



ASsessment and IImprovement of the EPBD IImpact (for new buildings and building renovation)

International WorkShop on the Impact, Compliance and Control of Energy Legislations: *The case of Spain*



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Introduction

- Situation in Spain prior 2002
 - Regulation of Building Envelope
 - NBE-CT-79
 - Fixed limits for global thermal transmittance (Kg)
 - Five Winter Climatic Zones
 - Regulation of HVAC Systems
 - RITE
 - Fixed energy efficiency limits for some equipment
 - Technical Instructions for HVAC systems
- Revision started in 1995
 - initially in the frame of SAVE 76/93 Directive, finally produced a complete BUILDING TECHNICAL CODE, technical works finished by 2002, published in March 2006, covering EPBD articles 4,5,6
 - New version of RITE (August 2007), part of BTC, covering EPBD articles 8 and 9, and 4,5 and 6 for HVAC systems.
 - Royal Decree on Certification of New Buildings (January 2007)
 - Royal decree on Certification of Existing Buildings (being prepared, to be finished by the end of 2009)

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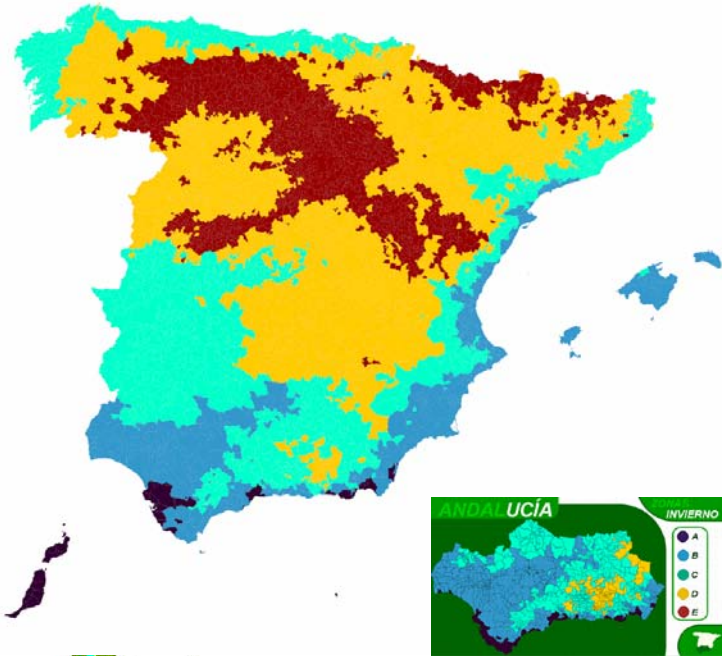
5. Conclusions

Impact of EPBD (I)





- **EPBD minimum requirements** (Articles 4,5,6) are supposed to be fulfilled when the building complies with the requirements stated in the basic document about the building energy aspects in the new building technical code.
- In terms of net energy demand, the new requirements were selected for obtaining a 25% reduction.
- **Spain is divided in 5 climatic winter zones and 4 climatic summer regions, in total, 12 climatic zones.** For every one of these zones, in addition to a minimum level of insulation for avoiding condensations and moulds, prescriptive limits for *thermal transmittances* for opaque components and glazing are imposed. For summer conditions maximum values of *modified solar factors* for windows have been selected, depending on the internal gains of the buildings.
- Compliance is obtained in two ways:
 - **Prescription:** all the building elements are better than the maximum values;
 - **Performance:** the calculated net energy demand is lower than that of a reference building built with the prescriptive elements.

