SOLARGE

Enlarging Solar Thermal Systems in Multi-Family-Houses, Hotels, Public and Social Buildings in Europe

National market analysis for Enlarging Solar Thermal Systems in Multi-Family-Houses and Hotels in Europe

Spain

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Part A: Information on respondents

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Part B: Information on national structure of the housing and multi family housing sector

1. Information on the existing building stock

1.1 Residential buildings

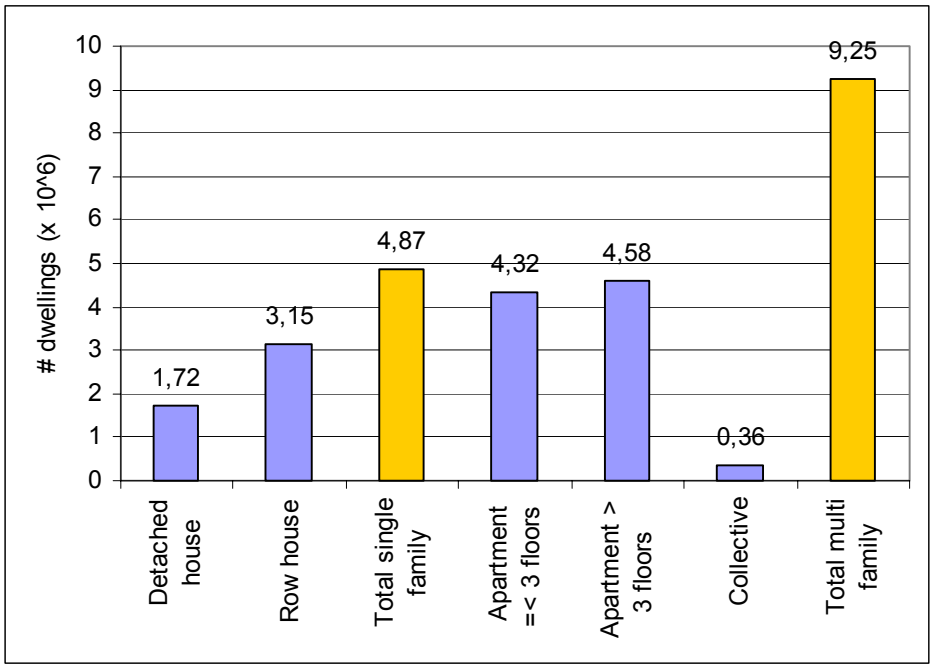


Figure 1 Deviation of dwellings in Spain (Source: INE, 2001)

The total number of occupied dwellings in Spain was about 14.12 million in 2000, corresponding to approx. 1,271 million m^2, on average approx. 90 m^2 per dwelling.

Fraction of multi family houses is about 65.5 % (figure 1). About 42 % of this building stock was built in the period from 1980–2000. The distribution of new dwellings in the period from 1992 to 1999 per province in Spain is given in figure 2.

The share of private owned dwellings in Spain is around 85 %. Over the period 1990–2000 in total 1.02 million new residential building where built corresponding with 5.11 million m^2, see for details figure 3, 4 and 5.

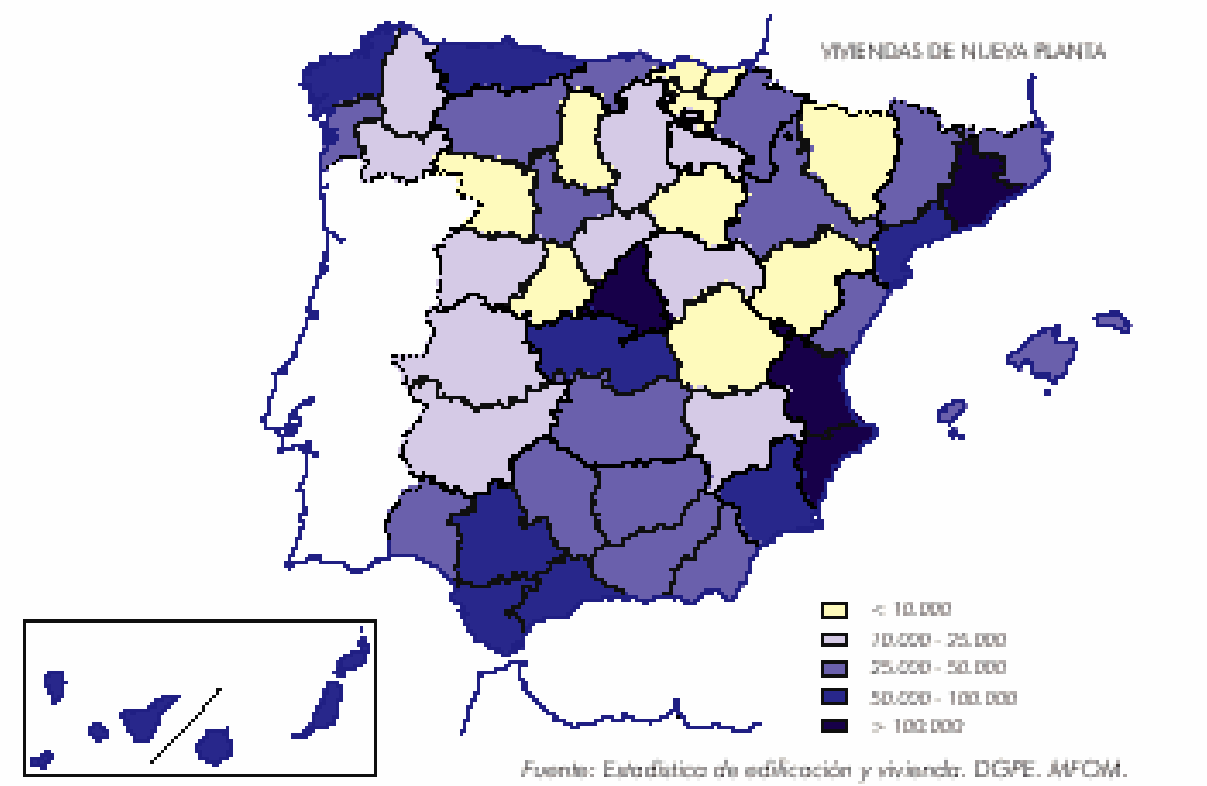


Figure 2 **Distribution of new dwellings in the period 1992–1999 (Source: Estadística de edificación y vivienda del Mº de Fomento, 2001)**

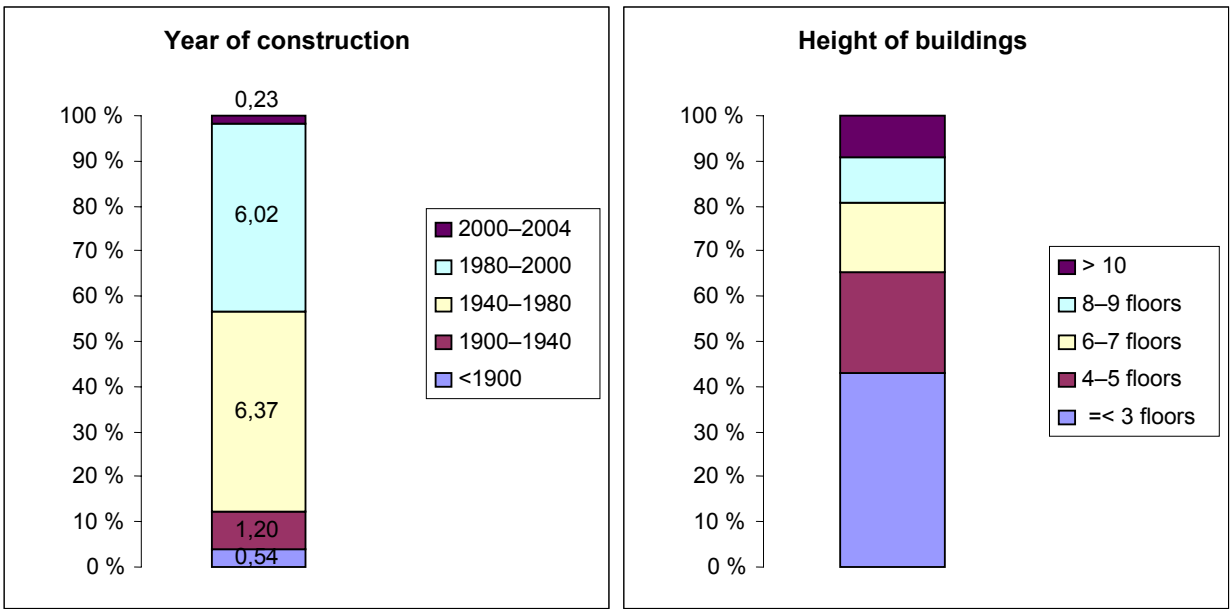


Figure 3 **Year of construction (numbers of dwellings, left) and height of buildings by number of floors (right) (Source: INE (Censos de Población y Viviendas) 2001)**

1.2 Non-residential buildings

Total m^2 of non-residential buildings in 2000 are summarised in the next table. The fraction of office buildings of non-residential buildings is about 33 %. In the period 1990–2000 in total 4.161 new office buildings where built corresponding with 9.2 million m^2, see for details figure 4 and 5.

