'SPANISH EXPERIENCE IN SOLAR ENERGY IN BUILDINGS'

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

Athens; 12th of December 2007

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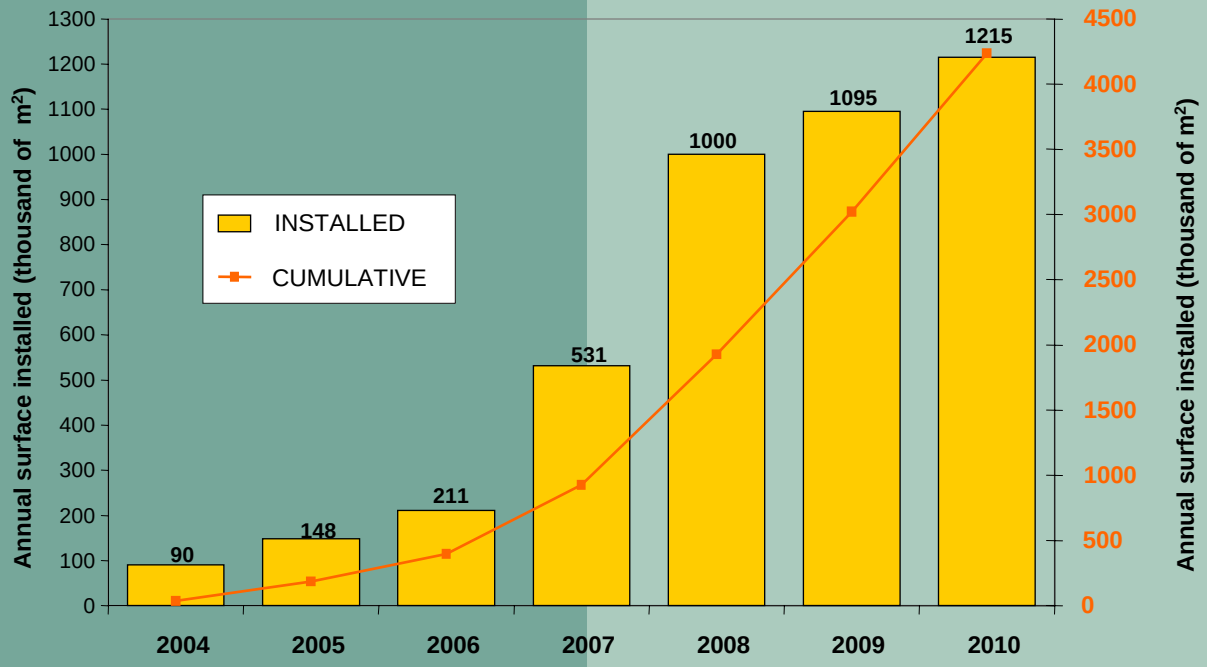
SOLAR THERMAL

Renewable Energy Plan REP 2005-2010

- Renewable Energy Plan was **approved** in Cabinet Meeting on August 26th 2005.

Objectives:

- Solar Thermal 4,200,000 m² *(4,900,000 m² 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 28th 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 29th 2006.
- **mandatory** application of the regulation starting on September 29th 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

