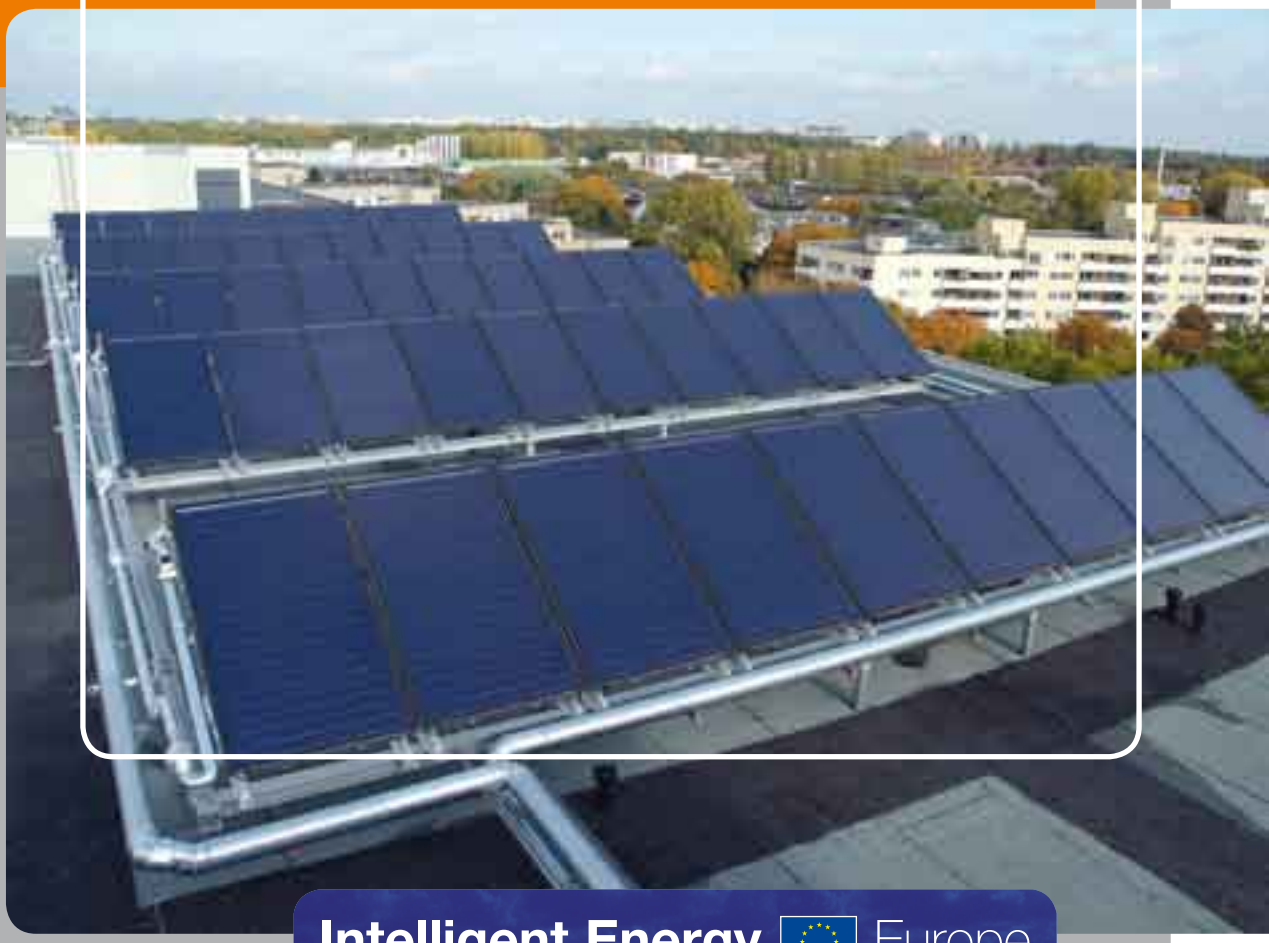
SOLARGE

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

Project Report & Key Results

January 2005 to December 2007



Intelligent Energy Europe

Table of Contents

Foreword

The best answers for finding solutions for the energy challenges of the future are harboured by the buildings we use. And this by no means only implies electricity. About a third of Europe's final energy consumption alone is used for space and water heating in buildings. This is a huge potential for the use of solar thermal energy with a technology that has been tested, tried and proven a million times everywhere in Europe. Regrettably, mostly in single-family houses. But there is an additional important fact.

For the EU countries analysed within SOLARGE it can be estimated that approximately 50 % of the dwellings are located in multi-family houses. The time has therefore come for targeting these untapped potentials in the area of renewable heating supply for bigger and larger buildings – buildings where we rent a flat, or go to work or spent our leisure time. SOLARGE was a project launched in 2005 with the financing from the Intelligent Energy – Europe programme of the European Union and dedicated to making progress in the area of collective solar thermal systems (CSTS). Within three years the eleven partners of the SOLARGE consortium implemented activities in the area of market and good practice research, capacity building for installers, planners and decision makers, information and promotion to potential investors as well as issuing recommendations for national and European policy.

This publication is there to give you an overview of the key results and wants to invite you to use SOLARGE findings, publications and products if you happened to share the "big is beautiful" vision of getting more as well as larger solar thermal systems on the roofs of European multi-family houses, office buildings and hotels.

Andreas Steege, target GmbH
Project Co-ordinator

Project Basics

Acronym:	SOLARGE
Full title:	Enlarging Solar Thermal Systems in Multi-Family Houses, Hotels, Public and Social Buildings in Europe
Topic:	Promoting solar thermal systems with collector areas of more than 30 square metres in housing industry, hotels and public buildings in Europe
Financing:	Intelligent Energy – Europe
Contract number:	EIE/04/082/S07.38178
Budget:	€ 1,367,243 (EU contribution: 49.75 %)
Duration:	January 2005 – December 2007
Co-ordinator:	target GmbH, Hannover
Countries:	Belgium, Denmark, France, Germany, Italy, Netherlands, Slovenia, Spain
Number of partners:	11
Project website:	www.solarge.org

Results Overview

Market Research	8 National market studies (CY, DE, DK, ES, FR, IT, NL, SL) 1 Common market report
Good and Best Practice	111 Good practice examples in database 3,600 copies of best practice catalogue in EN, DE, ES
Capacity Building	Checklists, tools and template training materials for CSTS 23 exemplary assessment reports More than 30 training courses with a total of 1,100 participants Over 30 information events for the demand side with more than 2,300 participants
Policy Advice	17 National workshops with a total of 300 participants 2 European workshops with a total of 90 participants 7 National position papers for policy makers 1 Common position paper
Promotion	Project website in 8 languages with a total of about 8,000 visitors and 25,000 page views per months 6,900 copies of CSTS image brochure in EN, DE, DK, ES, IT, NL and SL 6 Newsletters 4 Promotional campaigns 58 presentations at fairs and conferences ManagEnergy Case Study Official partner of the Sustainable Energy Europe 2005–2008 Campaign

Partners Say

Henrik Steffensen
Engineer, District heating systems, Rambøll Danmark A/S
Denmark

Large collective solar thermal systems are not a novelty in the Danish context and Rambølls core services within CSTS are development, design, planning, optimisation and economic assessment. In Denmark the 200 largest solar plants covers 68,000 m^2 and produce 30 GWh per year. Nevertheless, there is still a great potential in both expanding the national market and transferring our expertise to other European settings. Taking the background in existing project results in the participating countries one of the great achievements of SOLARGE has been a systematic and international comparison of projects and dissemination of results for the first time. To overcome the barriers and at the same time to reach the EU objectives 2020 it is of great importance to focus on bringing down the price per yield ratio. CSTS in connection with district heating is seen as the answer in Denmark. This should also include household appliances like washing and dishwashing machines and the replacement of electrical by absorption cooling.

Bruno Gagnepain
ADEME, Department Renewable Energy
France

In the case of France we clearly saw a need for quality standards and monitoring for those CSTS plants that were initiated by subsidy schemes such as the Plan Soleil, which were implemented by ADEME. Within the course of SOLARGE the experiences and insights from the other partners supported the development of a better quality and subsidy management for CSTS. At present, we are on a good way to establish a Solar Thermal Observatory, which will enable to provide data about effective solar production and backup energy savings for a wide part of CSTS newly installed. Furthermore, this would contribute to make owners be completely aware of their CSTS functioning and global performance. Finally, it will help to guarantee that large solar thermal systems in France are running smoothly and efficiently during all lifetime of plants.

Richard Loyen
ENERPLAN Association Professionnelle de l'Energie Solaire
France

Like almost everywhere in Europe, the market for solar thermal systems has also been growing in France. But for ENERPLAN as a professional association not only market figures matter. We want to make the transgression to a real skilled and sophisticated industry with more than 9,000 qualified installers in France. We started the initiative Qualisol in cooperation with ADEME in 2006 to attend to the general training needs. The work within SOLARGE provided us with enough tools, exchange and best practices to include the issue of CSTS within this qualification initiative.

Gerhard Stryi-Hipp
Managing Director, Bundesverband Solarwirtschaft (BSW)
Germany

50 % of all heating demand in Europe occurs in multi-family housing and if the policy objectives of 20 % of renewables by 2020 are to be taken seriously this can only imply that the CSTS markets have to be targeted. As the largest professional association for solar industry in Germany we know that the CSTS markets are very complex and include a lot of barriers. The work within the SOLARGE project has enabled us to see much more clearly how the land lies – here in Germany in and in other relevant countries. And we have been able to foster capacity building within the course of the project, which offers a good position to carry on what is inevitable in our view: improving the conditions for the use of solar energy in buildings with more than 3 dwellings.

Susanne Berger
Consultant, Berliner Energieagentur GmbH
Germany

For public-private-partnership with the key aim of offering energy consulting services for public authorities, industry, business and housing companies in a large urban area, the issue of CSTS has to be a top priority. Within the SOLARGE project we especially made progress in the area of promotion and campaigning. We were able to develop a best practice marketing approach in cooperation with a gas utility with included "solar detectives" and proved to be very effective. A further real asset is also the SOLARGE best practice catalogue, which is also available in German and was already widely disseminated by us.

Andreas Steege
Managing Director, target GmbH
Germany

Our company has been developing trainings for solar thermal systems almost fifteen years and progress has certainly been made in what kind of technical issues, topics and target groups we address today compared to the past. With SOLARGE we seemed to have hit the mark. Not only our project partners, but also regional stakeholders were keen to address the issue of large-scale and complex solar systems for bigger buildings and the necessity of increased knowledge of installers, consultants and engineers.

Marco Calderoni
Researcher, Ambiente Italia srl
Italy

In Italy we face barriers such as subsidy stop-and-go, bureaucratic procedures for granting permissions or tax reductions. But we have witnessed changes for the better here within the course of the SOLARGE project. While collecting good practice examples of realised systems, however, it was quite obvious that the market for CSTS is rapidly increasing in Italy. Especially encouraging was the improvement of collaboration between housing associations or other house owners that we were able to make thanks to efforts made within the SOLARGE project.

