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Software for Obtaining the Solar Coverage of a Solar Thermal Energy Installation for Domestic Hot Water Supply by Applying the f-Chart Method

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Abstract: This project presents the design of a simple software for the determination of solar coverage (f-Chart method) in domestic hot water installations. This program allows to determine in a fast and simple way, the fulfillment of the minimum needs of solar thermal energy supply according to the Technical Building Code.

Keywords: software; solar energy; water; f-Chart

1. Introduction

The exponential growth of electricity demand in Spain together with the high dependence on foreign primary energy, much higher than the European Union average, contribute to the need to promote new energy actions. Solar thermal energy is presented as an appropriate measure in the fight for reducing this dependence since Spain is in a geographical and climatological zone of great benefit for the use of solar radiation in the process of power generation.

Moreover, the Technical Building Code requires that in buildings with a demand for Domestic Hot Water (DHW), some of these thermal energy needs must be covered by the incorporation of low temperature thermal systems. Therefore, this project presents the design of a simple software for the determination of solar coverage in domestic hot water installations.

This program allows to determine in a fast and simple way, the fulfillment of the minimum needs of solar thermal energy supply according to the Technical Building Code [1].

2. Methodology

The designed program has seven tabs (Figure 1) and different databases have been included with the information provided by Spanish Regulations [2-5]:

- Tab: [Home]
- Tab: [1-Initial data]
- Tab: [2-Demand calculation]
- Tab: [3-Surface sizing]
- Tab: [4-Shadow losses]
- Tab: [5-Results]
- Tab: [6-f-Chart calculation]

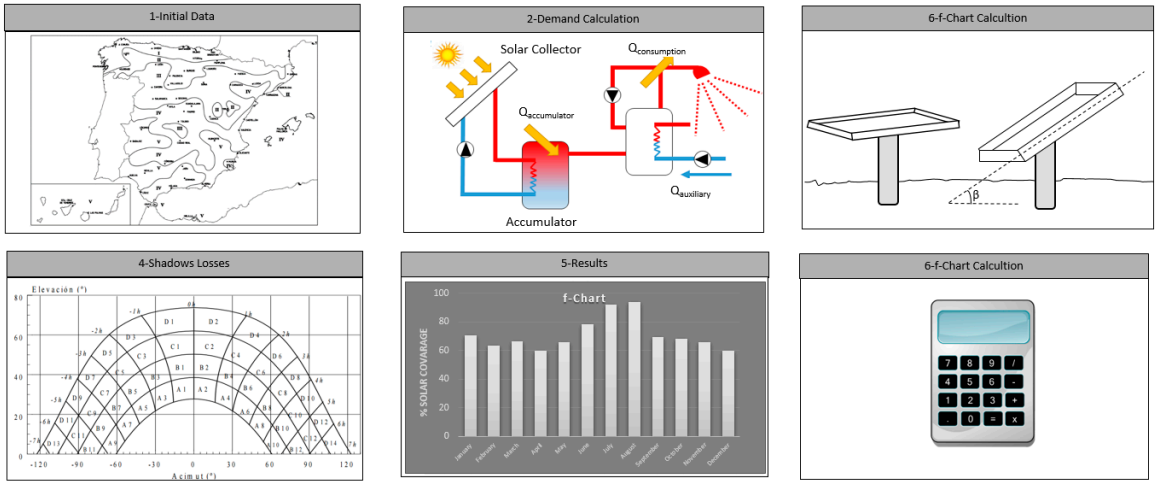

Figure 1. Tab [Home].

The correct functioning of the developed program has been verified by means of a practical example in a facility consisting of:

- Establishment: 5-star hotel;
- Maximum capacity: 50 people;
- Location: Sevilla, Spain;
- Positioning of the collectors: On a gabled roof with an inclination of 45° by superposition;
- Orientation of the collectors: S-SE forming 30° with South.

3. Results

The results obtained by using the software developed are shown below:

- The installation is located in a climatic zone V, with a latitude of 37.2°;
- The average demand of the installation is 1934.88 L/day;
- The required accumulation volume has a value of 100 L/m^2;
- The optimum inclination of the collectors is 47.2°;
- Losses due to orientation and inclination are 3.208% and shadows are 3.280%. In total, the losses are of 6.488%;
- The number of collectors needed is 22. These collectors occupy a total area of 41.8 m^2;
- Solar coverage is set at 67.123%;
- The minimum solar coverage established by the CTE is set at 60%.

4. Conclusions

The developed software allows the verification of the fulfillment of the minimum requirements of solar contribution in a matter of minutes covering the need generated by the non-standardization of a common and specific method that allows to calculate the required solar fraction.

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