

NET-ZERO ENERGY BUILDINGS

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Abstract: *Due to the fast speed of global resources depletion there have been world- widely initiated methods of reducing non-renewable resources consumption. Since even renewable resources have harmful side effects - the humanity switched its attention from new ways of producing energy to energy preservation and energy efficiency. Energy efficiency has to be increased at all stages of the energy chain, from generation to final consumption. EU initiatives are therefore focused on areas where the potential for savings is the highest, such as in buildings sector. A significant part of Energy Efficiency is constituted currently by the net-zero energy buildings. These buildings release overall less greenhouse gas to the atmosphere than similar non-ZE buildings. Subsequently by using energy more efficiently, humans can lower their energy bills, reduce their reliance on external suppliers of oil and gas, and help protect the environment.*

Keywords: *Pollution, Energy Efficiency, nZEB, Sustainability, Legislation.*

Planet Earth is our home. We, humans, being here for about 4.5 million years were living because of earth resources. But there is a problem- our lovely planet is dying. It's not that it will disappear tomorrow, but it is slowly giving up.

Considering how fast we are destroying the global resources, on worldwide level it had to be put in practice different ways of reducing non-renewable resources consumption. We all have heard about Solar Panels, Wind Turbines, Hydroelectric Power Plant, Biomass and other modern, renewable resources of energy. Of course they have less negative effect on the Earth, although, they are not as harmless as we may think. For example Biomass, Solar Panels and Wind Turbines can cause land erosion and habitat loss, especially for a small agrarian country like Moldova, also Wind Turbines, due to the noise and visual pollution, which occasionally even can lead to physical manifestation of different diseases. Regarding Hydroelectric Power Plants - they require a fast flow of water, which is mostly created by artificial water accumulations, that also cause land loss and floods. Also dams are damaging for underwater ecosystems.

Entirely aware of all mentioned above, the world had turned its attention from new ways of producing energy to energy conservation and efficiency. Energy efficiency has to be increased at all stages of the energy chain, from generation to final consumption. At the same time, the benefits of energy efficiency must outweigh the costs, for instance those that result from carrying out renovations. EU measures therefore focus on sectors where the potential for savings is bigger, such as buildings.

On 30 November 2016 the European Commission proposed an update to the Energy Efficiency Directive including a new 30% energy efficiency target for 2030, and measures to update the Directive to make sure the new target is met.

On 14 June 2018 the Commission, the Parliament and the Council reached a political agreement which includes a binding energy efficiency target for the EU for 2030 of 32.5%, with a clause for an upwards revision by 2023 [5]. It was decided that the political agreement must be translated into all EU languages and formally adopted by the European Parliament and the Council, and then published in the Official Journal of the EU.

It is very important to mention nZEB buildings as a significant part of new constructions with high Energy Efficiency futures. [4].

A zero-energy building, also known as net-zero energy building (NZEB) is a building with zero net energy consumption, meaning that the total amount of energy used by the building on an annual basis is roughly equal to the amount of renewable energy created on the site, or in other definitions by renewable energy sources elsewhere. These buildings consequently release overall less greenhouse gas to the atmosphere than similar non-ZE buildings. They do at times consume non- renewable energy and produce greenhouse gases, but at other times reduce energy consumption and greenhouse gas production elsewhere by the same amount.

A similar concept under the name "Energy Performance of Buildings Directive" from 2010 approved and implemented by the European Union and other agreeing countries is nearly Zero Energy Building (nZEB) [1], with the goal of having all buildings in the region under nZEB standards by 31 December 2020,

beside that after 31 December 2018, new buildings occupied and owned by public authorities are nearly zero-energy buildings. According to this measure it is necessary to increase the number of buildings which not only fulfill current minimum energy performance requirements, but are also more energy efficient, thereby reducing both energy consumption and carbon dioxide emissions. For this purpose Member States should draw up national plans for increasing the number of nearly zero-energy buildings and regularly report such plans to the Commission.

Generally, most zero net energy buildings get half or more of their energy from the grid, and return the same amount at other times. Buildings that produce a surplus of energy over the year may be called "energy-plus buildings" and buildings that consume slightly more energy than they produce are called "near-zero energy buildings", "ultra-low energy houses" or "passive houses".

An **energy-plus house** produces more energy from renewable energy sources, than it imports from external sources. This is achieved using a combination of micro-generation technology and low-energy building techniques. However, many energy-plus houses are almost indistinguishable from traditional ones, preferring to use highly energy-efficient appliances, fixtures, etc., throughout the house.

While **Passive house** is a rigorous, voluntary standard for energy efficiency in a building, which reduces the building's ecological footprint. It results in ultra-low energy buildings that require little energy for space heating or cooling. Passive design is not an attachment, but a design process that integrates with architectural design. Although it is principally applied to new buildings, it has also been used for refurbishments.

Each country is free to establish:

- how much energy the building may consume;
- which renewable energy sources are permitted;
- how close to the building the energy has to be generated.

In August 2010, there were approximately 25,000 such certified structures of all types in Europe. The vast majority of passive structures have been built in German-speaking countries and Scandinavia.

It is very interesting that even our ancestors, without knowing it- contributed to the creation of modern Passive Houses. If somebody remembers their grandparents' houses with: long roofs, that in summer helped to reduce solar radiation in the house and in cold seasons kept the heat inside. Same technologies are used even nowadays in modern buildings.

