

THE CONTRIBUTION OF PORTUGUESE SOLAR THERMAL PROGRAM ON THE COUNTRY ENERGY EFFICIENCY

Andreia Salgueiro^{*}, João Farinha Mendes

Laboratório Nacional de Energia e Geologia / Unidade Energia Solar, Eólica e dos Oceanos, Estrada Paço do Lumiar 22, 1649-038 Lisboa, Portugal.

^{*} Corresponding Author, andreia.salgueiro@ineti.pt

Abstract

Although the efforts on renewable energy investment during the last decade, Portugal is still importing up to 80% of its energy supply. The solar radiation available all over the year is a strong reason to promote the utilization of this resource and during the year 2009, a new program based on a 50% subsidy, was promoted by the Portuguese government, directed to domestic applications in individual houses and other installations, to increase substantially the solar thermal market. As expected, a significant number of new installations were realized, which will contribute to the corresponding reduction on energy imports. In 2009 the state program provided the installation of more than 50,000 systems under special conditions, representing up to 176,000m² of solar collector area. This area doubles the area installed in the previous year. Even without achieving the target initially proposed (250,000m² installed), the program can be considered a success and this paper gives an overview of the main goals and results obtained until now and its contribution to the evolution of the Portuguese solar thermal collector market.

1 Solar Thermal Energy Potential in Portugal

Portugal has a great potential on solar energy resource - 2,200 to 3,000 of sunshine hours per year – and like other countries a large number of applications where this resource can be applied, substituting imported energy. The most evident is the hot water preparation for low temperature applications in several industries and in the domestic or service sectors. A study on the potential, in the previous range of temperatures, was conducted some years ago in Portugal [1], showing a potential of 14 million m² of solar collectors and around 3 million as the reasonable potential to deal with, in the near future. This enormous potential was considered in the Portuguese strategy to reduce external energy dependency, to decrease CO₂ emissions and, by this way, to accomplish with Kyoto Protocol, considering a value of 1 million m² of solar thermal collectors that should be installed in Portugal until the year 2010 [2].

2 Solar Thermal Market in Portugal

In spite of the program designed since the beginning of last decade, “Solar Hot Water for Portugal”, with some fiscal incentives, dissemination of information, quality program to equipment and installers, severe restrictions to new building construction without implementation of energy efficiency measures, concluded with a solar obligation (is mandatory since 2006 to install solar thermal collectors for domestic hot water preparation in all new buildings), no remarkable effect has been noted in the statistic of the solar collector market, during the first 6 years this century.

The specific aim of this initiative was the creation of a sustainable market of solar collectors for hot water, contemplating quality of materials and installations, to reach 150,000m² of solar collectors installed per year [3].

At that time was necessary to define some main lines to help the development of solar thermal energy and to overcome some difficulties such as the weak credibility of users due to poor quality of most of the high cost equipment and facilities installed during the 80's [3].

3 The 2009 Solar Thermal Governmental Program

Initially the approach of the governmental program was only to sponsor small systems (domestic solar solutions). This program included three types of systems: thermosyphon type systems with 200 and 300 liters storage volume and 300 liters storage in forced circulation systems.

A set of characteristics were defined to cover all solutions, and a set of more specific ones to apply to each system in particular.

All suppliers admitted in the Program forwarded the relevant documentation of the systems (test report and certificate of the collector). This information as well as other relevant technical information was verified by LNEG, which has the task to assist the company contracted by the Government to manage the Program [4].

The contribution of LNEG was also related with energy assessment of each solution presented by suppliers, according to the characteristics previously established for each system.

The annual energy delivery of solar thermal systems was calculated using LNEG SolTerm software. The simulated general characteristics for obtaining the energy value for each system were:

- Simulations carried out for Lisbon, with 3° shading of solar collectors; with azimuth of 0° and 30° tilt;
- Consumption – 200l and 300l (water preparation temperature 60°C) with a single accumulation at 6pm each day, all over the year;
- Piping system (Thermosyphon) – 5m pipe length outdoors, using 18mm inner diameter tube with thickness of 1.5mm and thermal conductivity 380W/m/K, for the isolation were used a 30mm thick with a conductivity of 0.03W/m/K and mechanical protection;
- Piping System (Forced circulation) – 10m length with 2m (using mechanical protection) route outside, the other characteristics are equal to the thermosyphon system;
- For the flow rate was considered the literature suggested value and the antifreeze mixture percentage used was 25%;
- The back-up system wasn't considered relevant at this stage because it was only intended to determine the solar fraction.

Thus, the final consumers could choose the system, based on energy produced by each system, in a standard application.

During the last three months of 2009, the governmental program was extended to other associations (private social solidarity institutions and public utility sport associations); in this case each plant was different, depending on hot water needs; the suppliers made different proposals that after evaluation were classified to enable each association to choose the more convenient solution.

