Country fact sheets on legal framework in neZEH countries

WP2 Experience and viability of nZE refurbishment projects - D2.3

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THE EU INITIATIVE NEARLY ZERO ENERGY HOTELS (neZEH)

neZEH's scope is to accelerate the rate of refurbishment of existing hotels into Nearly Zero Energy Buildings (nZEB), providing technical advice to hoteliers for nZEB renovations, demonstrating the sustainability of such projects, challenging further large scale renovations through capacity building activities, showcasing best practices and promoting the front runners. The project covers seven (7) EU countries: Greece, Spain, Italy, Sweden, Romania, Croatia, France and has a wide EU level impact.

The expected results are:

- 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 participating countries
- Practical training, informational materials and capacity building activities to support nationally the implementation and uptake of nZEB projects;
- Integrated communication campaigns 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 assist the European hospitality sector to reduce operational costs, to improve their image and products and thus to enhance their competiveness; contributing in parallel to the EU efforts for the reduction of GHGs.

neZEH started at May 2013 and will end at April 2016 and is co-financed by the Intelligent Energy - Europe (IEE) programme.

PROJECT PARTNERS

Technical University of Crete, Renewable and Sustainable Energy Systems Lab (ENV/TUC) *Project Coordinator*	Greece
United Nations World Tourism Organization (UNWTO)	EU/Int.
Network of European Regions for a Sustainable and Competitive Tourism (NECSTouR)	EU
Federation of European Heating, Ventilation and Air-conditioning Associations (REHVA)	EU
Agency of Braşov for Energy Management and Environment Protection (ABMEE)	Romania
Creara Consultores S.L. (CREARA)	Spain
ENERGIES 2050 (ENERGIES 2050)	France
Energy Institute Hrvoje Požar (EIHP)	Croatia
Istituto Superiore sui Sistemi Territoriali per l'Innovazione (SITI)	Italy
Sustainable Innovation (SUST)	Sweden

PROJECT COORDINATOR

Associate Professor Theocharis Tsoutsos, Renewable and Sustainable Energy Systems Lab.
School of Environmental Engineering, TECHNICAL UNIVERSITY OF CRETE (ENV/TUC)

WP2 LEADER

Federation of European Heating, Ventilation and Air conditioning Associations (REHVA)

DELIVERABLE EDITOR

Federation of European Heating, Ventilation and Air-conditioning Associations (REHVA)
Contribution from all neZEH partners

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1. Introduction

This deliverable was intended for national market mapping which implies understanding and analyzing the existing framework and recent development of the national nearly zero energy building (nZEB) definitions.

Based on 2 templates elaborated by REHVA, the Regional Leaders collected the present (October - December 2013) legal requirements and strategic plans influencing the deployment of nZEH in each country:

- Building codes and legal frameworks, available national nZEB definitions and requirements and national action plans for increasing the number of nZEBs (template presented in Annex 5);
- Funding mechanisms (template presented in Annex 6, collected data presented in D2.6).

Information regarding building codes and legal frameworks, available nZEB definitions and requirements and national action plans for increasing the number of nZEBs was collected from the countries involved in the project i.e. Croatia, France, Greece, Italy, Romania, Spain and Sweden. Data were collected during the period October-November 2013, therefore they reflect the status, as was at that time. For the most recent information regarding national legislation on nZEB, the reader is encouraged to visit the websites of the national competent authorities which are listed under References. This information should be used during the design phase of the pilot projects by the project's engineers.

The collected information included:

- Present minimum energy performance requirements according to the national transposition of EPBD:
  - The present in force energy performance requirements that give a maximum value for an energy type (primary energy, delivered energy, energy need);
  - The metric used, the measurement unit e.g. kWh/(m^2·a), kWh/(m^3·a) and the value type, i.e. fixed (in measurement unit) or relative to reference building;
  - Numeric values by building type according to the national selected building typology;
  - Calculation methodology;
  - The energy flows; there are countries who have different requirements e.g. with lighting and/or appliances included.
- Input data for energy calculation:
  - Technical information for knowing how the metric used is calculated (the hypotheses); these refer to the building's operation behavior (internal heat gains, operation time and DHW) and indoor air quality (ventilation rate);
  - Important observations are noted here, e.g. reference to standards or any other relevant data regarding the filled in values.
- nZEB definition/requirements:
  - nZEB definition and requirements;
  - The definition might have been transposed at national level identically as in recast EPBD or with modifications. (In a law most certainly)
  - The requirements might be just a few or many. These are probably found in technical regulations (documents);

- On-site RE production is not matched with the energy use, so the possibility of exporting the energy is useful. This is important if on-site renewable energy sources are included in the used metric calculation.

- RER (renewable energy ratio) definition/requirements
  - Defining just the maximum primary energy use, as it was proved in the previous example is not enough (in the case of very low energy factor for renewable fuels). In such a case, a minimum energy performance must also be defined (delivered energy or total energy use);
  - On top of these a renewable energy ratio may also be set as a complementary indicator. The RER is somehow misleading because the renewable energy sources are already taken into account in the primary energy use calculation.
  - RER could be redundant if nZEB definitions provide: required primary energy use < required total energy use.
- Overview on energy related requirements and energy performance certificate class A according to the national transposition of EPBD;
  - All the requirements in force related to energy performance; e.g. requirements for building envelope thermal resistance, for energy in current existing buildings, for energy in renovations, for energy efficiency of equipment.
- Present current action plans for progression to nZEB regarding the above information:
  - Next steps on how the progression to nZEB will continue;

Due to the delay of national transposition of the nZEB definition the original plan of using existing national regulation was impossible. For this reason the collected information on national building codes according to the EPBD recast was valued for developing country specific benchmarks for each partner country. Since most of the national nZEB definitions and - more importantly – the details on national reference values are missing, REHVA elaborated a methodology for defining country specific benchmarks for the partner countries providing some recommendation for Regional Leaders and WP5 leader how to use them together with the national building codes during the identification, planning and implementation of pilot projects. The result of this work is shown in an additional deliverable to D2.3.

2. Overview

The present energy performance requirements according to the national transposition of EPBD vary in type of requirements (e.g. primary energy, delivered energy, energy need, minimum thermal resistance, equipment's energy efficiency, renewable energy sources contribution).

The input data and methodologies for energy calculation are not harmonized at European level which makes the comparison of present energy performance requirements a near to impossible task.

Even though most of the countries have transposed the nZEB definition at national level, they are behind schedule with the actual nZEB requirements (primary energy indicator and renewable energy ratio). No clear enough information is available about future nZEB requirements (France could be considered as an exception).

A brief summary of the present (October - December 2013) situation is presented in Table 1.

Table 1 Partner countries energy performance requirements and nZEB requirements overview

Country	nZEB definition	nZEB requirements		Expected date to be ready	Energy performance class A	
		Residential	Non-residential		Residential	Non-residential
Croatia	Yes	Yes	No	2014	Fixed values	Relative values
France	No*	No*	No*	*	Fixed values	Fixed values
Greece	No**	No	No	NA	Relative values	
Italy	No**	No	No	June 2014	Relative values	
Romania	No**	No	No	NA	Fixed values	Fixed values***
Spain	No	No	No	2016-2017	Relative values	
Sweden	No****	No****	No****	NA	Relative values	

* So far, there is not yet a French official definitive definition or requirements for nZEBs, but it is generally agreed that nZEBs will be Low Consumption Energy Buildings (BBC) which are the newly constructed buildings abiding to the latest building codes (thermal regulations) RT2012.

** Only qualitative definition transposed in the national legislation.

*** Only for commercial buildings.

**** Presently, in Sweden, the buildings with an energy performance by 25% higher than that stated in the building codes are referred to as low-energy buildings and those with an energy performance by 50% higher are classified as having very low energy use.

3. National fact sheets for the neZEH countries

3.1. Croatia

Name and email of contact person: Marko Bišćan, mbiscan@eihp.hr, Energy Institute Hrvoje Požar, Croatia

Present minimum energy performance requirements according to the national transposition of EPBD

Energy requirement type:

- Metric used: Energy need for heating for apartment and non-residential buildings and primary energy for family houses;
- Measurement unit: [kWh/(m^2·a)] for residential buildings and [kWh/(m^3·a)] for non-residential buildings;
- Fixed values: Yes;
- Relative to reference buildings: No.

Table 2 Numeric values for buildings types - Croatia

Apartment buildings	Non-residential buildings
51,31 - 95,01 depending on building shape factor f0	16,42 - 30,40 depending on building shape factor f0

Calculation methodology:

- Monthly method: Yes;
- Hourly tool: NA;
- Simulation tools accepted: Yes;
- Energy flows included: Not relevant for the energy requirement type for apartment and non-residential buildings. Heating, domestic hot water, cooling and ventilation for family houses.
- Primary energy factors: Yes, specified for all categories (Factors are being currently revised and will be changed soon)
  - Electricity 3;
  - District heating 1,3;
  - Oil, natural gas, LPG and hard coal 1,1;
  - Brown coal 1,2;
  - Firewood 0,2.
- On site renewable energy sources included: All requirements are without renewable energy sources.