Sašo Medved
Faculty of Mechanical Engineering, University of Ljubljana
Slovenia

There is a long tradition in renewable energy sources use in Slovenia, especially in wood biomass and hydro energy. Solar energy and especially the use of CSTS are underdeveloped. And this cannot only be blamed on the lack of financial support, which was at times very attractive for CSTS. We clearly experienced lack in the promotion of CSTS and capacity building for installers, planner and engineers. Here the SOLARGE project was truly helpful. Also the networking with CSTS stakeholder from public authorities, professional associations and research were improved within the course of SOLARGE.

Frank Zegers
Project Manager, Ecofys Netherlands BV
The Netherlands

I would like to point out two milestones we achieve in the area of policy support and promotion in Holland within SOLARGE. With support of the SOLARGE partner Ecofys, the Dutch industry federation Holland Solar published a Solar Thermal Roadmap in March 2007 describing a clear vision and strategy for a market transition for more solar thermal systems in Holland including the need to get active in the field of larger systems. Secondly we were able to involve and address a large number of stakeholders from the housing industry and building sector with workshops, dissemination of information and excursions on the topic of CSTS.

Roland Voskens
Managing Director, Ecofys S.L.
Spain

Due to the solar obligation in place in Spain and the positive implications on the development on the demand side of CSTS we seemed to be the odd one out within the SOLARGE project consortium. However, we still see how important it is to have the right flanking measures in place such as effective control, state-of-the-art training and awareness raising for a successful implementation. So we made the experience that a project like SOLARGE which addresses capacity building within these flanking areas was and still is more than needed in the booming Spanish market. The aim should not only be the maximisation of the solar thermal market but even more important, applying simple and solid system configurations to get satisfied consumers and thus creating a positive image.


RONA SOLAR

The Technology

SOLARGE focussed on large-scale solar thermal installations from 30 square metres of collector surface area upwards which are used for hot water supply, heating system support and cooling in multi-family buildings, hotels, public buildings or social and leisure facilities such as old people's homes, hospitals or sports centres. Large-scale solar thermal systems are also synonymously called collective solar thermal systems (CSTS).

Using solar thermal energy for heating purposes is a mature technology that has been proven thousands of times in all areas of Europe. Solar thermal systems have a lifetime of 20 years or more and have no disadvantages compared with conventional heating systems. Solar thermal systems are an enduring investment. They help secure high energy standards for the long term and therefore help a building keep its value.

And the use of solar thermal energy is on the advance. Today, over 19 million square metres of solar collectors are installed on Europe's roofs, most of them on detached and semi-detached homes. But large solar thermal systems are gaining market share. Increasingly, solar thermal systems are becoming popular in applications such as apartment blocks, public buildings and hotels. These need a lot of heat in summer as well as winter. And large solar thermal systems are more cost-effective than smaller ones. With a large collector area, major cost savings can be achieved in such buildings. And solar thermal systems are also a safe investment: While oil and gas prices will go on rising, the cost of solar thermal energy will remain steady for the long term.

Alongside economic aspects, another compelling factor in favour of solar thermal energy is its positive image. Installing a solar thermal system can help enhance tenant loyalty and reduce vacancy rates. For many hotels, solar collectors on the roof have long become a symbol of environmental responsibility and hence a useful marketing tool.

In the long run, investing into solar thermal energy will also help to meet legal requirements. Many European countries are already adopting statutory requirements to use solar thermal energy in new residential buildings. National energy saving regulations, energy certificates for buildings and of course the EU's Energy Performance of Buildings Directive (EPBD) mean high standards which will apply Europe-wide in the foreseeable future.

High-efficiency architecture with solar thermal systems will be the standard for new buildings in the near future. By 2030, buildings that run exclusively on solar energy will be the technical and environmental standard. The market for solar thermal systems is set to grow rapidly, with the installed total collector surface area predicted to continue expanding by at least 30% a year for the long term.

Although solar thermal technology is mature and well proven, researchers and manufacturers work constantly to improve it: Solar heat storage systems will attain ever higher storage densities. Total system efficiency will continue to rise and system costs to fall. Solar thermal systems will become simpler, cutting maintenance to a minimum. Architects and engineers are increasingly taking an integrated approach to building design, making optimum use of incident light, efficient thermal insulation and natural ventilation.

In a nutshell, large solar thermal systems

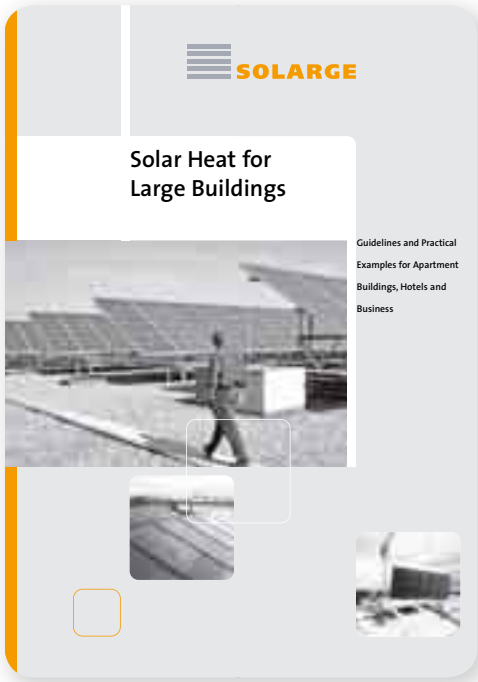
- are reliable, rewarding and have been proven thousands of times
- are a safe investment and keep energy costs manageable in future
- have a positive image, which is useful for marketing purposes
- are a clever option to meet legal energy saving requirements
- are constantly being improved technically and systems costs will drop
- will become the technical standards in high-efficiency buildings in future

SOLARGE: Sharing Results

Leaflets with the most frequently asked questions (FAQs) on large solar thermal are available in Danish, Dutch, German, Italian, Spanish and Slovenian.

An image brochure and a best practice catalogue in various languages also offer technical information in a nutshell for investors, policy makers or other interest groups.

All publications can be found at www.solarge.org in PDF format.



Key Results Market Research

Market Research	8 National market studies (CY, DE, DK, ES, FR, IT, NL, SL) 1 Common market report

Within SOLARGE a detailed inventory of key information on national markets and political frameworks for CSTS was 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 for comparison. All partners used the same research design: four key questions were answered to identify specific obstacles and barriers to CSTS implementation in each country:

The market research uncovered yet again the great diversity of European CSTS markets and the various factors, which determine favourable or not favourable frame conditions.

As the means of judging the potential for CSTS, the building as well as hotel stock was analysed. Among the total housing stock in the researched countries with around 108 million dwellings, approximately 50 % or 54.28 million are dwellings in multi-family houses. Germany and Spain are the only countries analysed, where there are more dwellings in multi-family houses than in single-family houses.

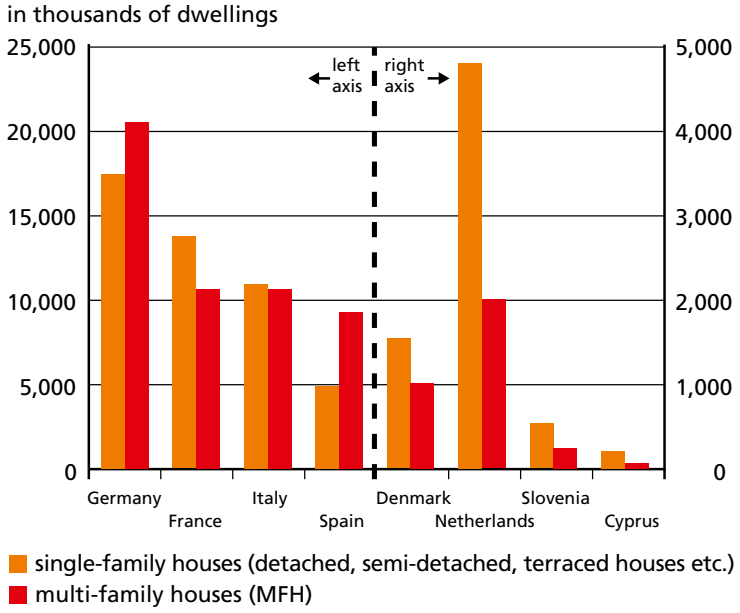


Figure 1:
Structure of dwelling stock in the partner countries (data from 2000 to 2005)
Source: SOLARGE national country reports 2005, www.solarge.org

The four countries with the most hotel stock are Germany, France, Italy and Spain. The national average number of beds per accommodation facility ranges from 31 in the Netherlands to 145 in Slovenia.

The total number of registered hotels in the eight countries researched was 124,166, which provide around 10.05 million beds.

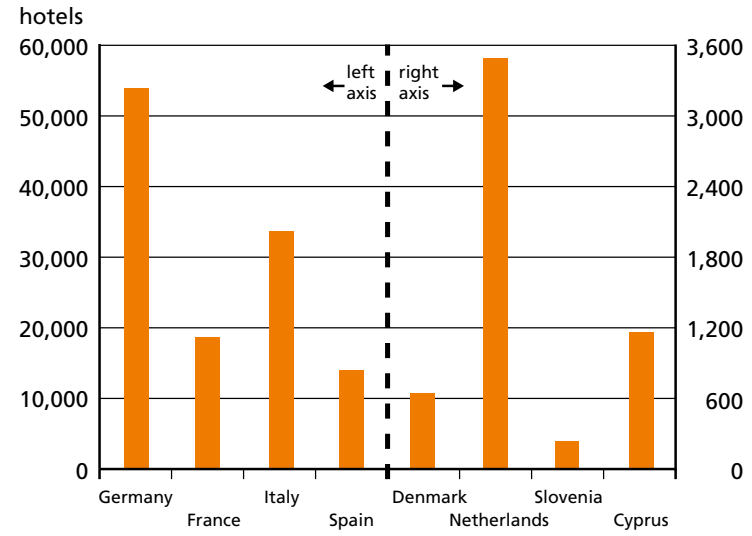


Figure 2:
Structure of hotel building stock in the partner countries (data from 2003 and 2004 respectively)
Source: SOLARGE national reports 2005, www.solarge.org

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.

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.

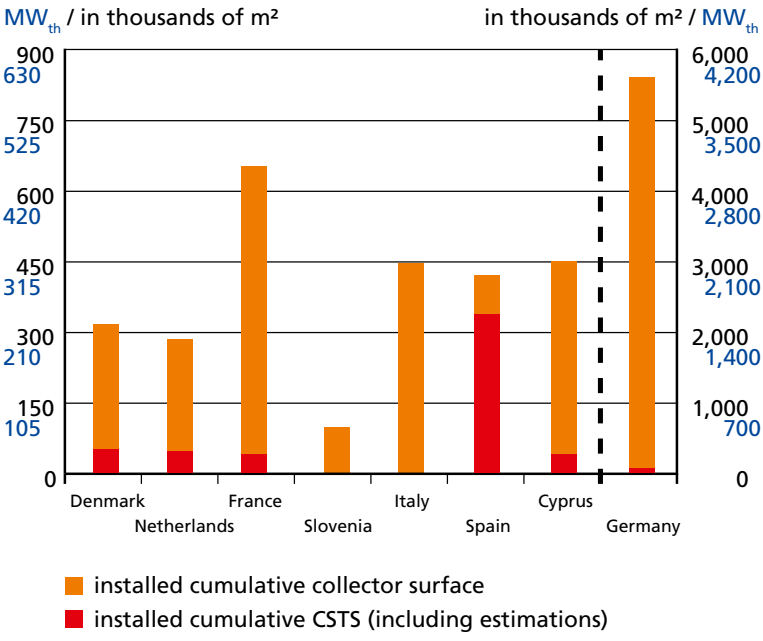


Figure 3:
Solar thermal collector surface area [m²] and capacity [MW$_{th}$] installed in partner countries in 2004 and proportion of CSTS
Sources: ESTIF 2005, www.estif.org; ADEME, 2005; SOLARGE national reports 2005, www.solarge.org

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. Denmark is second, with a total of approximately 55,000 m² of CSTS installations in 2004 which represents around 16 % of the installed cumulative collector surface in 2004. The Netherlands are a close third with 45,000 m² and 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 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 CSTS in operation makes up a market share of 6 % in the country. This has grown rapidly in recent years.