	Millions of m^2	Source
Office	79	IDAE, 2000
Hospital	15	Antiguo INSALUD, 2000
Hotel	92	D.G. de Turismo, 2000
Commercial	56	D.G. Política Comercial, 2000
Total	**242**	

Table 1 Overview of the Spanish non-residential building stock, (Source: E4, 2003)

Building period	**Built before 1980**		**Built from 1981 - 2000**		**Built from 2001 - 2004**	
Type	# units (x 10^6)	Total m^2 (x 10^6)	# units (x 10^6)	Total m^2 (x 10^6)	# units (x 10^6)	Total m^2 (x 10^6)
Single-family houses	2,49	224	1,83	164	0,072	6,48
Multi-family houses (> 1000 m^2)	5,29	467	3,88	349	0,154	13,86
Office building (>1000 m^2)	No data	*60,6	No data	*18,4	No data	5,12

* Assumption 23.3 % in 1981–2000

Table 2 Overview of the Spanish building stock (Source: INE, 2001)

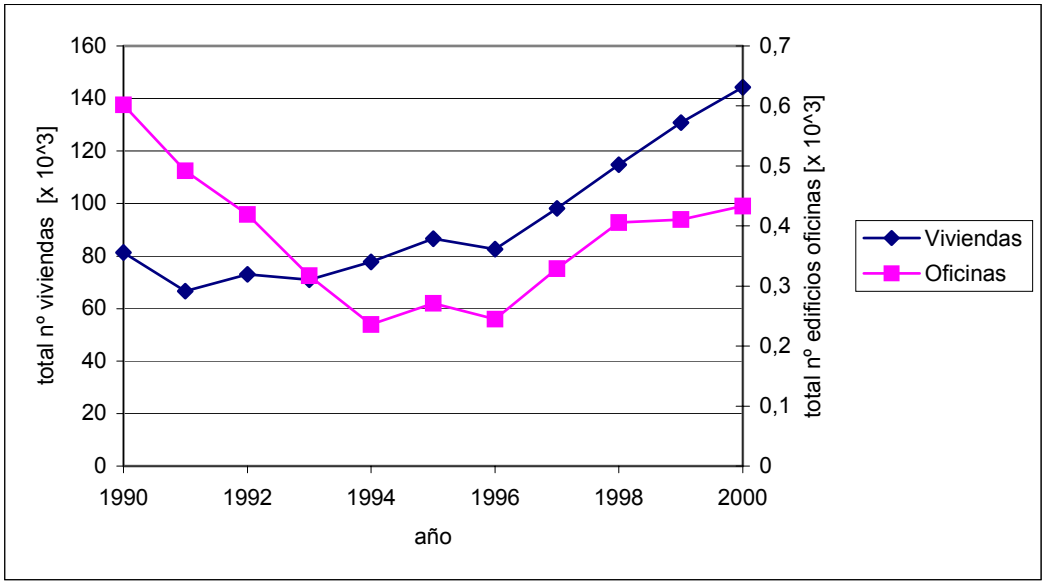


Figure 4 **Construction of new buildings (number) in Spain divided in residential and office buildings (Source: Estadística de edificación y vivienda del Mº de Fomento, 2001)**

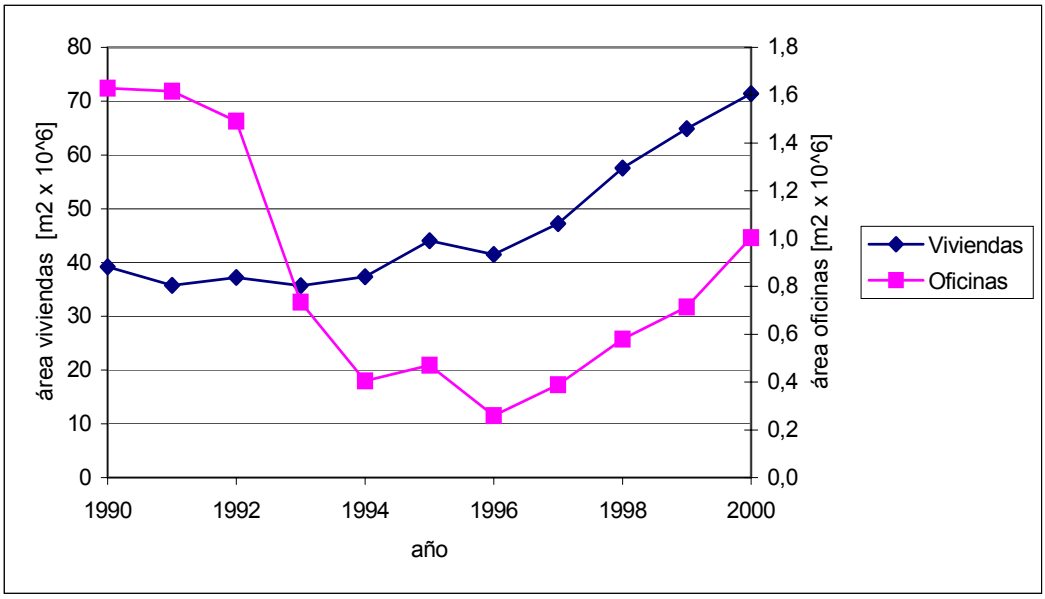


Figure 5 **Construction of new buildings (m^2) in Spain divided in residential and office buildings (Source: Estadística de edificación y vivienda del Mº de Fomento, 2001)**

2. Information on used heating systems in multi family houses

2.1 Energy use in dwellings

Heating is used in most areas only in the winter months December, January and February. As a consequence of the different zones in Spain the penetration of heating equipment differs accordingly. See figure 6 for penetration of central heating in dwellings in five typical

autonomous regions and the whole of Spain.

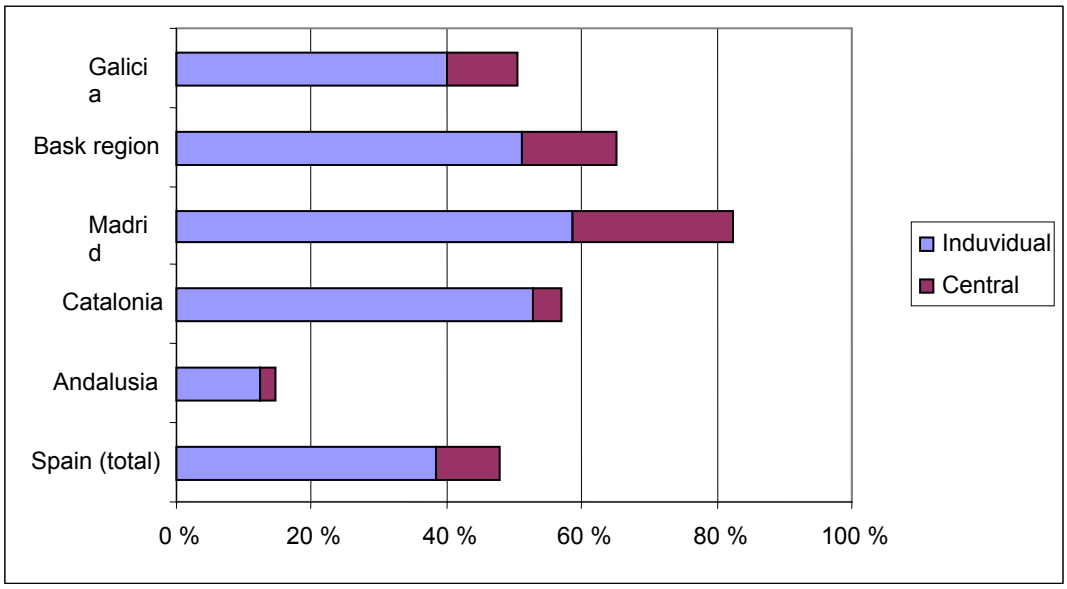


Figure 6 Penetration of individual (per dwelling) and centralized (per apartment building) heating equipment in different regions (Source: INE, 2001)

In Spain different kinds of energy ressources are used for heating (see table 3). In figure 7 the different energy sources for space heating are given for five typical Spanish autonomous regions and for the whole of Spain. In the last couple of years the natural gas grid has increased considerable, especially in cities and populated areas. In 2001 the total residential buildings with gas connection were 25.1 % (INE, 2001). Electricity is still a major source for space heating in Spain (37 %). In many cases this is combined with cooling (reversible heat pump). The Spanish heat pump market has also increased considerably in the past few years (about one million new installed heat pumps in 2003). The sales increased by 250 % between 1997 and 2000 and about 4 million heat pumps were installed at present 2003 (source: IEA Heat Pump Centre 2002 and ENEBC 2004). This growth rate is expected to continue for the next few years. Heat pumps have been installed in all sectors, but market penetration has been different in each one.

The residential sector has the greatest number of installed heat pumps (circa 60 %), followed by the commercial sector (33.5 %), with the industrial sector having the smallest number of sales. Heat pumps are normally installed as refrigerating equipment and in many cases as a complementary heating system.