Input data for energy calculation

Table 3 Input data for energy calculation - Croatia

Building type	h / day	day / week	Lighting [W/m^2]	Appliances [W/m^2]	Occupancy[W/m^2]	Vent. rate [h^{-1}]	DHW [kWh/(m^2·a)]
Apartment	24	7		5		0,5 - 1,5	12,5 - 16
Office	17	5		5		0,5 - 1,5	NA
Hotel	24	7		5		0,5 - 1,5	Table B.1

Observations: For operational time, values in table are used if not stated differently in project documentation for specific buildings. All internal heat gains are summed up and 5 W/m^2 is used. Ventilation rate is defined as number of air changes in one hour and depends on building exposure. Numbers given in table are for occupied building. When not occupied minimal ventilation rate must be 0,2 h^{-1}. DHW is 12,5 kWh/(m^2·a) for residential buildings under 3 apartments and 16 kWh/(m^2·a) for other residential buildings. For offices DHW is not calculated. For hotels, numbers from table B.1 from annex B of EN 15316-3-1:2007 (transposed at national level) are used.

nZEB (nearly Zero Energy Building) definition/requirements

So far calculations were made only for family houses.

The results show that new cost optimal houses have primary energy use of:

- 41 kWh/(m^2·a) for continental zone of Croatia;
- 33 kWh/(m^2·a) for coastal zone of Croatia.

According to the same calculations cost optimal refurbishment of existing family houses brings the primary energy use down to:

- 51 kWh/(m^2·a) for continental zone of Croatia;
- 52 kWh/(m^2·a)for coastal zone of Croatia.

These consumptions will be chosen for nZE family houses subject to renovation from the existing building stock.

Also, there will be follow up on these calculations to include firstly apartment building, then non-residential buildings.

RER (renewable energy ratio) definition/requirements

NA

Overview on energy related requirements and energy performance certificate class A according to the national transposition of EPBD

The Energy Performance (EP) requirements for new buildings differ with regard to the temperature at which

the buildings are heated (Θ_i), their purpose (residential and non-residential) and their size.

The regulations impose limits among others on the followings:

- Maximum permitted annual energy use for heating per m^2 of usable floor area (residential) or m^3 of volume of the heated part (non-residential) of a building .
- Maximum allowed thermal transmittance U of building components of new buildings, small buildings and after renovation works performed on existing buildings (see table below).

Table 4 Maximum allowed thermal transmittance of building components of new buildings

No.	Building element	U [W/(m²·K)]			
		$\Theta_i \geq 18\ ^0C$		$18\ ^0C > \Theta_i > 12\ ^0C$	
		$\Theta_e > 3\ ^0C$	$\Theta_e \leq 3\ ^0C$	$\Theta_e > 3\ ^0C$	$\Theta_e \leq 3\ ^0C$
1	External walls, walls to the garage, attic	0,60	0,45	0,75	0,75
2	Windows, balcony doors, roof windows, transparent façade elements	1,80	1,80	3,00	3,00
3	Flat and pitched roofs above heated rooms, ceilings to the attic	0,40	0,30	0,50	0,40
4	Ceilings above external air, ceilings above garages	0,40	0,30	0,50	0,40
5	Walls and ceilings to non-heated rooms and non-heated stairways at a temperature higher than 0 ^0C	0,65	0,50	2,00	2,00
6	Walls to the soil, floors on the soil	0,50	0,50	0,80	0,65
7	External doors, doors to non-heated stairways, with non-transparent door wings	2,90	2,90	2,90	2,90
8	Walls of the roller shutter box	0,80	0,80	0,80	0,80
9	Ceilings between apartments, ceilings between heated working premises of various users	1,40	1,40	1,40	1,40

where Θ_e is the mean monthly temperature of the outdoor air in the coldest month of the year.

Energy performance certificate class A+ for residential buildings in energy need for heating in kWh/(m^2·a):

- Heating < 15 kWh/(m2·a)

Energy performance certificate class A+ for non-residential buildings in relative value of annual energy need for heating in % (relative to present maximum energy need for heating):

- Heating < 15 %

Present current action plans for progression to nZEB regarding the above information

By the end of 2013 it is planned to set the energy performance of a building (with numeric indicator of primary energy). The action plan for progression to nearly zero energy buildings is expected to be developed by the end of 2013.

In September 2012, activities began in relation with the definition of reference buildings, for the purpose of cost-optimal calculations in order to set the minimum energy performance requirements. In the first stage, four building types will be defined (single family building, apartment buildings, office building and building with educational functions). For now, calculations were made only for family houses.

3.2. France

Name and email of contact person: Stéphane POUFFARY, stephane.pouffary@energies2050.org, ENERGIES 2050, France

Present minimum energy performance requirements according to the national transposition of EPBD

Energy requirement type:

- Metric used: Primary energy consumption;
- Measurement unit: kWh/(m^2·a);
- Fixed values: Yes;
- Relative to reference buildings: No.

Numeric values for buildings types:

Table 5 Numeric values for buildings types - France

Apartment buildings	Office buildings	Hotels
50	70	100 (night part) 150 (day part)

The values in Table 5 are average values. For detailed values please see Annex 2.

Calculation methodology:

- Monthly method: No;
- Hourly tool: Yes;
- Simulation tools accepted: Yes;
- Energy flows included: Heating, cooling, domestic hot water, lighting and auxiliaries (pumps and fans);
- Primary energy factors:
  - Electricity 2,58
  - Fuels (other energies) 1
- On site renewable energy sources included: The 2012 Thermal Regulation (RT2012) includes the requirement of renewable energy use in houses (see subchapter which refers to RER for additional information). Self-supply production of renewable energy is not taken into account beyond 12 kWh/(m²·a) primary energy.

Input data for energy calculation

Observations: The primary energy use is calculated by approved software with a quite complex algorithm.

3 types of parameters can be defined:

- Intrinsic parameters which correspond to the characteristics of the building components;

- Integration parameters which correspond to the implementation of the building components;
- Parameters independent from the building which are defined in a conventional way (see table in Annex 1 for detailed values):
  - Different operation times (for lighting and ventilation);
  - DHW;
  - Internal heat gain due to human presence;
  - Internal moisture gain due to human presence;
  - Internal heat gain due to appliances (lighting is not taken in count);
  - Internal moisture gain due to appliances.

Ventilation data for residential in presented in Table 6.

Table 6 Ventilation minimum extraction air flow rate for residential buildings - France

Number of main rooms	Minimum air flow rate of extraction	
	m^3/h	L/s
1	35	9,72
2	60	16,67
3	75	20,83
4	90	25,00
5	105	29,17
6	120	33,33
7	135	37,50

nZEB (nearly Zero Energy Building) definition/requirements

So far, there is not yet a French official definitive definition for nearly zero energy buildings (nZEBs). Having said that, it is generally agreed that, according to RT2012, nZEBs will be Low Consumption Energy Buildings (BBC), that is, the newly constructed buildings abiding to the latest thermal regulation, RT2012.

A maximum value of C_{ep} (C_{epmax}) is imposed by laws. This C_{epmax} is adjusted depending on numerous factors: climate zone, altitude, type of building, type of used energy etc.

For example, the RT 2012 imposes a C_{epmax} of 50 kWh/(m²·a) primary energy. In fact, the value fluctuates between 40 and 65 kWh/(m²·a) primary energy, for a house around the German border, or by the Mediterranean shore.

In addition, the RT 2012 has introduced a new parameter: B_{bio} (bioclimatic balance). It allows assessing the quality of the bioclimatic design of the building, and determining the heating, cooling and lighting needs. B_{bio}

needs to be lower than B_{biomax}.

For what concerns the hotel industry, the situation is detailed and slightly different according to the category of the hotel: “0 and 1”, “2”, “3”, “4 and 5” stars and also the type of renovation. Please find the details of the calculation and examples in Annex 2.

Details have been published by decree in the Official Gazette dated 1st of January 2013 – “Decree of 28 December 2012 on the thermal characteristics and energy performance requirements for new buildings and new parts of buildings other than those covered by Article 2 of the Decree of 26 October 2010 on the thermal characteristics and energy performance of buildings”.

RER (renewable energy ratio) definition/requirements

Under the RT 2012, every individual house must use a renewable energy sources.

The following solutions are possible:

- Domestic hot water with solar thermal systems;
- Connected to a district heating network (which produces at least 50% of the supplied energy from renewable sources or from energy recovery sources);
- Renewable energy production of at least 5 kWh/(m^2·a) from the primary energy use of the building.

The alternatives are:

- DHW production with thermodynamic hot water boiler;
- Micro-CHP boiler for heating and / or DHW.

Overview on energy related requirements and energy performance certificate class A according to the national transposition of EPBD

Table 7 Minimum requirements for existing residential buildings for certain building elements - France

No.	Building element	Climate zone	Minimum requirements
1	Insulation materials of external opaque walls	H1, H2	R = 2,3 (m^2·K)/W
		H3	R = 2 (m^2·K)/W
2	Glazing	H1, H2, H3	U = 2 W/(m^2·K)
3	Boiler	H1, H2, H3	89% - 90,9% efficiency for nominal powers 20 - 400 kW > 90,9 % efficiency for nominal powers > 400 kW

Requirements for existing residential buildings regarding primary energy consumption (heating, cooling and domestic hot water)

Table 8 Requirements for existing residential buildings regarding primary energy consumption (heating, cooling and domestic hot water) - France

Type of heating	Climate zone	Minimum requirements
Fossil fuel, biomass, heat networks	H1	130 kWh/(m^2·a)
	H2	110 kWh/(m^2·a)
	H3	80 kWh/(m^2·a)

Requirements for existing buildings subject to renovation:

- < 150 kWh/(m2·a) primary energy for residential buildings;
- At least 30% reduction of energy consumption.

