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Terms and definitions for high performance buildings

DETAILED REPORT

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1 Topic: High Performance Buildings in the EU Member States

- Which types of high performance buildings are known and have been realised in the different EU Member States?
- Are the definitions and the energy requirements for the building types the same all over Europe, or has a building called, for example, 'low energy house' in Scandinavia a totally different level of requirements than that of a building in the Mediterranean?
- Is there a need for a common understanding and maybe even a common definition of the terms in Europe?

All these questions have been discussed during the EPBD Concerted Action in June 2008 and will take new added urgency with the new EPBD recast. The conclusions of the discussions are presented in this report.

2 Which terms for high performance buildings are used in the European Member States?

The following list presents the terms for high performance buildings that are used in 14 different EU Member States. From the 23 different terms, 17 have been listed in the questionnaire (from *low energy house* to *green building*), whereas the remaining 6 terms have been added by specific experts (from *CSH - code for sustainable homes* - to *TBQ - total quality planning and rating*).

Many terms are used in one country only, while others are used in more than one country. The 17 originally listed terms are generally understood and used in more than one country. *Low energy house* (13 of 14 countries), *passive house* (11) and *energy saving house* (7) are the terms used in the highest number of countries.

List of terms for high performance buildings used in the Member States:

- *low energy house*
- *eco-building*
- *energy saving house*
- *ultra low energy house*
- *3-litre-house*
- *passive house*
- *zero-heating energy house*
- *zero-energy house*
- *plus-energy house*
- *zero-emission house*
- *zero-carbon house*
- *emission-free house*
- *carbon-free house*
- *energy self-sufficient house/energy autarkic house*
- *triple zero house*
- *BREEAM building*
- *green building*
- *CSH (code for sustainable homes)*
- *bioclimatic house*
- *lider A*
- *very low energy house*
- *climate:active house*
- *TBQ (total quality planning and rating)*

The terms relate mostly to one of the three following options:

- **low energy consumption** (*low energy house, energy saving house, ultra low energy house, 3-litre-house, zero-heating energy house, zero-energy house, plus-energy house, very low energy house, energy self-sufficient house, energy autarkic house*), or to
- **low emissions** (*zero-emission house, zero-carbon house, emission-free house, carbon-free house*), or to
- **sustainable or green aspects** (*eco-buildings, green buildings, CSH, bioclimatic house, climate:active house*).

One of the terms refers to a **national standard** (*lider A* used in Spain), while two others refer to **private organisations** (*passive house*) or **public bodies** (*BREEAM buildings*). Finally, some terms for high performance buildings try to incorporate more than one of the mentioned issues (*triple zero house, TBQ*).

3 What kind of high performance buildings have been built in the countries?

The national experts in the CA also gave information on the types and the estimated numbers of high performance buildings that have been built in their countries. Not surprisingly, the terms used in most countries also correspond to the types of buildings which are built most often. This concerns the *passive houses*, with realised examples in 13 out of 14 EU Member States -including 2 countries where pilot projects have been realised, but the corresponding term is not really used-, as well as the *low energy houses*, with realisations in 11 Member States. The other terms seem to correspond to really built buildings only in up to 4 out of the 14 countries.

It is not easy to establish a reliable number of the existing high performance buildings in the various countries. The answers given by the national experts regarding the details, as well as the period, differ. Some have stated, for example, that *low energy houses* are nowadays standard buildings, which does suggest that the definition was not updated with new national requirements. Others stated that about 10% of all new buildings are *energy saving houses*, while a third group gave an estimation of all existing buildings in their country that follow the relevant definition. If *low energy houses* are not taken into account, the number of realised high performance buildings seems to be rather low (< 200 in total) in most countries, with the exception of Austria, Germany, Czech Republic, and Slovenia.

4 What kinds of definitions are applied?

The definitions of high performance buildings vary widely, not only in the quality of the de-fined requirements, but also regarding the calculation methods used. Here, examples for both the use of the current national energy performance calculation methods (*liger A, 3-litre-house*) and for calculation methods that differ from the nationally applied standards, such as the *passive house*, can be found. In this case, the houses cannot simply be sorted into the different certification scheme labels within the country. It also has to be mentioned that some of the definitions only cover part of the energy uses that have to be assessed according to the EPBD. For example, not all of them include domestic hot water or cooling energy use. Few of the definitions are based on primary energy (for example, the *3-litre-house*, which gives a calculated primary energy consumption, is a notable exception) or on CO₂ emissions.

