

Development and Assessment of a Solar Coffee Processing Center for Cooperative Use in Indonesia

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ABSTRACT

Since the government of Indonesia launched a policy to enhance coffee productivity proposed concept in coffee handling operation is to centralize the harvest in a processing center covering a given acreage. Farmer cooperative bean collectors or private companies can operate the units according to their interest. The Indonesian Coffee and Cocoa Research Institute has developed a model of middle scale coffee processing unit since the past three years. The processing building has one hundred forty four (144) meter-square of forced convection type plate solar collector as a roof. The collector produces heat for a flat bed type dryer having capacity of about nine tons of fresh coffee parchments. The results showed that the optimum air flow through the collector ranged between 1.000-1.500 m³/hr/a ton of wet parchment. When the daily insolation rate was 4.50 kWh/m² the collector was able to heat the drying air go to 60°C at relative humidity of 12%. The time required to produce dried coffee bean at marketable moisture level of 11% was 144 hours (six days), whereas sun drying was more than 218 hours (nine days). A high efficient wood furnace equipped with a smoke-free heat exchanger provided additional heat for drying process during rainy season. The heat output of the furnace ranged from 50 to 100 kW that was sufficient to heat the drying air up to 80°C at volumetric rate of 15.000 m³/hr. The combination operation of both solar collector and the furnace alternately during the day and night time could significantly shorten the drying time to 72 hours (three days). The improvement in the rate of drying could reduce the risk of spoilage and microbial infestation to the coffee beans both during the drying process and in subsequent storage. The product was free against dust soil, insects and other undesirable materials due to protected drying operation. All of these factors contributed to a significantly improved and more consistent product quality. The cost analysis showed that the processing cost, at an annual output of 100 tons dried coffee beans was Rp 123,50 kg dried bean. The investment cost was Rp 65 million at 25 year expected service life.