HE4 SECTION ON SOLAR THERMAL ENERGY OF TBC

General approach

Existence of DHW consumption

Covered swimming pool

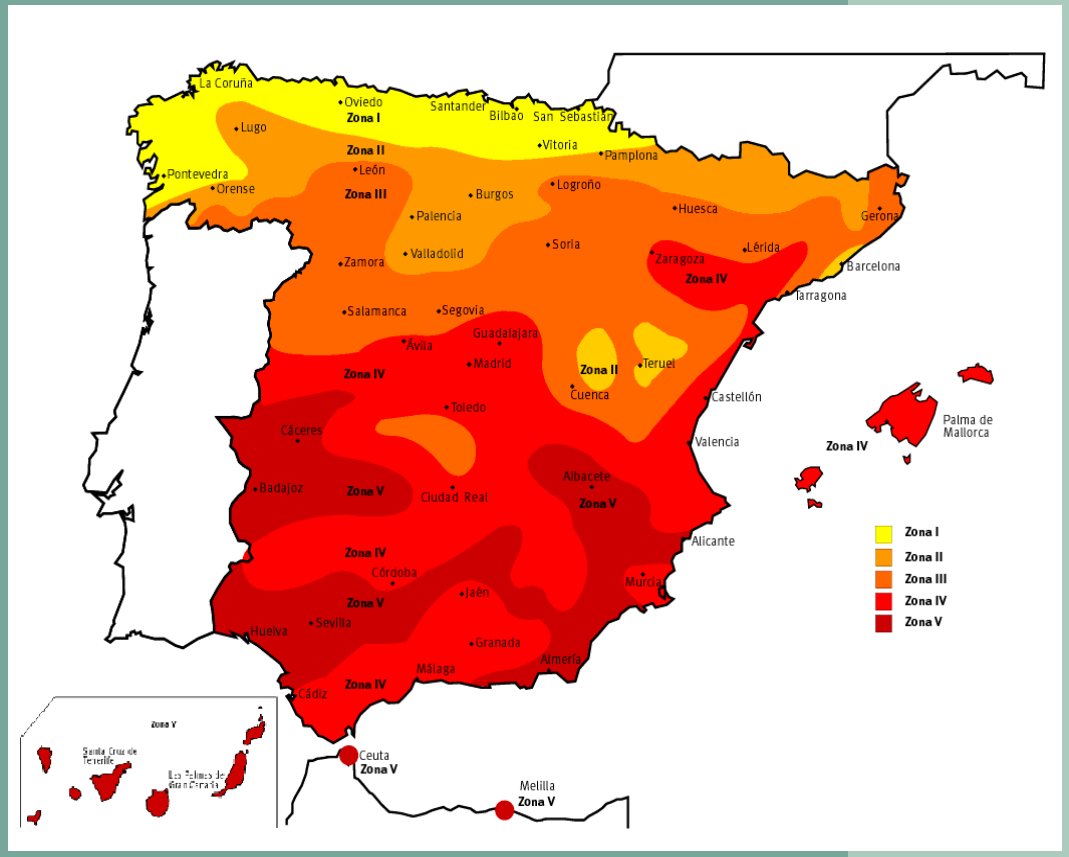
→ Solar thermal energy up to a given contribution (30%-70%)

