

# Portugal's experience with building regulations in the context of a mild climate

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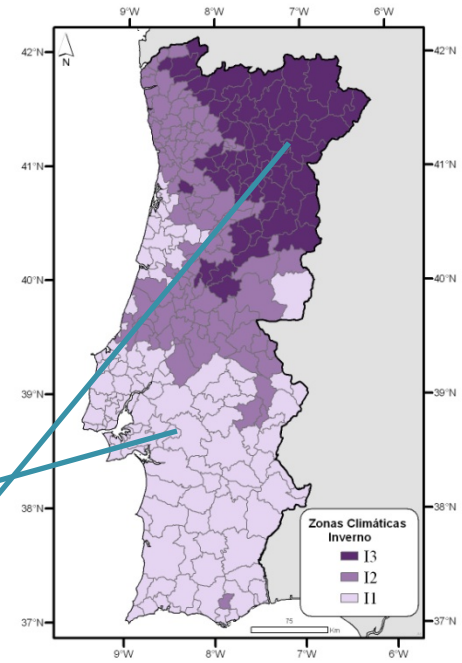


Universidade do Porto  
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Horsens, 6 April 2016

# Portugal

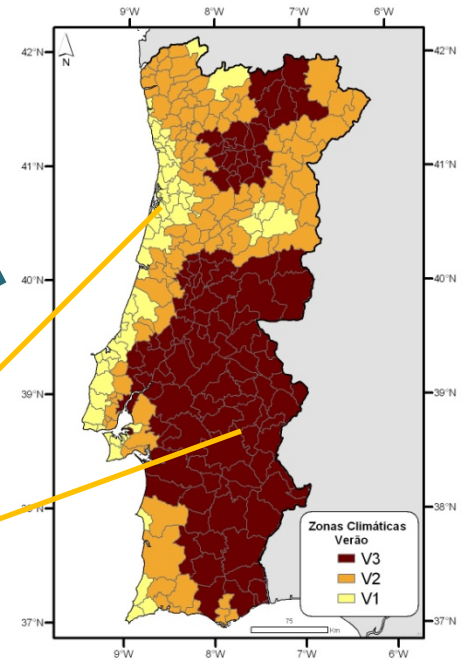


winter

< 1,300 °C.days

> 1,800 °C.days

(Ref. 18°C)



summer

Average T < 20°C

Average T > 22°C

We do not know the meaning of words like “snow” and “freezing”... except a couple of days a year in zone I3...



# Typical buildings

- **Average size dwelling**: 120 m<sup>2</sup> for a family of 4;
- **Heating habits**: only occupied spaces during occupancy (ca. 13.4% of all-winter 24/7 heating consumption);
- **Ventilation**: natural ventilation is most common, central extraction through bathrooms and kitchens in large multifamily buildings – no tradition of balanced ventilation in dwellings;
- **Very little AC.**

- Heavy masonry construction
- Heavy inertia
- 10-15°C day-night outside variation;
- 3-4 °C indoor temp. variation.



# Building Regulations

- **First set in 1990;**
- **Revised with EPBD in 2006;**
- **Last update with EPBD recast in 2013.**
  
- **Cost-optimal calculated on the basis of 24/7 heating and cooling needs winter and summer;**
- **Calculated primary energy needs between 50 and 150 kWh/m<sup>2</sup>.year on that basis (in reality, between 10 and 20 kWh/m<sup>2</sup>.year...);**
- **Ventilation load alone would represent over 60 kWh/m<sup>2</sup>.year in the coldest regions;**
- **Cost-optimal calls for balanced ventilation systems with heat recovery;**
- **Public, building industry and government strongly oppose such a change.**



