A Big Pilot Solar Thermal Installation in a Social House, Bulgaria
Sofia Energy Centre, Bulgaria

Summary

A big pilot solar thermal installation was constructed and brought into operation in April 2002 in the elderly people home "St. Vassilij Veliki" in the town of Plovdiv, Bulgaria. The installation is situated on the flat roof of the building. It comprises 66 solar collectors, each of them with area 2 m^2, with total area of 132 m^2. The investment for the installation was provided within the framework of a 5-year Program of the Greek Government for Assistance to the Neighboring Countries. The aim is, by means of solar energy for heating the domestic hot water (DHW), to reduce the large expenses for energy bills and particularly for diesel oil. The results prove that the combined solar thermal installation with boilers on liquid fuels for DHW for a social house is a profitable socio-economic solution. This solution is economically attractive for the society. Besides, this action could be applied in all social houses, since the production of DHW is done on the base of local boilers on liquid fuel.

End-user area	Target Audience	Technical
New buildings	Citizens	Energy efficiency
Refurbishment of buildings	Households	Heating
Transport and mobility	Property owners	Cooling
■ Financial instruments	Schools and universities	Appliances
Industry	Decision makers	Lighting
Legal initiatives (regulations, directives, etc)	■ Local and regional authorities	CHP
Planning issues	Transport companies	District Heating
■ Sustainable communities	Utilities	■ Solar energy
User behaviour	ESCOs	Biomass
Education	Architects and engineers	Wind
Other	Financial institutions	Geothermal
	Other	Hydro power
		Other

Context

Sofia Energy Centre participates in the implementation of activities in Bulgaria within the framework of the Program of the Greek Government.

The elderly people home "St. Vassilij Veliki" was constructed and brought into operation in 1983. In that period, the price of the energy carriers was insignificant. In the transition period and presently the price of energy reached the international values, as a result to which the cost of the energy needs constitutes almost 50% of the maintenance costs of the house. Therefore, the construction of the big solar thermal installation for domestic hot water of the elderly people home has not only economic, but also a social effects, since the resources saved, instead of being spent on liquid fuels, will be allocated for improvement of the living standard of the inhabitants of the house and the food. Taking into consideration that it could be multiplied not only in the elderly people home, but also in homes for children deprived of parent cares, etc., the effect could be very great.

The idea is, to the existing heating system for DHW to be integrated a solar thermal installation, which could meet the needs of DHW in the period April-October.

Objectives

The main objectives of the project are to reduce the costs for heat energy, while meeting the DHW needs of 200 old people, living in the house "St. Vassilij Veliki". Through the construction of a big solar thermal installation free energy is obtained from the sun (instead of expensive imported liquid fuels), while at the same time the harmful emissions of carbon dioxide (CO_2) are reduced. A third objective is achieved – a positive attitude towards RES of a wider group from the population. The fourth project objective was to examine the performance of a big solar thermal installation from a technical and economical point of view, while operating jointly with a DHW installation, on the base of liquid fuel boilers. The fifth project objective was achieved through large project dissemination for a wider utilization of solar thermal installations in the existing social housing.

Figure 1. Elderly people home "St. Vassilij Veliki" – general view

Process

The key concept of the project is the utilization of solar energy for supply of DHW to the 200 old people living in the elderly people home "St. Vassilij Veliki". The aim is to reduce the large expenses for heating with decentralized, i.e. local heating supply, and to use solar energy in compliance with the world tendencies for clean energy generation and sustainable development.

The project is elaborated on the base of the existing local installation for heating and DHW. The installation comprises of three water heating boilers (two of them are of 350 thousand kCal and one of the boilers is of 600 thousand kCal) on liquid fuels – diesel oil. The installation disposes of three hot water storage tanks, each of them for 2 m^3.

The solar installation was based on a detailed analysis of the energy consumption and bills, the existing system for DHW, roof conditions, shading and orientation, local weather conditions (280 solar days and solar radiation of 1500 kWh/m^2), environmental aspects, financial goals and economic parameters.

The solar thermal installation is projected to operate in the period, when there are no freezings, i.e. April-October, and is project to secure the normal daily needs for DHW, i.e. except in the days with increased hot water consumption (for example bathing days).

The installation is situated on the flat roof of the building. It comprises of 66 solar collectors, each of them 2 m^2, with total area of 132 m^2. The solar collectors are situated in six rows, with 11 collectors in a row. The solar collectors are manufactured in Greece and are of flat-plate type. The panels lay on special stands with inclination of 45°. They are oriented at 12 ° in south-east direction. The separate plates are interconnected with metal pipes and the necessary protective fitment.