Traditional buildings consume 40% of the total fossil fuel energy in the US and European Union and are significant contributors of greenhouse gases. For example in Moldova the building sector is the largest energy consumer and the largest contributor to greenhouse gas emissions, accounting for about 47% of total energy consumption.

The low energy performance of existing buildings also has a strong social impact, especially affecting socially vulnerable populations. On average, household heating costs reach a value from 15% to 50% of their income.

In recent years, energy efficiency projects in the Republic of Moldova have demonstrated their viability, becoming partners of all those who value not only the reduction of heating costs but also the protection of the environment.

The legal part of the energy performance of buildings in our country is specified in the Law Nr. 128 from 11.07.2014 [2]. It identifies general provisions, assignments of the administrative authorities public in the field of energy efficiency buildings, energy performance of buildings, certification of energy performance the buildings, periodical inspection of heating systems, and of lemmatization, the national information system in the area building energy efficiency, independent control systems energy performance

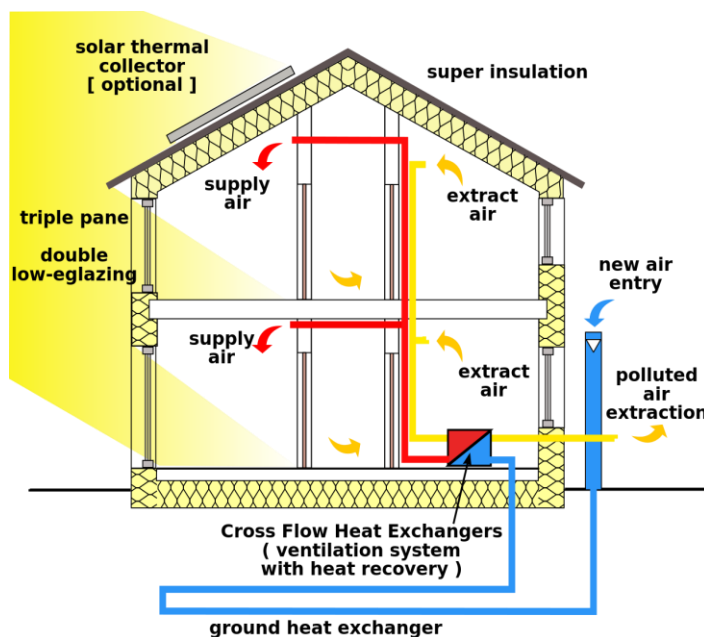


Figure 2. The Passive house uses a combination of low-energy building techniques and technologies.

certificates and inspection reports. Also following this the government exercises the following tasks in the field of energy efficiency of buildings:

- a) establishes the priority directions of the state policy in the field of energy efficiency of buildings;
- b) approves national action programs and plans for improving the energy performance of buildings, including the National Plan to increase the number of buildings with almost zero energy consumption;
- c) establishes and implements financial incentives for:
 - Measures to improve the energy performance of existing buildings, their units and elements;
 - promoting the construction of new buildings whose energy consumption is almost zero and the conversion of existing buildings into buildings whose energy consumption is almost zero.

They key-responsible organization in Moldova for energy efficiency investments is Energy Efficiency Fund. The Fund was designed to identify, evaluate and finance energy efficiency and renewable energy resources projects that contribute to improving energy consumption and reducing greenhouse gas emissions.

At the moment, the only building in Moldova that is aligned with international energy standards is a kindergarten [3]. In Călărași town, located about 50 km from Chișinău, more than a year ago was started the construction of a kindergarten according to the German "passive house" standard, which means low heat consumption, minimal heat loss and increased methods of conservation. The project, not only for this city, but also for the whole country, has become possible thanks to the support of the Development Bank of one of the EU-Germany members. The Bank has allocated 1 million euros for the construction of the new kindergarten, which was later named "DoReMicii". The investment was made through the project "Social Infrastructure and Energy Efficiency", and implemented by the Social Investment Fund of Moldova.

The concept implies total building energy independence, with heating via three renewable energy types: a biomass boiler, 5 geothermal pumps and 4 PV panels. The institution will accommodate about 100 children. As a result, the maintenance costs of the kindergarten, with an area of 1100 m², will be comparable to those of a three-room apartment. Specialists assure that the bill will not exceed, on average 2,000 lei per month. Currently this is the only completed building of this kind in Moldova, however the City Hall of Chișinău is now responsible for the thermal rehabilitation and renovation of several public buildings in Chișinău.



Figure 3. Kindergarten DoReMicii- passive house from Călărași

In 2011, the renewable energy sources in the Republic of Moldova were at the level of 2% of the total energy consumed. Today, this indicator has reached over 15%, of which 90% is biomass-based energy. This result was also ensured through the EU-funded "Energy and Biomass" Project, which promotes energy consumption from biomass and stimulates sustainable energy production and local development.

At present, the use of low energy consumption is no longer a challenge for the Republic of Moldova to overcome. With the help of European funds, alternative energy sources are increasingly safer than traditional ones, contributing both to reducing energy losses and to ensuring the country's energy security.

By using energy more efficiently, humans can lower their energy bills, reduce their reliance on external suppliers of oil and gas, and help protect the environment. The EU has support schemes and initiatives to accelerate energy efficiency investments.

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