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. 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.

On the basis of the figures researched in 2005, the SOLARGE consortium made conclusions and recommendation on the area of national framework, the multi-family as well as the hotel sector in every involved country.

Denmark

National framework

In Denmark, manufacturers possess the knowledge and the capacity required to serve the CSTS 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 are of interest. A further focus should be on the construction sector, based on building energy performance regulations. Unfortunately, there are currently no incentives for CSTS, even though high fuel prices result in a growing market. The promotion activities by SOLARGE emphasise the advantages of CSTS compared with other energy sources.

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.

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.

Germany

National framework
While the parties involved in the solar thermal market in Germany are showing an increasing interest in improving and expanding the CSTS sector, this segment is underdeveloped. The national conditions, however, are supportive, due to the fact that energy prices are high and continue to increase. Furthermore, the requirement of an energy efficiency label for residential buildings will further push the demand for CSTS. In addition to favourable legislative and economic frameworks, different subsidies in place which might generate positive effects for the CSTS market.

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.

Hotel sector
Although financial resources for additional activities such as solar thermal solutions are limited, 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, especially in the wellness and eco-tourism sectors.

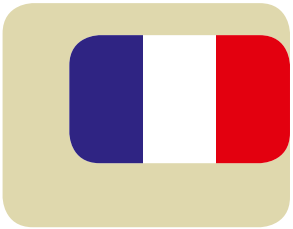
Netherlands

National framework
Changing policies explain stabilising sales in the Dutch CSTS market. When SOLARGE started, there were no specific incentive programs for solar thermal energy. However, increased requirements on the energy performance of buildings are to stimulate demand from 2006 onwards as will the market for renovation incorporating solar thermal energy. The interest of the government has shifted from solar towards other renewable op-

tions in recent years. Therefore SOLARGE's key national activity is developing a roadmap for solar thermal energy jointly with the industry federation and research institutes.

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 are owned by housing associations. Consequently, these are the most important stakeholders, and should therefore be the focus of SOLARGE activities.

Hotel Sector
The existence of a small number of large hotel chains allows SOLARGE to focus promotion activities. 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.



France

National framework
The activities of public authorities still strongly determine the national CSTS market. Key actors such as manufacturers are not well organized yet and lobbying is still seldom. However, the legislative and economic conditions are promising. The new law of 2005, which defines a market share of solar thermal energy, has been adopted. All in all, France offers advantageous conditions for CSTS, including a growing promotional scheme. In order to successfully integrate CSTS into the market, local authorities must be the main focus of SOLARGE activities.

MFH sector
In this sector in particular, there is a great potential for CSTS. Social housing is one of the segments with the highest rates of solar installations. The various institutions dealing with social housing have shown their motivation in past. In the private sector, the great need for new construction and renovation activities in is an attractive starting point.

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.

Slovenia

National framework

Although Slovenia has national subsidy schemes, 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 due to increasing energy prices. A long-term subsidy scheme should nevertheless be implemented. SOLARGE activities should concentrate on national institutions, highlighting successful practical examples. Moreover, SOLARGE should promote the demand in multi-family buildings and hotels.

MFH sector

Due to high energy consumption and the predominance of individual systems, there is a promising potential for solar thermal energy in Slovenia. A strong legal barrier is the fact that flats in multi-family houses are often privately owned condominiums. In order to increase the number of CSTS, designers and facility managers are an important target group.

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.

Italy

National framework

In Italy, the supply side is not sufficiently established to satisfy a broader demand. Thus, cooperation with all the players on the supply side is a crucial aspect. 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. A long term research program is essential for developing appropriate technologies and generating the required confidence on the market.

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.

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

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 the new building code (CTE), which will have a major effect on the market. The combination of the CTE, the Renewable Energy Plan as well as subsidies will create a sound basis for development.

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 multifamily 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.

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.

Cyprus

National framework

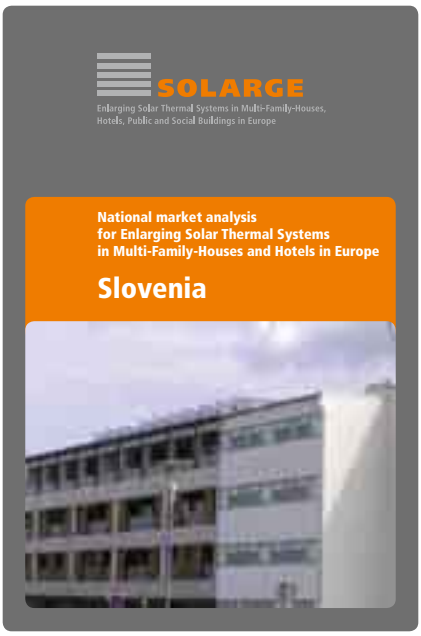
In Cyprus, the local industry for solar thermal energy is well established. Thus other applications could well be introduced – this could be implemented in international co-operations. High energy prices are an incentive to install a larger number of CSTS, although there is no legal correlation between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

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.

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.

SOLARGE: Sharing Results

The market reports on CSTS from Cyprus, Denmark, France, Germany, Italy, the Netherlands, Spain and Slovenia as well as the common market report can be downloaded for free from www.solarge.org.



Key Results Good and Best Practice

Good and Best Practice	111 Good practice examples in database 3,600 copies of best practice catalogue in EN, DE, ES

It is common knowledge that positive practical experiences from existing projects are the best way to encourage new ones. Right from the start, there was no doubt that SOLARGE was to communicate the best possible examples of existing collective solar thermal systems in its participating countries and a very ambitious plan for a database was created. Since most project partners did not have a stock of current examples including "soft data" such as financing and first hand quotations from project stakeholders, a complete new data collection according to a comprehensive, standardised questionnaire had to be carried out. The stocktaking in the SOLARGE partner countries showed that there where much fewer outstanding projects than expected due to the comparably short time of experience which large solar systems. Many projects researched had strengths as well as weaknesses, and therefore SOLARGE partners opted for labelling the case studies of the database "good practice". At present the database includes 111 portraits of multi-family and pension houses, hotels, hospitals and sport centres. The data sheets are divided into three major sections. The technological description includes nearly every imaginable data one could wish to know about a solar plant including operation modes, yields and monitoring. The second section on financing and investment allows an insight into the basic economic data whereas the third section on development and experiences describes problems, lessons learnt and recommendations. On the whole, the database is easy do navigate – projects can be selected according to country, building type or size.

The most innovative, convincing and sound examples of the database were selected for the SOLARGE Best Practice Catalogue.

SOLARGE: Sharing Results

The good practice database is unprecedented in scope and size and represents a major result of SOLARGE. The database is accessible to the public at www.solarge.org.
The best practice catalogue presents 21 case studies from all countries and is available in English, German and Spanish. You can download PDF from www.solarge.org or order a hardcopy from brennig@bsw-solar.de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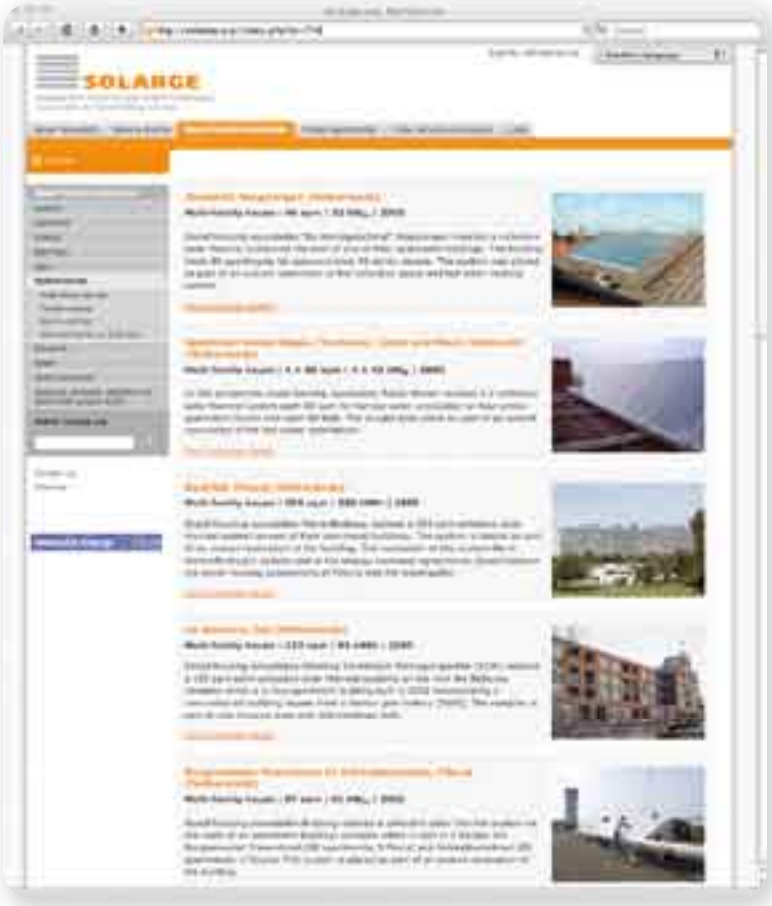

SOLARGE

Best Practice No. 1

Vèrtix - San Cugat des Vallès Multi-Family House

Motivation

The main reason to install the CSTS was the San Cugat des Vallès Solar Ordinance. This municipal ordinance mandates the installation of solar thermal systems for hot water generation in new buildings with a minimum solar proportion of 60 %. This building was the first Vèrtix building where a solar thermal system was installed for hot water generation.

Profile

- Real estate company
- New multi-family house, 39 dwellings
- 61 m² flat-plate collector (gross area), on flat roof
- 60 % reduction of final energy consumption for hot water generation (calculated)

Facts in brief

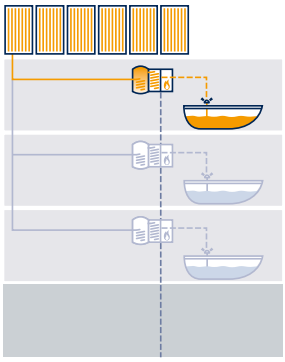
Year of construction of CSTS	2004/2005
Aperture area of collectors	60 m²
Thermal output	42 kW_{th}
Collector yield	796 kWh/(m²·a)
Total costs of solar hot water system*	89,133 €
Subsidies	0 %
CO_2-emissions avoided	14.13 t CO_2 per year
Reduction of final energy	59,765 kWh/a
Replaced energy source	Natural gas

*costs without conventional heating system

2

Collector area per apartment:	1.5 m²
Investment costs per apartment:*	2,285 €
Solar fraction of global heat demand:**	60 %

* without consideration of subsidies
** measured



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For further information, please refer to www.solarge.org

Technical Description

The solar storage devices are distributed in a decentralised manner and are connected in series to a modulated combination boiler (for space heating and hot water generation).

