SOLARGE

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

# Market report for Enlarging Solar Thermal Systems in Multi-Family-Houses and Hotels in Europe

Denmark, Germany, Netherlands, France, Slovenia, Italy, Spain, Cyprus

# SOLARGE – Climate Protection and Economic Development

The use of solar thermal energy is an important method of reducing greenhouse gas emissions in Europe, one third of which are, after all, caused by the building sector.
Collective solar thermal systems on multi-family houses, hotels, public and social buildings are currently no more than demonstration projects. However, there is enormous potential for job creation and regional economic development in the building sector – not to mention the climate protection aspect.
The SOLARGE project is a co-operation of 11 partner organisations from 8 European countries promoting the installation of collective solar thermal systems (CSTS) with collector areas of 30 m² and larger.
SOLARGE analyses the main market barriers and promoting factors for CSTS and develops practical tools for investors, suppliers, planners, installers and political decision makers. The project started in January 2005 and will run until December 2007. The target markets include the housing and hotel industry, public authorities, manufacturers of solar thermal equipment, planners, architects and engineers.
As part of SOLARGE, 8 comprehensive national reports, which provide a detailed inventory of key information on national markets and political frameworks for CSTS, were prepared in 2005. For this purpose, all project partners and an institution from Cyprus compiled current data and facts about their national solar markets for multi-family houses and hotels to compare them.
All partners used the same research design: four key questions were answered to identify specific obstacles and barriers to CSTS implementation in each country:

1. What is the current situation in the existing national housing and hotel sector (national building stock, used heating systems, renovation and construction activities, players involvement in the solar industry)?
2. What stage has the development of the national solar thermal market and the national solar thermal industry reached?
3. How conducive is the framework provided by the existing national energy policy (political objectives, administrative procedures of programmes, subsidies)?
4. How conducive are the existing national legal and economic conditions (energy prices, capital market terms, legal conditions for renovation work, building sector regulations)?

This brochure is based on the results of the national reports. It gives a short overview of the specific political, economic and general legal conditions for CSTS implementation in each partner country. The conclusions drawn from the analysis of the data, facts and general conditions will again form an important basis for the campaign in 2006 and 2007.
A further integral part of SOLARGE is the best practice database, which will be expanded continuously via the eight-language website www.solarge.org. This website will showcase various items: successful projects, exemplary technical and financial solutions as well as tips and interviews.
We would like to take this opportunity to invite all interested building owners, experts and manufacturers to join and benefit from the SOLARGE project:

- Presentation of their projects to international experts as well as the (own country) and European public
- Use of SOLARGE specialist information and practical tools
- Co-operation with (own country's) and eventually European players

Best regards

Gabi Schlichtmann Andreas Steege

target GmbH, SOLARGE project co-ordinators

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# Status Quo in Different SOLARGE Partner Countries

**General overview of the multi-family housing sector, the hotel sector and collective solar thermal systems (CSTS) in operation**

## Key figures on the housing and hotel sector

In all European countries analysed within SOLARGE, there are fewer dwellings located in multi-family houses than in single-family houses, except for Germany and Spain. There is a total potential of about 54.28 million dwellings in multi-family buildings in the partner countries: (from North to South) Denmark, Germany, Netherlands, France, Slovenia, Italy, Spain and Cyprus. The total number of registered hotels in the eight countries researched was 124,166. The corresponding hotel stock provides around 10.05 million beds.
However, the size and the owner structure of multi-family buildings and hotels vary a lot in different countries as do the demand and existing infrastructure for water heating and space heating.

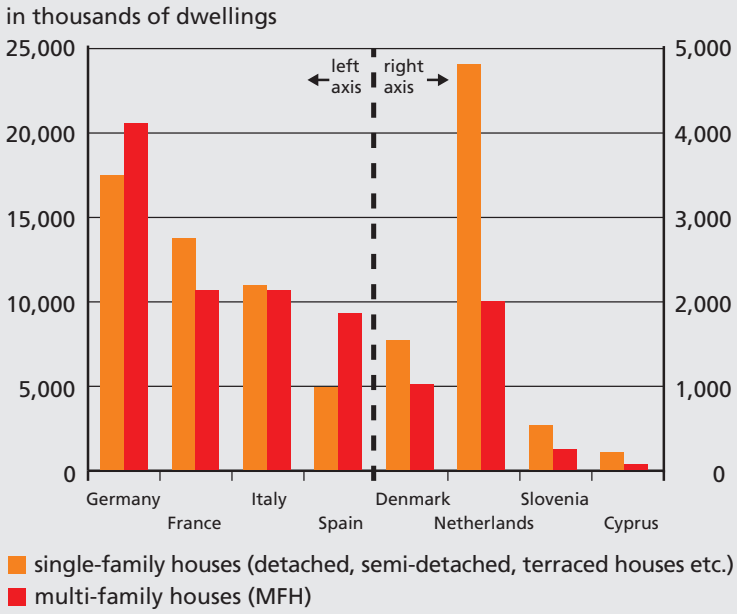
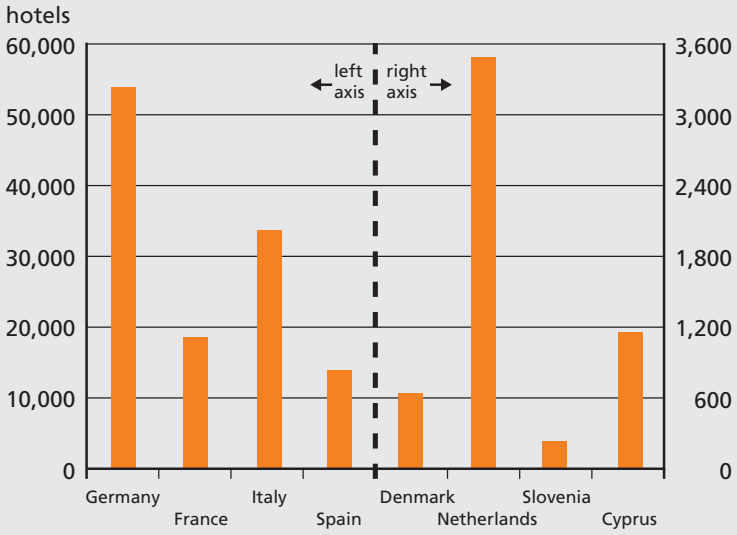



*Figure 1: Structure of dwelling stock in the partner countries (data from 2000 to 2005)*
*Source: SOLARGE national country reports 2005, www.solarge.org*

Among the total housing stock in the researched European countries with around 108 million dwellings, approximately 50 % are dwellings in **multi-family houses.** A remarkable aspect is that Germany and Spain are the only countries analysed in SOLARGE, where – at 20.51 million and 9.25 million respectively – there are more dwellings in multi-family houses than in single-family houses. On the contrary, Cyprus has the lowest proportion of dwellings in multi-family houses in the national dwelling stock, just 23 %, followed by the Netherlands with 29 %. Looking at the absolute number of buildings, Germany, Italy and Spain have the most multi-family houses and the Netherlands, Slovenia and Cyprus the least.

The four countries with the most **hotel building stock** are Germany, France, Italy and Spain, with a total of 119,589 hotels. The national average number of beds per accommodation facility ranges from 31 in the Netherlands to 145 in Slovenia. However, the average number of beds in European hotels is approx. 81 per accommodation facility. An interesting fact is that, based on the data gathered, the Netherlands provide the least beds per hotel but maintain the highest recorded occupancy rate (63.2 %) in the sector.




* Please note that the definition of "hotel" varies in each of the countries researched. This should be taken into account when comparing countries' hotel building stocks data.

*Figure 2: Structure of hotel building stock in the partner countries (data from 2003 and 2004 respectively)**
*Source: SOLARGE national reports 2005, www.solarge.org*

## National development of collective solar thermal systems (CSTS)

The total glazed collector surface area installed in the eight countries analysed so far is about 8.26 million m², producing approximately 5.79 million kW of thermal heat. In 2004, about 1.05 million m² of new collectors were installed in these countries, of which approximately 116,000 m² make up 11 % of glazed collector surface area installed in CSTS.
As a result of the different national conditions for CSTS implementation in multi-family houses and hotels, and different populations there is great variation in the development of the CSTS market in different countries, as shown in the figure below. However, the varying numbers of CSTS in operation in different countries are not solely the result of these conditions, they also depend to a great extent on existing national legal, economical and political frameworks, which either support or hinder CSTS implementations. The extent to which the solar industry has developed in each country and can provide customised solutions is also an important factor for market development.

