

# 'SPANISH EXPERIENCE IN SOLAR ENERGY IN BUILDINGS'

"SOLARBUILD: INTEGRATION OF SOLAR TECHNOLOGIES INTO BUILDINGS IN MEDITERRANEAN COMMUNITIES"

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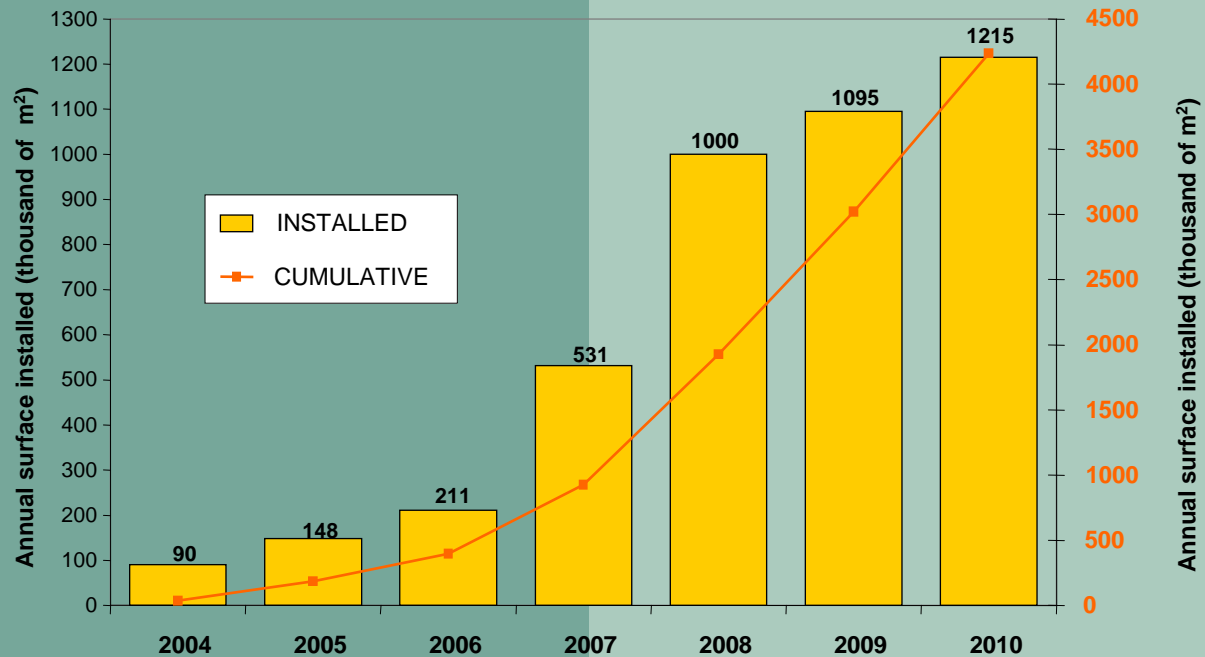
## SOLAR THERMAL

## Renewable Energy Plan REP 2005-2010

- Renewable Energy Plan was approved in Cabinet Meeting on August 26<sup>th</sup> 2005.

### Objectives:

- Solar Thermal 4,200,000 m<sup>2</sup> (4,900,000 m<sup>2</sup> in 2010).



## SOLAR THERMAL

## Renewable Energy Plan REP 2005-2010

### Priority measures

- *CTE (Building Technical Code) APPROVAL.*
- *PUBLIC AIDS TO INVESTMENT.*
- *CITIZENS' AWARENESS CAMPAIGN.*
- *WIDESPREADING AND BACKING TO LOCAL COUNCILS TO APPROVE FISCAL AND SOLAR ORDINANCES.*
- *SUPPORT OF INSTALLATIONS FOR COOLING APPLICATIONS*
- *WIDESPREADING AND TRAINING TO PRESCRIBERS AND LOCAL COUNCIL EXPERTS.*

## TECHNICAL BUILDING CODE

## HE Basic Document

Approval of the TBC thanks to RD 314/2006 (Spanish Official Journal, dated March 28<sup>th</sup> 2006).

It seeks to reach a rational use of energy by reducing energy consumption and replacing part of conventional energy sources by renewable ones.