# Evolution of Minimum Requirements 1990-2020

| Time interval  |                                     | 1990-2006 |         | 2006-2012<br>(First EPBD)   |         | 2012-2016<br>(Recast EPBD) |         | After 2016<br>(Towards NZEB) |         |
|--|-------------------------------------|-----------|---------|---|---------|----------------------------|---------|------------------------------|---------|
|  |                                     | Lisbon    | Bragaça | Lisbon  | Bragaça | Lisbon                     | Bragaça | Lisbon                       | Bragaça |
| U-value<br>[W/m <sup>2</sup> .K]                         | External<br><b>walls</b>            | 1.4       | 0.95    | 0.7   | 0.5     | 0.5                        | 0.35    | 0.4                          | 0.3     |
|  | External<br><b>roof/floor</b>       | 1.1       | 0.75    | 0.5   | 0.4     | 0.4                        | 0.3     | 0.35                         | 0.25    |
|  | External<br><b>window</b>           | 4.2       | 4.2     | 4.2   | 3.3     | 2.9                        | 2.4     | 2.8                          | 2.2     |
|  | <b>Flat<br/>thermal<br/>bridges</b> | None      |         | 2 x U-value (closest element)   |         |                            |         |                              |         |
| Maximum<br>window solar<br>gain factor<br><b>g-value</b> | Light<br>inertia                    | 0.15      |         |   |         |                            | 0.1     | 0.15                         | 0.1     |
|  | Medium<br>and<br>heavy<br>inertia   | 0.56      |         |   |         |                            |         |                              |         |
| <b>Ventilation</b> (ACH)                                 |                                     | None      |         | ≥ 0.6   |         | ≥ 0.4                      |         |                              |         |
| <b>Renewable</b> energy systems                          |                                     | None      |         | Minimum solar energy contribution for domestic hot water<br>(reference value 0.65 m <sup>2</sup> /occupant) |         |                            |         |                              |         |



# Renewables are required for DHW (since 2006)



**Every new building and major renovation (dwellings and non-residential) must have solar thermal collectors to cover ca. 60% of DHW needs.**



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# Systems Requirements first set in 2013

| Building type                             | Technical system                        |                          | Requirement evolution   |  |  | Standard                |
|---|---|--------------------------|---|--|--|-------------------------|
|   |   |                          | Before 2013   | 2013-2015  | After 2016   |                         |
| Residential and non-residential buildings | Heat pumps                              | Cooling                  | None  | Eurovent Label C<br>(Example: Chiller<br>COP ≥ 2.8; EER ≥ 2.7)                 | Eurovent Label B<br>(Example: Chiller<br>COP ≥ 3.0; EER ≥ 2.9) | EN 14511                |
|   |   | Heating                  |   |  | Eurovent Label B<br>(Example: Chiller<br>COP ≥ 3.0; EER ≥ 2.9) | EN 14825                |
|   |   | Domestic hot water (DHW) |   | COP ≥ 2.3  |  | EN 16147                |
|   | Boilers                                 |                          |   | Minimum nominal efficiency 86%   | Minimum nominal efficiency 92%                                 | -                       |
|   | DHW gas heater                          | Power ≤ 10kW             |   | Efficiency ≥ 82%   |  |                         |
|   |   | Power > 10kW             |   | Efficiency ≥ 84%   |  |                         |
| Residential                               | Domestic electric storage water heaters |                          | Maximum stand-by heat loss  |  | EN 60379   |                         |
| Non-residential                           | Air handling unit                       |                          | Eurovent Label D<br>Efficiency ≥ 47%<br>Velocity ≤ 2.5 m/s<br>Δp ≥ 125 Pa | Eurovent Label C<br>Efficiency ≥ 57%<br>Velocity ≤ 2.2 m/s<br>Δp ≥ 170 Pa      | EN 13053   |                         |
|   | Pumps                                   |                          | Minimum EFF2 label  | Minimum IE2 or IE3 class   |  | IEC60034-30             |
|   | Fans                                    |                          |   | Minimum IE2 or IE3 class<br>Minimum SFP 4 or 5 W/(m³/s)                        |  | IEC60034-30<br>EN 13779 |
|   | Lighting                                |                          | None  | Maximum power (W/m²)/100lux<br>Example: Offices 2.5 (W/m²)/100 lux for 500 lux |  | EN 12464-1<br>EN 15193  |
|   | Lifts                                   |                          |   | Minimum C  | Minimum B  | VDI 4707                |
|   | Central building management system      |                          |   | Mandatory if HVAC thermal power > 250 kW                                       |  |                         |