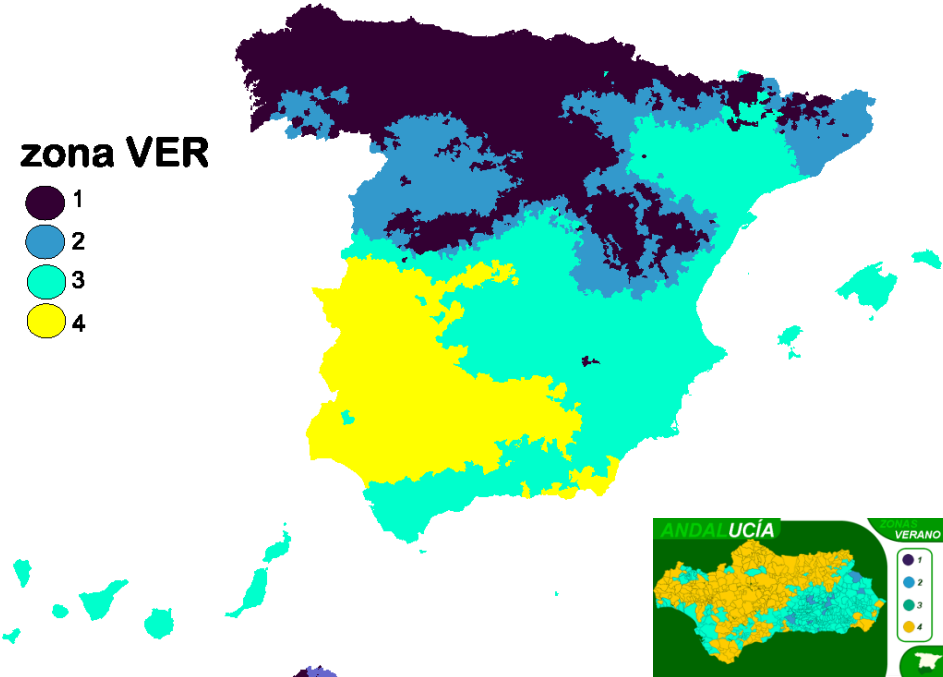
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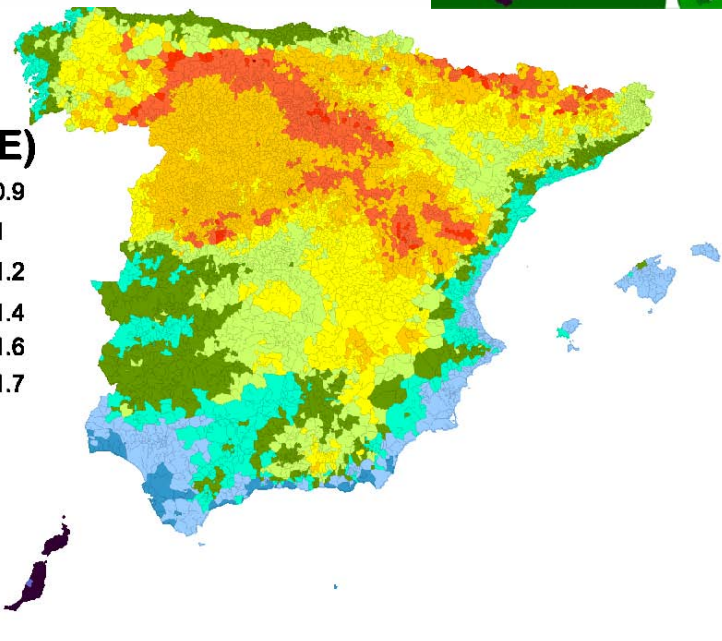
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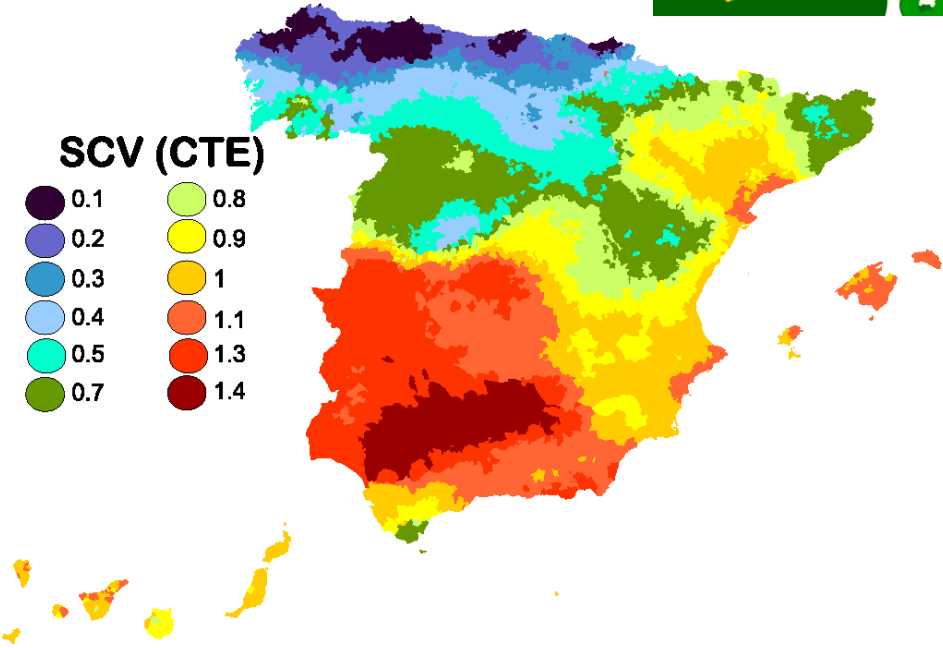
SCI (CTE)

- | | |
|---|---|
|  -0.2 |  0.9 |
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|  0.3 |  1.4 |
|  0.5 |  1.6 |
|  0.7 |  1.7 |



SCV (CTE)

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|--|---|
|  0.1 |  0.8 |
|  0.2 |  0.9 |
|  0.3 |  1 |
|  0.4 |  1.1 |
|  0.5 |  1.3 |
|  0.7 |  1.4 |



Impact of EPBD (I)

ZONA CLIMÁTICA D3

Transmitancia límite de muros de fachada y cerramientos en contacto con el terreno

$$U_{Mlim}: 0,66 \text{ W/m}^2 \text{ K}$$

Transmitancia límite de suelos

$$U_{Slim}: 0,49 \text{ W/m}^2 \text{ K}$$

Transmitancia límite de cubiertas

$$U_{Clim}: 0,38 \text{ W/m}^2 \text{ K}$$

Factor solar modificado límite de lucernarios

$$F_{Llim}: 0,28$$

% de huecos	Transmitancia límite de huecos ⁽¹⁾ U_{Hlim} W/m ² K				Factor solar modificado límite de huecos F_{Hlim}					
	N	E/O	S	SE/SO	Baja carga interna			Alta carga interna		
					E/O	S	SE/SO	E/O	S	SE/SO
de 0 a 10	3,5	3,5	3,5	3,5	-	-	-	-	-	-
de 11 a 20	3,0 (3,5)	3,5	3,5	3,5	-	-	-	-	-	-
de 21 a 30	2,5 (2,9)	2,9 (3,3)	3,5	3,5	-	-	-	0,54	-	0,57
de 31 a 40	2,2 (2,5)	2,6 (2,9)	3,4 (3,5)	3,4 (3,5)	-	-	-	0,42	0,58	0,45
de 41 a 50	2,1 (2,2)	2,5 (2,6)	3,2 (3,4)	3,2 (3,4)	0,50	-	0,53	0,35	0,49	0,37
de 51 a 60	1,9 (2,1)	2,3 (2,4)	3,0 (3,1)	3,0 (3,1)	0,42	0,61	0,46	0,30	0,43	0,32

Compliance is obtained in two ways:

- **Prescription:** all the building elements are better than the maximum values;
- **Performance:** the calculated net energy demand is lower than that of a reference building built with the prescriptive elements.