Energy Saving Basic Document:

- **voluntary** application of the regulation starting on March 29<sup>th</sup> 2006.
- **mandatory** application of the regulation starting on September 29<sup>th</sup> 2006.

## TECHNICAL BUILDING CODE

## Basic Document ES - Energy Saving

### OBJECTIVES OF THE BASIC DOCUMENT ES -ENERGY SAVING

- a) limitation of the energy demand; (HE1)
- b) increase of thermal facilities output (HE2);
- c) increase of efficiency in lighting facilities (HE3);
- d) introduction of the solar thermal energy use (HE4);
- e) introduction of the solar photovoltaic energy use (HE5).

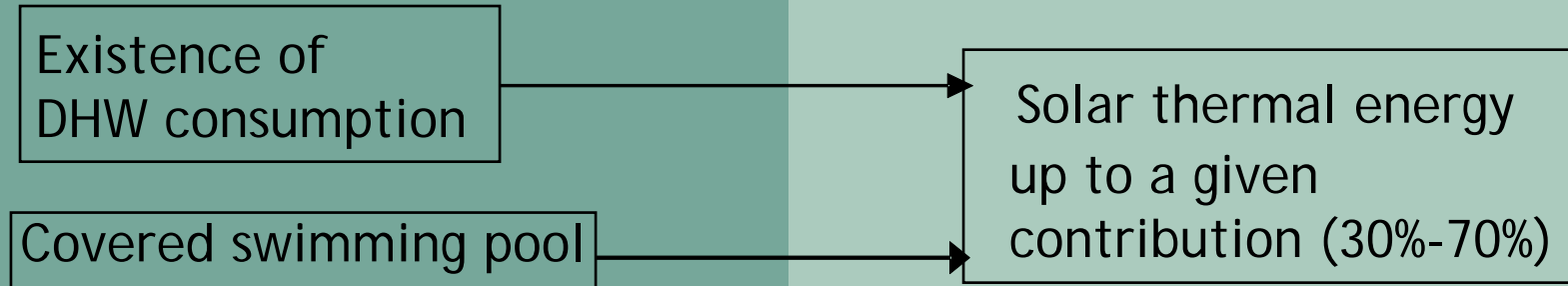
## HE4 SECTION ON SOLAR THERMAL ENERGY OF TBC

## Content

1. General approach
  2. Characteristics and quantification of the demand
  3. Calculation of sizing
  4. Maintenance plan
- Appendixes

## HE4 SECTION ON SOLAR THERMAL ENERGY OF TBC

## General approach



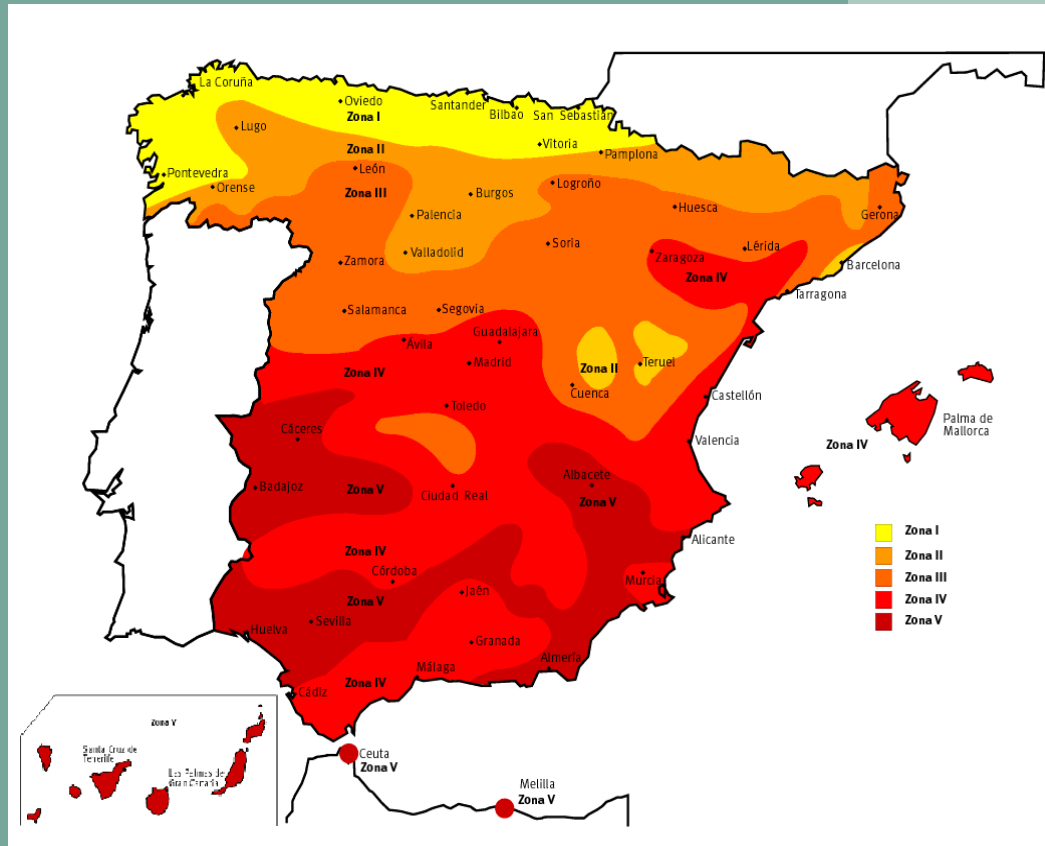
In new and refurbished buildings where the demand of DHW may be planned, the contribution percentage will vary according to the:

