Country fact sheets on legal framework in targeted countries

WP2 Experience and viability of NZE refurbishment projects - D2.3, updated

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www.nezeh.eu

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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

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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
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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 information about legal requirements and strategic plans influencing the deployment of in their countries in December 2013 the first time and updated the information in January 2016 about the following topics:

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

Information regarding building codes and legal frameworks, existing nZEB definitions 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. This information was 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 (due to the lack of numerical nZEB criteria in all partner countries in 2013):
  - Underline the present in force energy performance requirements that give a maximum value for an energy type (primary energy, delivered energy, energy need);
  - Present 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;
  - The values required for the used metric should be further specified by building type according to the national selected building typology;
  - The energy performance calculation methodology is split up into bullets. Each bullet represents an essential part of the methodology;
  - If the metric is different from primary energy use then the last 2 bullets are not relevant for that type of energy requirement;
  - The energy flows included help to better compare primary energy use indicators. There are countries who give the requirements e.g. with lighting and/or appliances included.
- Input data for energy calculation:
  - The information requested for this point is in more technical depth 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 should be noted here, e.g. reference to standards or any other relevant data regarding the filled in values.

- nZEB definition/requirements:
  - Present the 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;
  - Include 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 equipments.
- Action plans for progression to nZEB regarding the above information:

Due to the delay of national transposition of the nZEB definition the original plan of using existing national regulation was impossible. For this reason neZEH collected information on national building codes according to the EPBD recast to develop 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 was shown in an additional deliverable to D2.3 (D2.3b).

End of 2015 till February 2016 the Regional Leaders provided updated information about the nZEB related national requirements and action plans and also the building codes where there were significant changes. New information was collected also about the national strategies on the acceleration of nZEBs.

2. Overview of the status on nZEB definitions in the neZEH countries

neZEH used the publications of BPIE[1] and the CA-EBPD country reports as basis of information; the BPIE summary table was updated by all the partners with the very latest available information in their countries, as shown in Table 1 below. By 2016 the majority of the neZEH partner countries transposed the nZEB definition in the national law and defined also numerical values, with the exemption of Greece and Spain. France continued the legislative process towards positive energy buildings. A brief summary of the situation of nZEB definitions is presented in *Table 1* below.

Legend:

[1] For residential buildings, the EPBD takes into account the following energy services: heating, cooling, domestic hot water, air conditioning, and, for non-residential buildings, lighting is considered in addition

[2] Depending on the reference building

[3] Depending on the location

[4] Requirement depending on the RES measures adopted

[5] Maximum primary energy consumption defined as a percentage of primary energy consumption (EP) of a reference building.

[6] No cooling for residential buildings

[7] In the National nZEB Plan, BBC / “Bâtiments Basse Consommation” (buildings which comply with the Thermal Regulation 2012) are defined as buildings with an energy consumption close to zero, but it is foreseen that buildings will be positive energy buildings from 2020

[8] The cost-optimal study, which will define numerical indicators, is under preparation for the competent Ministry. The national nZEB plan is not expected before the end of 2016 or beginning of 2017

[1] nZEB Definitions across Europe, BPIE, 2015

Table 1. nZEB definitions in the neZEH partner countries[2]

Country	nZEB definition for new buildings						nZEB definition for existing buildings		
				Maximum primary energy [kWh/m^{2}y]			Maximum primary energy [kWh/m^{2}y]		
	Status of definition	EPBD scope of nZEB definition [1]	Numerical indicator	Residential buildings	Non-residential buildings	Share of renewable energy	Status of definition	Residential buildings	Non-residential buildings
Croatia	✓	✓	✓	35-80 [5]	25-250 [5]	✓ 30%	The same as for new buildings		
France	Definition of Positive Energy Buildings under development [7]	✓	✓	less than 50 [5]	70-110 [2,3]	✓ Quantitative [4]	✓	80 [3]	60% of the benchmark for similar building [5]
Greece	Under development	✓	Under development [8]			Minimum share in current requirements for all buildings	Under development		
Italy	✓	✓	✓	no fixed figures [6]		50% RES for Domestic Hot Water (DHW) + 50% RES for (DHW + heating + cooling)	✓ As for new buildings		

[2] Source: BPIE factsheet: nZEB definitions across Europe, Status as of April 2015.
Updated by the neZEH partner countries in February 2016

Country	nZEB definition for new buildings						nZEB definition for existing buildings		
				Maximum primary energy [kWh/m^{2}y]				Maximum primary energy [kWh/m^{2}y]	
	Status of definition	EPBD scope of nZEB definition [1]	Numerical indicator	Residential buildings	Non-residential buildings	Share of renewable energy	Status of definition	Residential buildings	Non-residential buildings
Romania	✓	✓	✓	93-217 [2,3]	50-192 [2,3]	✓ Quantitative	ND*		
Spain	Under development	✓	Under development	Included in the calculation; it is foreseen that buildings will need to comply with class A	Minimum share in current requirements for all buildings	Under development			
Sweden	✓	✓	Still to be approved (suggested values by Boverket 2015)	55-80 [2,3] Delivered energy, not primary energy	50 [2,3] Delivered energy, not primary energy	All energy from RES will be excluded from the consumption values	ND*		

*ND = No data

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: Heat Transfer Coefficient, Energy need for heating, Primary energy need and Delivered energy;
- Measurement unit: [kWh/(m^2·a)];
- Fixed values: Yes;
- Relative to reference buildings: No.

Table 1 Numeric values for new buildings - Croatia

Building type	Heat Transfer Coefficient	Energy need for heating	Primary energy need	Delivered energy
Multi apartment buildings	depending on building shape factor f0	depending on building shape factor f0	120 - inland 90 - costal	80 – inland 60 - costal
Family houses	depending on building shape factor f0	depending on building shape factor f0	115 - inland 70 - costal	80 - inland 50 - costal
Office	depending on building shape factor f0	depending on building shape factor f0	70 - inland 70 - costal	40 - inland 40 - costal
Education	depending on building shape factor f0	depending on building shape factor f0	65 - inland 60 - costal	60 - inland 60 - costal
Hospital	depending on building shape factor f0	depending on building shape factor f0	300 - inland 300 - costal	220 - inland 220 - costal
Hotel and restaurant	depending on building shape factor f0	depending on building shape factor f0	130 - inland 80 - costal	90 - inland 50 - costal
Sports hall	depending on building shape factor f0	depending on building shape factor f0	400 - inland 170 - costal	290 - inland 110 - costal
Commercial	depending on building shape factor f0	depending on building shape factor f0	450 - inland 280 - costal	290 - inland 170 - costal
Other	depending on building shape factor f0	depending on building shape factor f0	150 - inland 100 - costal	80 - inland 60 - costal

Table 2 Numeric values for reconstruction of existing buildings - Croatia

Building type	Heat Transfer Coefficient	Energy need for heating	Primary energy need	Delivered energy
Multi apartment buildings	depending on building shape factor f0	depending on building shape factor f0	180 - inland 130 - costal	120 – inland 85 - costal
Family houses	depending on building shape factor f0	depending on building shape factor f0	135 - inland 80 - costal	120 - inland 60 - costal
Office	depending on building shape factor f0	depending on building shape factor f0	75 - inland 75 - costal	40 - inland 40 - costal
Education	depending on building shape factor f0	depending on building shape factor f0	90 - inland 75 - costal	60 - inland 60 - costal
Hospital	depending on building shape factor f0	depending on building shape factor f0	340 - inland 330 - costal	250 - inland 230 - costal
Hotel and restaurant	depending on building shape factor f0	depending on building shape factor f0	145 - inland 115 - costal	90 - inland 80 - costal
Sports hall	depending on building shape factor f0	depending on building shape factor f0	420 - inland 215 - costal	295 - inland 190 - costal
Commercial	depending on building shape factor f0	depending on building shape factor f0	475 - inland 300 - costal	290 - inland 185 - costal
Other	depending on building shape factor f0	depending on building shape factor f0	180 - inland 130 - costal	-

Calculation methodology:

- Monthly method: Yes;
- Hourly tool: NA;
- Simulation tools accepted: Yes;
- Energy flows included: Heating, air-conditioning, domestic hot water and ventilation for residential building. Non-residential buildings also include lighting.
- Primary energy factors: Yes, specified for all categories. Calculations are made with only unrenewable component.
  - Electricity 0,798;
  - District heating 1,494;
  - Oil 1,138;
  - Natural gas 1,095;
  - LPG 1,160;
  - Coal 1,0381;
  - Firewood 0,1108.

- On site renewable energy sources included: There are additional requirements concerning RES share in total delivered energy for energy systems in building. Total requirement is 20% RES share or specific shares in heating, air-conditioning and DHW depending on specific RES (from 25% for solar to 70% for geothermal).
-

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
Residential buildings	24	7		5		0,5 - 1,5	12,5 – 16 kWh/(m^2·a)
Office	17	5		6		0,5 - 1,5	16 l/working place
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 or 6 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 calculated as 16 l per working place. 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

nZEB values are defined according to building type and location. The values are the same for new nZEB and reconstruction of existing buildings to nZEB standard.

Table 4 Numeric values for nZEB - Croatia

Building type	Heat Transfer Coefficient	Energy need for heating	Primary energy need	Delivered energy
Multi apartment buildings	depending on building shape factor f0	depending on building shape factor f0	80 - inland 50 - costal	80 – inland 60 - costal
Family houses	depending on building shape factor f0	depending on building shape factor f0	45 - inland 35 - costal	80 - inland 50 - costal
Office	depending on building shape factor f0	depending on building shape factor f0	35 - inland 25 - costal	40 - inland 40 - costal
Education	depending on building shape factor f0	depending on building shape factor f0	55 - inland 55 - costal	60 - inland 60 - costal
Hospital	depending on building shape factor f0	depending on building shape factor f0	250 - inland 250 - costal	220 - inland 220 - costal
Hotel and restaurant	depending on building shape factor f0	depending on building shape factor f0	90 - inland 70 - costal	90 - inland 50 - costal
Sports hall	depending on building shape factor f0	depending on building shape factor f0	210 - inland 150 - costal	290 - inland 110 - costal
Commercial	depending on building shape factor f0	depending on building shape factor f0	170 - inland 150 - costal	290 - inland 170 - costal

RER (renewable energy ratio) definition/requirements

At least 30% of primary energy needs has to be derived from RES

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.
- Maximum permitted annual primary energy use for heating, air-conditioning, ventilation, DHW and lighting per m^2 of usable floor area
- Maximum permitted annual delivered energy use for heating, air-conditioning, ventilation, DHW and lighting per m^2 of usable floor area
- Minimal required RES share in annual delivered energy
- 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 5 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	0,45	0,30	0,50	0,50
2	Windows, balcony doors, roof windows, transparent façade elements	1,80	1,60	2,80	5,50
3	Flat and pitched roofs above heated rooms, ceilings to the attic	0,30	0,25	0,50	0,40
4	Ceilings above external air, ceilings above garages	0,30	0,25	0,50	0,40
5	Walls and ceilings to non-heated rooms and non-heated stairways at a temperature higher than 0 ^0C	0,60	0,40	1,20	0,90
6	Walls to the soil, floors on the soil	0,50	0,40	0,80	0,65
7	External doors, doors to non-heated stairways, with non-transparent door wings	2,40	2,00	2,90	2,90
8	Walls of the roller shutter box	0,80	0,60	0,80	0,80
9	Ceilings between apartments, ceilings between heated working premises of various users	0,80	0,60	1,20	1,20

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

The plan for increasing the number of nZEB till 2020 was completed by the end of 2014. Plan described the most significant data of the existing building stock in Croatia. Also, 6 building types have been identified and primary energy use for heating, air-conditioning, ventilation, DHW and lighting with minimal RES share have been calculated to achieve nZEB standard.

All the goals have been adopted to collide with other strategic documents (NEEAP being the most important). Projections for increasing the number of nZEB has been made with needed increased investment costs. Action plan states the goal of 10% of new buildings being built according to nZEB standard with the addition of reconstructed building. Overall, 155 000 m^2 of building space is planned to be refurbished/reconstructed to nZEB standard till 2020.

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 6 Numeric values for buildings types - France

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

The values in Table 6 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 7.

Table 7 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 8 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 9 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

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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 10 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 2,90;
  - 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 11 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 12

* With reference level for measurement 0,8m;

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

Table 12 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 11 and Table 12 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 13;

Table 13 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 14;

Table 14 Maximum average U_m for new buildings or major renovation - Greece

F/V (m⁻¹)	Maximum average U_m (W/m²K)			
	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 13;

- 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.

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

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

- **Metric used:** Primary energy
- **Measurement unit:** [kWh/m^2·y]
- **Fixed values*:** NO, not for primary energy, because the limit value depends on the specific features of the building object of analysis
- **Relative to reference buildings**:** **YES.** Law 90/2013 establishes the energy performance requirements to be settled by using reference buildings (RB). RBs have the same physical features (e.g. shape and dimensions, plant type) of the building object of analysis, but different thermal properties and systems efficiencies.

Table 15 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

Table 16 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

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 17 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 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”

Table 18 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 18: 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.

For instance, it is forbidden to use electricity produced by photovoltaic to provide the total energy needs of an electric radiator.

Dealing with heat pumps, aero, hydro and geothermal heat pumps are considered among the renewable sources only if their final efficiency is at least 5% higher than the primary energy needed by the heat pump to work. Moreover, the amount of renewable energy provided by the heat pump is only the share of energy produced from RES.

Specifying the above sentence with formulas, the amount of RES provided by aero, hydro and geothermal heat pumps is:
$\mathbf{E_{RES} = Q_{usable} * (1 - 1/SPF)}$
$\mathbf{Q_{usable}}$ = estimated amount of heat produced by heat pumps having the minimum requirements of energy efficiency**
SPF = seasonal efficiency factor

** Heat pumps fulfilling the minimum requirements of energy efficiency must have:

SPF > 1,15 * 1/η
η = ratio electricity produced /primary energy needed to produce this electricity.
In Italy **η = 0,459**, for heat pumps fueled by electricity, **η = 1**, for heat pumps fueled by gas.

The formula just showed is the calculation method of the limit value for the energy efficiency of aero, hydro and geothermal heat pumps that can be included among the RES.

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 19 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 19: 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 19.
** 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 qve,o,k and the value of fve,t,k depends on the building type as it is presented in Table 20.

Table 20 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 21 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

DEFINED. As prescribed by D.M. 26-06-2015[2], nearly zero energy buildings should simultaneously fulfill the following requirements:

- The global heat transmission coefficient H_T must be lower than the limit shown in the table below.

Surface area (S) to Volume (V) ratio	Climatic zone							
	A and B	C		D		E		F
	≤ 900 dd	> 900 dd	≤ 1400 dd	> 1400 dd	≤ 2100 dd	> 2100 dd	≤ 2100 dd	> 3000 dd
S/V ≥ 0.7	0.58	0.55		0.53		0.50		0.48
0.7 > S/V ≥ 0.4	0.63	0.60		0.58		0.55		0.53
0.4 > S/V	0.80	0.80		0.80		0.75		0.70

- The parameter $A_{sol,est}/A_{sup\ utile}$ must be lower than 0.03 for residential buildings and lower than 0.04 for non-residential buildings.
- Indexes $EP_{H,nd}$ (primary energy heating need), $EP_{C,nd}$ (primary energy cooling need) and $EP_{gl,tot}$ (global total primary energy) must be lower than the corresponding indexes calculated for a reference building implementing the 2021 reference values.
- System efficiencies η_H, η_W, η_C must be higher than the limit values for the reference building.
- Calendar quota of renewable energy sources for domestic hot water: 50%
- Total calendar quota of renewable energy sources for DHW+heating+cooling energy demand: 50%

There are no differences in requirements between new and existing building.

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 22 Requirements for maximum thermal transmittance for all building types - Italy

No.	Building element	U [W/(m²·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/(m²·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/(m²·a)] Energy performance for class A, for residential buildings: EP_{DHW} < 9 kWh/(m²·a);
- $EP_{e,envelope}$ (energy need for cooling) [kWh/(m²·a)] Energy performance for class I, for all the building types: $EP_{e,envelope}$ < 10 kWh/(m²·a);
- EP_{gl} (primary energy for heating and DHW) [kWh/(m²·a)] Energy performance for class A+, for residential buildings: EP_{gl} < 25% of the primary energy requirements for new buildings + 9 kWh/(m²·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 National Energy Efficiency Action Plan[7] issued in July 2014, list some general measures for increasing buildings' energy efficiency as possible solutions to foster the market uptake of nearly Zero-Energy Building. Namely, the measures quoted are:

- Tax deduction for energy efficiency improvement actions: **65% deduction of gross tax** (progressively reduced in 2015-2016) for projects obtaining an EP_H at least 20% lower than the reference values;
- The **thermal account** incentivizing the generation of thermal energy from Renewable Energy Sources and small scale energy efficiency projects;
- **White certificates**, that are tradable securities certifying the achievement of energy savings in the final uses of energy through energy efficiency measures and projects;
- **European Structural Funds 2014-2020**;
- **National Fund for Energy Efficiency**.

An action plan for increasing the number of nearly zero-energy buildings was published in November 2015[8]. In this document, a more detailed description of a nearly Zero Energy Building is given in terms of required energy performances. Moreover national and regional case studies and incentive schemes for nZEBs are presented.

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 23 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 24.

Table 24 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 25.

Table 25 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

Romania has started the development of the legal framework regarding the energy savings in buildings in 2000 and continued to build a robust regulatory framework, while transposing EPBD (2003) and EPBD recast (2010) along with other EU legal provisions and policies in the field of energy performance of buildings, energy efficiency and renewable energy. In Romania, the implementation of EPBD is under the responsibility of the Ministry of Regional Development and Public Administration (MDRAP), while the RESD and EED are in the responsibility of the Ministry of Economy (now the Department for Energy within the mentioned Ministry). The regulation of the construction sector, including all aspects related to energy policy

in buildings (for all three relevant directives), is the responsibility of MDRAP.

The EPBD has been transposed into the national legal framework by the adoption of Law 372/2005 on Energy Performance of Buildings, which was amended in 2013, in order to be in compliance with the recast EPBD. The energy performance certificate (EPC) is mandatory as provided in the EPBD. For the buildings or building units on sale or rental, the owner/investor/manager of the building is responsible for the EPC elaboration and presentation to the potential buyer or tenant. The selling contracts made without the existence of an EPC may be cancelled according to the provisions of the Civil Code. The general framework for EPC and inspection reports verification and sanctions/penalties for non-compliance were introduced.

The building regulation C107/2005 contains prescriptive element-based criteria for thermal insulation, as well as a global heat transfer coefficient of the heated volume, G-value (W/m³K), as an overall minimum requirement, depending on the number of the building floors and the external area per volume ratio (A/V). This regulation has been amended in October 2010 (C107/2010 Annex 3) by raising the level required in terms of thermal resistance values for new buildings. Currently there is no minimum energy performance requirement in terms of global indicator, neither for new buildings nor for renovations, except for residential buildings, where the maximum allowed heat demand (per total heated volume) varies from 15 kWh/m³.year to 37.5 kWh/m³year, depending on the external area per volume ratio (A/V). The maximum indicated heat demand is expressed in terms of final energy, without taking into account the system efficiency. Cooling and Domestic Hot Water (DHW) are also not considered.

The building energy performance is computed and displayed (EPC) based on the calculation methodology (Ministry Order 1057/2007) for the energy performance of buildings (Mc 001/1, 2, 3 - 2006), taking into account the EPBD standards, especially the EN 13790 for heating and cooling, which was available in draft when the methodology was issued. The methodology includes also alternative calculation methods for heating and hot water consumption, based on previous Romanian research activity. The methodology was amended and supplemented with a calculation summary of the energy performance of buildings and EPC template for apartments (2009), by publishing climatic data for EPB calculation methodology application (2012, revised monthly data for 40 cities and reference year for 9 cities), approving procedure for EPC control (2013, State Inspectorate in Constructions), and providing guides for inspection of HVAC and heating systems (2013). The methodology is available both for new and existing buildings, as well as for residential and non-residential buildings.

Regarding the energy certification system, classes in EPC are from A (the most efficient) to G (the most energy consuming). Class A in the energy performance certificate (EPC) ranges from 125 kWh/m²yr (heating, domestic hot water -DHW- and lighting) to 150 kWh/m²yr (all energy uses). EPC covers heating, cooling, ventilation, DHW and lighting (these are the “utilities“, i.e. energy uses). For a building which has no cooling system and no mechanical ventilation system, the energy use class A is below 125 kWh/m²/yr. These values are not actually imposed as a minimum requirement for new buildings since there is no requirement for final and primary energy in Romania.

Source: RePublic_ZEB, "Report on the EPBD national implementation",
http://www.republiczeb.org/filelibrary/WP3/D3-1_EPBD-implementation.pdf

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

Relevant existing national plans in the context of EPBD implementation and towards nZEB public building stock are the National Plan for increasing the number of nZEB, the third Energy Efficiency Action Plan, and the Strategy for mobilising investments in the renovation of residential and commercial building stock.

Furthermore, the second National Action Plan on Energy from Renewable Sources (http://www.minind.ro/pnaer/PNAER_29%20iunie_2010_final_Alx.pdf), the Status Quo Analysis Report, BUILD UP Skills – Romania project (August 2012) and the Roadmap for National Qualification of Building Workforce, BUILD UP Skills – Romania project (April 2013) contain useful information for the substantiation of a nZEB renovation strategy.

National Plan for increasing the number of nZEB

The plan was elaborated during 2013-2014 (published in September 2014) and included for the first time a detailed application in practice of the definition of nZEB in Romania, which includes the non-renewable primary energy indicator, introduces intermediate target (2015) to achieve low energy buildings and presents policies and measures identified for renovation of buildings to achieve nZEB levels (see paragraph on nZEB definition).

The nZEB plan starts form several policies impacting on energy use, as follows:

- The energy roadmap for Romania (GD 890/2003) aiming at a final electricity consumption of 57.59 TWh in 2015;
- The strategy on renewable energy sources (GD 1535/2003) reinforced by the Renewable Energy Action Plan under the RE Directive;
- The national strategy on energy efficiency (GD 163/2004);
- The national strategy on the heating supply of localities through district generation and distribution systems (GD 882/2004);
- The national programme “Heating 2006–2015 heat and comfort” (GD 462/2006) for rehabilitation of the district heating systems and thermal rehabilitation of buildings;
- The National Development Plan 2007–2013, in conjunction with ERDF sectorial programmes and with three major sub-programmes on efficient and sustainable energy, renewable energy sources and interconnection networks;
- Romania’s national energy strategy 2007–2020 (GD 1069/2007) aiming to reach a primary energy intensity of 0.32 in 2015 and 0.26 in 2020;
- The national strategy on the sustainable development of Romania – Horizons 2013-2020- 2030 (GD 1460/2008).

Romania’s energy strategy for 2007–2020 includes forecast of the energy consumption made in 2007. However, such forecasts do not consider the influence of the economic crisis.

The main measures of the strategy related to buildings are:

- Intensifying the information campaigns of the population and of the business environment;
- Continuing the “Heating 2006–2015 heat and comfort” programme;
- Continuing the Programme for the improvement of energy efficiency of blocks of flats;
- Expanding the national programme for energy efficiency (retrofitting the heating system, retrofitting public buildings) for 2011–2015;
- The compulsory issuing of the energy performance certificates, starting with 2010, for residential buildings (i.e. single family homes and apartments) that are sold or leased out;
- The enforcement by the central and local public authorities of legislation on energy efficiency and the promotion of the final consumer use of energy from renewable sources.

For an alternative approach, the following range of possible policy measures was identified:

- Establishment of an energy efficiency investment fund to tap into private funds, structural funds, auctioning revenues under EU ETS provisions and possibly the state budget;
- Conducting energy audits and training of energy auditors;
- Consumer awareness-raising and advice campaigns, to raise awareness among households of the benefits of energy audits through energy advisory services in building energy;
- Regulations or voluntary agreements;
- Supporting the development of ESCOs, including developing the regulatory framework for the effective operation of the ESCO, developing the market of these companies and promotion of energy performance contracts by 2016.

hese measures are aimed at improving the regulatory framework for building renovation and to mobilise investments in building renovation in order to increase the number of nZEBs.

Third Energy Efficiency Action Plan

According to the provisions of the National Reform 011-2013 (NRP 2011-2013, approved in April 2011), Romania set as targets for 2020 to reduce the consumption of primary energy by 20% compared to the PRIMES 2007 forecasts (estimated at circa 10 Mtoe), a decrease in the greenhouse gas emissions by 19% compared to the reference year 1990 (corresponding to 28.289 thousand CO2 tons), respectively a weight of 24% of the energy from renewable sources in the gross final energy consumption (corresponding to 7.267 thousand toe). In order to detail the actions considered to achieve these targets, the second National Energy Efficiency Action Plan was published in 2012 and included strategies and measures for primary energy savings (to produce electricity and heat and for the distribution and transport), final energy savings in end-use sectors, and measures to increase EE in domestic, industrial, transport, service sectors and as well as the public sector. However, like the National Renewable Energy Action Plan, the second NEEAP did not provided a clear quantification of measures engaged in the buildings sector and the support measures included for the building sector were rather general, based on two National programmes for increasing the energy performance of existing buildings (Government Emergency Order No 18/2009 – for collective buildings and Government Emergency Order No 69/2010 - with funds from bank loans with Government guarantee.

The third National Energy Efficiency Action Plan was elaborated in 2014 and is currently in approval process to be submitted to EC.

According to the updated forecast presented in the Plan, the revised target for 2020 (corresponding to an estimated energy consumption for 2020 of 42.99 million toe) for the reduction of primary energy consumption is 1.15 million toe. In terms of final energy, the reduction target for 2020 is 1.64 million toe (corresponding to an estimated final energy consumption of 30.32 million toe).

For the building sector, the Plan references the Strategy for mobilising investments in the renovation of residential and commercial building stock and the definition of nZEB levels which will be approved for 2015, 2018 and 2020. A substantial reduction in energy consumption in buildings can be considered achievable in stages, only through a combination of energy efficiency measures and implementing the use of renewable energy resources and buildings. The three key successive phases identified and proposed national fund to renovate buildings are:

Phase 1: Determine the conditions in which major renovations can become a target within 5 years;

Phase 2: Technological development for buildings renovation that can provide the means to achieve substantial reduction of energy consumption and achieve the level of nearly zero energy buildings from conventional sources, within about 15 years;

Phase 3: Deep renovation of buildings within 15 years.

For Government Buildings, based on the inventory of public buildings heated and/or cooled with a total useful floor area greater than 500m2, owned and occupied by central authorities (6.74 million m²), primary energy savings by renovating 3% each year were estimated at 44,194 GWh / year (3,800 toe), resulting total energy savings of 22,800 toe for 2014-2020. For building stock under local government (which sums 27 million m² of a total 67.2 million m² of non-residential buildings), total energy savings were estimated at about 11,600 toe by thermal rehabilitation to increase their energy performance.

The Regional Operational Programme for 2014-2020 provides thematic objectives (TO) linked to increasing energy efficiency: TO4 - Supporting the shift towards a low-carbon and TO6 - Protecting the environment and promoting resource efficiency, with specific priority axes for Energy efficiency in public buildings and for Sustainable Development (including The energy efficiency of residential buildings).

Other key actions included in the Plan refer to the implementation of monitoring systems (including smart metering), availability of qualification, accreditation and certification systems (especially for energy managers – EED) and programs for energy awareness of final consumers.

Strategy for mobilising investments in the renovation of residential and commercial building stock

The strategy for mobilizing investments in the renovation of existing residential and commercial building stock, both public and private was developed by MDRAP starting from the BPIE report developed in consultation with Romanian stakeholders and published in April 2014.

The strategy was developed using a five-phase stepwise approach (BPIE): (1) identify key stakeholders and information sources, (2) building stock characterization, economic appraisal of renovation potential and quantification of investment requirements, (3) comprehensive appraisal of barriers and development of holistic policy package, (4) draft renovation strategy and consultation, and (5) publish final strategy, commerce policy implementation process, establish monitoring and evaluation process and review and update strategy every three years.