# Cost-Optimal

ok on dwellings

room for improvement on non-residential buildings

|                  |          | Weighted average for primary energy levels  |   |                |
|------------------|----------|---|---|----------------|
|                  |          | Cost-optimal levels of minimum energy performance requirements [kWh/m <sup>2</sup> .year] | Minimum energy performance requirements in force [kWh/m <sup>2</sup> .year] | Difference [%] |
| Residential      | New      | 33.24   | 30.59   | 7.97           |
|                  | Existing | 52.97   | 52.94   | 0.10           |
| Office buildings | New      | 137.3   | 192.0   | - 39.5         |
|                  | Existing | 129.6   | 164.0   | -26.0          |





# Energy Performance Certificates

**Certificação Energética e Ar Interior EDIFÍCIOS** Nº CER 1234567890

**CERTIFICADO DE DESEMPENHO ENERGÉTICO E DA QUALIDADE DO AR INTERIOR**

**TIPO DE EDIFÍCIO: EDIFÍCIO HABITAÇÃO UNIFAMILIAR / FRACÇÃO AUTÓNOMA DE EDIF. MULTIFAMILIAR**

Morada / Situação: \_\_\_\_\_  
 Localidade: \_\_\_\_\_ Freguesia: \_\_\_\_\_  
 Concelho: \_\_\_\_\_ Região: \_\_\_\_\_  
 Data de emissão do certificado: \_\_\_\_\_ Validade do certificado: \_\_\_\_\_  
 Nome do ponto qualif: \_\_\_\_\_ Número do ponto qualif: \_\_\_\_\_  
 Imóvel descrito na:  Conservatória do Registo Predial de \_\_\_\_\_  
 sob o nº  Aut. municipal nº \_\_\_\_\_ Fração autónoma \_\_\_\_\_

Este certificado realça o desempenho energético do edifício em função do seu uso, em conformidade com o Regulamento de Eficiência Energética dos Edifícios (RETEE), aprovado em 2013, e atualizado em 2015. O presente certificado é emitido em conformidade com o Regulamento de Eficiência Energética dos Edifícios (RETEE), aprovado em 2013, e atualizado em 2015. O presente certificado é emitido em conformidade com o Regulamento de Eficiência Energética dos Edifícios (RETEE), aprovado em 2013, e atualizado em 2015.

**1. ETIQUETA DE DESEMPENHO ENERGÉTICO**

**INDICADORES DE DESEMPENHO**

Necessidades anuais globais estimadas de energia útil para climatização e águas quentes:  kWh/m².ano

Necessidades anuais globais estimadas de energia primária para climatização e águas quentes:  kgpe/m².ano

Valor limite máximo regulamentar para as necessidades anuais globais de energia primária para climatização e águas quentes:  kgpe/m².ano

Emissões anuais de gases de efeito estufa associados à energia primária para climatização e águas quentes:  Toneladas de CO<sub>2</sub> equivalentes por ano

**CLASSE ENERGÉTICA**

A+ A A- B B- C C- D D- E E- F F- G

**2. DESAGREGAÇÃO DAS NECESSIDADES NOMINAIS DE ENERGIA ÚTIL**

| Necessidades nominais de energia útil para: | Valor estimado para as condições de conforto térmico de referência | Valor limite regulamentar para as necessidades anuais |
|---|--|---|
| Aquecimento                                 | kWh/m².ano   | kWh/m².ano  |
| Arrefecimento                               | kWh/m².ano   | kWh/m².ano  |
| Preparação das águas quentes sanitárias     | kWh/m².ano   | kWh/m².ano  |

**NOTAS EXPLICATIVAS**

As necessidades anuais globais estimadas de energia útil para climatização e águas quentes, e as necessidades anuais globais estimadas de energia primária para climatização e águas quentes, são calculadas com base no modelo de cálculo de desempenho energético dos edifícios (MCEDE), aprovado em 2013, e atualizado em 2015. O presente certificado é emitido em conformidade com o Regulamento de Eficiência Energética dos Edifícios (RETEE), aprovado em 2013, e atualizado em 2015.