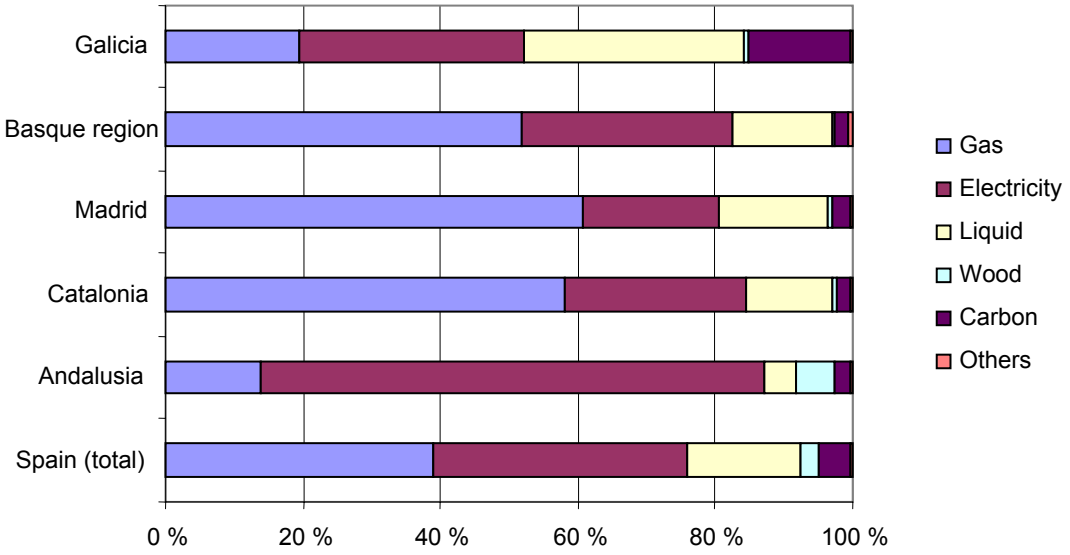


Figure 7 Penetration of energy sources for space heating in different regions (Source: INE, 2001)

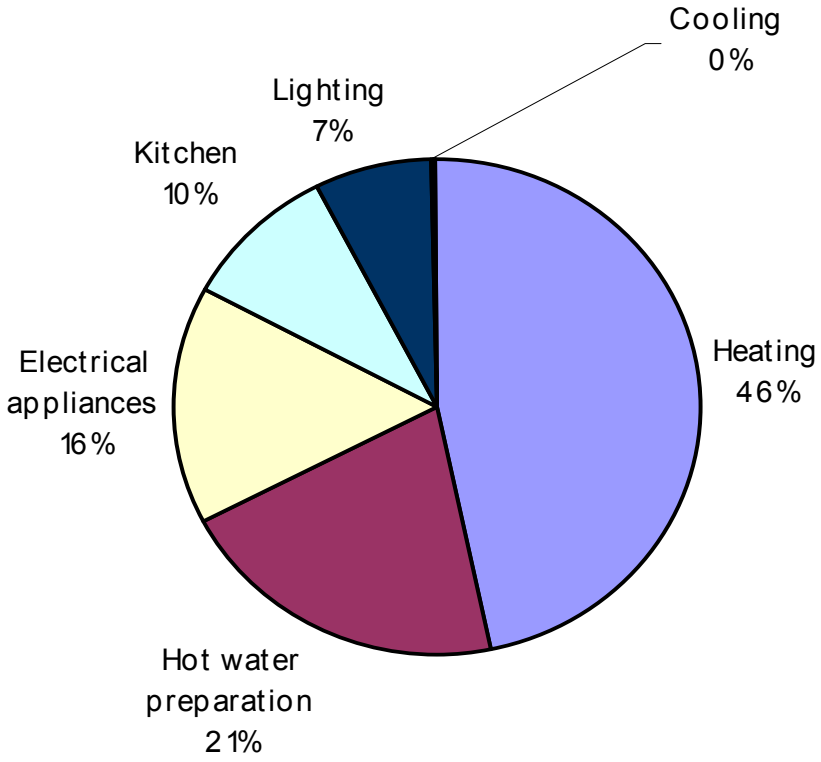


Figure 8 Distribution of energy consumption in dwellings (Source: IDEA, 2004)

In 2000 the total energy consumption in the built environment was 14,491 ktep. This is 16 % of the total final energy consumption in Spain. The residential buildings are responsible for about 8,900 ktep (61 %) of this consumption. The national goal of the Spanish government is to reach a saving in the built environment of about 11.4 % (1,773 ktep) until 2012, laid down

in the E4-documents.

The average final energy consumption per dwelling in Spain in 2000 was 31 GJ (8,611 kWh) of which 38 % was used as electricity. The use of energy for different function is shown in figure 8.

Dwellings that where built in the period between 1994 and 1999 have different penetrations of energy resource connections. In table 3 the penetration of these connections are summarised. Figure 9 shows the penetration of gas connections in new dwellings in that period. It can be seen that the gas connections are more common in the northern part of Spain. Over the same time period it was reported that 88 % of the new dwellings are equipped with a hot water device and 42 % are equipped with space heating.

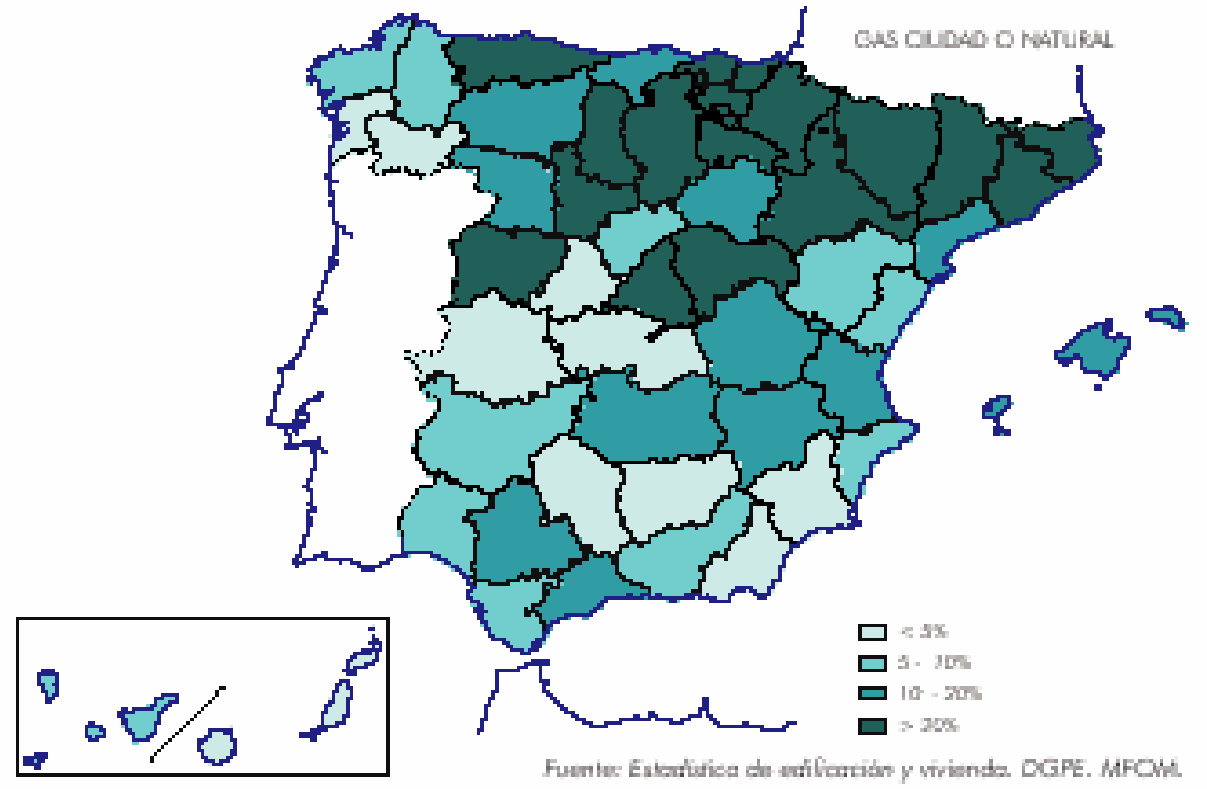


Figure 9 Distribution of gas connections in new dwellings in the period 1994–1999 (Source: Estadística de edificación y vivienda del Mº de Fomento, 2001)

Energy resource	Penetration [%]	Remark
Electricity	99.9	For electrical appliances, lighting, cooling, and in some cases for heating and hot water preparation
Solid fuels	2.1	Only for heating and hot water preparation
Natural gas or city gas	19.6	
Other gases	20.9	
Liquid fuels	8.8	
Solar energy	0.33	

Table 3 Penetration of energy resource connections in new dwellings (1994–1999) (Source: Estadística de edificación y vivienda, DGPE, MFOM, 2001)

To date district heating is vary rare in Spain for heating purposes, however in some new building areas the application of district heating is considered.

2.2 Energy demand hot water preparation and heating

In the next table the energy consumption for space heating and hot water preparation is presented for existing dwellings in Spain. The energy consumption for heating is given for three different typical climate zones in Spain.