Impact of EPBD (II)

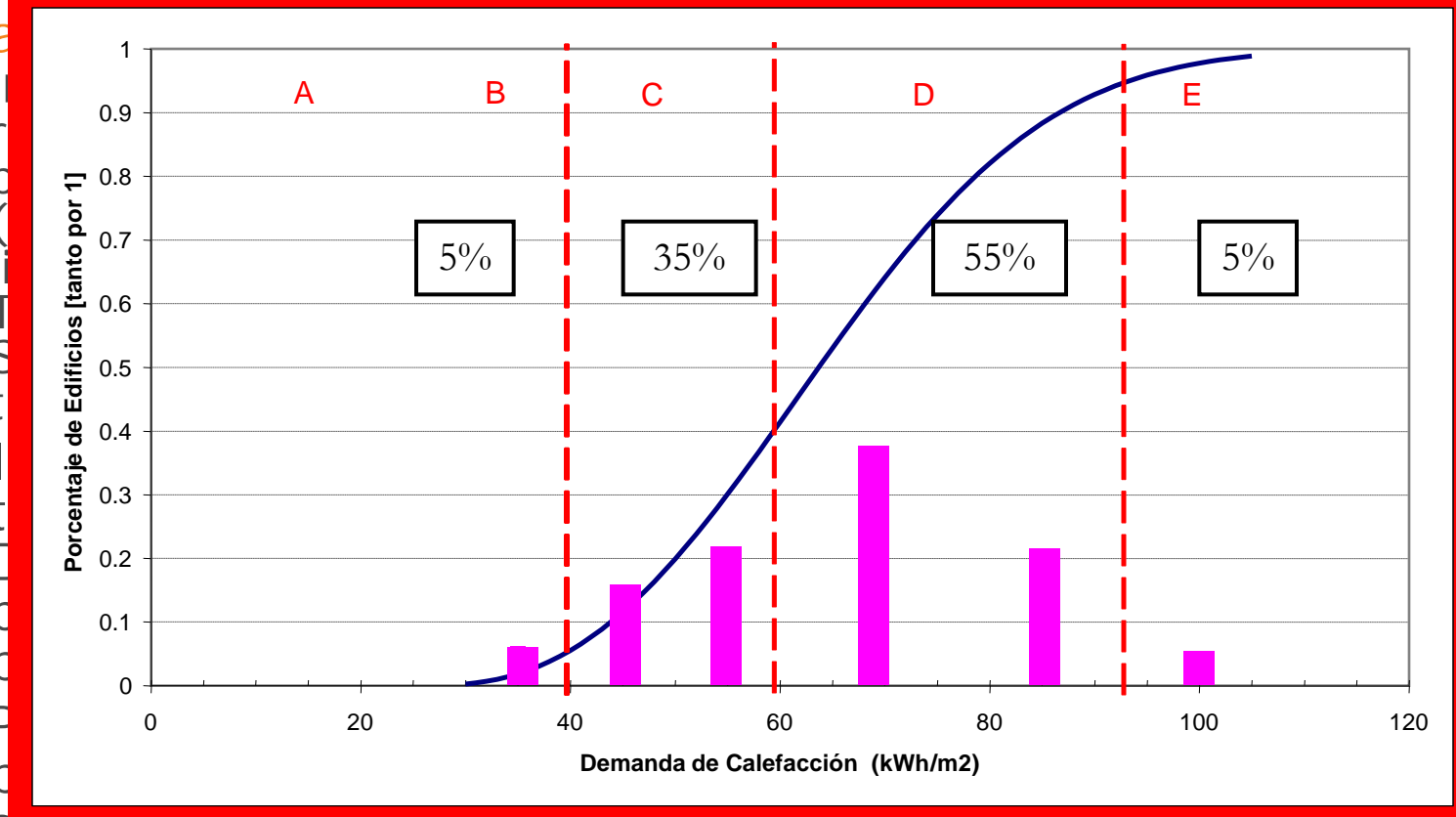
- In addition to minimum requirements for energy demand, there is also requirements for a minimum level of air renovation in residential buildings, and the same for the air renovation in non residential buildings, according to the building type, plus an indication in terms of indoor (operative) temperature and relative humidity for winter and summer periods. These examples and all of the rest of Technical Instructions for the thermal installations in buildings are regulated by another Royal Decree, the RD 1027/2007 RITE [3].
- **The EPBD transposition was a first step since 1979**, after almost 30 years without a signal of activity and without complying with any building thermal regulation. In this first step, the EP requirements are indirectly set by limiting on the one hand the net energy demand, and in the other hand the efficiency of equipments (not systems!).
- It is foreseen that the CTE should be revised every 5 years, and the first revision will be carried out in 2010/2011.