The proposals submitted by suppliers were classified according solar fraction, technical characteristic and cost per kWh, assuming a life time period of 20 years. Each association received the three top proposals and was free to choose one of them, although the maximum incentive (65% of the tender) was calculated based on the value presented by the supplier ranked in first.

4 The Governmental Program Results

The growth in domestic solar collectors' usage is obvious (Fig. 1) especially after 2006, when government provided more effective tax benefits and after oil price increased in the middle of the decade. In 2009, due to state re-imburement, keeping the previous benefits and obligations, the market increased significantly, with market values that can be important to establish and secure a solar thermal industry in Portugal.

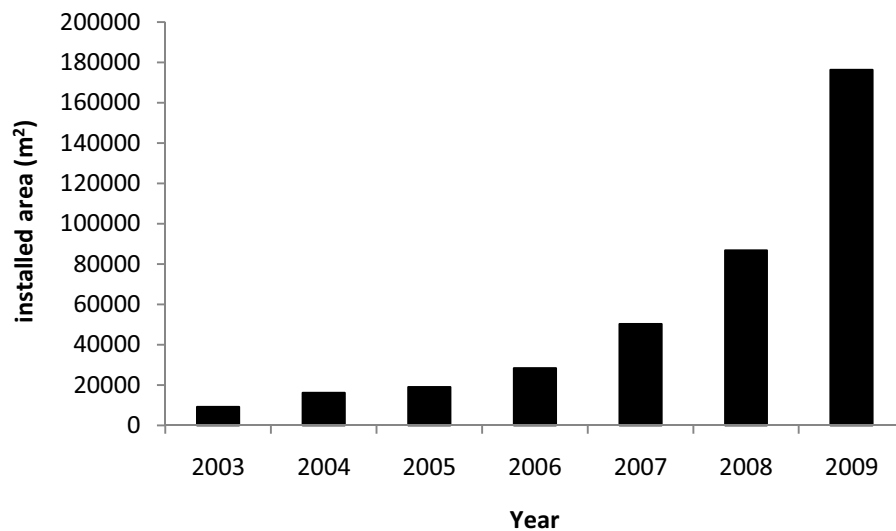


Fig.1. Evolution of solar thermal collectors market in Portugal [4]

Due to the great success of the program, not all the adjudicated systems (176,000m²) were installed during 2009, transferring to 2010 the installation of part of that area (Fig. 2). This is also because, during the last quarter of 2009, the program was extended to other associations, always in applications of hot water preparation. And due to the uncertainty with the continuation of the program in 2010, a large amount of new installations was adjudicated.

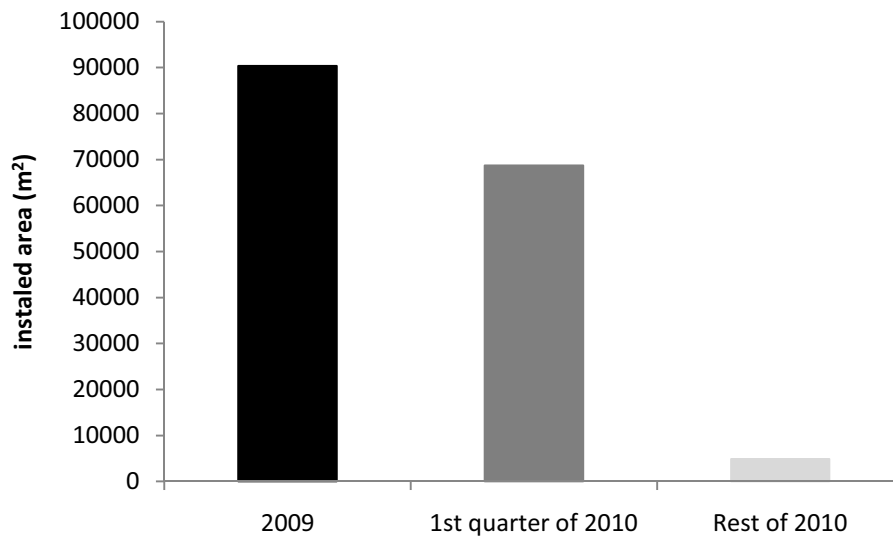


Fig. 2. Distribution facilities under the measure of government granted in 2009 for the domestic sector [4].

The success of the program was based on the benefits for users and for the collectors' manufacturers and distributors due to the business' increase in this sector. The domestic applications in individual houses had the following benefits:

- Turnkey service for financing, equipment and installation;
- Maintenance and warranty provided for a six years period;
- Payment of half value of the installation, the government pays the other half until a maximum value of €1,641.70 (in 2009);
- 30% reduction in annual taxation (IRS), to a maximum value that varies accordingly the fiscal year (maximum of €796.00 in 2009 IRS);
- Reduction in annual energy bill in 20% for the most current system design;
- Easy ordering process;
- 100% financing on personal loans with special conditions;
- Possibility of prompt payment.

The third benefit was extremely generous, and was the greatest innovation associated to this Program, since the deduction on annual taxation was already available and the reduction of the energy bill by using a solar thermal system was becoming more popular after increasing prices of energy to the consumers since the middle of last decade.