- Climatic zone where it is located.
- Building's demand (l/day).
- Kind of conventional fuels substituted.



## HE4 SECTION ON SOLAR THERMAL ENERGY OF TBC

## Minimum Solar Thermal Contribution



### CLIMATIC ZONES

Zone 1:  $H < 3.8$

Zone 2:  $3.8 \leq H < 4.2$

Zone 3:  $4.2 \leq H < 4.6$

Zone 4:  $4.6 \leq H < 5.0$

Zone 5:  $H \geq 5.0$

H is measured in  
 $\text{kWh/m}^2$

Source: INM. Generated from global annual solar radiation isolines on a horizontal surface.

## HE4 SECTION ON SOLAR THERMAL ENERGY OF TBC

## Minimum Solar Thermal Contribution

### Percentages of solar contribution for DHW. GENERAL CASE

Total demand of DHW in the building (l/d)	Climatic zone				
	I	II	III	IV	V
50-5.000	30	30	50	60	70
5,000-6,000	30	30	55	65	70
6,000-7,000	30	35	61	70	70
7,000-8,000	30	45	63	70	70
8,000-9,000	30	52	65	70	70
9,000-10,000	30	55	70	70	70
10,000-12,500	30	65	70	70	70
12,500-15,000	30	70	70	70	70
15,000-17,500	35	70	70	70	70
17,500-20,000	45	70	70	70	70
> 20,000	52	70	70	70	70

## HE4 SECTION ON SOLAR THERMAL ENERGY OF TBC

## Minimum Solar Thermal Contribution

Percentages of solar contribution for SWIMMING POOL HEATING

Covered swimming pool	Climatic zone				
	I	II	III	IV	V
	30	30	50	60	70

# HE4 SECTION ON SOLAR THERMAL ENERGY OF TBC

# Municipal Ordinances

## DISTRIBUTION OF THE APPROVED ORDINANCES



IDAE. Own study  
June 2006

## HE4 SECTION ON SOLAR THERMAL ENERGY OF TBC

## Minimum Solar Thermal Contribution

If the **real solar contribution** exceeds 110% during any month of the year , or reaches 100% of the energy demand during 3 consecutive months. We must take some of these protection measures:

- a) Excess energy will be dissipated.
- b) The collector field will be partially covered.
- c) The collector field will be partially emptied.
- d) The excess energy will be diverted to other existing applications.