Quality labels offered after renovation for residential buildings (primary energy):

- High Energy Performance 2009 (HPE 2009) 150 kWh/(m^2·a);
- Low Energy Consumption Renovation 2009 (BBCR 2009) 80 kWh/(m^2·a).

Quality label offered after renovation for non-residential buildings:

- Low Energy Consumption Renovation 2009 (BBCR 2009): if after renovation the building consumes over 60% less energy than before.

Energy performance certificate class A+ for residential buildings in primary energy indicator in kWh/(m^2·a):

- Heating, cooling, domestic hot water, lighting and auxiliaries < 50 kWh/(m^2·a).

Energy performance certificate class A+ for hotels in primary energy indicator in kWh/(m^2·a):

- Heating, cooling, domestic hot water, lighting and auxiliaries < 100 kWh/(m^2·a).

Present current action plans for progression to nZEB regarding the above information

The RT 2012 is fully enforced since the 1st of January 2013. It matches the requirements of the BBC-Effinergie label, and concerns new buildings in the residential and services sector, with different level of performance depending on the case.

As explained, the regulation introduces a new parameter: B_{bio} (bioclimatic balance). It allows assessing the quality of the bioclimatic design of the building, and to determine the heating, cooling and lighting needs.

This parameter is a unit of measure without a dimension and is evaluated by a number of points. Just like the C_{ep}, the B_{bio} needs to be lower than a reference (B_{biomax}) modulated by the same factors as the C_{epmax}.

The RT 2012 still includes a limit to summer temperatures, to grant users a comfortable use of the building in both warm and cold weather.

“BBC-Effinergie renovation” (BBC-ER) is a label designed for the owners who want to achieve better energy performance than required by the RT for existing buildings. The label imposes a C_{epmax}, taking into account that the C_{ep} is calculated excluding the on-site production of energy (if any). This measure prevents

buildings to compensate their low-efficiency by a huge production of on-site electricity.

By 2020, all new buildings will be positive energy building (already in the law and in the upcoming RT2020).

Positive energy building (BEPOS) label lays down, so far, the most ambitious requirements in energy-efficiency. BEPOS provides a clear definition of nZEB to be shared by all the actors of the building sector. Based on the calculation method of the RT 2012, the BEPOS label was born after extensive reflexion and exchange among the members and partners of the Effinergie association in February 2013. Although the label is not official, it was created specifically to satisfy the EPBD definition of a nZEB. The Effinergie association hopes it will serve as basis for the construction of the French nZEB definition.

A positive energy building is before anything else a passive building, with very little energy needs. This is achievable through a careful conception, an intelligent design, an excellent isolation and very efficient devices. The small amount of energy required is then produced by on-site renewable sources. This label imposes a C_{epmax}, and B_{biomax}, and introduces a new requirement: high airtightness (measured in $m^3/h/m^2$ under a pressure of 4 Pa). Furthermore, the label insists on evaluating the eco-mobility potential, and the grey energy balance of the building. Moreover, whereas the previous labels evaluated the C_{epmax} for some key consumption, BEPOS limits the global consumption, including all the appliances (TV, refrigerator, etc.). This complexity illustrates the fact that a positive energy building requires some awareness from the user regarding energy uses.

3.3. Greece

Name and email of contact person: Maria Frangou, maria.frangou@enveng.tuc.gr, Technical University of Crete, School of Environmental Engineering Renewable and Sustainable Energy Systems Lab, Greece

Present minimum energy performance requirements according to the national transposition of EPBD

Energy requirement type:

- Metric used: Primary energy;
- Measurement unit: [kWh/(m^2·a)];
- Fixed values: No;
- Relative to reference buildings: Yes.

Table 9 Numeric values for building types - Greece

All building types
Minimum energy class is B, defined as: 0,75 K.A. ≤ E.A. ≤ 1,00 K.A. where: E.A. is the primary energy consumption of the building under consideration, and K.A. is the primary energy consumption of the reference building*

*Reference building: A building with the same geometric characteristics, position, orientation, use and operation characteristics as the ones of the examined building. The reference building fulfils the minimum standards and has technical characteristics set, both in its exterior building elements, as well as in the electromechanical installations concerning HVAC of interior spaces, production of DHW and lighting.

Calculation methodology:

- Monthly method: Yes, all building types (based on EN 13790);
- Hourly tool: No;
- Simulation tools accepted: Yes;
- Energy flows included: Energy for heating, cooling, air-conditioning, for production of domestic hot water and lighting. Lighting is only accounted for buildings of the tertiary sector;
- Primary energy factors:
  - Electricity 2,9;
  - Natural gas 1,05;
  - Heating oil 1,10;
  - Biomass 1,00.
- On site renewable energy sources included: Yes, in the calculation methodology the positive effect of the following systems is taken into account: active solar systems and other systems for production of heat, cooling and electricity with the use of RES.

Input data for energy calculation

Table 10 Input data for energy calculation - Greece

Building type	h / day	day / week	Lighting* [W/m^2]	Appliances [W/m^2]	Occupancy [W/m^2]	Vent. rate [l/(s·m^2)]	DHW at 45^{0}C [m^3/(bedroom·a)]**
Apartment	18	7	6,4	4	4	0,21	27,38
Office	10	5	16,0	15	8	0,83	-
Hotel	24	7	9,6	3 summer hotels and 4 winter hotels	11	0,83	See Table 11

* With reference level for measurement 0,8m;

** There were no values available for kWh/(m^2·a).

Table 11 DHW in Hotel Buildings - Greece

Annual operation hotel (Lux)	**36,50**
A and B class	29,20
C class	21,90
Hotel of summer operation	21,23
A and B class	17,00
C class	12,74
Hotel of winter operation	24,27
A and B class	19,41
C class	14,56

The values presented in Table 10 and Table 11 are found in the Technical Directive of the Technical Chamber of Greece 20701-1/2010 (publication April 2012) for Calculating Energy efficiency of buildings. According to the document, these values are based on European standards EN ISO 13790:2008, EN 15251:2007 and other international standards.

Energy efficiency of buildings is calculated based on a methodology of primary energy consumption calculation. The calculation methodology includes at least the following:

- Use of the building, desirable condition of interior environment (temperature, moisture, ventilation), operational characteristics and number of users;
- Climate data of the area (temperature, relative and absolute moisture, wind speed and solar radiation);
- The geometric characteristics of the structural components of the building envelope (shape and form of the building, transparent and non-transparent surfaces, sunshades etc.) in respect to the orientation and characteristics of the internal structural elements;
- The thermal characteristics of components of the building envelope (thermal transmittance, thermal mass and absorption of solar radiation, permeability, etc.);
- The technical characteristics of the installation for space heating (type of systems, distribution network, system performance, etc.);
- The technical characteristics of the HVAC installation (type of systems, distribution network, system performance, etc.);
- The technical characteristics of the mechanical ventilation installation (type of systems, distribution network, system performance, etc.);
- The technical characteristics of DHW installation (type of systems, distribution network, system performance, etc.);
- The technical characteristics of the lighting installation for buildings of the tertiary sector;
- Passive solar systems.

In the calculation methodology, where relevant, the positive effect of the following systems are accounted for:

- Active solar systems and other heat production systems, cooling and electricity with the use of RES;
- Energy produced through co-production of electricity and heat;
- Central heating and cooling systems located in the area or the building block (district heating);
- Natural lighting.

nZEB (nearly Zero Energy Building) definition/requirements

In June 2010 the definition of the Nearly Zero Energy Building was introduced in the national legislation and it coincides with the precise EPBD definition.

The law specifies that, after January 1st 2015, every new building of the public sector should be nZEB. This obligation is also applied to all new buildings constructed after January 1st 2020. However, the national application of the nZEB definition has not yet been made.

No numeric value for the definition of nZEB is set yet. However, according to law 4122/2013:«Nearly Zero Energy Building»: Is a building with very high energy efficiency, which is calculated according to article 3 (of the same law)*.

The nearly zero or very low amount of energy required to meet the energy demand of the building, must be covered largely by renewable energy sources, including energy produced locally or near the building.

The law specifies that from the 01.01.2021, all new buildings have to be nearly zero energy buildings. For new buildings of the public sector, this obligation stands from the 01.01.2019. There are some special

cases of buildings, for which the cost-benefit analysis for their economic lifetime has a negative result and so they will be excluded from the obligation of being nZEB.

*Energy efficiency is calculated based on the calculated or the actual annual consumption of energy for covering the needs associated with its use and includes the energy demand for heating, cooling, ventilation and lighting to achieve the internal conditions of thermal and optical comfort, as well as the demand for DHW.

RER (renewable energy ratio) definition/requirements

NA

Requirements up to now: In new buildings, it is mandatory covering part of the DHW needs with solar thermal systems. The minimum solar share in annual basis is set to 60%. The minimum amount can be re-adjusted with the decision of the Minister of Environment, Energy and Climate change. This obligation does not apply:

- For exceptions such as monuments, protected buildings, worship places, industrial facilities, buildings for temporary use and buildings with surface less than 50 m^2;
- When the needs for DHW are partly covered by other systems based on RES, co-production of electricity and heat, district heating systems in a nearby area and heat pumps;
- For categories of buildings with low demand in DHW.

