

NEARLY ZERO ENERGY HOTELS THE EUROPEAN PROJECT NEZEH

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ABSTRACT

The European Union (EU) aims to a 20% reduction of the Europe's annual primary energy consumption by 2020. Furthermore, EU commits to reduce GHG emissions to 80-95% below 1990 levels by 2050. One of the main issues of the EU energy strategy is the radical improvement of the energy performance of new as well as existing buildings.

Within this frame, the rate of renovations needs to be increased, as the existing building stock represents the largest potential sector for energy savings. For new buildings, the EPBD recast fixes 31 December 2020 as the deadline for all new buildings to be “nearly zero energy” (NZEB).

Focusing our attention on the hospitality industry, which is responsible for 2% of the world’s CO₂ emissions, NZEB applications could add important advantages:

- Energy consumption is usually higher in hotels than in residential buildings, so there is a larger margin for energy saving measures;
- Hotel guests can experience the comfort of living in NZEB, learning how relevant architectural and technical solutions can also be replicated at home;
- The competitive advantages gained by the initiators will push other hotels to imitate.

Currently the NZEB market is limited. Significant efforts are required to promote the concept to the stakeholders, to link the demand and supply side and to challenge further replication.

This paper presents the methodology, activities and outcomes of the EU initiative NEZEH (Nearly Energy Zero Hotels) including examples of NZEH and the legal and institutional framework status in various EU countries in order to tackle the main market barriers that prevent SME hotels from investing in major refurbishment projects towards nearly zero-energy consumption levels.

In long-term, the NEZEH initiative will support the hospitality sector to reduce operational costs and to improve its image and services, so as to enhance their competitiveness and sustainability contributing in parallel to the EU fight against the climate change and energy uncertainty.

KEYWORDS

Zero energy buildings; NZEB; hotels; energy saving; high energy performance buildings

1 INTRODUCTION

There is an urgent need to increase the energy efficiency of European building stock. Buildings account for approximately 40 percent of total energy consumption and 36% of greenhouse gas (GHG) emissions in Europe (Farrou et al 2012) in the European Union. To face this problem the European Union (EU) has set ambitious targets for 2020 and even more ambitious for 2050 (European Commission 2010; 2011; 2012). Among them, EU aims to the drastic reduction of the domestic GHG emissions by 80-95%, compared to 1990 levels, by 2050. The building sector is one of the key sectors to contribute to this aim and has to do its part through brave refurbishments.

Nearly zero energy buildings (NZEBs), a new generation of low energy buildings, with integrated renewable energy sources, increased levels of comfort and limited environmental impact, will play a critical role in improving European building stock.

Focusing on the hospitality industry, which is responsible for 2% of the world’s CO₂ emissions, Near Zero Energy Hotel (NEZEH) applications could add important advantages since:

- Energy consumption is usually higher in hotels than in residential buildings, presenting so a larger potential for energy saving measures;

- Hotel guests can experience the comfort of living in NZEB, learning relevant architectural and technical solutions, which could also be replicated at home;
- The competitive advantages gained by the pioneers will push other hotels to imitate.

Within this frame, the rate of building renovations needs to be increased, as the existing building stock represents the field with the higher potential for energy savings.

Currently, there is low awareness of the Nearly Zero Energy Buildings (NZEB) concept and there are limited successful demonstrations at EU level to inspire and drive replications in the private non-residential sector (Karagiorgas et al, 2007). National markets lack familiarity and expertise with integrated design process and interventions and there are an inadequate number of qualified craftsmen and designers for NZEB. The national applications of NZEB definition are still under development in most EU MS; in March 2013, only six Member States had their national application of the Nearly Zero-Energy Buildings definition legally fixed (EC, 2013).

In the participating countries, there are, if any, different national approaches for the NZEB definition. The NZEB concept is not yet understood by the majority of developers/providers/suppliers. Even the NZEB early adopters cannot easily find the appropriate technical actors.

To counter this, as a follow up of other EU initiatives (Karagiorgas et, 2006; various, 2013), the European project "Nearly Zero-Energy Hotels" (NEZEH) will link the supply and demand side, bridging the gap between industry and the interested SME hotel owners and will mobilise major key actors of the building construction industry increasing awareness about the challenges ahead with regard to NZEB targets. The NEZEH's main objective is to accelerate the rate of refurbishment of existing buildings into Nearly Zero Energy Buildings (NZEB), focusing to the hotels sector:

- a) providing technical advice to hoteliers determined to go for NZEB renovations;
- b) demonstrating the competitive advantages and sustainability of such projects in order to increase the rate of renovation in the hotels industry;
- c) challenging further large scale renovations through capacity building activities and showcases of the front runners.

The methodological approach, the outcomes and the first findings of the new European project NEZEH is presented in the current paper.

2. THE NZEB DEFINITION

An overview of the European Energy-in-Buildings policy is depicted in fig.