Location	% building stock	Space heating [kWh/m^2/year]		Hot Water [kWh/m^2/year]	
		Row house	Apartment building	Row house	Apartment building
Madrid	34 %	51	35	20	32
Sevilla	63 %	39	23		
Burgos	3 %	93	65		
Weighted average		**45**	**28**	**20**	**32**

Table 4 Energy consumption for heating for three different typical climate zones in Spain (Source: E4, 2003)

3. Information on refurbishment and new construction activities in the multi family housing sector

	Multi family houses stock (*1000)	Refurbishments in total	Equivalent in % of existing stock	New constructions	Equivalent in % of stock
Year					
2000	8,833	56	0.63	n. a.	n. a.
2001	8,867	56	0.63	343	3.9
2002	8,903	56	0.63	363	4.1
2003	8,941	56	0.63	383	4.3
2004	8,981	50	0.56	403	4.5

Table 5 Refurbishment and new construction activities in the multi family housing sector of Spain (Source: INE, 2001 and IDAE, 2004)

Detailed numbers of multi family stock are not available. The assumption was made that from the total building stock 65 % are apartments.

4. Information on actors in the housing sector

4.1 Information about the ownership structure of the national housing sector

	% of the whole housing stock	**Number in total on national level**
Condominium ownership	89 %	12.0
Non profit (social) housing associations	4 %	0.54
Commercial MFB ownership	7 %	0.96
Private owners of MFH	0 %	n. a.
Total	100 %	13.5

Table 6 Ownership structure of the national housing sector (Source: INE, 2001)

4.2 Important associations or organisations in the national housing sector

Asociación de Promotores Constructores de España (APCE)

Adresse : Diego de León, 50

E-28006 Madrid

Tel: +34 91 5624036

Internet: www.apce.es

This association of property developers have offices is all 52 provinces in Spain. There is no significant strategic activity reported towards energy efficiency and renewable energy.

5. Conclusion for SOLARGE

The total number of occupied dwellings in Spain was about 14.12 million in 2000, corresponding to approx. 1,271 million m², on average approx. 90 m² per dwelling. The fraction of apartment buildings is about 65.5 %. About 42 % of this building stock was built in the period 1980–2000. The share of private owned dwellings in Spain is around 89 %.

In Spain 48 % of the dwellings are equipped with a heating system. The penetration varies with the different climate zones (from 15 % up to 82 %). In 24 % the heating system is a centralised system. Gas is the main energy source for heating (39 %) followed by electricity 37 % and liquid fuels (16.5 %). The penetration of the different energy courses for heating varies with the different climate zones.

New building activities in Spain are amongst the highest in Europe with growth rates between 4 and 4.5 % (650,000 new dwellings in 2004). For the next coming years it is expected this will drop to a level of 450,000 dwellings per year. The refurbishment activities are quite moderate in Spain, a little bit more than 0.5 %.

Especially the new housing sector (multi family buildings) is an interesting market segment for SOLARGE.

Condominium ownership of apartments is the most important market segment for SOLARGE. Within the existing building stock the association of owners are the most important actors. For new buildings the property developers are the most important actors.

Part C: Information on national structure of the hotel sector

1. Information on the existing hotel building stock

The total number of hotels in 2004 was 13,832. Total number of camping grounds was about 1,200. In the table below the distribution over the different categories is given.

Category	Total number of hotels [1]	Total number of beds	Total numbers of person nights	Occupation per bed (%)	Occupation per bed weekend (%)
TOTAL	**13,832**	**1,173,894**	**234,919,282**	**53.58**	**58.90**
HOTELS					
5 stars	133	45,139	8,061,648	48.33	56.92
4 stars	1,205	378,547	84,124,056	59.49	66.32
3 stars	2,002	394,872	91,328,290	61.56	66.58
2 stars	1,657	114,051	20,034,696	47.25	52.08
1 star	1,109	51,370	7,340,635	38.62	42.71
HOSTELS					
2 or 3 stars	2,706	91,637	12,358,266	36.58	40.80
1 star	5,020	98,278	11,671,692	32.28	33.63

[1] The total number of hotels reflects the average number of hotels that are open during the year.

Table 7 Overview of the Spanish hotel sector (Source: INE, 2004)

80 % of the total beds can be found in 6 autonomous regions:

- Balearics 24 %
- Canary islands 11 %
- Catalonia 18 %
- Andalusia 14 %
- Valencia (com) 7,5 %
- Madrid (com) 5 %

2. Information on used heating systems in hotels

Heating and hot water preparation in general are produced by central systems. In general the

energy source is natural gas or oil (detailed information is not available). Key numbers of energy use are: 19 kWh/person/night or 403 kWh/m². The use of energy for different functions is shown in figure 8.

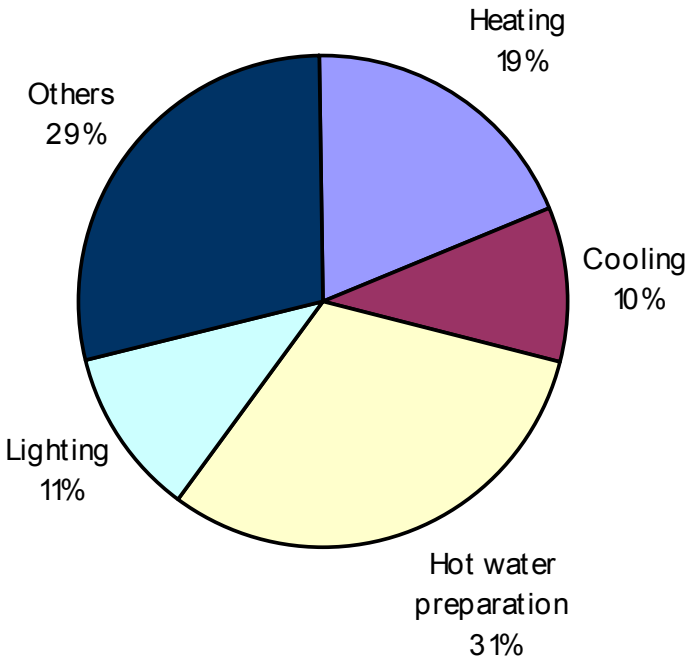


Figure 10 General energy use in hotels for different functions in Spain (Source: IDEA, 2004)

3. Information on refurbishment and new construction activities

	Building inventory[1]	New constructions	Equivalent in %
Year			
2000	14,870	-172	-1.16 %
2001	14,880	10	0.07 %
2002	13,523	-1.357	-10.03 %
2003	13,680	157	1.15 %
2004	13,832	152	1.10 %

[1] The total number of hotels given reflects the average number of hotels that are open during the year

Table 8 Overview on the development of the hotel sector (Source: INE, 2004)

Analysing the figures a bit more detailed (hotels versus hostels) shows an increase of number of hotels over this period on average 3.4 % (3.9 % in beds) and a decrease in the number of hostels over this period on average -4.7 % (-0.8 % in beds) with a major drop in number of hostels in 2002 of about 1,250. The occupancy per bed dropped from 60.9 % (1999) to 53.5 % (2004), on average -1.5 % per year.

4. Information on actors in the hotel sector

4.1 Information about the ownership structure of the hotel sector

	(%) of the whole hotel sector	Number in total on national level
Commercial ownership (chain of hotels)	30 % (about 50 % of total beds)	4,200
Private owners of hotels	70 %	9,700
Other		
Total	100 %	13,900

Table 9 Ownership structure of the hotel sector (Source: La Asociación de Cadenas Hoteleras Españolas (ACHE), 1999)

4.2 Important associations or organisations in the national hotel sector

National level:

Federación Española de Hoteles (F.E.H)

La Asociación de Cadenas Hoteleras Españolas (ACHE)

Regional level:

On a regional level about 40 associations are known (see table below).

Zona de Andalucía
Horeca - Cádiz
Asociación Provincial de Hoteles de Huelva
Asociación de Empresarios de Alojamiento de Jaén
Asociación Provincial de Hoteles de Sevilla
Asociación de Empresarios de Hospedaje de Granada
Asociación de Empresarios de Hostelería de Cordoba

Zona de Aragón
Asociación Empresarial de Hosteleria de Huesca
Federación Empresarial de Hospedaje-Horeca Zaragoza
Zona de Asturias
Unión Hotelera del Principado de Asturias
Zona de Canarias
Fed. de Empresarios de Hostelería y Turismo de Las Palmas
Zona de Cantabria
Asociación Empresarial Hostelería de Cantabria
Zona de Castilla la Mancha
Asociación Empresarial de Hostelería de Albacete
Asociación Empresarial de Hostelería de Ciudad Real
Agrupación Provincial de Hostelería de Cuenca
Asociación Prov. Empresarios de Hostelería de Guadalajara
Asociación Empresarial de Hostelería de Toledo
Zona de Castilla y León
Fed. Provincial de Empresarios de Hostelería de Burgos
Asociación Provincial de Hostelería de León
Asociación Provincial de Hostelería de Valladolid
Zona de Cataluña
Gremio de Hoteles de Barcelona
Gremio de Hostelería del Maresme
Asociación Empresarial de Hostelería de Tarragona
Asociación Empresarial de Hospedaje de Lleida
Zona de Comunidad Valenciana
Gremi D´hotelers de Valencia
Zona de Extremadura
Confederación Empresarial de Turismo de Extremadura
Zona de Galicia
Federación Provincial de Hostelería de Orense
Asociación Empresarial de Hospedaje de Santiago
Asociación de Empresarios de Hostelería del Ferrol
Federación Provincial de Hostelería de Lugo
Asociación Empresarial de Hostelería de Arosa

Asociación de Empresarios de Hostelería de Vigo
Asociación Empresarial de Hospedaje de Pontevedra
Zona de Madrid
Asociación Empresarial Hotelera de Madrid
Asociación de Cadenas Hoteleras Españolas
Zona de Murcia
Federación Provincial de Hostelería de Murcia
Zona de Navarra
Asociación Empresarial de Hostelería de Navarra
Zona del País Vasco
Asociación Patronal de Alojamientos Alaveses
Asociación de Empresas Hoteleras de Guipúzcoa
Asociación de Empresarios de Hostelería de Vizcaya
Zona de la Rioja
Asociación Riojana de Hoteles y Afines

Table 10 Regional hotel associations (Source: FEH, 2004)

No significant campaign towards solar thermal energy is reported.

