GEM Parboiling Technology

Brief to the point description of the technology

An improved parboiling technology called grain quality-enhancer, energy efficient and durable material (GEM) parboiling technology combines the use of a uniform steam parboiler and an improved parboiling stove. When the quantity of paddy to be parboiled is more than 50kg per session, other components (paddy soaking tank, laborsaving devices and improved drying surface) are required. The GEM parboiling technology is not only about the equipment but also the ***process***.

The ***parboiler*** consists of a stainless steel mesh basket that sits on a support in a stainless steel tank. During steaming, boiling water in the tank produces vapor that steams the paddy in the mesh basket. The tank is closed by a tight fitting lid that reduces heat loss but the system is not pressurized. The ***paddy soaking tank*** is made from stainless tank with a false bottom, a water discharge point and a paddy discharge point.

The ***stove*** is an improved rocket stove made of baked clay bricks with special ventilation. The stoves protects the user from heat and smoke exposure.

The ***laborsaving devices*** are either a rotational hoist or a chain hoist system for paddy weights less than 50 kg or paddy weights between 50—100kg respectively.

The ***improved drying surfaces*** are cemented floors that have a 5% slope and raised 50cm from the ground. These surfaces have walkways that prevent users from walking directly on the drying surfaces to reduce contamination.

The GEM parboiling technology can be tailor for small (20—300kg), medium (300—1000kg) and large (1000—3000kg) scale processors. The ***cost*** of the technology will depend on the components and the scale of operation.

Suitable ecologies

The GEM parboiling technology is suitable for both rainfed and irrigated ecologies but it's profitability is higher in irrigated ecology due to reduced brown to black spots on paddy.

Gender Sensitiveness

The GEM parboiling technology was co-developed with women from the Glazoue Innovation Platform (IP) in Benin. The technology was developed to ***reduce drudgery***, the ***risk of heat burns*** and ***exposure to smoke*** to the operator who are mostly women.

Changes and or impact

Women parboilers that use the GEM technology make an ***extra 200 USD*** on every ton of rice parboiled compared to parboilers using the traditional system.

The GEM parboiling technology has higher output rate of up to ***25 tons of milled rice per month*** of high quality (lighter and uniform color, absence of heat-damaged grains and impurities, low levels of broken fractions).

The GEM parboiling technology reduces expenditure on firewood from ***1.83 to 0.64 USD per 100kg*** of paddy parboiled.

The GEM parboiling technology reduces the steaming time from about ***60—90 min to 20—25 min per 100kg*** of paddy.

Women who use the GEM parboiling technology indicate that they do not suffer from ***heat burns*** and other sickness especially those related to ***smoke exposure and poor hygiene*** and face less difficulty in lifting loads.

The internal rate of return (IRR) of the GEM parboiling technology is ***70% compared to 14%*** for the traditional technology.

For more information visit:
http://www.ricehub.org/RT/post-harvest/gem-parboiling/

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Biomass Gasification Technology

Brief to the point description of the technology

The biomass gasification technologies at AfricaRice employs top-lit updraft gasifiers (**stoves**) for the generation of thermal energy from agricultural residue for household, restaurant and small scale food processing industries.

Two types of gasifiers have been modified, tested and validated with women in Benin. The ***AfricaRice MV gasifier*** is suitable of both indoor and outdoor use while the ***AfricaRice MPO gasifier*** is suitable for outdoor use only.

These gasifiers use ***a solar battery powered 12 volt fan*** to prompt air necessary for the gasification process to be efficient.

Efficiency and effectiveness

These gasifiers have been tested and shown to burn efficiently with the following agricultural residues as fuel: ***rice husk***, ***rice husk mixed with palm nut shell (***up to 50% w/w partial replacement of rice husk***)***, ***rice husk pellets***, and ***groundnut shells.*** Other fuels with similar characteristics to those mentioned above are also expected to be gasified efficiently by these stoves to produce clean thermal energy.

The solar powered battery that is coupled to this technology can also supply electrical energy to three 12—17 volts bulbs for ***lighting three rooms*** in a rural setting where electricity is absent.

The gasifiers have a burning time of 30—90 min depending on the fuel type with 25—50% rice husk-palm nut shell mixture having the highest burning time.