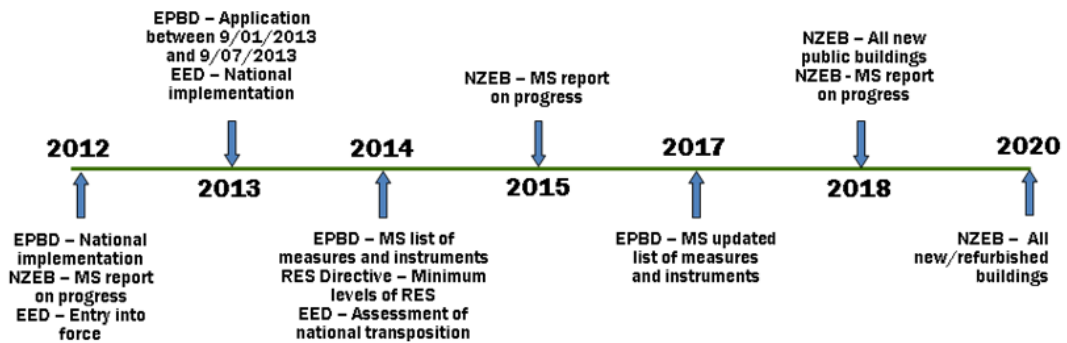


Figure 1: Energy in Buildings-Policy overview

Table 1 provides a summary of the interaction between the three relevant EU Directives.

Table 1: Interaction between the three EU Directives - EBPD, EED and RED (EC 2013)

	EPBD recast	EED - ESD	RED
Target	No	Indicative	Binding
Scope	Heat, Power	Heat, Power, Transport	Heat, Power, Transport
Actions	Yes	Yes	Yes
Action Plan required	No	Article 14	Article 4
Reporting	Yes	Article 14	Article 22
Pubic/visited buildings	Article 7	Article 5	No
Information & Training	Article 20	Article 7	Article 14
Energy Certificates/Audits	Articles 11,12	Article 12	
Competent persons	Article 17	Article 8	Article 14
Financial instruments	Article 10	Article 9,11	Some
Energy suppliers	No	Articles 6,10,11,13	Yes
Metering and billing info	Article 20	Article 8	Some
Smart metering/building monitoring	Articles 8,14,15	Articles 12,13	Some

The EPBD recast obliges the Member States (MS) to ensure that minimum Energy Performance requirements are set with a view to achieving cost-optimal levels (art. 4). The MS should also take the necessary measures to ensure that new buildings, buildings undergoing a major renovation, and replaced or retrofitted building components that form part of the building envelope, meet the requirements set with a view to achieving cost-optimal levels (art. 6 & 7) (EC, 2013).

The cost-optimal level is “the energy performance level which leads to the lowest cost during the estimated economic lifecycle” (art. 2.14).

Article 9 of the EPBD recast puts deadlines, such as that “*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*”.

MS shall furthermore “*draw up national plans for increasing the number of nearly zero-energy buildings*” and “*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*”.

It is estimated that there are at least 23 different terms for high performance buildings used in the EU MS: e.g. passive house, low-energy house, green building, eco-building etc. Especially for NZEB, this term is defined in article 2 of the recast EPBD as “*a building that has a very high energy performance... . 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*”.

Annex I of the recast EPBD gives a common general framework for the calculation of the EP of buildings, including NZEB, as follows: “*The energy performance of a building shall be determined on the basis of the calculated or actual energy that is consumed in order to meet the different needs associated with its typical use, and shall reflect the heating energy needs and cooling energy needs (energy needed to avoid overheating) to maintain the envisaged temperature conditions of the building, and domestic hot water needs.*”

Furthermore, the Annex lists the aspects that should be taken into consideration for the methodology applied. These aspects include natural and mechanical ventilation, and built-in lighting installation (mainly in the non-residential sector).

3. METHODOLOGY

The geographical coverage at local and national level of the project is:

- six (6) Southern European countries: Spain, Greece, Italy, Romania, Croatia and France
- one (1) Nordic country (Sweden).

The consortium also involves:

- two (2) European networks the Federation of European Heating and Air-conditioning Associations and the Network of European Regions for a Sustainable and Competitive Tourism, and
- one (1) international organisation the United Nations World Tourism Organization, which will contribute to spread the effects of the project across EU.

All targeted regions have a robust tourism industry, but in different typology (geographic/climate zone, diverse touristic products, different technical solution).

At the same time, they face different level of maturity in terms of market's experience at EE and RE technologies and with regard to the NZEB concept familiarity and know-how.

