

# DEVELOPMENT OF THREE BURNER BIOMASS STOVE

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ORLANDO TUAZON MASIADO  
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## ABSTRACT

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The study on the development of a three burner biomass stove was conducted at the College of Engineering, Cavite State University, Indang Cavite from December 27 1999 to February 19, 2000. The general objective of the study was to develop a three-burner biomass stove.

The biomass stove was evaluated using four biomass fuels, namely: firewood, coconut shell, rice hull and coffee hull as fuel substitute to liquefied petroleum gas (LPG). The performance of the stove was evaluated in terms of boiling time, fuel consumption rate, thermal efficiency and temperature profile. The cost and return of the biomass stove was also analyzed.

The average time to boil thirty (30) liters of water using coconut shell was only 48.23 minutes; using firewood was 55.50 minutes; for rice hull it was 329.75 minutes; and 386.50 minutes for coffee hull.

The biomass stove consumed 12.25 kg of coconut shell, 18.25 kg of firewood, 26 kg of rice hull and 36.75 kg of coffee hull for boiling 30 liters of water.

The thermal efficiency of the biomass stove was 3.21 percent using firewood, 4.57 percent using coconut shell, 3.14 percent using rice hull and 1.95 percent coffee hull as fuel.

Temperature profile shows the heat distribution above the surface of combustion chamber. The large burner acquired the highest temperature of 322 °C. The



temperatures of the two small burners were almost 1.5 times lesser than the temperatures of the large burner varying from 190 °C to 193 °C (if coconut shell or firewood were used) because it was about 45 cm away from the fire.

The percentage ash/char produced during boiling test describes the degree of burning of the fuel. The amount of ash/char was taken after the boiling test of 30 liters of water using firewood, coconut shell, rice hull and coffee hull as fuel. The biomass stove could burn 97 percent of the coconut shell, 95 percent of the firewood, 90 percent of the rice hull and 84 percent of the coffee hull.

The acquisition cost of the biomass stove was P 8,121.00 and it was assumed that it would be useful for about 10 years. The total fixed cost was P 3,671.87 and the variable cost was P 500. The annual total operating cost was P 4,171.87. The biomass stove had a net benefit of P 10,828.13 per year on the basis of the cost of LPG, which was pegged at P 5.00/kg. for nine (9) hours operation per day. The stove had a payback period of 112.5 days.



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