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BREEAM NOR & MINERGIE®

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Summary

This essay is about the comparison of the two commonly used sustainable building certifications of Norway and Switzerland, BREEAM NOR and MINERGIE®.
While the MINERGIE® label is established since more than ten years in Switzerland, Norway is in the process to create its own certification scheme. BREEAM NOR is an adaption of the world leading method of certification for buildings BREEAM to the Norwegian context. This process is still going on and therefore, BREEAM Europe is also introduced.

Within the framework MINERGIE®, three different labels are offered: MINERGIE®, MINERGIE-P® (with tighter restrictions), and MINERGIE-A® (zero energy building). All of them can be combined with an add-on regarding health and environment to MINERGIE-ECO®, MINERGIE-P-ECO® and MINERGIE-A-ECO®.
Also with this add-on, MINERGIE® stays a energy label and is therefore quite different from BREEAM. Then BREEAM widens the bandwidth to more aspects, which influences the sustainability of a building: It evaluates also management, land use and ecology, transport, waste and more.

The MINERGIE®'s focus on energy is its strength (simpler) and weakness (almost just energy). BREEAM is complex to apply, because a special educated BREEAM assessor is needed, but due to its complexity it covers almost the entire meaning of sustainability.

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1 Introduction

“Sustainability” is a today’s buzzword with no standard definition. It seems that “sustainability” has now been ‘hijacked’ by companies with many different interpretations. To be precise, it is actually “sustainable development”, then, it is a continuous process which is going on for a longer period of time. This will be further discussed in chapter 2.1.

There is scientific and political consensus that there is an unequivocal link between climate change and global warming and that greenhouse gas emissions have to be cut by 20% by 2020 [1]. For sure, this has also an effect on the building sector. In Germany 30% of greenhouse gas emissions, 40% of the demand of primary resource as well as primary energy and 50% of waste are attributable to the building sector [2]. In addition there is a huge potential: In advanced countries the energy used in buildings represents 40 to 50 per cent of energy consumption [3].

In response, numerous of assessment methods and house rating schemes has been established to achieve sustainable and zero emission buildings [4]. The course “Use and Operation of Zero Emission Buildings” pursues the objective to introduce these current methods of environmental assessment methods in structure as well in content. It is the theory course and builds together with the main design course the program “Design for Zero Emission Buildings”.

This essay is the assignment for the theory course whereas the topic can be chosen individually. The author is currently an exchange semester at the Norwegian University of Science and Technology, NTNU in Trondheim, Norway. His home university is the Swiss Federal Institute of Technology, ETH in Zurich, Switzerland. A comparison of the two commonly used certifications in both countries was chosen as a focus for this essay. What are the differences between these two certifications schemas, mainly regarding the energy issue? What are the strength and the weaknesses of both?

The essay is split in four parts: First is the theory in chapter 2 with an explanation and definition of sustainability and a short overview about environmental assessment method. In chapter 3 the labels of the two countries are presented, beginning with the new developed assessment scheme of Norway, BREEAM NOR and followed by the scheme of Switzerland, MINERGIE®. The analysis and comparison is done in chapter 4, followed by the Discussion in chapter 5.

2 Theory

2.1 Sustainability

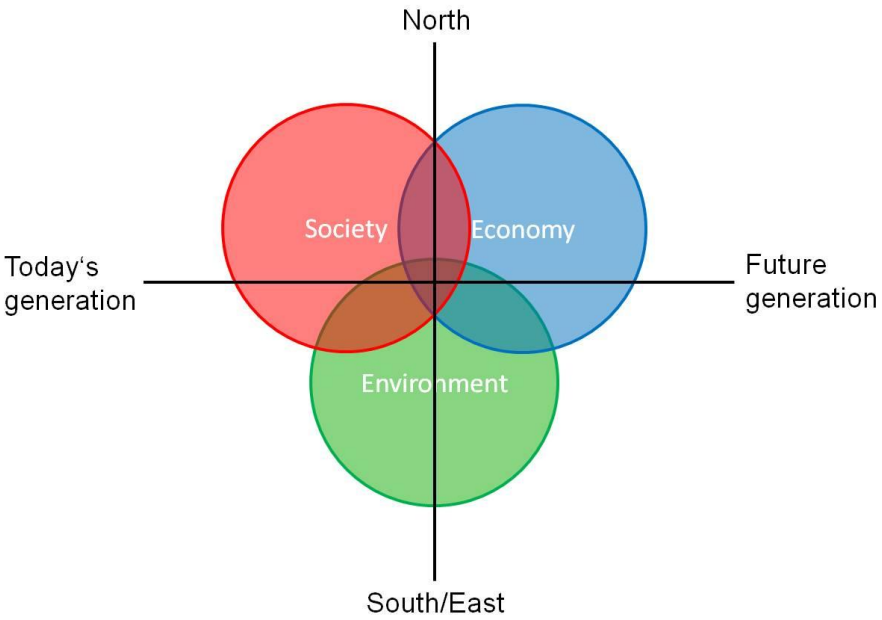
Although mentioned in the introduction that sustainability is a trend it has a long history. In 1713 Hans Carl von Carlowitz wrote the book “Sylvicultura Oeconomica” (forestry economics). In this document he gives instructions for the natural directive on wild tree-breeding and formulates sustainability in forestry: Methods of the timber industry where the forest is protected as a natural resource for the timber industry in the long run. Free summarized it means that: Live on the earnings and not on the substance [5].

Sustainability is not a final state; it is an on-going process and development. In 1987 the Brundtland-Commission of the United Nations defined Sustainable Development as followed [6]:

“Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”

Sustainable development is based on the “three pillar” of sustainability: environment, society and economy. In addition, there is a time dimension (expressed in: generation today - future generation) and a geographically dimension (north - south/east). Figure 1shows the definition of sustainable development.