Overview on energy related requirements and energy performance certificate class A according to the national transposition of EPBD

Every new building, as well as any building going under major renovation, has to fulfil some minimum technical requirements described below.

The minimum energy requirements are fulfilled when the building fulfils the minimum requirements described below and:

- Either its total primary energy demand is smaller or equal than the total primary energy demand of the reference building (energy class B);
- Either the building has the same technical characteristics as the ones of the reference building.

Minimum requirements of buildings:

- Building design:
    - The following parameters need to be taken into account:
        - Proper siting and orientation of the building for maximum use of local climatic conditions;
        - Landscaping to improve microclimate;
        - Appropriate design and siting of openings by orientation depending on the requirements for insolation, natural lighting and ventilation;
        - Siting of functions according to the use and the comfort requirements (thermal, natural ventilation and lighting);
        - Incorporation of at least one of the following Passive Solar Systems: direct solar gain (openings to the south), mass wall, Tombre wall, sunroom (green house);

- Solar protection;
- Techniques of natural ventilation;
- Ensure visual comfort through technical and natural lighting systems.

- Building envelope:
  - Thermal characteristics of the envelope's structural components:
    - The individual components of a new building or one going under major renovation must comply with the insulation restrictions presented in Table 12;

Table 12 Maximum thermal transmittance for certain building elements - Greece

No.	Building element	U [W/(m²·K)] Climate zones			
		A	B	C	D
1	Roofs	0,50	0,45	0,40	0,35
2	External walls	0,60	0,50	0,45	0,40
3	External floors	0,50	0,45	0,40	0,35
4	Floor in contact with the ground or with closed non-heated spaces	1,20	0,90	0,75	0,70
5	External walls in contact with the ground or with closed non-heated spaces	1,50	1,00	0,80	0,70
6	Openings	3,20	3,00	2,80	2,60
7	Glass facades	2,20	2,00	1,80	1,80

- For passive solar system components, the restriction of maximum allowed U does not apply, with the exception of direct solar gain system;
- The value of the average U_m of any new building or one going under major renovation should not exceed the limits presented in Table 13;

Table 13 Maximum average U_m for new buildings or major renovation - Greece

F/V (m^{-1})	Maximum average U_m (W/m^2K)			
	Zone A	Zone B	Zone C	Zone D
≤0,2	1,26	1,14	1,05	0,96
0,3	1,20	1,09	1,00	0,92
0,4	1,15	1,03	0,95	0,87
0,5	1,09	0,98	0,90	0,83
0,6	1,03	0,93	0,86	0,78
0,7	0,98	0,88	0,81	0,73
0,8	0,92	0,83	0,76	0,69
0,9	0,86	0,78	0,71	0,64
≥1,0	0,81	0,73	0,66	0,60

- For buildings that incorporate passive systems in their envelope, except the system of direct solar gain (south openings), those systems are not accounted in the calculations of the average U_m value as such, but instead they are replaced with corresponding conventional structural non transparent elements with thermal characteristics as set in Table 12;
- The procedures for calculating thermal transmittance coefficients of structural components, the linear thermal transmittance coefficients (thermal bridges) and the maximum permissible average U (U_m) of the building are determined by a relative Technical Directive upon approval by the Minister.

- Electromechanical installations:
  - Individual electromechanical installations must meet the following restrictions:
    - Each central air-conditioning unit installed in the building with supply of fresh air ≥ 60%, achieves heat recovery at least 50%;
    - All distribution networks (water or other means) of central heating or cooling installations or DHW system, have thermal insulation specified with a Technical Directive upon approval by the Minister. Particularly the network installations traversing outdoor spaces have a minimum thermal insulation thickness of 19mm for heating and / or cooling and 13mm for DHW with conductivity of insulating material λ = 0,040 W / (m·K) (at 20^0C);
    - The conditioned air distribution ducts traversing outdoor spaces, have thermal insulation with an insulating material conductivity λ = 0,040 W / (m·K) and insulation thickness of at least 40 mm, while for traversing indoors the corresponding thickness is 30 mm;

- The distribution networks of hot and cold medium have a compensation system for the tackling of partial loads, or another equivalent system to reduce energy consumption under partial load;
- In the case of a large circuit with recirculation of DHW, circulation with fixed Δp is applied and a pump with speed control based on the demand for DHW;
- Covering part of DHW from solar thermal systems is obligatory. The minimum percentage of the solar share on an annual basis is 60 %. This obligation does not apply in some exceptions and when the demand for DHW is covered by other decentralized energy supply systems based on renewable energy, CHP, nearby district heating systems or heat pumps whose seasonal efficiency (SPF) is greater than (1,15 x 1 / n), where n is the ratio of total gross electricity production to primary energy consumption for electricity production according to EU Directive 2009/28/EC. For now SPF should be greater than 3.3;
- General lighting systems in buildings of the tertiary sector have a maximum energy efficiency of 55 lumen / W. For an area greater than 15 m^2, artificial lighting is controlled by separate switches. In spaces with natural lighting the quenching ability of at least 50% of the lamps should be ensured;
- Where cost distribution is required, autonomy of heating and cooling is imposed;
- Where cost distribution for space heating is required, as well as in central systems for production of DHW, calorimetry is applied;
- Thermostatic control of indoor temperature per controlled heat zone is required for all buildings;
- In all buildings of the tertiary sector, the installation of proper equipment to compensate the reactive power of electric consumption is required, to increase the power factor (cos phi) at a minimum of 0,95.

Energy performance certificate class A+ for all building types in primary energy [kWh/(m^2·a)] relative to the reference building:

- E.A. ≤ 0.33 K.A.

where: E.A. is the primary energy consumption of the building under consideration, and K.A. is the primary energy consumption of the reference building (same building but with the building elements according to the current requirements).

The new regulation of the Energy Performance of Buildings sets minimum requirements for the efficiency of heating and cooling systems, as well as for domestic hot water production for all buildings, plus lighting for buildings of the tertiary sector.

- Boilers must be certified with at least a 3 star energy efficiency rating;
- Heat pumps for heating must have at least a COP=3,2 if air cooled and a COP=4,3 if water cooled;
- Heat pumps for cooling must have at least an EER=2,8 if air cooled and an EER=3,8 if water cooled.

Present current action plans for progression to nZEB regarding the above information

The Ministry of Environment, Energy and Climate change is examining institutional, administrative and economic incentives, taking into consideration their cost-benefit analysis and communicates these to the

European Commission every 3 years. For works aiming to improve the energy efficiency and use of RES in buildings, funding may be available from the Public Investment Program. Programs concerning interventions in the building sector to improve the energy efficiency of buildings are being announced.

3.4. Italy

Name and email of contact person: Sara Levi Sacerdotti levi@siti.polito.it, Stefania Mauro stefania.mauro@siti.polito.it, Tiziana Buso tiziana.buso@polito.it, Istituto Superiore sui Sistemi Territoriali per l'Innovazione, Italy

Present minimum energy performance requirements according to the national transposition of EPBD

Energy requirement type:

- Metric used: Primary energy;
- Measurement unit: [kWh/(m^2·a)] for residential buildings and [kWh/(m^3·a)] for non-residential buildings;
- Fixed values: Yes. The limit values depend on the buildings' climate zone and on the surface/volume ratio;
- Relative to reference buildings: No.

Table 14 Numeric values for residential buildings - Italy

No.	Surface area to volume ratio	Residential buildings									
		Heating [kWh/(m^2·a)]									
		Climate zone									
		A	B		C		D		E		F
		≤600 dd	>600 dd	≤900 dd	>900 dd	≤1400 dd	>1400 dd	≤2100 dd	>2100 dd	≤3000 dd	>3000 dd
1	≤ 0,2	7,7	7,7	11,5	11,5	19,2	19,2	27,5	27,5	37,9	37,9
2	≥0,9	32,4	32,4	43,2	43,2	61,2	61,2	71,3	71,3	94	94

Reference for Table 14: Decreto 26-01-2010 "Aggiornamento del decreto 11 marzo 2008 in materia di riqualificazione energetica degli edifici"

Table 15 Numeric values for non-residential buildings - Italy

No.	Surface area to volume ratio	Non-residential buildings									
		Heating [kWh/(m^3·a)]									
		Climate zone									
		A	B		C		D		E		F
		≤600 dd	>600 dd	≤900 dd	>900 dd	≤1400 dd	>1400 dd	≤2100 dd	>2100 dd	≤3000 dd	>3000 dd
1	≤ 0,2	1,8	1,8	3,2	3,2	5,4	5,4	7,7	7,7	10,3	10,3
2	≥0,9	7,4	7,4	11,5	11,5	15,6	15,6	18,3	18,3	25,1	25,1

Reference for Table 15: Decreto 26-01-2010 “Aggiornamento del decreto 11 marzo 2008 in materia di riqualificazione energetica degli edifici”

For buildings with values of surface/volume ratio and/or degree days (dd) between the limit values for heating and cooling are calculated by linear interpolation.

