

## Exploratory Trials Using a Perforated Cap on Top of a TLUD

A cap perforated with 7.9 mm holes was placed on top of a TLUD (7.7 cm diameter) burning wood pellets, to see how it would modify the syngas fire. The gasification rate in the TLUD was adjusted by blocking some of the primary air holes, but the secondary air was un-adjusted, so the fuel/air mixture of the syngas fire became richer as primary air was increased. Secondary air was preheated by the outside of the combustion chamber wall.

At full primary air, the gas fire penetrated the holes in the cap, and the flamelets produced smoke indicating incomplete combustion. Smoke was reduced if a chimney with holes for secondary air was placed on the cap (Fig. 1).

At reduced primary air, the gas fire stayed below the cap (Fig. 3), and appeared to burn smoke-free, however, there were small soot deposits on the underside of the cap at the end of the burn (Fig. 4).



Fig. 1: A chimney over the cap with holes for secondary air improves combustion if the gas fire penetrates the holes in the cap.



Fig. 2: With maximum primary air, the gas fire penetrates the cap, with incomplete combustion producing a small amount of smoke



Fig. 3: Gas fire confined and swirling under the cap, by cutting back on primary air. No visible smoke.



Fig. 4: Underside of cap after the burn in Fig. 3. Soot deposits are black patches, especially at the top-left.

The conclusion was that the cap was useful to protect the syngas fire from wind, and probably increased the temperature in the head space above the fuel/charcoal bed. However, if the gasification rate was increased so that the syngas fire penetrated the holes in the cap, then the cap resulted in less complete combustion than if no cap was present and the syngas formed a tall, elongated cone.

An attempt was made to start the gas fire above the cap. If the holes in the cap are too small, the velocity of the gas mixture is too high, and flamelets are suspended up and off the cap, and easily flame out. When the diameter of the holes are increased (to 7.9 mm), a broad blue-flame fire can be established on top of the cap, but now the flame can travel down through the holes and ignite the gas below the cap.