Figure 1: Sustainable development



Source: own drawing adapted from www.prowasserschloss.ch

2.2 Measuring the sustainability

Sustainability is so comprehensive that there are many issues of definition around what comprise a "green building". Correspondingly, there are numerous factors, which could be accounted for the sustainability of a building (emission, construction materials, water and energy consumption etc.). A variety of techniques, methodologies and schemes exist to measure these factors [7].

For instance, there is the so called Life Cycle Assessment (LCA). It considers only the environmental aspects and consequently it does not evaluate the building in the entire sense of sustainability. This assessment analyzes systematically the environmental affect over the entire life cycle of a certain product or material. The score hereby is to detect weak points and room for improvements or to get an ecological statement. [5]
MINERGIE®-ECO is such a LCA based building label. It gives standards and requires procedures that influence the environmental impact of the building positive as the human health and well-being. [8].

On the other hand there are certification systems which consider the whole meaning of sustainability. The scheme detects the negative and positive affect that a – in this context – building may has on the environment. It is also a tool to rate the building's sustainable (environmental, social and economical) behavior.

2.3 Different building certification and their history

Due to the large energy consumption of the building sector this segment has a huge potential and is in the focus to implement sustainability. Therefore different building certificates are developed and established and several countries have developed their own label and rating scheme [4]. Thus, that today there are plenty of different building labels: As much as 104 certification schemas are available worldwide, thereof 60 in Europe [9].

The first label was BREEAM, originally from UK and now global spreading. Later on there followed a lot of labels; LEED (Origin in North America and now adopted in some parts of the world, e.g. China), Green Star (Australia) or HQE (France) to just name a few. Figure 2 shows an overview of the historical development of building labels.

In general, building certificates can be separated in two generations: *Green Buildings* represent the first generations of certification systems. They focus only on the green performance as the environmental and energy aspect, so not on all "three pillars" of sustainability. LEED and BREEAM represent well this generation. The second generation of building labels *is Sustainable Building*. They take the entire meaning of sustainability into account. Examples for these labels are SBTool[1], LEnSE[2] and DGNB[3].

MINERGIE® is established in 1998 in Switzerland. Since then the label was enhanced and by now there are several sublabels available. Norway is currently in the process of adapting BREEAM to Norwegian context.

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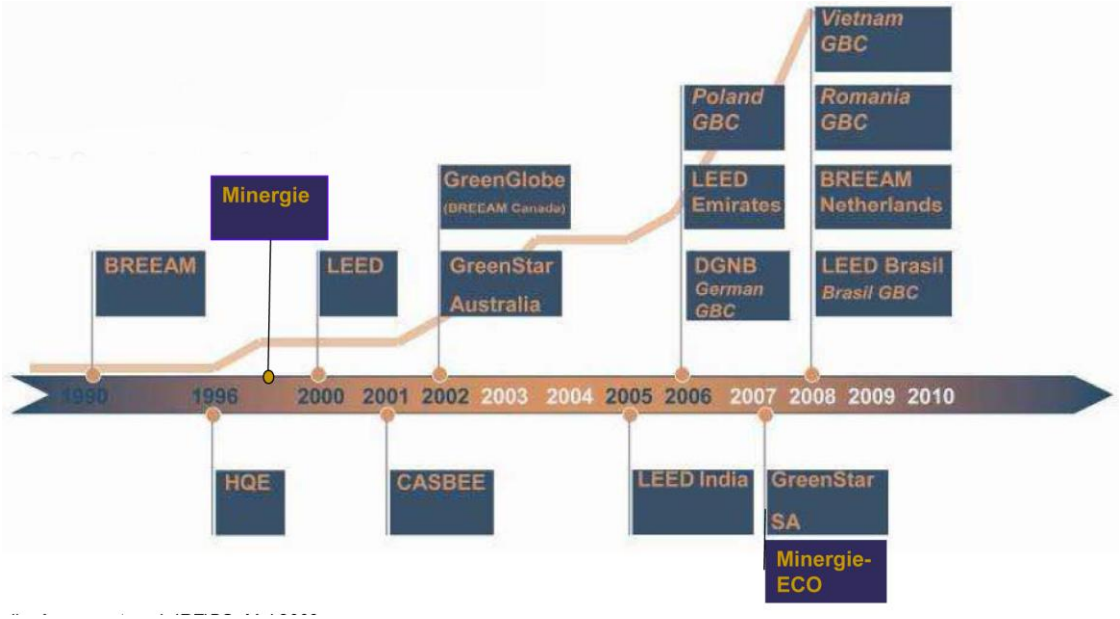
[1] SBTool is developed from iiSBE (International Initiative for a Sustainable Built Environment) and rates the sustainable performance of buildings and projects [10].

[2] LEnSE (Label for Environmental, Social and Economic Buildings) is a European research project for an assessment for the building's sustainability performance [11].

[3] DGNB ist he certificate of Deutsche Gesellschaft für Nachhaltiges Bauen) [12].

Figure 2: Historical development of building labels



Source: Presentation in the course “Nachhaltiges Bauen” from Prof. Dr. H. Wallbaum at ETH Zurich (adjusted, Origin: IRE/BS, May 2009)

2.4 Benefits of building certifications systems

As can be seen in Figure 2, the amount of labels increased the last years drastically. It seems that the labels become more and more popular and it corresponds very well to the trend of sustainability in companies.

Building certificates can be used for marketing purposes to discover potential of sustainability. The use of the logo awarded by a label offers marketing advantages to a building being sold. Consequently, there is a higher safety of capital investment and a better risk management. To build accordingly to a given scheme offers certain financial benefits. The lower operating cost combined with the higher ROI[4] are also positive.

Residents also benefit from a healthier living and working environment, which also increases the attractiveness of the building for renting or selling. Furthermore, a sustainable building can also be part of the firm’s image and demonstrate the corporate social responsibility [5].

[4] ROI: Return on investment

3 The two labels

In this chapter the two labels are introduced and presented, beginning with BREEAM (Chapter 3.1) and later on MINERGIE® (Chapter 3.2). Both labels are described briefly and their criteria and procedure are presented as well.