- operation mode: low-flow
- type of hot water heating: decentralised
- type of space heating: decentralised
- solar buffer storage: 39 x 150 l

Financing

The project developer, Vèrtix, financed the CSTS installation themselves without applying for a subsidy or special loans.

Comments

- "The CSTS installation on San Cugat Vallès was the first one completed by Vèrtix. However, the implementation of the system was mandated by the municipality's Solar Ordinance. It was also taken on as a challenge by the project developer to comply with this obligation. The favourable results of the installation and the lack of major problems gave Vèrtix the confidence to invest in solar thermal systems in future buildings."

"The CSTS is running well. At the beginning there were some complaints because of the noise from one pump. The pump was changed and no more problems have been reported. In the beginning there were also some problems reported with the collector fluid. There were some small leaks in the circuit which caused pressure drops within the circuit. The leaks were detected and repaired and the circuit was filled again."

Decentralised heating system. Solar heat storages and backup heaters are located in each apartment. The building is composed of 39 apartments on 5 floors.

Best Practice No. 2

Tablis Wonen - Sperwerflat I Multi-Family House

Profile

- Social Housing Association
- Multi-Family House (1968), 80 dwellings
- 90 m² flat-plate collector (gross area), on flat roof
- 57,000 kWh/a reduction of final energy consumption (measured)

Motivation

The project took place as part of an overall renovation of the hot water installation. Small individual gas-fired kitchen tap water heaters that emitted exhaust gases into the dwellings have been replaced by a central solar hot water system. There are several benefits for the tenants:

- hot water facility has been improved;
- indoor air quality has been improved (no more exhaust gases, less humidity);
- problems with mould on the kitchen walls have been solved due to lower humidity in the flats.

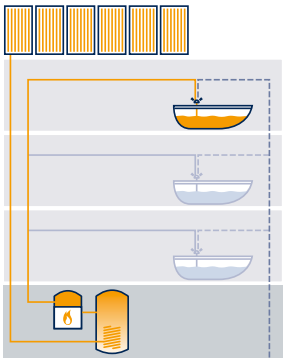
Facts in brief

Year of construction of CSTS	2003
Aperture area of collectors	89 m²
Thermal output	62.3 kW_{th}
Collector yield	448 kWh/(m²·a)
Total costs of solar hot water system	50,211 €
Subsidies	31 %
CO_2-emissions avoided	10.5 t CO_2 per year
Reduction of final energy	57,000 kWh/a
Replaced energy source	Natural gas

4

collector area per apartment:	1.1 m²
investment costs per apartment:*	628 €
Solar fraction of global heat demand:	n/a

* without consideration of subsidies



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Technical Description

The solar hot water system consists of a 90 m² collector surface and a buffer storage with a storage volume of 3,000 litres. The solar collectors and buffer storage tank are connected by a plate heat exchanger. Solar heat is stored in the tap water. Drain-back protects against freezing and overheating.

- operation mode: high flow
- type of hot water heating: central
- type of space heating: central
- solar buffer storage: 3 m³

Financing

The turn-key system cost amounted to EUR 564/m² (total EUR 50,000) paid for by the owner/investor, Tablis Wonen. Subsidies were granted from three sources for a total of 31% of the cost.

Comments

- "The complete retrofitting of the Sperwer building with a central solar hot water system resulted in a lot of 'wins' for the tenants: Better comfort, better indoor air quality, lowered indoor humidity, savings in energy bills and a contribution to climate change mitigation. Since this project, 8 other buildings have been equipped with a similar central solar hot water system."

"Installing solar thermal systems fits in with the social responsibility policy goals of Tablis. This is one such example where the hot water system for the flats has been modernised to improve living conditions (no exhaust gases in the flats, less humidity and mould) and comfort (improved hot water facilities). In order to compensate for the related increase in energy consumption (due to central hot water circulation losses and better facilities) the solar systems were added."

Flatplate collectors and solar heat storage of the Sperwer building

Best Practice No. 3

ATC Torino – Multi-Family House

Motivation

ATC Torino, a social housing public agency in the province of Turin, has dealt with environmental and energetic matters since 1996. Whenever possible, new technologies (especially renewable energy sources) have been integrated into ATC's buildings in order to reduce their environmental impact.

Profile

- Social housing association
- Multi-Family House, 42 dwellings
- 96m² flat-plate collectors (gross area), solar roof
- 69 % reduction of final energy consumption for hot tap water (estimated)

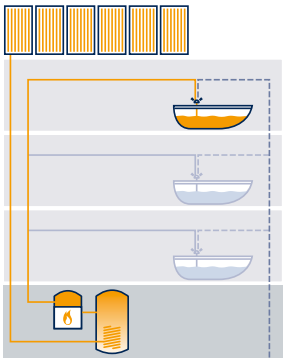
Facts in brief

Year of construction of CSTS	2005
Aperture area of collectors	90 m²
Thermal output	63 kW_{th}
Collector yield	633 kWh/(m²·a)
Total costs of solar hot water system	76,287 €
Subsidies	43 %
CO_2-emissions avoided	20.7 t CO_2 per year
Reduction of final energy	76,000 kWh/a
Replaced energy source	Natural gas

6

collector area per apartment:	2.1 m²
investment costs per apartment:*	1,816 €
Solar fraction of hot water demand:**	46 %

* without consideration of subsidies
** heat demand for hot tap water generation (value: estimated)



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For further information, please refer to www.solarge.org

Technical Description

The solar system heats the buffer storage tank via an external heat exchanger. The buffer storage tank then loads one of three hot tap water tanks through a second external heat exchanger. The other two hot water storage tanks are heated by both the first buffer storage tank and the boiler. In order to assure the sanitary quality of the hot water, the solar hot water tank can also be heated up by the boiler.

- operation mode: low flow
- type of hot water heating: central
- type of space heating: central
- solar buffer storage: 4.0 m³

Financing

The province of Turin subsidised a part of the total investment costs through a demonstration programme (publications and presentations from various newspapers, newsletters and exhibitions on the Province's web site).

Comments

- "The building located in Moncalieri near Juglaris, illustrates the appeal of solar thermal technology. Due to the integration of the collectors into a solar roof, which is a cost effective and innovative solution in Italy, our solar thermal system is very attractive from an architectural point of view as well.

Roof integrated flat-plate collectors and solar heat storage in Moncalieri

Best Practice No. 6

Sundparken – Multi-Family House

Motivation

The Chairman of the housing society motivated the tenants to support the installation of the system despite the rent increase that would be incurred over a limited period of time. Rent rates would then return to lower levels.

Profile

- Co-operative housing society
- Multi-Family Houses, 425 dwellings
- 336 m² flat-plate collectors (aperture area), on roof
- 123,000 kWh/a of solar heat

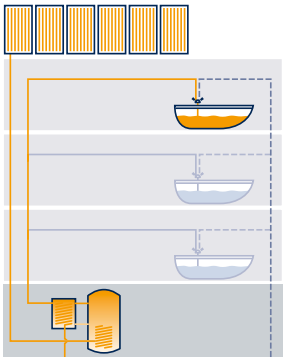
Facts in brief

Year of construction of CSTS	2000
Aperture area of collectors	336 m²
Thermal output	235 kW_{th}
Collector yield	approx. 366 kWh/(m²·a)
Total costs of solar hot water system	240,000 €
Subsidies	13 %
CO_2-emissions avoided	n/a
Reduction of final energy	123,000 kWh/a
Replaced energy source	District heating

8

collector area per apartment:	0.8 m²
investment costs per apartment:*	565 €
Solar fraction of global heat demand:**	3.1 %

* without consideration of subsidies
** measured



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For further information, please refer to www.solarge.org

Technical Description

The solar heating system is a low flow system with a 10,000 l hot water tank. Due to the orientation of the buildings the CSTS was designed as two separate systems with a common storage tank. Half of the solar collectors (168 m²) face east, the other half of the solar collectors (168 m²) face west.
The collector tilt is 15° from the horizontal for all the collectors. Both the east-facing and the west-facing collectors have their own solar collector loop, circulation pump, external heat exchanger and control system.

- operation mode: low flow
- type of hot water heating: central
- type of space heating: central
- solar buffer storage: 10 m³

Financing

The project was financed mainly through reserves from the housing association's own revolving funds as well as a small loan, national subsidies and a tax break.

Comments

- "There is great potential for the expansion of the solar collector area for space heating, but, at the moment, the return temperature from the radiator system is considered to be too high.

Flat plate collectors and the central control system

Best Practice No. 15

Die Fabrik – Hotel

Motivation

The hotel, "Die Fabrik", is located in a former industrial building, where telephones were once produced. In 1994, when the building was remodelled as a hotel, rooms, bathrooms, a large lobby and a restaurant were created. The 50-year-old, out-of-date steam heating system was not sufficient to maintain an acceptable level of comfort for the guests. Therefore, in 1999, the whole building was energetically modernised, including the boilers (switched to natural gas) and the heating system (pipes, radiators). The installation of a

Profile

- Private ownership
- Hotel, 120 beds
- 27 m² vacuum tube collectors (gross area), on a flat roof
- 16,000 kWh/a of solar heat

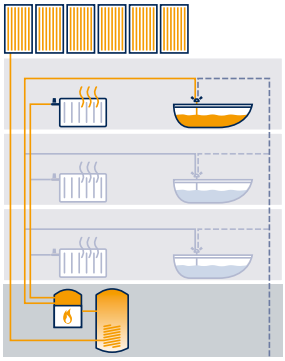
Facts in brief

Year of construction of CSTS	1999
Aperture area of collectors	23 m²
Thermal output	16 kW_{th}
Collector yield	approx. 695 kWh/(m²·a)
Total cost of solar heating/ hot water system	40,000 €
Subsidies	33 %
CO2-emissions avoided	4.8 t/a
Reduction of final energy	35,000 kWh/a
Replaced energy source	Natural gas

10

collector area per bed:	0.2 m²
investment costs per bed:*	333 €
Solar fraction of global heat demand:**	7.1 %

* without consideration of subsidies
** calculated



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For further information, please refer to www.solarge.org

solar thermal collector for hot-water generation and heating support was planned. The entire renovation was substantially funded by the UFP Environmental Funding Program of Berlin.

Technical Description

27 m² vacuum tube collectors were installed flush to the flat roof of the hotel's rear building - without a mounting system. This solution was chosen because of static reasons. The high-performance collectors are connected with an efficient buffer storage system, measuring 2.25 m³, in the heating centre. Integrated into the heating system, with a shared control unit, the system covers 8 % of the energy needs for heating and 43 % of the energy needs for hot water generation (simulation result).