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



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

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 kWh/m^2

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

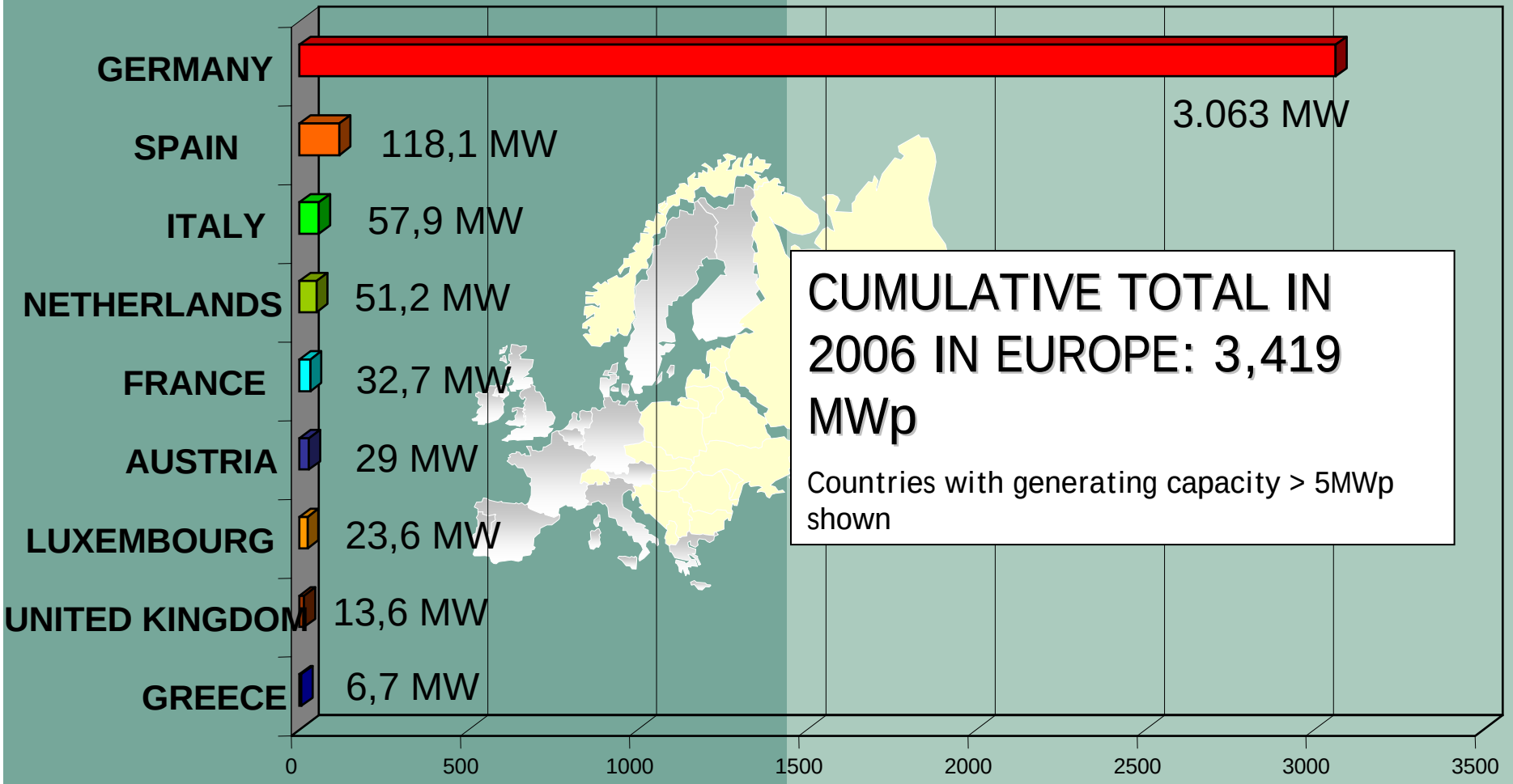
Technical Building Code Impact

SOLAR THERMAL ENERGY

Housing outlook (houses/year)		250,000	450,000
Installable surface	(m^2)	1,583,000	2,554,000
Replaced energy	(toe)	99,983	163,972
CO_2 avoided	(tCO_2)	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



