout the building. In all entrance areas, suitable measures (dirt locks, Brossen mats, etc.) will ensure that as little dirt as possible is brought into the building.

#### MNI5.030 Respirable mineral fibres

Building materials that can release respirable fibres (e.g. mineral fibre insulation materials) are not in direct contact with indoor air.

MNI5.040 Building product labels (paints and varnishes)

The paints used inside the building (wall paints, varnishes, wood and floor coatings) bear the environmental label category A or B of the Swiss Paint Foundation or an equivalent label. http://stiftungfarbe.org/verzeichnis/

MNI5.050 Building product label (installation materials and joint sealants)

Products for the installation of floor coverings (e.g. primers, undercoats, fillers and adhesives) and joint sealants bear the EMICODE EC1, EC1 plus, eco-Institut-Label, Eco-1, Eco-2 or an equivalent label.

http://www.emicode.com/produkte/

MNI5.060 Ventilation after completion (pollutant emissions)

There is a minimum of 30 days between the completion of the building and the date of occupancy. During this time, good ventilation of the rooms is ensured.

MNI9.010 Indoor air measurements (CO2)

After completion of the building, indoor air measurements are carried out in the main rooms. The measured values of the CO2 concentration of all examined rooms are below the limit value for indoor air quality RAL 3 according to SIA standard 382/1 under everyday conditions of use.

MNI9.020 Indoor air measurements (radon)

Radon measurements are carried out after completion of the building. The measured values of the radon concentration of all examined rooms are below 100 Bq/m3.

MNI9.030 Acceptance measurements (non-ionising radiation low frequency 50 Hz) By means of acceptance measurements, compliance with the limit values is randomly checked. In rooms in use zone A, 0.4  $\mu$ T or 50 V/m are exceeded, in rooms in use zone B 1  $\mu$ T or 500 V/m, and in the other rooms the limit values of the NISV are not exceeded.

So far the criteria of indoor air, or perhaps better translated as indoor well-being. Of course, it is important to know that in contrast to the exclusion criteria, these points do not have to be fulfilled compulsorily, but only a minimum two thirds of all. This can be criticised, but it can also be argued that thanks to this flexibility, more Minergie-ECO buildings will be certified, and thus more healthy buildings will be constructed.

So much for the health aspects of the chapter on indoor climate. As mentioned above, the sustainability aspects can be consulted in Annex 1.

NOT CONSIDERED HEALTH ASPECTS IN THE CERTIFICATION SYSTEM

Without any scientific claim, and probably expandable, here is a list of criteria that are apparently not taken into account for the Minergie-ECO certificate. First an overview, followed by brief explanations of the terms, and some thoughts on Minergie-ECO's considerations of the criteria.

- 1 Radioactivity of materials
- 2 Endocrine disruptors
- 3 Static load
- 4 Natural radiations. Geobiology
- 5 Sick building syndrome
- 6 Synthetic materials
- 7 Water: treatments and systems
- 8 Biophilia

The following aspects are listed as possible extensions, but are not analysed further in this paper for various reasons. One because of a very weak scientific basis, the other because their integration into a building label and especially its verification would be a very difficult undertaking.

10 Neuroarchitecture

- 11 Architecture and inclusion
- 12 Architecture and gender
- 13 Feng shui
- 14 Sacred geometry

1 Radioactivity of materials

Natural stones with radioactive nuclides and their gamma radiation, as well as ceramic products (uranium and thorium).

\* Ecobau seems not to have paid attention to these factors.

# 2 Endocrine disruptors

"Hormonal contaminants in building materials and equipment. Some of the most known products of chemical origen are phthalates, bisphenol-a, isocyanates, Perfluorinated (PFCs, PFOA, PFOS) but also heavy metals such as lead, cadmium, mercury.

These products are found in a wide range of building materials, such as paints, varnishes and glues, almost all fossil-based insulation materials, PVC windows, flooring and pipes, as well as carpets and fluorescent tubes, and many other building materials, furniture and electronic devices." [5]

\* Endocrine disruptors are indirectly integrated in the Minergie-ECO criteria by certifications of materials like Blue Angel, EMI-codes etc.

# 3 Static load

Electrostatic charge that arises from the friction of different poorly conducting materials. This is caused by sinthetic fibres and plastics, especially at low humidity. For example, the following plastics: carpets, curtains, PVC windows, paints, etc. [6]

\* These criteria concerns in many occasions furniture, which is not integrated into the criteria, as it is usually purchased by the users and replaced over its useful life.

