

## Improved Rice Parboiling System Saves Biomass and Lives

Bangladesh produces over 40 million tons of rice a year – making it the fourth largest rice producer in the world, after China, India, and Indonesia. Like many South Asians, the Bangladeshis like their rice parboiled – in other words, precooked in the husk, making it firmer, less sticky, and more nutritious. Thus, 90% of the rice harvest in Bangladesh is cooked in small or medium-sized rice parboilers right at the mills. The often primitive systems are fired with the rice husks and rice bran that remain after the rice is dehusked.

Although Bangladeshis find the resulting parboiled rice quite tasty, the parboiling process produces a number of important problems for the country. First of all, Bangladesh, an energy-starved country that relies on biomass for 50% of its total energy supply, is now burning up over half of its most plentiful source of biomass, rice husks, in highly inefficient systems. Rice husks can be made into briquettes that are widely used in small restaurants and urban household or used as bed spread in poultry farms, while rice bran is a high-value animal feed and is also made into edible oil. However, both rice husks and rice bran are now increasingly scarce and prohibitively expensive.

Not only are the rice parboilers wasting scarce biomass resources, they are also very dangerous for the operators and onlookers: Over 100 people die each year and over 500 people suffer severe injuries when boilers explode because internal steam pressure builds up. Hand throwing fuel into the furnaces also causes dangerous flashback to the operators. In addition, the furnaces emit smoke, carbon monoxide, and particles that cause eye ailments, bronchial problems, headaches, and cancer.

Short of weaning Bangladeshis off their parboiled rice – a highly unlikely occurrence – the obvious solution is to introduce much more energy efficient and safer systems, which is exactly what the Sustainable Energy for Development (SED) Program, a joint undertaking of the Bangladesh Ministry of Power, Energy, and Mineral Resources (MoPEMR) and the German Federal Ministry



Traditional rice parboiling system

for Economic Cooperation and Development through the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH set out to do.

The SED Program began by surveying the existing parboiling landscape. They found over 50,000 small and medium-sized steam-generating parboiling systems, most of which were operating at thermal efficiency levels of 20-30%. Although some of the larger rice mills were using imported industrial steam generators with efficiency levels well over 50%, these are far too expensive for most small and medium-sized mills, which more typically use a locally produced cylindrical or semi-cylindrical vessel with half that efficiency or a simple oil drum boiler with thermal efficiency of only 15%. Most systems have no safety valve, pressure gauge, water level indicator, or chimney.

In conjunction with the Bangladesh Rice Research Institute, the Energy Audit Cell of MoPEMR, and Modern Erection Ltd., the SED Program successfully developed improved rice parboiling system models in

two rice mills. The team worked to optimize the geometry of the boiler, furnace, flue gas duct, and chimney. The boiler was constructed from steel sheets and insulated with glass wool to reduce heat loss. The team added a pressure gauge, a water-level indicator, and a simple dead-weight safety device which opens automatically when pressure exceeds the safety limit – thus preventing explosions. A twelve-meter chimney was constructed to aid combustion, maintain a clean flue gas exhaust, and retain the ash and other particulate matters, thus removing air pollution in the work area and surroundings. For proper and uniform combustion control and heat transfer, rice husk (fuel) is fed into the furnace with the help of a blower.

The pilot rice parboiling systems reduced the use of rice husks by over 50%. In one of the two pilot plants, in Kaliakoir, near Dhaka, the new rice parboiling system (capacity of 18 tons of rice a day) achieved a thermal efficiency of 54%. The mill owner had been previously working with a system operating at only 24% efficiency, so that he now uses 50% less rice husks. In other words, while he previously needed 169 kg of rice husk, today he requires only 80 kg to parboil one ton of rice. The saved rice husk and rice bran are being sold for alternative uses. Furthermore, the danger to his staff of death, injury, or disease has been vastly reduced.

The same Bangladeshi technicians who build the traditional models can be trained to build the improved system. Although the new system is clearly more expensive than the previous system, the savings in fuel mean that the payback period for the new system can be less than six months (depending on intensity of usage). Demand for this new rice parboiling system is high. The SED Program, in conjunction with the rice mill owners' associations in various mill clusters is replicating this innovative parboiling system all over the country. Already 42 improved parboiling systems have been installed in different rice mill clusters. More demonstration plants are planned in other rice milling areas.



Improved rice parboiling system

One of the major barriers to dissemination is the initial investment required. The SED Program has therefore been advising banks and financial institutions about the benefits of the new system and encouraging them to provide loans to millers. If the 50,000 traditional parboiling systems in operation across Bangladesh can be successfully replaced with the new technology, not only will hundreds of deaths and injuries and thousands of health problems be prevented; the country will also save at least two million tons of rice husk a year – a highly significant increase in energy and biomass resources in a country with one of the lowest per capita energy consumption levels in the world.

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