3.1 BREEAM

3.1.1 BREEAM Europe

Description of the scheme

Because of Norway is now in the process to adapt BREEAM to Norwegian condition, BREEAM Europe is also introduced in this chapter. It serves as the basis for the Norwegian version. BREEAM NOR is presented with all its changes and adaptations in a further step.

BREEAM stands for Building Research Establishment (BRE) Environmental Assessment Method and it was the first assessment method for buildings. It is been established in 1990 by the Building Research Establishment (BRE) in the UK. BREEAM is a measurement rating for green buildings (first generation of sustainable buildings).

BREEAM is the most widely used method of certification for buildings. More than 110 000 projects are certificated all over the world. Numerous well-know global players like Coca-Cola®, IKEA® or Google® require BREEAM certification for all new office buildings that they rent or own worldwide [13].

Today there are 15 different BREEAM-versions for different countries and region available [5]. They are for following building types: retail, offices, education, prisons, courts, healthcare, industrial and multi-Residential. Once the certificate is received, it is valid for an indefinite period. The final rating and certificate shows that e.g. a new building “as built” environmental performance meets the requirements of the BREEAM Standard [14]. Therefore the “BREEAM In Use Assets scheme” is recommended in order to maintain the building’s performance into and throughout the operation of its life cycle and to help to reduce the running cost [14].

Criteria

Depending on the amount of collected credits out of the total, five scores or benchmarks from “pass” till “outstanding” can be achieved. The rating can be found in Table 1.
BREEAM has nine different categories or sections, where a specific performance target has to be achieved to award the available BREEAM points. Furthermore, there is a minimum standard for each category and rating level (see Table 4 in the annex).

The section “Innovation” provides *“additional recognition for building that innovates in the field of sustainable performance, above and beyond the level that is currently recognized and rewarded within standard BREEAM issues.”* [14]. The maximum number of credits in this category is 10 points.

Table 1: Rating of BREEAM

BREEAM Score	Percentage
Pass	> 30
Good	> 45
Very good	> 55
Excellent	> 70
Outstanding	> 85

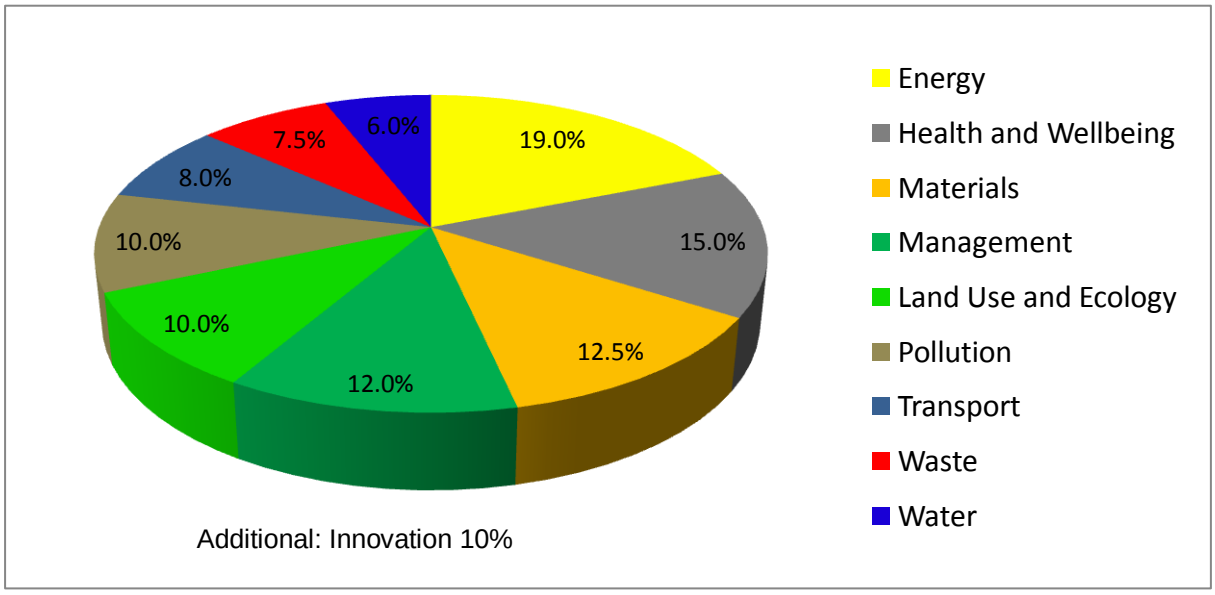
However, the weighting is not equal for each category, but varies from 6% (water) to 19% (energy). The detailed overview is given in Figure 3. In addition, points are given for “Innovation”. These are extra points and therefore not displayed in the figure.

Procedure

The procedure to achieve a BREEAM certificate is accomplished by a BREEAM assessor. The education and instruction of BREEAM assessor is done in special training courses, organized and held by BREglobal. The assessor follows the BREEAM Assessor’s Spreadsheet Tool with associated calculations to determine the BREEAM rating.

Each BREEAM section offers a certain possible amount of credits. The BREEAM assessor determines the number of credits in accordance with BREEAM’s assessment criteria, which are listed in the scheme manual. To get the section rating, the percentage of achieved credits is calculated for each section and multiplied with the correspondent section’s weighting (see Figure 3).

Figure 3: Sections and weighting of BREEAM Europe



Source: own drawing adapted from [14]

Each section score are summed up to give the BREEAM scores. For each “Innovation” credit an additional 1% can be added to the total score (maximal 10%). This final score is compared to the benchmark (see Table 1) and the relevant BREEAM rating is achieved, provided the minimum standards have been confirmed. An example of a BREEAM score calculation can be found in the annex, Table 5.

BREEAM should be involved early in the design project. On the official webpage of BREEAM[5] a tool called “Pre-Assessment Estimators” is available, which provides a quick evaluation and is an aid for decision making during early state of the design process.