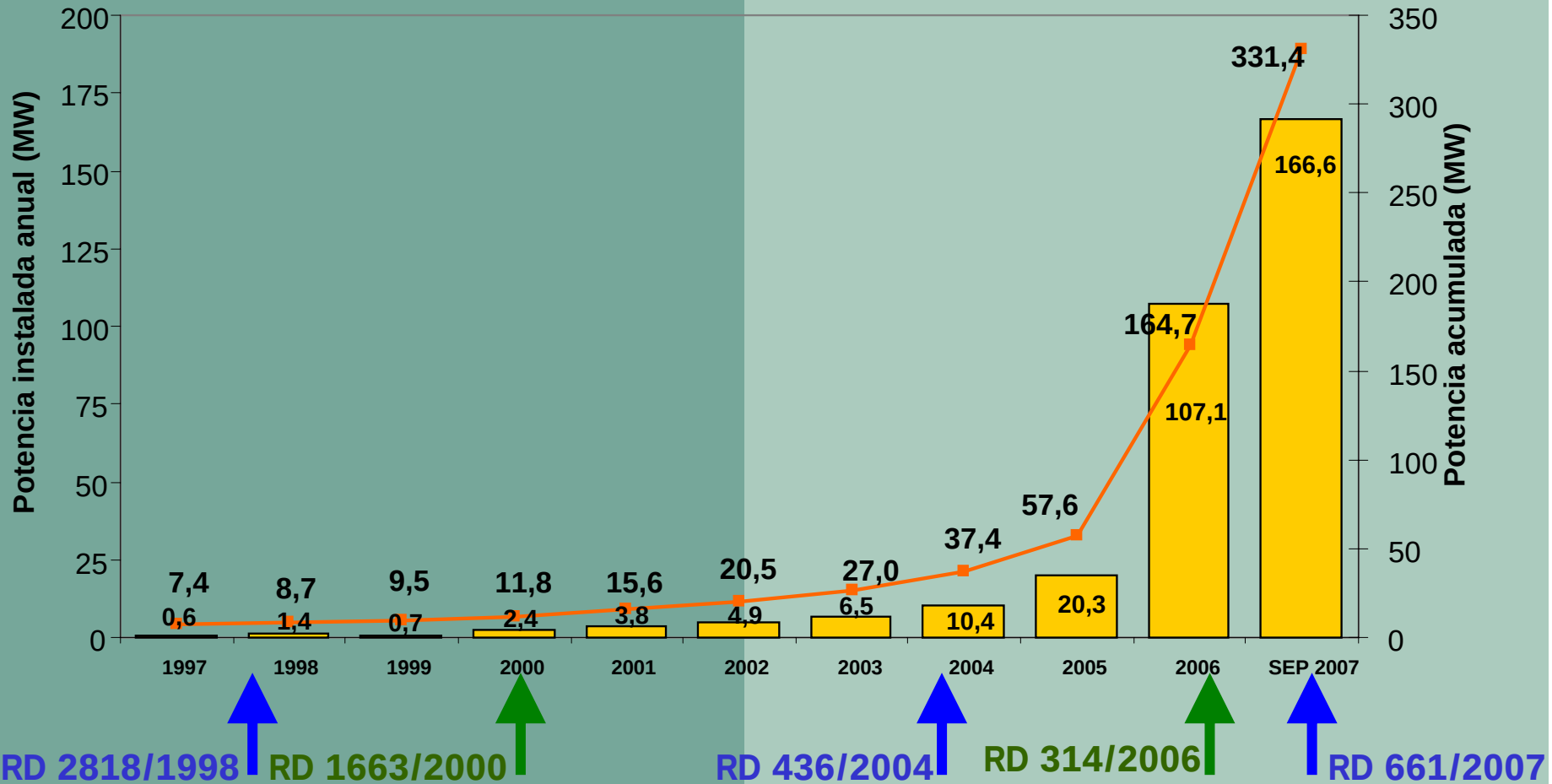
CUMULATIVE TOTAL IN 2006 IN EUROPE: 3,419 MWp

Countries with generating capacity > 5MWp shown

Fuente: EurObservÉR 2007

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^2	Floor surface
Multistore. Leisure centre	3,000 m^2	Floor surface
Storage premises	10,000 m^2	Floor surface
Administrative	4,000 m^2	Floor surface
Hotels & hostels	100	Tourist beds
Hospitals y clinics	100	Beds
Pavilions in exhibition centers	10,000 m^2	Floor surface

HE5 SECTION ON SOLAR PV ENERGY

Minimal PV Contribution

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

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

- 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 & 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 m2 > 3,132 m^2

100 (tourist) beds > 99 (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^2)	B (kW)	S (m^2)
Administrative	**5.71**	1.1	**0.001223**	**+1.35870**	**3,132**
Hostel & Hotel	**2.43**	1.1	**0.003516**	**-7.81250**	**2,850**
TOTAL	**8.14**				**5,982**

HE5 SECTION ON SOLAR PV ENERGY

Solar Photovoltaic Summary of CTE

SOLAR PHOTOVOLTAIC ENERGY	*MINIMUM*	*MAXIMUM*
Scenario (generating capacity in kWp)	**6.25**	**100**
Total installable capacity (MWp)	**68**	**93**
Energy replaced (MWh)	**74,800**	**102,300**
CO_2 avoided (tCO_2)	**45,000**	**61,400**
Impact on the construction cost of buildings (%)	**0.15**	**0.75**
Investment (€m)	**473**	**651**

THANK YOU FOR YOUR ATTENTION

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Athens, December 12th 2007