Impact of EPBD (III)

- Although **the minimum requirements are not related to the actual energy consumption**, the certification is very restrictive in what respect the assignation of the Class of energy. So, for residential buildings, it was decided that 90% of the buildings just passing the CTE minimum requirements was assigned to class D (50%) or C (40%), 5% would be E and another 5% would be B. The limit between B and C classes is 70% of the limit between C and D. The limit between B and A classes is an additional reduction of 70%. So the A class building has an energy performance lower than 50% than the average building that just complies with the CTE.
- In the frame of the EPBD transposition and for guiding the path towards 2020, the Spanish government has published a Document on the **National Strategy for Energy Efficiency** in part devoted to the energy efficiency measures applicable to both new and existing buildings.
- Public awareness of the EPC of buildings is not high mostly because for the moment in Spain only new buildings are being certified. Once the certification for existing buildings will be in place it is expected that the awareness will be raised.

Impact of EPBD (III)

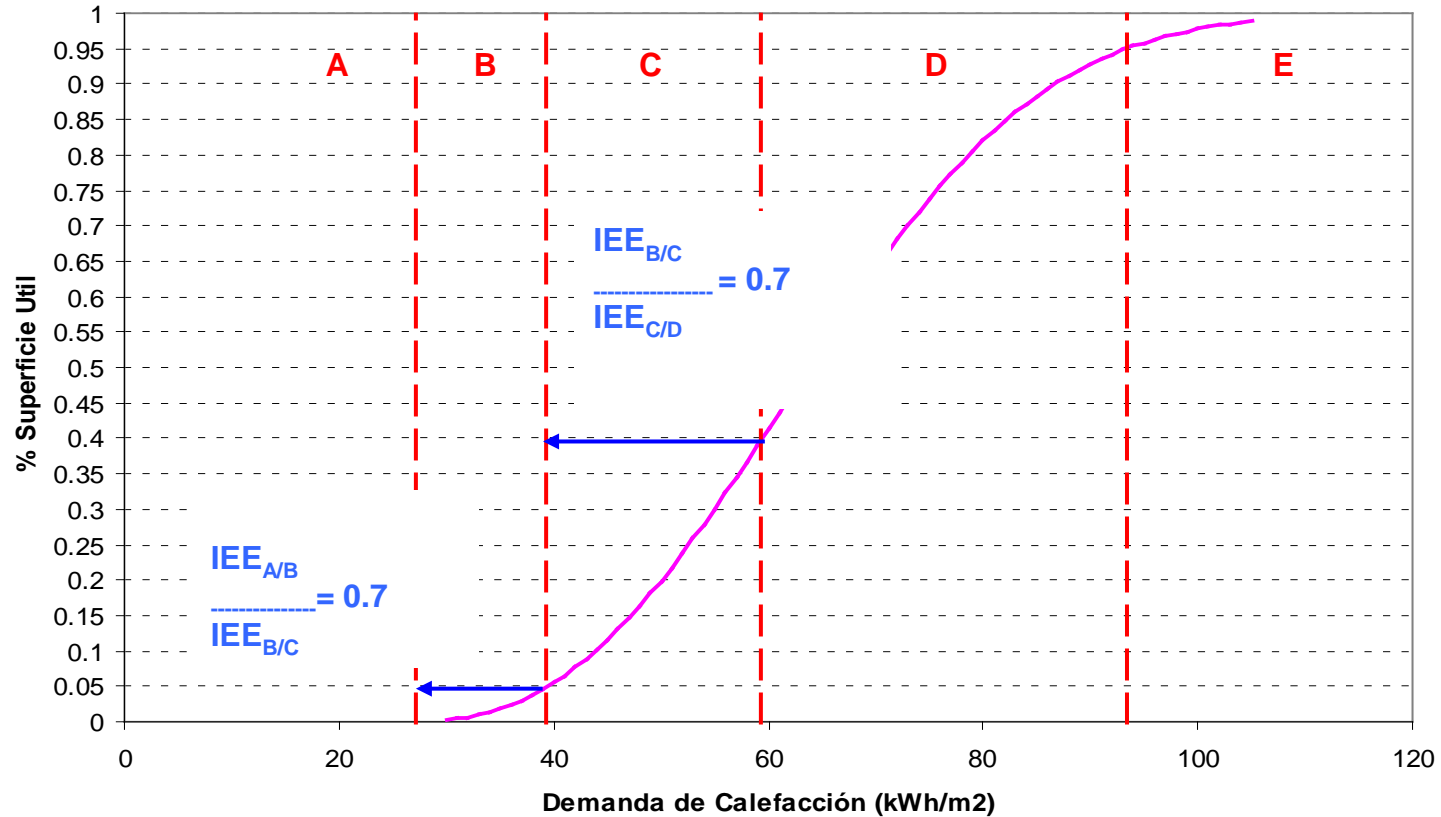
- Although the minimum requirements are not related to the



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Certified. Once the certification for existing buildings will be in place it is expected that the awareness will be raised.