3.1.2 BREEAM NOR

Description of the scheme

BREEAM NOR will be the new BREEAM version adapted to Norway. It is still under development and the planned launch was in 2011 [13]. The Norwegian edition of BREEAM is hosted by the Norwegian Green Building Council, which was established 17.09.2010. This council is open for everyone and consists of 120 members (Nov. 2011) with very different background. A lot of different sectors are represented in this council in various numbers: 3 cities, 1 tenant, 42 real estate, 23 industry / contractor, 35 consults / architects and 16 science / NGO / other. [15].

BREEAM NOR is adapted to the country’s specific needs and covers these four building types: Retail, Office, Industry and Educational.

Criteria

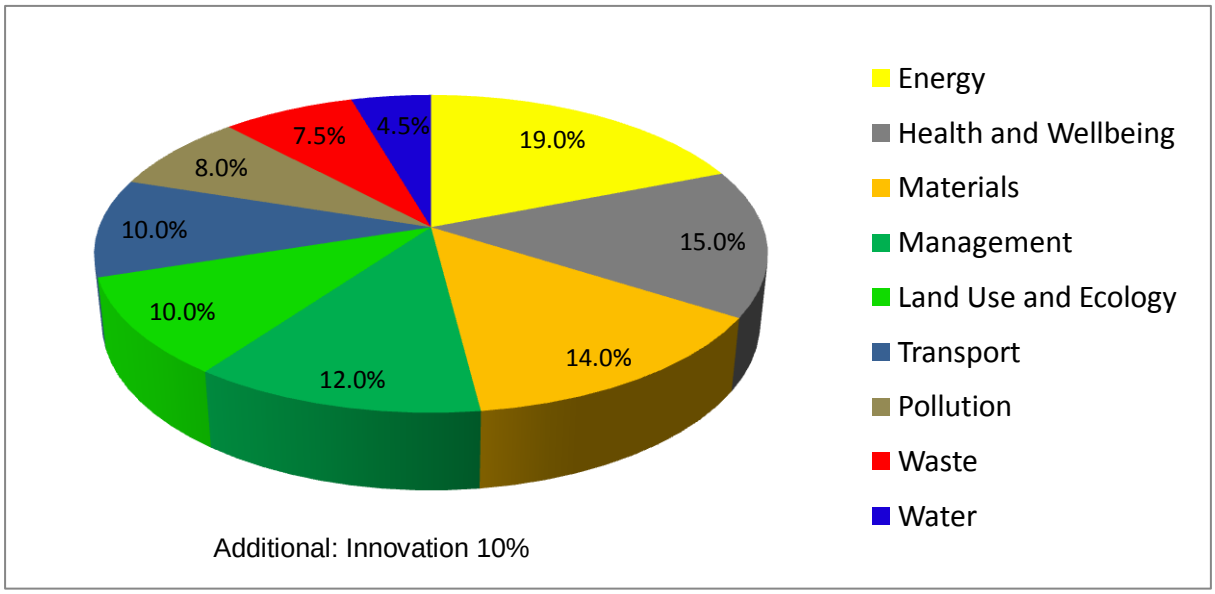
The benchmark for the BREEAM NOR remains the same as for the European version. The nine sections plus the additional one “Innovation” stay as well. However, the weighting has changed slightly, which affects four categories: “Transport” is new weighted with two percent points more and “Materials” with 1.5 percent points more. Therefore, “Pollution” loses 2 percent points and “Water” 1.5 percent points [16]. The weighting of BREEAM NOR is shown in Figure 4.

Procedure

The procedure remains the same as for BREEAM Europe.

[5] www.breeam.org

Figure 4: Sections and weighting of BREEAM NOR



Source: own drawing adapted from [16]

3.2 MINERGIE®

Description of the scheme

MINERGIE® identifies itself as a sustainability brand for new and refurbished buildings. It is a registered label and is mutually supported by the Swiss Confederation, Swiss Cantons and along with trade and industry. It is founded in 1998 and organized as an association.
MINERGIE® is a voluntary energy label for buildings and stands for quality, where comfort is the central theme – comfort of the users living or working in the building. To achieve this high level of comfort, a high-quality building envelops and a systematic renewal of air are necessary [17].

On the official website of MINERGIE® [18], it says that there are at least three advantages with MINERGIE® for all the sublabels: higher comfort, improved conservation of value and last but not least, lower energy costs due to the lower energy consumption.

By the year 2010, a total number of 19’412 buildings were certificated with a MINERGIE®-label in Switzerland. This leads to an average of 2.5 MINERGIE® buildings per 1’000 inhabitants [19]. The total number includes completed buildings as well as projects and it might vary from other statistics, because not every project gets certificated in the end [19].

Three different products are offered within the framework of MINERGIE® registered trade mark: These are called MINERGIE®, MINERGIE®-P and MINERGIE®-A. Furthermore, the supplementary ECO can be added on to one of them. Therefore, ECO can only be used in combination with one of the other three labels. All three products as well as ECO are presented in details below in chapter 3.2.1 et seqq. after this overview over MINERGIE®.

Criteria

The criteria depend on the label that is to be achieved. The focus is on the building envelope, whereas the controlled renewal of the air is also important. Basically, there are requirements regarding the energy demand. MINERGIE® has lower energy requirements, followed by MINERGIE-P®. The specific criteria are presented in the accordant section.

Procedure

Everyone can apply for the MINERGIE® certification by filling in the corresponding forms. An example application can be found on the official webpage from MINERGIE®[6]. Unfortunately, all the documents are only available in German, French or Italian. The English website focuses primarily on general information and marketing the franchise license in other countries.

The application consists of different documents, whereas the *Excel*-Spreadsheet with calculation and descriptions are the main part. These forms have to be handed in to the MINERGIE® association, during the planning phase. The association checks the application and issues a temporary certification. The definitive certification can be applied for after completing the building. Some specific details can be controlled by the association randomly.

3.2.1 MINERGIE®

Description of the scheme

The regular MINERGIE®-standard is the oldest within the MINERGIE® framework and it was established in 1998. This label has lower requirements compared with the other MINERGIE®-standards.