Many of the terms for high performance buildings are defined descriptively only, and are sometimes accompanied with rough or relative benchmarks. An example for this is the *low energy house*, which is understood in most countries as a building with a calculated energy consumption that is significantly lower than the national requirements. This can be regarded as an informal definition, and was -and still is- applied differently in different countries, sometimes even within the same country. For example, in Germany, within a former market launch programme, the definition included a required reduction ratio compared to the national requirements that was fixed differently in the various federal states in order to apply for tax reductions. However, a positive result of such open definitions is that they can be adapted to updates of the national energy performance requirements. Yet, as a result, the absolute energy performance of a *low energy building* in, for example, Austria, cannot be compared to that of a *low energy building* in Sweden, because not only the national boundary conditions such as climate, calculation method, default values, etc. are different, but also because the required ratio (if defined) will probably differ. However, the relative performance, as a ratio of the national requirements, can be compared. In some countries, the term *low energy house* and its definition were used in the past, but have been replaced by other terms some years ago.

Other terms such as *ecobuildings* do not include any quantitative definition which allows an interpretation that differs from country to country. *Ecobuildings* are defined by the European Commission [1] as “meeting point of short-term development and demonstration in order to support legislative and regulatory measures for energy efficiency and enhanced use of renewable energy solutions within the building sector, which go beyond the Directive on the Energy Performance of Buildings. Double approach: to reduce substantially, and, if possible, to avoid the demand for heating, cooling and lighting, and to supply the necessary heating, cooling and lighting in the most efficient way and based, as far as possible, on renewable energy sources and polygeneration.” This may be one reason why this term for high performance buildings is only used in rather few of the countries.

An example of a high performance building term with a rather exact quantitative definition is the *passive house*. Several countries (Austria, Germany, Czech Republic and Denmark) use the same definition, which was developed by a private organisation for the German building market:

- Maximum calculated net energy use for heating: 15 kWh/m²yr
- Maximum total calculated primary energy consumption: 120 kWh/m²a (incl. equipment)
- Required air-tightness value: n₅₀ ≤ 0,6 1/h

As the calculation procedure differs from the national German procedure and is fixed as such, it can also be used in other countries with similar climate (see also the countries mentioned). With the help of IEE projects¹, an effort was made to adapt the definition to several other climates. For example, the definition for *passive houses* in Finland allows for slightly higher energy consumption, due to the more severe climate. However, there are several national experts that understand the term *passive house* in a completely different way: as a house with passive systems to support the heating and cooling systems, as a house without heating and cooling systems, etc. In this respect, it has to be mentioned that the original German *passive house* includes in all cases a heating system. The heating energy is generally supplied by air-heating via the ventilation system, which replaces the otherwise common hydronic heating system. The air-heating is mostly realised by an air-to-air heat pump.

¹ For example: the Passive-on Project (<http://www.passive-on.org>), NorthPass (<http://northpass.vtt.fi>)

Other interesting definitions provided by national experts in the Concerted Action are:

- *3-litre-house* (Germany): Calculated primary energy consumption for heating and ventilation (DHW not included), using the national calculation standard, corresponding to maximum 3 litres of oil per m² (~ 34 kWh/m²yr primary energy consumption).
- *Triple zero house* (Germany): The annual balance of calculated primary energy consumption is 0. Use of recycled material only (closed material loop). The annual balance of emissions (from energy consumption) is 0.
- *Climate:active house* (*klima:aktiv haus* /Austria): The standard consists of four main areas, which are:
 - planning and realisation
 - energy and accommodation
 - construction materials and construction
 - health and comfort

Each area contains between 8 and 24 sub-items which are awarded with a certain amount of defined points. For example, solar water heating (covering > 50% of demand) is awarded with 60 points. The designer can add the defined points in each area, and the building will be a "*klima:aktiv haus*" if at least 1,000 points are accumulated.

Similar definitions that include energy as well as other types of items (e.g. visual comfort, availability of bike parking lots, handicapped accessibility) have been or are currently developed in many EU Member States, such as BREEAM² in the UK or DGNB³ in Germany.

