

Improved Rice Parboiling System Saves Biomass and Lives

Background

Bangladesh produces over 40 million tonnes of rice a year, making it the fourth largest rice producer in the world, after China, India and Indonesia. Bangladeshis prefer their rice parboiled or, precooked in the husk, making it firmer, less sticky, and more nutritious. About 90 percent of the rice harvested in Bangladesh is cooked in small or medium sized rice parboiling systems right at the mills. Primitive parboiling systems are fuelled with rice husks and partial rice bran mixtures that remain after the rice is dehusked.

The parboiling process causes a number of problems. Bangladesh is an energy-starved country that relies on biomass for more than 50 percent of its total energy supply; rice husk constitutes nearly 25 percent of the country's total biomass sources. More than half the rice husk is burnt off in inefficient rice parboiling systems. Rice husk has other productive uses. For example, small restaurants and urban households make briquettes out of them and poultry farms use them as bed spreads, while rice bran is a high-value animal feed and is made into edible oil. However, both rice husks and rice bran are now increasingly scarce and expensive. Traditional rice parboiling systems not only waste these resources but are very dangerous for the operators and onlookers.

More than a 100 people die each year, while 500 people suffer severe injuries and countless more become disabled for life when boilers explode due to increased internal steam pressure. Injecting fuel into the furnaces through hand-feeding also causes dangerous flashback for the onlookers.

In addition, the furnaces emit smoke, carbon monoxide and particles that cause eye ailments, bronchial problems, headaches, and cancer. Many suffer from various smoke-related diseases after continuously working for 4-5 years in traditional rice parboiling systems. It is highly unlikely that Bangladeshis will shift from their favourite parboiled rice, a food habit that has grown over centuries.

The solution is to introduce more energy efficient and safer systems, which is the aim of the Renewable Energy and Energy Efficiency Programme (REEEP). REEEP is a joint undertaking of the Bangladesh Ministry of Power, Energy, and Mineral Resources (MPEMR) and the German Federal Ministry for Economic Cooperation and Development (BMZ). It is implemented by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. Sustainable and Renewable Energy Development Authority (SREDA) is REEEP's Government Counterpart.

Our Approach

GIZ started its intervention 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 percent. Although some of the larger rice mills had been using imported industrial steam generators with efficiency levels well over 50 percent, these generators are very expensive for most of the small and medium-sized mills. The smaller rice mills typically use locally produced cylindrical or semi-cylindrical vessels with less efficiency or simple oil drum boilers with thermal efficiency of only 15 percent. Most of these systems have no safety valve, pressure gauge, water level indicator or chimney. In collaboration with the Bangladesh Rice Research Institute, the Energy Audit Cell of MPEMR and Modern Erection Ltd, GIZ successfully developed improved rice parboiling system models with 50 percent efficiency and initially piloted in two rice mills.

The team optimised the geometry of the boiler, furnace, flue gas duct, and chimney. The boiler was constructed from steel sheets and was insulated with glass wool to reduce heat loss.

The team added a pressure gauge, a water-level indicator and a dead-weight type safety device which opens automatically when pressure exceeds the safety limit - thus preventing explosions. A twelve-meter high chimney along with a well-designed flue duct was constructed to aid in combustion, maintain a clean flue-gas exhaust and retain the ash and other particulate matters, thus removing air pollution from the work place and surrounding work area.



Efficient & pollution free IRPS in operation in a rice mill

For proper and uniform combustion strike-through and heat transfer, husk (fuel) is fed into the furnace with the help of a blower.

Benefits of Improved Rice Parboiling System

The pilot rice parboiling systems reduced the use of rice husk by over 50 percent. In one of the two pilot plants, the new rice parboiling system (with the capacity of parboiling 18 tonnes of rice a day) achieved a thermal efficiency of 54 percent against its previous efficiency level of 24 percent. This increased efficiency has resulted in a reduction of rice husk consumption by 50 percent.

In other words, while the owner previously needed 169 kgs of rice husk, now he only requires 80 kgs to parboil one tonne of rice. Leftover rice husk and rice bran are being sold for alternative uses. Furthermore, this new technology improves occupational health and safety of the workers due to safety features incorporated in the system and lower emission compared to traditional technology.

Although the new system is more expensive, the savings in fuel reduces the payback period up to 2 years (depending on the intensity of usage). The traditional boiler technicians can also be trained to build the improved rice parboiling systems. Following the national directive to replace inefficient and unsafe boilers with better ones, demand for this new rice parboiling system is gaining momentum.

GIZ, in conjunction with the rice mill owners' associations, is introducing this innovative parboiling system to the rice mill clusters. As of now, 75 improved parboiling systems have been installed in different rice mill clusters. If the 50,000 traditional parboiling systems currently in operation across Bangladesh are successfully replaced with this new technology, multiple deaths, injuries and health problems can be avoided. The country will also save at least two million tonnes of rice husk and a significant amount of rice brans a year, resulting in substantial savings of energy and biomass resources. GIZ is now working with Swisscontact to strengthen market uptake and rollout of IRPS.

Results and Impacts

- Efficient use of rice husk results in surplus supply of husk, which is a major source of primary energy
- Surplus husk has many useful usage such as briquetting, as poultry bed spread and for power generation
- Improved Rice Parboiling System (IRPS) can be operated by pure husk and leftover rice bran is used for edible oil production which is a high-value import substitute
- Cost saving from husks makes the business more financially viable and competitive
- Better longevity of the equipment
- Improved boiler safety
- Reduced smoke, pollution and carbon emission

Way Forward

- Establish the business case combining improved rice parboiling system, integrated drying and improved milling.
- Policy advocacy with the Bangladesh Government
- Arranging access to finance

Published by Deutsche Gesellschaft für
Internationale Zusammenarbeit (GIZ) GmbH

Registered offices Bonn and Eschborn, Germany

Renewable Energy and Energy Efficiency Programme
PO Box 6091, Gulshan 1
Dhaka 1212, Bangladesh
T + 880 2 5506 8746-52
F + 880 2 5506 8753
giz-bangladesh@giz.de
www.giz.de/bangladesh

Author S. M. Zahid Hasan

Layout Ananya Rubayat

As at June 2017

In cooperation with



On behalf of Federal Ministry for Economic
Cooperation and Development (BMZ)

Addresses of the
BMZ offices

BMZ Bonn Dahlmannstraße 4 53113 Bonn, Germany T +49 (0) 228 99 535-0 F +49 (0) 228 99 535-3500	BMZ Berlin Stresemannstraße 94 10963 Berlin, Germany T +49 (0) 30 18 535-0 F +49 (0) 30 18 535-2501
--	---

poststelle@bmz.bund.de
www.bmz.de

GIZ is responsible for the content of this publication.