

IMPROVED VERSIONS OF THE CONTINUOUS-TYPE RICE HUSK GAS STOVE FOR HOUSEHOLD-USE

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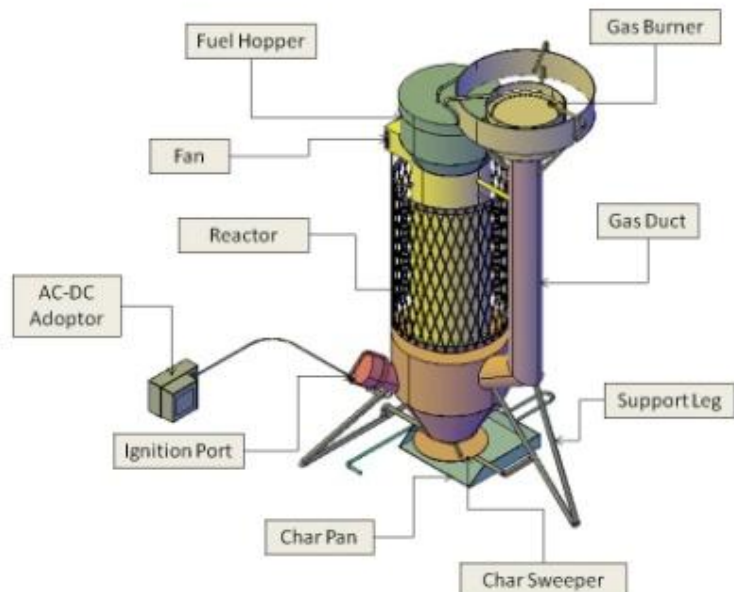
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Glory to God!!

An improved version of the continuous-type rice husk gas stove was developed to provide rural households a technology for cooking not requiring frequent unloading of char and refueling of rice husk fuel. The improved version of the stove comes in two different models, these are: (a) The single-burner stove, with 12cm-diameter reactor and (b) The double-burner stove, with 14cm-diameter reactor. To ensure safe operation, both models are powered by a 12-volt DC fan making it more adaptable to available power source - may it be a grid, a battery, or a solar panel. This development is another breakthrough by the Center for Rice Husk Energy Technology (CRHET) with funding support from the Rolex Awards for Enterprise 2008 and The Tech Awards 2010. CRHET aims to broaden the adoptability of the rice husk gasifier stove as a cooking device for households as well as for home-based industry.



The stove, shown at the right, basically consists of the following parts: a fuel hopper where rice husks are fed; a fan which supplies the air needed for gasification; a reactor where rice husks are gasified using limited amount of air; a gas burner where combustible gases generated are ignited; a gas duct where gas produced is channeled from the reactor to the burner; an ignition port where rice husk fuel is ignited; an adoptor which is used



to regulate the intensity of the flame; a char sweeper which facilitates the removal of burnt rice husks; a pan which makes the collection of char easy; and support legs which support the entire structure. A continuous and easy operation is achieved in these improved models of the stove where a smokeless blue flame, which is similar to that of an LPG- fueled burner, is obtained. The salient feature of these improved models is that there is no need of reloading and igniting rice husk fuel just to prolong the operation of the stove. The intensity of fire can be controlled either by adjusting the opening of the gas burner or by changing the input voltage of the adaptor selector switch. With the two-burner stove, households can finish cooking in a shorter period of time since they, for instance, can cook rice and cook dish or boil water simultaneously.



During the performance testing of the stove, it was observed that the single-burner has a bit longer start-up time to generate gas than the double-burner which is 5 to 10 minutes and 4 to 7 minutes, respectively. This difference in start-up time may be attributed to the size of the ignition port, which is smaller for the single-burner stove. Rice husk consumption of the single-burner stove is 1.1 kg per hour while that of the two-burner is 1.6 kg per hour. Results of performance tests further revealed that the gas temperature at the duct is hotter for the two-burner, which is around 110°C, than the single-burner, which is around 90°C. The temperature beneath the pot is measured at 410° and 460°C for the single- and double- burner, respectively. In terms of boiling test, two liters of water takes 17 minutes to boil in the single burner while 8 and 9 minutes in the double burner, with 1 liter on each burner. The

Design Specification and Performance of the Stove

Parameters	Single Burner	Double Burner
Reactor Diameter (m)	12	14
Reactor Height (m)	40	40
Blower Size (cm x cm x cm)	4 x 4 x 2	6 x 6 x 3
Fuel Consumption Rate (kg/hr)	1.1	1.6
Start Up Time (min)	5-10	4-7
Gas Temperature (C)	90	110
Temperature Beneath the Pot (C)	410	460
Boiling Time Using 2 liters of Water (min)	17	8 and 9
Specific Gasification Rate (kg/hr-m ²)	94	102
Power Input (kWt)	3.7	5.6
Power Output (kWt)	1.0	1.8
Char Production Rate (kg/hr)	0.33	0.48
Overall Thermal Efficiency (%)	27	32

computed specific gasification rate is 94 kg/hr-m² for the single-burner and 102 kg/hr-m² for the double-burner stoves. The power input and output for the single- burner are 3.7 and 1.0 kWt and for the double-burner are 5.6 and 1.8 kWt, respectively. The char obtained per hour of operation is 0.33 and 0.48 kg from the single- and from the double-burner stoves, respectively.

These stove designs were simplified versions of the continuous-type rice husk gasifier stove prototype model. Local materials can be used in the construction of these stoves employing local labor in the rural areas. One person can build a unit of the single-burner stove in less than 2 days while the same number of labor can build a unit of the double-burner in not more than 3 days. The stoves are available at P3,500.00 per unit of the single-burner and at P5,500.00 per unit of the double-burner stove. Comparing it with the LPG-fueled stove, users of these improved-version stoves can recover their investment cost in 4 months. These improved-version stoves have the advantages over the conventional direct combustion stoves in terms of reduced greenhouse gas emission (CO₂ and black carbon) and of savings on fuel.

Further development on the stove is underway applying the steam injection principle to further enhance its performance.

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