The solar installation, which is a closed system, disposes of a circulation pump. The obtained hot water flows to the three existing hot water storage tanks. In case when larger quantities of hot water are needed, it is obtained through utilization of the boilers of liquid fuel.

Figure 2. General view of the solar collectors.

On the ***figure 3*** is presented the applied system.

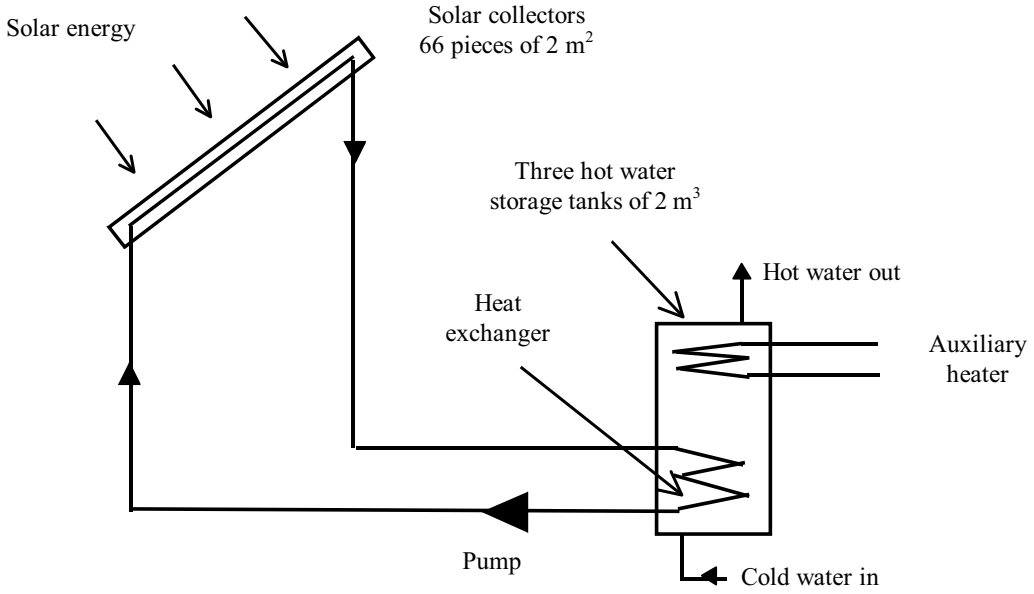

Figure 3

Financial resources and partners

The investments in the Solar Thermal Installation amounted to EUR 64 500 and were granted by the Greek government.

The administration of the Municipality of Plovdiv actively participated in the process of investigation and establishment of the socio-economic results and effects.

Results

The solar thermal installation was finished and brought into operation in April 2002. During the past 3-year period the operation of the system was monitored in the period April-October and the following conclusions were reached:

The average annual use of diesel oil for heating purposes (heating and DHW) in the house is 160 tons. Thanks to the solar installation, the consumption of diesel oil is reduced in average by 20 tons. At the current price of diesel oil 1.65 lv/litre, the annual savings amount to 33 000 lv. (EUR 16 870).

The price of the solar thermal installation comes up to EUR 64 500 or the simple pay-back is 3.8 years. This period could be reduced if the installation is adjusted for all-year operation.

The annual energy saved is 232 640 kWh.

Lessons learned and repeatability

The project proved that the utilization of solar energy for DHW in Bulgaria is profitable, especially in social housing. This case study could be applied to a wide range of social housing, not only in Bulgaria, but anywhere in Europe, since meeting the needs for DHW is done mainly on the base of local diesel oil installations.

The following recommendations could be made:

- With existing buildings – analysis and optimisation of the heating flows of DHW;
- With new buildings – optimal integration of the system within the architectural and construction plan and the hot water plan;
- Application of the European Standards and Certification procedures.

Besides, the utilization of Big Solar Thermal Installations has positive impacts as:

- Clean energy generation, which contributes to the environmental protection;
- Positive socio-economic impact on socially weak groups from the population;
- Financial support (reduces the quantities of bought imported energy resources) to the social housing;
- Opportunity for ESCOs to build and operate big solar thermal installations to ensure DHW for social housing and buildings with high hot water consumption (hospitals, kindergartens, etc.);
- From national point of view, local energy potentials are utilized and the energy independency is increased, new job opportunities are offered, pollution to the environment is reduced and most importantly, the attitude of people toward the utilization of energy and especially RES is changed.

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