Criteria

There are certain requirements to fulfill to get the certificate with MINERGIE®. The standard postulates requirements regarding energy demand and final energy[7] consumption. Therefore the heat energy demand must be lower than 90% of the legal requirements. These calculations are based on SIA 380/1:2009[8]. These are the primary requirements regarding the building envelope.
In addition, the changing of the air has to be controllable all year long. Consequently, a ventilation system is required for the renewal of the air. Next, a so called MINERGIE®-boundary value of a weighted energy demand index is not to be exceeded. This value is a measure of the total net energy delivered during a year relative to the reference “energy surface”. In the simple case, this corresponds to the sum of the final energy supplied. Usually, the energy sources (fossil, renewable energy or electricity) to calculate the energy index are weighted differently (e.g. factor 0 for solar energy, factor 2 for electricity, 1 for heating oil). The corresponding boundary value depends on the type of building (for residential, it is 38 kWh/m^2).

[6] www.minergie.ch

[7] The final energy does not include energy used in production or lost during transportation.

[8] SIA is the Swiss Society of Engineers and Architects and stipulates the buildings regulations or code for Switzerland. SIA 380/1 regulates the thermal energy in buildings and its newest edition is published in 2009.

Further, the thermal comfort during summer time has to be regarded and the water has to be heated with at least 80% of renewable energy. Depending on the type of building some additional standards regarding the lighting, industrial cold and generation of heat are required [20].
Finally, the additional costs must not exceed 10% compared with conventional object [20].

A further criterion for energy efficiency was found in a figure, which describes the concept of MINERGIE-ECO® (Figure 6 in chapter 3.2.4). On the figure, following demands have to be below average: the total energy demand at least 25% and the fossil energy demand at least 50% [20]. Unfortunately, these numbers cannot be founded in another document or description.

Procedure

The documents and the corresponding forms, together with a documented evidence of conformity about the thermal comfort during summer time have to be hand in to the cantonal certification bureau.

3.2.2 MINERGIE-P®

Description of the scheme

The MINERGIE-P® standard is similar to the regular MINERGIE®, but the requirements are higher. The letter "P" in the label's name stands for "Passivhaus" (passive house) according to the Passivhaus standard[9]. MINERGIE-P® is established in 2003.

Criteria

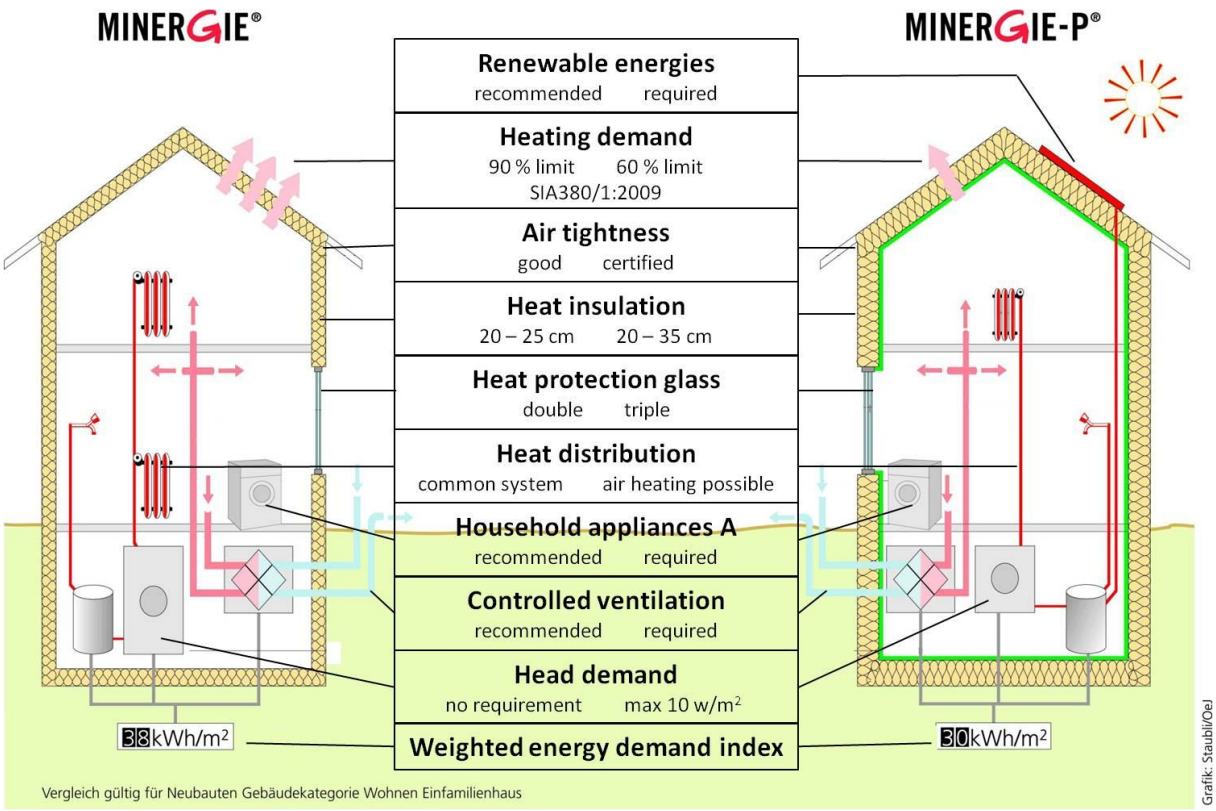
In addition to the MINERGIE® requirements, MINERGIE-P® asks for a maximal specific heating power, an airtight building envelope and household appliance A are just allowed.
The tightened requirements affect in particular a lower weighted energy demand index (30 kWh/m^2 for residential) and the heat energy demand must be lower than 60% of the legal requirements. All the necessary tasks for MINERGIE-P® may not increase the total cost of more than 15% [20].
The difference criteria and the consequences thereof between MINERGIE® and MINERGIE-P® are shown in Figure 5

Procedure

In contrary to the regular MINERGIE® certificate, there are just two MINERGIE-P® bureaus for entire Switzerland, where the application can be handed in. However, the procedure itself remains the same.