The definitions for zero-energy/emission/carbon buildings can be interpreted in different ways and should be analysed with care. These buildings can either be defined as to consume no energy or emit no carbon at all, which is a very expensive strategy, as large storage systems for heating and cooling or even for electricity are needed, or they can be defined as yearly balanced buildings. In this case, the buildings still consume energy, but produce in one period of the year at least as much energy as they need during the whole year. The realisation is mostly made by including renewable technologies (mainly solar and/or biomass) in the energy concept. Thus, the buildings have the same definitions as energy/emission/carbon neutral buildings. IEA SHC Task 40/ECBCS Annex 52 [2] is currently working on the definition of so-called "*net zero-energy buildings*".

Important questions regarding the definitions for high performance buildings:

- Are they the same in all countries?
- Are they compatible with the national requirements?
- Are they updated together with the national requirements?
- Are the calculation methods the same as the national energy performance calculation method?
- Are these definitions exact or descriptive, and how detailed are they?

5 Are there national incentive programmes for high performance buildings?

In nearly all of the countries participating in the inquiry (2008), there had already been or there was a running national incentive programme for high performance buildings at the time, or there was one planned to start sometime soon thereafter. Incentive programmes took many forms: subsidies (direct financial support), reduced loans for house credits by the state bank, tax reductions, reduced tax on the sale of the house, and funding of demonstration buildings. In most cases, the financial support is given depending on the calculated energy performance of the building, often requiring an energy performance

² Website of BREEAM: <http://www.breeam.org>

³ Website of DGNB: <http://www.dgnb.de>

certificate. In some countries, however, financial support depends on the actual (measured) performance of the building.

In 9 countries, the national energy policy plan for up to the next 20 years mentions one or several of the terms for high performance buildings as a goal or a minimum standard for future buildings.

Are some of the high performance buildings sponsored by the state through cheaper loans, tax reduction or direct contributions?

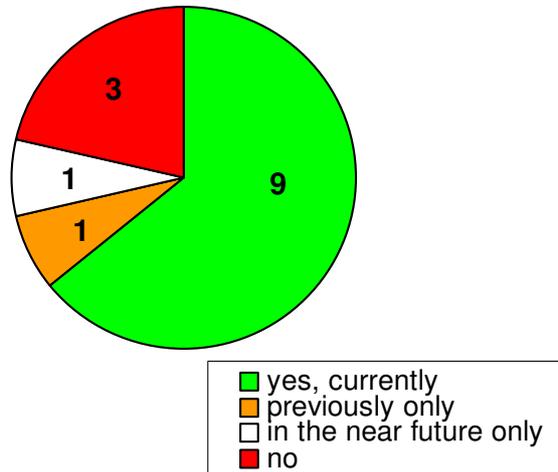


Figure 1. Answers given by the national experts in the Concerted Action to the question: 'Are some of the high performance buildings sponsored by the state through cheaper loans, tax reduction or direct contributions?'

6 Is there a need for a harmonised approach?

The national representatives in the Concerted Action were also asked whether they see a need for the standardisation of the terms and definitions for high performance buildings. The majority of the experts answered the question with a yes. Those giving a negative answer explained that they would only refer to national definitions and therefore there would not be a need for a standardised international approach. Others pointed out that this would be a very ambitious goal to achieve.

Do you see a need for standardisation of the terms and definitions for high performance buildings?

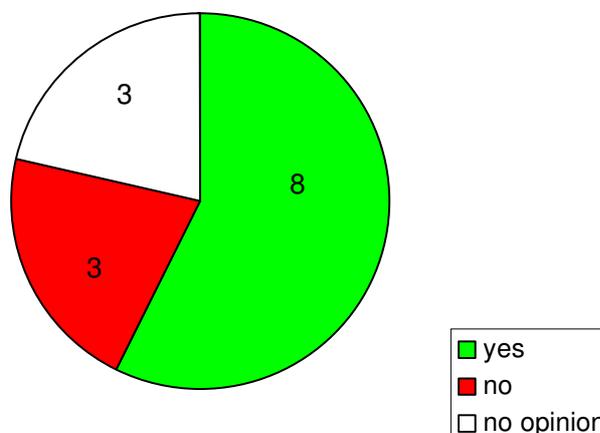


Figure 2. Answers given by the national experts in the Concerted Action to the question: 'Do you see a need for standardisation of the terms and definitions for high performance buildings?'

