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POTENTIAL OF SOLAR ENERGY FOR TEA DRYING IN SRI LANKA

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Tea industry is one of the biggest energy consumers in Sri Lanka. Its thermal energy requirements for withering and drying are supplied by fuel oil and fuel wood. Solar heating is a viable alternative to the low and medium temperature heat produced by conventional oil or fuel wood. High solar insolation in many parts of the tea growing areas further improves this viability. The true potential of solar energy needs to be assessed as the first step in the development of solar energy for tea processing in Sri Lanka. This paper evaluates the capacity of solar air pre-heating systems for supplying thermal energy for tea drying.

A solar air pre-heating system heats air in a solar collector and then sends this pre-heated air to the conventional air heater already existing in the factory. Heating load at the air heater is therefore reduced thus saving fuel and the money required for purchasing the fuel. Solar fraction - the quantity of heat supplied by the solar energy system as a fraction of the total heating requirement for drying (in this case), is a useful indicator of the performance of a solar energy system.

Air pre-heating can be done only during daytime under sufficient solar radiation. In addition, solar fraction will depend on the size and efficiency of the air collector, tea production and the capacity of tea dryer and a few other minor factors. The seasonal variations of the tea crop, tea manufacturing practices and the meteorological parameters are well identified. The seasonal variation is linked to six regions of tea manufacture based on the altitude and the change of environmental factors from east to west due to monsoons. The solar fraction will therefore depend on the region. The cost is a prime concern in the design of solar energy systems. Therefore roof supported large area low cost solar air collectors that can be fabricated locally are considered in this study. Their performance is obtained under varying air flow rates using appropriate models.

A computer simulation study of the performance of solar air pre-heating systems in the six regions of tea manufacture is done. Systems employing black painted collectors of 34% efficiency give solar fractions greater than 50% in three regions; (1) south western low-country (2) southern, western and northern mid-country and (3) eastern mid-country with the dry center of Uva. Low ambient temperatures and solar resource coupled with the process heating requirements results in very poor thermal performance in the central top country. In the other two regions solar fraction is less than 50% for the same solar collector efficiency.