Some general presentations on (solar) energy were given at workshops and seminars.

5. Conclusion for SOLARGE

The hotel market in Spain is big: 13,832 hotels with in total 1.2 millions beds. Hot water demand is normally high from 50 to 100 liters per day per bed. The energy costs for hot water production are significant, so therefore this is an interesting market segment for SOLARGE.

Heating and hot water preparation in general are produced by central systems. This is a favorable situation for the application of solar thermal systems as well for new as for exciting hotels.

The construction rate of new hotels is quite low, around 1 %. The main focus of SOLARGE should be existing hotels preferable connected to refurbishment or renovation of the (hot water) installation.

For the hotel sector in Spain the economical saving on investments will become more and more important. This is caused by a decreasing interest choosing Spain as a tourist destination.

Part D: Information on the national CSTS market development in the past

1. Market background and history of solar thermal market and the CSTS segment

1.1 Brief historic overview of solar thermal market development in Spain

The Spanish solar thermal market has finally overcome the situation characterised in the ESIF report “Sun in Action I” with the words “small size and unable to grow”. The change is due to the following factors:

- A greater sensibility of the population to the dangers of urban pollution and the potential of renewable energies to solve them.
- A reduction of the interest rate on private and commercial loans (from 14–18 % down to 6–8 % within two years) which directly improved the competitiveness of solar thermal energy. Manufacturers are beginning to use the good return on investment as a marketing argument.

The impulse was stemming from the Plan for the Development of Renewable Energies (PFER), which was approved by the Spanish Government on 31 December 1999. This plan is the central instrument to achieve the 2010 targets set for Spain by the European Commission. The results of this impulse are already evident. There are new regulations in some municipalities, which require the use of solar thermal in new buildings. Barcelona was the first to enact such a regulation: new buildings with more than 22 dwellings must use solar thermal if their daily hot water consumption exceeds 2,500 liters at 45 °C. The experience of the City of Barcelona is already showing considerable success. This has motivated other cities to announce that they will follow the example of Barcelona (amongst them Pamplona, Madrid, Seville, and Valencia).

Although the market started to grow, the annual figures were still far from reaching the objectives outlined for 2010. To accomplish these objectives, an average of more than 400,000 m² has to be newly installed each year between 2001 and 2010.

This shows that a stronger drive is needed. The administration could then achieve two goals:

1. to establish a good image through the promotion of solar thermal and

2. to nurture an emerging industry which still battles with the bad image it earned through faulty installations in the 1980s.

The problems described in “Sun in Action I” prevailed until the year 2000. Two main events changed this situation: the government endorsed more money for solar thermal and detailed regulations covering both technical and economic quality became mandatory for installers. This stimulated the market, as consumers received much better quality. The publication of this regulation also signified the strong determination of the Spanish government to support the solar thermal market.

It seems that these regulations had the expected impact, at least for medium and large-scale installations. For smaller installations it proved to be quite complicated, as installers had difficulties with the complexity of the regulation. These installers were allowed to prove their qualification by showing a “sufficient number” of systems they had previously installed.

This regulation also sparked actions by other authorities; municipalities especially realised that their support for solar energy could improve their image, and thus established their own solar thermal regulations (beginning with the City of Barcelona). However, as these are mostly linked to building constructions (new built or major refurbishment) it takes at least one year for the results to show.

2. Market size, market share and market growth of CSTS

Year	m² of yearly installed collector surface in total	Market size in terms of capacity (in kWth)	m² of yearly installed collector surface in CSTS* (>30 m²)	Market share of CSTS in the solar thermal market (%)	Market growth solar thermal market (%)
2002	60,500	46,200	n. a.	n. a.	n. a.
2003	87,800	49,000	25,800	29.38	45.12
2004	90,000	63,000	53,700	59.67	2.51
Cumulated by 2004	420,366	294,256	336,292	80.00	–

Table 11 Overall installation figures on the national solar thermal and CSTS market today (Source: ESTIF, 2005; IDAE, 2004; PER, 2005)

No accumulated data found on the market segment CSTS (>30 m²). From the data of 2002 it

is known that about 69 % of total installed systems have a collector area of 30 m² or more, representing 92 % of the totalled installed collector area in 2002, see figure 11 below. From the analyses of the subsidy scheme of IDAE (IDAE, 2005) some more data was found on the division of the market, see figure 12. From this figure it is clear that small systems (<20 m^2) are gaining terrain, from 5 % in 2002 to 19 % in 2004.

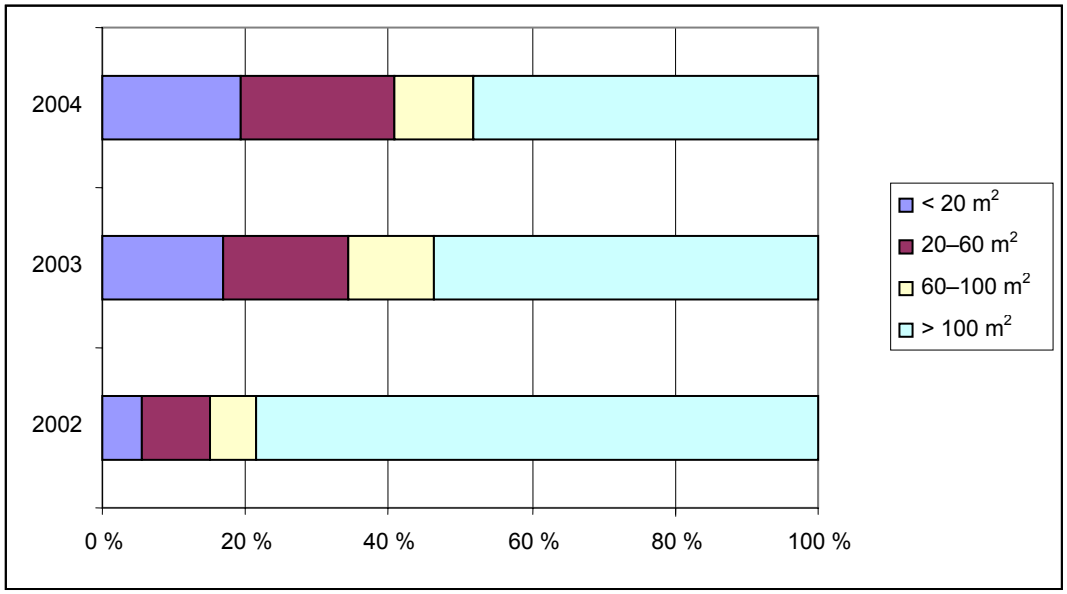


Figure 11 Classification of annual installed collector area by collector size

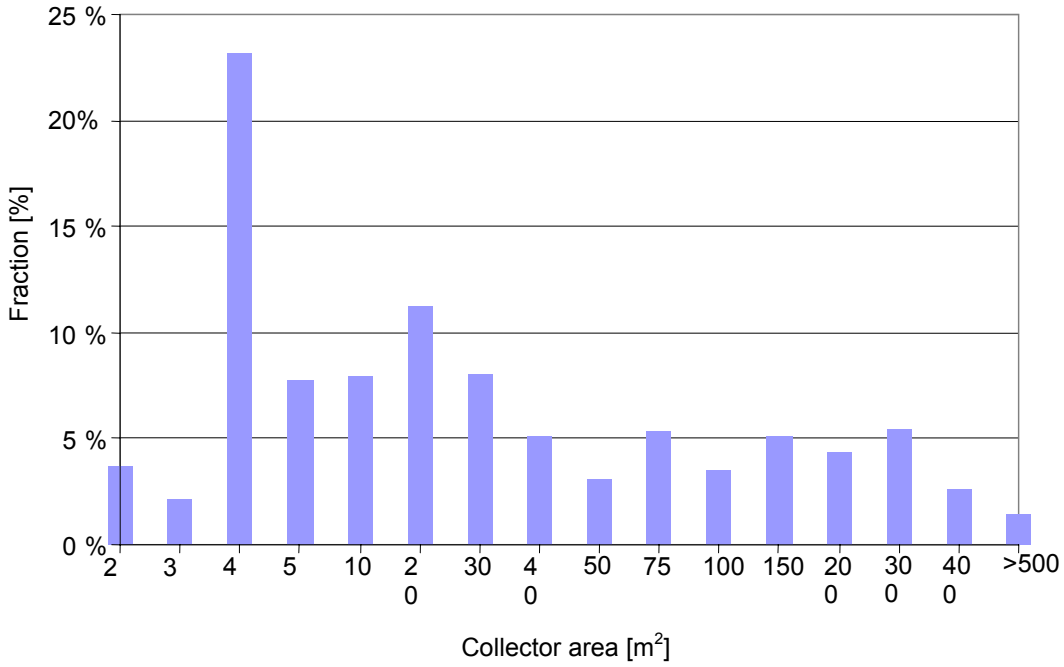


Figure 12 Fraction of SWH systems sales in 2002, classified is system size (n=1053) (Source: IDAE, 2003)

The distribution of different applications of solar thermal systems in 2004 is given in the table below.