## HE4 SECTION ON SOLAR THERMAL ENERGY OF TBC

## Minimum Solar Thermal Contribution

### Partial occupancy of tourist use facilities:

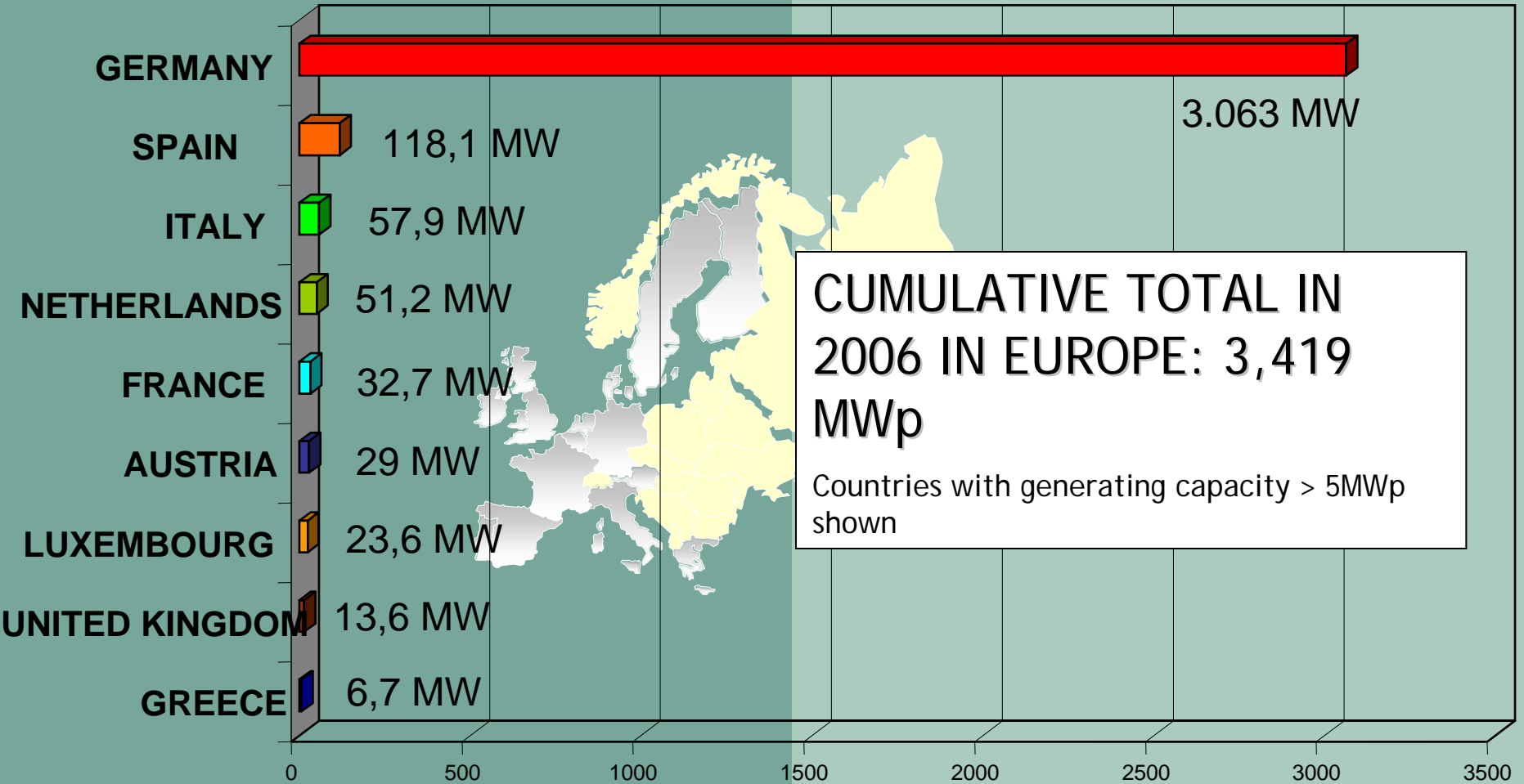
- Getting as close as possible to the maximum level of minimum solar contribution.
- The sizing of the system will be limited by the condition that the produced energy by the system may not exceed, in any month of the year, 110% of the energy demand, or 100% of it in more than three months.
- For this purposes, the periods of time during which the demand is 50% below the corresponding average for the rest of the year **will not be taken into account**, and therefore, the necessary protection measures will be adopted.