As necessidades anuais globais de energia primária para climatização e águas quentes, e as necessidades anuais globais de energia primária para climatização e águas quentes, são calculadas com base no modelo de cálculo de desempenho energético dos edifícios (MCEDE), aprovado em 2013, e atualizado em 2015. O presente certificado é emitido em conformidade com o Regulamento de Eficiência Energética dos Edifícios (RETEE), aprovado em 2013, e atualizado em 2015.



**GRANDE oportunidade**

**Magnífica Moradia de arquitetura moderna e acabamentos de luxo em fase de acabamentos. Situada num exclusivo condomínio privado.**

Contacto: 212 852 963

**Certificação Energética e Ar Interior EDIFÍCIOS** SCE1234567890

**Certificação Energética e Ar Interior EDIFÍCIOS** Certificado Energético Edifício de Habitação SCE1234567890 Válido até 31/12/2015

**IDENTIFICAÇÃO POSTAL:** Morada AP FONTES FERREIRA DE MELO, Nº51 A Nº51-G Localidade LISBOA, Freguesia S. SEBASTIÃO DA PEDREIRA, Concelho LISBOA, GPS 38.7326, -7.0000

**IDENTIFICAÇÃO PREDIAL/FISCAL:** 9ª Conservatória do Registo Predial de LISBOA Nº de inscrição na Conservatória 816 Artigo Municipal nº 598 Fração Autónoma X

**INFORMAÇÃO ADICIONAL:** Área interior útil de Pavimento: 320 m²

Este certificado apresenta a classificação energética deste edifício no âmbito do presente Regulamento de Eficiência Energética dos Edifícios (RETEE), aprovado em 2013, e atualizado em 2015. O presente certificado é emitido em conformidade com o Regulamento de Eficiência Energética dos Edifícios (RETEE), aprovado em 2013, e atualizado em 2015. O presente certificado é emitido em conformidade com o Regulamento de Eficiência Energética dos Edifícios (RETEE), aprovado em 2013, e atualizado em 2015.

**INDICADORES DE DESEMPENHO**

**Aquecimento Ambiente**

Referência: 200 kWh/m².ano  
 Edifício: 79 kWh/m².ano  
 Renovável: 50 %

**Arrefecimento Ambiente**

Referência: 20 kWh/m².ano  
 Edifício: 21 kWh/m².ano  
 Renovável: 90 %

**Água Quente Sanitária**

Referência: 30 kWh/m².ano  
 Edifício: 30 kWh/m².ano  
 Renovável: 0 %

**CLASSE ENERGÉTICA**

Mais eficiente

A+ 9% a 25%  
 A 26% a 50%  
 B 51% a 75%  
 B- 76% a 100%  
 C 101% a 150%  
 D 151% a 200%  
 E 201% a 250%  
 F Mais de 251%

Menos eficiente

**ENERGIA RENOVÁVEL**

Contributo de energia renovável no consumo de energia útil do edifício: 15%

**EMISSIONES DE CO<sub>2</sub>**

Emissões de CO<sub>2</sub> estimadas ao consumo de energia: 0,8 toneladas

**Entidade Gestora:** ADENE - Agência Nacional de Eficiência Energética

**Entidade Fiscalizadora:** Direção Geral de Energia e Geologia

- EPCs are well implemented since 2007
- Upgraded in 2015
- Energy Rating required in advertisements (if there is an EPC...)
- The national database is well designed and used for policy making
- But... their quality is very questionable – the average cost is under 100 € - there is no political will to enforce quality and training of the Qualified Experts.