Application	Distribution (%)
Hot water preparation	43
Hot water preparation and space heating and/or swimming pool heating	38
Hot water preparation and swimming pool heating	12
Swimming pool heating	5
Solar cooling	2

Table 12 Distribution of different applications of solar thermal systems in 2004 (Source: IDAE 2005)

3. Conclusion for SOLARGE

The Spanish solar thermal market is becoming slowly mature and more professional, due to the fact of a greater sensibility of the Spanish population on environmental issues in combination whit favourable incentives of the national and local governments.

Large systems (>20 m²) are still the main market segment in Spain (approx. 80 % of total installed collector area in 2004). For SOLARGE this is positive also due to the fact that the market share of apartment buildings in Spain will remain high and thus the need for large systems will also remain.

Since the market segment “apartment buildings” is important for the solar thermal market in Spain, it is important to develop adequate/solid solutions for decentralised systems (central collector and de-central storages). Existing solutions are normally quite complicated and overheating solutions are badly developed: e. g. covering the collector (by hand) in case of danger, fan-coils to get rid off the heat, oversized deposits, etc.

Also the minimal technical requirements in Spain are quite poor. To date only a Spanish collector test is needed (not the whole system) for subsidy and finance application. Finally optimal (building) integration is not fully developed yet.

Part E: Information on the economic and legislative framework for CSTS

1. Energy prices

Natural Gas GROUP (2005) (ex. IVA)		Fixed costs €/client/month	Variable costs €/kWh
3.1	Consumption <= 5,000 kWh/year (only cooking and hot water)	2.29	0.041650
3.2	Consumption > 5,000 kWh/year and <= 50,000 kWh/year	5.12	0.034854
3.3	Consumption > 50,000 kWh/year and <= 100,000 kWh/year	39.71	0.026553
3.4	Consumption > 100,000 kWh/year	59.25	0.024209

Electricity TARIFFS LOW TENSION (2005) (ex IVA)		Fixed costs €/kW.month	Variable costs €/kWh
2.0	General, up to 15 kW	1.461129	0.083007
2.0	Night tariff	1.461129	day: 0.085274 night:0.038670
3.0	General	1.430269	0.083728
4.0	General (large consumption)	2.284634	0.076513

Table 13 Energy prices for natural gas and electricity (2005) for different consumers (Source: Orden ITC/ 104/2005 de 28 de enero, B.O.E. Nº 26 del 31 de enero de 2005)

In the case of individual heating systems (per dwelling) the energy consumption will be invoiced according to the real energy use on a monthly (or two monthly) base. In the case of centralised heating systems (per apartment building) normally the total energy costs will be divided between apartment users (so not depending on real consumption of each apartment). The energy costs are part of the service costs and will be paid to the energy service provider.

2. Capital market terms in the housing and in the hotel sector

The interest rate for real estate investments in Spain is Euribor + 0.35–1.25 %. The current Euribor is around 2.5 %. The common minimum equity rate for real estate investments is 20 %. The expected payback time for refurbishment investment should be in the range of 5 to 10 years.

3. Conditions for refurbishment by housing sector

The rate of refurbishment is quite low in Spain. Conditions for the housing sector are laid down in the new building code (CTE) which will probably come into force 2006. Note that the conditions for the application of the CTE for refurbishment are the same as the EPBD conditions (e. g. >1,000 m²).

Contracts for commercial rent normally have a length of 5 years. The yearly rent increase during this period is linked to the official inflation rate. After this period the contract can be renewed for another period and the rent can be adapted.

4. Building sector regulations relevant for the CSTS market

4.1 Solar Ordinances

Figure 12 Municipalities with Solar Ordinance in place or in preparation (Source: IDAE, 2005)

Several municipalities have a Solar Ordinance in place for SWH. In this case a SWH is obligatory in new buildings and renovation projects with in general a minimum solar fraction of 60 %. The first Solar Ordinance came into force in August 2000 in Barcelona. The model was successfully copied by other municipalities (see figure 10). To date around 50 municipalities in Spain have a Solar Ordinance in place or in preparation, representing about 9 million inhabitants.

4.2 Building code (CTE)

CTE (Codigo Tecnico de la Edificación)

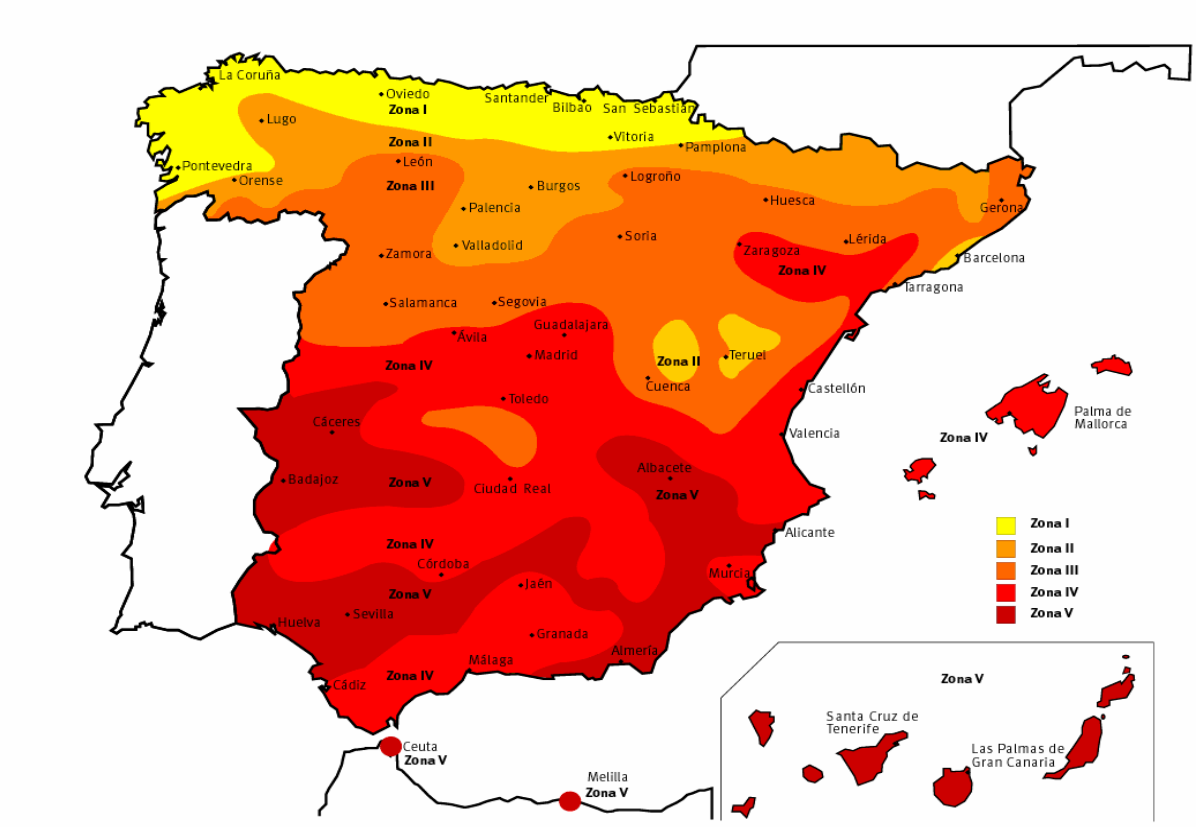
In addition to the E4-document the national government is working on a new building code CTE (the current one is already 25 years in place!). This new code is expected to be accepted in 2005 and will come in force in 2005/2006. This new code is based on the upcoming EU energy in building directive (EPBD) and the main objective is to save a total of 6.8 Mtep in the period 2004–2012. The estimated investment is 14,400 M€. The CTE is applicable for all new buildings and major renovation projects (>1,000 m²) according to the criteria of the EPBD. The CTE is divided into 5 parts:

- Limitation on energy demand (HE1)
- Efficiency of thermal installations (HE2 = Rite)
- Efficiency of lighting installations (HE3)
- Application of solar thermal systems for hot water preparation (HE4)
- Application of solar photovoltaic installations (HE5)