Impact of EPBD (III)

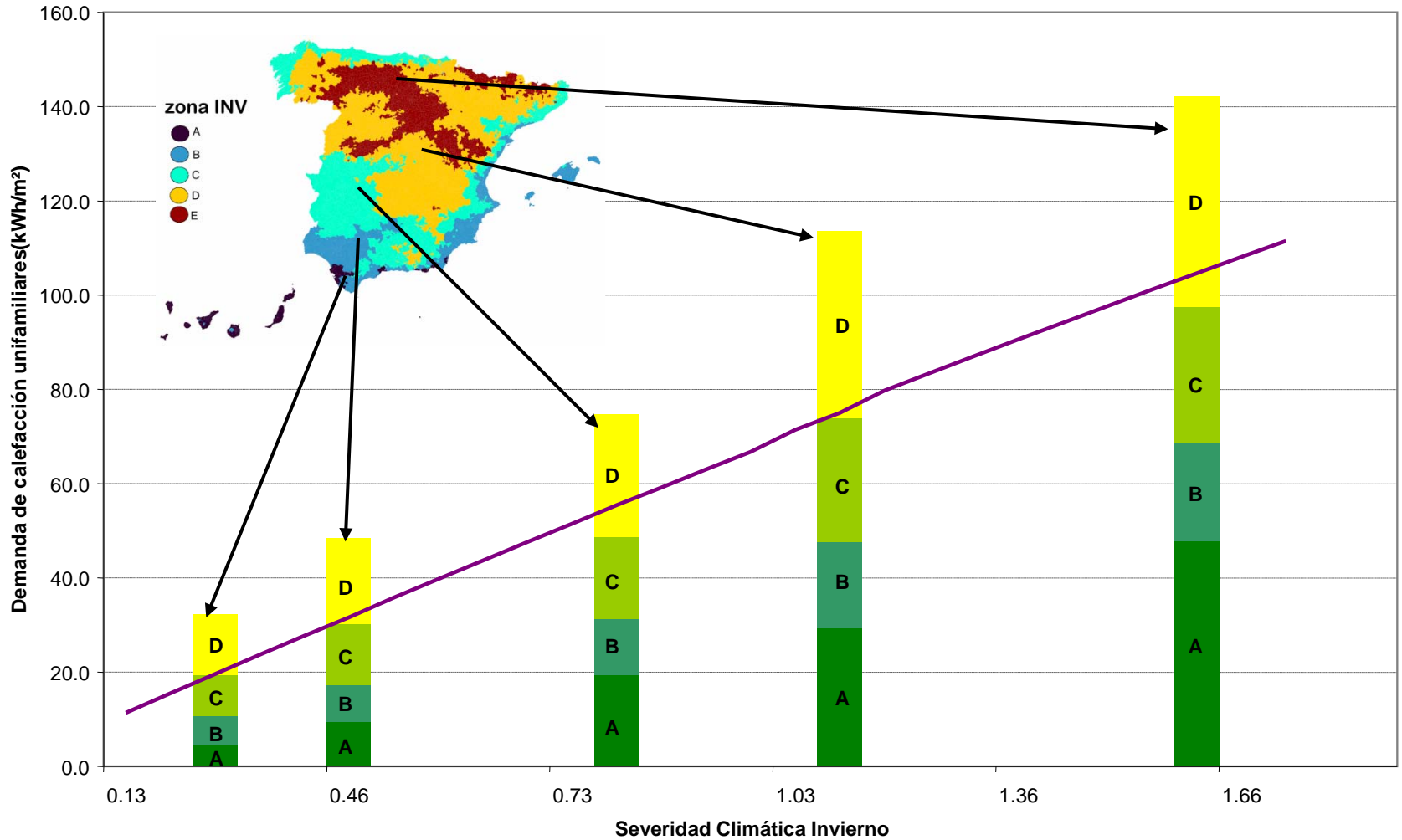


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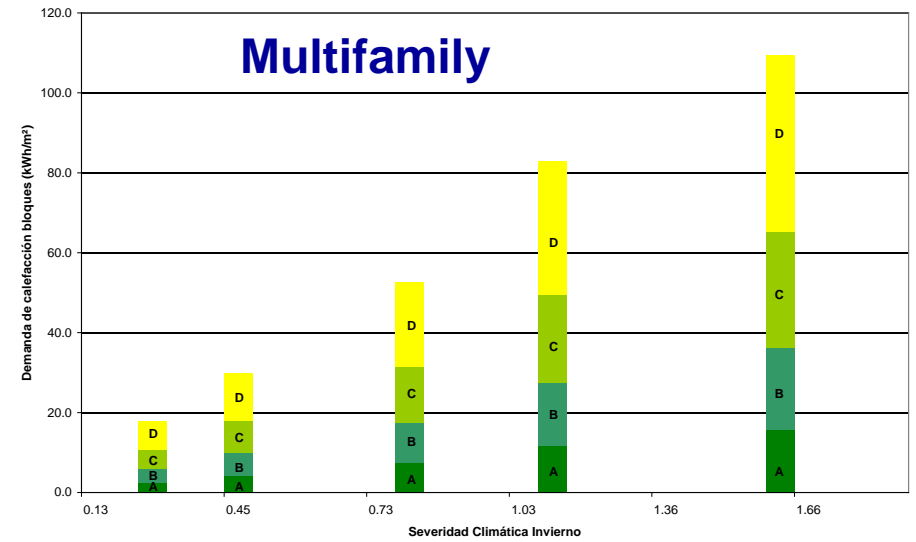
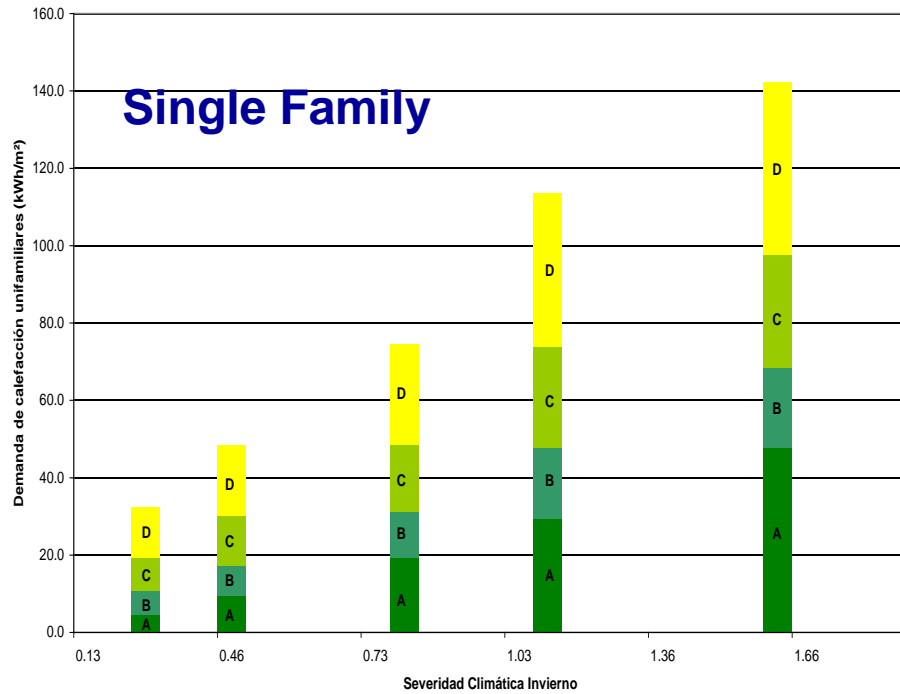
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Impact of EPBD (III)



Impact of EPBD (III)

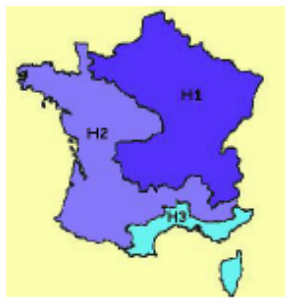


Public awareness of the EPB of buildings is not high mostly because for the moment in Spain only new buildings are being certified. Once the certification for existing buildings will be in place it is expected that the awareness will be raised.