- operation mode: low flow
- type of hot water heating: central
- type of space heating: central
- solar buffer storage: 2.25 m³

Financing

The solar thermal system was installed as a key element in the energetic modernisation of the hotel. The subsidies granted from the UFP Program amounted to one third of the total costs (planning and installation). Thanks to the resulting high level of energy savings, particularly through the reduction of system losses and assistance from solar thermal energy, as well as the grants, the entire project was favourably profitable. As early as 1999 the overall measure was almost profitable.

Comments

- "Within the scope of the changed utilisation of the building from industrial to hotel use, the solar thermal system was, and is, a highly valued part of the building's concept. The energy created by the solar thermal system provides economic relief from the energy costs which is becoming even more important due to the current increase in energy prices. In addition, the image of "Die Fabrik" is enhanced by the innovative energy concept - a factor that is well received by the guests."

Vacuum-tube collectors and display panel of the hotel "Die Fabrik"

Best Practice No. 16

DomParaplegikov – Hotel

Motivation

The health resort is designed for the physically handicapped and offers them an option for healthy and relaxing vacations. Disabled sportsmen can use the resort for preparing for sports competitions. This health resort is meant to become an incubator of ideas for all areas of life of a physically disabled person. The solar system was completed in 2007. One of the first results of the SOLARGE project was the fact that we have installed calorimeters in the solar system pipeline and connected to the BMS (Building Management System).

Profile

- Private ownership
- Hotel, Sports building Hospital, 120 beds
- 78 m² flat plate collectors (gross area), on roof

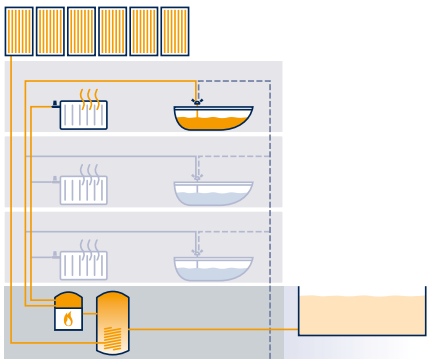
Facts in brief

Year of construction of CSTS	2006
Aperture area of collectors	72 m²
Thermal output	50 kW_{th}
Collector yield	n/a
Total cost of solar heating/ hot water system	34,317 €
Subsidies	90 %
CO2-emissions avoided	n/a
Reduction of final energy	n/a
Replaced energy source	Liquid gas

12

collector area per user:	0.6 m²
investment costs per user:*	286 €
Solar fraction of global heat demand:	n/a

* i without consideration of subsidies



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For further information, please refer to www.solarge.org

Technical Description

Two liquid-gas, high-temperature boilers were installed for space and tap water heating. Rooms are heated by radiators with thermostatic valves. Some parts of the building – therapy, congress room, and restaurant – have air-conditioning systems. Hot tap water as well as sea water is pumped into the pool and preheated by the solar system. The system consists of two sections of solar collectors with a total area of 72 m². Water heated by the solar collectors flows through a tube heat exchanger, integrated in the heat storage tank (2 m³) for hot tap water generation and heating support or through a plate heat exchanger for the preheating of sea water for the pool.

- operation mode: high flow
- type of hot water heating: central
- type of space heating: central
- solar buffer storage: 4 m³

Financing

The Health Resort Centre in Pacug was planned in such a way that quality was given first priority. The decision for a solar system was made a few years ago. This was a very good decision in hindsight, because the price of liquid-gas has increased. The institution, which financed the construction of the health resort, supported the decision. In the end, the price per square metre of solar collectors was a little higher than expected.

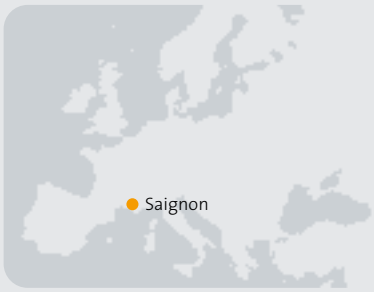
Comments

- „We are aware of the growing importance of energy conservation and therefore the decision to use as many renewable energy sources as possible was easy. With regard to the fact that our building lies in the sunniest area of Slovenia – 2,292 hours of sunshine per year – the solar system was a logical choice. One of the first results of the SOLARGE project will be the installation of calorimeters in the solar system and their connection to the building's management system."

Flatplate collectors on roof and Solar heat tanks

Best Practice No. 18

Saignon Elderly House – Retirement home



Motivation

This specialised retirement centre in Saignon, intended for physically handicapped persons, is an example of a high-quality, environmentally oriented design process. This building was designed according to bioclimatic structure, with special regard to solar design, and has a one-floor construction to accommodate the needs of handicapped persons.

Profile

- Social Association
- Retirement home, 21 beds
- 56 m² flat plate collectors (gross area), on the ground
- 33,000 kWh/a of solar heat

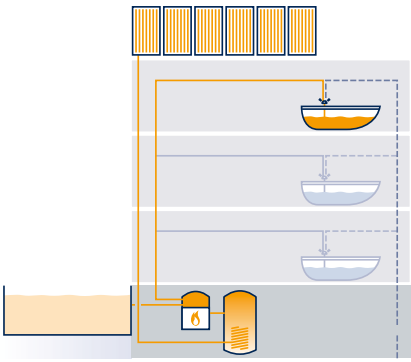
Facts in brief

Year of construction of CSTS	2002
Aperture area of collectors	50 m²
Thermal output	35 kW_{th}
Collector yield	approx. 660 kWh/(m²·a)
Total cost of solar heating/ hot water system	57,600 €
Subsidies	82 %
CO_2-emissions avoided	10.5 t/a
Reduction of final energy	49,700 kWh/a
Replaced energy source	Heating oil and electricity

14

collector area per room:	5 m²
investment costs per room:*	5,750 €
Solar fraction of global heat demand:	n/a

* without consideration of subsidies



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For further information, please refer to www.solarge.org

Technical Description

The installation has been in service since 2002 and is composed of 50 m² flat-plate collectors located on an embankment near the building facing south and with an inclination of 30°.
The hot water is stored in a solar tank measuring 3,000 litres and has two back-up tanks measuring 1,500 and 1,000 litres.

- operation mode: n/a
- type of hot water heating: central
- type of space heating: central
- buffer storage: 3 m³

Financing

The 50 m² solar installation of the retirement centre in Saignon cost EUR 57,600 including engineering and VAT and was subsidised with EUR 45,000 from free financing (state regional council and ADEME).

Comments

- This building was designed with an environmental and bioclimatic approach and, logically, a CSTS was integrated for hot tap water production.
  An all-round project was carried out using an architectural contest and a commission was created to finalise project details and to draft a contract to choose the contracting companies.
  The CSTS runs perfectly and provides 60 % of the hot tap water needs of the building, as determined by the feasibility study.

Rear side of the building and flat plate collectors located near the building on an embankment

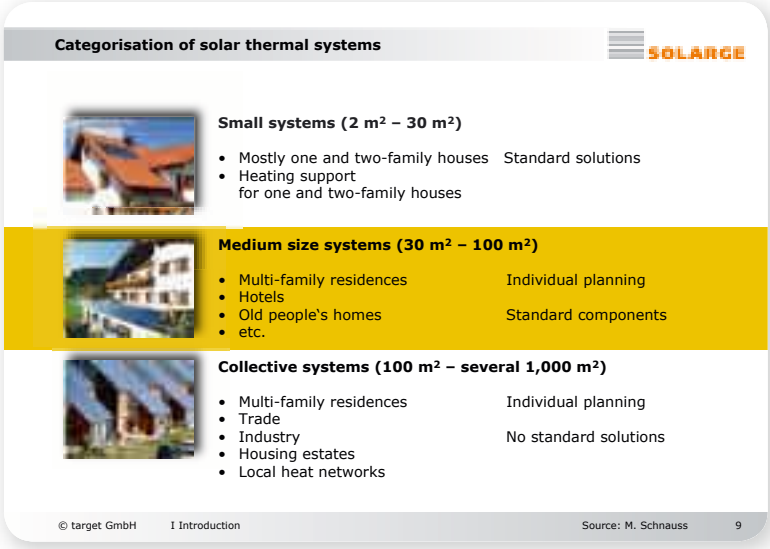
Key Results Capacity Building

Capacity Building	Checklists, tools and template training materials for CSTS 23 exemplary assessment reports More than 30 training courses with a total of 1,100 participants Over 30 information events for the demand side with more than 2,300 participants

Comprehensive training materials on CSTS have been available for all SOLARGE partners in an English master version. The original consists of more than 200 slides structured into 12 thematic chapters plus annex. Every slide presents a basic diagram or graph and is to be used in face-to-face training units. Explanatory texts to every slide are summarized in the corresponding manuals, which can then be produced as handouts for training participants.

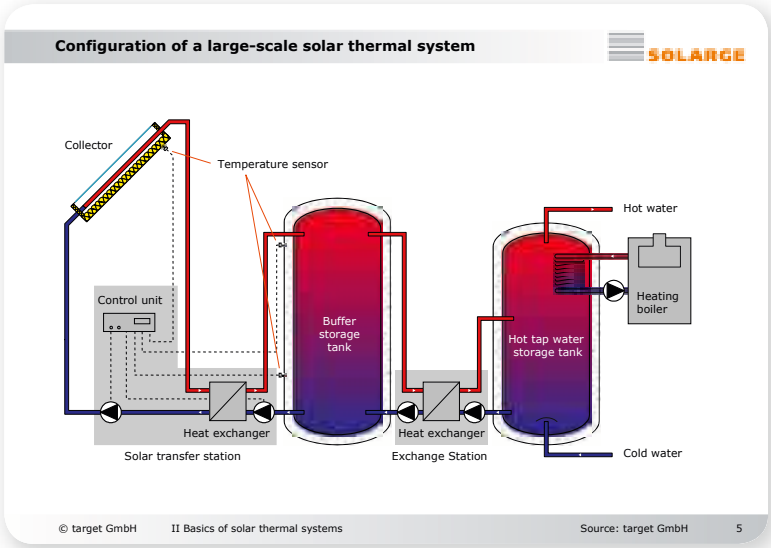
The training is primarily meant for installers and planners but also manufacturers, traders, utilities and contracting companies are addressed. A central precondition for participants is a sound basic knowledge of solar thermal technologies. If all available slides are used, a training covering all units would require approximately a 3 day course, especially if excursion and hands-on experiences are to be included. The modular set-up of the training materials however allows shortening and a customising according to target group. All SOLARGE partners had access to the English master version and adapted and translated the materials to suit national needs.

Unit 1: Introduction



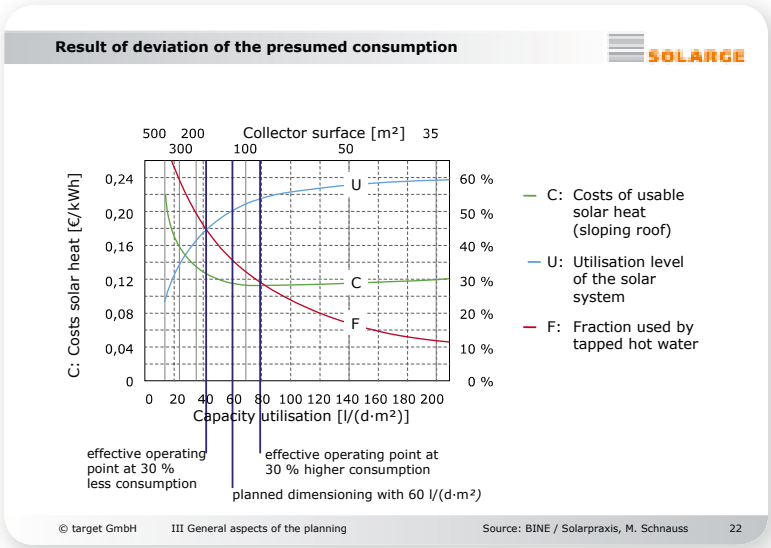
20 slides as a general introduction to the potential of CSTS setting the frame with economic, environmental and market developments.