For big installations the success was based in the subsidy of 65% resulted in a benefit that significantly increased the use of solar thermal systems.

The Solar Thermal Program, created 2 March 2009, provided 95 millions €, in the first instance just to the domestic applications in individual houses and later extended to other associations, proved to be a good incentive on renewable energy usage.

Almost 87% of the existing value for the program was allocated to residential systems and the rest was not enough for all applications submitted (the remaining 13% were not enough for the 1,358 requests made by other associations) (Table 1).

Table 1. Total of orders/requests for private and other associations under the encouraging solar thermal systems governmental measure [4].

	Orders/Request	Area (m ²)	Value	Subsidy (€)
Private	50,223	176,283	167,823,918.00€	82,451,099.00€
Other associations	1,358	78,764	43,999,200.00€	28,599,480.00€
Total	51,581	255,047	211,823,118.00€	110,050,579.00€

As the ceiling budget remaining available was not sufficient, only part of the associations were able to take advantage of the subsidy granted by government (Fig. 3).

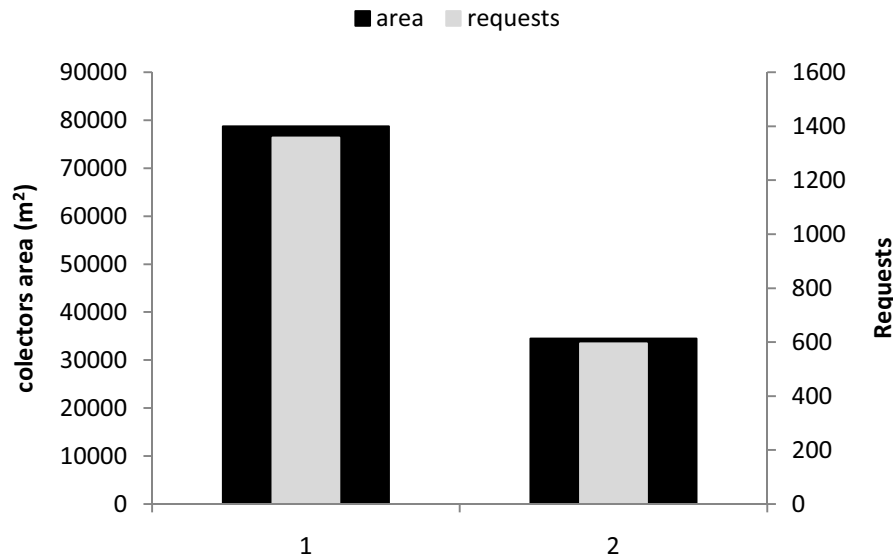


Fig. 3. Received orders and corresponding total area of solar collectors (1) and funded (2) (as ceiling available) by the government for associations.

5 Developments and Conclusion

The promotion of solar thermal energy, using governmental subsidies has proved a highly successful result. Although Portugal is far from the goal of 1 million m² of solar collectors installed, this measure allowed the installation of 176,000m² of solar collectors, doubling the facilities installed during the previous year.

These values are only related to small domestic systems that were installed under the governmental

measure. Part of larger systems hasn't been installed due to the limited period of time (the last three months of the year) of subsidy availability.

In early 2010 it was not sure that the measure would continue to support large systems, but recently 9.5million€ were made available for the installations of solar thermal systems for small and medium enterprises until October 15th 2010.

Later this year, an extra 50 million€ support for energy efficiency, including solar systems installation, was announced for other associations. The first stage of this support (20million€) is available for this projects until October 29th 2010.

As a result of these type of measures we had a strong solar collector market development in Portugal, new companies in the production and installation sectors appeared because the market was foreseen as a well established market based on the subsidy program, on fiscal measures and the national obligation of installation solar thermal collectors in all new buildings. Although limited at the subsidy side, we think that those measures being kept in 2010 are providing a base for the sustainable development of this market. Anyway most of the agents of the sector are not happy with this type of "stop and go" measures, showing their strong agreement with a continuous support program that could be even modest at the subsidy side and avoiding instability in the Portuguese solar energy market.

6 References

[1] H. Gonçalves, A. Joyce, L. Silva, (2002). Fórum Energias Renováveis em Portugal – Uma contribuição para os objectivos de política energética e ambiental, ADENE/INETI, Lisboa, Portugal.

[2] E.O. Fernandes, J.F. Mendes, J.C. Oliveira, L. Silva, S. Spencer, M.J. Carvalho, J.C. Costa, E. Maldonado, (2003). "Promoting Solar Water Heating and other Renewables in Portugal", ISES Solar World Congress, June 14-19, Gotenborg, Sweden.

[3] Iniciativa Água Quente Solar

http://www.aguaquentesolar.com/fich/18/Caract_ST_Pt_2008.pdf

[4] Yunit (2010). Unpublished data supplied by the company responsible (Yunit) for monitoring the governmental program.