# Implementation of the EPBD

## major tendencies in the EU

### I – best practices

- **Clear indication of the NZEB level in the issued EPCs;**
- **Clear administrative procedures requiring a valid EPC as part of the documents needed to obtain a use license (or a construction permit);**
- **Clear requirement for the presence of an EPC during transactions (sales,rent);**
- **Combine EPBD and EED in terms of qualifications for issuing EPCs (energy auditors required);**
- **On-line check of an EPC before it can be issued;**
- **On-line publication of the list of public buildings and their EPCs;**
- **Clear guidelines for inclusion of required energy efficiency in advertisements and no advertisement without the rating;**
- **Combine boiler & AC EPBD inspections with other required safety and F-gas inspections;**
- **Subsidy schemes for rehabilitation of existing buildings towards NZEB with a required EPC before and after the works.**



# Implementation of the EPBD

## major tendencies in the EU

### 2 – bad practices

- EPCs exist and are required by Law, but nobody really checks;
- EPC quality not checked plus lax requirements and training of QEs, means that EPCs are really almost useless;
- Low-cost or free, self-produced EPCs are possible in a few MS – the reputation of EPCs as a worthless piece of paper;
- Very poor TBS requirements in all but less than a handful of MS;
- Lack of compliance checks for legal minimum requirements, EPC quality, EPC display, inclusion of energy labels in advertisements, mandatory inspections – or a make-believe compliance check that really produces nothing useful;
- Assume 100% compliance success because the law so requires and nobody would dare break the Law...;
- Lack of sanctions, or define sanctions that are so absurd – prison, expulsion for life as QE as the only possible penalty - that they simply never apply;
- Rather high allowable primary energy needs for NZEB residential buildings ( $> 100 \text{ kWh/m}^2 \cdot \text{year}$ ) that do not seem to meet the objective “low energy needs... covered by RES”.



# Implementation of the EPBD

## major tendencies in the EU

### 3 – loopholes

- **Advertisements with energy indicators only if there is an EPC.**  
**In contrast with good practices by other MS where publication without the energy rating is simply not allowed;**
- **EPC display in public buildings only if an EPC already exists;**
- **Most proofs of equivalence for alternative measures for inspections are a nice exercise of imagination...**



# Conclusions (PT)

- Portugal has upgraded its Thermal Regulations for buildings to beyond “cost-optimal” in terms of envelope;
- **Cost-optimal** calculated on the basis of an unrealistic heating/AC use pattern by most of the population;
- **90%** of the population lives in the mild climate zones, but the cold northeast (I3) is just as cold as Paris...
- **There is a huge general resistance (unwillingness) to move from natural ventilation (or simple extraction) to required balanced ventilation with heat recovery – not cost-effective under common use patterns;**
- **Renewables for DHW** are now a standard for new construction and major renovations;
- **Discussions with the EC over the use of heat pumps (and balanced ventilation) are ongoing...**



# Conclusions (EPBD)

- **The EPBD has always aimed at very ambitious goals;**
- **The upcoming revision should take stock of its current status of implementation and take a more realistic stand;**
- **NZEBs by 2020 still look as a distant mirage in most MSs;**
- **EPCs need to gain their correct role: a rating but not a replacement for an audit for renovation decisions – they are not (correctly) accepted by banks;**
- **Inspections schemes are simply not working in most MS – regular preventive maintenance and monitoring large systems may be more effective;**
- **Financial schemes for renovation need to be scaled up by several orders of magnitude – NZEB goals shall never be reached otherwise.**



# Common EPCs for Non-Residential

- The new scheme has been postponed until the set of **CEN** standards is ready it should be published in **2016**;
- **The latest version is built upon national reference buildings;**
- This solution shall not solve the its main objective: **compare buildings from on a common basis anywhere in Europe;**
- **This is very important for large building owners (ex., a hotel chain; a property fund; international stores, etc.,...)**
- **Buildings are a very complex issue... with lots of vested interests... and with very powerful lobbies...**