HE4: In the draft version it is stated that for all new buildings (and renovations according to EPBD) with hot water demand (> 50 liters/day) a minimum solar fraction is required from 30 to 70 % (depending on the climate zone and the energy source for back-up heating), see tables below:

Minimal solar fraction in % **(non electrical back-up system)**					
Hot water demand building at 60 ºC (l/d)	Climate zone				
	I	II	III	IV	V
50–5000	**30**	**30**	**50**	**60**	**70**
5001–6000	**30**	**30**	**55**	**65**	**70**
6001–7000	**30**	**35**	**61**	**70**	**70**
7001–8000	**30**	**45**	**63**	**70**	**70**
8001–9000	**30**	**52**	**65**	**70**	**70**
9001–10000	**30**	**55**	**70**	**70**	**70**
10001–12500	**30**	**65**	**70**	**70**	**70**
12501–15000	**30**	**70**	**70**	**70**	**70**
15001–17500	**35**	**70**	**70**	**70**	**70**
17501–20000	**45**	**70**	**70**	**70**	**70**
>20000	**52**	**70**	**70**	**70**	**70**
Minimal solar fraction in % **(electrical back-up system)**					
Hot water demand building at 60ºC (l/d)	Climate zone				
	I	II	III	IV	V
50–1000	**50**	**60**	**70**	**70**	**70**
1001–2000	**50**	**63**	**70**	**70**	**70**
2001–3000	**50**	**66**	**70**	**70**	**70**
3001–4000	**51**	**69**	**70**	**70**	**70**
4001–5000	**58**	**70**	**70**	**70**	**70**
5001–6000	**62**	**70**	**70**	**70**	**70**
>6000	**70**	**70**	**70**	**70**	**70**

Table 14 **Minimal required solar fraction for buildings affected by the CTE depending on climate zone, hot water demand and type of back-up system (Source: CTE, 2004)**



Zone 1:	H < 3.8 kWh/m²
Zone 2:	3,8 < H < 4.2 kWh/m²
Zone 3:	4,2 < H < 4.6 kWh/m²
Zone 4:	4,6 < H < 5.0 kWh/m²
Zone 5:	H > 5.0 kWh/m²

Note: If also a municipality Solar Ordinance is into force, one should comply with both regulations, meaning the highest solar fraction should be met.

Some technical criteria's:

- Irradiation losses in general for orientation and inclination (OI) max 10 %, shadow (S) 10 %, and total (OI + S) 15 %.
- System > 10 m² only with forced circulation
- Standard installation of mixing valve
- Overall heat-loss coefficient < 10 Wm²/K
- Volume accumulator > 50 litres per m² and < 180 litres per m²

Figure 13 Different climate zones is Spain concerning the application of solar systems in the new building code (CTE) (Source: INM, 2004 and CTE 2004)

5. Conclusion for SOLARGE

Energy prices in Spain are quite low and therefore not a main driver for the solar thermal market development.

The interest rate for real estate loans is quite low at the moment (3–4 %). Common minimal equity for real estate investments is 20 %. Payback time for refurbishment should be in the

range from 5 to 10 years. These terms are quite good for the solar thermal market and the required payback time can be achieved normally.

The rate of refurbishment is quite low in Spain. Conditions for the housing sector are laid down in the new building code (CTE) which will probably come into force in 2006. Note that the conditions for the application of the CTE for refurbishment are the same as the EPBD conditions (e. g. >1,000 m²)

The introduction of the new Spanish building code will have a major effect on the solar thermal market especially in the new building sector. To demonstrate it in a simple calculation: if we consider an annual production of 450,000 dwellings per year, (80 % solar thermal applicable) and a collector surface of 2 m² on average then this segment will generate an annual market of 720,000 m². This is more than the total accumulated market in 2004. Note that the effect of the introduction of the CTE will be fully developed over a couple of years (from building permit to final realisation). The main challenge will be to facilitate the implementation process: speed-up production, training of installers, knowledge transfer to developers, architects and engineers, etc.

As a result from the introduction of the CTE (amongst the other incentives) a significant market growth is expected. The main challenge will be how to facilitate and control this process: training of public administration, controlling building permits, public awareness, etc.

Part F: Information on national energy policy framework for CSTS

1. Overview: national strategy and framework for solar thermal systems and CSTS promotion

1.1. National goals and targets for solar thermal systems

Considering that the solar potential in Spain is the highest in Europe and that the ratio of installed collector surface for each 1,000 inhabitants is below the European average, it is feasible that with the country specific conditions, ratios at least similar to countries like Austria or Greece could be reached. Therefore, it has been assumed by IDAE (Spanish institute of diversification and energy saving) that the collecting surface installed in 2010 could reach up to 4.5 million m² (i. e. a ratio of 115 m²/1,000 inhabitants). The forecasts made by the IDAE for 2010 are based on the following considerations:

Supposing a solar contribution of 50 % and not making any type of restriction, the potential market of solar thermal energy is 27 million m^2 including the following sectors:

- Domestic, corresponding to the existing park of family houses: 20 million m^2 (7 million m^2 in one family houses and 13 million m^2 in multi family houses).
- Hotels: 1 million m² (considering the rooms available, degree of occupancy and a solar fraction of 75 %).
- Collective housing: 300,000 m^2 (including residences, schools etc.).
- New constructions: 5 million m^2 (assuming that during the period 2000–2010 a total of 250,000 houses/year will be built).
- Other applications: 500,000 m^2 (including swimming pools, low temperature applications in the industry, etc.)

Recently (August 2005) an update of the plan was published, PER, 2005 (Plan de Energías Renovables en España 2005–2010). The new goal for solar thermal was set to 4.2 million m² (additional collector surface in 2005–2010, reaching a total accumulated collector surface of 4.9 million m² in 2010. Figure 14 shows the total installed collector area in the last years, and the new goal for 2010.

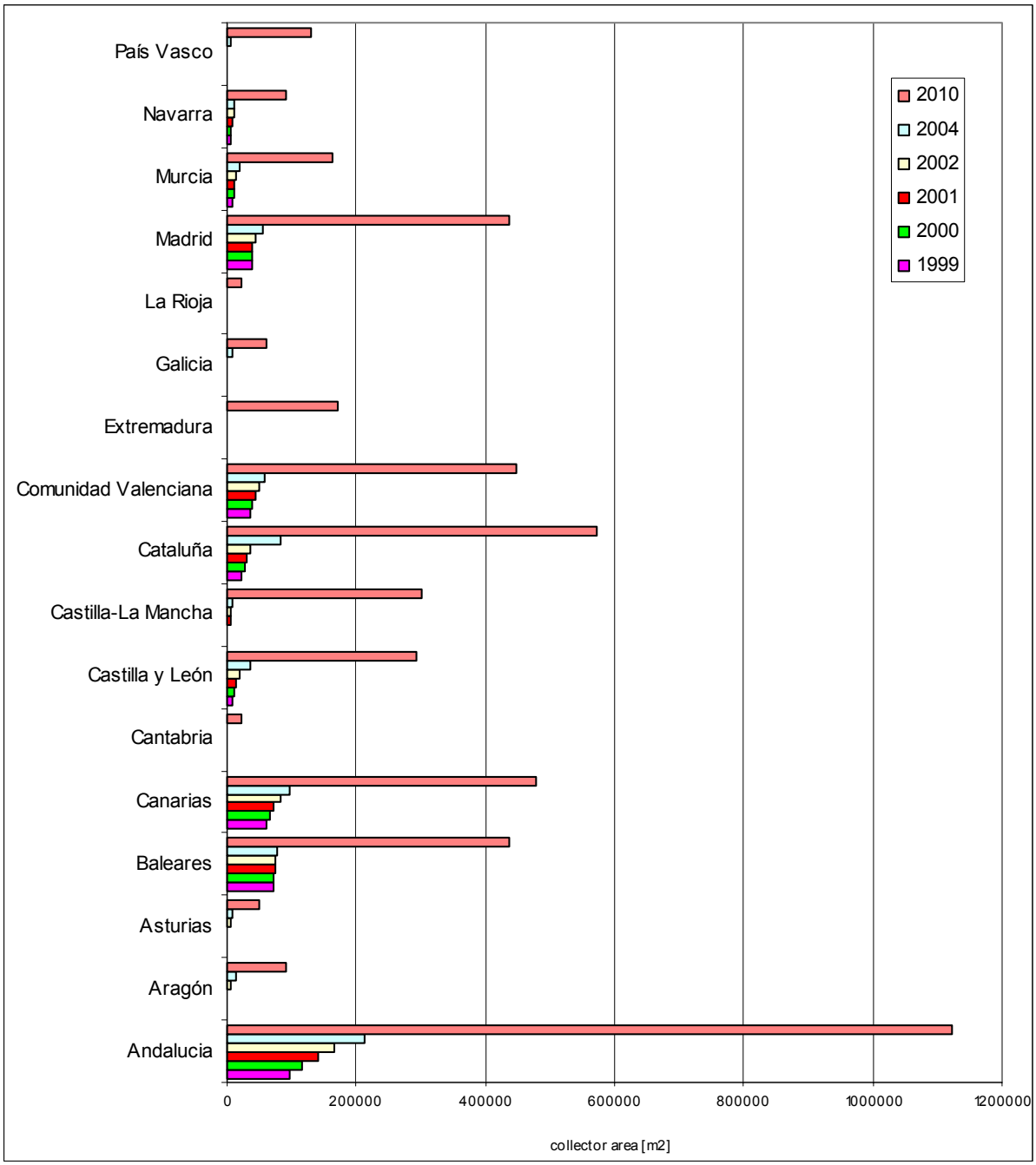


Figure 14 Total installed collector area and the goal for 2010 of each local government (Source: IDAE, 2005 and PER 2005)

1.2. National strategy and programme of activities for solar thermal and CSTS promotion

As mentioned above the plan de Fomento was recently updated, now called PER 2005. In this plan an inventory was made of the barriers for the successful speed-up of the solar thermal market to reach the targeted goal in 2010. The different barriers are summarised in the next table. To tackle these barriers a package of incentives/measures will be developed

according to the plan. To support the economical feasibility of solar thermal systems a budget of 348 M€ is reserved for subsidies and special loans for the period 2005–2010.