Example:

If we want to calculate the limit heating energy consumption for a residential building with S/V=0,2 and dd=800: $EP_{limit,\ heating}$ = (((800–900)/(600-900))*7,7) – (((800-600)/(600-900))*11,5) = 10,23 kWh/m^2·a

If we want to calculate the limit heating energy consumption for a residential building with S/V=0,5 and dd=600: $EP_{limit,\ heating}$ = (((0,5–0,9)/(0,2-0,9))*7,7) – (((0,5-0,2)/(0,2-0,9))*11,5) = 9,33 kWh/m^2·a

Dealing with the EP limit values for cooling, it must be noted that the energy performance for cooling is expressed as energy need.

Table 16 Numeric values for residential buildings - Italy

No.	Surface area to volume ratio	Residential buildings					
		Cooling [kWh/(m^2·a)]					
		Climate zone					
		A	B	C	D	E	F
1	≤ 0,2	40	40	30	30	30	30
2	≥0,9	40	40	30	30	30	30

Reference for Table 16: dPR 59/2009 “Regolamento di attuazione dell'articolo 4, comma 1, lettere a) e b),

del decreto legislativo 19 agosto 2005, n. 192, concernente attuazione della direttiva 2002/91/CE sul rendimento energetico in edilizia"

Table 17 Numeric values for non-residential buildings - Italy

No.	Surface area to volume ratio	Non-residential buildings					
		Cooling [kWh/(m^3·a)]					
		Climate zone					
		A	B	C	D	E	F
1	≤ 0,2	14	14	10	10	10	10
2	≥0,9	14	14	10	10	10	10

Reference for Table 17: dPR 59/2009 "Regolamento di attuazione dell'articolo 4, comma 1, lettere a) e b), del decreto legislativo 19 agosto 2005, n. 192, concernente attuazione della direttiva 2002/91/CE sul rendimento energetico in edilizia"

Calculation methodology:

- Monthly method: Yes, based on the Italian standard UNI/TS 11300;
- Hourly tool: No;
- Simulation tools accepted: All the tools certified as coherent with the calculation method specified by the UNI/TS 11300 are accepted;
- Energy flows included: Heating and cooling as mentioned above;
- Primary energy factors: The primary energy factors are determined by the AEEG, the national authority for electricity and gas, and the current values are (These are total primary energy factors. Non-renewable energy factors are not specified yet):
  - Fuels 1;
  - Electricity 2,18.
- On site renewable energy sources included: RES are included in the energy performance calculation. The D.Lgs. 28/2011 lists renewable energy sources which can be included:
  - Solar thermal panels,
  - Photovoltaic panels,
  - Biomass,
  - Aero, hydro and geothermal heat pumps.

However, no specific limitation on other possible RES is mentioned. The only prohibition is to use electricity produced from on-site RES to provide all the energy required to the equipment with function of heating, cooling or DHW production.

Dealing with heat pumps, aero, hydro and geothermal heat pumps are considered among the renewable sources only if: SPF > 1,15 · 1/η, where:

SPF - Seasonal performance indicator;

n - Ratio electricity produced /primary energy needed to produce this electricity. (in Italy η = 0,459,

for heat pumps fuelled by electricity, η = 1, for heat pumps fuelled by gas).

The amount of RES provided by aero, hydro and geothermal heat pumps is:

ERES = Q_{usable} · (1 - 1/SPF), where: Q_{usable} - Estimated amount of produced heat.

Reference: D.Lgs. 28/2011 “Attuazione della direttiva 2009/28/CE sulla promozione dell'uso dell'energia da fonti rinnovabili “

Input data for energy calculation

In the Italian standard UNI/TS 11330, input data for energy calculation vary according to the type of evaluation required for the building object of analysis. If an asset rating useful to certify the building is needed, the standard input data is used. Therefore in the followings the input data used for a standard (asset rating) evaluation is provided.

Table 18 Input data for energy calculation - Italy

Building type	h / day*	day / week*	Lighting[W/m^2]	Appliances[W/m^2]	Occupancy[W/m^2]	Vent. rate [l/(s·m2)]**	DHW [kWh/ (m2·a)]***
Apartment	24/24	7/7	if floor area (A_f) ≤ 120 m^2, $7{,}987 \cdot A_f - 0{,}0353 \cdot A_f^2$				
			if floor area(A_f) >120 m^2, 450 W = FIXED VALUE				
Office	24/24	7/7		6			
Hotel	24/24	7/7		6			

Reference for Table 18: UNI/TS 11300 – part 1

* In this context the h/day and day/week are intended by SiTI as the hours during which the values for the internal gains must be considered as proposed in Table 18.

** The reference ventilation rate is generally calculated as:

$q_{ve,k,mn} = q_{ve,o,k} \cdot f_{ve,t,k}$ [m^3/s], where:

$q_{ve,o,k}$ - design ventilation rate [m^3/s]

$f_{ve,t,k}$ - correction factor depending on the building type [-]

The calculation method of $q_{ve,o,k}$ and the value of $f_{ve,t,k}$ depends on the building type as it is presented in Table 19.

Table 19 Calculation method of correction factors - Italy

Building type		$q_{ve,o,k}$	$f_{ve,t,k}$
Apartment		n·V/3600, where n=0,5 [h-1]	0,60
Office	Single office, open space	Calculation from norm UNI 10339	0,59
	Meeting rooms		0,51
Hotel	Hall	n·V/3600, where n=0,5 [h^{-1}]	1,00
	Conference room		0,47
	Dining room		0,34
	Rooms		0,26

Reference: UNI/TS 11300 – part 1

*** DHW is generally calculated as:

$Q_{hw} = \rho * C * V_W * (\theta_{ER} - \theta_O) * G$, where:

- ρ - density of water [kg/m^3];
- C - specific heat of water, 1,162 Wh/(kg·°C);
- V_W - Water volume need during the period of time considered in the calculation [m^3];
- θ_{ER} - Temperature of the hot water given to the user [°C];
- θ_O - Temperature of the cold water coming from the aqueduct [°C];
- G - Days of the period of time object of analysis.

The V_w value depends on the building type: $V_W = a \cdot N_u$ [l/G], where:

- a - Specific daily need;
- N_u - Parameter related to the building function.

Table 20 Water volume calculation coefficients based on building type - Italy

Building type		a	N_u
Apartment	≤ 50 m^2	1,8 [l/G·m^2]	Floor area (S_u)
	51 - 200 m^2	4,515·S_u - 0,2356 [l/G·m^2]	
	> 200 m^2	1,3 [l/G·m^2]	
Office		0,2 [l/G·m^2]	Floor area (S_u)
Hotel Without laundry / With laundry	1 star	40/50 [l/G]	No. of beds and no. of days (G)
	2 star	50/60 [l/G]	
	3 star	60/70 [l/G]	
	4 star	70/80 [l/G]	

Reference: UNI/TS 11300 – part 2

nZEB (nearly Zero Energy Building) definition/requirements

The brand new law 90/2013 just reports the general definition of nZEB provided by the EPBD recast which is: Technically and reasonably achievable energy use of > 0 kWh/(m^2·a) but no more than specified limit value of non-renewable primary energy, achieved with a combination of best practice energy efficiency measures and renewable energy technologies.

The definition of numerical target is still an on-going process, which shall show results into the National Action Plan to be published by 30 June 2014. However, it comes out from the law that the target will deal only with the energy performance indicator: a limit value for RES integration is not mentioned in the document.

RER (renewable energy ratio) definition/requirements

Calendar quota of renewable energy sources for domestic hot water 50% and total calendar quota of renewable energy sources for DHW + heating + cooling energy demand:

- 20% renewable quota for all building permits requested between May 31st 2012 - December 31st 2013;
- 35% renewable quota for all building permits requested between January 1st 2014 - December 31st 2016;
- 50% renewable quota for all building permits requested after January 1st 2017.

Moreover, there is a minimum amount of installed power (P) for electricity produced from plants using renewable energy sources - plants which must be installed in or nearby the building: P= (1/K)·S [kW], where:

S - Floor area of ground floor of the building [m^2];

K = 80 [m^2/kW], for all building permits requested between May 31st 2012 - December 31st 2013;
K = 65 [m^2/kW], for all building permits requested between January 1st 2014 - December 31st 2016;
K = 50 [m^2/kW], for all building permits requested after January 1st 2017.

Reference: D.Lgs. 28/2011 “Attuazione della direttiva 2009/28/CE sulla promozione dell'uso dell'energia da fonti rinnovabili “

Overview on energy related requirements and energy performance certificate class A according to the national transposition of EPBD

According to the Constitution, energy related topics are a shared task between the State and the 21 Regions and Autonomous Provinces. Consequently, regional authorities may implement autonomous transpositions of the EPBD, as long as they do not contradict the general principles and requirements provided by national and EU regulations. The national regulation stays in force for those regions which have not published their own legislation.

The general framework for the transposition of the EPBD at national level, setting the minimum requirements for the Energy Performance (EP), and the U-values for windows, walls, floors and roofs, in case of new buildings and major renovations has been drawn.