## HE4 SECTION ON SOLAR THERMAL ENERGY OF TBC

## Technical Building Code Impact

### *SOLAR THERMAL ENERGY*

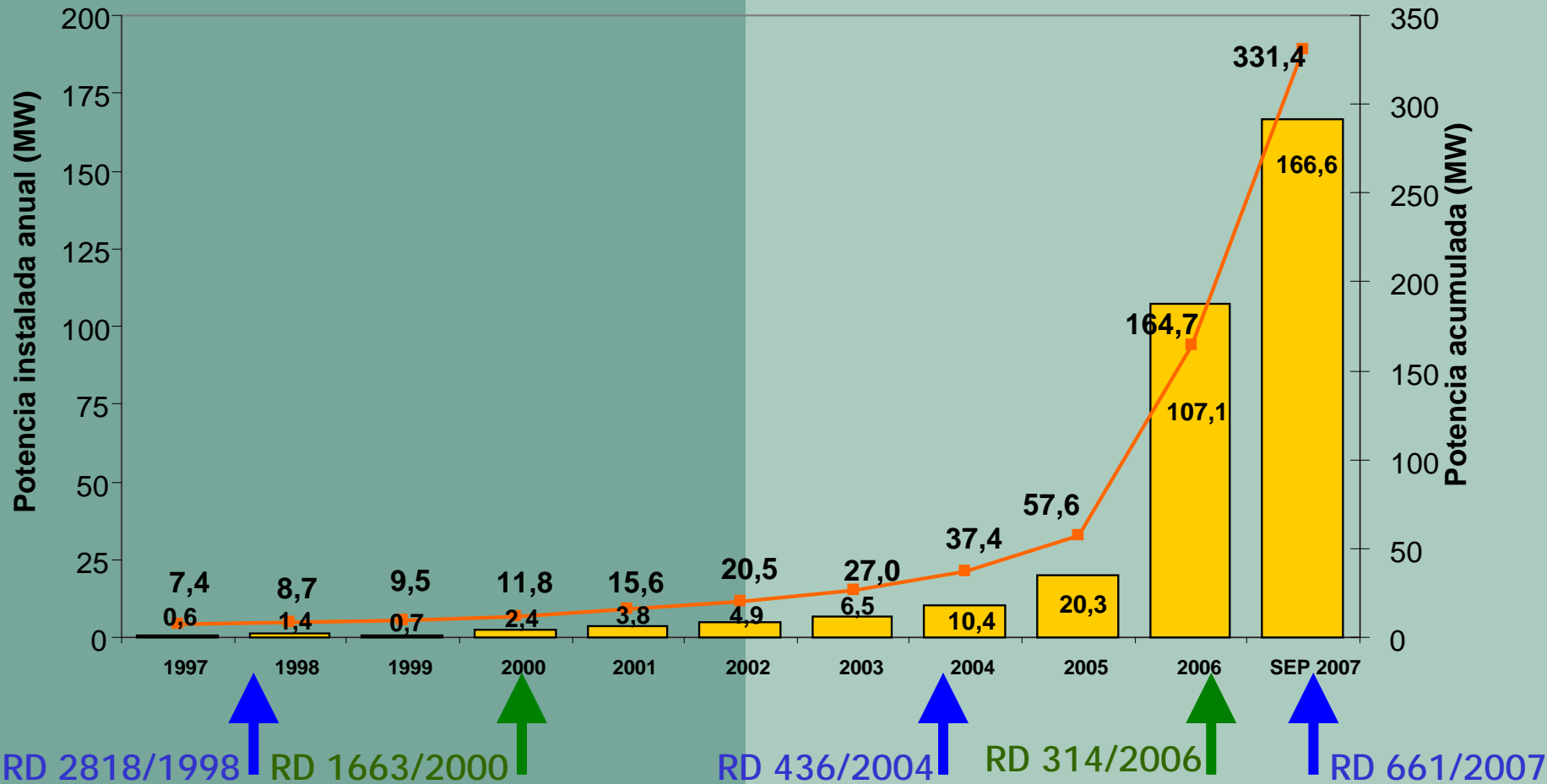
Housing outlook (houses/year)		250,000	450,000
Installable surface	(m <sup>2</sup> )	1,583,000	2,554,000
Replaced energy	(toe)	99,983	163,972
CO <sub>2</sub> avoided	(tCO <sub>2</sub> )	375,073	605,311
Impact on the buildings' construction costs	(%)	0.5 - 0.8 %	
Investment	(M€)	980	1,620

***CURRENT SITUATION******Solar Photovoltaic  
Europe up to 2006***



# CURRENT SITUATION

# Power Installed up to September 2007



## HE5 SECTION ON SOLAR PV ENERGY

## *Solar Photovoltaic Building Regulations*

Certain types of building are to incorporate photovoltaic systems either for their own use or to feed into the grid.

