

High Efficiency Solar Thermal Collectors Utilization in Process Heat: A Case Study of Textile Finishing Industry

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Abstract : Solar energy, since it is available every day, is seen as one of the most valuable renewable energy resources. Thus, the energy of sun should be efficiently used in various applications. The most known applications that use solar energy are heating water and spaces. High efficiency solar collectors need appropriate selective surfaces to absorb the heat. Selective surfaces (Selektif-Sera) used in this study are applied to flat collectors, which are produced by a roll to roll cost effective coating of nano nickel layers, developed in Selektif Teknoloji Co. Inc. Efficiency of flat collectors using Selektif-Sera absorbers are calculated in collaboration with Institute for Solar Technik Rapperswil, Switzerland. The main cause of high energy consumption in industry is mostly caused from low temperature level processes. There is considerable effort in research to minimize the energy use by renewable energy sources such as solar energy. A feasibility study will be presented to obtain the potential of solar thermal energy utilization in the textile industry using these solar collectors. For the feasibility calculations presented in this study, textile dyeing and finishing factory located at Kahramanmaraş is selected since the geographic location was an important factor. Kahramanmaraş is located in the south east part of Turkey thus has a great potential to have solar illumination much longer. It was observed that, the collector area is limited by the available area in the factory, thus a hybrid heating generating system (lignite/solar thermal) was preferred in the calculations of this study to be more realistic. During the feasibility work, the calculations took into account the preheating process, where well waters heated from 15 °C to 30-40 °C by using the hot waters in heat exchangers. Then the preheated water was heated again by high efficiency solar collectors. Economic comparison between the lignite use and solar thermal collector use was provided to determine the optimal system that can be used efficiently. The optimum design of solar thermal systems was studied depending on the optimum collector area. It was found that the solar thermal system is more economic and efficient than the merely lignite use. Return on investment time is calculated as 5.15 years.

Keywords : energy, renewable energy, selective surface, solar collector

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