7 Main conclusions

The analysis of high performance building terms, definitions, number of constructed buildings and their inclusion in the national energy policy can be summarised as follows:

- Various terms for high performance buildings are used in the EU Member States.
- Most of the definitions are descriptive only and need to be clarified.
- The definitions for the same term partly differ in the EU Member States.
- The calculation methods for high performance buildings partly differ from the national energy performance standards.
- In most countries, high performance buildings receive incentives.
- Most countries include high performance buildings as a goal or a minimum standard for future buildings in their national energy plans.
- There is a need for a harmonised approach for both terms and definitions.

8 Future Work

The recast EPBD of the 19th of May 2010 [3], in article 9, requests that the *Member States shall ensure that:*

- a) by 31 December 2020, all new buildings are nearly zero-energy buildings; and*
- b) after 31 December 2018, new buildings occupied and owned by public authorities are nearly zero-energy buildings.*

Member States shall draw up national plans for increasing the number of nearly zero-energy buildings. These national plans may include targets differentiated according to the category of building. Member States shall furthermore, following the leading example of the public sector, develop policies and take measures such as the setting of targets in order to stimulate the transformation of buildings that are refurbished into nearly zero-energy buildings.

Nearly zero-energy buildings are defined in article 2 of the recast as follows:

'Nearly zero-energy building' means a building that has a very high energy performance, as determined in accordance with Annex I. The nearly zero or very low amount of energy required should be covered to a very significant extent by energy from renewable sources, including energy from renewable sources produced on-site or nearby.

Therefore, according to article 9, the Member States must have in their national plans a *detailed application in practice of the definition of nearly zero-energy buildings, reflecting their national, regional or local conditions, and including a numerical indicator of primary energy use, expressed in kWh/m² per year.* The national plans shall also include *intermediate targets for improving the energy performance of new buildings by 2015, with a view to preparing the implementation of nearly zero-energy buildings.*

In the period 2011 - 2015, the Concerted Action EPBD foresees a core theme dedicated to the topic *Nearly zero-energy buildings*. Within this core theme, the national approaches for applying the definition will be gathered and discussed. Plans for policies and support initiatives will be compared, and ideas for such will be exchanged between national representatives.

Based on the discussions on high performance buildings presented in this report, the following recommendations for the future work on the national applications of the definition of nearly zero-energy buildings can be given:

- The national applications of the definition of *nearly-zero energy buildings* must be made in line with the national assessment methods including all boundary conditions. Consequently, a nearly zero-energy building should therefore receive a top energy performance certificate. Further thoughts have to be spent on how to integrate recent developments like energy-surplus houses into the certification scheme.

- Primary energy (possibly together with CO₂ emissions) shall be the main indicator for a nearly zero-energy building.
- The national applications of the definition of *nearly-zero energy buildings* must be technology-open and must neither favour some technologies over others nor limit the technical options and innovations.
- The national applications of the definition of *nearly-zero energy buildings* must be precise and transparent to building professionals and policy makers, but also understandable to the public.
- A common understanding on the use of terminology and the definition of nearly zero-energy buildings is needed.
- The most important task for the energy efficiency of buildings is to improve the existing building stock. Therefore, it has to be ensured that the transfer of concepts for nearly zero-energy buildings from new buildings to renovations of buildings is kept in mind from the beginning of the national developments, especially concerning the technology incentive programmes.

9 References

- [1] Ecobuildings - an initiative of the European Commission (DG TREN) within the sixth Framework Programme. Common portal for seven Eco-buildings demonstration and policy support projects. <http://www.ecobuildings.info/>
- [2] Towards Net Zero Energy Solar Buildings. Websites of the IEA SHC Task 40: <http://www.iea-shc.org/task40/> and IEA ECBCS Annex 52: <http://www.ecbcs.org/annexes/annex52.htm>
- [3] Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings (recast). Official Journal of the European Union. <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:153:0013:0035:EN:PDF>
- [4] Erhorn, H. and Erhorn-Kluttig, H.: Report of a workshop session on methods and procedural aspects for energy performance characterisation: High Performance buildings. Concerted Action supporting transposition and implementation of Directive 2002/91/EC of the European Parliament and of the Council, Core Theme 4. Unpublished (2008).

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