Unit 2: Basics



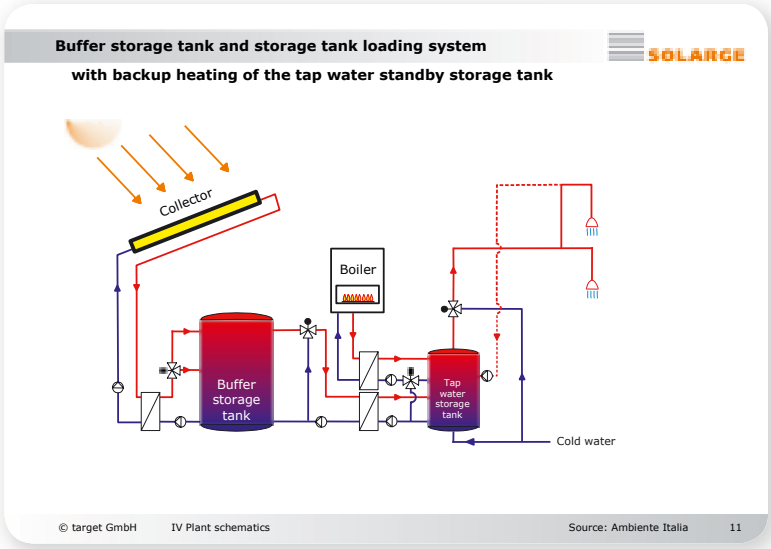
19 slides on the basic technological set-up of solar thermal systems

Unit 3: General Aspects on Planning



27 slides on the general aspects of planning a collective solar thermal system

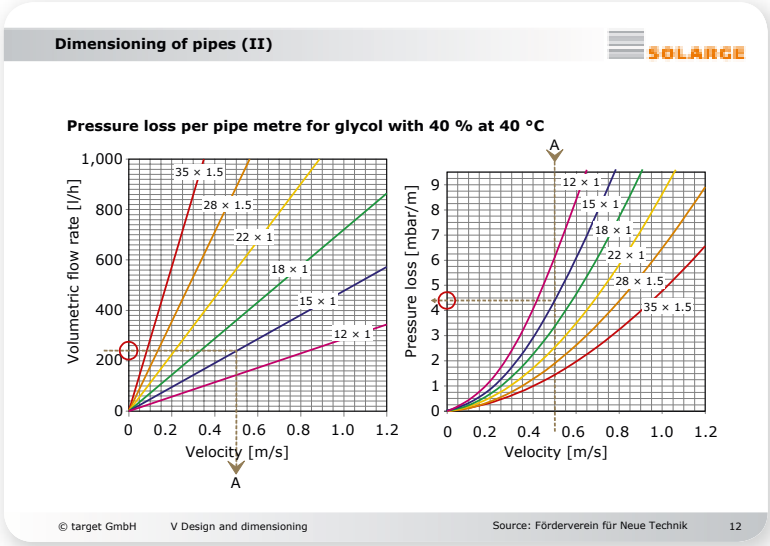
Unit 4: Plant Schematics



22 slides on possible plant schemes and the state-of-the art application

Unit 5: Design and Dimensioning

24 slides of the dos and don'ts of successful plant design and dimensioning

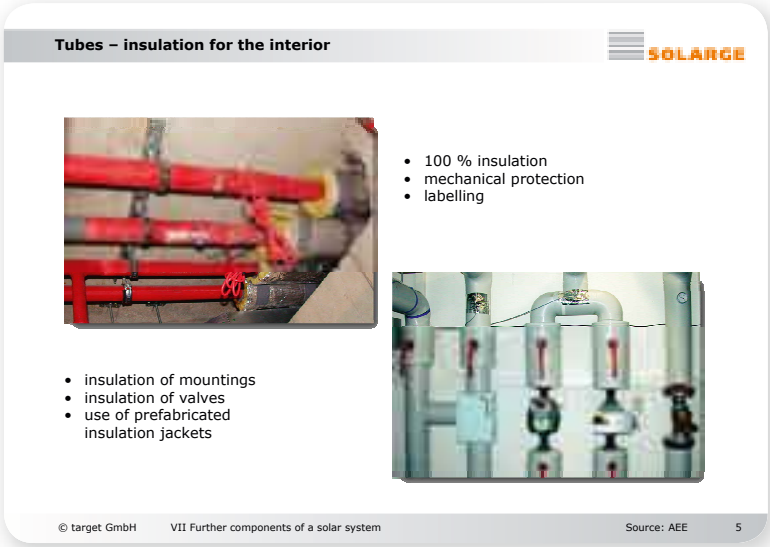


Unit 6: Collector Field

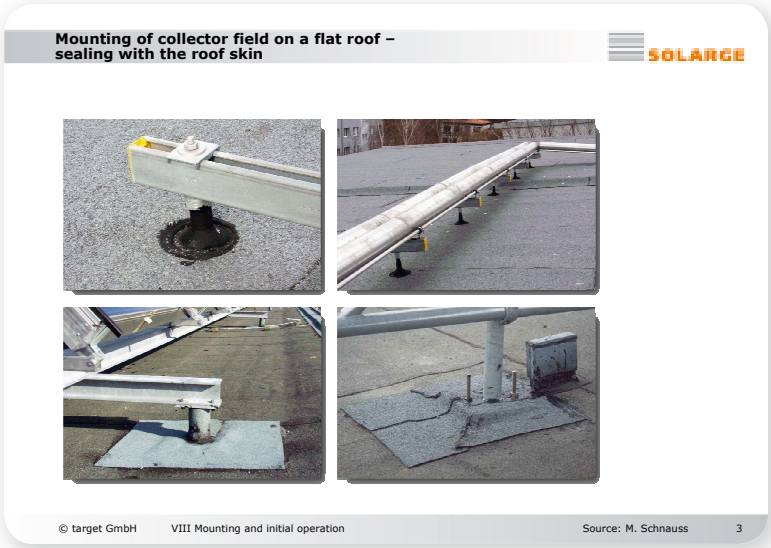
The heart of every solar system is the collector field. 17 slides on the special requirements for CSTS.

Unit 7: Further Components

Errors in the operation are often not discovered and could be caused by smaller components. 17 slides on these tricky details.

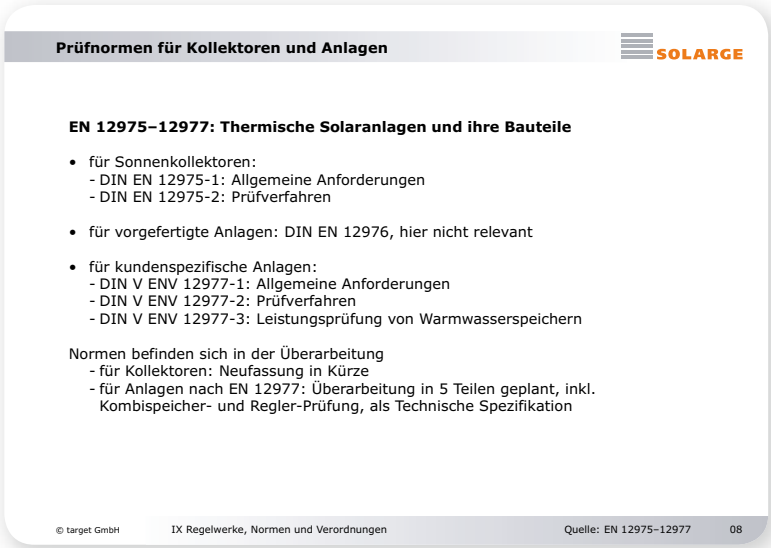


Unit 8: Mounting and Initial Operation



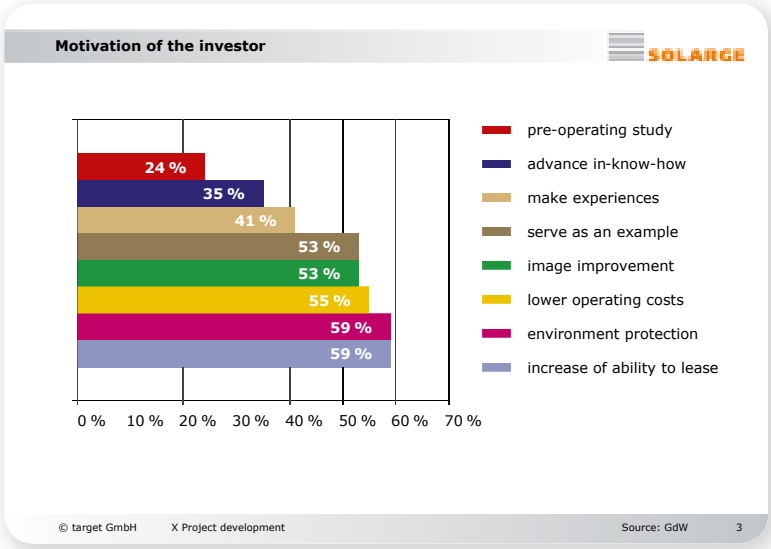
Mounting a CSTS can be difficult and putting into operation requires sound knowledge. 30 slides on the where and how of various technical options.

Unit 9: Standards and Regulations



The unit of standards and regulations has to be adapted to national frameworks, because they might vary considerably from country to country.