In terms of the cumulative number of installations by 2004, Spain dominates the CSTS market with by far the highest cumulative amount of 336,300 m² – 80 % of CSTS in the collector surface area in operation in the country. There is clearly no other country with such a high market share of CSTS. Denmark is second, with a total of approximately 55,000 m² of CSTS installations in 2004. CSTS is estimated to represent around 16 % of the installed cumulative collector surface in 2004.
The Netherlands are a close third with 45,000 m² (CSTS also 16 % of the cumulated collector surface by 2004). In Germany, there is currently around 60,000 to 75,000 m² of CSTS, which made up 1.1 to 1.3 % of the total glazed collector surface area in 2004. This is quite remarkable, as Germany is registered as by far the leading country in Europe for solar thermal installations in terms of the total cumulated collector area from 2000 to 2004.
Not Germany but France – with about 38,500 m² of CSTS installed to date – is among to the four leading countries where the proportion of the national collector area accounted for by CSTS is concerned. CSTS in operation makes up a market share of 6 % in the country. This has grown rapidly in recent years.

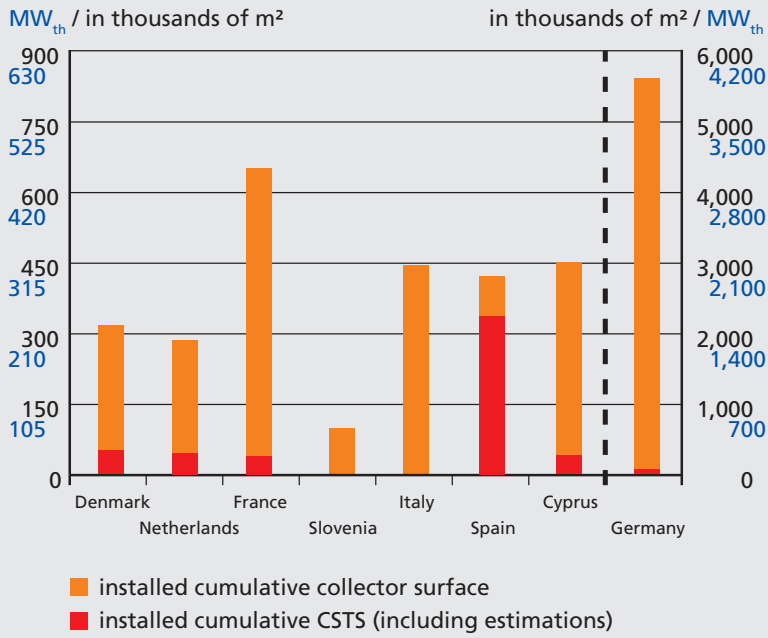



*Figure 3: Solar thermal collector surface area [m²] and capacity [MW$_{th}$] installed in partner countries in 2004 and proportion of CSTS*
*Sources: ESTIF 2005, www.estif.org; ADEME, 2005; SOLARGE national reports 2005, www.solarge.org*

Notes: ESTIF – European Solar Thermal Industry Federation – counts cumulated national collector surface areas by national capacities "in operation": it is calculated assuming an average lifetime of 20 years (15 years for systems installed until 1989). Most current systems are designed to work longer, but individual systems can have a shorter lifetime due to demolition, change of use of the building or poor maintenance.
France: As a difference to common ESTIF collector statistics the data for France – provided by the French Energy Agency "ADEME" – refer to metropolitan France and the Overseas Territories.

# Denmark

**Knowledge and capacity of the manufacturers available for a larger market – rather unconducive national framework**

By the end of 2005, an estimated 55,000 m² of CSTS (16 % of the total collector surface area) will be in operation in Denmark, where large systems are still being installed by the manufacturers. This sector is predicted to grow by 50 % in 2005. Compared to the periods before 2002, however, the Danish CSTS market is still at a low level.
District heating systems, for which a wide range of prices exists, are common in this country and regarded as a special characteristic of Denmark. The combination of heat and power is also wide-spread in large scale plants. Because of this, big cities often benefit from reduced prices. All in all, heavy taxation and the resulting relatively high energy prices provide motivation to invest in CSTS. Moreover, low interest loans are guaranteed and a new building code is to come into force in 2006.

## National Multi-Family Housing (MFH) Sector

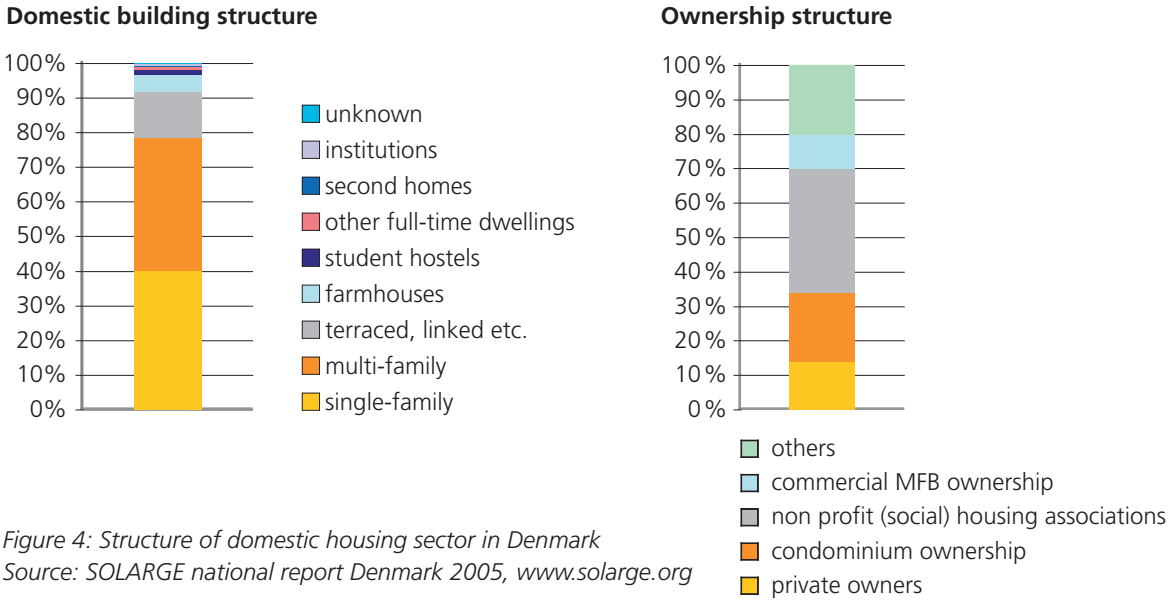
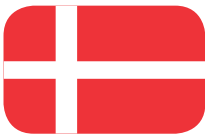



*Figure 4: Structure of domestic housing sector in Denmark*
*Source: SOLARGE national report Denmark 2005, www.solarge.org*

There are approximately 2.6 million dwellings in Denmark. Most of them (40 %) are located in single-family houses, followed by multi-family (38 %) and terraced, linked or semi-detached houses (13 %). The majority of dwellings was built between 1970 and 1974 or even before 1900.
In Denmark, district heating makes up a large proportion of heating systems, while central oil or gas heating is rare. In almost all residential buildings in Denmark, domestic hot water and space heating is provided by the same energy source.
The rate of new construction activities exceeded 4.0 % in 2004. In contrast, the estimated renovation rate amounts to only 0.2 %.
Relevant investors for CSTS implementations are non-profit housing associations who dominate the ownership structure with a share of 36 %. Another 20 % of the multi-family houses are in condominium ownership and 20 % are owned by municipalities and others.

**Conclusion**
**MFH sector**
More CSTS must be installed for district heating plants, although district heating will not be possible for new buildings.
Solar thermal heating will become more of an issue for buildings currently heated with oil or gas.
Widespread use of central water heating for individual buildings is essential for CSTS.



Area: 43,096 km²
Inhabitants: 5.397 million
Gross domestic product (GDP) per inhabitant in 2003: 26,100 EUR
Annual solar radiation: 925–1,000 kWh/m²

Nevertheless, solar energy is given low priority by the government, as it is considered an expensive way to reduce carbon dioxide emissions. Thus, there are currently no direct subsidy schemes and incentives for solar energy, in spite of national promotion schemes undertaken by the Energy Agency under the Ministry of Traffic and Energy.