The NEZEH consortium is consist of the:

- Technical University of Crete, Renewable and Sustainable Energy Systems Lab-TUC (project coordinator, GR)
- United Nations World Tourism Organization-UNWTO (ES)
- Network of European Region for a Sustainable and Competitive Tourism-NECSTour (BE)
- Federation of European Heating and Air-conditioning Associations-REHVA (NL)
- Agency of Braşov for Energy Management and Environment Protection-ABMEE (RO)
- Creara consultants (ES)
- ENERGIES 2050 (FR)
- Energy Institute Hrvoje Požar-EIHP (HR)
- Istituto Superiore sui Sistemi Territoriali per l'Innovazione-SITI (IT)
- Sustainable Innovation (SE)

4. MAIN OUTPUTS

The major outputs of the NEZEH initiative will be:

- An integrated set of decision support tools to assist hoteliers in identifying appropriate solutions and designing feasible and sustainable NZEB projects.
- A dynamic communication channel between the building sector and the hotels industry, which will enable the exchanging between demand and supply side and the endorsement of the NZEB concept.
- Demonstration pilot projects in 7 countries to act as “living” examples, aiming to increase the rate of NZE renovation projects in the targeted countries.
- Practical training and informational materials and capacity building activities to support nationally the implementation and dissemination of NEZEH projects.
- Integrated communication tools to increase awareness for the NZEB benefits, to promote front runners and to foster replication; challenging much more SMEs to invest in refurbishment projects in order to achieve NZE levels.

In the long term the project will help the European hospitality sector to reduce operational costs, to improve their image and products and so to enhance their competitiveness contributing in parallel to the EU efforts for the reduction of GHGs.

5. ENERGY INDICATORS IN HOTELS

The selection criteria during the initial research phase include:

- 1) Declared energy performances and renewable energy production
- 2) Emissions from energy certificates

- 3) Potential labelling and certifications
- 4) Sustainable management strategies
- 5) Geographical location and climate conditions

A list was then integrated including hotels identified by desk research and also the hotels suggested by the NZEH project's partners who provided national examples of high energy performance hotels. The second step for the selection of potential hotel examples analyses the profile of the 27 sustainable hotels identified so far, in order to assess which hotels can be defined as nearly zero energy buildings.

Table 1 presents indicative data of selected hotels during the NEZEH activities.

Table 1: Examples of hotels committed to achieve these targets within NEZEH project

Location of the hotel	No of rooms	Floor area (m ²)	Electricity use (kWh/year)	Gas / heat use (kWh/year)	Total energy use per floor area (kWh/ m ² .year)	Floor area to be renovated (m ²)	Energy savings (%)	RES integration* (%)
Chania Crete GR	225	20,300	1.007.050	563.225	77,3	2.000	20	70
Rethymno Crete GR	100	2.570	196.640	74.607	105,5	600	20	60
Lassithi Crete GR	270	13.458	1.500.000	832.560	173	2.500	25	50
Peloponnese GR	27	1.220	35.747	41.137	63	1.220	16	70
Karlovac, HR	40	1.610	160.000	260.000	261	1.000	40	70
Zagreb, HR	44	3.000	185.000	274.000	153	300	10	50
Briancon, FR	20	500	38.500	108.254	294	500	25	40
Bari Sardo IT	30	2.200	129.000	38.000	75,9	400	50	40
Turin, IT	106	4.000	583.644	1.342.188	481,5	1.000	25	40
Brasov, RO	14	2.000	59.753	211.309	135,5	2.000	20	60
Minorca, ES	243	13.500	1.141.628	770.072	141,6	1.475	12	50
Palma de Mallorca, ES	356	20.000	2.000.000	2.000.000	200	20.000	20	50
Palma de Mallorca, ES	183	16.500	1.700.000	140.000	112	16.500	25	40

6. CONCLUSION

For the assessment phase of existing successful NZEH examples it was proved that the number of realised high performance buildings of general use seems to be rather low (< 200 in total) in most countries, with the exception of Austria, Germany, Czech Republic, and Slovenia.

The NEZEH initiative will have a positive impact in reducing the building sector. During the project: 15.000 hotel owners are going to be informed and gain access to the project results in EU level. Pilot projects, in seven (7) countries, will demonstrate the profitability and benefits of such an investment and will become a powerful example to inspire emulation by other hotel owners.

The increasing number of NEZEH may:

- inspire the supply side to provide more suitable solutions, reducing the costs for the demand side;
- raise the visibility of the NZEB concept to a large number of hotel owners;
- increase the number of “green” hotels thus having a positive effect over the demand;
- In the long-term, NEZEH will support the hospitality sector to reduce operational costs and to enhance competitiveness and sustainability.

A prerequisite of the success of the NEZEH initiative is the commitment of the tourism industry to increase the visibility and promote the NEZEH hotels challenging much more SME hotels to invest in refurbishment projects that achieve NZE levels.

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NOMENCLATURE

EPBD	Energy Performance of Building Directive
EU	European Union
GHG	GreenHouse Gas
HES	Hotel Energy Solutions (project)
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
MS	Member State(s)
NZE	Near Zero Energy
NZEB	Near Zero Energy Building
NEZEH	Near Zero Energy Hotels
RELACS	Renewable Energy for Tourist Accommodation Building s(project)
SME	Small and Medium Enterprise
UNWTO	United Nations World Tourism Organisation

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