Unit 10: Project Development



Often CSTS development has to take complex investor and decision making structures into account. 18 slides on good approaches to get the project done

Planning can often be enhanced by software tools. This unit deals with the overview as well as exercises of the regular tools

Comparison of the simulation programmes

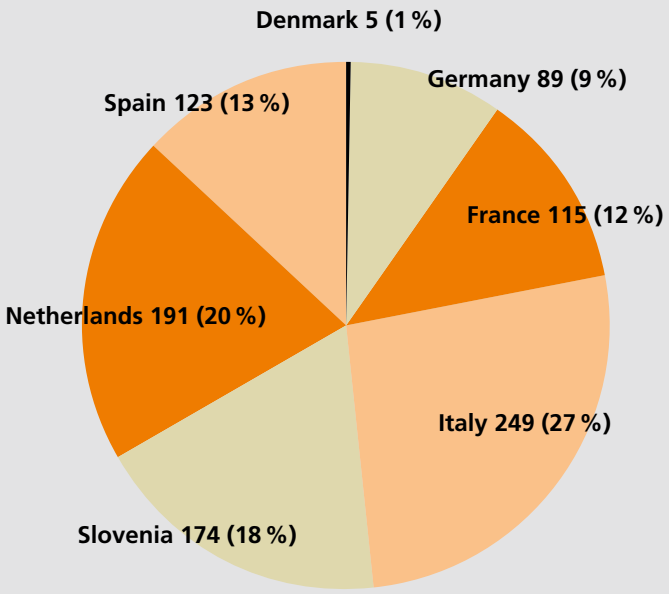
Product name	F-Chart	GetSolar	Polysun	Smile	T*SOL	TRNSYS	Luftikuss	SW-Simu
current version	7.0	8.1	4.0.1.0		4.3	16		3.0
market introduction	1988	1993	1994		1993	1974	1997	1988
basic price [€], incl. VAT	295.80	230.84	536.90	500.00	603.20	5,881.20		591.60
internet	istnet.de	getsolar.de	spf.ch	smilenet.de	valentin.de	transsolar.de	grammer-solar.de	istnet.de
energy yield projection	+	+	+	+	+	+	(+)	+
system optimisation	(+)	+	+	+	+	+	(+)	(+)
technology comparison	o	(+)	+	+	(+)	+	(+)	o
profitability analysis	o	o	+	+	+	+	o	o
ecology	(+)	(+)	(+)	+	(+)	+	(+)	o
marketing, acquisition	+	+	+	o	+	(+)	(+)	(+)
training	+	+	+	o	+	(+)	(+)	(+)
visualisation	o	+	o	+	+	+	o	o
error analysis	o	(+)	(+)	+	(+)	+	o	o
research and development	o	(+)	(+)	+	(+)	+	o	o
expert version	o	o	+	+	+	+	o	o
datasets for (number)								
collectors	80	230	+		480			
storages			+					
weather data	100	250	6,300	+	900	+	10	90

© target GmbH XI Planning – Exercises and software utilisation Source: V. Quaschning, M. Zehner 4

Within the SOLARGE project from January 2005 to December 2007 the following trainings were implemented:

Germany: Four trainings with a total of 62 participants
France: Four trainings with a total of 52 participants
Italy: Five trainings with a total of 132 participants
Slovenia: Two trainings with a total of 87 participants
Netherlands: Ten trainings with a total of 611 participants
Spain: Five trainings with a total of 167 participants
Denmark: one training with a total of 5 participants

Share of man-days of training



SOLARGE: Sharing Results

A master version of the training concept and slides is available in English. PDF slide overviews can be downloaded at www.solarge.org. You can contact Andreas Steege at steege@targetgmbh.de if you wish to get more information on using the developed materials.

Key Results Policy Advice

Policy Advice	17 National workshops with a total of 300 participants 2 European workshops with a total of 90 participants 7 National position papers for policy makers 1 Common position paper

For every country involved in SOLARGE the project consortium drafted a national position paper aimed at providing policy makers and political multipliers with clear proposals for effective policies to support collective solar thermal systems (CSTS). This is an abstract from the national specifics and distils the common recommendations applicable everywhere in Europe and beyond.

Common Position Paper on Large-Scale Solar Thermal Systems
Published by the SOLARGE consortium in November 2007

The European solar thermal market is still dominated by individual water and space heating systems supplying just one household. So far, less than 10 % of the market is made up of large-scale systems supplying several households with hot water and/or space heating. A series of reasons combined are responsible for the small share of CSTS amongst all solar thermal systems today. Additionally, national as well as local framework conditions can play an extra role, such as support policies, which are designed in a way, that they – often inadvertently – favour individual systems.

Generally, SOLARGE consortium has identified six key barriers, which contribute to the lower interest in CSTS so far and has published the following recommendations to national policy and decision makers in the involved countries.

Barrier No. 1: Technical Complexity

It is obvious that a system supplying heat not to one but to several apartments is more complex. Better planning and installation is needed to reach a good result. Technical complexity might result in:

- **Insufficient marketing:** Professionals like architects, planners, installers shy away from promoting the solar thermal option to their clients because they lack knowledge and training. This is even stronger in this market segment with technically more challenging systems than for individual solar thermal systems.

- **Problems in planning and installation**: Solar thermal does not require "rocket science" but it is also not the same as the typical gas heating system. The hydraulic layout of the system is more complex, the heating system must be connected with the collectors on the roof, and temperature levels can be higher. Planners and installers, who have never received solar thermal training, run a high chance of making mistakes.

- **No standardisation**: While there is quite a choice of "package" or "kit" systems for small domestic hot water systems, there is little standardisation in CSTS yet. This puts a higher burden on the planner as well as installer.

SOLARGE consortium recommends

- Training of professionals (architects, planners, installers)
- Support for the development of standardised systems, thus simplifying planning and possibly also installation
- Support of further R & D to enhance CSTS, and their integration with conventional building technology

Barrier No. 2: Owner Structure and Motivation

The owners of such systems are different and they have different motivations. Multi-family houses, public buildings, office and other commercial buildings typically have commercially interested owners. They decide differently from a single family, which has to choose a heating system just for their own one-family house. Also the ownership structure of suitable buildings is different from that of individual solar thermal systems. The different ownership creates additional challenges, the most important ones being:

- **More complex decision-making process**: A family can decide more easily about their heating system. Housing companies, owners of office buildings etc. typically face more complex, technical and commercial options, which have a direct effect on the decision-making process.

- **Commercial considerations often more important than for private individuals:** Owners of multi-family houses, office or commercial buildings often have a strong focus on economic aspects. For example, payback times of more than ten years are often not attractive to these owners.

- **Energy independence and environmental benefit less of a selling point:** For private individuals, the choice of their heating system is sometimes more based on non-commercial considerations, such as the sustainability or the independence from fossil fuels. Owners of multi-family houses, office and other commercial buildings often do not believe that a solar thermal system increases the attractiveness of their buildings.

SOLARGE consortium recommends
Enhancing the value added by a solar thermal system, e. g. in energy performance certificates: The European Energy Performance of Buildings Directive required all Member States to introduce energy performance certificates for buildings. They are implemented in very different ways throughout Europe, but often they do not show the opportunities from the possible use of solar thermal energy in the building. A higher emphasis on the existing or missing solar thermal option would help raise or lower the commercial value of the building, thus internalising non-commercial attributes of the building.

Barrier No. 3: Low Awareness

Amongst the target group, the awareness of solar thermal options is sometimes even lower than in the individual system market (mostly individual private households). This is due to the following facts:

- **Blind eye on commercial target groups:** Awareness raising measures and campaigns often target only private households; other target groups such as commercial building owners are sometimes simply "forgotten".

- **Lack of published examples:** While many European citizens already know that they could have a solar domestic hot water system, the availability of CSTS for larger buildings is often much less known. Good and best practice examples are less publicised thus hindering its adoption even further.

SOLARGE consortium recommends
- Targeted awareness raising specifically addressing owners and operators of multi-family houses, office and other commercial buildings. Information material should highlight technical issues and proven solutions as well as discuss financial viability and available financial incentives.

Barrier No. 4: Owner-Tenant-Dilemma

CSTS are often installed in buildings, which are rented out. In such situations, the interest of the owner and the tenant often diverge. While the tenant would benefit from a lower consumption of conventional energy, it is the owner, who must decide about the heating system. But the owner has to bear the higher initial investment cost and – depending on the local laws – may not be able to recover the cost for the solar thermal installation from his tenants. Or simply: benefiting from the solar systems in not the one who has to invest.

Owner-Tenant-Dilemma

SOLARGE consortium recommends

- Legislation/regulation must clearly allow passing on the higher initial investment costs. So far, legislation often forbids or makes it difficult for the owner to recuperate the higher initial investment costs, which is a strong barrier for the adoption of CSTS. Over time, the tenant should pay for the solar thermal system, which helps reduce their running costs.
- Well-designed energy performance certificates, which clearly show the lower energy costs of heating systems with CSTS, can help make the object more interesting to potential tenants. Energy performance certificates should make obvious the "saved costs" due to the higher energy performance.

Barrier No. 5: Higher Initial Investment

While the costs per kWh can be dramatically lower than for individual systems, the larger size of CSTS means a higher absolute investment costs. Almost the total costs of solar thermal occur at the beginning, the benefit is realised over time. The additional investment costs for a CSTS can be quite substantial, thus making a decision by the owner more difficult.

SOLARGE consortium recommends

- Public loans with low interest and / or deferred payback can help make the decision in favour of a large solar thermal system. While many private households would not want to take on a loan for a solar thermal system, the situation is quite different for commercial owners. For them, the advantages of a low or no interest loan can make the difference and let them decide for the solar thermal option.

Barrier No. 6: Commercial Payback Time

While private householders often invest into their houses as a long-term investment, commercial building owners often expect short payback times. In most Central and Northern European countries, payback times of solar thermal systems are typically longer than those expected by the building owners. Even a ten-year amortisation of the investment is often not enough to convince owners to include solar thermal in their building's heating system.

SOLARGE consortium recommends

- For new buildings and those undergoing refurbishment SOLARGE fully supports the European Commission's proposal to require the use of renewable energy (minimum shares). Already today, solar thermal is one of the most cost efficient options for sustainable heating and the penetration of CSTS in buildings will clearly increase through this measure. Member States and local governments should not wait to enact solar thermal obligations already now (please see "important note" below).
- For existing buildings not undergoing refurbishment, offering financial incentives for the installation of solar thermal systems is recommended.

Important note on solar thermal obligations:

Solar thermal obligations radically change the market. They create a strong push, which even goes beyond the obliged market segments (e. g. new and refurbished buildings). But they add a new type of customer: The ones that are not interested in solar thermal at all and who will choose the cheapest systems fulfilling the legal requirements. Therefore, governments introducing solar thermal obligations must foresee mechanisms to ensure a good quality of the hardware and of the planning / installation.

Conclusion: A Coherent Mix Makes It!

Collective solar thermal systems face various challenges in the market. Addressing only one or two of them often does not have a strong effect. In order to support the wide introduction of CSTS, governments should help overcome the barriers – with a coherent mix of support measures:

- Training of professionals
- Further support of R & D into CSTS
- Energy performance certificates explicitly showing the (missing) solar thermal option – or the lower energy costs with a solar thermal system
- Specific awareness raising targeted at owners of multi-family houses, office and commercial buildings
- Legislation allowing to pass on, over time, the higher initial investment costs to the tenant
- Favourable loans, with low or no interest rates or deferred payback
- New and refurbished buildings: solar obligations
- Existing buildings: financial incentives

SOLARGE: Sharing Results

The national positions papers for Denmark, France, Germany, Italy, the Netherlands, Slovenia and Spain can be downloaded from www.solarge.org.

Key Results Promotion

Promotion	Project website in 8 languages with a total of about 8,000 visitors and 25,000 page views per months 6,900 copies of CSTS image brochure in EN, DE, DK, ES, IT, NL and SL 6 Newsletters 4 Promotional campaigns 58 presentations at fairs and conferences ManagEnergy Case Study Official partner of the Sustainable Energy Europe 2005–2008 Campaign

Spreading the word about large-scale solar thermal systems was a key intention of SOLARGE and during the project period from January 2005 to December of 2007 the project consortium was very active to address potential investors, decision makers, and individual experts as well as networks alike at regional, national and EU level. The project consortium organised 17 national workshops as well as two European workshops to address stakeholders, professionals or experienced experts. More than 30 information events in various settings were organised to address stakeholders on the demand side, like building associations, housing industry or hotel sector. All in all SOLARGE was presented at more than 130 occasions on conferences, seminars, trade fairs and workshops for various target groups and at various levels.