Impact of EPBD (III)

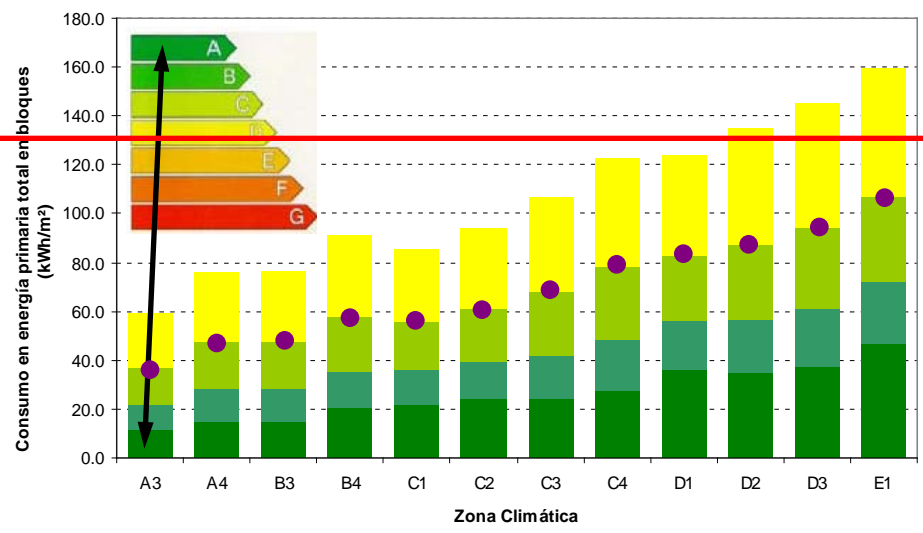
Maximum consumption expressed in primary energy for heating, cooling and production of sanitary hot water in new residential buildings

Type of heating	Climatic zone*	Maximum consumption
Fossil fuels	H1	130 kWh primary/m ² /year
	H2	110 kWh primary/m ² /year
	H3	80 kWh primary/m ² /year
Electric heating (including heat pumps)	H1	250 kWh primary/m ² /year
	H2	190 kWh primary/m ² /year
	H3	130 kWh primary/m ² /year

