

Rice Paddy Husk as an Alternative Fuel for Bakeries, Sri Lanka

Themes

- ★ Renewable energy
- * Linkages with other environmental goals
- * Innovative technology applications
- ❖ Financing mechanisms and private sector involvement
- ❖ Technical capacity development
- * Poverty alleviation (MDG 1)

PROJECT DATA

Name: Introduction of paddy husk as an alternative to firewood for the operation of bakeries

Implementing organization: Integrated Development Association, IDEA (NGO)

Location: Polonnaruwa district, Sri Lanka

SGP contribution: \$7,497

Start date: September 2000

ENERGY OVERVIEW

Energy resource: biomass (rice paddy husk)

Technology: paddy husk oven

Application: baking bread

Sector: commercial

Cost of oven: \$570

Cost of fuel: approximately \$2.50/month in electricity; paddy husk currently free

Number served: 5 bakeries through SGP project; 15 additional bakeries through a second phase

BACKGROUND

More than 90% of Sri Lanka's bakeries use firewood to fuel their ovens, accounting for 9% of total biomass fuel used in the country as of 1995. A medium-sized bakery uses about 3 cubic feet of firewood per day; a single medium-sized free provides about 4 cubic feet. Some firewood is taken illegally from protected forests. Only 23% of Sri Lanka's forest cover remains. However, rice mills regularly discard paddy husk, dumping it along roadsides and stream banks. Due to its high silica content, paddy husk takes a long time to decompose, so the "mountains" of paddy husk are eventually burned, which releases carbon dioxide as well as lightweight ash. Paddy husk also attracts wild elephants, which sometimes cause property damage.

PROJECT DESCRIPTION

Overview

This project tested the use of a converted bakery oven that burns rice paddy husk instead of fuel wood, thereby reducing impacts on forests and alleviating the problem of paddy husk accumulation. Since the converted oven also costs less to operate, it can increase income to bakers.

Implementation

The National Engineering Research and Development Centre



Motor for improved bakery oven using rice paddy husk as fuel (Sri Lanka).

of the Ministry of Science and Technology had conducted a pilot study on the possibility of converting bakery ovens to use paddy husk as fuel, but had encountered problems in maintaining a minimum temperature due to the lightweight nature of paddy husk. However, a Sri Lankan baker had developed such an oven, testing and perfecting it over a period of five years. The implementing agency, IDEA, learned of this and received his permission to disseminate the invention even though Mr. Divulgane had obtained patent rights to its use. Prior to implementation, IDEA conducted a baseline study in the Polonnaruwa district, determining the number and size of bakeries and rice mills, bakers' income levels, firewood use and paddy husk discharge rates. A workshop was organized to advertise the new oven, which was well received. Five bakeries were selected as test sites for the oven. The oven uses a small amount of electricity to operate a huller, which breaks up the paddy husk, and a blower that sends the husk into the combustion chamber. When electricity is not working a hand-tractor can be used to power the huller and blower manually.

Previously, bakeries were spending about \$4 per day to purchase 3 cubic feet of firewood. The new oven costs about \$2.50 per month in electricity costs to operate, and paddy husk is currently available for free from rice mills; at most, transportation costs must be paid and these amount to about \$0.20/day. However, an up-front investment of about \$570 is necessary to purchase the oven. During the pilot project, the cost of ovens was split equally between the bakery owner and IDEA.

A few difficulties arose during the pilot project, but all were successfully addressed. For example, one bakery received complaints from a neighbor about ash emitted from the oven's chimney landing on his property. The problem was solved by

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raising the height of the chimney to 18 feet, which ensures that the ash settles back into the fire chamber. The ash is then expelled from the chamber into a collection area. A productive use has been found for the ash – the “black ash” can be used as a fertilizer in paddy farming, and the “white ash” in banana and other vegetable cultivation. The higher chimneys also ensure that the smoke rises high enough into the air not to cause local problems.

Following the initial installations in 5 bakeries, the grantee undertook a second project phase through which 15 additional bakeries were fitted with stoves. Four bakeries are from the Polonnaruwa District, the original project site, and 11 are from the Anuradhapura District. So far, all 15 new stoves are functioning properly.

Environmental Benefits:

Global: The ovens substitute discarded paddy husk for fuel wood. Each oven in the pilot project now no longer uses 3 cubic feet of firewood per day as before. Together, the five bakeries in the pilot project therefore save 15 cubic feet (almost 4 trees) of fuel wood every day. With at least 15 additional bakeries converted, more trees will be saved. Discarded paddy husk, if it decomposes, produces methane, which is a worse greenhouse gas than carbon dioxide produced by burning it. There is a positive net effect to the environment.

Local: The use of paddy husk by bakeries avoids the local environmental problems produced by discarded paddy husk decomposing in public places. In addition, the project benefits local forest ecosystems which otherwise might be felled for firewood. Finally, measures have been taken to minimize local environmental impacts of the ash and smoke. However, it is not known if raising the chimneys has simply transferred smoke problems to other places. .

Local Livelihood Benefits:

Poverty alleviation: Use of the ovens substantially reduces expenditures on fuel to produce bread. While the equipment requires about \$570 up front, the cost of firewood (about \$4 per day) is avoided. The electricity costs of running the huller and blower to send paddy husk into the oven is quite low, only about \$2.30 per month. Currently, the paddy husk is provided for free by rice mills. Thus, the savings are substantial. The project’s baseline study collected information about bakers’ income levels. About 45% have a monthly income of approximately \$140, while the remaining 55% make less than this, with some making less than \$60 per month. During the pilot project, IDEA covered 50% of the investment cost and the bakers assumed the other 50%. During the project expansion to 15 additional bakeries, bakers assumed 90% of the cost of the converted oven, while IDEA covered the remaining 10%.

National Benefits

Each bakery that switches to paddy ash as a fuel saves about one medium-sized tree per day. If scaled up, this project offers Sri Lanka one good way impact on its forests.

Capacity Development

The project organized a workshop for 50 bakers in the region to educate them about the stove, but only 5 of these were selected for the pilot project. These five received training in how to operate the oven. The inventor, himself, was involved in training bakers how to operate and maintain the ovens.

Partners

In addition to IDEA, bakeries are the most important partners. They have covered half the cost of installing the converted ovens and, following an assessment of the project, are now covering 90% of the costs in the project expansion phase. SGP is a key player, having provided the funds to support the effort, and the National Steering Committee has been involved in monitoring results. Finally, government officials have agreed to help spread word about the ovens to other districts.

LESSONS LEARNED

Environmental Management

The project illustrates one way in which biomass waste products can be substituted for firewood, thereby decreasing net carbon dioxide emissions. A key element of the approach taken by this project is its use of a baseline study. This provides critical information for targeting the project to the right areas, and has been used in assessing possibilities for scaling up the project.

The SGP national coordinator has noted the importance of starting with a small number of bakeries in the pilot project, due to the need to pay close attention to every detail and problem that arose in the process, and also suggested that an assessment be conducted of the extent to which the project has achieved increased awareness of climate change and biodiversity.

Barrier Removal

Technical: The project is built around a local invention, which now may be widely implemented in rice-producing regions of the country thanks to the successful pilot project. