NEARLY ZERO ENERGY HOUSING FOR WARM/MEDITERRANEAN CLIMATE ZONES

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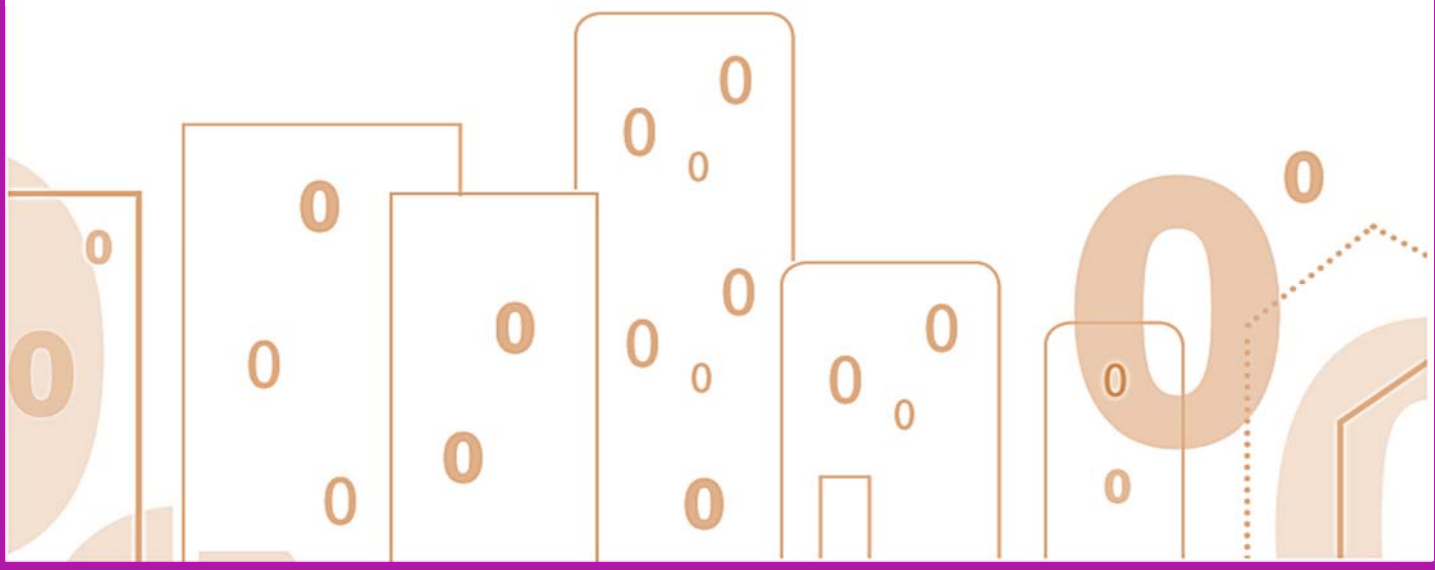
TaskForce Needs Analysis & Work Programme including nZEB Legislation Review



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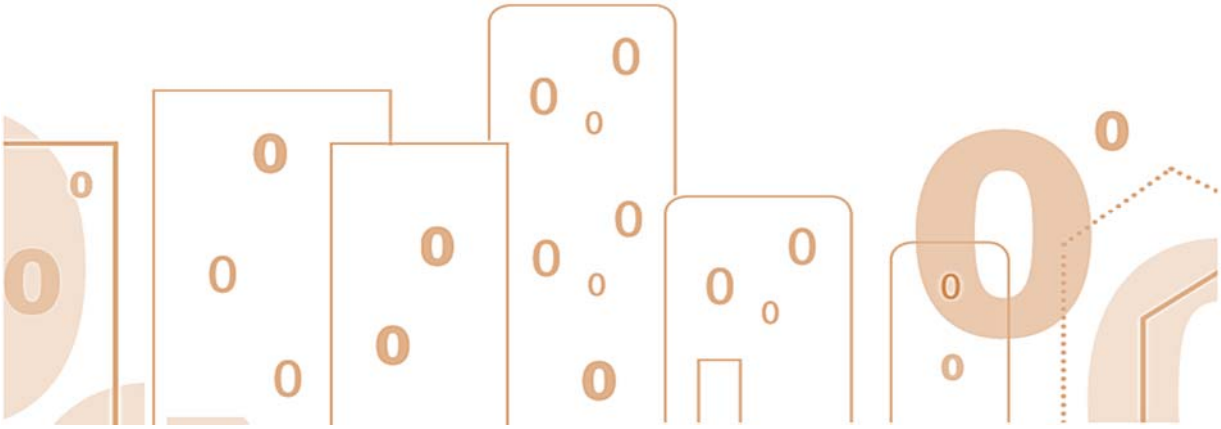

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1. Introduction

1.1 Italy

1.1. Administrative division

Italy is organized territorially into 21 Autonomous Regions with wide legislative and executive autonomy, with their own regional governments, in the field of environment, territorial organisation and housing. The State has the competence in order to set up minimum requirements.

The Regions are divided into provinces and average 8000 municipalities. The public housing system (Housing agencies, former IACPs) is organized at provincial level.

1.1.2. Climate

As known, Italy is generally considered as a country that enjoys Mediterranean climate. However Italy has a varying typology of mountains and planes stretching 1.500 km from North to South and is subject to considerable climate variations.

Italian legislation (law 10/91) identifies six official winter climate zones based on degree days (DD) from the warmest Zone A (DD < 600) to the coldest Zone F (DD > 3 000).

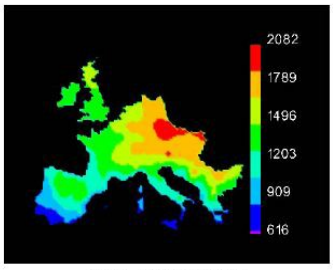


Fig. 4. 1 – Winter Degree-Days

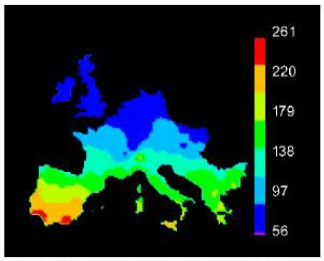


Fig. 4. 3 – Radiation over horizontal surface in winter (kW/m^2)

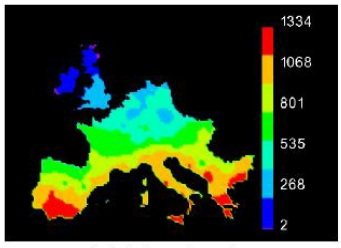


Fig. 4. 2 – Summer Degree-Days

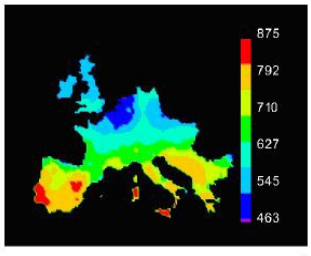


Fig. 4. 4 – Radiation over horizontal surface in summer (kW/m^2)

HDD /CDD and Solar Radiation in Europe

Source: Passive-on project

Figure 3: Heating degree days and cooling degree days for European countries. The black lines indicate the city with the highest and lowest value respectively

Source: Schild, Klinski and Grini, 2010

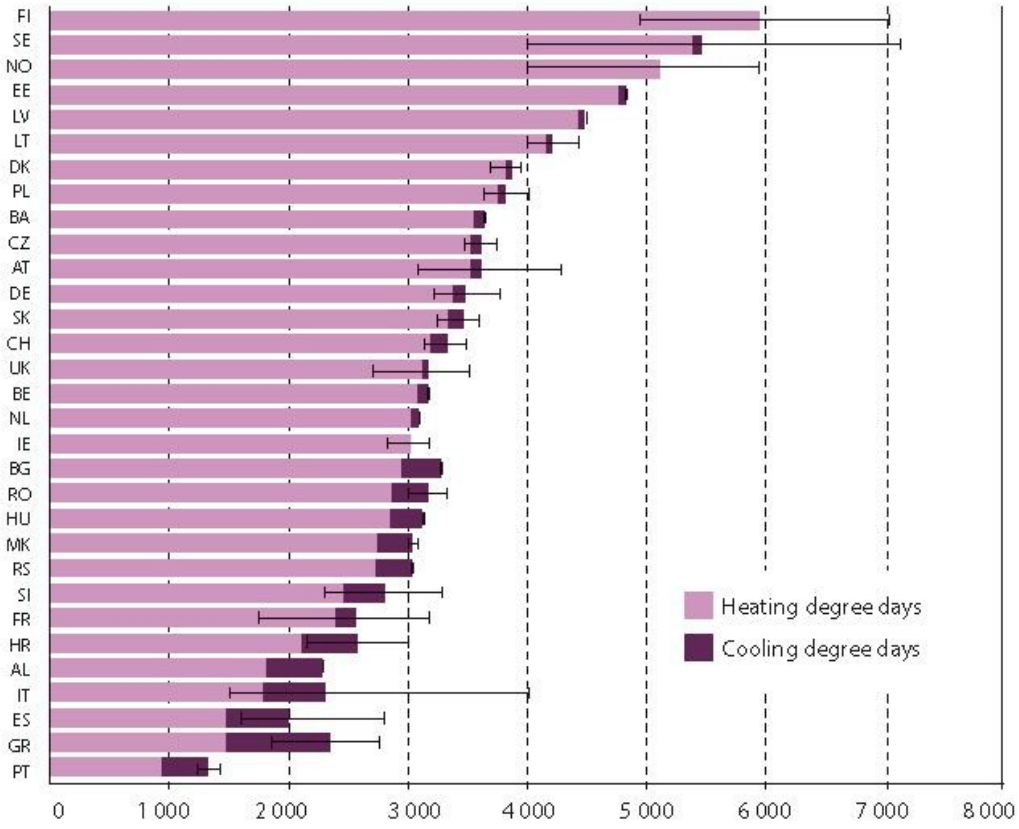


Figure 14. Indication of climatic zones within the national territory. The colour used for each province refers to the climatic zone of the majority of the municipalities in that province.

Table 1: Winter climatic data (from November 1st to February 28th).

	Climate Zone	Winter Degree Day	Temp. mean	Temp. min	Wind speed (average)	Relative humidity (average)	Global solar radiation (average)
			[°C]	[°C]	[m/s]		[Wh/m² day]
Milan	E	2 404	2,8	-11,0	0,7	83%	1 263
Rome	D	1 415	9,9	-4,0	4,1	79%	2 048
Palermo	B	751	13,9	4,8	4,3	73%	2 143

Table 2: Summer climatic data (from June 1st to August 31st).

	Climate Zone (CNR)	Summer Degree Day	Temp. mean	Temp. max	Daily temperature variation (average)	Wind speed (average)	Relative humidity (average)	Global solar radiation (average)
			[°C]	[°C]	[°C]	[m/s]		[Wh/m² day]
Milan	7	482	21,7	32,6	8,9	1,0	71%	4 855
Rome	3	568	23,3	31,8	7,5	3,3	75%	4 918
Palermo	1	842	25,1	34,0	4,0	3,3	74%	6 471

Example of Climatic in three different locations along the Italian territory

Source: Passive-on project

This well know geo-climatic statement should be very clearly reaffirmed before any further discussion on how to implement in this country the nZEB concept, still vaguely stated on the EPBD2.

The implementation of the nZEB in Italy is not starting yet mainly because any definitions and related requirements have been established officially. The transposition of the EPDB1 introduced a good basis in terms of energy requirements, including the important calculation of the energy consumption for cooling in the definition of the total primary energy.

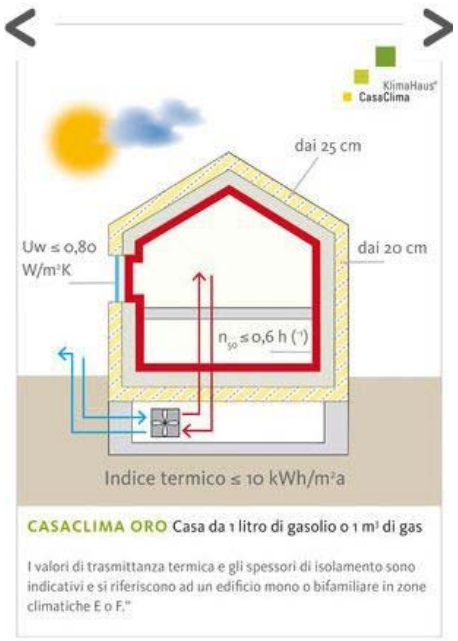
The "energy performance of the building envelope for summer cooling" namely "Epe" should be calculated as a function of the summer temperature and through as indicated by the UNI / TS 11300- 1, and make sure that this does not exceed the following values: For residential buildings (in class E1) (2): 40 kW / m² year for climatic zones A and B and 30 kW / m² year for climatic zones C, D, E, F

However, due a delayed governmental action to deliver the technical guidelines for the operative transposition of the EPBD1 at national level, several regions have proposed their own interpretation of the EPBD1. This EPDB1 regionalisation causes a high confusion

on the building sector and would be a negative factor for the forthcoming EPBD2 implementation.

In this phase of definition of the nZEB concept at the national level, we agree that the above mentioned diversity can enriched the debate but a common and shared definition should be defined. After this, as the national legislative organization allows, any region could implement a more stringent transposition at the local level.

However, at present, in this knowledge gap situation, the situation seem to be strongly oriented towards a well-experiment "standard" in limited area of the country, the CasaClima Clima Haus concept, born in 2001 in the northern Italian territory. This initiative was inspired to the *Passivhaus*, born in Germany in 1991, thanks to Wolfgan Feist and Bo Adamson.



Fabbisogno di energia termica dell'edificio per la climatizzazione invernale (riferito alla superficie netta)

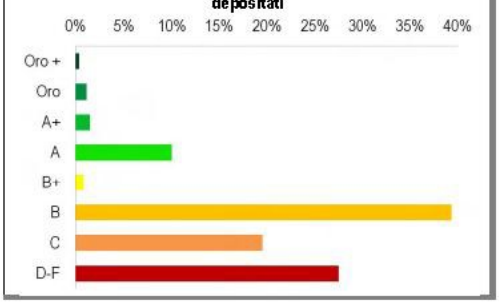
Classe d'efficienza dell'involucro	Fabbisogno ideale di energia termica dell'edificio per riscaldamento [kWh/m² anno]
Gold	≤10
A	≤ 30
B	≤ 50
C	≤ 70
D	≤ 90
E	≤ 120
F	≤ 160
G	≥160

Classificazione dell'efficienza complessiva dell'edificio

Classe	Indice $CO_{2\ NGF}$ [kg CO_2 /m²a]
Gold	≤ 5
A	≤ 10

Edifici certificati in Alto Adige[99].

Classe energetica	2009		2010		2011	
	N	R	N	R	N	R
Oro +	10	0	0	0	0	0
Oro	11	0	13	2	6	1
A+	10	1	28	1	4	0
A	103	6	119	9	49	11
B+	11	1	8	1	3	0
B	390	29	411	109	167	66
C	23	63	21	271	6	200
D-F	0	423	5	267	6	117
Totale	**558**	**523**	**605**	**660**	**240**	**395**



Legenda
N: Edifici di nuova costruzione
R: Edificio sottoposto a risanamento

We agree that the *Passivhaus* has and is *a* phenomena for the European building sector: the development of homes which meet the *Passivhaus* has grown vertiginously. As of 2005, more than 6,000 homes conforming to the *Passivhaus* standard have been built in Europe,
4.000 of which in Germany.

What makes the *Passivhaus* concept so successful is possibly that the standard codifies precisely energy and quality requirements for new homes and then provides a relatively standard set of solutions by which these requirements can be met. In consequence a *Passivhaus* is a well defined product, understood by the developer, architect and owner; everyone involved in the process knows what they are getting.

As known, The *Passivhaus* standard was born to respond to the requirements of relatively cold central Europe and examining it on the technical point of view (high whole envelope insulation with typically 25 to 40 cm. of insulation, lack of significant thermal bridges, air leakages reduced to a minimum, active ventilation with highly efficient heat recovery and insulated window frames with triple, gas-filled, low-e glazing) we can easily understand that it is a brilliant invention for the northern countries.

- *Heating criterion: The useful energy demand for space heating does not exceed 15 kWh per m² net habitable floor area per annum.*

– *Primary energy criterion: The primary energy demand for all energy services, including heating, domestic hot water, auxiliary and household electricity, does not exceed 120 kWh per m² net habitable floor area per annum.*

– *Air tightness: The building envelope must have a pressurization test result according to EN*

-113829 of no more than 0.6 h .

– *Comfort criterion room temperature winter: The operative room temperatures can be kept above 20 °C in winter, using the abovementioned amount of energy.*

– *All energy demand values are calculated according to the Passive House Planning Package (PHPP) and refer to the net habitable floor area, i.e. the sum of the net floor areas of all habitable rooms.*

Current German *Passivhaus* Standard for Central European Countries

As known, homes in southern Europe have different needs (and citizens have different lifestyles…) and need not only to be warm in winter but this also is accompanied by a need to ensure comfort in summer, which at times can be the predominate issue. Without any conservative look at the reality, traditional vernacular architecture in southern parts of Spain and Italy reflects this need and we need to revisit many of these traditional solution with a modern Passive Design and not a Passivhaus design.

We are aware that an Italian *Passivhaus* can be achievable and pertinent in some areas in Italy with relatively severe if short winters (e.g. Milan and the North in general) and also to mountainous regions further south.

However, in the MED area, and in Italy, what is need to achieve a successfully nZEB implementation it's not a passivhaus standard package but an *intelligent* and tailored transfer of knowledge. So, in Italy, the Task Force will work to looked to see what elements of the standard could be useful in promoting the diffusion of nZEB design and not to Mediterranean Passivhaus design.

This position might all seem a little abstract but what we aim to promote and disseminate needs to be clear.

Technically and so strategically, for new buildings, we will start from the outputs of the

IEE Passive-on project that investigates the implementation of a Passive House (not Passivhaus) standard for warm European climates.

- *Heating criterion: The useful energy demand for space heating does not exceed 15 kWh per m² net habitable floor area per annum.*
- *Cooling criterion: The useful, sensible energy demand for space cooling does not exceed 15 kWh per m² net habitable floor area per annum.*
- *Primary energy criterion: The primary energy demand for all energy services, including heating, domestic hot water, auxiliary and household electricity, does not exceed 120 kWh per m² net habitable floor area per annum.*
- *Air tightness: If good indoor air quality and high thermal comfort are achieved by means of a mechanical ventilation system, the building envelope should have a pressurization test (50 Pa) -1 result according to EN 13829 of no more than 0.6ach. For locations with winter design ambient temperatures above 0°C, a pressurization test result of 1.0 h-1 is usually sufficient to achieve the heating criterion.*
- *Comfort criterion room temperature winter: The operative room temperatures can be kept above 20 °C in winter, using the abovementioned amount of energy.*
- *Comfort criterion room temperature summer: In warm and hot seasons, operative room temperatures remain within the comfort range defined in EN 15251. Furthermore, if an active cooling system is the major cooling device, the operative room temperature can be kept below 26 °C.*

Proposed *Passive House* Standard for Warm European Climates

As stated on the Passive-on project, it's achievable to design NZEB by using a passive design, using custom-tailored solutions for MED climate areas. In particular, providing an effective strategy for passive summer cooling such as solar shading provided by roof eaves or Persian shutters reducing solar gain through windows. Also, a natural night time ventilation strategy supplemented with active cooling using a low power reversible heat pump on particularly warm days.

[…A typical German Passivhaus uses special 3 pane low-e windows. But 3 pane high performance windows are not widely available on the market in Italy apart in the area of Bolzano, and obviously they are more expensive and to a degree bulky which may not respond to the aesthetic tastes of everyone. Given the general milder climate of Italy it is reasonable to investigate whether less stringent characteristics can be applied to windows…]

[…the Passivhaus Standard for cold climate tries to limit the undesired airflows and imposes to the permeability of the building envelope the limit of 0,60 h-1 at 50 Pa. Even if achievable, this value implies an increase of the building costs, and its attainment could cause some problems above all due to uncareful installation: it is generally necessary to carry out some test before meeting the Blower Door Test in the verification procedure. Relaxing the limit of the n50 parameter would allow a simplification in the construction process…]

Source: Passive-on project report

So, as demonstrated on the Passive-on project, we believe that some of the implicit and explicit requirements of the *Passivhaus* standard represent over engineering (also in terms of up-front costs) in southern Europe. For example the *Passivhaus* standard makes an explicit requirement to limit the permeability of the building envelope (n50 ≤ 0,6 h1) which makes an implicit need for an active air ventilation system. However, experience, for example from Spain and Portugal, shows that effective low energy homes can be built without the need for active ventilation systems and with less stringent building shell criteria.

So, we are convinced that it's necessary to find a nZEB road focusing on appropriate climate-specific criteria. For this, as technical info or cost/benefit analysis are still missing regarding customized Med solutions and also best-practices benchmark for nZE-homes in MED countries, we will propose to establish a definition of nZEB for the MED area.

For example, proposing the introduction of an explicit limit for energy demand for summer cooling, some minimum requirements for summer comfort, relaxing the limit on the air tightness of the building envelope to n 50 ≤ 1 h1 (and in certain circumstances less) will allow the NZB implementation without the need for an active ventilation system.

In parallel, we will work to identify not only the technical framework but also the necessary market, legal administrative and financial to boost the NZB implementation in Italy.

Moreover, the above mentioned Task force effort will not oriented only to new homes but also on the most challenging task of the Italian building sector: the existing building stock.

1.1.3. Dwelling sector

As described in Figure 1, almost 48% of the Italian building stock has been constructed in the period 1946-1981. In this period, the input was to build up in a fast way new dwellings to satisfy the growing population demand; at this time, no energy regulation was yet implemented. Only in 1976, Italian Government issued the first law about energy performance in residential buildings for the new construction.

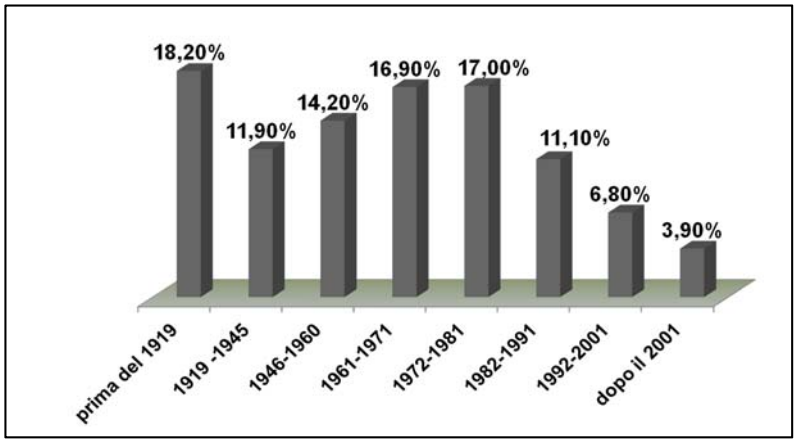


Figure 1 – ENEA, CRESME 2010: Existing residential building stock in Italy.

As a result, a significant part of the existing stock (except for historical buildings) has a high energy consumption rate, so, the energy refurbishment of existing buildings is a key theme to be considered in the implementation of EPBD2.

In Italy, the public housing sector handles about 1 million homes, 760,000 of them in the hands of the former IACP. If we consider certainly without adequate insulation of the housing built since the war in 1981, are about 450 000 housing with the need for urgent refurbishment. The users of these units pay an average of 100 € / month rent and two / three times as much for heating and electricity. Fees so low not even allow proper maintenance of housing. In addition, this public property is fragmented into over 20,000 Condominiums mixed public / private partnerships, and has a potential for investment in

further 500,000 private accommodation.

With regards to this, a close link will be established with the Task Force: NZC for Private/Divided Ownership.

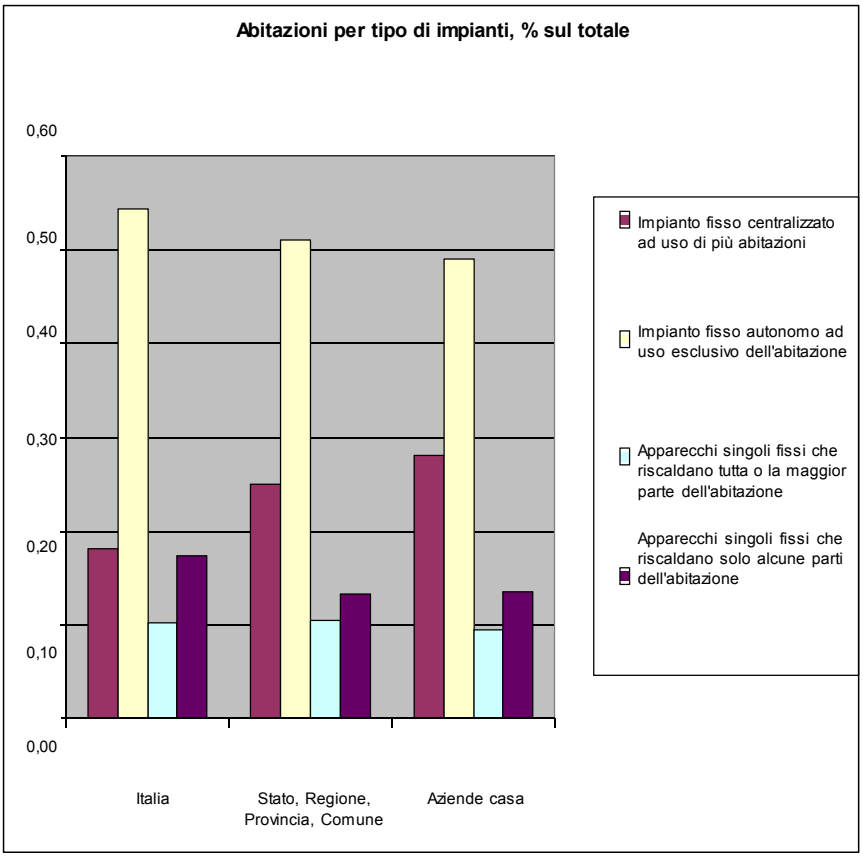


Figure 2. ISTAT, 2001. Dwellings per type of heating system

1.2 Spain

1.2.1. Introduction

Spain is a country and member state of the European Union located in south-western Europe on the Iberian Peninsula. Its mainland is bordered to the south and east by the Mediterranean Sea; to the north by France; and to the northwest and west by the Atlantic Ocean and Portugal.

With an area of 504,030 km², it is the second largest country in European Union after France. Spain is a democracy organised in the form of a parliamentary government under a constitutional monarchy. It has the ninth or tenth largest economy in the world by nominal GDP, and very high living standards (15th highest Human Development Index), including the tenth-highest quality of life index rating in the world, as of 2005.

1.2.2. Administrative divisions

Spain is a nation organized territorially into 17 Autonomous Communities and two Autonomous Cities. The basic institutional law of the Autonomous Community is the Statute of Autonomy. The autonomous communities have wide legislative and executive autonomy, with their own parliaments and regional governments. The distribution of powers may be different for every community, as laid out in their Statutes of Autonomy.

Autonomous Communities are composed of provinces. In turn, provinces are composed of municipalities.

Autonomous	Population	Surface
Andalucía	7.687.518	87.599
Aragón	1.249.584	47.729
Asturias	1.073.761	10.610
Balears	955.045	5015
Canarias	1.915.540	7.455
Cantabria	554.784	5.320
Castilla y León	2.493.918	94.193
Castilla-La Mancha	1.848.881	79.412
Cataluña	6.813.319	32.229
Comunidad Valenciana	4.543.304	23.280
Extremadura	1.075.286	41.679
Galicia	2.750.985	29.675
Madrid	5.804.829	8.020
Murcia	1.294.694	11.315
Navarra	584.734	10.383
País Vasco	2.115.279	7.242
La Rioja	293.553	5.044

Figure 2 Spain map. Source: Barcelona Doctor Association

1.2.3. Climate

Spain has a very diverse climate throughout its territory. The Mediterranean character is predominant in most of its geography.

The climate of the coasts of southern and eastern is called Mediterranean coast climate: mild temperatures and abundant rainfall except in summer. As we move into the interior the climate is more extreme, we find the Continental Mediterranean climate, which covers almost the entire peninsula: low winter temperatures, high and irregular rainfall in summer.

Figure 3. Spain climates zones. Source: ISFTIC Images banc

In general, Western communities receive more precipitation than the eastern.

Thus, Galicia and Cantabria have a Maritime climate characterized by an abundance of rainfall throughout the year especially in winter and cool temperatures. The mountain climate can be seen in high altitudes where there are very cold winters) and abundant rainfall.

Arid or semiarid climates are found in certain eastern peninsular points: Almería, Granada, Murcia, or Alicante. The subtropical nature is characteristic of the Canary Islands, with warm temperatures throughout the year and little precipitation. However, this atmosphere also occurs in the southern coasts of the peninsula (Málaga, Granada and

Almería), where temperatures are relatively mild throughout the year, although rainfall is more abundant than in the Canaries.

Autonomous	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Andalucía	10,3	11,4	13,2	15,2	18,6	22,5	25,8	25,9	23,4	18,6	13,8	10,7	**17,4**
Aragón	5,0	6,6	8,8	11,2	15,0	19,4	23,0	22,4	19,5	14,1	8,5	5,5	**13,3**
Asturias	7,5	8,5	9,5	10,3	12,8	15,8	18,0	18,3	17,4	14,0	10,4	8,7	**12,6**
Balears	11,6	11,8	12,9	14,7	17,6	21,8	24,6	25,3	23,5	20,0	15,6	13,0	**17,7**
Canarias	17,7	17,8	18,4	18,9	20,2	21,8	23,8	24,5	24,1	22,5	20,5	18,5	**20,7**
Cantabria	9,7	10,3	10,8	11,9	14,3	17,0	19,3	19,5	18,5	16,1	12,5	10,5	**14,2**
Castilla y	3,5	4,9	6,8	8,9	12,5	16,8	20,3	19,9	17,2	12,1	6,8	4,0	**11,1**
Castilla-La	5,3	6,7	9,0	11,3	15,4	20,3	24,3	23,9	20,4	14,4	9,0	5,8	**13,8**
Cataluña	7,4	8,9	11,0	13,1	16,8	20,7	24,0	23,7	21,2	16,5	11,0	8,0	**15,2**
Comunidad	10,6	11,6	12,9	14,7	17,6	21,4	24,3	24,8	22,5	18,5	14,0	11,3	**17,0**
Extremadura	8,3	9,7	11,9	13,6	17,3	22,3	25,7	25,2	23,1	17,4	12,1	8,9	**16,3**
Galicia	8,0	8,9	10,1	11,5	13,8	17,0	19,2	19,4	18,0	14,5	10,8	8,6	**13,3**
Madrid	6,2	7,4	9,9	12,2	16,0	20,7	24,4	23,9	20,5	14,7	9,4	6,4	**14,3**
Murcia	10,6	11,4	12,6	14,5	17,4	21,0	23,9	24,6	22,5	18,7	14,3	11,3	**16,9**
Navarra	4,5	6,5	8,0	9,9	13,3	17,3	20,5	20,3	18,2	13,7	8,3	5,7	**12,2**
País Vasco	6,8	7,8	8,8	10,4	13,4	16,3	18,8	19,0	17,6	14,4	9,8	7,4	**12,5**
La Rioja	5,8	7,3	9,4	11,5	15,1	19,0	22,2	21,8	19,2	14,4	9,1	6,3	**13,4**

Table 2. Distribution of monthly and annual average temperatures in Spain by Autonomous Communities. Source: Own w

1.2.4. Dwelling sector

At the end of 2006, Spain had a stock of 24.677.227 dwellings, according to the Bank of Spain. Taking in account that there were 16,03 million homes, these figures indicate an average of 1,54 homes per dwelling. According to the sources only 15% were rented.

	Before								
									2,36
					1,95				

Table 3. Number of persons per dwelling. Source: INE (National Statistical Institute)

The average price of new housing in Spain is 2.510 €/ m2, according to the Pricing Society to December 31, 2005. The price of housing, however, varies markedly depending on the regions and provincial capitals.

Autonomous Communities	2001	2002	2003	2004	2005	2006	2007	2008
Andalucía	3.554.198	3.677.608	3.806.819	3.922.607	4.032.264	4.163.281	4.288.016	4.408.278
Aragón	657.555	672.438	687.679	699.563	713.854	727.517	740.896	759.921
Asturias	524.336	533.877	543.960	556.612	569.923	583.858	595.413	607.620
Balears	504.041	516.757	529.088	539.826	551.480	562.372	575.292	587.918
Canarias	855.022	884.064	910.671	937.084	962.896	990.461	1.014.885	1.045.184
Cantabria	286.901	294.039	302.697	311.303	317.695	327.718	337.047	345.145
Castilla y León	1.455.050	1.487.057	1.514.294	1.543.748	1.576.866	1.618.567	1.657.603	1.695.579
Castilla-La Mancha	988.555	1.005.293	1.023.217	1.045.585	1.072.011	1.110.140	1.163.713	1.214.458
Cataluña	3.328.120	3.403.260	3.477.698	3.571.897	3.658.330	3.740.376	3.829.026	3.923.033
Comunidad Valenciana	2.558.691	2.628.135	2.692.389	2.767.763	2.862.658	2.952.338	3.037.589	3.123.236
Extremadura	575.284	584.471	596.487	606.080	616.274	625.425	638.997	651.406
Galicia	1.312.496	1.344.733	1.372.715	1.405.098	1.437.554	1.470.805	1.507.380	1.544.625
Madrid	2.482.885	2.524.353	2.567.758	2.635.616	2.706.368	2.781.631	2.841.352	2.890.229
Murcia	595.319	609.285	624.403	646.435	670.134	712.148	745.298	778.815
Navarra	261.147	267.293	272.666	278.103	284.801	293.811	301.381	310.175
País Vasco	892.009	910.390	922.705	936.935	952.202	966.649	983.211	997.294
Rioja	156.769	161.349	165.484	169.612	174.709	181.011	186.804	193.904
TOTAL	**21.033.759**	**21.551.426**	**22.059.220**	**22.623.443**	**23.210.317**	**23.859.014**	**24.495.844**	**25.129.207**

Table 4. Total dwellings by Autonomous Communities. Source: Housing Ministry

In the following paragraphs different data about the Spanish housing stock are exposed:

Building TYPE	Number of buildings	Number of dwellings
Single Unit Houses	6.682.591	6.682.591
Multi Unit Houses	1.930.825	14.140.864
Building Stock total	8.613.416	20.823.455

Table 5. S-1.1 Frequency of building types of the national buildings stock 2001. Source: INE (National Statistical Institute)

	1 room	2 rooms	3 rooms	4 rooms	5 rooms	6 rooms	7 rooms	8 rooms	9 rooms	10 or mor
Number of dwellings	77.431	34.6131	136.0974	2.838.537	5.413.152	2.811.754	742.915	321.495	131.370	143.410

Table 6. Dwellings by number of rooms. Source: INE (National Statistical Institute)

	Before 1900		1900-1920		1921-1940		1941-1950		1951-1960		1961-1970		1971-1980		1981-1990		1991-2001	
Single Unit Houses	767.656	11%	354.954	5%	405.196	6%	435.942	7%	679.882	10%	761.201	11%	1.084.141	16%	1.096.051	16%	1.097.568	16%
Multi Unit Houses	554.412	4%	369.027	3%	498.539	4%	548.948	4%	1.305.565	9%	2.910.774	21%	3.888.633	27%	1.781.978	13%	2.282.988	16%
Total	**554.412**	**4%**	**369.027**	**3%**	**498.539**	**4%**	**548.948**	**4%**	**1.305.565**	**9%**	**2.910.774**	**21%**	**3.888.633**	**27%**	**1.781.978**	**13%**	**2.282.988**	**16%**

Table 7. Total dwellings by type of building from different periods. Source: INE (National Statistical Institute)

	Before 1900		1900-1920		1921-1940		1941-1950		1951-1960		1961-1970		1971-1980		1981-1990		1991-2001	
Single Unit Houses	767.656	11%	354.954	5%	405.196	6%	435.942	7%	679.882	10%	761.201	11%	1.084.141	16%	1.096.051	16%	1.097.568	16%
Multi Unit Houses	132.086	7%	71.292	4%	91.147	5%	102.782	5%	205.484	11%	327.792	17%	418.935	22%	262.965	14%	318.342	16%
Total	**899.742**	**10%**	**426.246**	**5%**	**496.343**	**6%**	**538.724**	**6%**	**885.366**	**10%**	**1.088.993**	**13%**	**1.503.076**	**17%**	**1.359.016**	**16%**	**1.415.910**	**16%**

Table 8. Total buildings by type and year of construction. Source: INE (National Statistical Institute)

	Buildings to construct		Buildings to rehabilitate	Buildings to demolish
	Residential	Non-residential		
2005	184.218	19.159	33.086	20.997
2006	208.631	21.413	35.856	28.480
2007	166.322	20.825	33.359	26.141
2008	79.752	13.926	34.807	14.573
2009	**39.564**	**12.180**	**33.267**	**7.984**

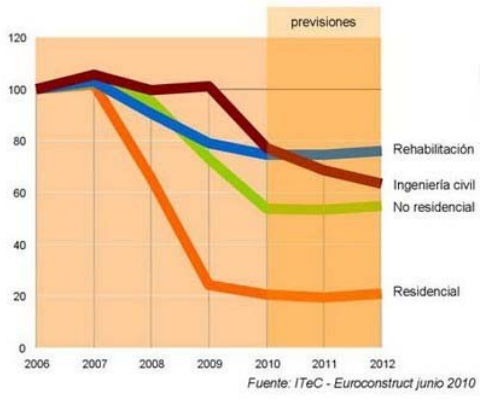


Table 9. Number of buildings to construct, rehabilitate or demolish.
Source: INE (National Statistical Institute)

Autonomous Communities	Single Unit Houses	Multi Unit Houses
Andalucía	19	15
Aragón	28	16
Asturias	34	17
Balears	20	13
Canarias	21	14
Cantabria	29	17
Castilla y León	28	16
Castilla-La Mancha	23	14
Cataluña	17	20
Comunidad Valenciana	21	15
Extremadura	23	14
Galicia	32	15
Madrid	12	16
Murcia	22	14
Navarra	26	17
País Vasco	29	19
La Rioja	28	15
Total	**24**	**15**

Table 10. Average age of residential buildings by Autonomous Communities. Source: INE (National Statistical Institute)

Number of dwellings	Single unit houses	Multi unit houses	Total
Room heating systems	1.796.449	3.495.573	5.292.022
Dwelling heating systems	1.534.781	3.900.316	5.435.097
Building heating system	82.312	1.243.172	1.325.484
Without heating system	826.613	1.219.168	2.045.781

Table 11. S-2.1 Centralisation of the heat supply (for space heating) 2001. Source: INE (National Statistical Institute)

Number of dwellings	Before 1900	1900-1920	1921-1940	1941-1950	1951-1960	1961-1970	1971-1980	1981-1990	1991-2001
Gas	194.822	128.698	181.892	191.891	445.965	925.240	1.118.434	583.567	918.644
Electricity	212.026	137.888	181.744	203.075	469.054	942.000	1.094.406	595.262	631.959
Petroleum or derivates	108.609	47.396	63.601	71.973	147.092	287.215	562.001	370.890	322.740
Wood	54.078	22.160	24.121	24.615	36.920	43.851	54.794	54.798	42.326
Coal or derivates	76.215	32.425	38.741	41.043	67.862	88.391	88.783	60.311	38.603
Others	3.441	2.001	2.166	2.515	5.040	8.954	11.720	5.847	5.095

Table 12. S-3.2 Heat generation of space heating systems. Source: INE (National Statistical Institute)

	UE	Spain
Coal	217,64	20,24
Oil	599,53	70,85
Natural Gas	386,56	31,6
Nuclear	232,37	14,36
Electric balance	4,91	-0,5
Renewable energies	102,38	10,23
Primary energy Consumption	**1.543,39**	**146,78**

Table 13. Primary energy Consumption in 2007 (Mtep) . Source: AVEN (Valencia Energy Agency)

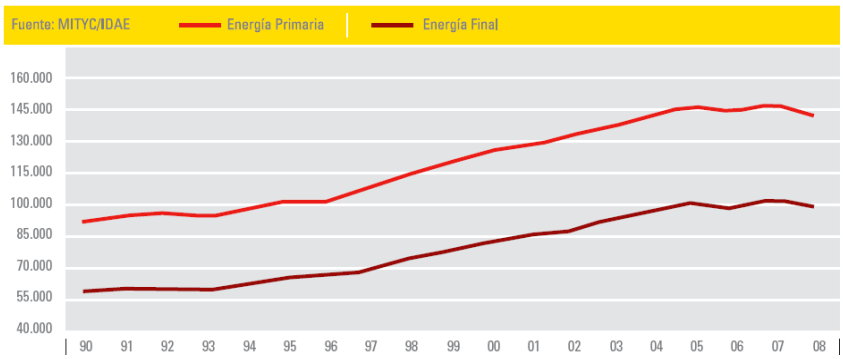


Figura.1. Energy consumption Evolution in Spain 1990-2008. Source: IDEA (Institute for the Diversification and Saving of Energy)

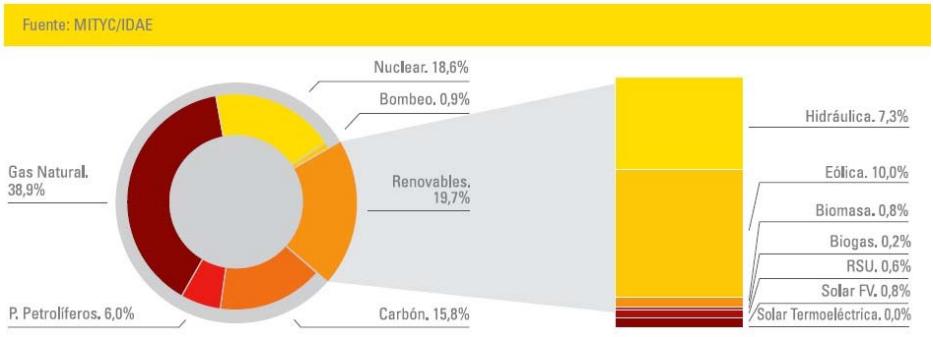


Figura.2. Structure of electricity production 2008. Source: IDEA (Institute for the Diversification and Saving of Energy)

	1980	1982	1984	1986	1988	1990	1992	1994	1996	1998	2000	2002	2004	2006	2007
INDUSTRY	**24306**	**23130**	**22683**	**21787**	**22853**	**24423**	**23594**	**24923**	**26581**	**30420**	**32826**	**33080**	**35561**	**33889**	**35260**
Coal	3191	5094	4873	4131	3766	3893	3248	2847	2306	2414	2466	2432	2360	2240	2467
P.Oil	15731	12725	11879	11375	11363	11306	10857	12123	12720	13804	13350	12551	12112	10027	9871
Gas	720	722	1024	1417	2635	3677	4000	4333	5650	7604	9602	10135	12318	12406	13384
Electricity	4664	4589	4907	4864	5088	5547	5491	5620	5906	6599	7408	7963	8771	9215	9537
TRANSPORT	**14570**	**14929**	**15663**	**16365**	**19537**	**22716**	**23904**	**25233**	**27461**	**30306**	**32276**	**34320**	**37832**	**39803**	**40702**
Coal	11	8	2	2	1	0	0	0	0	0	0	0	0	0	0
P.Oil	14414	14769	15486	16168	19333	22478	23643	24967	27166	29981	31913	33910	37384	39343	40229
Gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Electricity	146	152	174	195	203	238	261	266	295	324	362	410	448	461	473
OTHER	**11332**	**11006**	**11850**	**12902**	**13204**	**13531**	**15135**	**15293**	**16680**	**19488**	**21671**	**24131**	**26837**	**27463**	**28265**
Coal	302	443	568	650	470	378	263	130	158	140	80	55	46	25	31
P.Oil	7592	6983	7216	7678	7631	7109	7981	7735	8221	9897	10365	10793	12123	11549	11726
Gas	500	456	525	587	518	854	1154	1315	1675	2084	2690	3905	4024	4024	4395
Electricity	2938	3124	3541	3987	4585	5190	5737	6114	6627	7367	8536	9378	10645	11864	12112
TOTAL	**50208**	**49065**	**50196**	**51054**	**55593**	**60669**	**62634**	**65449**	**70723**	**80214**	**86772**	**91531**	**100230**	**101155**	**104226**
Coal	3504	5545	5443	4783	4237	4271	3511	2977	2464	2554	2546	2486	2405	2265	2498
P.Oil	37737	34477	34581	35221	38328	40893	42481	44826	48107	53682	55628	57253	61619	60919	61826
Gas	1220	1178	1549	2004	3153	4531	5154	5647	7325	9688	12292	14040	16342	16430	17779
Electricity	7748	7865	8622	9046	9876	10974	11488	11999	12827	14290	16306	17751	19864	21540	22122

Table 14. Final energy consumption Evolution in Spain. 1980-2007. (Unit: ktoe) Source: AVEN (Valencia Energy Agency)

	3	1982	1984	1986	1988	1990	1992	1994	1996	1998	2000	2002	2004	2006	2007
Population (million inhab.)	37,39	37,96	38,34	38,67	38,81	38,96	39,11	39,31	39,67	39,85	40,5	41,84	43,2	44,71	45,2
Coal/capita	0,36	0,45	0,47	0,48	0,39	0,49	0,49	0,46	0,4	0,46	0,55	0,54	0,51	0,44	0,48
Oil/capita	1,34	1,17	1,07	1,05	1,14	1,23	1,29	1,32	1,4	1,55	1,6	1,61	1,64	1,58	1,57
Natural Gas/capita	0,04	0,05	0,05	0,06	0,09	0,13	0,15	0,16	0,21	0,3	0,38	0,45	0,57	0,68	0,7
Nuclear/hab.	0,04	0,06	0,16	0,25	0,34	0,36	0,37	0,37	0,37	0,39	0,4	0,39	0,38	0,35	0,32
Hydraulic/capita	0,07	0,06	0,07	0,06	0,08	0,06	0,04	0,06	0,09	0,08	0,07	0,07	0,1	0,09	0,11
PRIMARY ENERGY/capita	**1,84**	**1,79**	**1,82**	**1,9**	**2,04**	**2,26**	**2,35**	**2,38**	**2,47**	**2,78**	**3**	**3,07**	**3,2**	**3,14**	**3,16**

Table 15. Primary energy consumption Evolution per capita 1980-2007 (toe / capita). Source: AVEN (Valencia Energy Agency)

	1980	1982	1984	1986	1988	1990	1992	1994	1996	1998	2000	2002	2004	2006	2007
Population (million	37,39	37,96	38,34	38,67	38,81	38,96	39,11	39,31	39,67	39,85	40,5	41,84	43,2	44,71	45,2
Coal/capita	0,09	0,15	0,14	0,12	0,11	0,11	0,09	0,08	0,06	0,06	0,06	0,06	0,06	0,05	0,06
P.Oil/capita	1,01	0,91	0,9	0,91	0,99	1,05	1,09	1,14	1,21	1,35	1,37	1,37	1,43	1,36	1,37
Gas/capita	0,03	0,03	0,04	0,05	0,08	0,12	0,13	0,14	0,18	0,24	0,3	0,34	0,38	0,37	0,39
Electricity/capi ta	0,21	0,21	0,22	0,23	0,25	0,28	0,29	0,31	0,32	0,36	0,4	0,42	0,46	0,48	0,49
FINAL ENERGY/	**1,34**	**1,29**	**1,31**	**1,32**	**1,43**	**1,56**	**1,6**	**1,67**	**1,78**	**2,01**	**2,14**	**2,19**	**2,32**	**2,26**	**2,31**

Table 16. Final energy consumption Evolution per capita 1980-2007. (toe / capita) Source: AVEN (Valencia Energy Agency)

2. Overview nZEB in Each Country

2.1. Current number of "nZEB" projects

2.1.1. Italy

Number of projects already completed or planned.

Italy	
new nZEB	*No official database is available*
Existing buildings renovated in accordance to nZEB standard	*No official database is available*

However, we can affirm that buildings similar to nZEB concept (= energy class A or more) represents less that 1% of the total building stock.

This estimated data could be confirmed by the analysis of the number of certified buildings in Class A in some "front-runners" regions. For example, in Friuli Venezia Giulia, the certified buildings in Class A/ A+ represents around 3,9% of the total certified buildings in 2011.
The nZEBs (or similar for the low energy consumption) are mainly located in some "front-runners" regions, that have promoted or are promoting regional energy legislation oriented towards nZEB, such as Trentino Alto Adige, Friuli Venezia Giulia, Lombardia and Piemonte.
These nZEB projects are mainly single houses and rarely multifamily buildings.
Moreover, they are often promoted by private owners or builders and rarely by public social housing organisations and/or social housing coops.

Some Examples of Social housing projects similar to nZEB concept

Consorzio Nazionale CasaQualità	• 2012 Bolzano- Edificio residenziale nel nuovo quartiere CasaNova by Confcooperative Bolzano
Federcasa	• Bolzano- *La Casa Passiva Bronzolo* by Istituto per l'edilizia della provincial autonoma di Bolzano • Brescia • Firenze
FINABITA	

Even if there is not yet a legal definition of nZEB in Italy, the contacted experts gave to FINABITA some examples of nearly zero consumption buildings, especially of the residential sector.

New Built

In particular, ZEPHIR gave the web link for the "PassivHaus database", which contains some example of certificated *Passive Houses* in Italy. They are eight new buildings in total, five of them built up in Südtirol, one is located in Lombardia (Lonato), one in Veneto and one in Sicily. No subsidies were provided, they are all realized from private initiatives, only the one located in Lombardia is owned by a social housing cooperative.

Retrofitting

There are also examples of nearly zero buildings from refurbishment, but they are pilot intervention, such as the so called "Casa Kyoto" of ANIT association, which is located in Gavirate (Lombardia). It's an interesting example of energy total refurbishment which allows the building to achieve nearly zero consumption for heating starting from an annual heating requirement of 200 kWh/m2.

This preliminary survey with experts done by FINABITA confirms that in Italy the nZEB concept is assimilated to the CasaClima approach. Another example is the analysis of the existing publications about nZEB: all of these are presenting buildings designed with the CasaClima approach.

→The recent publication "quaderni per l'energia vol.3 CasaClima FVG Edifici a energia quasi zero" by APE Agenzia per l'energia del Fiuli Venezia Giulia.

What are the driving forces behind these projects?

Main driver force is the positive/stringent local legislation framework that is stimulating all the building stakeholders to innovate.

However, in some case, these projects have been built thanks to a strong voluntary effort to innovate and to propose to the actual building market a more competitive "product". The proposers of these advanced projects are often well informed and courageous and invest own resources to go beyond the actual building market.

2.1.2 Spain

Spain	
new nZEB	*No official database is available*
Existing buildings renovated in accordance to nZEB standard	*No official database is available*

There are some new nZEB buildings all around Spain, but most of them as demonstration projects, others are official public buildings.

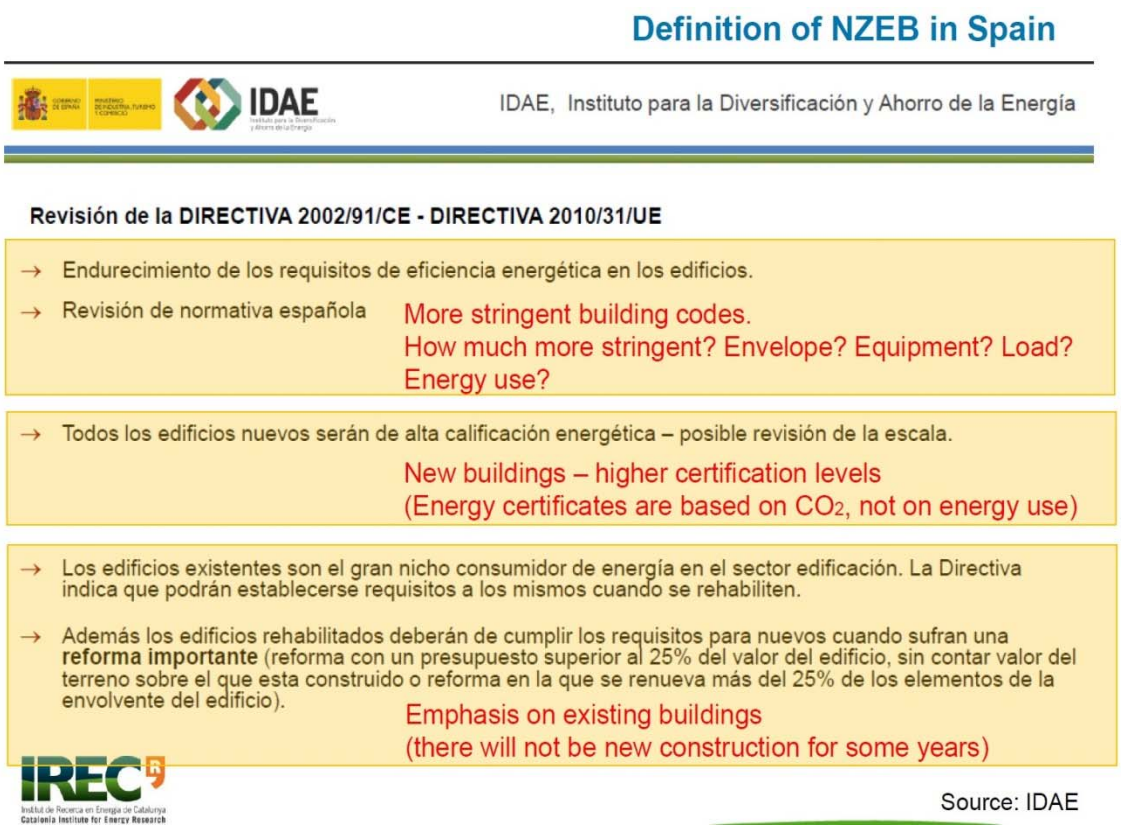
We do not know about any samples of nZEB renovation

Experiences of NZEBs in Spain - CIRCE

- Research building in Zaragoza (tertiary)
- Target: Life cycle zero emissions building
- Includes green construction concepts.

Experiences of NZEBs in Catalunya - LIMA

- Residential prototype in Barcelona
- Target: drastically reducing the environmental impact of residential buildings in the Mediterranean Area
- LCA
- Sustainability (not only energy)



2.2. Documentation, monitoring and evaluation studies

1.2.1. ITALY

1. Web site “Edifici a Energia quasi zero”: presentations and reports , good practices examples. Short Guidelines with legislation report (national and regional)

› http://www.edilportale.com/csmartnews/eeqz_modulo.asp

2. Discussions, free tools :

› http://www.mygreenbuildings.org

3. Official texts and software tools are available on the national websites:

› http://www.sviluppoeconomico.gov.it/

2.2.2. SPAIN

1. Web site “Código Técnico de la Edificación”: national update legislation about energy efficiency in buildings.

› http://www.codigotecnico.org/web/

2. Discussions, free tools :

›http://www.epbd-ca.eu/themes/nearly-zero-energy

›http://www.buildup.eu/communities/nzebs

3. Official texts and software tools are available on the national websites:

›http://www.minetur.gob.es/ENERGIA/DESARROLLO/EFICIENCIAENERGETICA/CERTIFICACIONENERGETICA/Paginas/certificacion.aspx

2.3. Public financing assistance

2.3.1. Italy

At national level:

No relevant and really specific public financing assistance for nearly zero energy buildings has been implemented. All the experts interviewed by FINABITA agreed that public financing assistance should be addressed only to refurbishment interventions, assuming that new nZEBs are by themselves cost effective buildings.
However, based on the implementation of the EPBD directive (2002/91/CE), some national incentives and subsidies have been implemented to promote the energy efficiency in the building sector. Due the actual economic crisis and the need to implementation the PAEE and the EPBD2, these are currently under revision.

The Tax credit programme for building efficiency measures:
This main national financial incentive in Italy to promote energy efficiency in Italy.
A 55% tax credit for private owner (and not for public bodies such as Public social housing organisations), to be distributed in max 10 fiscal years is available for the following

measures:

- Electric, absorption cycle and geothermal heat pumps, condensing boilers and solar collectors;
- Retrofitting of building envelope elements that satisfy the minimum building renovations that globally satisfy building performance of less than 20% of the Energy performance requirements in force.

For existing buildings a tax deduction is given of up to 55% of the amount remaining payable by the taxpayer for interventions such as thermal insulation of the opaque building surfaces, replacement of single gazing by double glazing, and the use of efficient boilers and air conditioners. Tax reductions and respective subsidies are allowed for solar panels

Established in 2007, this programme was extended to 2012 and some adjustments are under discussion. (possible decrease to 50% tax credit from January 2013).

In the period 2007-2010, 840.000 interventions of energy renovation have been supported, involving around 2 million of flats and an investment of 11M€.

This programme has a positive impact on the sector, in terms of saved energy (around 6.500 GWh/y), induced investment and benefits to SMEs and employment.

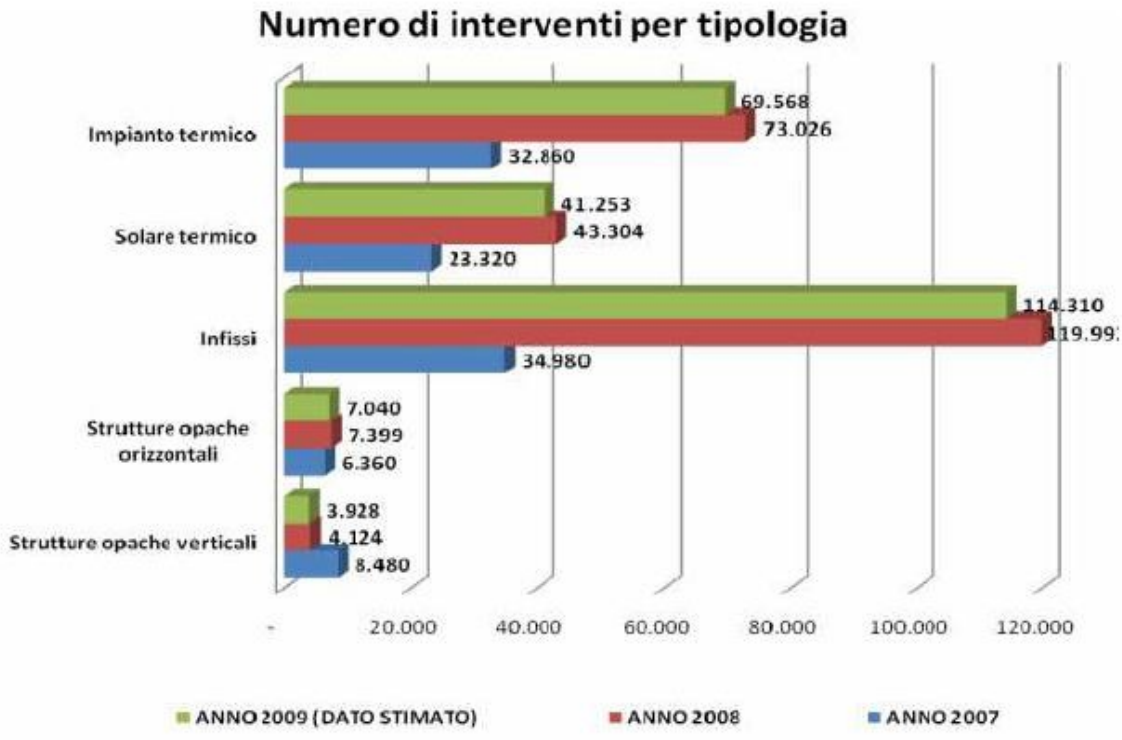


Tabella 3.2 Risparmi energetici conseguiti dal riconoscimento delle detrazioni fiscali (55%) per la riqualificazione energetica degli edifici esistenti (FEC)

Interventi	Misura PAEE	Risparmio energetico (FEC) [GWh/anno]				
		2007	2008	2009	2010	Totale 2007-2010
Coibentazioni superfici opache	RES-1	54	218	199	108	**579**
Sostituzioni serramenti	RES-2	177	350	297	173	**997**
Installazione di pannelli solari termici per acqua calda	RES-6	135	394	247	195	**971**
Impiego impianti di riscaldamento efficienti	RES-8	370	837	705	420	**2.332**
Camini termici e caldaie a legna (caldaie a biomassa)	RES-9	51	160	40	74	**325**
	Totale	**787**	**1.959**	**1.487**	**970**	**5.204**

N.B. Il valore totale relativo al 2010 tiene conto solo del primo semestre dell'anno perché in fase di elaborazione, visto che le domande possono essere modificate fina a settembre 2011.

Source: National Action Plan for EE 2011

This regulation does not belong to a national structured energy efficiency program, but it has been re-approved by the Parliament every year: This uncertainty does not work properly because house landlords of course do not schedule intervention in terms of total energy refurbishment, but only about single energy retrofitting interventions. Furthermore, financial regulation is not for cooperatives, even if they are among the most interested subjects in energy refurbishment.

Recently, annual financial regulation has been just approved: it allows to recover the 50% of the costs by a tax deduction. Unfortunately this law not only refers to energy retrofitting but in general to all home maintenance works. ANIT argues that this law is a devaluation of energy retrofitting (e.g. people might prefer to change toilet furniture instead of improving the insulation of the building envelope) and strongly conflicts with the roadmap to nZEB definition.

For more info:

- Full report of the impact of this programme: „Le detrazioni fiscali del 55% per la riqualificazione energetica del patrimonio edilizio esistente 2008“ , prepared by ENEA is available at: http://www.enea.it/it/produzione-scientifica/edizioni-enea/2012/detrazioni-fiscali-del-55-2008
- Analisi sull'impatto socio-economico delle detrazioni fiscali del 55% per la riqualificazione energetica del patrimonio edilizio esistente prepared by Cresme – Ministero dello Sviluppo, Luglio 2010.

A revision of the 55% incentive is planned by the National government in order to promote more stronger energy efficient measures at condominium level (full building envelope and / or heating systems), avoiding the partial works limited to one dwelling.

Photovoltaic energy production premium tariff

In the framework of the Photovoltaic production premium tariff, an increase of up of 30% of the tariff itself is available for building submitted to a renovation, leading to reduced energy consumption at least of 105.
EPC assessment, before and after the renovation is the necessary requirement and the way of demonstrating the result has been achieved.
→ For more info: 5°Conto Energia: decreto interministeriale 5 luglio 2012 – Incentivi per energia da fonte fotovoltaica.
http://www.sviluppoeconomico.gov.it/index.php?option=com_content&view=article&viewType=1&idarea1=593&idarea2=0&idarea3=0&idarea4=0&andor=AND&sectionid=0&andorcat=AND&partebassaType=0&idareaCalendario1=0&MvediT=1&showMenu=1&showCat=1&showArchiveNewsBotton=0&idmenu=2263&id=2023797

Public buildings
Since December 2006, about 8ME has been budgeted for energy diagnosis and certification of buildings, throughout the Regions.

Thermal solar energy production premium
The Decree n. 28/2011of 03.03.2011 in the art. 27/28 foresee new incentives for the so called “Conto Termico” in order to promote the use of thermal solar energy production from RES thanks a reduction of the gas tariff of small energy efficient interventions.

This decree contains also an important measure (article 11, comma 1): Obligation to cover 50% of the annual primary energy demand for hot water with the use of renewable energy sources.

***First Steps towards* public financing assistance for nearly zero energy buildings**

Probably as a first reaction to the EPBD recast (2010/31/EU), the National Government has launched some small initiatives to promote the low energy buildings:

Incentives for low energy buildings

A Decree Law of March 2010 (D.L n.40/2010 “decreto Incentivi” e DM 26 Marzo 2010) offers a public grant for new residential buildings if the achieved energy performance is less than the minimum requirements in force.

The State allocated € 60 million, subsidized contributions (reimbursement) for the purchase of first high energy-efficient home.

This granted system was based on the following achievements:

- For Class A: building (energy performance improved by 50% compared with the normative actual limits), is granted a contribution of € 116.00 per square meter, up to a maximum of 7,000 €.
- For Class B: buildings (30% better energy performance), the incentive is € 83.00 per square mete, up to a maximum of 5,000 €.

This contribution could cover about 60% of the extra costs per m2, but was limited to 5.000 € and 7.000 € per intervention.

At present, the foreseen budget is finished: with this public grant, the sale of 2.450 Calls B buildings and 1.154 Class A buildings have been promoted.

→ For more info: Published in Gazzetta Ufficiale il 25 maggio 2010 il Legge n. 73 del 22 maggio 2010 di conversione del DL n. 40/2010

Kyoto fund

The Ministry of Environment has budgeted a revolving fund for sustainable energy investments, which is manged by thr Regions willing to assume the responsibility for the organisation of the call for projects, including those towards nZEB.

This includes € 600 million in total, spread over three cycles annual programming (200 M € per year), which should be distributed to Regions and Autonomous Provinces. The Fund should finance small-medium interventions size promoted by both public and private, through loans subsidized and 0.5% for 6 years (up to 15 years for public bodies)

Misura usi finali:

sull'involucro di edifici esistenti, parti di edifici esistenti o unità immobiliari esistenti, riguardanti strutture opache verticali, orizzontali o inclinate, chiusure trasparenti comprensive di infissi e vetri, chiusure apribili e assimilabili quali porte e vetrine anche se non apribili, delimitanti il volume riscaldato, verso l'esterno e verso vani non riscaldati;

I) per la climatizzazione diretta tramite teleriscaldamento da impianti di cogenerazione di potenza nominale fino a 500 kWe alimentati da gas naturale, biomassa vegetale solida, biocombustibili vegetali liquidi, biogas e in co-combustione gas naturale-biomassa. Tale intervento è ammissibile solo se contempla sia la realizzazione dell'impianto di cogenerazione che la realizzazione della rete di teleriscaldamento ad esso abbinata, inclusi gli allacciamenti agli edifici;

II) per la climatizzazione degli edifici da impianti geotermici a bassa entalpia fino a 1 MWt;III) impianti di cogenerazione di potenza nominale fino a 5 MWe alimentati da gas naturale, biomassa vegetale solida, biocombustibili vegetali liquidi, biogas e in co-combustione gas naturale-biomassa.

The Kyoto fund is now under revision due to Art. 57 of the DL 83/12 „Misure per lo sviluppo dell'occupazione giovanile nel settore della green economy"

At Regional level

Piedmont region:

- "Regional Call for nZEB projects " in 2011: in the framework of this public regional call, capital grants of 25% of eligible costs for the construction of buildings "nearly zero energy" (Around 2 M€). This was aimed to co-finance any additional effort in the design phase and the extra costs of the innovative technologies. With a max. public fiancing of 200.000 € for each proposed project. The call defined minimum technical requirements for heating and cooling in order that the project could be defined as "nearly zero energy".

  → deliberazione n. 41-2373 del 22 luglio 2011, pubblicata sul B.U.R. n. 30 del 28 luglio 2011

Toscana Region:

- Distretti Energetici Abitativi (DEA): new neighbourhoods with high energy performance (energy saving around 500 euro for family per year and 50% of CO2 emissions reduction). The energy performance is around 33 KW/m2year. The investment is of 5 million for 568 dwelling in 20 small neighbourhoods. This is the first action under the Regional Energy Plan.

  → Example of housing project:

  - the Condominium "Residenza di Primo Inserimento a Calenzano" in Florence by CasaSpa.
  - the Programma integrato "Giuncoli" in Florence by CasaSpa / EOS Consulting

2.3.2 Spain

In Spain, due to the economical crisis, cuttings have impacted seriously in the energy sector. There are not any kind of fund for nZEB buildings, moreover the grants concerning the energy saving, at national, regional and local level have been eliminated.

Paradoxically, the Co2 emissions have a decreasing trend due to the collapse of the industries and the lower consumption in homes.

National level

Directive 2006/32/EC on end-use efficiency of energy and energy services sets a minimum target indicative energy savings target of 9% in 2016 and provides, in article 14, the obligation for Member States to introduce the European Commission a national Action Plan II (National Energy Efficiency Action Plan, NEEAP) where proceedings are set and mechanisms to achieve the goals set.

Moreover, the European Council of 17 June 2010 has set a 2020 target to save 20% of its primary energy consumption.

As a result of these obligations, the Ministry of Industry, Tourism and Commerce, in collaboration with the I.D.A.E., has developed the Action Plan and Energy Efficiency Savings 2011-2020, including an annex to the quantification of energy savings achieved in the 2010 compared to 2004 and 2007, according to the methodological recommendations on measurement and verification of savings from the European Commission. Both documents have been recently approved by the Council of Ministers of 29 July 2011 and will be sent to the Commission to comply with its mandate.

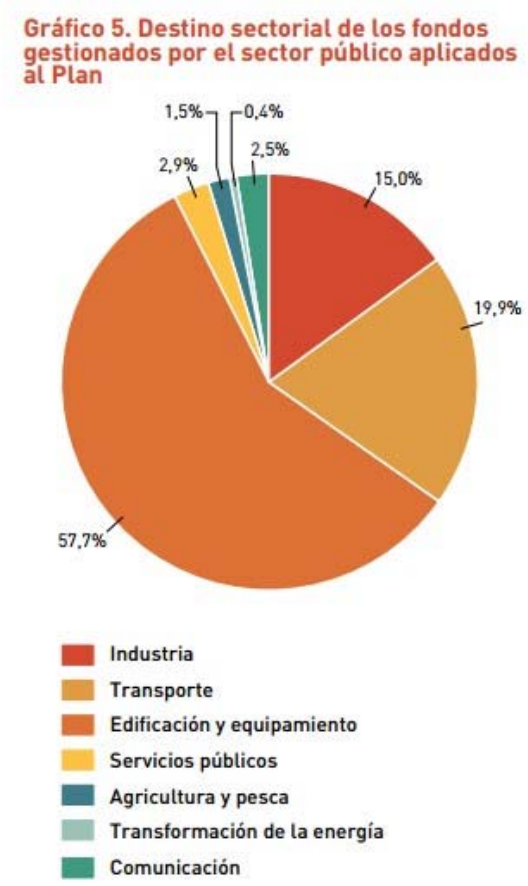


Figure 4. Destination of funds by sector: Reource I.D.A.E.

For the period 2011-2020, the Action Plan envisages a number of measures that will tend to reduce both the energy demand for heating and cooling (improving the thermal envelope of buildings),as to improve the energy efficiency of energy intensive installations of air conditioning and lighting. In the case of buildings new strategy will focus on promoting high energy rating of buildings (classes A and B) and in the development of a specific energy consumption buildings almost zero. As refers to domestic or commercial equipment will focus on improving energy efficiency Park facilities appliances and commercial refrigeration. Projections of national consumption in 2020 terms of final energy point to growth weight in the building sector consumption on

Final energy consumption for energy, from 26% in 2010 to 28% in 2020. It also provides for a reduction of 3% in the ratio domestic energy sector (tep/m2) Due to simultaneously reducing power consumption by2% increase in homes built area at 1%.

Furthermore, it has been considered a reduction8.5% in service sector energy ratio (tep / employee), because despite the increase provided for consumption by 6%, the number of sector employees increased by 20%.

List of ACTIONS:

Action 1	Rehabilitación energética de la envolvente térmica de los edificios existentes
	Rehabilitation the energy thermal envelope buildings existing
Action 2	Mejora de la eficiencia energética de las instalaciones térmicas de los edificios existentes.

	Improved efficiency energy facilities the thermal existing buildings
Action 3	Mejora de la eficiencia energética de las instalaciones de iluminación interior en los edificios existentes
Action 4	Construcción de nuevos edificios y rehabilitación de existentes con alta calificación energética
	Construction of new buildings and rehabilitation of existing high rating energy
Action 5	Construcción o rehabilitación de edificios de consumo de energía casi nulo
	Construction or rehabilitation buildings consumption nearly zero energy
Action 6	Mejora de la eficiencia energética de las instalaciones de frío comercial
	Improving the energy efficiency of commercial cooling installations

Action 7	Mejora de la eficiencia energética del parque de electrodomésticos
	Improved efficiency energy Park appliances

	Ahorros de energía final (ktep)		Ahorros de energía primaria (ktep)		Emisiones evitadas de CO_2 ($ktCO_2$)		Apoyos gestión pública (M€)			Inversiones (apoyo + aportación privada) (M€)		
	2016	2020	2016	2020	2016	2020	2011-2016	2017-2020	2011-2020	2011-2016	2017-2020	2011-2020
Edificación y equipamiento	2.674	2.867	5.096	5.567	11.116	12.120	1.730	1.153	2.883	16.393	10.929	27.322
Rehabilitación energética de la envolvente térmica de los edificios existentes	775	775	1.319	1.329	2.921	2.943	665,7	443,8	1.109,5	3.356,4	2.237,6	5.594,0
Mejora de la eficiencia energética de las instalaciones térmicas de los edificios existentes	908	908	1.546	1.558	3.424	3.449	169,8	113,2	283,0	4.354,8	2.903,2	7.258,0
Mejora de la eficiencia energética de las instalaciones de iluminación interior en los edificios existentes	674	842	1.588	1.986	3.400	4.251	115,2	76,8	192,0	5.257,8	3.505,2	8.763,0

[Continuación]

	Ahorros de energía final (ktep)		Ahorros de energía primaria (ktep)		Emisiones evitadas de CO_2 ($ktCO_2$)		Apoyos gestión pública (M€)			Inversiones (apoyo + aportación privada) (M€)		
	2016	2020	2016	2020	2016	2020	2011-2016	2017-2020	2011-2020	2011-2016	2017-2020	2011-2020
Construcción de nuevos edificios y rehabilitación de existentes con alta calificación energética	224	247	425	473	901	1.002	472,8	315,2	788,0	2.920,8	1.947,2	4.868,0
Construcción o rehabilitación de edificios de consumo de energía casi nulo	0,4	0,8	0,8	1,5	1,6	3,2	3,0	2,0	5,0	11,4	7,6	19,0
Mejora de la eficiencia energética de las instalaciones de frío comercial	0,8	1,6	1,9	3,8	4,0	8,1	3,0	2,0	5,0	12,0	8,0	20,0
Mejora de la eficiencia energética del parque de electrodomésticos	92	92	216	216	463	463	300,0	200,0	500,0	480,0	320,0	800,0

Nota: los cálculos de emisiones de CO_2 evitadas como resultado de las medidas de ahorro y eficiencia energética incorporadas en este Plan son cálculos efectuados *ad hoc* para el mismo y suponen una traducción de los ahorros calculados en diferentes bases (2004 y 2007), en términos de energía final y primaria, a emisiones de CO_2 evitadas; este cálculo no tiene por qué coincidir, por tanto, con los realizados con enfoques o bases contables distintos como parte de los informes periódicos realizados en relación con la evolución de las emisiones de gases de efecto invernadero.

Fuente: IDAE

Figure 5. Summary table MEASURES BY SECTOR BUILDING AND EQUIPMENTReource I.D.A.E.

Regional level

The I.D.A.E. (Institute for the Diversification and Saving of Energy) of the Ministry of Economy of Spain provides direct aid is repayable through the Autonomous Communities (ACs), investments in certain types of projects that promote energy efficiency or renewable energy drive.

These aids include those that are part of the Renewable Energy Plan 2005-2010 (PER) and the 2008-2012 Action Plan of the Strategy of Energy Saving and Efficiency in Spain (E4) and jointly managed with CC . AA. across several agreements established between IDEA and each Autonomous

The respective Autonomous Communities are responsible for the development of public aid programs, their preparation and call for regulatory bases, managerial, procedural and technical assessment records, resolution of such aid, certification and payment of the same, including the regime control, and, where appropriate, the reinstatement and punitive.

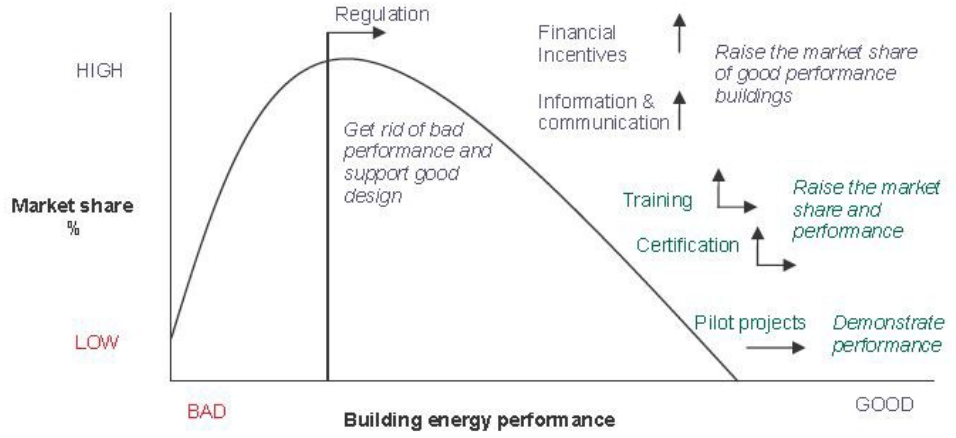
The regional public authority has not develop a public aid program about Action 5 : Construction or rehabilitation buildings consumption nearly zero energy .

2.4. Current barriers for new or retrofitted nZEB

2.4.1 Italy

Market area:

- low awareness among general public and low interest/demand for nZEB
- high skepticism about the nZEB concept
- Inadequate *marketing* (not adapted to the general public) to communicate the concept to general public
- too few and wrongly presented good examples
- Small/niche national markets
- difficult to finance the construction of nZEB and low profitability to build nZEB
- negative and incorrect debate/information in media concerning nZEB.
- unfavourable energy price/structure



Market transformation: schematic effects of supportive mechanisms for low energy buildings

Requirements/regulations area

- No official definition / standard / specifications for nZEB
- Not enough intermediate targets for nZEB implementation and adequate targets for retrofitting
- Lack of control/evaluation in nZEB operation phase
- the financial gap between cost-optimality and the binding nZEB requirements may need to be bridged by additional policies and support measures. This financial gap is

  highly influenced by the future evolution of numerous economic factors, one of the most important ones being technology costs as a reaction to more mature markets and larger production volumes.
- For supporting the nZEB implementation it would be useful to merge the regulations for renewable energy with the existing building regulations or to broaden the scope of the existing buildings regulations by introducing renewable energy requirements (also indicated by Article 13 of the Renewable Energy Directive, 2009/28/EU).
- No integrated approach between the buildings' and local utilities' policies. This may facilitate a faster and cheaper implementation of nZEBs
- Inadequate reference for calculation methodology at national level. Too fragmented methodologies.
- Current legislation more oriented to promote a single EPC than a collective one

in multifamily buildings.

- Inadequate existing legislation to allow collective energy retrofitting in multifamily building with high divided ownership property.
- Inadequate cooling consumption weighting in the actual calculation methodology to moderate low heating degree days.

Skill/Knowledge area

- bad or inadequate experience/feedback
-
- problems related to risks are e.g. economic risks for the developer of nZEB, building technological and building services engineering risks with e.g. untried solutions;
- high design time consuming for designers that are not recognized and rewarded by clients;
- inadequate competence/knowledge of building stakeholders to build nZEBs: (from designers, builders to craftsmen to design, build, install innovative technologies)
- inadequate specific competence of public technicians to manage the forthcoming nZEB requirements;
- difficulties to implement an integrated design, involving multiple parties at the earliest stages
- inadequate knowledge of potential energy and cost savings for nZEB;
-
- inadequate knowledge of technical possibilities, not enough R & D and demonstration projects;
- inadequate availability of technologies/products and higher prices for the existing ones;
- inadequate product development resulting in poor or missing low energy products/technologies
- inadequate knowledge on how to identify the right/smart technology mix for nZEB, on how to assess a ranking of technologies according to their cost-effectiveness
- too few good examples /demonstrative cases to get solid results;
- lack of quality control of results (no post evaluation of results and costs);
- lack of energy audit of existing buildings in order to define the energy consumption baseline, in case of retrofitting;

Both the general public and most professionals simply are not aware of the available technical solutions for energy efficiency and the scope of renewable energies and, even more important, of the economic saving potential. This is a vicious circle: the customer does not ask for energy-efficient solutions as he does not know about them and the professionals do not offer them as they are not requested.

- problems related to user/behavior are e.g. indoor environment problems, inadequate operation and use, no dialogue between the developers and the users/tenants to arrive at a well-functioning nZEB;
- Lack of dedicated knowledge centre to gather the necessary info;

Financial / Costs area

- lack of private financial capital to implement nZEB
- Financing and funding issues are the main inhibitors of taking greater action and engage more proactively in 'smarter' practices. Access to finance is perceived as the main obstacle to go beyond the building code. SH coops demand more funding to invest in technologies more than technologies.
- perceptions of high up-front construction/investment costs,
- incorrect cost estimates not showing the real and true costs
- no reference to evaluate the financial gap between cost-optimality and the forthcoming binding nZEB requirements.
- no life cycle (cost) perspective, no awareness of the pay-back
- lack of specific public/regional incentives or funds, also for the implementation of energy audits of existing buildings, in case of retrofitting;
- too short time horizon used for bank loans and cost estimates.
- lack of support/financing from banks /Esco, especially to face a retrofitting project related to the whole building and not only a single flat (lack of the control of results)
- Owners/promoters must understand the technologies and systems available, as the choices significantly affect budgets and schedules.

For the refurbishment of existing estate the main problem in MED area is the long investment return due to climate conditions:

- The winter period is short and the temperatures not so cold, so the heating cost is in most cases not so high and the money saved by improving energy efficiency is not enough to repay the investment.
- The main problem is the hot summer period, but it's very difficult in residential sector to evaluate the saving potential due to the diffusion of individual electrical conditioners.

Other barriers

In Italy we underline the problem related to Banks and ESCo that are reluctant to engage in long-term energy efficiency financing contracts and tend to prefer shorter term. The lack of a systemic approach to bundling energy efficiency investments is another problem as well.

In addition at this time there is a particular law related to "Stability and Growth Pact" for public bodies that blocks public investments in general and for energy efficiency as well. Now it is very important that EU legislation encourages and under certain circumstances obliges Members States in the investments that can lower running costs, such as the energy saving measures. This Stability Pact with the national government hinders the creation of deficits by local authorities, even in case they are used to finance projects aimed at meeting EU goals on energy efficiency. It limits both investments for energy efficiency projects (which cannot be financed by local authorities due to constraints to local deficit creation, embedded in the Italian national law) but also for the renovation of dwellings, when these dwellings become available for renting. This results in a vicious circle: The region has duties with the National government to reduce energy consumption. So, the region makes regional policies to improve energy efficiency and, in order to be of example for the private sector as well, the region starts from the public sector, where there are forecasts for performance improvement of buildings. However, at municipal and provincial level, there are no possibilities to make the energy efficiency projects on buildings owned by public authorities, because of the Stability Pact, which hinders any financing of public authorities, resulting in no investments at local level. Another recent barrier is the "spending review" that limits and sometimes blocks totally investments.

2.4.2 Spain

Funding and legislation

- The main obstacle is the lack of capital available to finance energy buildings nearly zero. The owners don't have the required budgets and neither to find funding for carry out the investments.
- Periods of possible investment return are too long, especially in areas with warmer climates, so need new models other than those that exist today.
- Investment funds in the long term, energy service companies and so-called "Green Funds" are new funding mechanisms that can be a great opportunity, but the main problem is that they can be used depend heavily on new local laws and state, pending the drafting and approval.
- There is uncertainty and irreversibility on the investments. It will be very difficult to recover these investments if the people observe unprofitable. Moreover they are uncertain investments both the savings finally achieved as the future price of energy.

Information:

- As many studies show, some consumers don't have enough information to consider investments in energy efficiency and saving properly. This is worsened because users don't have detailed information on the energy bills of their dwellings. It is essential to monitoring the buildings through automation and control mechanisms.
- Cost-benefit misunderstood, because the main aspect the users look for when purchasing HVAC or domestic hot water equipment in their dwellings, essentially is based on the initial cost, eliminating the long-term economic benefits that could accrue to the purchase of more efficient equipment.

Training

- There is a perceived failure in the training and qualifications of professionals to ensure quality of services and enable the development of the sector to its full potential.
- The workforce is not qualified to install technological solutions and most innovative devices in the field of energy efficiency.

Transfer and innovation

- There are currently on the market innovative solutions in energy efficiency for designing energy consumption buildings nearly zero, but we can find excessive delays in the dissemination and implementation of these. This is enhanced by uncertainty about the savings that can be achieved and the inertia of a construction sector in Spain, which is still quite conservative and traditional, with some reluctance towards the use of new solutions, because there is no validated experience time.

Priorities

- The actions of saving and efficiency energy are not usually priority for the inhabitants.

  Therefore they use to be postponed them, because there are more urgent actions to carry out. For example, in the case of refurbishment, users prefer to invest in the structural safety of the building, installing an elevator, … leaving as a last option energy retrofit, when the budget is almost spent.
- This situation is aggravated by the total absence about maintenance of buildings in Spain, a fact that has led to premature aging of the housing stock, in need of important repair and renovation, which provide limited opportunity for energy efficiency. This lack of maintenance culture has also caused, even at new buildings, that the installation of solar panels, required under current regulations in Spain, are not working and it is frequently to have to use support systems. It be absurd to install efficient and innovative equipment, if the users are not going to maintain it. This problem is a mixture of misinformation, lack of compliance with certain laws, bad practices and habits, ... which leads to many problems, not only for energy efficiency.

Social and political fragmentation

- Because of to the heterogeneity of consumers in a building type in Spain, is very difficult to study the benefits of an energy efficiency action, because what for some users may be profitable, due to continuous use, for others may be unprofitable.
- On the other hand, to have a single agent to carry out an efficiency investment

(eg owners of offices or dwellings on leased), it is possible not be profitable, because they do not enjoy the lower cost of energy service. However, there is not a common case in Spain, where inhabitants are often the owners of the dwellings.

- Finally, not always the needs and interests of the Administration agree with those of private entities.

2.4.3 Required measures to overcome these barriers

Maybe the new SCF programming period 2014-2020 has to be more addressed to energy efficiency measures especially for social houses, at a local level for smaller-scale investments on longer investment durations.

It would be important too that EU encourages and allows the financing tools for technical assistance such as ELENA and IEE-MLEI to become structural.

From a technical point of view it can be appropriate to make different goals for new building and refurbishment.

2.5. Needs to help overcome barriers for social housing providers within the NZC project?

2.5.1 Italy

According to experts, the approach to the nZEB must be "bottom up", that means that the users should be involved on the definition and implementation of the forthcoming nZEB way, (for new or refurbished interventions).

Referring to new buildings, this is possible only if the construction process is clear to the tenants in order to have a real cost effectiveness nZEB. An interesting point of view is that of Norbert Lantschner (Climabita): the new standard of buildings will be defined not only by regulations but also by the housing market request, so it seems important to present the nZEB not as an obligation but a good occasion to stimulate the housing market. To obtain such a result, it is important to inform people and tenants about the cost-effectiveness of nZEB, especially considering the current oil price in Italy. Actually, there are lots of prejudices about it.

Referring to refurbished nZEB, financial regulations are needed with regards to social housing cooperatives: financial operators and banks must also be involved in the process, together with ESCos (Energy Service Companies) with Energy Performance Contracting solutions.

Hereby some preliminary/uncategorized suggestions to overcome in the above mentioned barriers:

- To address the forthcoming SCF programming period 2014-2020 more towards to energy efficiency measures for residential sector, especially for social housing sector, by promoting for smaller-scale investments on longer investment durations, at a local level;
- To encourage and allows the financing tools for technical assistance such as ELENA and IEE-MLEI to become structural;
- To set different goals for new building and refurbishment;
- To set intermediary targets rather long term (2015-2020) objectives
- To set a central or regional database (energy registrery) in order to ensure a better control of results and a higher knowledge of the energy performance of the building stock;
- To boost a specific national fund to finance preliminary energy audits
- To allow relevant retrofitting projects beyond the “Stability and Growth Pact”
- To set a national/regional fund to allow a full and efficient retrofitting approach of existing building stock
- To boost a calculation methodology for a balanced technology mix based on local heating and cooling degrees days.
- To boost a national loan integrated with existing tax credit programme (55%)
- To boost a national legisltation a distribution of costs for nZEB between stakeholders in retrofitting projects
- To encourage the application of LCC.analysis for showing the long term advantage of nNEBs compared with traditional buildings.
- To encourage the development of common specifications for nZEB, possibly oriented to MED specificities. This will simplify for all from users to the developers.
- To gather feedback from previous experience of low energy buildings. It always makes sense to learn from previous mistakes and success. Low energy buildings were built already in the last year as demonstration projects.
- To boost the update educational/knowledge/competence level of SHOs on nZEBs/low energy buildings.
- To disseminate/publish more good examples of low energy residential buildings.

The information on the good examples has to be relevant and from a reliable source. For this purpose a standardized way to measure and compare energy efficiency is needed.

- To disseminate/publish more good examples of low energy products/technologies.

  This will increase the competition and result in more, better and cheaper low energy products/technologies.
- To inform the users/tenants on nZEB concept and benefits.
- To verify low energy products and concepts through demonstration projects and field/lab testing
- To explicit the (fair) distribution of costs for nZEB between stakeholders
- To expand training and education and targeted information for SHOs
- To increase info on good practices (including data of use phase, user acceptance/satisfaction and lessons learnt/difficulties encountered).

2.5.2 Spain

- It is necessary to adapt the CTE (Spanish Technical Regulation) to this kind of buildings
- To set up a educational and training plan for NZEB projects.
- To set up information campaigns
- The creation of a National Action Plan for NZEB renovation
- To promote the exchange of experiences

From these barriers, the strategic lines that should facilitate their overcoming. They are presented below:

- Coordination at territorial level, better articulate EEB policies to the regional scale (more important role for the regional authorities).
- Different policies and mechanisms adapted to the diversity of building typologies, residents, socio-economic situation.
- Innovate financial mechanisms to invest in nZEB.

- Promote training for nZEB. professional profiles, at any level.
- Develop efficiency energy systems at urban level, from the infrastructure point of view and for the planning point of view (better orientations, etc.)

2.6. Expected trends regarding nZEB

2.6.1 Italy

No specific national roadmap for nZEB and/or intermediate targets have been established yet.

A National Decree is going to be prepared by the Ministry of Economical Development and it will explain the "nearly zero energy consumption standards", fixing the minimum requirements and also the type of consumption considered to satisfy the requirements themselves (e.g.: only heating requirement, or heating and hot water, etc.). It will be clarified also the role of renewable energies, that it is to say if they will participate in defining the energy performance of the nZEB or not. The text of the Decree will be a synergy between the Ministry of Economical Development, the Ministry of Infrastructures and the Ministry of Environment and it should be ready within the beginning of 2013.

The Italian Government established a working group with all the stakeholders to point out the nZEB standards. Some of the contacted experts participate to this working group, in order to create technical know-how.

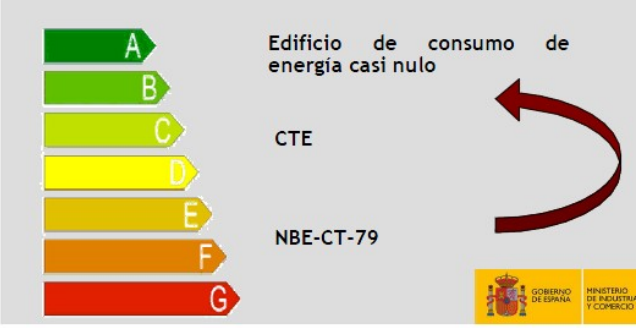
The roadmap to nZEB definition and application will be a work-in-progress process, which means not only fixing technical/economical regulations but also monitoring the subsequent results, in order to take actions to better achieve the Directive EPBD2 results.

2.6.2. Spain

Although the Ministry is working on a national road map for NZEB buildings, there is not a final document yet.

As one of the measures, the national government is conducting a review of the energy efficiency legislation. The proposed schedule is:

- 2011. New Technical Code of Buildings with new requirements that obliges all buildings to be class C or higher.
- 2015-2016. New Technical Code of Buildings with new requirements that obliges all buildings to be Class B or higher
- 2020. New Technical Code of Buildings with new requirements that obliges all buildings to be build with "near zero emissions" criteria.



So, in case of delays in the legislation IVE will use the Spanish A class criteria as equivalent of "near zero emissions" criteria, due to the draft documents say NZEB buildings would be equivalent to A class.

3. MED Task Force Needs Analysis

Important to note that no specific questionnaires or surveys have been elaborated/conducted to elicit the needs and barriers.
The analysis below reported is mainly based on an discussion between the management board of the participating partners in this T.F and results of some interviews done by Finabita in his T.F work.
Important to note that the following need analysis is based on the barriers reported on
chapter 2.3 and consistent with the previous need analysis done for the PHE project.

In synthesis, hereby the main barriers to overcome. These have been categorized by n° 5 areas:

- For Italy: as highlighted on the PHE need analysis, the most important barriers to address are the organisation of energy efficient projects, the financing issues and technical issues.

- For Spain the main priority are the technical aspects, the organisation of energy/building projects, Financing issues, the tenant energy use and strategies for sustainable asset management. Under the technical issues, also Spain underlines the importance of ventilation.

3.1. Priorities

So the priorities identified for MED Taskforce are the follow:

- Sharing knowledge especially Practicalities and usability and cost experiences related

to low energy/nearly zero energy housing
- Monitoring of NZ-buildings: real-life operation costs and energy consumption data
- Cost optimality: theory and practice
- Cost effective solutions for cooling and ventilation: technical aspects. Practical usability and cost experiences related to cooling/natural ventilation (renovation and new build)
- Integration of RES
- Financing to overcome low access to cost of capital and Landlord-tenant dilemma

3.2. What MED expect from other taskforces

- Recommendations/suggestions for innovative financing solutions, such as i.e ESCO schemes
- Communication tools addressed to tenants
- Simplified evaluation for cost effectiveness
- Practical audit models

4. MED Task Force Work Programme

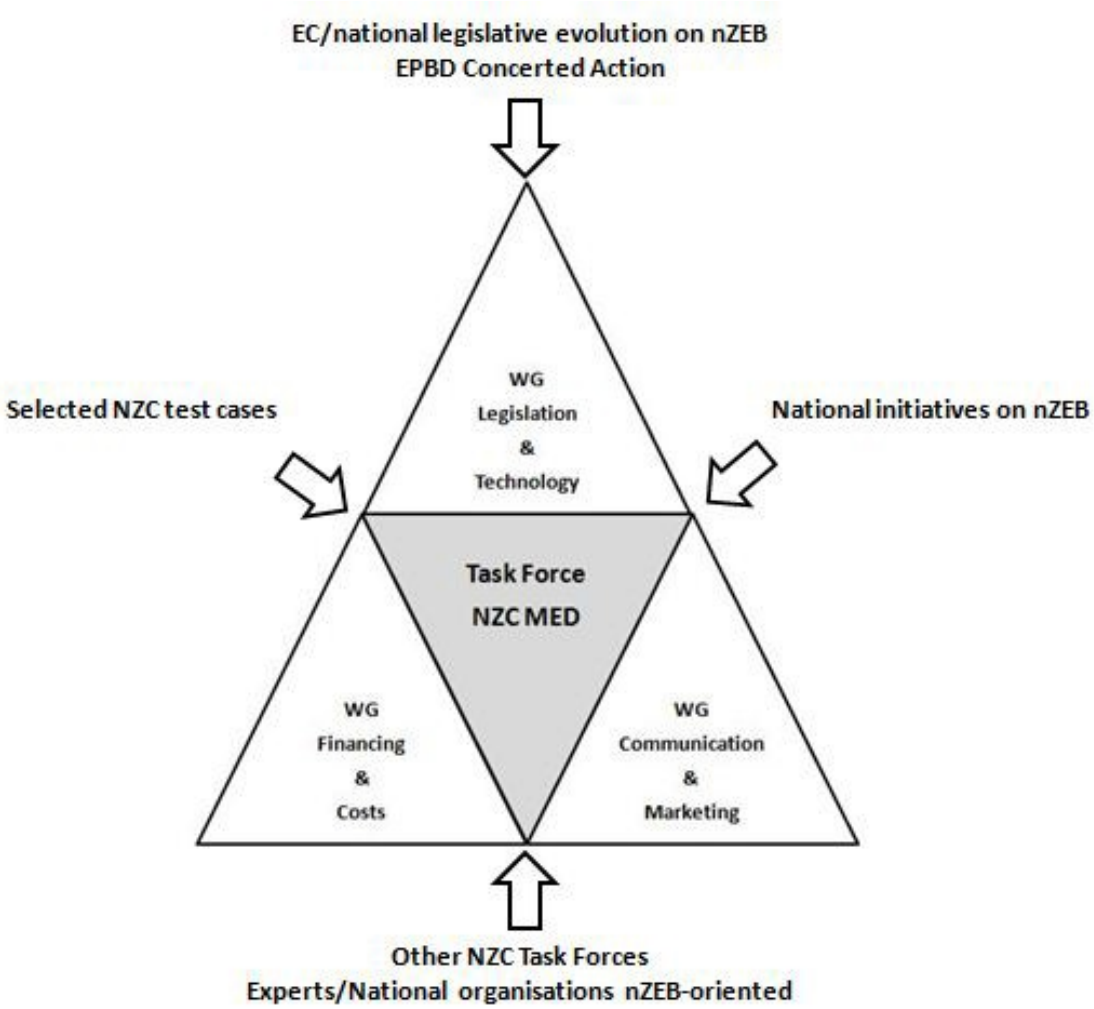
4.1 Proposed Task-Force organisation

N. 3 interrelated Working Groups will be established in order to address the barriers underlying in the T.F need analysis and produced the due T.F deliverables.

Working Group	Objectives	Coordination

WG Legislation/Technology	- to identify the technical elements of the nZB definition that are already stipulated with the EPPD implementation in MED area (by collecting /analysing public&private initiatives); - to discuss the forthcoming nZEB definition in terms of its applicability for the Social Housing sector; - to collect and analyse the technical elements of the selected pilots.	CNC in collaboration with IVE and CENER
WG Financing/Costs	- to monitor/collect energy consumption and evaluate energy costs for the selected pilots - to collect maintenance costs for the selected pilots to collect used financing models and highlight any innovative financing ones the selected pilots → link to TF "financing" will be implemented.	AVS with IVE, CENER and Members of AVS
WG Communication/Marketing	- to provide information to inhabitants along operation phase for the selected pilots - to provide information to inhabitants on summer and winter consumption trends for the selected pilots.	Federcasa with Federcasa members and Tenants Union

Working Group	**Responsible for the production of Deliverables**
WG Legislation/Technology	D4.1 – D4.2 – D4.3
WG Financing/Costs	D4.1 – D4.2 – D4.3 D4.4- D4.6 D4.7
WG Communication/Marketing	D4.1 – D4.2 – D4.3 D4.5 – D4.7- D4.8 D4.9


EC/national legislative evolution on nZEB
EPBD Concerted Action
Selected NZC test cases
National initiatives on nZEB
WG
Legislation
&
Technology
Task Force
NZC MED
WG
Financing
&
Costs
WG
Communication
&
Marketing
Other NZC Task Forces
Experts/National organisations nZEB-oriented

4.2. Work Programme

- **Taskforce workshops Agenda**

3 Taskforce workshops will be organised during the project. During the workshops, the participants will have the opportunity to discuss the themes of the taskforce and plan the next steps. The first workshop will be held in Madrid, jointly with the Project General Meeting, while the second workshop will be joined to the study visits planned in Italy (April 2013). Maybe the third will be joined to the second study visit too if possible. External experts will be invited to the WS to bring their contribution.

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3

May 2013: First study visit - Italy , Area fiorentina + Second TF workshop
September 2013: Second study visit - Spain (Barcelona)

2014

May 2014: local study visit - Italy, Latina
October 2014: local study visit – Italy,
Ancona **2014**: local study visit - Spain, to be
defined **End of 2013 or 2014**: Third TF
workshop

2014: Third study visit - Southern France or Portugal

From June 2013 to February 2015 will be developed the monitoring phase.

- **On-line NZC course**
  to start in March 2013

→ **Annex n°3 :** Draft programme of the on-line NZC course

4.3. Knowledge and expertise

4.3.1. Possible experts to contact for Italy

Italy	
Gaetano Fasano	ENEA UTEE-ERT, Dipartimento Energetica Edifici Pubblici
Norbert Lantschner	Ideatore Agenzia Casaclima
Fabio Fantozzi	Docente di Ingegneria Energetica, Università di Pisa
Lorenzo Pagliano	Docente di Ingegneria Energetica, Politecnico di Milano
Valeria Erba	**ANIT**
Fabrizio Tucci	Docente di Tecnologia dell'Architettura, Università di Roma
Ulrich Klammstainer	CasaClima (Agency of energy certification of Bolzano Province)
Francesco Nesi	Zephir (Zero Energy and Passivhaus Institute for Research, affiliated to the Power House Institute)
Francesco Toso	CRESME (National research centre)
Edoardo Zanchini	Legambiente (League for the Environment, the most widespread environmental organization in Italy)
	To be completed

Possible networks/initiatives to contact

Italy
ENEA UTEE-ERT, Dipartimento Energetica Edifici Pubblici
Agenzia Casaclima
ANIT (Italian Association for Thermal Insulation)
Fondazione Sviluppo Sostenible
Universities, Products/Tecnologies producers,…
To be completed

4.3.2. Valencia Institute of Building (IVE) commitment

IVE will involve in the Project Institutions and experts with proven experience in energy efficiency in both new construction and rehabilitation, involved in the development of projects, documents and applications in the field of sustainable building in both European and national programs, and assist in the development of state and regional regulations.

The Valencia Institute of Building (IVE) is a private non-profit making foundation with public interest established in October 1986 that seeks to improve the quality and sustainability in the construction process through the R&D in the building field. Since the Foundation of the Institute its work has consisted in assisting in the management and self-regulation of the construction sector and in the actual implementation of measures for environmental efficiency. During 20 years of its existence the institute has remained very active in the drafting of technical documents to support the pre-normative research of building process and to promote the disclosure of all aspects related to the quality and sustainability in the design, construction and use of buildings.

4.4. EPBD: nZEB and Cost Optimality

The recast of the Energy Performance of Buildings Directive (EPBD) introduced, in Article 9, “nearly Zero -Energy Buildings” (nZEB) as a future requirement to be implemented from 2019 onwards for public buildings and from 2021 onwards for all new buildings. The EPBD defines a nearly zero energy building as follows: A nearly zero energy building is a “building that has a very high energy performance… The nearly zero or very low amount of energy required should to a very significant extent be covered by energy from renewable sources, including renewable energy produced on-site or nearby.”

Acknowledging the variety in building culture and climate throughout the EU, the EPBD does not prescribe a uniform approach for implementing nearly Zero-Energy Buildings and neither does it describe a calculation methodology for the energy balance. To add flexibility, it requires Member States to draw up specifically designed national plans for increasing the number of nearly Zero-Energy Buildings reflecting national, regional or local conditions. The national plans will have to translate the concept of nearly Zero -Energy Buildings into practical and applicable measures and definitions to steadily increase the number of nearly
Zero-Energy Buildings.[1]

[1] BPIE 2011

As a method for an economic assessment, the EPBd recast suggests the net present value (nPv). The net present value is a standard method for the financial assessment of long-term projects. It measures the excess or shortfall of cash flows, calculated at their value at the start of the project.

Such a net present value calculation can be performed by using the global cost calculation method described in En 15459: (Energy performance of buildings – economic evaluation procedure for energy systems in buildings). an appropriate calculation can be described by the following formula:

$$C_g(\tau) = C_I + \sum_j \left[\sum_{i=1}^{\tau} \left(C_{a,i}(j) \times R_d(i) \right) - V_{f,\tau}(j) \right]$$

$C_g(\tau)$	Global costs referring to starting year τ_0
C_I	Initial investment costs
$C_{a,I}(j)$	Annual costs year i for energy-related component j (energy costs, operational costs, periodic or replacement costs, maintenance costs)
$R_d(i)$	Discount rate for year *I* (depending on interest rate)
$V_{f,\tau}(j)$	Final value of component *j* at the end of the calculation period (referred to the starting year τ *0*). Here also disposal cost (if applicable) can be taken into account.

The global costs are defined by:

- the initial investment costs at the start of the measure;
- plus the present value of the sum of the running costs (e.g. fuel costs) during the calculation period; minus the net present value of the final value of components at the end of the calculation period.

The En 15459 does not prescribe the use of a specific calculation period. The calculation period might be set at 30 years, as this timeframe covers the lifetime of most of the measures assessed. longer calculation periods are not recommended, as beyond a 30-year timeframe, assumptions on interest rates and forecasts for energy prices (these have to be defined for the calculation period) become difficult due to the fact that only one calculation period can be defined for assessing the total building, the chosen calculation time might be shorter or longer than the lifetime of individual components or systems.

To ensure a lifecycle perspective, residual values are taken into consideration for components with lifetimes that are longer than the chosen calculation period. For components that have a shorter lifetime than the chosen calculation period, the replacement of the component needs to be taken into account.

This lifecycle approach is important as it does not limit the assessment to partial or short-term optimisations.

Resource:

http://www.bpie.eu/documents/BPIE/BPIE_costoptimality_publication2010.pdf

4.5. Link to the EPBD Concerted Action

As Italy, the RENAEL -Rete delle Agenzie Energetiche Locali (National network for local energy agencies) represents the Italina Government at the European "Concerted Action EPBD 1e 2" initiative. Link with RENAEL will be established.

As Spain, the I.D.A.E.(the Spanish Institute for Diversification and Energy Saving) and ATECYR (Spanish Technical Association of Air Conditioning and Refrigeration)represents the Spain Government at the European "Concerted Action EPBD " initiative. Link with ATECYR are established.

http://www.epbd-ca.eu/themes/nearly-zero-energy

4.6. Study visits

Study visit	Country
May 2013	**Italy**
September 2013	**Spain**
April 2014	**Southern France or Portugal**

5. nZEB Legislation Reports

5.1 Italy

5.1.2. Introduction

In Italy standards and codes about energy are within the concurrent responsibility of the national government/parliament and of the local (i.e. 21 regions or autonomous provinces) government/parliament. Due this legislative situation, there are potentially two levels of standards and codes: a *national level* that establishes the minimum energy performance requirements applicable to the whole nation and a *local level* that could set higher requirements. In particular, the energy certification process should be under the control of the local governments.

In synthesis, the Ministry of Economic Development, in collaboration with the Ministry of Environment and the Ministry of Infrastructure, are in charge of the regulation on Energy Conservation of Buildings (ECB). The opinion of the Committee of Region is required, because energy policy in Italy is partially delegated to Regions and Autonomous Provinces, leaving the drafting of the general framework to the central government while Regions have the final power to adapt their own local requirements. Regions are in charge of the entire certification system, which is based on regional registries and databases.

This statement about the national organisation of the legislation framework is important to better understand the actual situation of the EPBD and EPBD recast directives, as explained on the below document.

5.1.2. Current Status of the implementation of the 2002/91/EC (EPBD) and 2010/31/EC (EPBD recast) directives.

At national level

In Italy, the 2002/91/CE “EPBD” Directive was adopted with two legislative acts: D. Lgs 19/08/2005 n.192 subsequently amended by D. Lgs 29/12/2006 n. 311 which established the general framework for the implementation of the Directive and updated the performance requirements for new buildings.

These were supplemented D. Lgs 30/05/2008 n. 115 that defines the qualifications of the professionals involved, by D.P.R. 02/04/2009 n. 59 that defines the technical standards to be used for the calculations and by D.M. 26/06/2009 (issued by the Ministry for Economic

Development) establishing the national guidelines for the energy certification of buildings.

As already pointed out, the national guidelines for certification and the minimum requirements for new buildings apply absent legislation enforced by local governments (regions/autonomous provinces) that can implement local certification systems and/or require for the new buildings an energy performance higher than the national minimum.

In the initial phase, the certification of the energy performance of buildings will include the primary energy used for heating and domestic hot water preparation. In addition, the building energy need for space cooling (envelope performance) must be reported in the energy certificate.

In a later phase, energy certification will cover also primary energy use due to cooling and lighting, but, at the moment, the indications about the evaluation of the primary energy performance indicators for cooling and lighting and for they inclusion in the certificate, are still missing (but they could be implemented by the local governments).

At the end of 2010, the revision process of the current legislation at the national level was completed and most of the regions started to implement the regional transposition, according to the national model and guidelines, generally adding more demanding elements than in national regulations.

It's important to note that, before the end of the above mentioned revision process, and specifically before the publication of the national guidelines, some regions started to produce their own regulation on energy certification and sometimes not perfectly consistent with these guidelines. This generated a further confusion and fear for the building stakeholders about the applicability of the energy certification.

To these regions that had already enforced regulations, it was requested to modify the adopted requirements that were less stringent or to add some neglected issues in order to fit their instruments to the national guidelines.

<u>With regards to the national transposition of Directive 2010/31/EC</u>

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The national referent for this transposition is the Ministry for Economic Development while the RENAEL -Rete delle Agenzie Energetiche Locali (National network for local energy agencies) represents the Ministry at the European "Concerted Action EPBD 1e 2" initiative.

The national transposition started on 2011 via the Decree called "comunitaria 2011" and the cession of the Senate was di approved the directive within the deadline given in the Directive itself (9 July 2012). So, initially, it was planned to approve the transposition within the 9 May 2012 and after in the last June 2012 but at present this has not happened yet.

Important to note that in July 2011, the Ministries of Environment and Economic Development presented to the European Commission the National Action Plan for

Energy Efficiency (PAEE) and proposed a *Strategy for the increase of nZBs* with some *objectives (section 3.8 p.119)*:

1. Definition of "nearly zero energy buildings" in relation with specific parameters (climate, social and economical context) in kWh/m2 per year.

2. A gradual adoption of Minimum requirements, taking care of the differences between different building typologies. Probably intermediate steps should be identified.

3. Dissemination and information about possible financial support in order to achieve "nearly zero energy buildings",

4. Reinforce the role of energy certification

And this strategy proposes three measures:

- To achieve a more effective coordination between private and public bodies in the energy efficiency sector
- To simplify the rules and/or procedures to overcome the barriers that slow down the market penetration of efficient products and technologies;
- To increase the number of legal entities or technologies that can take advantage of support or incentives to access to the energy efficient market.

However, this legislative gap has not filled with any transitional period and has produced as happened already previously to the publication of national guidelines of EPBD, so the *free Interpretation* of this European Directive.

So, the main problem was the missing common definition of nearly zero energy building around the country and consequently a common understanding of the terms related to high performant buildings.

This lack of a common definition causes a further confusion on the building sector because the building actors were not sure if the nearly zero energy building was a building with the class A as given in the Piedmont region or in the Province of Bolzano.

In fact, as mentioned above the regionalisation of the ECB system caused more negative aspects than positive ones. This produces a diversity of approaches moving from one area to another of the country (in Italy there 21Regions and Autonomous provinces…),

creating obvious confusion in the identification of the final class building for the building designers, difficulties in the circulation of qualified experts form one region to another, as well as uncertainty in the market on the real significance of a certain building class for buyers coming from other regions.

For the national transposition of Directive 2010/31/EC , this regional fragmentation generated an strange effect around the country in the common definition of nearly zero energy building : today, the nearly zero energy building is assimilated to the KlimaHaus CasaClima system developed the Bolzano autonomous province (www.agenziacasaclima.it), an a energy certification system for buildings introduced in 2002 and mainly based on the German PassivHaus concept.

Even before the European "Energy performance of building directive" (EPBD) was released in December 2002, the Autonomous Province of South Tyrol had introduced a comprehensive energy certification scheme for buildings. This was the first successful initiative in Italy. First the certification was a voluntary measure. Due to the success of first years and the new availability of specialized planers and craftsmen, since September 2004, the regional government requires a maximum space heat requirement (SHR) of 70 kWh/m²a for new buildings and the CasaClima certification (from here on abbreviated CC) can be used as documentation.

Meanwhile, the provincial government made the certification obligatory for refurbishments and new buildings. Whereas the latter have to fulfil the requirement of a SHR lower then 70 kWh/m²a. Buildings with a SHR lower then 50 kWh/m²a are labeled KlimaHaus CasaClima (CasaClima B:=< 50, CasaClima A:=<30 and CasaClima Gold:= 10 kWh/m²a), all of them can thus be considered as *low energy buildings.*

From beginning of the CC project on it was assumed that the success would not only depend on general promotional measures through media, but also on specific informational and educational measures of all stakeholders. These are understood as end consumers, planners, tradesmen, craftsmen and constructional companies. Accordingly numerous organizations such as the National Craftmen's Association were delegated to hold courses on CC topics. Up to now some Thousand planners (architects, engineers, surveyors) and craftsmen have attended courses on of different level of detail.

Since the implementation of the CC certification scheme, the number of units that were labelled CasaClima B or better significantly rose each year. Since it can be assumed, that the number of low energy buildings was equal or lower in years before the introduction, it becomes obvious, that the project did not only bring the common

advantages of a energy performance of buildings certification, such as the possibility to compare the energy performance of different new buildings, but in fact, drastically increased low energy buildings applications in South Tyrol.

Probably the above mentioned successfully story of the the KlimaHaus CasaClima System can explain why most of the building stakeholders today believe that it represents an exemplary experience to reach the nZEB target in Italy.

This is also the recent national communication called „Tour Edifici a Energia Quasi Zero“ (
below mentioned) that is mainly oriented on the widespread of the CasaClima system approach, even if this professional debate around the country is moderated by others experts not CasaClima - oriented.

Of course, we are aware that when discussing moving the entire market toward nZNB, it is important to differentiate between the technical feasibility, the economic rationale, and the policy implications of such actions. The existence today of numerous CasaClimaClass A buildings—mostly residential but also school buildings—demonstrates that under certain conditions it is possible to deliver a nZNB building.

So, the nZNB road map in Italy should be enriched by the existing experiences such as CasaClima but should find its own and shared way.

Moreover, even if an effort was made to adapt the definition of PassivHaus concept to several other climates than the Nordic one, not only within the KlimaHaus CasaClima system but also thanks the European project such as *Passive-on*, we believe that the forthcoming common definition of nearly zero energy building that will be produced by the national transposition of Directive 2010/31/EC can pave the way for a more MED approach of nZEB in Italy.

In fact, as stated on the article 9, the Member States must have in their national plans a detailed application in practice of the **definition of nearly zero-energy buildings, reflecting their national, regional or local conditions**, and including a numerical indicator of primary energy use, expressed in kWh/m² per year.

“There is no "one-size fits all" solution. Solutions for Nearly Zero Energy Buildings should be best defined at national level.

At Regions Level

A said a national effort is underway to define nZNB within the end of 2012 And even if the famous and successful example of the Bolzano autonomous province seems to act as ambassador for the NZEB implementation in Italy, in a parallel effort, several regions have initiated efforts to put the building sector on a path to nZNB and are working as front runners to implement the EPBD recast. For example

- Region Trentino Alto Adige- Provincia Autonoma di Bolzano approved on 25.06.2012 by *Deliberazione* 939/2012
  Main measures adopted:

- increase of the proportion of renewable energy for heating, cooling and sanitary hot water production. the total primary energy must be covered for at least 40% by renewable energy. From 1 January 2017 this percentage will rise to at least 50%;
- when replacing or upgrading existing heating/cooling systems, the total primary energy must be covered for at least 25% renewable energy. From 1 January 2017 this percentage must be at least 30%;
- All new buildings should be in CasaClima Class B or more. From 1 January 2017, All new buildings should be in Class A or more;
- limits for Co2 emissions of residential buildings (in kg Co2/m2a) based on heating degree days. (from 30 to 50 kg Co2/m2a).

- Region Liguria

approved on 30.07.2012 by Regional law n.23/2012

An operative regional directive should be published to define the minimum requirements for nZEB. These will be updated each 5 years.

- Region Sardegna

Law draft “Legge europea regionale 2011 - To be approved
Main measures proposed:
(Art. 6 Disposizioni in materia di impianti alimentati da fonti rinnovabili e di edifici ad energia quasi zero)

- proportion of renewable energy for sanitary hot water production. The primary energy for sanitary hot water production must be covered for at least 50% by renewable energy for all new buildings and relevant retrofitted buildings. (20 % on historical context);
- increase of the proportion of renewable energy for heating, cooling and sanitary hot water production. the total primary energy must be covered by renewable energy for at least 30% by 2013, 40% by 2016 and 50% by 2017 for all new buildings and relevant retrofitted buildings;
- In the design phase, buildings designers should provided a sufficient surface for thermal solar energy;
- Installation of photovoltaic systems as foreseen in D.Lgs.n. 28/ 2011.

An operative regional directive should be published to define the minimum requirements for nZEB, the incentives for the buildings built in accordance with the n.9 of 2010/31/CE directive.

5.1.3. Other governmental & non-governmental initiatives related to nZEB

National „Tour Edifici a Energia Quasi Zero“ promoted by Edilportale, Archiportale (NGOs

– Web portal for building stakeholders) aimed to discuss and widespread the implementation of the nZEB concept within the stakeholders of the building sector.

Launched in March 2012, the Tour is proposing technical meetings in different cities: Ancona, Bergamo, Cagliari, Catania, Firenze, Genova, Bari, Napoli, Padova, Parma, Perugia, Pescara, Roma, Torino, Udine.

This initiative was candidate at the Sustainable Energy Europe Awards (*Category ‘Communicating’)* in the framework of the Sustainable Energy Week 2012.

The edition 2012 of “Edifici a Energia Quasi Zero ” Tour, the second one, has been coordinated by Edilportale, Archiportale with the collaboration of Agorà and the support of numerous building stakeholders: Ministero dello Sviluppo Economico - Ministero dell’Ambiente - Patto dei Sindaci - Consiglio Nazionale degli Ingegneri - Consiglio

Nazionale degli Architetti, Pianificatori, Paesaggisti e Conservatori – Consiglio Nazionale dei Geometri e Geometri laureati - Consiglio Nazionale dei Periti Industriali e Periti Industriali laureati - Consiglio Nazionale dei Geologi - Istituto Nazionale di Urbanistica – Federcostruzioni – ENEA – Patto dei Sindaci - Legambiente - Unione Nazionale Costruttori Serramenti, Alluminio, Acciaio, Leghe.

More info on website: http://www.edilportale.com/csmartnews/eeqz_modulo.asp

Tavoli di Lavoro 4E promoted by ENEA aimed to create synergy between key stakeholders in the building sector and improve the demand-supply relationship for effective low-carbon renovation. This initiative is a consultation mechanism launched in April 2011, in parallel to the IEE REQUEST Project

Main results are position papers, shared proposals to the central government and clustering for Energy Efficiency targets achievement.

The "Tavoli di Lavoro 4E" initiative produced two main key documents:

1) Proposal called "55% Plus" (September 2011) : Consensus around an improved financial scheme for energy renovation
2) Position paper on energy performance certification (June 2012): a shared vision for the Italian transposition of the EPBD Recast.

This document proposes the following

A) Improving the Energy Performance Certificate

- Update the EPC layout and content
- Integration of estimated consumption indicators
- Quality and details of EPC recommendations
- Remote web-based information system to assure further and more detailed/customised information

B) Integrating regulations and standards

- Mandatory EPC (energy performance certificate) before and after renovation when accessing/granting public incentives

- Mandatory light energy audit and/or visit in order to issue trustable recommendations
- Developing a monitoring system for retrofit and consumption savings
- A harmonised EPC-based system for defining and assessing policies
- Fostering certification of the overall buildings rather than individual building units in multifamily buildings (condominiums)
- A communication campaign for promoting certification and step-by assistance for renovation

This initiative has involved many national Stakeholders 's participants: 32 national associations and federations in the energy and building sector (almost 150 representative entities) : ACER , AESS Modena , AGESI , AIPE , AIRU , ANCE , ANDIL, ANIT, ANPE, ASSITES, ASSOLTERM, ASSOTERMICA , ASSOVETRO , BROSS/REDAIS, CESARCH, CESTEC, CNA, CNAPPC, CNI, CNPI, CONSIP, EUESCO, FEDERCASA, FINCO, FIRE, GBC, GSE, ICIE, ICMQ, RENAEL, SUSDEF, UNCSAAL.

More info on website: http://www.efficienzaenergetica.enea.it/edilizia/tavoli-di-lavoro-4e/

"**Tavolo EPDB2"** organised by Fondazione Sviluppo Sostenibile (NGO) aimed to integrate skills and building capacity in order to promote and facilitate the effective implementation in Italy under the guidance of the Directive and the Directive EPBD1 EPBD2, as part of a broader commitment to improving the energy efficiency of buildings.

Main objectives of this EPDB2 working group:

- to develop intervention methods and technical solutions that represent the best balance between performance and investments for major building types in the national territory;
- to analyse and design formulas and procedures so that the financial viability of the interventions, both with respect to the best use of credit facilities available, both with respect to the development of new incentives, national or local;
- to establish a constant dialogue and targeted with relevant institutions, particularly the Ministry of Economic Development, Ministry of Environment, the regional governments and representatives of the European Commission in Italy;
- to produce documentation and guidance materials for operators, in order to disseminate best practices, methodologies and procedures from time to time are developed from the table;

- to organize meetings and seminars as well as engage in direct support to associations or groups of companies or entities whose representatives participate in the table.

The "Tavolo EPDB2" initiative produced different key documents such as the Tavolo EPDB2's proposal for PAEE (National Action Plan for Energy Efficiency) that contains operative proposals to overcome the barriers to the national implementation of EPDB1/2.

Important to note that the Fondazione Sviluppo Sostenibile strongly emphasizes **the role of Public sector**: in fact, new public buildings must be nZE buildings starting from 31/12/2018, so two years before than other kind of property. This could be a good occasion to design and implement "pilot projects" and to disseminate nZEB concept among people.

This initiative has involved many national Stakeholders 's participants and national experts: ACER REGGIO EMILIA - Azienda Casa Reggio Emilia, ANACI - Associazione Nazionale Amministratori Condominiali ed Immobiliari, AGESI - Associazione Imprese di Facility Management ed Energia, ANCI - Associazione dei Comuni Italiani, A.N.D.I.L. - Associazione Nazionale Degli Industriali dei Laterizi, A.N.I.T. - Associazione Nazionale per l'Isolamento Termico acustico, CIME - Consiglio Italiano Movimento Europeo, C.N.A. - Confederazione Nazionale dell'Artigianato e della Piccola e Media Impresa, DIPARTIMENTO DATA Università della Sapienza di Roma, EDIZIONI AMBIENTE, ESCO eu. - Associazione di Esco, EURALIA - Società Francese di competenze giuridiche istituzionali su Energia e Ambiente, FEDERCASA - Federazione Italiana per la casa, F.IN.CO - Federazione Industrie prodotti impianti e servizi per le Costruzioni, , GESTA S.p.A - Global Service Makers, KINEXIA - Società per la produzione di energia da fonti rinnovabili, KYOTO CLUB, LEGA COOP, MAMUTENCOOP, SERNET - Società di consulenza e progettazione specializzata nel campo dell'efficientamento energetico in edilizi, SORGENIA - Azienda di produzione di energia elettrica e fonti rinnovabili,…

More info on website:
http://www.fondazionesviluppososTenibile.org/

5.1.4. Status of the process and time schedule

In Italy, the calculation of cost-optimal level of minimum energy performance requirements is under discussion. According to ENEA (National Energy and Research Agency), these requirements shall take into account local conditions. This aspect could be crucial in Italy, due to the presence of different climates and therefore to different way of buildings (materials, etc). Furthermore, the costs for the elements of the envelope, the systems for heating and cooling, and labour costs are different from area to area. It is difficult to

harmonize the different price lists coming from different Italian areas. Probably it will be pointed out a unique and national price list "ad hoc" to be used as a reference for the evaluation of the pay-back time. The deadline should be the beginning of 2013.

5.1.5 Preliminary results: nZEB definitions and cost optimality

As explained above, at present in Italy there is not yet a final and legally binding definition for nZEB. According to some experts contacted by Finabita in July 2012, a nZEB is characterized by a nearly zero energy consumption for heating: the very few heating requirements should be satisfied by renewable energy sources. Standards are going to be fixed (e.g. thermal transmittance of glazing surfaces, etc.) and also the percentage of energy contribution from renewable energy. A National Decree is going to be prepared by the Ministry of Economical Development and it will explain the "nearly zero energy consumption standards", fixing the minimum requirements and also the type of consumption considered to satisfied the requirements themselves (e.g.: only heating consumption, or heating and hot water, etc.). It will be clarified also the role of renewable energies, that it is to say if they will be participate in defining the energy performance of the nZEB or not. The text of the Decree will be a synergy between the Ministry of Economical Development, the Ministry of Infrastructures and the Ministry of Environment and it should be ready for the beginning of 2013. Probably it will fix the "intermediate requirements" for building energy efficiency until 2015. This step is necessary, in order to check the response of the stakeholders (building constructors, designers, tenants): the definition of the definitive nZEB standards will depend on the results that means on the efficiency of the buildings which will be constructed until 2015.

References

- *Attuazione della certificazione energetica degli edifici in Italia RAPPORTO 2012* by CTI
- "Implementation of the EPBD in Italy – Status in Nov. 2010" by EC Concerted Action
- Project Outputs of the IEE Passive-on Project
- M.C Torricelli, *Una vision mediterranea per gli edifici a energia (quasi) zero*, Costruire in Laterizio n°147

5.2. Spain

The regulation in force regarding energy saving is the "Basic Document: Energy Saving" titled CTE-HE from the "Technical Code of Buildings (CTE)". The CTE is a comprehensive legislation on building regulations that come into force in 2006. The regulation in force regarding thermal building systems is the 'Regulations for thermal systems in Buildings (RITE)'. The previous Spanish legislation regarding energy saving in buildings dates from 1979 and the previous regulation on thermal building systems from 1998.

The "Technical Code of Buildings (CTE)" was the answer to the Energy Performance of Buildings Directive that gave the Spanish Government the chance to include more stringent energy criteria into this review, not just for the fulfilment of the EU obligations, but also for the implementation of other National Energy Policies, such as the National Energy Efficiency Plan – Energy Strategy E4 - and the Renewable Energy Plan.

5.2.1 Current Status of the implementation of the 2002/91/EC (EPBD) and 2010/31/EC (EPBD recast) directives.

Legal context

The EPBD was transposed in Spain by means of three royal decrees:

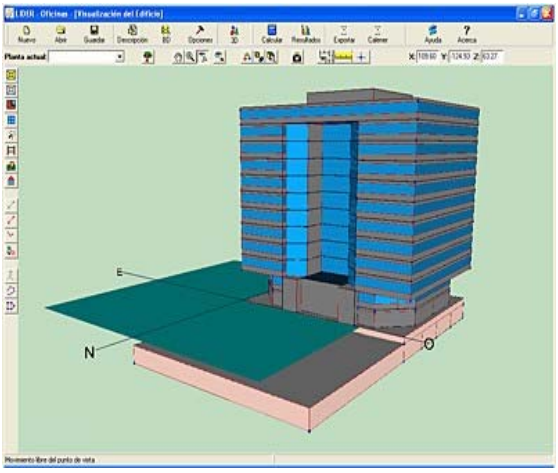
› Royal Decree approving the 'Technical Code of Buildings (CTE)', approved by the Council of Ministers on the 17th of March 2006 and published in the Official Gazette on the 28th of March 2006.

› Royal Decree on the Basic Procedure for Energy Performance Certification of new buildings, approved by the Council of Ministers on the 17th of January 2007, and published in the Official Gazette on the 31st of January 2007.

› Royal Decree approving the review of the current 'Regulations for thermal systems in Buildings (RITE)', which was approved by the Council of Ministers on the 20th of July 2007 and published in the Official Gazette on the 29th of August 2007.

Calculation procedures

The CTE includes a 'Basic Document' on energy saving, titled CTE-HE. This document is in line with the new requirements for energy performance in buildings described in the framework given by the EPBD, including energy saving and RES.



The Spanish calculation procedure is presented in the document 'HE-1 Energy Saving' of the CTE. This Basic Document also includes a software tool, LIDER, designed to fulfil the energy demand limitation requirements as a general option.

As an alternative to the general case, there is a simplified option following a prescriptive approach, to be used in the case of dwellings and within certain limitations, as described below.

Energy Requirements for new buildings

The CTE prescribes minimum energy requirements for new buildings.
The requirements apply to building permits requested after the 17th of September 2006.

The type and level of the performance requirements depend on the climatic zone where the building is located and cover:

› Maximum U-values for different building components;

› Solar factors for windows, roof lights, etc;

› Minimum Efficiency performance for thermal systems, depending on 'solar zones' (see below);

› Minimum Efficiency performance for lighting systems;

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2 2 This entire section is a summary of the chapter "Implementation of the EPBD in Spain: September 2008" from the report: "Implementation of the Energy Performance of Buildings directive 2008: Country reports" draw up by the EPBD Buildings Platform

› Minimum natural lighting contribution;

› Minimum solar contribution to Domestic Hot Water (DHW);

› Minimum photovoltaic contribution to electric power.

Compliance with the requirements of 'Energy demand limitation' (HE1) can be checked using either a simplified procedure (comparing the real values with the limit values for roof, facades, floor and walls in contact with the ground, as a function of the orientation) or by a complex procedure. The complex procedure requires the use of software tools. LIDER, developed by the Government and available for free, is the official such software.

Climatic zones

For limiting energy demand 12 climatic zones have been set identified by a letter corresponding to the division of winter (A, B, C, D,E), and a number corresponding to the splitting of summer (1,2,3,4).

Climate zone of any town is obtained from a table based on the height difference which exists between the locality and the reference height of the capital of their province.

The climatic severity combine degree-days and solar radiation, so that it can be shown that when two locations have the same severity of winter weather (SCI) the heating energy demand of the same building in both locations is equal. The same is applied for the climatic severity of summer (SCV).

For winter five different divisions are identified:

A	B	C	D	E
SCI ≤0,3	0,3 <SCI ≤0,6	0,6 <SCI ≤0,95	0,95 <SCI ≤1,3	SCI>1,3

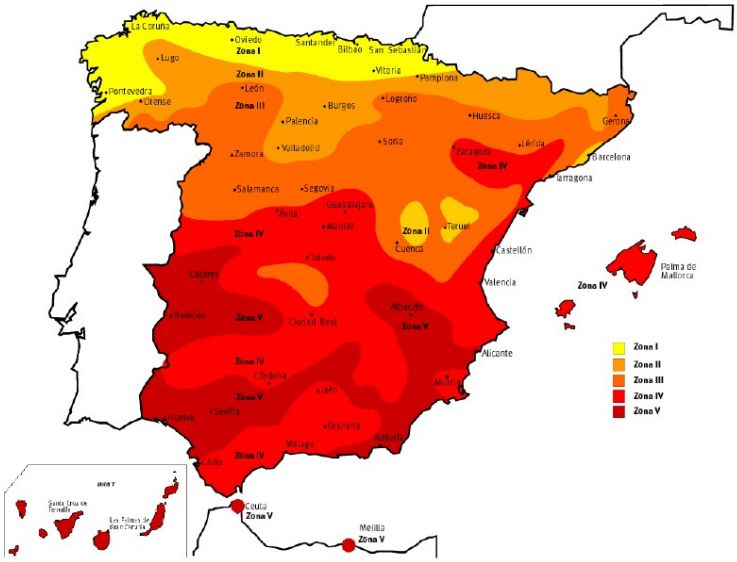
Table 1. Climatic severity of winter. Source: CTE

For summer, 4 different divisions are defined:

1	2	3	4
SCV ≤0,6	0,6 <SCV ≤0,9	0,9 <SCV ≤1,25	SCV>1,25

Table 2. Climatic severity of summer. Source: CTE

Combining the five divisions of winter with summer four would get 20 different areas, of which only 12 are possible.



Zone 1: H < 3.8

Zone 2: 3.8 ≤ H <4.2

Zone 3: 4.2 ≤ H < 4.6

Zone 4: 4.6 ≤ H<5.0

Zone 5: H ≥ 5.0

H is measured in kWh/m²

SC (verano)					
A4	B4	C4		E1
A3	B3	C3	D3	
		C2	D2	
		C1	D1	
SC (invierno)				

Figure.1 Spain CTE Climate zones. Source: INM. Generated from global annual solar radiation isoclines on a horizontal surface.

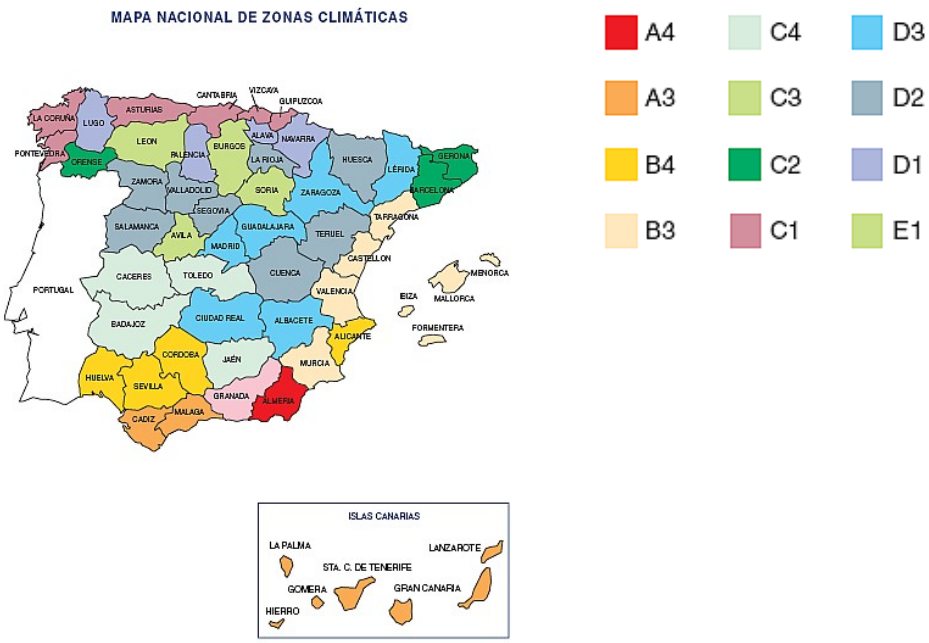


Figure 6. Climatic Zones by provinces. Source: Construmática

Climatic zone	A3	A4	B3	B4	C1	C2	C3	C4	D1	D2	D3	E1	A3
Number of buildings	717.936	89.276	1.314.112	797.136	1.225.491	869.191	452.862	506.210	799.991	720.062	995.334	796.912	717.936
% of buildings	8%	1%	14%	9%	13%	9%	5%	5%	9%	8%	11%	9%	8%

Table 17. Number of existing buildings located in each climatic zone in 2001. Source: Own work

Requirements for existing buildings

Existing buildings have to comply with the same minimum requirements as new ones, when building rehabilitation, enlargement or renovation are carried out, the floor area exceeds 1.000 m^2, or more than 25 % of the building envelope undergoes renovation. As for new buildings, these requirements are mandatory as of September 17th 2006.

Certification of buildings

Certification is obligatory for new buildings when the application for a building permit was made to the Local Authorities after the 31st of October 2007. This applies to all types of buildings (residential, public, commercial etc.).

Certification of existing buildings is still in the process of administrative approval, with another relevant Royal Decree under way. As yet, it is not mandatory when selling or renting, but a 'Basic procedure' for the certification of existing buildings is expected to be ready and mandatory in 2012.

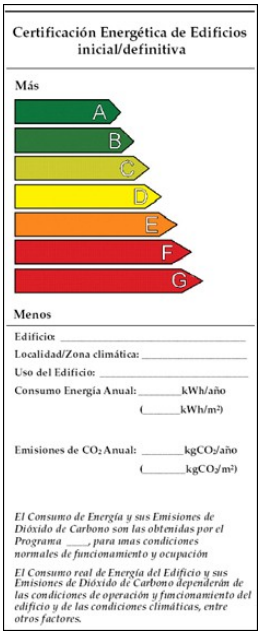


Figure 7.
Energy certification label

The energy rating scale in Spain ranges from A (very high performance- to G, which represents low performance. Besides the government does not publish the classification F and G, so all the buildings beyond a certain value are class E, but can be F and G. This global rating is assessed according to the building's global emissions: CO2 emitted per unit floor area per year (kgCO2/m2.year), regardless of the existing partial ratings relative to the various consuming energy services (heating, cooling and hot water, only). Moreover, there are partial ratings depending on the demand and energy consumption stated in terms of kWh/m2.year of end-use and primary energy, and in kgCO2/m2.year for the various energy-consuming services (heating, cooling and hot water).

Linked you will find the last report about this issue

Report about "implementing the Energy perfomance Of Building Directive" for countries.

http://www.epbdca.org/Medias/Downloads/CA_Book_Implementing_the_EPBD_Featuring_Country_Reports_2010.pdf

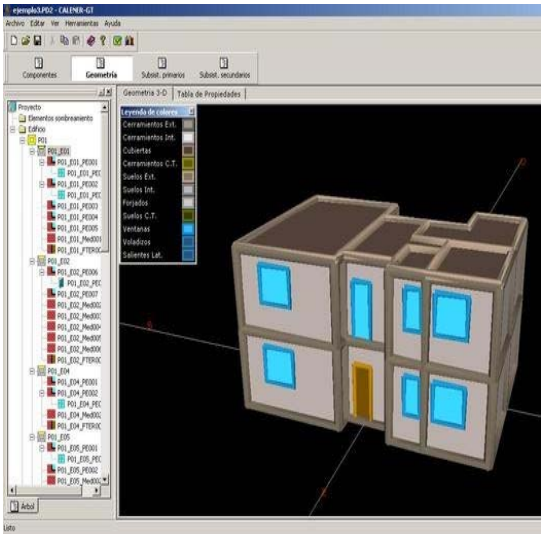


Figure 8. CALENER GT user interface

As for the calculation of energy demands, the 'National Basic Procedure' for energy certification allows for two possible methods: a simplified method and a complex method. The latter requires the use of a software tool, the official one being 'CALENER'. So far, there are two different versions: CALENER_VYP (for dwellings and small tertiary sector buildings) and CALENER_GT (for big tertiary sector buildings). All matters pertaining to the control, inspection and registration of the energy performance certificates of buildings are under the authority of Autonomous Communities Governments.

In this way, basic requirements for thermal systems and HVAC systems are defined at a national level by RITE. In it, inspection procedures and inspection deadlines are standardized. In addition, the Ministry of Industry, has already published 13 guidelines on inspection methodologies, developed a software insulation tool and created a 'Subsidy Line' for regular energy efficiency inspections. As in the case of the Energy Performance Certificates for buildings, RITE is put into practice by the Autonomous Communities Government administrations. They have the authority to strengthen the national basic requirements for inspections of boilers and HVAC systems (the full installation must be inspected) and are in charge of its practical implementation and data collection. Thus, the Autonomous Communities governments are in charge of the 'practical implementation'.

Valencia Institute of Building has developed software that could make it easier for application of certification of new buildings. This tool is a document recognized by state government.

CERMA is an HOURLY SIMULATION TOOL that takes 5 seconds to do the calculation based on pre-simulated thermal components. The model definition is non geometrical. It is devised for certification of new residential buildings. It tries to do predict the outputs from the first official national calculation tool in Spain (CalenerVyP) to keep the coherence of the national certification scheme but increasing the calculation speed. Features: It assigns fossil CO2 emissions to all the architectural components of the building , just to discover which is producing problems thus allowing the fixing of the problem. It makes a parametric study (in 30 seconds, 48 runs) on actions on the architecture to reduce the emissions (improve the letter)
- i.e. increase de isolation 1cm, 2cm, 3cm, etc...- and on actions regarding the systems -i.e. changing for a condensing boiler, using a better heat pump, etc.

There is a version for existing buildings:
CERMA [R].

The most important is that it is a simple tool for the design and to understand the energy performance of the building.

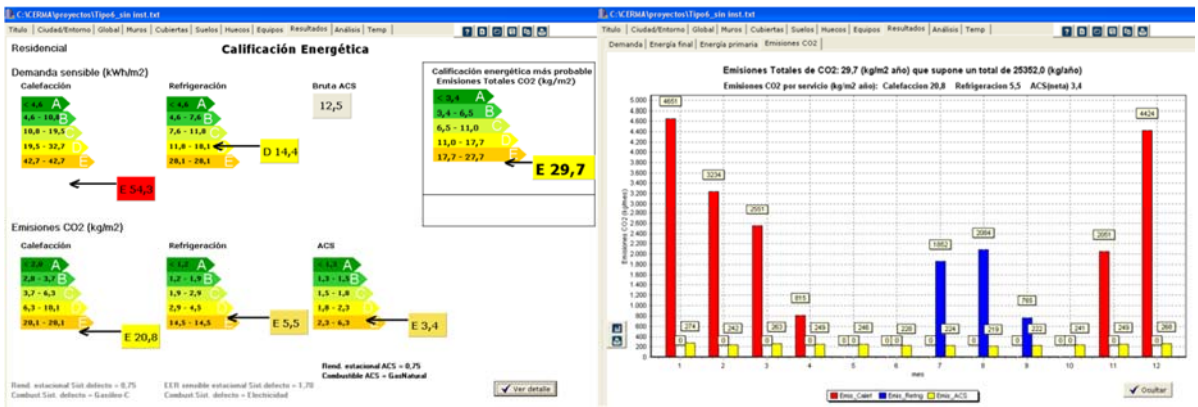


Figure 9. CERMA user interface

More info on website:
http://www.minetur.gob.es/energia/desarrollo/EficienciaEnergetica/CertificacionEnergetica/DocumentosReconocidos/Paginas/documentosreconocidos.aspx

Legislation information

Official texts and software tools are available on the national websites:

› http://www.codigotecnico.org

› http://www.mityc.es/Desarrollo/Seccion/EficienciaEnergetica/CertificacionEnergetica/

› http://www.mityc.es/Desarrollo/Seccion/EficienciaEnergetica/RITE

5.2.2. Other governmental & non-governmental initiatives related to nZEB

There is not a national road map for NZEB buildings although the Ministry is working on it.

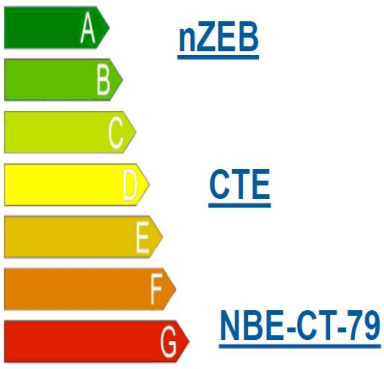
The federal government is conducting a review of the legislation em energy efficiency matter buildings.The proposed schedule is as follows:

- 2011. New Technical Code of Buildings with some requirements that lead to all buildings to class C or higher.

- 2015-2016. New Technical Code of Buildings with some requirements that lead to all buildings to Class B or higher

- 2020. New Technical Code of Buildings. Criteria buildings "near zero emissions.

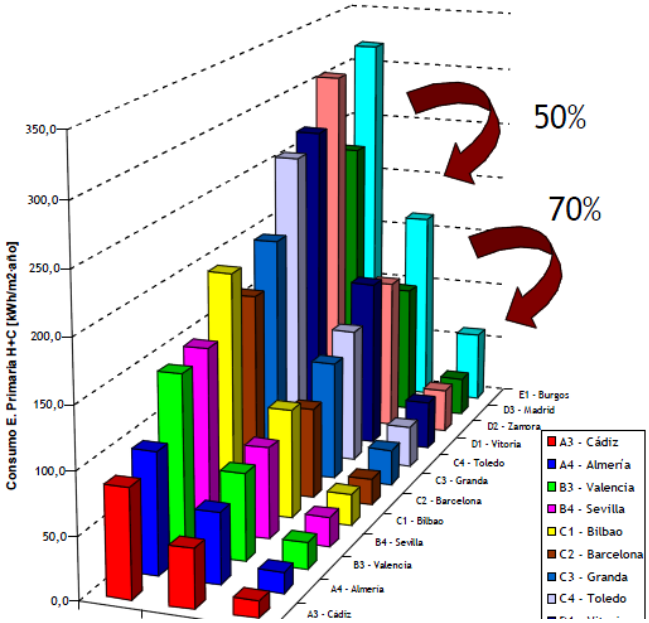
Figure 10. Proposal agenda for national legislation. Resource: ENERGYLAB



The criteria for the reviews will be known from the beginning, so that those who build class C buildings positively know that this building will be out of requirements in the year 2015-2016. This is intended to encourage buildings to be built from high school already. On the other hand, are preparing solution packages with the best cost-effective to serve as references to prescribers.

Figure 11. Comparation evolution of the national legislation and energy efficiency scale for buildings.

Resource: ENERGYLAB



The criteria for the reviews will be known from the beginning, so those who build a class C building will know that this building will be out of requirements in the year 2015-2016. This is intended to encourage buildings to be built already with "near zero emissions" criteria. On the other hand, the government is preparing cost-effective solution packages to serve as a reference.

So, in case of delays in the legislation IVE will use the Spanish A class criteria as equivalent of "near zero emissions" criteria, due to the draft documents say NZEB buildings would be equivalent to A class.

Figure 12. towards energy efficiency zero buildings Resource: I.D.A.E.

6. Case studies and data sets required

6.1. Criteria for selection of case studies

Case studies selected by the taskforces must be useful in the context of influencing the nearly zero definitions and roadmaps.

Therefore the pre-selection of possible case studies should reflect the following criteria:

- *already existing new buildings and renovated buildings to nZE standard (in order to get real data for energy consumption and costs)*
- *selection of best practice projects in the respective countries (this should reflect the current status of innovation)*
- *the projects should be well documented, data should be available according data requirement template*
- *the projects should have a realistic potential for replication within the next 5-10 years (road map to 2020), the analysis of our case studies should provide a reliable basis for nZEB covering relevant market shares within the next years*
- *therefore, we do not focus on high-end research (e.g. plus energy standard) or avant-garde projects in terms of architectural design*

Annex 5: communication to Federcasa membe

Annex I - Energy performance requirements for new residential buildings in Italy in accordance the implementation of EPBD

Heating

The national territory of Italy is subdivided in 6 climate zones (A -F) depending on the heating degrees days (HDD) There are three main requirements for new buildings established at the national level.

a) The *heating primary energy performance indicator (EPi)* for space heating, obtained as the ratio of the annual primary energy consumption vs. surface (for residential buildings) or volume (for other buildings), must be lower than (or equal to) the maximum limit established by the law as a function of the climate and the aspect ratio S/V (surface vs. volume) indicator. These limits will be progressively lowered up until year 2010 when they
will range, for residential buildings, from 8,5 to 116 kWh m^{-2} $year^{-1}$ depending on the climate and the S/V (see following tables)

Building aspect ratio S/V	Climate zone A	B		C		D		E		F
	≤ 600 HDD	601 HDD	900 HDD	901 HDD	1400 HDD	1401 HDD	2100 HDD	2101 HDD	3000 HDD	> 3000 HDD
≤ 0,2	**8,5**	**8,5**	**12,8**	**12,8**	**21,3**	**21,3**	**34**	**34**	**46,8**	**46,8**
≥ 0,9	**36**	**36**	**48**	**48**	**68**	**68**	**88**	**88**	**116**	**116**

Table 1: year 2010 prescribed limit values (EPiL) of the EPi heating performance indicator (kWh m^{-2} $year^{-1}$) for residential buildings

Building aspect ratio S/V	Climate zone									
	A	B		C		D		E	F	
	≤ 600 HDD	601 HDD	900 HDD	901 HDD	1400 HDD	1401 HDD	2100 HDD	2101 HDD	3000 HDD	> 3000 HDD
$\leq 0{,}2$	**2,0**	**2,0**	**3,6**	**3,6**	**6**	**6**	**9,6**	**9,6**	**12,7**	**12,7**
$\geq 0{,}9$	**8,2**	**8,2**	**12,8**	**12,8**	**17,3**	**17,3**	**22,5**	**22,5**	**31**	**31**

Table 2: year 2010 prescribed limit values (Epi_L) of the EPi heating performance indicator (kWh m^{-3} $year^{-1}$) for other buildings

b) The thermal transmittance (U) of the building envelope components must be lower than (or equal to) the maximum limit established by the law as a function of the climate and the S/V indicator. These limits will be progressively lowered up until year 2010. For example, the 2010 limit values for the vertical opaque walls will range from 0,62 to 0,33 W m-2 K-1 depending on the climate (see table 3) . The opaque structures (walls and floors) separating different units inside a building (for example a walls between two different apartment) ant the opaque parts of the envelope of unheated buildings must have a U value lower than 0,8 W m-2 K-1 .

Climate area	Opaque vertical walls	Roof	Floor (over unheated space)	Window (average)	Glazing
A	0,62	0,38	0,65	4,6	3,7
B	0,48	0,38	0,49	3,0	2,7
C	0,40	0,38	0,42	2,6	2,1
D	0,36	0,32	0,36	2,4	1,9
E	0,34	0,30	0,33	2,2	1,7
F	0,33	0,29	0,32	2,0	1,3

Table 3: year 2010 prescribed limit values of the thermal transmittance U (W m^{-2} K^{-1})

c) The average seasonal efficiency of the heating system (ηg), expressed as ratio of the energy delivered to the heated space vs. the primary energy used, must be at least equal to the minimum value established by the law, depending on the boiler heating capacity (Pn) measured in kW, up to a maximum value of 84% as follows:

$$\eta g = 75 + 3 \log(Pn) \%$$

Cooling

There are three main requirements for new buildings established at the national level.

d) The cooling energy performance indicator of the building envelope (EPe, invol) for space cooling, calculated as the ratio of the annual energy removed (or that should be removed) from space for cooling (usually to maintain the indoor temperature equal to 26 °C) vs. surface (for residential buildings) or volume (for other buildings), must be lower than (or equal to) the maximum limit established by the law (see table 4):

	Climate zone	
Building type	**A - B**	**C - F**
	< 900 HDD	> 901HDD
Residential	**40 kWh/m^2**	**30 kWh/m^2**
Other	**14 kWh/m^3**	**10 kWh/m^3**

Table 4: prescribed maximum values of the EPe,invol cooling performance indicator

e) The opaque part of the building envelope in climate zones A, B, C, D and E in areas where the average value of solar irradiance on the horizontal plane, in the month with higher summer irradiation, (Isol,mean) is greater than 290 W / m2 must satisfy the requisites shown in table 5 :

Building structure	**Requisite**

	periodic thermal transmittance (UNI EN ISO 13786:2008)
Opaque vertical walls (excluding walls facing NO, N, NE directions)	**$(Y_{ie}) < 0,12$ W /m^2 K** **OR** mass per unit area **(Ms) > 230 kg/ m^2**
Roof (and other horizontal or inclined walls)	periodic thermal transmittance (UNI EN ISO 13786:2008) **$(Y_{ie}) < 0,20$ W /m^2 K**

Table 5: requisites to be satisfied by the opaque part of the envelope

f) All the glazed elements of the envelope (windows, etc) must be protected by outside placed shading systems (there are some exceptions for glazed components with solar energy transmittance (g) < 0,5).

Domestic hot water

At least 50% of the primary energy needed to prepare domestic hot water must be obtained from renewable sources (there are exceptions for buildings located in the historical areas of the city center). If the supplied water hardness exceeds 15 French degrees of water hardness (150 mg $CaCO_3$/l) it must be properly conditioned in order to prevent clogging and corrosion.

The *domestic hot water primary energy performance indicator (EPacs)*, calculated as the ratio of the annual primary energy used for domestic hot water preparation vs. surface (for residential buildings) or volume (for other buildings), must be evaluated and reported in the energy performance certificate of the building.

Local governments (i.e. regions or autonomous provinces) can establish stricter limits.

Classification criteria for energy certification of buildings.

The guidelines about the classification criteria for energy certification (currently limited to heating and domestic hot water) prepared at the national level are based on the A - G class system adjusted to account for local climate and S/V ratio. The *global classification indicator (EPgl)* is obtained dividing by the surface (or by the volume for non residential buildings) the primary energy used both for heating and for domestic hot water production.

$$EPgl = EPi + EPacs$$

The class limits are obtained from the 2010 limit values of the heating *primary energy performance indicator (EPi_L)* to define the limits of the classes of building energy performance

Classe A_{gl} +	< 0.25 EPi_L (2010) + 9 kWh/m^2 anno
0,25 EPi_L (2010) + 9 kWh/m^2 anno ≤	Classe A_{gl} < 0,50 EPi_L (2010) + 9 kWh/m^2 anno
0,50 EPi_L (2010) + 9 kWh/m^2 anno ≤	Classe B_{gl} < 0,75 EPi_L (2010) + 12 kWh/m^2 anno
0,75 EPi_L (2010) + 12 kWh/m^2 anno ≤	Classe C_{gl} < 1,00 EPi_L (2010) + 18 kWh/m^2 anno
1,00 EPi_L (2010) + 18 kWh/m^2 anno ≤	Classe D_{gl} < 1,25 EPi_L (2010) + 21 kWh/m^2 anno
1,25 EPi_L (2010) + 21 kWh/m^2 anno ≤	Classe E_{gl} < 1,75 EPi_L (2010) + 24 kWh/m^2 anno
1,75 EPi_L (2010) + 24 kWh/m^2 anno ≤	Classe F_{gl} < 2,50 EPi_L (2010) + 30kWh/m^2 anno
	Classe G_{gl} ≥ 2,50 EPi_L (2010) + 30 kWh/m^2 anno

Table 6: limits of the classes of building energy performance for residential buildings according to D.M. 26/06/2009

The energy performance certificate includes, in addition to the class, also the energy performance for heating, cooling and domestic hot water preparation (see fig. 1).

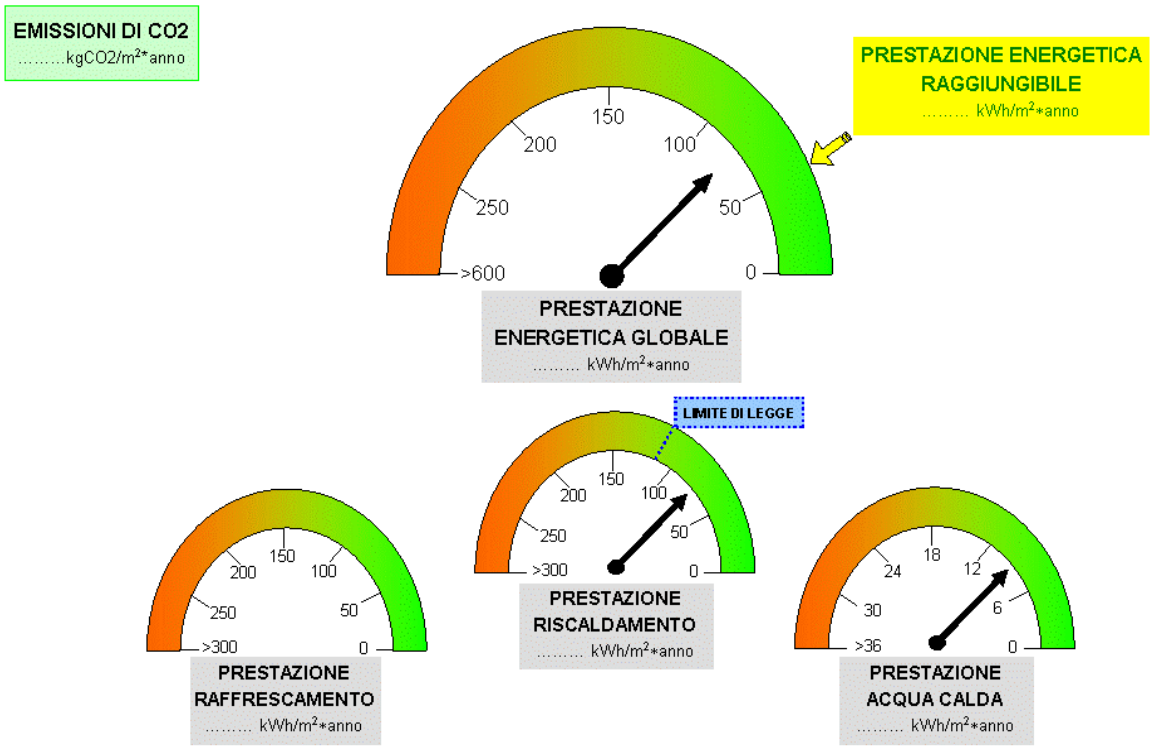


Figure 1: performance indicators as included in the national Italian certificate

Local governments (Regions and autonomous provinces) can adopt different certification criteria. For example, the autonomous province of Bolzano/Bozen and region Lombardy have already adopted the A- G classification without any correction for the S/V ratio. The autonomous province of Bolzano/Bozen uses a reference climate and a classification based on the *net* building energy need for space heating, the Lombardy region, instead, uses for classification the *primary* energy need for heating as calculated for the actual climate but has three different classification scales depending on the degree-days of the area.

Calculation method.

The calculation methods used to evaluate the energy performance of buildings are based on the UNI EN ISO 13790:2008 standard (i.e. the Italian version of EN ISO 13790:2008). The European standards are supplemented by the national technical specifications UNI/TS 11300-1 and UNI/TS 11300-2 . To calculate the building energy need for space heating the monthly method is recommended. Simplified methods for the certification of the existing buildings are outlined in the aforementioned UNI/TS 11300 technical specifications (that give pre-calculated values for thermal bridges and envelope structures as a function of building age and type). National technical specifications for cooling energy need calculations (UNI/TS 11300-3) and systems exploiting renewable sources (UNI/TS 11300-4)

are currently under preparation but not yet released. The local governments should use the same standards, but sometimes the local codes lag behind and still reference the old UNI EN 832 standard.

Conventional input data.

The conventional input data to be used to calculate the energy performance of buildings are indicated in the aforementioned UNI/TS 11300-1 and 2 technical specifications. For example for space heating calculations in residential buildings the internal set point temperatures should be equal to 20 °C and the average daily ventilation air flow rate equal to 0,3 vol/h. Local governments sometimes use different conventional data (i.e. average daily ventilation air flow rate for residential buildings equal to 0,5 vol/h).

Annex II - Energy performance requirements for new residential buildings in Spain in accordance the implementation of EPBD

The EPBD was transposed in Spain by means of three royal decrees:

- Royal Decree approving the 'Technical Code of Buildings (CTE)', approved by the Council of Ministers on the 17th of March 2006 and published in the Official Gazette on the 28th of March 2006.

  Sets out 5 HE guidelines for the following goals: limitation of energy demand, thermal efficiency, lighting efficiency, solar thermal contribution, solar energy contribution.

  Through a proposed Order will update the DB-HE basic document of the Technical Building Code (CTE) on the energy saving in order for compliance with European directives.

  In short, this proposed amendment to DB-HE is the first step to achieve energy consumption buildings nearly zero before those dates. Later, in the short term, the administration plans to establish new requirements stricter regulations aimed at achieving this objective. The approach in reviewingof legislation (draft):

	HE 2006	HE 2011	HE 2015	HE 2020
GLOBAL	NO	Global rating	Limitation Global consumption (absolute value)	Limitation Global consumption (nearly zero buildings)
DEMAND	Limitation demand: self-referential	Limitation demand: Heating+self-referential	Limitation demand: (absolute value)	Idem 2015 (increased requirement)
SYSTEM PERFORMANCE	No (only lighting)	Direct control Trough global requirement	Limitation system performance (residential and tertiary buildings)	Idem 2015 (increased requirement)

RENEWABLES	% thermal solar for Domestic hot water % photovoltaic for electricity	% thermal solar (and others) for Domestic hot water % photovoltaic (and others) for electricity	% renewables for all appliances % electric renowables	Idem 2015 (increased requirement)

- Royal Decree on the Basic Procedure for Energy Performance Certification of new buildings, approved by the Council of Ministers on the 17th of January 2007, and published in the Official Gazette on the 31st of January 2007.

- Royal Decree approving the review of the current 'Regulations for thermal systems in Buildings (RITE)', which was approved by the Council of Ministers on the 20th of July 2007 and published in the Official Gazette on the 29th of August 2007.

Near future of the regulation

Simplifying the regulatory framework:

Spanish energy legislation passed in recent years on the one hand provides the minimum energy requirements ('Technical Code of Buildings (CTE)'), and other energy certification of buildings (Royal Decree on the Basic Procedure for Energy Performance Certification of new buildings).

This approach requires a convergent energy of both standards, so that it is integrated with the same character and performance based.

To address energy efficiency globally, the government are working on performing a regulatory convergence regarding envelope (CTE) and regulations concerning building facilities ('Regulations for thermal systems in Buildings (RITE)')

Evolution of the Spanish energy legislation:

LEVEL1	LEVEL2	LEVEL3	LEVEL4
global consumption	Heating consumption	Heating demand	characteristic parameters of the envelope
		Seasonal Performance facilities	nominal performance
	Cool consumption	Cool demand	
		Seasonal Performance facilities	nominal performance
	Domestic hot water consumption	Solar contribution	
		Seasonal Performance facilities	
	Lighting consumption	Energy efficiency lighting	

Values of updating the rules in 2012 (draft):

Global energy consumption ≥ class C (primary energy)

Values of the envelope of buildings (residential)

	U Values (w/m2K)					
	Climate zone					
Element	Þ	A	B	C	D	E
Wall	0.94	0.50	0.38	0.29	0.27	0.25
Floor	0.53	0.53	0.46	0.36	0.34	0.31
Roof	0.50	0.47	0.33	0.23	0.22	0.19

		U Values (w/m2K)					
		Climate zone					
		Þ	A	B	C	D	E
solar gain	High	5.5-5.7	2.6-3.5	2.1-2.7	1.9-2.1	1.8-2.1	1.9-2.0
	medium	5.1-5.7	2.3-3.1	1.8-2.3	1.6-2.0	1.6-1.8	1.6-1.7
	Low	4.7-5.7	1.8-2.6	1.4-2.0	1.2-1.6	1.2-1.4	1.2-1.3

NEARLY ZERO ENERGY HOUSING FOR WARM/MEDITERRANEAN CLIMATE ZONES

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