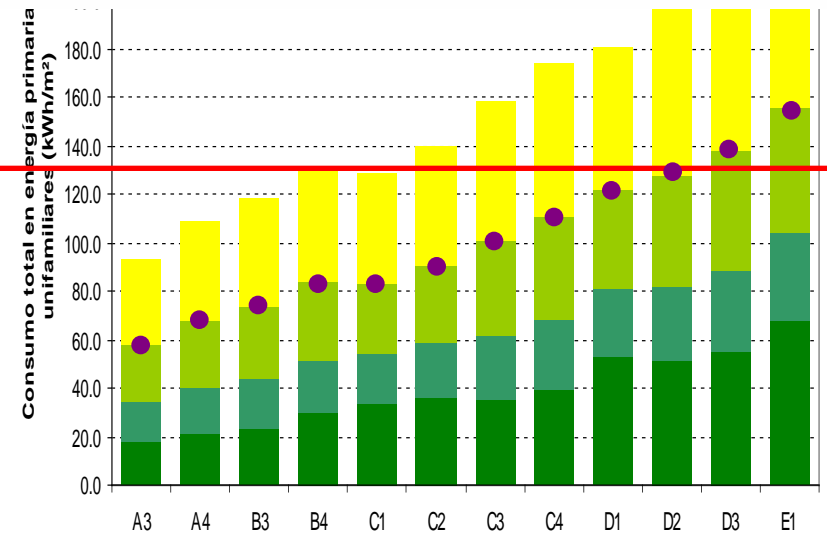


Comparison with France

* the climatic zones are defined in the Decree (H: North, to H3: Mediterranean zone)



Multifamily



Single Family

Non-Residential

Class A	if	$IEE < 0.4$
Class B	if	$0.4 < IEE < 0.65$
Class C	if	$0.65 < IEE < 1.00$
Class D	if	$1.00 < IEE < 1.30$
Class E	if	$1.30 < IEE < 1.65$
Class F	if	$1.65 < IEE < 2.00$
Class G	if	$2.00 < IEE$

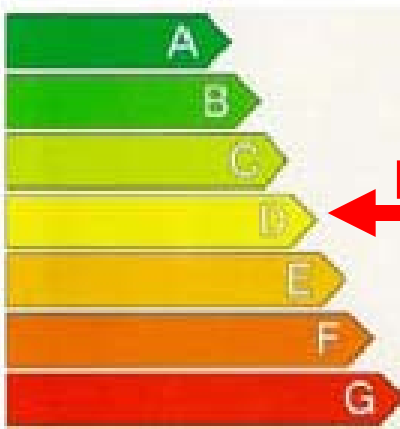
Residential

Class A	if	$IEE < 0.41$
Class B	if	$0.41 < IEE < 0.63$
Class C	if	$0.63 < IEE < 0.94$
Class D	if	$0.94 < IEE < 1.40$
Class E	if	$1.40 < IEE$

E1

Class A	if	$IEE < 0.29$
Class B	if	$0.29 < IEE < 0.55$
Class C	if	$0.55 < IEE < 0.93$
Class D	if	$0.93 < IEE < 1.49$
Class E	if	$1.49 < IEE$

A4



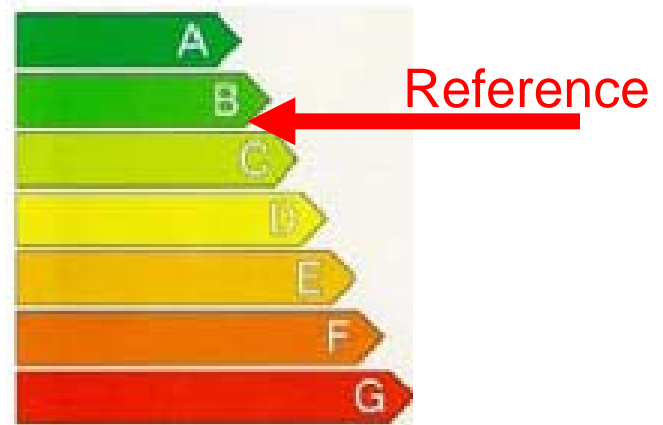
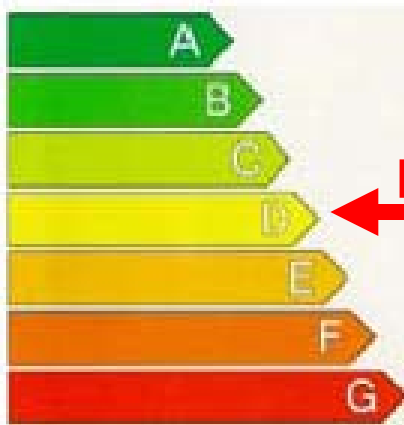
Reference

Non-Residential (Spain)

Class A	if	$IEE < 0.4$
Class B	if	$0.4 < IEE < 0.65$
Class C	if	$0.65 < IEE < 1.00$
Class D	if	$1.00 < IEE < 1.30$
Class E	if	$1.30 < IEE < 1.65$
Class F	if	$1.65 < IEE < 2.00$
Class G	if	$2.00 < IEE$

CEN

Class A	if	$EP < 0,5 R_r$	$IEE = \frac{EP}{R_r}$
Class B	if	$0,5 R_r \leq EP < R_r$	
Class C	if	$R_r \leq EP < 0,5(R_r + R_s)$	
Class D	if	$0,5 (R_r + R_s) \leq EP < R_s$	
Class E	if	$R_s \leq EP < 1,25 R_s$	
Class F	if	$1,25 R_s \leq EP < 1,5 R_s$	
Class G	if	$1,5 R_s \leq EP$	



Impact of EPBD (III)

- Although **the minimum requirements are not related to the actual energy consumption**, the certification is very restrictive in what respect the assignation of the Class of energy. So, for residential buildings, it was decided that 90% of the buildings just passing the CTE minimum requirements was assigned to class D (50%) or C (40%), 5% would be E and another 5% would be B. The limit between B and C classes is 70% of the limit between C and D. The limit between B and A classes is an additional reduction of 70%. So the A class building has an energy performance lower than 50% than the average building that just complies with the CTE.
- In the frame of the EPBD transposition and for guiding the path towards 2020, the Spanish government has published a Document on the **National Strategy for Energy Efficiency** in part devoted to the energy efficiency measures applicable to both new and existing buildings.
- Public awareness of the EPC of buildings is not high mostly because for the moment in Spain only new buildings are being certified. Once the certification for existing buildings will be in place it is expected that the awareness will be raised.