# 4 Natural radiations. Geobiology

How terrestrial radiation and areas of intense geophysical disturbance affect health.

\*This criterion remains without opinion on the part of Ecobau for the time being, as it was not on the author's consultation list.

# 5 Sick building syndrome

Sick building syndrome (SBS) is a condition in which people develop symptoms of illness or become infected with chronic disease from the building in which they work or reside. [7] \*The term SBS itself does not appear in the Minergie-ECO documents, but various criteria of the standard contribute to greatly reducing the probability of creating an SBS building.

# 6 Synthetic materials

They can contribute to reduce indoor air quality by introducing harmful chemical products and substances into the environment. They create spaces with more discomfort: with more static generation, fewer ambient ions. They act as electrical insulators and affect the behaviour of the magnificent electro climate. Furthermore, they do not have physical properties for regulating environmental parameters: closed pores, not breathable. [8]

\*Synthetic materials per se are not mentioned, but by controlling COVs, formaldehydes, and using material labels, a good deal of health problematic synthetic materials are excluded..

# 7 Water: treatments and systems

Quality control of the water and analysis for microbacterial and chemical contamination, as well as for radioactivity. Control of the content of metals, nitrates and mineral salts such as iron, manganese and lime, and other contaminants.

\* Until now, only the measures against legionella applied with regard to water. Since the issue of legionella is now sufficiently enshrined in law in Switzerland, this point will be removed in the new version of Minergie-ECO.

Because of the high water quality in Switzerland, further requirements will probably be waived.

# 8 Biophilia

The integration of plants to filter air particles, produce oxygen and relax users thanks to the colour quality.

\* Ecobau centers the focus on the fixed components of buildings, as plants are often independent of the architecture itself.

Following a lengthy conversation with Basil Monkewitz from Ecobau, responsible for the area of buildings, here is an overview of the considerations of possible additions to the catalogue of criteria from the label ECO. Ecobau is the association of federal, cantonal and municipal building authorities as well as educational institutions for architecture and construction that want to establish sustainable building as a standard in Switzerland. Ecobau is responsible for the technical content of the Minergie-ECO certification. In general, it must be stated that the association wants to promote sustainable construction and is interested in having many ECO certifications. Therefore, the criteria must be comprehensible and easily verifiable. Most ECO clients are exemplary builders who realise multifamily houses, school buildings and office buildings, often public developers. The declaration of the specifications is usually carried out by an architect or a building physicist, and therefore does not have to be too complex. The verifiability of the certification bodies must also be guaranteed. Most of the time, buildings are certified Minergie-ECO because the public administration requires it.

#### CONCLUSIONS

If energy efficiency is not a natural part of building design for many professionals in the building sector, the issue of health is often not even on their minds. In recent years, however, there has been an increase in awareness in this area, and we know more and more how much our health is affected by indoor spaces. Medical care is important for our health, but according to different studies it is only responsible for 10-20% of good health. Around 80% is influenced by other factors and 10-20% by our physical environment (check figure 1). Therefore, any progress in healthy building is welcome. In the everyday life of architects and planners, a standard that integrates health aspects can be of great help. Minergie-ECO takes an important part of the health aspects into account, is market-tested, and has affordable certification costs. We could observe that there is room for interpretation in the application of the criteria, apart from the exclusion criteria. Thus, not all criteria of the catalogue of requirements must be fulfilled. Furthermore, certain factors that influence health are missing. The standard certainly serves to make the building stock healthier, but it must be strictly adhered to and possibly supplemented in the case of particularly demanding and sensitive clients. Depending on the target audience, it must therefore be evaluated whether compliance with Minergie-ECO is sufficient or whether other aspects must be added. Furthermore, the standard must be adapted to the national market in order to be applied reasonably. We will see whether the current expansion strategy will change this situation.

Regarding the understanding of the handling of the standard and its advantages and disadvantages, below you find two quotes from a publication by Severin Lenel and Daniel Kellenberger. Even though they are from 2011, they are still valid today.

"MINERGIE-ECO 2011 is making a large step forward with these adjustments – not in the direction of a thematically broad sustainability label of the "second generation", but rather towards an integrated approach allowing for the easiest, most practical application possible. In so doing, MINERGIE-ECO does not want to reach so much a scientifically oriented audience but rather a high market share, thus coming closer to the objective of a sustainable way of building in Switzerland." [1]

"Whoever was involved with the process of a LEED certification knows the difficulties caused by a lack of tools. Right from the beginning, MINERGIE-ECO took the approach of providing all the necessary instruments. The purpose of a building label is not exclusively about documenting the finalized status quo, but also about striving towards project optimization. This, however, is only possible with an instrument that is able to depict all important features and capable of immediately displaying the results. The existing MINERGIE-ECO instrument for proof assumes exactly this function and has in principle proved its value. It will be adapted to the new structure and to the new evaluation method of MINERGIE-ECO 2011." [1]

# ANNEX

SPECIFICATION CATALOGUE OF MINERGIE-ECO CRITERIA FOR RESIDENTIAL BUILDINGS

Verification version 1.5 ME-ECO Online 2020 State 30. Mai 2023

# **Chapter overview**

Nr.	Торіс			
Α	Exclusion criteria	7	of	10
т	Daylight	all	of	Х
S	Soundproofing	14	of	14
L	Indoor well-being	18	of	18
G	Building concept	1	of	18
М	Materiales and building process	0	of	18
G	Embodied energy building materials	0	of	Х
<b>Total criteria</b>	related with health	40	of	78

Criteria partly related with health of occupants
Criteria exclusively related with health of occupants

# **Overview of the specifications**

Nr.	Торіс
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A	Exclusion criteria
MNA1.010	Pollutants in buildings
MNA1.030	Biocides and wood preservatives indoors
MNA1.040	Formaldehyde emissions from building materials
MNA1.050	Solvent emissions from construction and auxiliary materials
MNA2.010	Assembly and sealing work
MNA2.020	Heavy metal-containing weathered building components (roofing, façade and finishing materials)
MNA2.040	Wood selection
MNA2.050	Recycling (RC) - Concrete
MNA9.010	Indoor air measurements: Formaldehyde
MNA9.020	Indoor air measurements: TVOC
т	Davlight
	To be justified by calculation program
S	Soundproofing
MNS1.010	Sound insulation of the building envelope and between several usage units: Minimum requirements
MNS1.020	Sound insulation of the building envelope: increased requirements
MNS1.030	Sound insulation between several units in use (airborne and impact sound): increased requirements
MNS1.040	Sound insulation between several units in use (noise from technical installations): increased requirements
MNS2.010	Sound insulation within the usage units (airborne and impact sound): Level 1
MNS2.020	Sound insulation within the usage units (airborne and impact sound): Level 2
MNS2.030	Sound insulation within the usage units (noise from building services): Level 1
MNS2.040	Sound insulation within the utilisation units (noise from building services): Level 2
MNS3.010	Structural measures: Roof and waste water pipes
MNS3.020	Structural measures: Sanitary appliances
MNS3.030	Structural measures: Elevator systems
MNS4.010	Room acoustics
MNS5.010	Noise immission in the outdoor area
MNS9.010	Measurement of sound insulation after completion of construction work
	Indeer well being
I MNI1 010	Cleanability and protection of air-carrying components (ventilation and air-
	conditioning systems)
MNI1.020	Air conditioning of ventilation systems
MNI1.040	Initial hygiene inspection of ventilation systems
MNI2.010	Legionella
MNI2.020	Cooling towers or wet recoolers
MNI3.010	Measures to reduce radon contamination
MNI4.010	Non-ionising radiation (NIR zone plan, low frequency 50 Hz)
MNI4.020	Non-ionising radiation (main lines)
MNI4.030	Non-ionising radiation (laying of lines)
MNI4.040	Non-ionising radiation (antennas)
MNI5.020	Floor coverings

- MNI5.030 Respirable mineral fibres
- MNI5.040 Building product labels (paints and varnishes)
- MNI5.050 Building product label (installation materials and joint sealants)
- MNI5.060 Ventilation after completion (pollutant emissions)
- MNI9.010 Indoor air measurements (CO2)
- MNI9.020 Indoor air measurements (radon)
- MNI9.030 Acceptance measurements (non-ionising radiation low frequency 50 Hz)