[9] In Passivhaus buildings, the thermal comfort is obtained only with postheating and -cooling of the fresh air [21].

Figure 5: Differences between MINERGIE® and MINERGIE-P® and the consequences for the buildings.



Source: own modification, based on [20] and [22]

3.2.3 MINERGIE-A®

Description of the scheme

MINERGIE-A® is the newest label in the framework of MINERGIE® and is established in 2011. Only residential buildings can be certificated. MINERGIE-A® stands for zero energy building. The concept behind zero energy is that there is no energy from non-renewable sources. That means that the residual energy demands are completely covered by renewable energy. Because of the different approach and idea of this label, it can be combined with MINERGIE-P® [23].

Criteria

The requirements for the building's envelope are the same as for the basic MINERGIE® label, so lower than for MINERGIE-P®. The focus concentrates on the weighted energy demand index.
This leads to combination of wooden heating and solar collectors, both of which are working for the same hot water storage. At least the half of the heat demand has to be covered by thermal solar collectors. Another possibility is heat pumps, which run completely with energy from renewable source. No energy from non-renewable source during operation is mandatory [20].

In addition, a low energy demand should be reached with energy efficient equipment, such as household appliances A or “MINERGIE”-classified lamps. In MINERGIE-A®, the focus is on the evaluation of the building services. It should be part of a master plan for the entire building [20].

In an overall consideration, the proportion of embodied energy rises with decreasing energy requirement for the operation of buildings. MINERGIE assumes that the energy expenditure for the construction of the building is equal to the heating demand, water heating and air-renewal of a low energy house [20]. Hence, a limitation of the embodied energy of 50 kWh/m^2 requires an optimization in the design and materialization of the building [20]. The calculation follows the process of MINERGIE-ECO ® 2011 (see chapter 3.2.4).

Procedure

The procedure for applying for MINERGIE-A® is the same as for MINERGIE®.

3.2.4 MINERGIE-ECO® (2011)

Description of the scheme

MINERGIE-ECO® can just be combined with a MINERGIE®-label. They complement together the MINERGIE®-requirements of the components health and construction ecology. This “add-on” is established in 2007.

Since 2011, a further developed product in the line ECO is introduced. It is called MINERGIE-ECO® 2011 and it takes also the embodied energy into account. The combination of MINERGIE-A® is only possible with MINERGIE-ECO® 2011. This label will replace by the old one.

Criteria

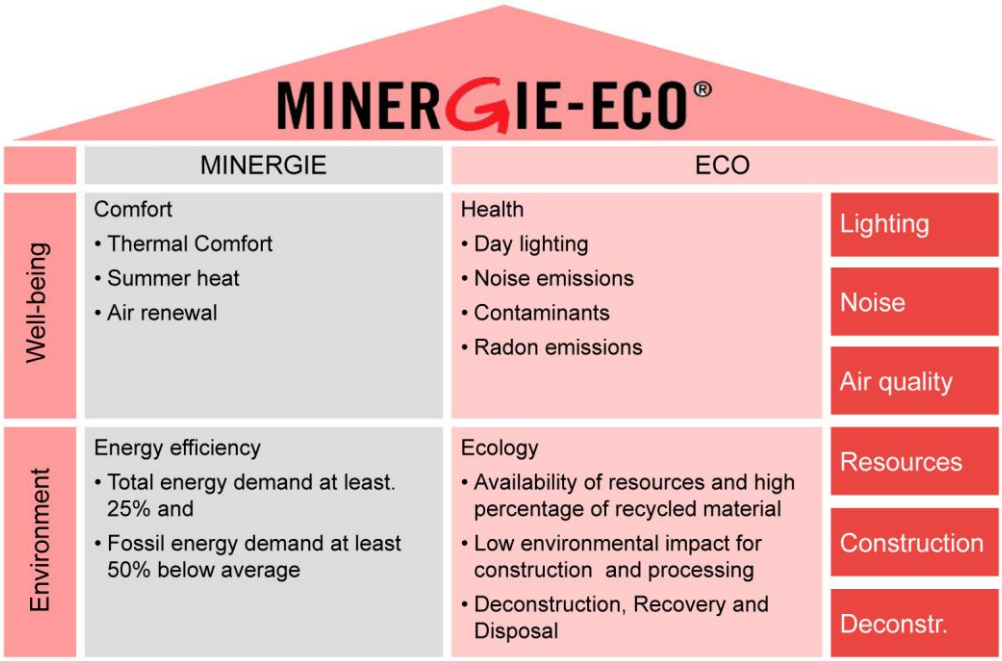
To achieve MINERGIE-ECO®, MINERGIE-P-ECO® or MINERGIE-A-ECO®, the requirements for the correspondent MINERGIE® label has to be fulfilled.
The specific ECO criteria relating to well-being are limiting values and regulation regarding lighting, noise and air quality. The environmental part concerns resources, construction and deconstruction. In the version of 2011, the embodied energy is also considered. Figure 6 shows the principle of MINERGIE-ECO® (not the 2011 version) [20].

Attention needs the exclusion criterions, which have no option for interpretation. It is about in principal usage of material which does not correlate with a healthy or ecological building technique. These are for example usage of usage of biocide, wood preservatives, high usage of formaldehyde-emitting timber, usage of materials with heavy metals, no usage of recycling concrete or usage of Non-European timber with no certificate [20].

Procedure

The procedure is based on a computer-assisted questionnaire. Each positively answered question gives a point and the importance and weighting of each question is documented. The requirements is considered met if it is implemented at least 80%. The exclusion criterions must be fulfilled 100%, though [20].

Figure 6: MINERGIE-ECO®



Source: [20]

This methodology allows a flexible use of the requirements. E.g. the embodied energy of building materials and natural light will not be evaluated on standards, but by means of calculated results [20]. The documents are handed in together with regular MINERGIE® application. The procedure is the same as for the MINERGIE®.

