Low-energy buildings in Europe

– Standards, criteria and consequences

A study of nine European countries

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What exactly is a low-energy house, a passive house or a zero energy house and how well is it defined – by law, by voluntary standards or by a certification brand? What criteria do they have to meet?

With the European Energy Performance of Buildings directive EPBD, all European member states are planned to reach standardization of *nearly zero energy* buildings by the year 2020. Energy savings and environmental protection are hot and common topics today, and different building types as *low-energy, passive house* and *zero energy house* have spread, appearing in media and for promotion and selling. But how are these building types defined? Are they defined by a regulation at all or are they just used in common speech? The growing of low-energy buildings causes also a demand of compliant products that meet the requirements on performance and quality, but the jungle of definitions makes it hard for manufacturers, especially on an international level.

The implementation of standardization of low-energy and passive houses has come differently far in European countries – Some have mandatory definitions; some voluntary standards and some allow certification by labels and brands.

9 European countries and their state of definition concerning low-energy buildings have been studied and their criteria relating to four subject areas: **Building envelope, Energy, Ventilation** and **Follow-up,** are examined.

Since mechanical ventilation plays a great role, especially in the concept of Passive houses, the interrelationship between ventilation and indoor climate should be considered. Even if energy efficiency is important, the main reason for buildings is to give a good indoor climate. A number of different studies have indicated significant relationships between the ventilation rates and both health and productivity, relating to offices, schools and dwellings. Therefore notable divergent limit values regarding ventilation rates have been discussed and examined relating to if they have possible consequences on the indoor climate or the indoor climate system.

The study included the countries Sweden, Norway, Denmark, Finland, Germany, Austria, Switzerland, Great Britain and Poland and was restricted to regulations for residential new built buildings.

Almost all nine countries have set standards where low-energy buildings are defined by a regulation, either **officially** (legislative), **semi-officially** (by an organisation or certification-brand) or **unofficially** (labelled names). In Sweden, FEBY, an organization funded by the Swedish Energy Agency has published voluntary standards for so-called *Minienergi* houses, *Passive* houses and *Zero energy* houses, available for certification and verification. In Denmark, low-energy buildings are defined in the national building regulation, divided into two classes, *low-energy building class 1* and *low-energy building class 2*. Additionally Denmark cooperates with the German institution Passivhaus Institut PHI, where passive houses can be certified according to the German definition. In Norway, an official standard for *low-energy* and *passive houses*, published by Standard Norge, is upcoming, probably being set in April 2010. Besides, even Norway has a cooperation with the German PHI, certificating passive houses according to the German definition. In Finland, the organisation RIL has published a voluntary definition for *low-energy* houses divided into *5 classes* and for *passive* houses divided into *3 classes*. In Germany a number of different building types have established – *RAL-certified low-energy* and *passive houses*, passive houses and corresponding *passive house suitable components* certified by the PHI, *Effizienzhouses 70* and *85* sponsored by the Kfw-bank, and the so-called *3-litre-house*, a labelled building type

by the Fraunhofer Institut. In Austria, *low-energy* and *passive houses* are mandatory defined for being state-aided; a *3-litre-house* basing on the same concept as the German one is available for certification and a program called klima:aktiv has released regulations for *klima:aktiv low-energy* and *klima:aktiv passive houses.* In Switzerland, the certification brand Minergie has published four building types – *Minergie, Minergie-P, Minergie-ECO* and *Minergie-P-ECO,* whereof the Minergie-P/P-ECO often is referred to the passive house concept.
In Great Britain, passive houses can be certified according to the German PHI. In Poland, passive houses have been built – reputed fulfilling the same criteria as required in the German definition, but certification is not available yet.

The level of specification of the definitions varies severely, both between the countries as between different building types within a country. In many standards the building is exclusively defined by its energy performance – the most definitions considering additional criteria are available in Germany, Austria and Switzerland.

The set criteria on the ventilation system are similar, which makes it possible to design components suiting many building types. Though, great attention must be paid regarding the required efficiency rates of heat exchangers – Not all regulations refer to the same efficiency definition; therefore many rates are not comparable.

Regarding indoor climate no remarkable consequences can be detected at the current state of definition. Noticeable differences between the countries were found according to limit values for minimum airflow rates – Most countries require a minimum air exchange rate of 0,4-0,5 ach (air changes per hour), whereas in German passive houses even an air exchange of 0,3 ach is allowed. In the upcoming standard in Norway, 0,7 ach are required for buildings with an area smaller than 110 m^2. Studies have indicated the positive effect of good ventilation, but concerning this topic further research is needed.

To attribute to a better understanding of the different standards between the countries and to enable the innovation of a possible common standard, common definitions and use of units are required – At the state of today these are great hinders for comparing the different building types.

Lund, March 2010.