Fueling the GEM with rice husk: Good for the household economy, the environment and health

With the adoption of the 'Big-GEM' parboiling system by innovation platforms in several rice sector development hubs, rice parboilers benefited from economies of scale, cleaner and healthier working conditions, reduced fuelwood consumption, and a high-quality product that earn better returns.[1]

In 2016, AfricaRice imported household gasifier stoves from Southeast Asia, increased their size, changed their air-supply system, and coupled to the GEM to develop the 'Mini-GEM' parboiler. The Mini-GEM was pilot-tested in Benin and Côte d'Ivoire.

Despite being a major improvement over traditional parboiling methods, the GEM's fuelwood energy supply presents problems. First, as forests and rural areas become depleted of dry wood, fuelwood prices continue to rise. In addition, burning wood produces smoke and soot, and the resulting blackened pots require extra labor to clean. A potential solution is to use a by-product of rice milling – husk. When burned in fan-assisted [2]gasifier stoves, rice husk can provide an efficient source of heat.

During the pilot-tests, women parboilers collected the husk from the miller along with their milled rice, allowing them to replace increasingly expensive fuelwood with a free fuel source.

"Before the GEM system, we parboiled 5 bags of 100 kg of paddy rice per week, but now we parboil 50 bags per week. Before we sold our rice at US$0.7 per kg because of its poor quality but because of the new Mini-GEM technology, we sell 1 kg of rice for US$2. Increased volume and better quality increased my income and today I can easily send my children to school and college" says Ms. Camara Aissatou, rice processor and president of SCOOPS-FG and the Bouake Innovation platform based in Bouaké (Figure 1).

An additional environmental benefit is that heat production from rice husk can produce biochar, an effective fertilizer. Women parboilers were trained to manage the combustion process so that the burning husk does not turn to ash but instead produces biochar as a valuable by-product.

As of December 2023, scaling effort with support from AfDB (TAAT), BMZ (ESA-PARBOIL), IFAD (PADFA), European Union (HealthyDiets4Africa), CGIAR System Organization (TAFS-WCA) funded projects have supported the demonstration of 55 Mini-GEM systems with a daily capacity of 400 kg/day in nine African countries (Benin (6) Cote d'Ivoire (20); Ethiopia (6); Madagascar (6); Nigeria (2), Mali (3); Mozambique (1), Senegal (1) Guinea Bissau (1). These efforts have transformed the lives of many different rice chain actors. "After our training, we have built and installed more than 20 systems in Ivory Coast. This has created new jobs for the young people who work with me. My business has also grown, and our turnover has doubled from US$12,000 per year to around US$46,000 per year" says COULIBALY Souleymane, designer and manufacturer of equipment working for By2R company (Figure 2).

An impact[3] study conducted in Benin showed that adoption of the GEM system increased household income by 17.77% and reduced poverty by 26%. The system's major advantages include higher output rates, improved head rice recovery, better nutritional quality, and low energy cost.

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1 *See* 'Improving the quality of parboiled rice', *AfricaRice annual report 2016*, pages 19–20.

2 Ndindeng SA, Wopereis M, Sanyang S, Futakuchi K, 2019. Evaluation of fan-assisted rice husk fuelled gasifier cookstoves for application in sub-Sahara Africa. *Renewable Energy* 139:924-235. https://doi.org/10.1016/j.renene.2019.02.132

3 Arouna A, Aboudou R, & Ndindeng SA, (2023). The adoption and impacts of improved parboiling technology for rice value chain upgrading on the livelihood of women rice parboilers in Benin. *Frontiers in Sustainable Food Systems*, 7, 1066418. https://hdl.handle.net/10568/130637

Figure 1. Mme. Camara Aissatou, president of SCOOPS-FG, Parboiled rice Innovation platform based in Bouaké and pioneer group that pilot-tested the Mini-GEM parboiler (Photo by Sali Ndindeng, January 2024).

Figure 2. Mr COULIBALY Souleymane, designer and manufacturer of equipment working for By2R company presents the Mini-GEM parboiler to US Secretary of State during his visit to Cote d'Ivoire (Photo by Sali Ndindeng, January 2024).

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