Table 21 Requirements for maximum thermal transmittance for all building types - Italy

No.	Building element	U [W/(m^2·K)]					
		Climate zone					
		A	B	C	D	E	F
1	Walls*	0,54	0,41	0,34	0,29	0,27	0,26
2	Roof*	0,32	0,32	0,32	0,26	0,24	0,23
3	Floors*	0,60	0,46	0,40	0,34	0,30	0,28
4	Windows*	3,7	2,4	2.1	2.0	1,8	1,6
5	Windows glass only**	3,7	2,7	2,1	1,9	1,7	1,3

*Reference: Decreto 26-01-2010 “Aggiornamento del decreto 11 marzo 2008 in materia di riqualificazione energetica degli edifici”
** Reference: dPR 59/2009 “Regolamento di attuazione dell'articolo 4, comma 1, lettere a) e b), del decreto legislativo 19 agosto 2005, n. 192, concernente attuazione della direttiva 2002/91/CE sul rendimento energetico in edilizia”

Requirements for energy efficiency:

- In case of renovation of the heating system, just as with new systems, the seasonal efficiency should be higher than (75 + 3 log Pn)%, where Pn is the nominal output power of the boiler;

- In case of boiler substitution, the minimum boiler efficiency (at maximum nominal power) should be higher than (90 + 2 log Pn)%;
- In case of heat pumps, the minimum efficiency should be higher than (90 + 3 log Pn)%, where the heat pump efficiency is the ratio of the delivered energy to the electric energy converted to primary energy, according to the national conversion rate. The efficiency will be higher than 1 whenever the Coefficient of Performance (COP) of the heat pump exceeds the conversion rate.

Reference: dPR 59/2009 "Regolamento di attuazione dell'articolo 4, comma 1, lettere a) e b), del decreto legislativo 19 agosto 2005, n. 192, concernente attuazione della direttiva 2002/91/CE sul rendimento energetico in edilizia"

Energy performance certificate:

- EP_i (primary energy for heating) [kWh/(m^2·a)] Energy performance for class A+, for residential buildings: EP_i < 25% of the primary energy requirements for new buildings;
- EP_{DHW} (primary energy for domestic hot water) [kWh/(m^2·a)] Energy performance for class A, for residential buildings: EP_{DHW} < 9 kWh/(m^2·a);
- $EP_{e,envelope}$ (energy need for cooling) [kWh/(m^2·a)] Energy performance for class I, for all the building types: $EP_{e,envelope}$ < 10 kWh/(m^2·a);
- EP_{gl} (primary energy for heating and DHW) [kWh/(m^2·a)] Energy performance for class A+, for residential buildings: EP_{gl} < 25% of the primary energy requirements for new buildings + 9 kWh/(m^2·a).

The EP_{gl} value is used to certify the building energy class in the energy performance certificate. At the actual stage, the energy classes for heating, domestic hot water and, consequently, the global energy class, are defined only for the residential sector, which in Italy includes also the hotels.

Present current action plans for progression to nZEB regarding the above information

The Second National Energy Efficiency Action Plan, issued in July 2011, carried some preliminary milestones for setting a national strategy for Nearly Zero-Energy Buildings (nZEB). Namely, it is stated that:

- New minimum requirements for building EP and for building elements will be set: the requirements should be laid down with a view to achieving cost-optimality;
- Incentive schemes: the Ministry of Economy and Finance, and the Ministry for Economical Development shall join in a task force to programme and manage a national incentive scheme;
- Social housing: introduction of an incentive/bonus for projects adopting innovative solutions (cool roof, active building envelope systems, etc.), integration of renewables, use of ecologic components and materials, optimization of local economic resources;
- Introduction of standardization in the use of Building Energy Management Systems (BEMS) for public buildings;
- Residential buildings: focus on the cluster of existing buildings built before 1976 (which sums up to more than 70% of all buildings). Provide incentives through low interest rate revolving fund schemes for renovations leading to a 50% decrease in energy consumption.
- Stakeholders involvement: the National Energy Agency (ENEA) will involve stakeholders in working groups, with the goal of proposing new lines of action;
- An observatory will be set up in order to monitor the effectiveness of the programmes and schemes;
- School buildings: simplified procedures to involve Energy Service Companies (ESCOs).

As required by the EPBD recast, recently translated into the national legislation with the law 90/2013, a new action plan for increasing the number of nearly zero-energy buildings is expected to be ready by the end of June 2014. It will introduce:

- Detailed application in practice of the definition of nearly zero-energy buildings, reflecting local conditions, and including a numerical indicator of primary energy use expressed in kWh/(m^2·a);
- Financial measures for the promotion of nearly zero-energy buildings;
- Specific cases where the cost-benefit analysis over the economic lifecycle of the building in question is negative, and therefore the nZEB goal do not have to be achieved;
- Intermediate targets for improving the energy performance by 2015.

The brand new law 90/2013 (which confirms the contents of D.L. 63/2013) establishes that the energy performance requirements shall be settled by using reference buildings. However, the definition of the quoted reference buildings and requirements is planned to come only with the National Action Plan, whose publication is planned for 30th June 2014. According to the brand new L. 90/2013:

- In residential buildings (building category E1) the included energy flows are heating, cooling, domestic hot water and ventilation;
- In non-residential buildings the energy flows include heating, cooling, domestic hot water, ventilation, lighting and electricity for elevators.

3.5. Romania

Name and email of contact person: Horia Petran - hpetran@gmail.com, Agency of Braşov for Energy Management and Environment Protection, Romania

Present minimum energy performance requirements according to the national transposition of EPBD

Energy requirement type:

- Metric used: Energy need. Note: The calculation of this energy requirement indicator is not performed using the National Methodology for EP calculation (according to Annex I of EPBD), but using a simplified yearly calculation method based on the global heat transfer coefficient 'G' from C107 Technical Regulation);
- Measurement unit: [kWh/m^3·a];
- Fixed values: Yes;
- Relative to reference buildings: No.

Table 22 Numeric values for building types - Romania

Apartment buildings
15 - 37,5
depending on the A/V ratio

Calculation methodology:

- Monthly method: Yes, Note: The answer is valid only in the context of the present requirements. In fact, the energy performance indicator is (according to the EP calculation methodology (MC 001-2007 with further additions) the final energy use (also reported in the energy performance certificate – EPC) and primary energy use (not reported in the EPC). The EP calculation methodology provides yearly, monthly and hourly methods, which could be selected by the auditor, but the most used methods are monthly and yearly ones;
- Hourly tool***: Yes, see note above;
- Simulation tools accepted: Not specified;
- Energy flows included: Heating;
- Primary energy factors: Not relevant for the requirement type;
- On site renewable energy sources included: Not relevant for the requirement type;

Input data for energy calculation

Observations: According to SR EN ISO 13789 (the transposition of EN ISO 13789).

nZEB (nearly Zero Energy Building) definition/requirements

Law 372 Article 14 Paragraph 1 states: New buildings, which will be commissioned after December 31st 2020, will be buildings with nearly zero energy consumption from conventional energy sources.

Law 372 Article 14 Paragraph 3 states: The energy requirements for buildings with nearly zero energy consumption from conventional energy sources, including the renewable energy requirements, is set through technical regulations, differentiated on zones with renewable energy sources potential and it is updated periodically according to technical progress.

RER (renewable energy ratio) definition/requirements

The RER is not yet fixed. Law 372/2005 (republished) requires that a feasibility study concerning the potential use of renewable energy in the designed building has to be provided for each new building at the authorizing stage.

Overview on energy related requirements and energy performance certificate class A according to the national transposition of EPBD

Requirements regarding minimum thermal resistances and maximum thermal transmittances for residential buildings designed after January 1st 2011 - thermal bridges are taken in consideration (Technical regulation for thermal calculation of building elements C 107 Part 1 Annex 3, 2010) are presented in Table 23.

Table 23 Minimum thermal resistances and maximum thermal transmittances for residential buildings - Romania

No.	Building element	Residential buildings	
		R'_{min} [$(m^2 \cdot K)/W$]	U'_{max} [$W/(m^2 \cdot K)$]
1	External walls	1,8	0,56
2	External windows	0,77	1,3
3	Slab over last building level	5	0,2
4	Slab over unheated basement	2,9	0,35
5	Slab over ground	4,5	0,22
6	Slab over ground for unheated basement	4,8	0,21
7	External walls for heated basement	2,90	0,35

Requirements regarding minimum thermal resistances for office buildings, commercial buildings and hotels designed after January 1st 2011 - thermal bridges are taken in consideration (Technical regulation for thermal calculation of building elements C 107 Part 2 Annex 4, 2010) are presented in Table 24.

Table 24 Minimum thermal resistances for office buildings, commercial buildings and hotels - Romania

No.	Climate zone	External walls a [(m²·K)/W]	External windows e [(m²·K)/W]	Slab over last building level b [(m²·K)/W]	Slab over ground or unheated space c [(m²·K)/W]
1	I	1,6	0,50	3,5	2,1
2	II	1,7	0,50	4,0	2,5
3	III, IV	1,8	0,50	4,5	2,9

For the hosting function building units the requirements for residential buildings apply.

No minimum energy performance requirements are yet set for new buildings neither for renovation of existing buildings. It is foreseen that in short time (1 month) minimum energy requirements will be approved and published, including final energy and primary energy for main building categories. It will use the same calculation methodology as for the energy performance of buildings certificates.

Energy performance certificate class A for residential buildings in total energy use kWh/(m²·a) (Romanian EP calculation methodology MC 001 Part 3, page 27, 2005):

- Heating < 70 kWh/(m²·a);
- DHW < 15 kWh/(m²·a);
- Air conditioning (cooling) < 20 kWh/(m²·a);
- Mechanical ventilation < 5 kWh/(m²·a);
- Lighting < 40 kWh/(m²·a);
- Total < 150 kWh/(m²·a).