Aspect	Barriers
Economical aspects	• Insufficient economical feasible without investment subsidies • Lack of fiscal incentives
Technological aspects	• Lack of initiatives and incentives for the development of innovative products • Low production rate of solar thermal collectors/systems; low mechanisation rate in production processes • Lack of professional and good trained installation and maintenance companies; newcomers on the market with low acquaintance in solar energy • Lack of good technical documentation and tools for proper system design
Legislative aspects	• Thermal solar energy not included in building regulations • Lack of technical norms about installations in general
Social aspects	• Need for awareness raising potential users • Need for awareness raising municipalities • Need for training of technical staff municipalities • Need for awareness raising and training all actors (architects, property developers, etc)

Table 15 Inventory of the barriers for the successful speed-up of the solar thermal market (Source: PER, 2005)

In general main (national) strategies to support solar thermal applications are:

- Solar Ordinances (local municipality)
- New building code (CTE) (national)
- Subsidy and financing schemes (national)

Beside the national subsidy program of IDAE there are several regional (autonomous regions, in total 17) programs to stimulate the use of solar energy. Some municipalities also have stimulation and or subsidy programs for solar (thermal). Regional subsidies in most cases are tender procedures. In general only open a few weeks a year, especially for building projects this is not very favorable. In general there is no objection to combine the different subsidies for systems/projects. In the region of Madrid it is not allowed to combine national and local subsidy.

1.3. National administration of policy framework and support schemes

Solar ordinances

Solar ordinances are mainly municipality ordinances issued and controlled on al local level (municipalities). On a national level the implementation process is supported by IDAE e. g. by providing the framework of the solar ordinance text via internet.

New building code CTE

The implementation of the EPBD in Spain of which the new Spanish building code CTE is part of is the responsibility of the national government (IDAE, ministerio de industria, turismo y comercio and ministerio de la vivienda). It was stated that the national government will set the minimum criteria's and that regional governments (Autonomous Regions) are allowed to improve the criteria's. Local implementation and control will be done by the regional government, board of architects and municipalities.

Subsidy and financing schemes

The national subsidy and finance scheme (ICO-IDAE) is coordinated by IDAE. ICO (national credit bank) is controlling the financing scheme. Applications for the national subsidy and financing scheme are handled by homologated commercial banks. On a regional level the schemes are coordinated and controlled by the regional governments (Autonomous Regions) and on a local level by municipalities.

2. National incentive systems for CSTS installations in the housing and hotel sector

2.1. Subsidy schemes for CSTS investments

Full name of support scheme	Convenio de financiación ICO-IDAE para el fomento de las inversions en energía renovables y eficiencia energética, año 2005
Type of support scheme (e.g. soft loan programme)	Combined scheme • Subsidy (up to 30 %) • Loan
Focus area of support scheme (e.g. installations 30-120 m²)	No limits for collector area Only for indirect solar thermal systems
Starting date (in place since):	Since 2002, yearly updated Updated version 2005 was published in May 2005
Expiry date:	Linked to the national renewed energy plan (PER 2005) 2000–2010, yearly update
budget volume of the support scheme and sources from which it is funded	7 million € (2005) Goal for 2005 is 100,000 m^2
Beneficiaries of support scheme	Private persons

	Public bodies Enterprises
Conditions of support scheme	Not applicable for direct solar systems Two categories: A: Prefabricated systems B: Systems compiled by elements Maximum eligible costs: A: 1.160 €/kW B1: 1.160 €/kW (up to 14 kW) B2: 1.015 €/kW (from 14 kW) B3: 1,450 €/kW (specials, e. g. applications high temperatures) Maximum finance 80% (eligible costs) Own investment 20% (eligible costs) Maximum subsidy is 30% (eligible costs) Loan Interest rate Euribor + 1 %, loan period 8 or 10 years.
Managing organisation (main responsible):	IDAE-ICO
Address:	C/ Madera 8 E-28004 Madrid
Phone:	+34 91 456 49 00
Fax:	+34 91 523 04 14
Internet (incl. downloads):	www.idae.es

Table 16 Subsidy schemes for CSTS investments (Source: ICO-IDAE, 2005)

2.2 Fiscal incentives for CSTS investments

There is a tax deduction of 10 % of investment costs in renewable energy (only for enterprises). If an enterprise invests in renewable energy one can deduct 10 % of the total investment of its profit (before tax), which will have a positive effect of the economical feasibility. This deduction can be done once in the first year. In the PER 2005 it was announced that also a fiscal incentive on income tax (IRPF) for private persons will be developed

3. Conclusion for SOLARGE

The combination of the new upcoming building code (CTE), the proposed measures and incentives of the renewed renewable energy plan (PER 2005) and the ICO-IDAE subsidy and credit line will create a sound basis for the solar thermal market development.

Facilitating the process of the implementation of the CTE (in general) and the solar thermal part in particular will be a critical success factor for a successful market growth. The key actors of the implementation will be the public bodies on a national, regional and local (municipalities) level.

Sources

Part B: Information on national structure of the housing and multi family housing sector

1. Information on the existing building stock

- INE - Censos de Población y Viviendas (resultados finales) Instituto National de Estadística — 2001
- Estadística de edificación y vivienda del Mº de Fomento — 2001

2. Information on used heating systems in multi family houses

- INE - Censos de Población y Viviendas (resultados finales) Instituto National de Estadística. — 2001
- IDAE - Boletín IDAE: Eficiencia Energética y Energías Renovables (Nº 6) — 2004
- Ministerio de Economía - E4 - Estrategia de ahorro y eficiencia energética en España 2004 – 2012 — 2003

3. Information on refurbishment and new construction activities

- INE - Censos de Población y Viviendas (resultados finales) Instituto National de Estadística. — 2001
- IDAE - Boletín IDAE: Eficiencia Energética y Energías Renovables (Nº 6) — 2004

4. Information on actors in the housing sector

- INE - Censos de Población y Viviendas (resultados finales) Instituto National de Estadística. — 2001

Part C: Information on national structure of the hotel sector

1. Information on the existing hotel building stock

- INE - INEbase (Database) del Instituto National de Estadística. Encuesta de ocupación hotelera 2004 — 2004

2. Information on used heating systems in hotel

- IDAE - Boletín IDAE: Eficiencia Energética y Energías Renovables (Nº 6) 2004

3. Information on refurbishment and new construction activities

- INE - INEbase (Database) del Instituto National de Estadística. Encuesta de ocupación hotelera 2004

4. Information on actors in the hotel sector

- La Asociación de Cadenas Hoteleras Españolas (ACHE) 1999
- Federación Española de Hoteles (F.E.H), Website 2004

Part D: Information on the national CSTS market development in the past

1. Market background and history

- ESTIF – Sun in Action II 2003

2. Market size, market share and market growth of CSTS

- IDAE - Overview of subsidy applications year 2002 2003
- IDAE - Boletín IDAE: Eficiencia Energética y Energías Renovables (Nº 6) 2004

  IDAE - Resultados de las ayudas gestionadas por el IDAE a la energía solar térmica, en el periodo 2000 – 2004 2005

  PER – Plan de energias renovables en espana 2005–2010. Ministerio de industria, turismo y comercio 2005

Part E: Information on the economic and legislative framework for CSTS

1. Energy prices

- Orden ITC 104/2005 de 28 de enero, B.O.E. Nº 26 2005

4. Building sector regulations relevant for the CSTS market

- IDEA - Presentation Barcelona 2005

- Instituto Nacional de Meteorología (Ministerio de Fomento) 2004
- CTE - Codigo Tecnico de la edificacion (draft) 2004

Part F: Information on national energy policy framework for CSTS

1. Overview: national strategy and framework for solar thermal systems and CSTS promotion

- Plan de Fomento 1999 1999
- PER – Plan de energías renovables en españa 2005–2010. Ministerio de industria, turismo y comercio 2005

2. National incentive systems for CSTS installations in the housing and hotel sector

- ICO-IDAE - Convenio de financiación ICO-IDAE para el fomento de las inversions en energía renovables y eficiencia energética 2005

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