#### G Building concept

- MNG1.010 Site preparation (demolition of existing buildings)
- MNG1.030 Environmental design
- MNG2.010 Flexibility of use of the supporting structure, requirement level 1
- MNG2.020 Flexibility of use of the supporting structure, requirement level 2
- MNG2.030 Flexibility of use through façade design
- MNG3.010 Accessibility of vertical HT installations
- MNG3.020 Accessibility of horizontal HT installations
- MNG3.030 Structural conditions for the replacement of machinery and large equipment
- MNG4.010 Deconstructability of building envelope and secondary structure
- MNG4.020 Deconstruction capability of building services and tertiary structure
- MNG5.010 Water-saving concept (apparatus and fittings)
- MNG5.020 Dealing with rainwater
- MNG6.010 Animal-friendly design
- MNG6.020 Outlook
- MNG7.010 Weather resistance of the façade
- MNG7.020 Weather resistance of the windows
- MNG8.010 Extension possibilities, reserve
- MNG8.020 Greenhouse gas emissions (CO2) Creation
- M Materiales and building process
- MNM1.010 Soil protection
- MNM2.010 Label for wood and wood-based materials
- MNM3.020 Recycled (RC) Structural concrete with increased content of RC material
- MNM3.030 Recycled (Rc) filling, casing and underlay concrete with increased content of recycled (RC) material
- MNM3.040 RC structural concrete with mixed granules
- MNM4.010 Cement types for normally stressed concretes
- MNM4.020 Insulating materials with unfavourable ecological properties (roofs, ceilings and foundation slabs)
- MNM4.021 Insulating materials with unfavourable ecological properties (walls)
- MNM4.030 Chemical root protection for waterproofing
- MNM4.040 Biocide-free facades
- MNM4.050 Halogen-free installation materials
- MNM4.060 Organic-mineral composite materials
- MNM4.070 Hard-to-separate plastic coverings and sealants
- MNM4.080 PVC building products with environmentally relevant components
- MNM4.090 Heavy metal-containing weathered building components outside the building envelope
- MNM5.010 No heating of the building shell
- G Embodied energy building materials
  - To be justified by calculation program

# Übersicht der Vorgaben (basis for translation)

# Nr.ThemaAAusschlusskriterienMNA1.010Schadstoffe in GebäudenMNA1.030Biozide und Holzschutzmittel in InnenräumenMNA1.040Formaldehyd-Emissionen aus Baumaterialien

- MNA1.050 Lösemittel-Emissionen aus Bau- und Hilfsstoffen
- MNA2.010 Montage- und Abdichtungsarbeiten
- MNA2.020 Schwermetallhaltige bewitterte Bauteile (Bedachungs-, Fassaden- und Abschlussmaterialien)
- MNA2.040 Holzauswahl
- MNA2.050 Recycling (RC) Beton
- MNA9.010 Raumluftmessungen: Formaldehyd
- MNA9.020 Raumluftmessungen: TVOC

#### T Tageslicht

## S Schallschutz

MNS1.010 Schallschutz der Gebäudehülle und zwischen mehreren Nutzungseinheiten: Mindestanforderungen

- MNS1.020 Schallschutz der Gebäudehülle: erhöhte Anforderungen
- MNS1.030 Schallschutz zwischen mehreren Nutzungseinheiten (Luft- und Trittschall): erhöhte Anforderungen
- MNS1.040 Schallschutz zwischen mehreren Nutzungseinheiten (Geräusche haustechn. Anlagen): erhöhte Anforderungen
- MNS2.010 Schallschutz innerhalb der Nutzungseinheiten (Luft- und Trittschall): Stufe 1
- MNS2.020 Schallschutz innerhalb der Nutzungseinheiten (Luft- und Trittschall): Stufe 2
- MNS2.030 Schallschutz innerhalb der Nutzungseinheiten (Geräusche haustechnischer Anlagen): Stufe 1
- MNS2.040 Schallschutz innerhalb der Nutzungseinheiten (Geräusche haustechnischer Anlagen): Stufe 2
- MNS3.010 Bauliche Massnahmen: Dach- und Abwasserrohre
- MNS3.020 Bauliche Massnahmen: Sanitärapparate
- MNS3.030 Bauliche Massnahmen: Aufzugsanlagen
- MNS4.010 Raumakustik
- MNS5.010 Lärmimmission im Aussenraum
- MNS9.010 Messung des Schallschutzes nach Baufertigstellung