**Conclusion**
### National framework

In Denmark, the manufacturers possess the knowledge and the capacity required to serve a larger market. Also, comparatively high energy prices, a result of heavy taxation, are an incentive for investing in CSTS.
Consequently, the large scale plants for district heating will be of interest for SOLARGE activities. Furthermore, we will also focus on the construction sector, based on building energy performance regulations.
Unfortunately, there are currently no incentives to promote CSTS, even though high fuel prices result in a growing market.
The promotion activities envisioned by SOLARGE must therefore emphasise the advantages of CSTS compared with other energy sources.

## National Hotel Sector

41,838 rooms were registered in Denmark in 2005. Hotel numbers plunged by 43 % between 1993 and 2003: there are currently 527 hotels*. In contrast, the number of rooms per hotel increased, leading to an occupancy rate of about 35 % in 2003.
The majority of the hotels is connected to district heating, while the domestic hot water segment is dominated by central systems. Space heating is generally implemented using radiators, though floor heating is common in some new hotels.
Nearly 72 % of the hotel sector is owned by commercial corporations, organised in chains of hotels. Hotel owners are normally reluctant to invest in solar thermal systems, because of the payback periods and the lack of adequate incentives.

**Conclusion**
### Hotel sector

As district heating is widespread, only a small percentage of hotel stock will be relevant for solar thermal use.
However, solar energy is attractive for central heating systems and hot water production.
There are still no adequate incentives for investments.

* Please note that the definition of "hotel" varies in each of the countries researched.
This should be taken into account when comparing countries' hotel building stocks data.

# Germany

**Despite conducive conditions and subsidies, the market sector for collective solar thermal systems (CSTS) is still relatively undeveloped**

In 2004, about 5 % of the total collector area installed in Germany was CSTS. In the multi-family housing sector, a total of about 60,000 to 75,000 m² of collector surface is in operation. Although players are showing an increasing interest in the improvement of the CSTS sector, this market segment is still underdeveloped and customized solar thermal solutions which meet all technical and economic needs of investors are rare.
However, the high energy prices and price increases in particular result in conducive conditions for CSTS. Moreover, the Energy Saving Ordinance (EnEV 2002) limits houses' energy supplies, and the requirement of an energy efficiency label for residential buildings will facilitate the integration of solar activities. In the hotel sector, admittedly, the payback periods are shorter than in the housing sector.

## National Multi-Family Housing (MFH) Sector

Building stock in Germany consists of about 17 million buildings in total. Around 60 % of the whole building stock is privately owned in the old federal states, whereas the majority – almost 70 % – in the new federal states is run by cooperatives, communities or municipal housing companies.

Most multi-family houses are equipped with central heating systems for several buildings. Natural gas is the most common energy source for heating. Although district heating and coal fired systems are also common in the new federal states, oil is used to a great extent in the old federal states.

In 2003, about 92 billion EUR were invested in renovation while 52 billion EUR were spent on new buildings.
80 % of multi-family houses use heating systems which would technically benefit from the installation of CSTS.

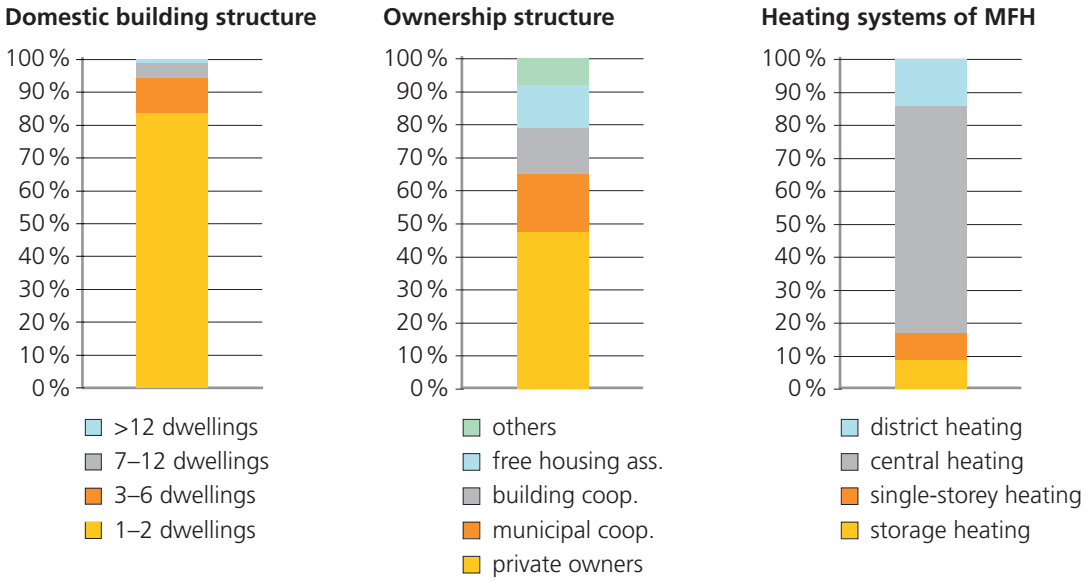



*Figure 5: Structure of domestic housing sector in Germany*
*Source: SOLARGE national report Germany 2005, www.solarge.org*

**Conclusion**
**MFH sector**
Integration of CSTS is based on a high potential for energy optimisation. Ownership associations are a relevant target group for the activities of SOLARGE.
Solar activities should be a part of the overall marketing strategy for demand-related market relations in particular.

Area: 357,027 km²
Inhabitants: 82.531 million
Gross domestic product (GDP) per inhabitant in 2003: 23,100 EUR
Annual solar radiation: 900–1,300 kWh/m²

Therefore, it is expected that the highly professionalised national solar thermal and heating industry will invest yet more time and resources into development and marketing of customized solutions to the multi-family housing and hotel sector.
By 2010, the cumulative collector surface area installed is forecast to reach 10 million m². Different subsidies are available in order to generate positive effects for CSTS. There are promotion initiatives as well as subsidy programs (Solarthermie 2000plus and market incentive program – Marktanreizprogramm) and soft loans granted by the Reconstruction Loan Cooperation (Kreditanstalt für Wiederaufbau – KfW).

**Conclusion**
### National framework
While the parties involved in the solar thermal market in Germany are showing an increasing interest in improving and expanding the CSTS market sector, this segment is still quite underdeveloped.
The national conditions, however, are conducive to the implementation of CSTS, due to the fact that energy prices are high and continue to increase. Furthermore, the integration of solar activities will be facilitated by the requirement of an energy efficiency label for residential buildings.
Despite the conducive legislative and economic framework, different subsidies are granted for CSTS investments in Germany, which might generate positive effects for the CSTS market.

## National Hotel Sector

In 2003, the German hotel sector offered a capacity of more than 2.5 million beds in 53,771 accommodation facilities*. Most overnight stays are registered in summer, which is conducive to the adoption of solar thermal energy.
In 2004, approximately 549 hotels were constructed and about 1,156 hotels were renovated.
The German hotel sector benefits from relatively short payback periods for CSTS investments. Also, image reasons play a role in the implementation of CSTS, which must be considered in different marketing measures.
There is a trend in ownership structure towards the expansion of hotel chains, which accounted for 38 % in 2000.

**Conclusion**
### Hotel sector
Although the financial scope in the hotel sector for additional activities such as the implementation of solar thermal solutions is relatively low, hotel chains are a relevant target group for SOLARGE. The integration of solar solutions in the hotel's marketing strategy could be an interesting way of positioning the accommodation facilities, especially in the wellness and eco-tourism sectors.

* Please note that the definition of "hotel" varies in each of the countries researched. This should be taken into account when comparing countries' hotel building stocks data.

# Netherlands

**Annual sales of large solar thermal installations stabilised due to changing government policies**

45,000 m² of cumulated collector surface area of collective solar thermal systems (CSTS) were installed in 2004. Of this, more than 5,000 m² of collector surface area went into operation the same year, contributing to a 16 % CSTS market share of the total collector surface installed. The CSTS market now has stabilised, due to the fact that national subsidy schemes were abolished in 2003.
Currently, there are no specific active support programs for solar thermal systems, with the exception of the tax reduction for companies, and some local incentives. It is unlikely that the previously set national goals for solar thermal energy will be reached by 2010. Nevertheless the supply side for CSTS systems has professionalised during the last years. This may form a good basis for autonomous market growth in coming years.

