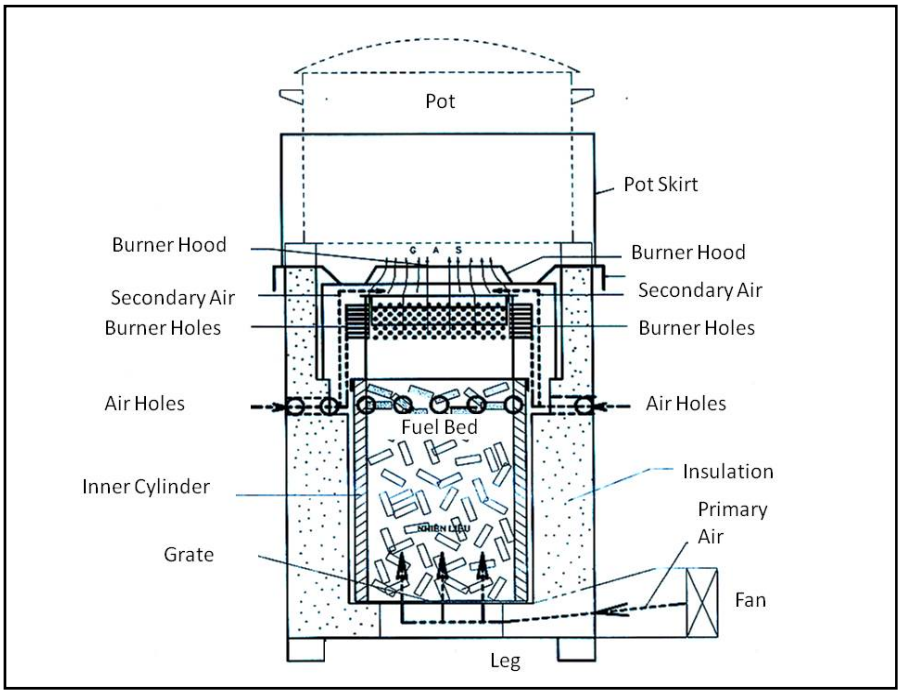
A CLEAN BURNING COOKSTOVE DEVELOPED IN VIETNAM

by Alexis Belonio, Tran Binh, Doan Thi Minh Nguyet, and Bui Dinh Hai

Vietnam is producing a lot of biomass, such as agricultural and forest residues, annually amounting to about 7 to 8 and 75 to 100 million metric tons, respectively. The country's pressing need for a low-cost fuel and a clean-burning cook stove has led VINASILIC to develop, in early 2009, a new generation cooking technology that is suitable for Vietnamese households. Adopting the TLUD principle for the stove, combined with the use of torrefied biomass pellets as fuel for the stove, enable VINASILIC to produce a biomass gas stove that emits blue flame, shown in right photo, with very low black carbon emission (less than 50 ug/m^3).

The stove, as shown in the above photo, consists of a cylindrical reactor, an outer cylinder, a gas burner, and a fan. The cylindrical reactor is where the fuel is gasified. It is provided with grate at the bottom for the passage of primary air. The outer cylinder serves as stove body and as burner support. The gas burner is where the gas generated from the reactor, mixed with preheated air, is ignited. The fan is attached to the stove body and is used to supply the air needed for gasification.



The stove is made of a metal sheet, an earthen ware and an ash

insulation to prevent escape of heat through the surface of the stove body. The primary air enters from the bottom end of the reactor with the use of a 0.15-Amp, 12-V DC fan. The secondary air, on the other hand, enters the reactor through the holes in the middle of the stove body and is mixed with the gas generated at the small holes located at the upper portion of the burner. A skirt is sometimes provided for the stove to increase heat transfer efficiency to the cooking pot.

The stove comes in different sizes, as shown in Table 1 below. Sizes 1 and 2 are for cooking soup. Sizes 3 to 5 are the standard cooking stove; whereas, size 6 is for cooking noodles. As shown, the reactor diameter varies from 11.5 to 21.0 cm and the height varies from 9 to 36 cm. The stove reactor can accommodate 0.17 kg of fuel for the smallest unit while 3.15 kg for the biggest. The fuel can be ignited to produce combustible gases within 3 to 8 minutes, depending on the size of the stove. Operating time is quite longer of about 50 to 75 minutes for the small stove while 180 to 240 minutes for the big stove. Thermal efficiency varies from 26 to 30%. The computed power output ranges from 0.25 kW for the small stove and 2.0 kW for the big stove. On the average, the stove takes less than 5 minutes to boil a liter of water. Other test results also show that one kilogram of rice husk pellets can boil 18 liters within 45 minutes. The temperature of the flame, measured using infrared thermometer, varies from 280 to 350°C.

Table 1. Design and Performance of the Stove.

Size	Reactor Diameter (cm)	Reactor Height (cm)	Fuel Capacity (kg)	Start Up Time (min)	Operating Time (min)	Thermal Efficiency (%)	Power Output (kW)
1	11.5	9.0	0.17	3	50-75	26	0.25
2	12.0	20.0	0.30	4	60-90	26	0.35
3	12.0	20.0	0.47	4	75-90	28	0.60
4	14.0	24.0	0.8	5	90-120	30	0.90
5	16.0	30.0	1.5	5	120-180	30	1.25
6	21.0	36.0	3.15	8	180-240	30	2.00

The advantage features of the stove are: (a) No smoke during operation, (b) No toxic gases are emitted from the burning flame, (c) Easy to ignite fuel, (d) Convenient to use and cooks food faster, (e) Easy to adjust cooking to the user's requirements, (f) High efficiency, which save much fuel, and (g) Low investment cost.

The stove uses torrefied biomass from agricultural and forest wastes, together with coal. The fuel is pelleted to have uniform sizes. A kilo of torrefied biomass pellets can supply gaseous fuel for more than one-hour cooking.

The stove is locally fabricated and is named as "Vietnam Magic Flame" Stove. It is sold at US$ 10 to 15 per unit. The biomass pellets, which are also developed and produced by VINASILIC, cost US$ 0.12 to 0.15 per kg. Compared with kerosene and LPG, the payback period for the stove is within 6 months. Moreover, VINASILIC has already started the promotion of the stove in Vietnam and will start its commercialization of the stove and the fuel soon to benefit the people.

For further information, please contact Professor Tran Binh (tranbinhshc@gmail.com), VINASILIC SJ, Socialist Republic of Vietnam or Alexis Belonio, Center for Rice Husk Energy, Philippines (atbelonio@yahoo.com).

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