Energy performance certificate class A for commercial buildings in total energy use kWh/(m²·a) (not yet included in the methodology – proposal included in a pre-normative research report by INCERC Bucharest, Dec. 2009)

- Heating < 68 kWh/(m²·a);
- DHW < 4,5 kWh/(m²·a);
- Air conditioning (cooling) < 2,3 kWh/(m²·a);
- Mechanical ventilation < 9,4 kWh/(m²·a);
- Lighting < 16,1 kWh/(m²·a);
- Total < 100,3 kWh/(m²·a).

Present current action plans for progression to nZEB regarding the above information

The action plan for progression to nZEB may include building codes, energy performance certification, research and development, raising awareness and other support measures. A good starting point might be the recently developed study by the BPIE "Implementing Nearly Zero Energy Buildings in Romania", published in August 2012, which proposes some actions for detached residential and office buildings.

Further steps for the introduction of nZEB standards are under consideration.

3.6. Spain

Name and email of contact person: Ignacio Guerrero Hernández, igh@creara.es, Creara Consultores S.L., Spain

Present minimum energy performance requirements according to the national transposition of EPBD

The transposition of the EPBD related to the Energy Performance (EP) requirements consists of the Royal Decree 314/2006 approving the TBC. It sets the minimum requirements that must be met by all new buildings (residential, non-residential, public and private buildings), as well as by existing buildings undergoing a renovation of more than 25% of their area.

With the enforcement of the TBC in 2006, building energy efficiency received a large boost.

The Strategy for implementing the EPBD and the nZEB in Spain is to progressively tighten the requirements of the TBC and the Regulation on Building Thermal Installations (HE2). These regulations will harden the conditions to build, which shall eventually meet nZEB requirements by the end of 2018.

The TBC consists of 6 documents:

- CTE DB HE0 – Consumption limitation;
- CTE DB HE1 – Limitation of energy demand;
- CTE DB HE2 – Performance of thermal installations (RITE);
- CTE DB HE3 – Energy efficiency in lighting installations;
- CTE DB HE4 – Minimum solar contribution for hot sanitary water;
- CTE DB HE5 – Minimum photovoltaic contribution for electric power.

The Technical Building Code (TBC) has been recently updated (September 2013) to tighten the requirements for the construction of new buildings with the following updates:

- New Basic Decree (DB HE0) for consumption limitation in buildings;
- Lighting efficiency increased
- Significant reduction for hot water demand
- Minimum energy label “B”
- Influence of internal loads into methodology for establishing demand
- Preventive maintenance for solar photovoltaic & thermal.

Energy requirement type:

- Metric used: Primary energy and CO_2 emissions;
- Measurement unit: kWh/(m^2·a) and kgCO_2/(m^2·a);
- Fixed values: No (Depends on Climate Zone, geometry and building typology);
- Relative to reference buildings: Yes.

Table 25 Numeric values for building types - Spain

Residential	Tertiary	Great Tertiary (Big buildings for tertiary use)
Guide values 26 - 104kWh/(m^2·a) The primary energy use must be within 15% and 50% of the primary energy use of the reference building	Guide values 150 - 620 kWh/(m^2·a) The primary energy use must be within 40% and 65% of the primary energy use of the reference building	Important variations depending on the internal loads (lighting, occupancy, infiltrations and equipments) The primary energy use must be within 40% and 65% of the primary energy use of the reference building

The guide values are for the current minimum label ("B") permitted for new building. Variations are due to the differences between climatic zones, occupancy and hours of operation.

Calculation methodology

- Monthly method: Yes (Residential and tertiary);
- Hourly tool: Yes (Great Tertiary);
- Simulation tools accepted: Calener VyP, Calener GT, C3X and C3E;
- Energy flows included: Residential (Heating, Cooling), Tertiary (Heating, Cooling, Ventilation, Lighting, Hot Water and Appliances), Great Tertiary (Heating, Cooling, Ventilation, Lighting, Hot Water, Appliances and Auxiliaries pumping);
- Primary energy factors:
  - Electricity low voltage 2,35;
  - Electricity mid-high voltage 2,25;
  - Natural Gas 1,07;
  - Diesel 1,12;
  - LPG 1,05.
- On-site renewable energy sources included: Solar thermal energy (Simulation tool's input is the average solar contribution in %), Solar photovoltaic energy (Simulation tool's input is annual production, only for Great Tertiary) and Biomass (Monthly basis for Calener VyP and Hourly for Calener GT). Rest of renewable energies can be introduced by other recognized tools in a monthly basis.

Input data for energy calculation

Table 26 Input data for energy calculation - Spain

Building type	h / day	day / week	Lighting [W/m^2]	Appliances[W/m^2]	Occupancy [W/m^2]	Vent. rate [l/(s·m^2)]	DHW [kWh/m^2·a)]
Residential	Fixed values presented in Annex 3 Table 1.						
Tertiary	Fixed values presented in Annex 3 Table 2, Table 3, Table 4 and Table 5.						
Great Tertiary	Measurements needed						

nZEB (nearly Zero Energy Building) definition/requirements

Current nZEB definition provided in both 2002 and 2010 directives is excessively vague. IDAE (Institute for Diversification and Saving of Energy) assures that an expanded definition will be published by Spain in the coming years (more precise information is not available).

RER (renewable energy ratio) definition/requirements

For the first time, the use of Renewable Energy Sources (RES) became compulsory in order to meet part of the energy needs of buildings, either to produce sanitary hot water (for both residential and non-residential buildings), as set forth in the CTE DB HE4, or to produce electric power in tertiary buildings as set in the CTE DB HE5. As this requirement is included in the TBC 2006, which is a national regulation, the use of RES in new buildings is mandatory in the whole Spanish territory.

Minimum requirements are shown in Table 27 and Table 28.

Table 27 Annual minimum solar contribution % for indoor swimming pool

Total hot water demand (l/d)	Climatic Zone				
	I	II	III	IV	V
Indoor pool	30	30	50	60	70

Table 28 Annual minimum solar contribution % for hot water

Total hot water demand (l/d)	Climatic Zone				
	I	II	III	IV	V
50 - 5.000	30	30	40	50	60
5.000 - 10.000	30	40	50	60	70
> 10.000	30	50	60	70	70

For the photovoltaic energy, the following formula shows how to calculate the minimum power for photovoltaics: P=C (0,002·S - 5), where:

P - Power (kWp);

C - Coefficient depending on the climatic zone (I - 1; II - 1,1; III - 1,2; IV - 1,3; V -1,4);

S - Floor area (m^2).

Overview on energy related requirements and energy performance certificate class A according to the national transposition of EPBD

Table 29 Energy performance class A - Spain

Residential	Tertiary	Great Tertiary (Big buildings for tertiary use)
Guide values 15-68kWh/(m^2·a) The primary energy use must be less than 15% of the primary energy use of the reference building	Guide values 110-385 kWh/(m^2·a) The primary energy use must be less than 40% of the primary energy use of the reference building	Important variations depending on the internal loads (lighting, occupancy, infiltrations and equipments) The energy ratio must be lesser than the 40% of the fixed primary energy value for the reference building

Thermal transmittance requirements for the building envelope are presented in detail in Annex 4.

Present current action plans for progression to nZEB regarding the above information

The regulatory approach of the building code to the nZEB requirements will be done in a gradual way, based on the results of cost-optimal studies, which are virtually completed.

The first updating of the current energy Code 2006 (CTE- DB HE) will be accomplished during 2013. A second updating is expected to be accomplished in the period 2016-2017.

Then, a regulatory definition of nZEB and the respective requirements will be established, in accordance with the recast EPBD, and will become mandatory after December 2018 for new buildings occupied and owned by public authorities, and by 2020 for all new buildings.

The conduction of cost-optimal studies in the years to come will be crucial in order to adjust the minimum requirements associated to nZEB.

3.7. Sweden

Name and email of contact person: Janine af Klintberg, janine.af.klintberg@sust.se, Sustainable Innovation, Sweden

Present minimum energy performance requirements according to the national transposition of EPBD

Energy requirement type:

- Metric used: Delivered energy;
- Measurement unit: kWh/(m2·a);
- Fixed values: Yes;
- Relative to reference buildings**: No.

In the Swedish building laws hotels are included in the non-residential building category.

Table 30 Numeric values for current renovations and new buildings - Sweden

No.	Climate zone	Residential buildings		Non-residential buildings	
		Other heating source	Electrical heating >10 W/m^2	Other heating source	Electrical heating >10 W/m^2
1	North	130	95	120	95
2	Middle	110	75	100	75
3	South	90	55	80	55

These values consider an air flow rate of 0,35 l/s. If the air flow rate is greater than this is taken into consideration. The maximum air flow rate is 1 l/s.