Various examples show that local partnerships of authorities, energy agencies and other (energy) stakeholders can successfully support the market introduction of large-scale solar systems. A specific promotion campaign

has to be well tuned to the actual market barriers and opportunities of the individual community. In the ideal case, the campaign contemporaneously activates policy, demand and supply side with suitable measures such as:

- qualification of professionals
- information campaign aimed at investors
- creation of favourable political basic conditions and financial support
- demonstration plants on public buildings

The SOLARGE consortium has implemented the following best practice examples, which show how convinced local communities benefit from the positive and innovative "solar" atmosphere in the housing sector:

Campaign Example 1

"Erdgas+Solar XXL"
Berlin, Germany

The regional campaign "Erdgas+Solar XXL", jointly initiated by the local natural gas supplier GASAG and the Berlin Energy Agency, is supporting the important market launching of large solar thermal systems considering in particular the offers made by GASAG for the funding of the combination of natural gas and solar heating. Through this campaign, potential investors and operators are informed by either information materials or via different events such as "solar breakfast". Special funding and consultancy for solar systems offer purposeful help right at the beginning of a project. Trained youngsters as so called "solar agents" support the housing industry in finding appropriate buildings. The German Solar Industry Association BSW is partner of the campaign. Although the campaign is still running, the following interim results have been reached:

- 3 information events with each 10–20 participants
- 15 feasibility studies produced or in process so far
- 4 solar thermal plants under construction

- Activation of the communal housing industry (5 exemplary buildings of each company under "solar examination")
- 40 buildings investigated by "solar agents"
- High level of information and attention for solar thermal on the decision makers' level in Berlin

Lessons learnt and repeatability
The campaign in Berlin has shown that the activation of decision makers is possible with concrete offers like feasibility studies. This offer seems to be the most activating part of the campaign "Erdgas+Solar XXL" so far. Another lesson learnt is that networking is a very relevant, especially at housing industry's level. It is necessary initiate a dialogue between the housing industry, the companies and the political decision makers in order to have a joint implementation of the campaign's aims.

The campaign was/is implemented by SOLARGE partner Berlin Energy Agency. A more detailed case study of the campaign in English is available at www.solarge.org.

Campaign Example 2

SOLARGE ROMA – Azioni di diffusione degli impianti solari termici di grandi dimensioni
Province of Rome, Italy

The Province of Rome implemented a promotion campaign for large-scale solar thermal plants in partnership with the SOLARGE project. The project started in 2006 and is still ongoing. It addresses investors, technicians and public administrations in the province of Rome, thus enhancing local know-how establishment. Outcomes of the SOLARGE project have been adopted in the campaign. Scientific support is being provided by the local cooperative Reseda Onlus. After an information and training phase, a call for tender has been launched to choose four target buildings for the installation of solar plants. Feasibility studies have been carried out and, finally, the plants are being installed. The campaign has been successful

so far. Future local campaigns should have, whenever possible, a higher budget and foresee a comprehensive communication campaign. Following results have been achieved within the project:

- four information seminars addressed to industry, residential building owners and banking institutes (140 participants)
- training course for technicians (40 participants)
- six feasibility studies
- four large-scale solar thermal plants currently being installed (about 450 m^2 of collectors in total)
- 1,000 brochures disseminated to municipalities, provincial bodies, social housing companies, building companies

Lessons learnt and repeatability

The most positive aspect of the project is the involvement of different actors: concerning the demand side, industry, house owners as well as municipalities have joined the call for tenders. On the supply side, planners and installers have been trained and are now experiencing a plant installation, thus gathering specific know-how with the support of experts. Conditions have been improved by involving banks, which have in some cases developed specific financial packages. For future initiatives it is recommendable that a higher budget is foreseen for co-financing and supporting the plant realisation. What is more, a more detailed communication programme should be carried out.

The campaign was/is implemented by SOLARGE partner Ambiente Italia. A more detailed case study of the campaign in English is available at www.solarge.org.

Campaign Example 3

Promocijska kampanja za CSOS v javnih in vecstanovanjskih stavbah
Municipality Zagorje ob Savi, Slovenia

The campaign in the area of municipality Zagorje runs in cooperation with local administration, the Regional Development Center (RCR) and important local players from the building sector. Main intention is informing of potential investors on available technologies and possible solutions of large solar systems for multi-family and public buildings in municipality. For this purpose, an information point was founded at RCR. For all interested, a guided visit of the successfully operating system in Zagorje church can be organised. The most important campaign result is the increased interest of local politicians, significant economy players and general public that was generated within the campaign. All actors were actively involved in the and local community earmarked means for solar energy exploitation in its budget for the first time. On the basis ob feasibility studies, carried out in the frame of SOLARGE project, local community acquired European funding of two CSTS, which are supposed to be build in 2009. Although almost all partners are public servants, their actions were not harmonised. A great success of the campaign was to link and establish cooperation between important local players, so they will work together on other efficient energy use projects in the future.

Another important achievement is active involvement of Regional Development Centre and getting in set-up for energy efficiency topics. Up until then, it was not engaged in the field of sustainable energy. RCR will have

a positive effect on creating local networks and we can expect further dissemination of knowledge about CSTS. The campaign established local media interest and encourage them to more systematic approach in public awareness rising about efficient use of energy and renewable energy sources.

Lessons learnt and repeatability
Awareness of local political actors is a key issue and that the lack of technical knowledge is only one of key obstacles for CSTS implementation. Local community's annual budgets are passed for year or two in advance, which means, that implementation of new, unknown technologies is a lasting process.

To achieve successfulness of such campaigns, subsidy schemes are essential. In the case of selected community, these didn't exist in, nor did local decision makers think of them. In Slovenia, the selection of campaign target groups was very important and involving local partners had the biggest impact.

The campaign was/is implemented by SOLARGE partner University of Ljubljana. A more detailed case study of the campaign in English is available at www.solarge.org.

Sustainable Energy Europe Partnership

The Sustainable Energy Europe 2005–2008 Campaign (SEE) is a communicative tool launched by the European Commission Directorate-General for Energy and Transport to complement financial support with awareness raising and promotion to create a broad public alliance for sustainable energy. The project consortium of SOLARGE agreed to apply becoming an official campaign partner, which includes a voluntary commitment to support the objectives of the SEE. End of October 2007 the European Commission officially welcome SOLARGE as a Sustainable Energy Partnership. This acknowledgement will enhance the dissemination commitment of the project since results and achievements will be widely promoted through the campaign channels. Currently the SEE has some 380 Partnerships and 70 Campaign Associates and thus represents roughly 5,000 single actors from all levels of sustainable energy stakeholders within Europe.
For more see www.sustenergy.org

ManagEnergy Case Study

In September 2007 a presentation of SOLARGE was published as Case Study No. 268 on the European Commissions ManagEnergy website. This highlights the importance of experiences and best practice in the field of large solar thermal systems and represents a great opportunity for disseminating the projects results. ManagEnergy was launched in 2002 by the European Commission Directorate-General for Energy and Transport on request of Energy Management Agencies across Europe. Key elements are training workshops and online events. The annual budget is about 1.7 million Euros. Some 2,700 organisations, including 350 energy agencies, are found in the ManagEnergy partner search system. The website is viewed by some 40,000 visitors per week and represents a top quality communication channel at European level.
More on www.managenergy.net

SOLARGE: Sharing Results

The details of the campaigns as well as all promotional materials such as leaflets, posters, slides can be found at www.solarge.org.

Outlook

When the SOLARGE consortium started analysing markets for large-scale solar thermal systems in eight European countries in 2005, the issue of solar heating was not a priority in the EU renewables policy agenda. And this was even truer for a comparatively more complex technology with a much more diverse group of potential investors such as large solar heating systems. The SOLARGE consortium identified good CSTS practice and developed quality tools and instruments to better understand the technological requirements. When SOLARGE partners were already spread the word about the advantages of CSTS via workshops, training seminars, campaigns and high-quality publications in 2007, the European Member States finally agreed to the binding target of 20 % of renewables in 2020. This binding target underlines more than ever the necessity to get active in areas that have been neglected so far, because buildings in general are responsible for 40% of Europeans overall energy demand. And the segment of solar thermal solutions for multi-family, office and commercial buildings has to grow substantially in the next years if we are to replace large quantities of conventional energy in hot water preparation and space heating. There is no way of getting around CSTS! SOLARGE has laid the basis for not only a better understanding of the current technological issues in the field of CSTS, but has also focused on the non-technological barriers that are so much at the heart of market underperformance. And SOLARGE has spelled out recommendations on how the CSTS field should be supported by policies within seven national and one European position paper. It is clear that strong and coherent policies are needed. Good polices really have the power to ignite a positive growth cycle in the CSTS segments.

Now after these policy recommendations have been published and discussed and SOLARGE has terminated, there is a new major progress on the horizon. A key driver for the adoption of solar thermal in the built environment is expected to come from the EU Renewables Directive, which was proposed by the European Commission in January 2008. The proposal adapts the model of solar thermal obligations, which have been successful already in Spain. Many other European countries, regions or municipalities have already adopted similar requirements and the largest EU economy, Germany, is currently debating a far-reaching legislative proposal, which would make the use of renewable heating mandatory for new buildings.

To further develop the CSTS markets in Europe, this kind of push-policies are really needed. But more information and capacity building are necessary to prepare for the increased demand in future. The SOLARGE project has encountered high interest and thus has shown that it came at the right point in time. Many market participants are looking into entering this market segment. High prices for conventional energy have made many owners of commercial buildings look for alternatives. More and more often CSTS are cost competitive with conventional solutions. And compared with other alternatives, CSTS often represent the lowest-cost solution to fulfil minimum renewables requirements.

On the whole, SOLARGE results provide a sound basis for activities in the area of CSTS. There are market studies which shed light on the status-quo. The large good practice database and catalogue present convincing and real-life experiences with CSTS examples in all partner countries and demonstrate that CSTS are deployed in many different circumstances and applications. The printed catalogue is going to be disseminated at international conferences and fairs, such as the Eurosun 2008, Intersolar and estec2009. Many professionals have been trained in connection with SOLARGE and will now be ready to put their knowledge into practice. And specific recommendations are ready and available to all policy makers and decisions makers within the position papers.

And while the SOLARGE project was building up capacity at national and regional level, implementing informational and promotional first measures as well as connecting experts at European level, policy-makers at EU-level were developing new legislation to create the necessary positive frame-work conditions for – amongst others – CSTS.

With the publication of a proposal for a EU Renewables Directive at the beginning of 2008 a new milestone has been reached.

SOLARGE was addressing the issue of CSTS before this new impulse. The project has created knowledge and tools, which will be used in putting the future Renewables Directive into action.

SOLARGE represents a good step forward in the development of the CSTS market. It is necessary to continue the work SOLARGE has started such as collecting and disseminating good practice examples, supporting the exchange of experience between European experts and stakeholder, to discuss and benchmark various supporting policies at national level and to continue promoting and campaigning for CSTS within the difficult target groups of housing companies, business and commercial enterprises with the growing backup of a strong regulative environment.

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