Why Nearly Zero Energy Buildings (NZEB)

The current EU building stock is old and energy inefficient. The latest studies show that buildings are responsible for approximately 40% of the energy consumption and 36% of the CO_2 emissions of the EU. Currently, about 35% of the EU buildings are over 50 years old and almost 75% of the building stock is energy inefficient. As such, the building sector has been recognized as the sector that could drasti-cally help in achieving the EU climate and energy targets (20/20/20 by 2020). In the long term, by increasing building energy efficiency and with a growing share of renewable energy sources (RES) buildings shall also significantly contribute to EU 2050 decarbonisation targets.

Besides the intensive efforts put into energy renovation of existing buildings, the EU is also concentrating on the implementation of advanced energy efficiency re-quirements for all new buildings. Moreover, Directive 2010/31/EU on the energy performance of buildings (EPBD) requires that by the end of 2020 all new buildings are nearly zero-energy buildings (NZEBs). (By the end of 2018 all new public build-ings must be NZEBs) [1].

NZEBs are buildings with a very high energy performance. The low amount of ener-gy that these buildings require comes mostly from renewable sources. In combina-tion, existing technologies related to energy savings, energy efficiency and renewa-ble energies are sufficient to reach the NZEB target. The slightly higher technology costs of early NZEBs are likely to be reduced by 2020 in reaction to more mature markets and larger volumes.

Even though in recent years there has been great progress in the field of energy efficient buildings, people still tend to have different views and various concerns regarding NZEBs, very often connected to the investment and maintenance costs. In addition to that, early NZEBs are often associated with a lack of trust among end-users, due to the complexity of systems and end-users' beliefs about various constraints regarding living in NZEBs. Understanding the doubts and fears as well as the benefits for the end-users living in NZEBs may substantially contribute to a better acceptance of high-energy performance buildings before the 2020 deadline and beyond.

The EU Project CoNZEBs (2017-2019) aims at the reduction of the NZEB market penetration barriers by studying in detail the cost-reduction opportunities and by addressing the most common end-users' beliefs and fears about living in NZEBs. The focus of the project is on multi-family houses. Cooperation with research partners with national housing funds enabled good insight into technology solution sets for reducing NZEB costs and into the attitude of current and future end-users to living in NZEBs.

CoNZ€Bs
Solution sets for the Cost reduction of new Nearly Zero-Energy Buildings

How to build Nearly Zero Energy Buildings (NZEB)

Key NZEB advantages:

- low energy demand for heating (and cooling),
- high share of renewable energy sources,
- low energy costs,
- low CO_2 emissions,
- good thermal comfort and indoor air quality.

The building sector is one of the key sectors to achieve the EU's ambitious climate and energy targets. New buildings will have to comply with high energy performance standards to contribute adequately. Commitment to high energy performance buildings (such as nearly zero energy buildings) is an effective way to foster innovation in energy efficiency and the use of renewable energy sources and therefore achieving a significant reduction of greenhouse gas emissions and energy use, as well as contributing to reduce EU energy import dependency.

According to the Energy Performance of Building Directive (EPBD), EU Member States are to ensure that by 31 December 2020, all new buildings are nearly zero-energy buildings and after 31 December 2018, new buildings occupied and owned by public authorities are to be nearly zero-energy buildings.

A Nearly Zero Energy Building (NZEB) means a building that has a very high energy performance and that consumes very little energy, as determined in accordance with the Energy Performance of Building Directive (EPBD). The nearly zero or very low amount of energy required should be covered to a great extent by energy from renewable sources, including energy from renewable sources generated on-site or nearby.

In practice, there are some common technical features and some frequently used technologies applied to NZEBs. The very high energy performance of the NZEB is based on a well-insulated thermal envelope, built without any thermal bridges and ensuring a high level of airtightness. Windows have thermally insulated frames and high quality glazing. Shading is important to reduce and/or prevent cooling needs, especially in warm climates. In many cases NZEBs have a mechanical ventilation system with heat recovery. However, the concrete characteristics of the building components and the technical systems installed in an NZEB are the subject of optimised design, undertaken by skilled architects and engineers, with consideration of the users' needs, location, climatic conditions and the renewable energy available on-site or nearby. Often NZEBs use heat pumps or biomass boilers, solar thermal collectors or they generate electricity by photovoltaic power panels - for their own use and/or for feeding the grid. The use of fossil fuels in NZEBs should be minimized and replaced by renewable energy available in the area. District heating systems either with a significant share of renewables or with high energy performance characteristics are a promising solution for NZEBs in urban areas.

For almost a decade now European countries have studied the technically optimized and economically viable NZEBs. A number of so called "early NZEBs" were built in different climates and following various building traditions; the experiences with these buildings were very useful for end-users, architects, engineers, contractors, technology producers, investors and policy makers. The EU Member States developed detailed national NZEB definitions and integrated them into their national building codes.

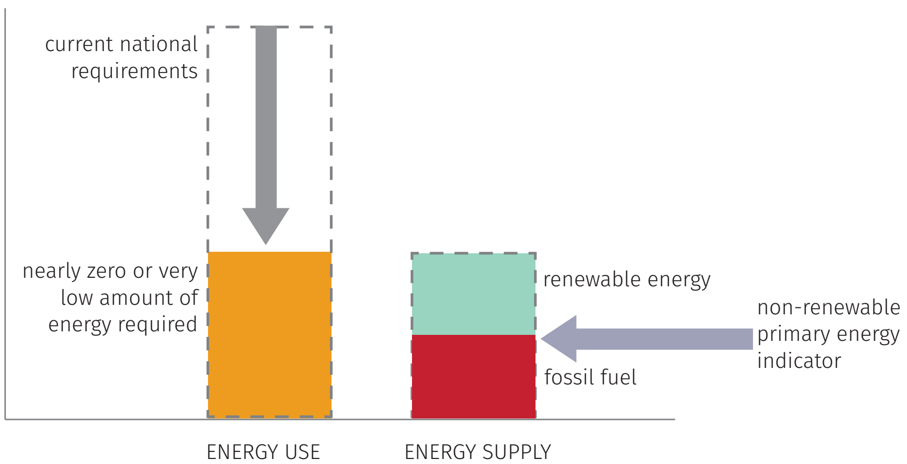

Figure 1: Graphical interpretation of the NZEB definition according to Articles 2 and 9 of the EPBD [1]

[1] H. Erhorn, H. Erhorn-Kluttig, Overview of national applications of the Nearly Zero-Energy Building (NZEB) definition, CA EPBD III, 2015