Table 31 Numeric values (prospect) for new buildings 2020

No.	Climate zone	Residential buildings		Non-residential buildings	
		Other heating source	Electrical heating >10 W/m^2	Other heating source	Electrical heating >10 W/m^2
1	North	75	50	70	50
2	Middle	65	40	60	40
3	South	55	30	50	30

Source: Swedish Energy Agency, 2013. (http://www.energimyndigheten.se/PageFiles/17865/Nationell%20strategi%20för%20lågenergibyggnader.pdf)

Table 32 Numeric values (prospect) for renovations 2020

No.	Climate zone	Residential buildings		Non-residential buildings	
		Other heating source	Electrical heating >10 W/m^2	Other heating source	Electrical heating >10 W/m^2
1	North	105	70	100	70
2	Middle	90	55	85	55
3	South	75	40	70	40

Source: Swedish Energy Agency, 2013. (http://www.energimyndigheten.se/PageFiles/17865/Nationell%20strategi%20för%20lågenergibyggnader.pdf)

Calculation methodology

- Monthly method: No;
- Hourly tool***: No;
- Simulation tools accepted****: No;
- Energy flows included: Heating, cooling, hot water and ventilation;
- Primary energy factors:
  - District Heating (Coal) 0,8 – 1,5;
  - District Heating (Biomass) 1,01 – 1,06;
  - District Heating (Garbage) 0,04;
  - District Cooling (average) 0,53;
  - Electricity mixture 2,7;
  - Electricity solar energy 0,7;
  - Domestic hot water 1,11;
  - Natural gas 1,09;
  - Coal 1,15;
  - Oil (E01, E02-5) 1,11;
  - Peat 1,01;
  - Nuclear power 2,92;
  - Fossil 2,20;
  - Renewable 1,1.
- On site renewable energy sources included: PV panels, Solar thermal panels and Biomass.

Comments:

- Regarding the three first bullet points of the calculation methodology: In Sweden for energy usage measured data is taken into consideration.

Input data for energy calculation

Table 33 Input data for energy calculation - Sweden

Building type	h / day	day / week	Lighting [kWh/(m²·a)]	Appliances [kWh/m²]	Occupancy [W/m²]	Vent. rate [l/(s·m²)]*	DHW [kWh/(m²·a)]
Apartment	14	7	30/30**	N/A		0.35	25/20***
Office	9	7	23	34		1.5	2
Hotel	N/A	N/A	N/A	N/A	N/A	N/A	N/A

*Lowest permitted;
**Apartment building / Smaller house;
***House / Apartment.

Observations: These values are estimated average values based on several measurements and surveys.

Source Apartments:
http://www.sveby.org/wp-content/uploads/2012/10/Sveby_Brukarindata_bostader_version_1.0.pdf

Source Offices:
http://www.sveby.org/wp-content/uploads/2013/06/Brukarindata-kontor-version-1.1.pdf

nZEB (nearly Zero Energy Building) definition/requirements

Presently, in Sweden, the buildings with an energy performance by 25% higher than that stated in the building regulations are referred to as low-energy buildings and those with an energy performance by 50% higher are classified as having very low energy use.

Other types of building definitions currently in use in Sweden are presented in Table 34 and Table 35.

Table 34 Passive House - Sweden

No.	Max Energy Consumption kWh/(m²·a)	Non-residential buildings	Residential buildings
1	North	12	14
2	Middle	11	13
3	South	10	12

Source:
http://www.nollhus.se/Documents/Kravspecifikation%20Passivhus%20version%202009%20oktober.pdf

Table 35 Mini Energy House - Sweden

No.	Max Energy Consumption kWh/(m^2·a)	Non-residential buildings	Residential buildings
1	North	20	24
2	Middle	18	22
3	South	16	20

Source:
http://www.nollhus.se/Documents/Kravspecifikation%20Minienergihus%20version%202009%20oktober.pdf

The definitions of Passive and Mini Energy houses should be looked at as guidelines from the Swedish Energy Agency but are not included in the actual building laws.

Both definitions, Passive houses and Mini Energy houses, include recommendations to move toward renewable energy sources or other sustainable options to assure the energy consumption, but does not state a “must have”.

RER (renewable energy ratio) definition/requirements

NA.

Overview on energy related requirements and energy performance certificate class A according to the national transposition of EPBD

Since 2006, the Swedish building regulations have been based on measured energy consumption. The measured values for heating, cooling, hot water and auxiliary energy are summed up to an energy usage figure [kWh/ (m^2·a)] (heated area to 10^0 C).

Requirements regarding maximum overall thermal transmittance for residential and non-residential buildings are presented in Table 36.

Table 36 Maximum overall thermal transmittance for residential and non-residential buildings - Sweden

No.	Climate zone	U [W/(m^2·K)]			
		Residential buildings		Non-residential buildings	
		Other heating source	Electrical heating >10 W/m^2	Other heating source	Electrical heating >10 W/m^2
1	North	0.4	0.4	0.6	0.6
2	Middle	0.4	0.4	0.6	0.6
3	South	0.4	0.4	0.6	0.6

Energy performance certificate class A for all building types in delivered energy [kWh/(m^2·a)] relative to the reference building: < 51% of the requirements for new buildings.

Present current action plans for progression to nZEB regarding the above information

The last part, Part 4 The role of renewable energy in nearly zero-energy buildings, of the action plan for progression to nZEB concerns Renewable Energy Sources (RES) in Swedish buildings and the Swedish energy supply system.

Sweden must also find out a way to show the renewable energy produced on-site or nearby the buildings which are not showed today. The document 'Vägen till Nära nollenergibyggnader' ('On the road to nZEB'), describing the role of renewables, is available on the government website.

4. Annexes

Annex 1: Annex 1. Input data scenarii for different types of buildings, France

Annex 2: Calculation of Cepmax and Bbiomax and examples, France

Annex 3: Building code reference values 1, Spain

Annex 4: Building code reference values 2, Spain

Annex 5: REHVA Template for Country fact sheets on building codes and nZEB definitions

5. References

Useful Resources:

- Agenda for a sustainable and competitive European tourism
- http://europa.eu/legislation_summaries/environment/sustainable_development/l10132_en.htm
- BPIE's Data Hub for the energy performance of buildings http://www.buildingsdata.eu/
- BUILD UP: The European portal for energy efficiency in buildings http://www.buildup.eu/
- Concerted Action Energy Performance of Buildings (CA-EPBD) http://www.epbd-ca.eu/
- eceee, the European Council for an Energy Efficient Economy http://www.eceee.org/about-eceee
- Energy Efficiency, European Commission portal http://ec.europa.eu/energy/efficiency/index_en.htm
- Energy Efficiency in buildings: Implementation by the EU Member States
- http://ec.europa.eu/energy/efficiency/buildings/implementation_en.htm
- Energy Roadmap 2050, COM(2011)885/2
- http://ec.europa.eu/energy/energy2020/roadmap/index_en.htm
- Eur-Lex, Access to European Union law
- http://eur-lex.europa.eu/en/index.htm
- Eurostat, European Statistics http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home
- Hotel Energy Solutions (HES) http://hotelenergysolutions.net/
- Intelligent Energy Europe Programme (IEE) http://ec.europa.eu/energy/intelligent/
- Report from the Commission to the European Parliament and the Council, Progress by Member States towards Nearly Zero-Energy Buildings, COM/2013/0483 final/2 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52013DC0483R(01):EN:NOT
- Technical definition for nearly zero energy buildings, REHVA http://www.rehva.eu/index.php?id=497&L=0%2527

National authorities responsible for the implementation of nZEB policy:

- Croatia: Ministry of Construction and Physical Planning - Ministarstvo Graditeljstva i Prostornoga Uređenja http://www.mgipu.hr/default.aspx?id=3967
- France: Ministry of Ecology, Sustainable Development and Energy - Ministère de l'Écologie, du Développement durable et de l'Énergie http://www.developpement-durable.gouv.fr/-Batiment-et-energie-.html

- Greece: Ministry of Environment, Energy and Climate Change - Υπουργείο Περιβάλλοντος Ενέργειας & Κλιματικής Αλλαγής
  http://www.ypeka.gr/
- Italy Ministry for Economic Development – Ministero dello Sviluppo Economico
  http://www.sviluppoeconomico.gov.it/
- Romania: Ministry of Regional Development and Public Administration - Ministerul Dezvoltării Regionale şi Administraţiei Publice
  http://www.mdrap.ro/
- Spain: Ministry of Energy, Industry and Tourism - Ministerio de Industria, Energía y Turismo
  http://www.minetur.gob.es/es-ES/Paginas/index.aspx
- Sweden: Boverket - The Swedish National Board of Housing and Planning
  http://www.boverket.se/Om-Boverket/About-Boverket/

neZEH TEAM

Project Coordinator
Technical University of Crete, School of Environmental Engineering
Renewable and Sustainable Energy Systems Lab, Greece

United Nations World Tourism Organization

Network of European Regions for a Sustainable and Competitive Tourism

Federation of European Heating, Ventilation and Air-conditioning Associations

Agency of Braşov for Energy Management and Environment Protection, Romania

Creara Consultores S.L., Spain

ENERGIES 2050, France

Energy Institute Hrvoje Požar, Croatia

Istituto Superiore sui Sistemi Territoriali per l'Innovazione, Italy

Sustainable Innovation, Sweden

CONTACTS

PROJECT COORDINATOR:
Technical University of Crete, Renewable and Sustainable Energy Systems Lab
Ms Stavroula Tournaki • stavroula.tournaki@enveng.tuc.gr • +30 28210 37861 • www.neZEH.eu

AUTHOR:
REHVA Jarek Kurnitski, neZEH Regional Leaders – see in the individual chapters
EDITORS: Anita Derjanecz • ad@rehva.eu, Andrei Lițiu • al@rehva.eu

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