4 Analysis

In this chapter, the differences are discussed. After that, an overview over strength and weaknesses of the two labels follows.

4.1 Differences

4.1.1 General

The two labels are quite different. The largest contrast between the MINERGIE® and BREEAM is the type and the bandwidth of aspects. MINERGIE® is primarily a label that certificate building with a low energy demand and is therefore an energy label. On the other hand, BREEAM is a fully certification scheme, which includes much more than just the energy aspect of the building. Its focus is wide open and it covers a lot of different aspects such as land use, planning and management of the project, transport, waste, etc. Many factors, which directly influence the sustainability of a building, are analyzed and evaluated in this scheme. Nevertheless, BREEAM does not cover the whole meaning of sustainability. The economical part is definitely missing.

In principal, MINERGIE® covers only one out of nine BREEAM sections (or ten with “Innovation”). Just the energy part is covered. The “add-on” ECO expands the sections with the well-being and the environmental aspects, which are comparable to the BREEAM sections “Health and Wellbeing” and “Materials”. This makes the two labels more comparable, but MINERGIE-® does also not cover the whole bandwidth of BREEAM in this particular meaning.

Because MINERGIE® is mainly a energy label the focus is on the energy. Therefore, energy is considered in particular in chapter 4.1.2 while Table 2 lists a part of the remaining overlapping criteria.

Table 2: Overlapping criteria in MINERGIE-ECO® and BREEAM

In section “Health and Wellbeing”	In section “Materials”
Acoustic performance	Resources availability
Visual comfort	Environmental impact
Noise protection	Contaminants
Vibrations	
Daylight	
Estival heat protections	
Interior room quality	
Radiation	

4.1.2 Energy

BREEAM

BREEAM[10] has – based to the entire scheme – a larger view on the section "energy" with nine different issues within the section. The majority of the points are given for the "energy efficiency". The amount of points depends on the percentaged improvement over the requirements of local building regulations regarding the operational energy consumption. It starts with 1% (1 point) and goes up to 100% (15 points) improvement, for new buildings.

Further, one extra points can be earned for *"carbon neutral building"* (e.g. in terms of building services energy demand) and two additional are given for *"true zero carbon building"* (in terms of building services and operational energy demand) [14].

Three points are given for low or zero carbon technologies. This should encourage reducing carbon emissions and atmospheric pollution by using renewable sources as a significant proportion of the energy demand.
Further, one point is given for each of the following issues: installation of an energy sub-metering for monitoring in-use energy consumption for systems (space heating, domestic hot water, humidification, cooling major fans, etc. Alternatively, a Building Management System (BMS) with individual monitoring can be installed), an energy sub-metering that indicates in-use energy consumption by tenant or end user, luminous efficient external lighting (specific values of for different areas like parking, access ways, etc.), measures taken to minimize heat loss and air infiltration trough the building fabric and for energy efficient cold storage system. For energy efficient transport system (lifts) two points are distributed [14].

MINERGIE®

MINERGIE®'s criteria are quite different. The main requirement is to reduce the heating demand to 90% (MINERGIE-P®: 60%) of the legal standard. With the weighted energy demand index the source of the delivered energy is taken into account. Further, MINERGIE® has also the requirement that the general energy consumption must be less than 25% and the fossil-fuel consumption less than 50% below average [20].

Comparison

By pretending MINERGIE® requirements into the BREEAM assessment scheme the following output is possible: MINERGIE® earns 5 and 10 BREEAM points with an improvement of 10% for MINERGIE® resp. 40% for MINERGIE-P® over the requirements of local building regulations.
The renewable energy is evaluated in MINERGIE® in the weighted energy demand index, what is rewarded with up to three points in BREEAM for low or zero carbon technologies. The next issue in common is the required minimized loss trough the building fabric (BREEAM, 1 point). MINERGIE® requires an air tight and a good building envelope. This is also, where the MINERGIE®'s main focus is.

In addition, with the extra three points for *"carbon neutral"* and *"true zero carbon"* building, the requirements is comparable with MINERGIE-A®. Nevertheless, an energy efficient cold storage (with

[10] The entire energy section is based on BREEAM Europe, because the Norwegian version was not available in this particular matter yet (Dec 2011).

Table 3: Amount of BREEAM credits for the MINERGIE®-labels

BREEAM criterion	MINERGIE®	MINERGIE-P®	MINERGIE-A®
Percentaged improvement over the requirements of building regulations	5	10	6
Low carbon technologies	3	3	3
True zero carbon building	-	-	3
Minimize heat loss and air infiltration through building envelope	1	1	1
Total	**9**	**14**	**12**

use of the waste heat in MINERGIE®) is also an issue in both labels. In MINERGIE®, this requirement is additional for corresponding buildings and in the following analysis not considered further.

By summing up the amount of points, which the single MINERGIE®-labels earn in BREEAM, the basic MINERGIE-P® earned maximum of 14 points, followed by MINERGIE-A® with 12 points and MINERGIE® with 9 points. Table 3 shows how much every MINERGIE® label got in the corresponding BREEAM criteria.

Furthermore, MINERGIE® has also the requirement of household appliances A, which is not a BREEAM criterion. In addition, MINERGIE® provides also some solution or "common practice" like (amount of layer of heat protection glass, thickness of heat insulation, etc., see also figure Figure 5 in chapter 3.2.2l).

4.2 Strength and weaknesses

4.2.1 BREEAM

BREEAM as the world leading scheme has a high credibility. This is definitive a strength of this scheme. The scheme has a large bandwidth, furthermore. This is on one hand a plus point, because it reflects the diversity of sustainability. On the other hand, the scheme is complex and it is difficult to get an overview. In return, the whole scheme is documented and the documents are public available on the official webpage[11].