## National Multi-Family Housing (MFH) Sector

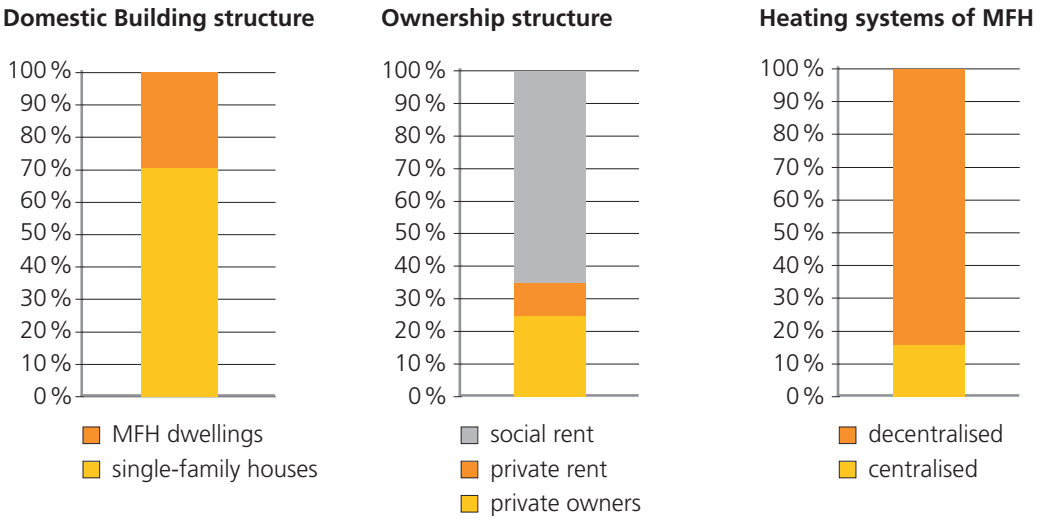



*Figure 6: Structure of domestic housing sector in the Netherlands*
*Source: SOLARGE national report Netherlands 2005, www.solarge.org*

The building stock in the Netherlands consists of about 6.8 million dwellings in total. Of these, two million, i. e. 30 %, are dwellings located in an estimated 70,000 multi-family houses.
Around 3.4 million dwellings were constructed after 1970.
About 16 % of the MFH dwellings are equipped with collective heating installations, whereas hot water is provided individually in 84 % of all cases.
Gas is the most common energy source in the overall building stock. It accounts for 97 % of space heating and 79 % of water heating. Electricity is used for water heating in 11 % of cases, and collective systems account for 10 %.
The annual renovation rate of heating installations in the Dutch housing sector is around 6.7 %, compared with a construction rate for new systems of only approx. 0.8 %. Non-profit housing associations are granted low interest rates. In this market sector, return on investment periods of 10–15 years are acceptable.
Most of the MFH dwellings (63 %) are owned by housing associations, while 27 % are privately owned and 10 % are privately rented. Non-profit housing associations own about 35 % of all dwellings in the Netherlands.

**Conclusion**
**MFH sector**
In the future, the interest in energy savings will increase due to rapidly growing energy prices. The promotion of solar thermal energy should be associated with renovation methods, emphasising convenience and health. The majority of multi-family buildings is owned by housing associations. Consequently, these are the most important stakeholders, and should therefore be the focus of SOLARGE activities.

Area: 41,526 km²
Inhabitants: 16.258 million
Gross domestic product (GDP) per inhabitant in 2003: 25,800 EUR
Annual solar radiation: 1,000 kWh/ m²

The predominant solar thermal technology in the Netherlands is solar water heating. However, some large combined solar water and space heating systems have been built recently.
From 2006 onwards, the existing energy performance requirements for new buildings will be increased by 20 %. This will increase the demand for solar thermal energy in new buildings. The introduction of the European Directive on the Energy Performance of Buildings (EPBD) may help promote solar renovation. Full reflection of the energy quality of buildings in rent prices could also be an important incentive.
However, the interest of the government in solar thermal energy has declined in recent years. Other parties such as the industry federation and some large market players have professionalised and taken a more proactive role.

**Conclusion**
### National framework
Changing government policies explain the stabilisation of sales in the CSTS market in the Netherlands. Currently, there are no specific active incentive programs for solar thermal energy. However, increased requirements on the energy performance of buildings are to stimulate the demand for solar thermal energy in the construction of new buildings from 2006 on, and the EPBD will stimulate the market for renovation measures incorporating solar thermal energy. Furthermore, the reflection of energy quality in rent rates could become an important stimulus for investments in CSTS.
The interest of the government in solar thermal energy has shifted towards other renewable energy options in recent years. For this reason, SOLARGE's key national activities will aim at developing a roadmap for solar thermal energy jointly with the industry federation and research institutes. This roadmap will address the roles different parties (industry, demand side, government, research institutes) can play in the development of the solar thermal energy market.

## National Hotel Sector

Within SOLARGE, the hotel sector is seen as a potentially interesting sector for solar thermal energy. In 2003, the Dutch hotel sector boasted a capacity of approx. 90,850 rooms in 2,900 hotels*. The average occupancy rate amounts to 63.2 %.
A small number of large (international) hotel chains own approx. 20 % of hotels. In contrast, roughly 80 % of the hotels belong to small companies.
Central gas-fired boilers are very commonly used for hot water supply and space heating in the Netherlands.
The renovation rate of hot water systems in 2004 is estimated to be around 7 %.
In this predominantly commercial sector, investments in energy savings have an expected payback period of three to five years.
In addition to the hotel sector, another 4,000 accommodations, such as guesthouses, youth hostels, group accommodations and camp sites provide bed capacity.

**Conclusion**
### Hotel Sector
The existence of a small number of large hotel chains allows SOLARGE to focus its promotion activities. For environmental image reasons, the interest in solar thermal may grow in the future – opportunities are more image-related than economic.
In addition, solar thermal energy has potential uses for other accommodation types such as campsites, which make up 34 % of the overall accommodation capacity.

* Please note that the definition of "hotel" varies in each of the countries researched. This should be taken into account when comparing countries' hotel building stocks data.

# France

**Consistent national conditions and promotion scheme, though development still strongly linked to the actions of public authorities**

In 2004, collector surface area of 7,768 m² was installed in collective solar thermal systems (CSTS) in France, which accounts for a market share of 9.9 %. The market is expected to have grown rapidly in 2005: roughly 14,000 m² of CSTS systems are predicted to contribute to the total collector surface installed of about 100,000 m². By the end of 2006, the annual installation rate target for CSTS is expected to be 15,000–20,000 m². However, the solar market is still characterised by relatively little organisation and lobbying by manufacturers and other players in this segment.
The new law "Programme des Orientations de la Politique Energétique" 2005 (POPE 2005), which comes into force in 2006, requires renewable energies to account for 15 Mtoe of heating in buildings by 2010. With regard to the legal framework, thermal regulations are to be developed, as are stricter requirements for energy performance in new

## National Multi-Family Housing (MFH) Sector

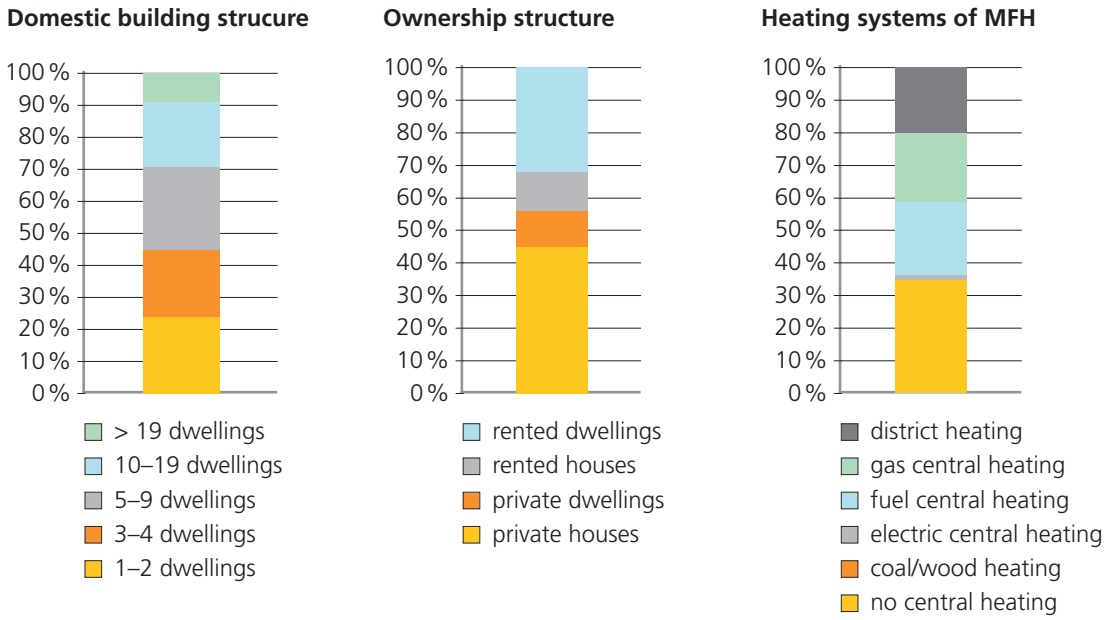



*Figure 7: Structure of domestic housing sector in France*
*Source: SOLARGE national report France 2005, www.solarge.org*

The building stock in France consisted of 29.4 million units in 2002. Around 10.6 million dwellings were located in multi-family houses.