The minimum installed capacity will depend on:

- Climatic zone where located.
- Built area.
- Type of use of building.

For certain uses, as of a given size, and depending on the climatic zone

Calculation of minimum solar photovoltaic generating capacity to be installed

## HE5 SECTION ON SOLAR PV ENERGY

## Minimal PV Contribution

Minimal application limits are higher:

Kind of use	Application limit	
Hypermarket	5,000 m <sup>2</sup>	Floor surface
Multistore. Leisure centre	3,000 m <sup>2</sup>	Floor surface
Storage premises	10,000 m <sup>2</sup>	Floor surface
Administrative	4,000 m <sup>2</sup>	Floor surface
Hotels & hostels	100	Tourist beds
Hospitals y clinics	100	Beds
Pavilions in exhibition centers	10,000 m <sup>2</sup>	Floor surface

## HE5 SECTION ON SOLAR PV ENERGY

## Minimal PV Contribution

- The peak power (P) to be installed is:

$$P \text{ (kWp)} = C \times (A \times S + B)$$

- C is the coefficient defined for each climatic zone.
- A & B are the coefficients defined for each type of use.
- S is the floor surface in square metres.

The minimal power limit will amount to 6.25 kWp. This value will prevail over the result of the formula.

## APPLICATION EXAMPLE

## Minimal PV Contribution

Coefficient C (Table 2.2)

The TBC includes a **list** with the Climatic Zone where the municipalities with a population of over 50,000 belong.

CLIMATIC ZONE	Coefficient C
Zone 1	1.0
Zone 2	1.1
Zone 3	1.2
Zone 4	1.3
Zone 5	1.4

## APPLICATION EXAMPLE

Minimal PV  
Contribution

Coefficients A &amp; B (Table 2.1)

Kind of use	Coefficient A	Coefficient B
Hypermarket	0.001875	-3.12500
Multistore. Leisure centre	0.004688	-7.81250
Storage premises	0.001406	-7.81250
Administrative	0.001223	1.35870
Hotels & hostels	0.003516	-7.81250
Hospitals y clinics	0.000740	3.28947
Pavilions in exhibition centers	0.001406	-7.81250

## APPLICATION EXAMPLE

Minimal PV  
Contribution

A building with minimal application limits are higher:

$$4000 \text{ m}^2 > 3,132 \text{ m}^2$$

$$100 \text{ (tourist) beds} > 99 \text{ (tourist) beds}$$

The application of the formula:

$$P = C \cdot (A \cdot S + B)$$

yields the data shown in the following chart:

KIND OF USE	P (kWp)	C	A (kW/ m <sup>2</sup> )	B (kW)	S (m <sup>2</sup> )
Administrative	5.71	1.1	0.001223	+1.35870	3,132
Hostel & Hotel	2.43	1.1	0.003516	-7.81250	2,850
<b>TOTAL</b>	<b>8.14</b>				<b>5,982</b>

## HE5 SECTION ON SOLAR PV ENERGY

## *Solar Photovoltaic Summary of CTE*

<b><i>SOLAR PHOTOVOLTAIC ENERGY</i></b>		<b><i>MINIMUM</i></b>	<b><i>MAXIMUM</i></b>
Scenario (generating capacity in kWp)		<b>6.25</b>	<b>100</b>
Total installable capacity (MWp)		<b>68</b>	<b>93</b>
Energy replaced (MWh)		<b>74,800</b>	<b>102,300</b>
CO <sub>2</sub> avoided (tCO <sub>2</sub> )		<b>45,000</b>	<b>61,400</b>
Impact on the construction cost of buildings (%)		<b>0.15</b>	<b>0.75</b>
Investment (€m)		<b>473</b>	<b>651</b>



THANK YOU FOR YOUR ATTENTION

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