Impact of EPBD (IV)

- Concerning the introduction of renewable energy sources in the building sector:
 - Thermal solar energy is mandatory for all Domestic Hot Water (DHW) installations, in all types of buildings with a DHW demand. This has been a huge impact in the sector, as the typical fraction to be covered by solar energy is 70%.
 - Photovoltaic solar energy is also mandatory for almost all non residential buildings, with a minimum power which is depending on the building size; the minimum being 6.25 kWp.
- Renewable energy production in the building is directly detracted from the delivered energy required by the building, reducing the CO₂ emissions.

Impact of EPBD (V)

- In Spain, the EP is expressed in terms of CO₂ emissions. The conversion factors are published by the Institute for Diversification and Energy Saving (IDAE) which depends of the Industry, Tourism and Trade Ministry (MITYC) and are applicable to the whole country:

Energy Carrier	PE Conversion Factors	CO ₂ emissions conversion factors (kg CO ₂ /kWh)
Domestic Coal	1.000	0.347
LPG	1.081	0.244
GasOil	1.081	0.287
FuelOil	1.081	0.280
Natural Gas	1.011	0.204
Biomass, BioFuels	1.000	0.000
Electricity (Continental Spain)	2.603	0.649
Electricity (Islands, CE, ME)	3.347	0.981

Impact of EPBD (and VI)

- The experts qualified for carry out the certification are the same qualified for designing the building and its technical installations (architects, engineers).
- There are training activities, bust mostly related to the use of the tools.

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Compliance and Control (I)

- The decree about certification of new buildings states the compliance procedures for EP requirements.
- The certificate is obtained first in the project phase, for obtaining the building permit, and must be confirmed later when the building is finished, as built.



- The actual checking is done by each regional government.
- Most of the 17 regions are working in the development of the administrative procedures, for registry, control and inspection.
- Up to date, only four regions have all the basic procedures stated, but only two have finished all the works; none of them have actually started the procedures.
- All of them plan on having them finished for the end of 2009.

Compliance and Control (II)

- There are three different laws that could be applicable depending on what parts of the regulations have not been fulfilled.
 - If the building does not comply with the requirements specified in the CTE, the applicable law would be the Law 38/1999 for the Ordination of the Building Sector (LOE), in this law the different actors participating in the construction process are liable for the defects that compromise the stability of the building during 10 years and for defect that compromise its habitability (insulation, installations...) during 3 years. This law obliges the people participating in the construction to take an insurance to cover the possible defects that could arise during the use of the building.
 - If the building installations do not comply with the requirements specified in the RITE the applicable law would be the Industry Law (Law 21/1992) which states different penalties going from economic fines to activity suspensions.
 - If the EPC has not been issued according to the building project or the final building the applicable law would be the General Law for the Defence of Consumers and Users (Law 26/1984). This could result in administrative penalties which would not substitute the possible civil or penal responsibilities which will be applicable. The expenditure and register of an EPC does not imply the fulfilment of the CTE and the RITE.

Compliance and Control (III)

- The regions can state a specific set of sanctions and some of them have done so.
- Most of the technical staff at the responsible organisms has been trained for understanding the basics of the procedures. Unfortunately, there are not enough manpower for undertaking all the control.

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Additional Topics

- Some activity is started to be seen in the building sector, but due to the actual economic turndown the market is not taking the new perspective of building energy efficiency as fast as it would be desirable.
- Some regions and the Spanish government are stating specific minimum requirements for the public buildings, and/or for social housing.
- Some companies want its own [new] buildings to get the best possible label [A Class, even zero or positive energy].

Additional Topics

- The Spanish government has transferred funds to the regional governments, in the frame of the National Strategy for Energy Efficiency, in particular for Buildings, in which there are subsidies schemes for the building sector, both new and existing:

Measure	Public Funds Application	Direct Savings kTep	Emissions Savings kt CO ₂	Public Funds k€	Total Investments k€
Renovation of existing buildings envelope	Direct subsidy or Reduction of interest rate	1.450	5.232	175.150	2.667.295
Energy efficiency Improvement for HVAC systems in existing buildings	Direct subsidy or Reduction of interest rate	1.685	6.452	243.315	3.719.205
Energy efficiency Improvement for lighting systems	Direct subsidy or Reduction of interest rate	3.339	17.397	176.292	2.694.681
Promotion of new buildings or renovation of existing buildings to obtain A or B class of energy	Direct subsidy or Reduction of interest rate	1.315	5.322	208.914	3.969.362
Revision of EP requirements	---	148	598	0	408.934
<i>Totals</i>		7.936	35.540	803.671	13.469.477

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Conclusions

- The impact of EPBD in the building sector in Spain is very important
- In despite the minimum requirements do not limit directly the EP, the certification procedure is very exigent
- The compliance is good (but only for new buildings) but control, responsibility of regional governments, is delayed due to administrative difficulties
- Public awareness is not yet important
- Subsidies are ready to be applied to energy efficient buildings

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