#### Innenraumklima

- MNI1.010 Reinigungsfähigkeit und Schutz luftführender Bauteile (Lüftungs- und Klimaanlagen)
- MNI1.020 Luftkonditionierung bei Lüftungsanlagen
- MNI1.040 Hygiene-Erstinspektion von Lüftungsanlagen
- MNI2.010 Legionellen

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- MNI2.020 Kühltürme oder Nass-Rückkühler
- MNI3.010 Massnahmen zur Reduktion der Radonbelastung
- MNI4.010 Nicht ionisierende Strahlung (NIS-Zonenplan, Niederfrequenz 50 Hz)
- MNI4.020 Nicht ionisierende Strahlung (Hauptleitungen)
- MNI4.030 Nicht ionisierende Strahlung (Verlegung von Leitungen)
- MNI4.040 Nicht ionisierende Strahlung (Antennen)
- MNI5.020 Bodenbeläge

#### MNI5.030 Lungengängige Mineralfasern

- MNI5.040 Bauproduktelabel (Farben und Lacke)
- MNI5.050 Bauproduktelabel (Verlegewerkstoffe und Fugendichtungsmassen)
- MNI5.060 Auslüftung nach Fertigstellung (Schadstoffemissionen)
- MNI9.010 Raumluftmessungen (CO2)
- MNI9.020 Raumluftmessungen (Radon)
- MNI9.030 Abnahmemessungen (Nicht ionisierende Strahlung Niederfrequenz 50 Hz)

#### G Gebäudekonzept

- MNG1.010 Grundstücksvorbereitung (Rückbau bestehender Gebäude)
- MNG1.030 Umgebungsgestaltung
- MNG2.010 Nutzungsflexibilität der Tragstruktur, Anforderungsniveau 1
- MNG2.020 Nutzungsflexibilität der Tragstruktur, Anforderungsniveau 2
- MNG2.030 Nutzungsflexibilität durch die Fassadengestaltung
- MNG3.010 Zugänglichkeit vertikaler HT-Installationen
- MNG3.020 Zugänglichkeit horizontaler HT-Installationen
- MNG3.030 Bauliche Bedingungen für den Ersatz von Maschinen und Grossgeräten
- MNG4.010 Rückbaufähigkeit von Gebäudehülle und Sekundärstruktur
- MNG4.020 Rückbaufähigkeit von Gebäudetechnik und Tertiärstruktur
- MNG5.010 Wassersparkonzept (Apparate und Armaturen)
- MNG5.020 Umgang mit Regenwasser
- MNG6.010 Tierfreundliche Gestaltung
- MNG6.020 Ausblick
- MNG7.010 Witterungsbeständigkeit der Fassade
- MNG7.020 Witterungsbeständigkeit der Fenster
- MNG8.010 Erweiterungsmöglichkeiten, Reserve
- MNG8.020 Treibhausgasemissionen (CO2) Erstellung

#### M Materialien und Bauprozess

- MNM1.010 Bodenschutz
- MNM2.010 Label für Holz und Holzwerkstoffe
- MNM3.020 Recycling (RC) Konstruktionsbeton mit erhöhtem Gehalt an RC-Material
- MNM3.030 Recycling (Rc) Füll-, Hüll- und Unterlagsbeton mit erhöhtem Gehalt an Recycling (RC)- Material
- MNM3.040 RC Konstruktionsbeton mit Mischgranulat
- MNM4.010 Zementarten für normal beanspruchte Betone
- MNM4.020 Dämmstoffe mit ungünstigen ökologischen Eigenschaften (Dächer, Decken und Fundamentplatten)
- MNM4.021 Dämmstoffe mit ungünstigen ökologischen Eigenschaften (Wände)
- MNM4.030 Chemischer Wurzelschutz für die Abdichtung
- MNM4.040 Biozidfreie Fassaden

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- MNM4.050 Halogenfreie Installationsmaterialien
- MNM4.060 Organisch-mineralische Verbundmaterialien
- MNM4.070 Schwer trennbare Kunststoffbeläge und -abdichtungen
- MNM4.080 PVC-Bauprodukte mit umweltrelevanten Bestandteilen
- MNM4.090 Schwermetallhaltige bewitterte Bauteile ausserhalb der Gebäudehülle
- MNM5.010 Verzicht auf Beheizung des Rohbaus

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