The BREEAM system has its main weakness in the procedure. A special educated "BREEAM assessor" is needed for the application of the building for BREEAM, what leads to extra costs. Due to the large coverage of BREEAM, the scheme is rather complex and not easy to get. Fortunately there is this online tool, called "Pre-assessment Estimator" tool, which works like a guide and an aid for the designers and projects members.

Another weak point is that the certification does not expire. If a building is once certificated, it is "sustainable" for an unlimited period of time. This does definitive not correspond with the meaning and def-

[11] www.breeam.org

inition of sustainable development. In addition, the scheme does not cover the whole meaning of sustainable development. The financial aspects of sustainability, one pillar out of three, is not considered.

4.2.2 MINERGIE®

MINERGIE® is a label for the planned energy demand. It doesn't say anything about the real energy use when the building is in operation. Furthermore, the specific value is the energy demand per square meter and not per head.

MINERGIE® provides no ranking, it indicates only if the regarding requirements are fulfilled or not. Consequently, its meaning is clear and it gives non-experts a good idea about the energy consumption of their building, but it does not different between lower energy consumption or higher. The underbidding is not rewarded.
The label is simple to get and easy to understand. But the association MINERGIE® does not provide a lot of information about every single scheme on their webpage. It is difficult to get the real numbers and values, e.g. one specific value for MINERGIE® is hidden in a figure, which describes the MINERGIE-ECO® methodology.

The main plus point is that everyone can apply for the MINERGIE® status. The procedure of MINERGIE® is open for everyone and as a result, the educated assessor is not needed.
MINERGIE® labels do not expire, but the association developed every other year a new label with tighter restrictions.

The focus of MINERGIE® is on energy. With the add-on ECO MINERGIE® tries to open the bandwidth with material and wellbeing aspects, but MINERGIE® remains basically an energy label. Therefore, MINEGIE® only evaluates one specific point of sustainability, not even one pillar. This is the biggest weakness of the MINERGIE® labels: Building MINERGIE®-conform doesn't mean sustainable in its entire senses.

5 Discussion

The Norwegian version of BREEAM is just slightly different from BREEAM Europe, mainly in the weighting. This relativized the adaption somehow and leads to the question, who is behind this adaption. The board is called “Norwegian Green Building Council” and consists mainly of producers of materials and consultancy. A few represent the consumer side (municipalities), authorities and science.

To get points in the energy issue, the energy consumption has to be lower than the legal regulations. This is the procedure in both labels. Is a sustainable building really reached by underbidding the legal requirements for energy demand? Sustainability is definitive a more complex topic than that. The circumstances vary for each country (and place) and hence, the legal regulations should take that into account accordant.

In the author’s opinion, the renewable energy is not considered sufficiently in BREEAM. Only up to three points are given for low or zero carbon technologies to reduce carbon emissions and atmospheric pollution. Besides, this includes nuclear electricity, which is not sustainable by its definition (see chapter 2.1).
In MINERGIE® the nuclear electricity is considered (like electricity from hydropower) with a factor two in the weighted energy demand index.

The author thinks that there is a risk that MINERGIE® prevents innovation by providing solution and common practice. BREEAM does not point out the way, how to reach the points (at least in the energy criteria).

An improvement for BREEAM would be, if the year of certification is part of the BREEAM certification. Then the change and improvements of requirements, state-of-the-art, etc. (meaning of sustainability) are taken into account accordantly. It seems that MINERGIE® develops new labels with higher requirements time by time and includes sustainable development with its improvement.

MINERGIE® is a good label for energy-efficient buildings, because it is easy to utilize and the outcome is clear and simple to understand. But the user has to know, that it is restricted on energy issues (health and wellbeing by using the add-on ECO).
On the other hand, BREEAM covers a bigger bandwidth, but is therefore a little more complex. Then it satisfies rather the meaning of sustainability, although not in the entire meaning.

So then it is up to the building’s owner, planer, etc., which label they want to apply for: The simpler one but mainly an energy-regarding solution are the MINERGIE-ECO® labels. By opening the focus BREEAM considers more aspects of sustainability and regards almost every MINERGIE® criteria.

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Annex

A 1 BREEAM

Table 4: Minimum BREEAM standards

BREEAM issue	BREEAM rating / Minimum number of credits				
	PASS	GOOD	VERY GOOD	EXCELLENT	OUTSTANDING
Man 1 - Commissioning	-	-	-	1	2
Man 3 - Construction site impacts	-	-	-	1	2
Man 4 - Building user guide	-	1	1	1	1
Hea 4 - High frequency lighting	1	1	1	1	1
Ene 1 - Energy Efficiency	-	-	-	6	10
Ene 2 - Sub-metering of substantial energy uses	-	-	1	1	1
Ene 5 - Low or zero carbon technologies	-	-	-	1	1
Wat 1 - Water consumption	-	-	1	1	2
Wat 2 - Water meter	-	-	-	1	1
Wst 3 - Storage of recyclable waste	-	-	-	1	1
LE 4 - Impact on site ecology	-	-	-	2	2

Source: [14]

Table 5: Example BREEAM score and rating calculation

BREEAM Section	Credits Achieved	Credits Available	% of Credits Achieved	Section Weighting	Section score
Management	7	10	70%	0.12	8.40%
Health & Wellbeing	11	14	79%	0.15	11.79%
Energy	10	21	48%	0.19	9.05%
Transport	5	10	50%	0.08	4.00%
Water	4	6	67%	0.06	4.00%
Materials	6	12	50%	0.125	6.25%
Waste	3	7	43%	0.075	3.21%
Land Use & Ecology	4	10	40%	0.10	4.00%
Pollution	5	12	42%	0.10	4.17%
Innovaton	1	10	10%	0.10	1.00%
Final BREEAM score					**55.86%**
BREEAM Rating					**Very Good**
Minimum Standards for BREEAM `Very Good` rating					Achieved?
Man 4 – Building User Guide					✓
Hea 4 - High frequency lighting					✓
Ene 2 Sub-metering of substantial energy uses					✓
Wat 1 - Water consumption					✓

Source: [14]