

Energy efficient hybrid water heating system

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As the world's energy resources are diminishing, we need to find greener solutions through renewable energy sources that can generate electricity for heating, lighting homes and for a variety of commercial and industrial uses. Among many types of renewable energy resources, such as wind and solar energy, are constantly replenished and will never run out. At present we are experiencing an electrical energy shortage in Sri Lanka. However, we are still wasting so much of electrical energy in spite of the above crisis. The University of Kelaniya has many cafeterias. The cafeteria attached to the Gymnasium is the largest food and refreshments supplier in the university. The main refreshment for the students is hot tea. Hence, every day, every hour, the canteen has to produce a large number of cups of tea by using considerable amount of electrical energy for boiling water. Hence, the purpose of this project is to minimize the electricity consumption in the boiler using freely available sunlight. Initially, the project was focused to power the boiler using a photovoltaic array. Even though this method was straight forward, investigations have shown that this method was not financially viable. Hence, the next approach was to utilize solar thermal energy to heat the make-up water to the boiler which is significantly cheaper to implement than the previous. Fresh water is circulating through the heat exchanger unit placed on the top of the roof of the cafeteria. Heated water is fed to the boiler as make-up water. Although the heating system is unable to produce boiling water. It is capable of producing nearly half of the energy requirement for boiling the water. A temperature sensor was placed to measure the boiler temperature and the output of the sensor is fed to the heating element to maintain the boiler temperature at 373 K. According to the observation it is clear that make-up water temperature in the morning is 332 K which is little lower than the temperature of make-up water in the afternoon which is 342 K due to overnight cooling of the storage tank. Therefore, morning electricity consumption of the boiler is little larger than the evening. The average daily hot water consumption for making tea is approximately 78 liters in the morning and 88 liters in the afternoon. According to the calculations, it can be shown that the hybrid system is capable of saving 50% of electrical energy of the boiler. It can be concluded that the total energy provided by the solar heating system or the saving of the system is around 2450 kWh per annum.

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