**Conclusion**
**MFH sector**
In the housing sector in particular, there is a great potential for CSTS. Social housing is one of the segments with the highest rates of solar installations, particularly those implemented in the 1980s or, for CSTS, largely since 1999. The various institutions dealing with social housing have shown their motivation in past and present measures. Also, in the private sector, the combination of the great need for new construction and renovation activities in multi-family houses is an attractive starting point for project developers.

The majority of buildings was constructed between 1949 and 1974 (35 %) and before 1948 (31.2 %). In France, decentralized heating systems are most common and in the majority of cases, gas and electricity are the main energy resources. However, there is a trend towards individual gas heating systems. More than half of the dwelling stock (56 %, i. e. 13.7 million dwellings) is privately owned, of which 2.6 million are located in multi-family houses. Roughly 45 % of the MFH dwellings are social housing.

Area: 543,965 km²
Inhabitants: 59.900 million
Gross domestic product (GDP) per inhabitant in 2003: 23,700 EUR
Annual solar radiation: 1,100–1,700 kWh/m²

buildings, especially for water heating. According to the laws "POPE" and "Solidarité et renouvellement urbain" (SRU), a bonus is already granted when renewable energies are used.
In order to reach the goal of one million m² of collector surface area installed, among which at least 200,000 m² are forecasted to be devoted to CSTS by 2010, increasing promotion measures will be linked with continuous measures and promotion schemes for CSTS. Regional and local authorities are a particularly relevant target group for the integration of CSTS.

**Conclusion**
**National framework**
The activities of public authorities still strongly determine the development of the national CSTS market. Key actors such as manufacturers are not well organized to a great extent yet and lobbying is still few distinct.
However, the legislative and economic conditions are promising. Regulations are being adapted and the new law of 2005, which defines the objectives for the market share of solar thermal energy, has been passed.
All in all, France offers conducive conditions for the implementation of CSTS, including consistent measures and a promotion scheme with increasing communication measures.
In order to successfully integrate CSTS into the market, local authorities, i.e. the regional councils, must be the main focus of SOLARGE activities.

**Conclusion**
**Hotel sector**
An interesting target group in the national hotel sector could be integrated hotel chains, which would then act as multipliers on the market.

## National Hotel Sector

The national building stock in the French hotel sector comprises 27,629 hotels of which half are privately or family owned*. Around 18 % of the hotels are commercially owned, by voluntary or integrated chains of hotels. The last category shows a great and continuous growth since the mid-1990s.
Decentralized systems are most common for water and space heating. While economy class hotels generally have electric heating systems, upper class hotels use different energy sources.

* Please note that the definition of "hotel" varies in each of the countries researched. This should be taken into account when comparing countries' hotel building stocks data.

# Slovenia

**Conducive national subsidy scheme and promising investment plans, but disorganised domestic industry**

Roughly 9,000 m² of collector surface area have been installed 2004, of which CSTS accounts for 1 %. In 2004, only two large solar thermal systems, with a collector area of largest 86 m², went into operation. The fact that few collective solar thermal systems (CSTS) systems have been installed is due to bad experiences with durability of the systems in the past. Although the domestic industry appears to be relatively disorganised, the subsidy schemes for CSTS will surely have an impact, on private investors in particular. Important aspects for the implementation of CSTS are its reputation for environmental friendliness and good practical examples.
As CSTS hardly compete with other technologies like heat pumps, the prospects for large solar thermal systems will improve, due to rising energy prices in particular. However, there are no requirements for CSTS and no solar ordinance

## National Multi-Family Housing (MFH) Sector

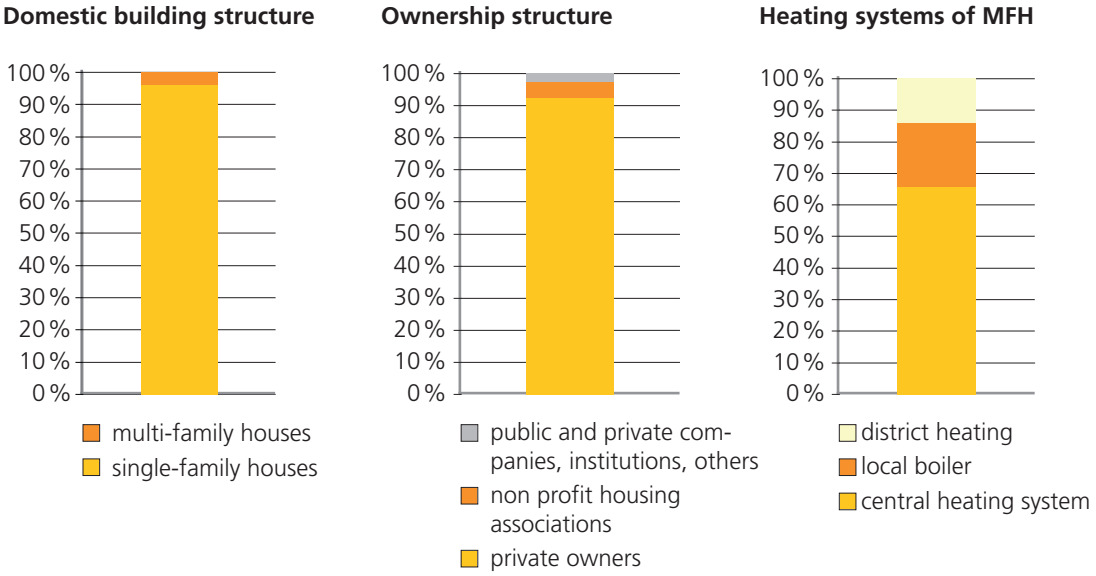



*Figure 8: Structure of domestic housing sector in Slovenia*
*Source: SOLARGE national report Slovenia 2005, www.solarge.org*

In Slovenia, there are about 777,000 dwellings, of which 242,000, i. e. 31 %, are MFH dwellings. Roughly 59 % of the building stock was constructed before 1975 and 31 % between 1975 and 1990. This results in high annual energy consumption for space heating (175 kWh/m²a) and water heating (32 kWh/m²a) per unit of floor area. Approximately 66 % of dwellings have individual heating systems. Electricity is also common for water heating and accounts for 29 % of energy resources.
The high energy consumption for water heating creates a promising potential for the adoption of solar thermal systems. For space heating, oil is the dominant energy resource, with almost 45 %, followed by biomass with 29 % and district heating with 12 %. During the last decade, renovation activities have increased. By contrast, the rate of new buildings in 2002 was less than 0.1 %. Recently, initiatives combining biomass and solar water heating have also featured, encouraged by special financing schemes. In most cases (92 %) the dwellings are privately owned in condominium ownership, due to the sale of the state-owned building stock in the 1990s. 27,000 dwellings are non-occupied.

**Conclusion**
**MFH sector**
Due to high energy consumption and the predominance of individual heating systems, there is a promising potential for solar thermal energy in Slovenia. A strong legal barrier is that dwellings in multi-family houses are each privately owned (condominium ownership). In order to increase the number of CSTS, designers and building managers are an important target group for SOLARGE.