Suitable ecologies

The AfricaRice MV and MPO gasifiers are suitable for all types of rice growing ecologies but are more adapted for households, restaurants and small food processing within the vicinity of rice milling facilities.

Gender Sensitiveness

Women who participated in the evaluation of the gasifiers indicated that they '***liked very much'*** the gasifier because they were '***very easy to operate'*** and produced ***'little or no smoke'*** and cooked food effectively

Benefits and added value

Biomass gasification technologies significantly reduce dependence on traditional wood and fossil fuels and cuts the cost of fuel for cooking and lighting to almost ***zero***.

The use of rice husk as fuel via gasification adds value to this wasted resource which in most cases is abandoned at rice milling sites or burned in the open air resulting in land and air pollution respectively.

The immediate by-product of husk gasification is ***bio-char***. In order use this bio-char as ***fertilizer***, the bio-char must be put in an ***oxygen-deprived environment*** to stop combustion after the gasification process is completed. The husk bio-char can be used to replenish impoverished soils by adding about **10 ton/ha**.

Rice husk ash can be generated from rice husk bio-char by allowing the bio-char to completely burn in air to produce white rice husk ash. Rice husk ash can be used to ***partially replace cement*** (30% w/w) in the fabrication of ***bricks***.

The **cost** of the entire setup (gasifier, fan, solar powered battery, three 12-17 volts bulbs and connecting cables is **400 USD**

For more information visit:
http://www.ricehub.org/RT/post-harvest/by-product-use/husk-gasification/

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Biomass Briquetting/Pelleting Technology

Brief to the point description of the technology

The high volatility and low density of rice husk and other agricultural residues (96-160 kg/m3) can pose challenges in handling and transportation. Biomass briquetting/pelleting technologies are used to densify agricultural at production sites prior to supplying distant markets. This technology can be used both for carbonized and non-carbonized biomass.

The technology comprises the equipment and the process. The equipment consist of the grinding for particle size reduction, the mixer and the briquetter/pelleter.

The multi-functional ***AfricaRice-TCMS grinder*** is is a hammer mill developed by AfricaRice and Techniques de Construction Mécano-Soudée (TCMS). This grinder can reduce the ***particle size*** of cereals, husk or other residue to ***less than 1 mm,*** which is the optimum particle size for briquetting/ pelleting. The grinder blades are made from stainless to increase depreciation time. The grinder has a capacity of 200kg/h. This grinder cost ***1500 USD***

The ***AfricaRice-TCMS mixer*** is a rotatory mixer with a capacity of 500kg/h. The maximum humidity of the mixture is 30%. This mixer cost ***750 USD***

The ***AfricaRice Multi-Piston briquetter*** is a manual briquetting machine that can produce 45—144kg briquettes/day (11% moisture content) depending on the type hydraulic system (Stargold® or Yale® jack). This equipment with Stargold® jack cost ***1000 USD***.

The ***AfricaRice-TCMS motorized screw press briquetter/pelleter*** has a capacity of 200kg/h. This equipment cost ***2000 USD*** and can be used to produce both briquettes, feed and wood pellets.

Note

- *For manual briquetting, entrepreneurs will have to acquire the grinder, mixer and manual briquetter.*
- *For mmotorized briquetting, entrepreneurs will have to acquire the grinder, mixer and motorized briquetter/pelleter.*

Suitable ecologies

The briquetting/pelleting technology is suitable for both rainfed and irrigated ecologies but it must be set up close to rice milling facilities if the target is rice husk.

Gender Sensitiveness

The briquetting/pelleting technology is suitable for youth be they male or female.

Benefits and added value

Wood pellets produced through this technology are used in gasification technology for thermal energy generation (see *biomass gasification technology*) .

Briquettes produced through is technology are burn in well-ventilated stove such as the improved rocket stove (see *GEM parboiling technology*) via the process of combustion to generate thermal energy.

Carbonized briquettes burn with no smoke but lower fire intensity compared to firewood and can completely substitute charcoal.
Non-carbonized briquettes burn with less smoke and with similar fire intensity compared to wood. As such these briquettes can substantially reduce the pressure on forest as a source of firewood.

For more information visit:
http://www.ricehub.org/RT/post-harvest/by-product-use/husk--densification/

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