Renovation is considered in the strategy as a major opportunity for sustainable modernization of existing buildings, which bring multiple benefits to households, businesses and public sector, while a strategic approach is crucial to stimulate the market which was currently supported only by fragmented initiatives. Funding renovation of buildings is considered the key to success. There are many sources of funding to be exploited and Energy Efficiency Investment Fund should be designed to facilitate investments in renovation of buildings.

A set of policy measures to underpin the renovation strategy was identified, structured by categories: strategic, legal and regulatory, technical, fiscal/financial, capacity building and research & development.

Among the defined most important policies during the next three years, providing support for a national

program to renovate the building stock and for renewable energy use in buildings (also improving the utilization of Cohesion and EU Structural Funds), ensuring the achievement of the renovation rate of 3% for central government buildings, developing stimulative regulatory framework for ESCOs and developing a scheme for energy efficiency obligations (EEO) to support extensive renovations after 2017 are crucial for the successful implementation of the renovation strategy. Other measures refer to further improvement of the effectiveness and public acceptability of existing centralized heating systems, to encourage the development of an internal industry of local supply chain to ensure the implementation of renovation measures, to develop promotion and dissemination activities to raise awareness building owners about the opportunities of extensive renovation and to provide a step by step support throughout the rehabilitation process. Creating a stakeholder forum is needed to assist in the implementation and continuous updating of the strategy.

Source: RePublic_ZEB, "Report on the EPBD national implementation",
http://www.republiczeb.org/filelibrary/WP3/D3-1_EPBD-implementation.pdf

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 26 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

UPDATE

The calculation methodology has been updated to the CEN standards. The most significant changes are:

- *Energy consumption indicator: non-renewable primary energy consumption has been adopted as an indicator of consumption in certification, according to Directive 2010/31 / EU.*
- *Climatic data and rating scales: climate data have been unified with the climate data included in the DB HE. Furthermore, rating scales have been corrected and adapted to new climates,*
- *Correction factors: Correction factors have been updated according to the following document "CO2 emission factors and Correction factors by different primary energy sources in final energy consumed in the building sector in Spain" which can be found in the RITE document.*
- *Replacement systems: the technical characteristics of replacement systems have been adequated to the requirements established by RITE.*
- *Levels of ventilation in residential buildings: levels have been adapted to the actual conditions of use of buildings.*

The associated documents are available in the following websites (The documents are available from January 14, 2016):

http://www.minetur.gob.es/energia/desarrollo/EficienciaEnergetica/CertificacionEnergetica/DocumentosReconocidos/Documents/20151126_Procedimiento%20Doc%20Reconocidos_v2.pdf

http://www.minetur.gob.es/energia/desarrollo/EficienciaEnergetica/CertificacionEnergetica/DocumentosReconocidos/Documents/20151119%20-%20Condiciones%20t%C3%A9cnicas%20de%20los%20procedimientos%20para%20la%20evaluaci%C3%B3n%20de%20la%20eficiencia%20energ%C3%A9tica.pdf

http://www.minetur.gob.es/energia/desarrollo/EficienciaEnergetica/CertificacionEnergetica/DocumentosReconocidos/Documents/2015_06_22_Nuevo%20Modelo%20de%20Certificado%20de%20Eficiencia%20Energ%C3%A9tica%20Versi%C3%B3n%20Web%20vac%C3%ADo.pdf

http://www.minetur.gob.es/energia/desarrollo/EficienciaEnergetica/CertificacionEnergetica/DocumentosReconocidos/Documents/20151123%20-%20Calificaci%C3%B3n%20de%20la%20eficiencia%20energ%C3%A9tica%20de%20los%20edificios.pdf

http://www.minetur.gob.es/energia/desarrollo/EficienciaEnergetica/CertificacionEnergetica/DocumentosReconocidos/Documents/20151123%20-%20Calificaci%C3%B3n%20de%20la%20eficiencia%20energ%C3%A9tica%20de%20los%20edificios.pdf

Input data for energy calculation

Table 27 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 28 and Table 29.

Table 28 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 29 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 30 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

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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 31 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 32 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 33 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 34 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 35 and Table 36.

Table 35 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 36 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 37.

Table 37 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

Note: Annexes are attached as separate documents due to different file format and easier use of the present document.

List of 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/

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