Area: 20,253 km²
Inhabitants: 1.996 million
Gross domestic product (GDP) per inhabitant in 2003: 16,400 EUR
Annual solar radiation: 1,000–1,600 kWh/m²

regulations to date, though a regulation on thermal protection and efficient energy use in buildings has been adopted.
In spite of the current conducive national subsidy scheme, a long-term incentive program should be envisioned for Slovenia, annually increasing the grant aid for investments. The current national environment protection program envisions that new solar collector surface area of 10,000 m² per year will be installed by 2010. However, the inclusion of solar energy in the national energy supply plan is not ambitious enough and there is no direct promotion scheme for CSTS. Thus, national institutions are one of the target groups for the promotion of the integration of CSTS.

**Conclusion**
### National framework
Although Slovenia currently has a conducive national subsidy scheme, government support should bring about greater effects for individual investors rather than for the hotel sector. Furthermore, the domestic industry is quite disorganised.
However, the future status for CSTS is predicted to improve, which will primarily be the result of increasing energy prices. However, a long-term subsidy scheme with annually increasing aid should nevertheless be implemented.
SOLARGE activities should therefore concentrate on national institutions, highlighting environmental reputation as well as successful practical examples. Moreover, SOLARGE should promote the demand in multi-family buildings and hotels.

**Conclusion**
### Hotel sector
The predicted plans for investment in renovation and construction are a useful indicator for the implementation of CSTS in the hotel sector. Hotel chains in particular are the main target group to focus on.

## National Hotel Sector

There are 190 hotels in roughly 30 major tourist centres, which were built mainly after 1965. The capacity of hotel stock in Slovenia is 27,500 to 30,000 beds*. Of this, the hotels have an average of 400 to 500 beds each. The annual occupancy rate in the sector is 47.9 %.
Several major hotel chains performed renovation work in recent years as a result of the developing tourism industry. By 2010, roughly 2,000 boilers are to be replaced, a total investment of 1,500 million EUR. Every year, about 90 new buildings are constructed.
Most of the hotels in Slovenia (65 %) are privately owned – there are few hotel chains. The 13 major campsites in the country might also be an interesting target for the implementation of solar thermal energy systems.

* Please note that the definition of "hotel" varies in each of the countries researched. This should be taken into account when comparing countries' hotel building stocks data.

# Italy

**Weak CSTS market with not yet sufficiently established supply side, but conducive national conditions**

At present, there are only 4,000 to 8,000 m² of CSTS installed in Italy, which corresponds to 1 – 2 % of the total collector surface area in operation. However, in the last years a significant increase of CSTS installations, of over 10 % annually, is observed. CSTS systems are mainly installed on multi-family houses, hotels and sports facilities. Italy's law 10/91 on the maximum primary energy demand of buildings and the requirement for administrations to install solar systems was innovative but weekly implemented. A new stimulus is given by several communal and regional laws implementing the European Directive on the Energy Performance of Buildings (EPBD), already including binding solar ordinances, becoming operative through the local building codes. The environment ministry provided grant aid of six million Euros in 2001 for the implementation of solar thermal systems, and a tax reduction of 10 % is granted.

## National Multi-Family Housing (MFH) Sector

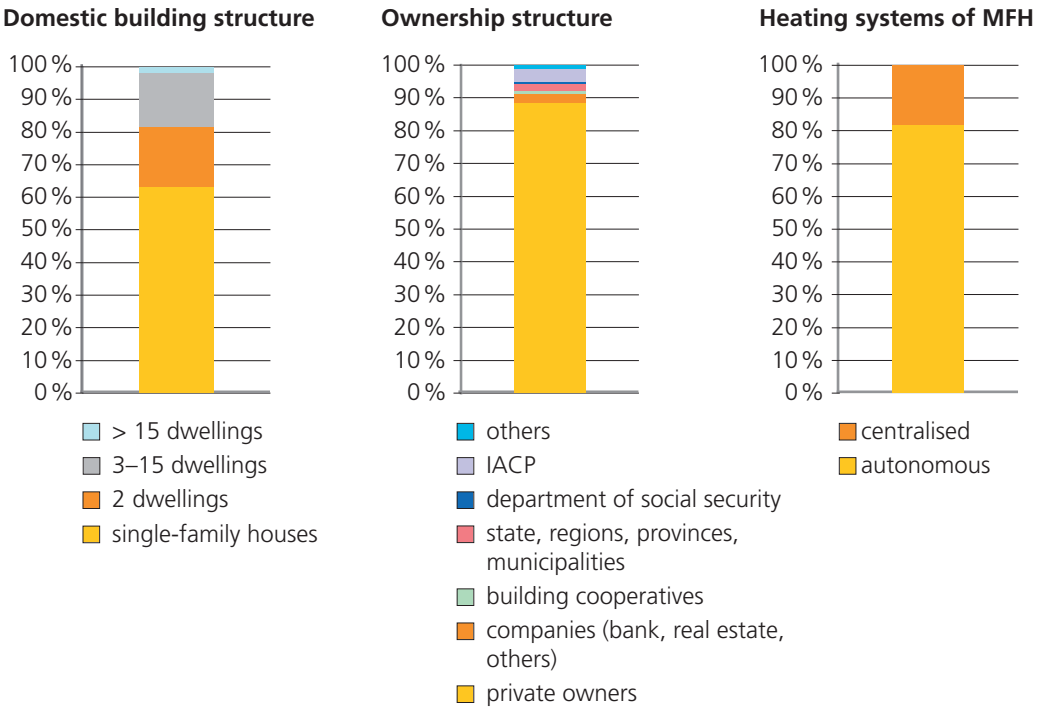



*Figure 9: Structure of domestic housing sector in Italy*
*Source: SOLARGE national report Italy 2005, www.solarge.org*

There are 10.9 million buildings in Italy, of which 3.95 million were built between 1961 and 1981. A large share of dwellings is situated in multi-family houses and the majority of the population owns their apartments.
15 million flats in total are privately owned, i. e. more than 90 % of the national total, including condominium ownership. Most buildings are group-owned, but managed by external companies or single administrators.

Autonomous heating systems, i. e. boilers, are very commonly used for domestic water heating. By contrast, centralised domestic hot water systems and district heating are rare, whereas they are in widespread use for space heating. There is a trend towards autonomous heating systems in the social housing sector in particular.
The renovation rate in Italy is high. Since 1991, more than 430,000 buildings have been renovated. A certain percentage of these multi-family houses is equipped with a heating system, suitable for the installation of CSTS.

**Conclusion**
**MFH sector**
The installation of CSTS is often hindered by technical and decision-related problems. Nevertheless, housing associations and building companies are an interesting target group for SOLARGE activities.

Area: 301,336 km²
Inhabitants: 57.888 million
Gross domestic product (GDP) per inhabitant in 2003: 22,800 EUR
Annual solar radiation: 1,200–1,800 kWh/m²

Furthermore, a subsidy program of 15.5 million Euros, managed by the regions, started in 2002 and a promotion program with a budget of nine million Euros for central and southern regions has been implemented. Nevertheless, the target of an installed collector surface area of three million m² by 2010 will not be reached.

**Conclusion**
### National framework

In Italy, the supply side of the solar thermal market is not sufficiently established yet to satisfy a broader demand. Another bottleneck for the implementation of CSTS is the installers' lack of knowledge. Thus, cooperation with all the players on the supply side is a crucial aspect for SOLARGE activities.
There is an important requirement for cost effective CSTS: energy prices are high in Italy. However, investors are not yet convinced, despite new economic and legislative schemes. Complete service packages and additional measures must still be established in conjunction with investors.
Also, a long term research and development program for CSTS is essential for developing appropriate technologies and generating the required confidence on the market.

## National Hotel Sector

There are almost 33,500 hotels in Italy, mostly located in the north and in the centre of the country, with a total of 1.9 million beds*. The occupancy rate in the hotel sector is 44 %.
For domestic water and space heating the most common system is centralised heating, with gas used as an energy resource in almost every hotel. In the south, there are also autonomous heating systems, while the islands use electricity for domestic hot water production.
Roughly 45 % of the biggest Italian hotels are part of consortias, whereas 25 % have sole owners or are franchises respectively. A large number of hotels, however, is managed by family-owned companies.

* Please note that the definition of "hotel" varies in each of the countries researched. This should be taken into account when comparing countries' hotel building stocks data.

**Conclusion**
### Hotel sector

The Italian hotel sector offers great technical potential for the implementation of solar thermal systems. Hotel operators in the south in particular are becoming more interested in solar thermal systems. However, the development is moderate, due to subsidised energy prices for hotel owners who assume short payback periods.

# Spain

**Potential for collective solar thermal systems (CSTS) remains – adequate solutions for decentralised systems required**

The main market segment for solar thermal systems in Spain are installations with a collector surface area of more than 30 m². Those systems make up 80 % of the market share and have experienced market growth of 5–11 % during the last two years.
Other than relatively low energy prices, the reason for this might be the payback periods of between five and ten years. However, a Solar Ordinance has been introduced in 50 municipalities, requiring the use of solar water heaters (SWH) in new and renovated buildings.
By 2006, a new building code "Código Tecnico de la Edificación" (CTE) will come into force, requiring that solar energy make up 30 to 70 % of energy in all new buildings and major renovation projects. In order to reach the

## National Multi-Family Housing (MFH) Sector

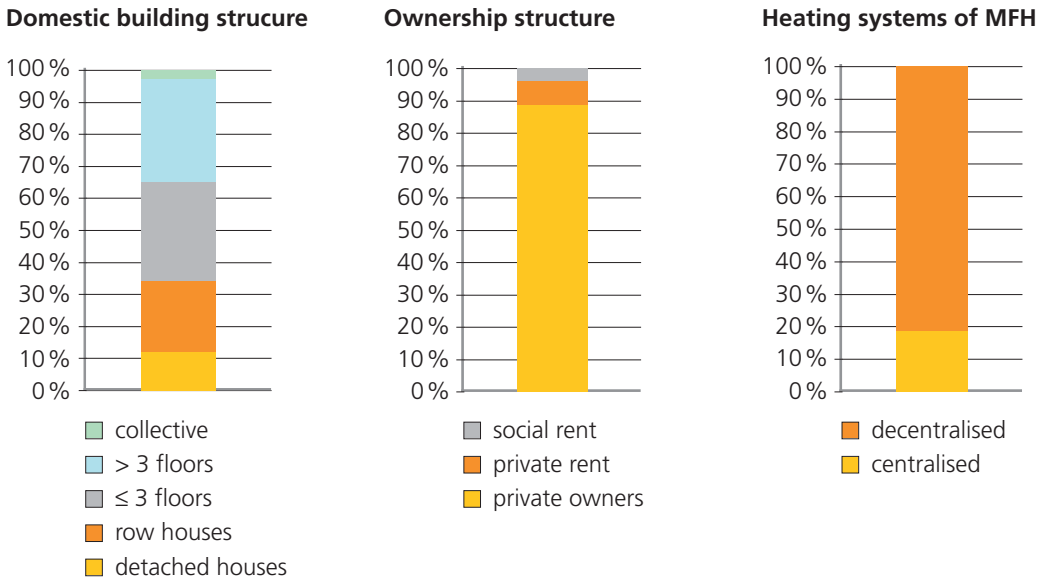



*Figure 10: Structure of domestic housing sector in Spain*
*Source: SOLARGE national report Spain 2005, www.solarge.org*

**Conclusion**
**MFH sector**
The national energy policy is to increase the demand for solar thermal systems.
Despite the market growth of the last years, there is still much potential for CSTS in the multi-family housing sector.
The new housing sector represents an interesting market segment for SOLARGE. However, the main focus should be on condominium ownership of flats and its legal effects on CSTS implementations.

In 2000, about 14.1 million occupied dwellings were registered in Spain. 12 million flats in total are privately owned in condominium ownership, i.e. approximately 90 % of the national stock of dwellings. Individual heating systems are dominant in the multi-family housing sector. They make up almost 40 % of the market, whereas centralised heating systems are far less common, at less than 10 %. Approximately 38 % of the dwellings are only partly heated using small mobile devices. Only 48 % of the total building stock has a professional heating system.

Gas is somewhat more common than electricity as a source for space heating, with each having a share of almost 40 %. However, the use of gas heating is increasing in new buildings. District heating, by contrast, is rare.
The renovation rate in Spain is 0.5 % per year, while there is much new building activity in the country.

Area: 504,782 km²
Inhabitants: 42.345 million
Gross domestic product (GDP) per inhabitant in 2003: 20,900 EUR
Annual solar radiation: 1,100–1,900 kWh/m²

goal of the updated Renewable Energy Plan "Plan de Energias Renovables en España 2005–2010" (PER 2005: 4.9 million m² of collector surface area installed by 2010), special financing instruments (subsidies and loans) of up to 80 % of the eligible costs are granted. Enterprises can already benefit from tax reductions of up to ten percent of the investment costs, whereas financial incentives for private persons are planned, but have not yet been implemented.

**Conclusion**
**National framework**

In Spain, the market for CSTS is slowly becoming mature and professional. However, the need for large solar systems remains, due to a high market share of apartment buildings. Thus, the technological development must be improved, linked with aspects like minimum requirements for solar energy supply and optimal (building) integration. In short: Adequate solutions have to be established for decentralised solar thermal systems. Another success factor is to facilitate the implementation of the new building code (CTE), which should have a major effect on the market. Key players for the adoption of the CTE are public bodies on national, regional and local level. The combination of both the CTE and the Renewable Energy Plan PER 2005 as well as subsidies and credit lines will create a sound basis, even though low energy prices are not a key factor for market development.


**Conclusion**
**Hotel sector**

Water heating is a promising market segment for SOLARGE, despite significant energy costs. The focus of CSTS installations will be on the existing hotel stock, due to low rates of construction.

* Please note that the definition of "hotel" varies in each of the countries researched. This should be taken into account when comparing countries' hotel building stocks data.

## National Hotel Sector

The hotel stock in Spain consisted of 13,832 buildings with almost 1.2 million beds in 2004*. Approximately 80 % of the beds are located in the following autonomous regions of Spain: Balearic Islands, Canary Islands, Catalonia, Andalusia, Valencia and Madrid. Space heating and hot water are generally provided by central systems, and gas and oil are the main energy sources.
Every year, around 152 new hotels are built, which produces a relatively low construction rate of 1.1 %.
In the Spanish hotel sector, where 70 % of the hotels were privately owned in 1999, the current occupancy rate is 54 %. Around 30 % of all Spanish hotels are commercially owned, and organized in hotel chains. This third of the hotel stock makes up roughly 50 % of the total of beds available.

# Cyprus

**High energy prices and great potential for collective solar thermal systems (CSTS) in the hotel and public building sector**

With a total surface area installed of 450,200 m² by 2004, Cyprus is world leader in the collector surface area installed per capita. Of this, 40,000 m² of CSTS were already in operation by 2004 and the market grows by 10–15 % every year. The national industry production capacities amount to about 30,000 m² yearly. However, there is potential for international cooperation in introducing other applications of solar thermal energy.
Cyprus is characterised by high energy prices; thus, the introduction of a great number of CSTS is promising at the moment.
Investments in solar thermal energy are subject to a grant scheme which covers up to 40 % of the investment costs. Schools, municipalities and communities benefit from the programme, run by the Cyprus Institute of Energy.

## National Multi-Family Housing (MFH) Sector

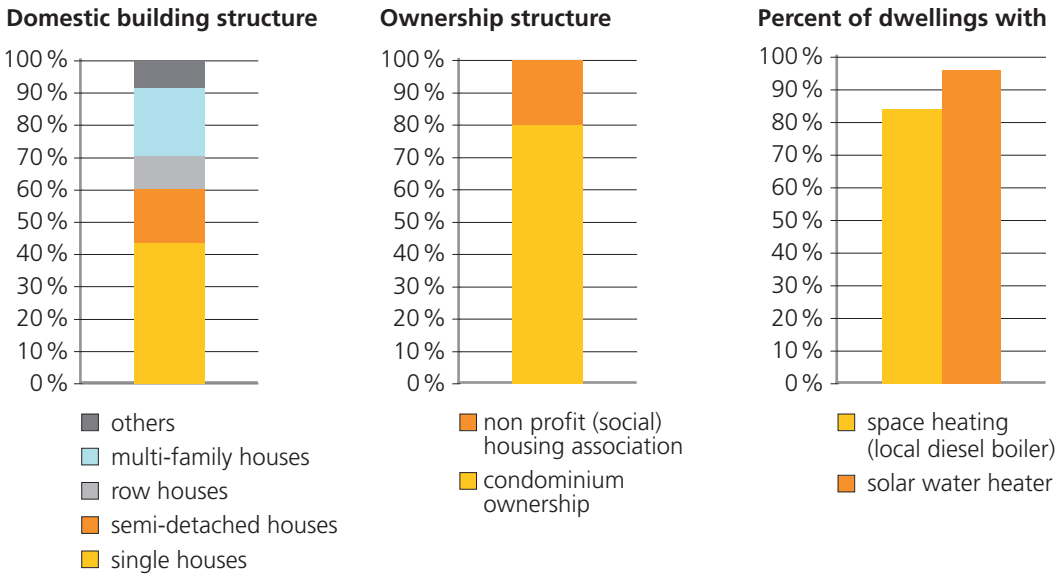



*Figure 11: Structure of domestic housing sector in Cyprus*
*Source: SOLARGE country report Cyprus 2005, www.solarge.org*

In 2003, the national building stock in Cyprus was about 300,000 dwellings, mainly consisting of single houses and apartment blocks. Currently, the number of multi-family houses with six to eight apartments is increasing rapidly.
Large diesel-fired boiler units are in widespread use for space heating. The hot water supply is generally managed by thermosiphon solar water heaters. Each dwelling in Cyprus has its own heating system.
The renovation rate is seven to nine per cent a year.
At approximately 80 %, condominium ownership dominates the housing sector, the rest consists of low-cost government housing schemes and self-help housing schemes.

**Conclusion**
**MFH sector**
One of the important target groups for SOLARGE activities are ministry departments.
The primary focus should be on space heating and on development of the systems, including forced circulation, for example.

Area: 9,251 km²
Inhabitants: 0.77 million
Gross domestic product (GDP) per inhabitant in 2003: 17,600 EUR

Moreover, the national action plan towards sustainable energy also focuses on the utilisation of solar thermal energy for further applications such as space heating and cooling.

**Conclusion**
### National framework

In Cyprus, the local industry for solar thermal energy is well established. Thus, other applications of the systems could be introduced – this could be implemented in international co-operations.
Currently, high energy prices are an incentive to install a larger number of CSTS, although there is no legal correlation between rent and the energy efficiency of a flat.
With the implementation of a scheme, many hotels will be renovated in the coming years to improve the quality of the services in the sector. Thus, new efficient systems will replace old solar thermal installations. Furthermore, new CSTS applications are planned for schools and municipalities under the current grant scheme.

## National Hotel Sector

The hotel capacity in Cyprus is approximately 100,000 beds in around 1,000 hotels, hotel apartments, apartment blocks and tourist villages*. Nevertheless, the occupancy rate has fallen from 75 % in 2001 to 55 % in 2004.
Half of the national hotel stock uses large solar water heating systems, supplemented by diesel-fired boilers during the winter months. Forced circulation systems are most common with a large array of flat plate collectors. Central heating systems are most commonly used for space heating.
The renovation rate in the hotel sector of Cyprus is 1,000 to 1,500 hotels per year. In the next few years, many hotels will be renovated with the implementation of the scheme. This will provide an incentive to replace old thermal systems with new efficient ones and result in a quality improvement in hotel sector services.
Before 1990, all the existing hotels were family businesses, whereas nowadays chains of hotels are taking over the business to an increasing extent. Those chains of hotels are often run by large companies who today already own 40 % of the total capacity of the hotel sector.

**Conclusion**
### Hotel sector

In order to improve the quality for tourist services, the Ministry of Commerce, Industry and Tourism is consulting other associations with the aim of introducing new measures and policies. This aspect might generate potential for SOLARGE activities.

* Please note that the definition of "hotel" varies in each of the countries researched. This should be taken into account when comparing countries' hotel building stocks data.

# Conclusions and Future Prospects

**Uneven potential for collective solar thermal systems (CSTS) due to different conditions in partner countries – promising conditions mainly in southern European countries**

As a result of the evaluation of the eight SOLARGE partner countries it can be stated that there is definitely potential for further implementation of CSTS in all the countries, especially when the increasing level of energy prices in several countries is considered. But no country currently has a fully consistent legal, economic and political framework for mass implementation of CSTS.

**Comparison of conditions in national housing and hotel sector**

| | CSTS in the MFH sector | CSTS in the hotel sector |
|---|---|---|
| **Denmark** | **0** | **--** |
| **Netherlands** | **+** | **0** |
| **Germany** | **+** | **+** |
| **France** | **++** | **++** |
| **Spain** | **+** | **++** |
| **Italy** | **+** | **+** |
| **Slovenia** | **0** | **+** |
| **Cyprus** | **+** | **++** |

*Figure 12 + 13:*
*Legend: +++ = optimal conditions, ++ = favourable conditions, + = rather favourable conditions, 0 = conditions without influence, - = rather unfavourable conditions, -- = very unfavourable conditions, --- = integration of CSTS almost impossible*
*Source: SOLARGE comparative country analysis 2005, www.solarge.org*

In France, the conditions for the integration of CSTS in building stock are considered the most conducive. The general conditions in hotel stock are slightly better in the partner countries. Thus, France, Spain and Cyprus have favourable conditions for the integration of CSTS. Spain and France in particular may act as role models, based on the efforts made in this sector to date.

Based on the conditions for both sectors, France appears to be the most promising market for CSTS implementation in the near future, followed by the southern European countries of Spain, Italy and Cyprus which are still placed ahead of Germany.

**Comparison of national framework conditions**

| | National energy policy for CSTS | National economic framework for CSTS | National legislative framework for CSTS |
|---|---|---|---|
| **Denmark** | --- | 0 | + |
| **Netherlands** | 0 | 0 | + |
| **Germany** | + | + | + |
| **France** | ++ | + | ++ |
| **Spain** | ++ | - | + |
| **Italy** | + | ++ | + |
| **Slovenia** | + | 0 | - |
| **Cyprus** | + | ++ | 0 |

Compared with the national sector conditions, the national political, economic and legislative frameworks for CSTS implementation in the partner countries are even more diverse and therefore offer various starting points as well as different target groups for further SOLARGE activities.

As shown in the figure, most existing national energy policy and the legislative frameworks are already somewhat conducive or at least not hindering the CSTS markets. But most national reports have also identified legal and political aspects to be improved by national authorities in order to establish a commercial market for CSTS.

The overall economic framework in each country comprises factors like energy prices but also capital market terms for real estate investments and expected payback periods for renovation projects seem to be a main barrier to encouraging CSTS in some partner countries. Only half of the countries currently report more or less conducive economic conditions. The only positiv exceptions are Italy and Cyprus.

All in all, France is currently regarded to have the best conditions of the eight partner countries for the implementation of collective solar thermal systems. This is not only due to the new law specifying the objectives for the market share of solar thermal energy, but also to the new thermal regulation dictating stricter requirements for the energy performance in new buildings. In other countries with relatively conducive legislative conditions, the building codes generally play a role, often in conjunction with regulations on the energy performance of buildings. Second, the integration of the European Energy Performance Building Directive (EPBD) in national policies is identified as an important stimulus for the installation of large solar thermal systems.

## Future prospects for SOLARGE 2006/2007

As all figures, tables and aspects in this brochure show, further SOLARGE activities, customised for each of the eight partner countries – are essential in order to improve the national conditions for CSTS implementations. Therefore, all the relevant market players must be convinced of the advantages of large solar thermal systems in multi-family houses and hotels. For this purpose, not only national institutions and public bodies, such as ministries of housing and economics, are important target groups, but also the investors, housing associations and hotel chains in particular. Moreover, increasing the capacity of supply side players, such as the industry, planners and craftsmen must be incorporated in SOLARGE activities.

The different tools SOLARGE is developing serve to overcome the existing barriers for the implementation of large solar thermal systems and to encourage the development of the CSTS market. In particular:

- a best practice database of model projects in Europe will be published for comparison
- training measures will be provided for relevant target groups
- local information campaigns for investors are envisioned
- national position papers giving concrete recommendations to improve political and legal frameworks will be drafted and, on a local level, municipalities and decision makers are to be supported and given proposals for an effective policy.

The above mentioned database will not only present technical data in the best practice examples, but also factors which contributed to the success of the respective project. Thus, the incentive for the installation will be explained, as will the relevant financing and support measures. Last, but not least, specific technical solutions implemented in the project will be detailed.

All project results are distributed EU-wide and will be published among others on the interactive project website www.solarge.org.

## Photographs / Sources

Title "rue des plantes", Paris; OPAC de Paris; source: target GmbH
Page 7 (Denmark) Marstal Solarfield; source: Ramboll
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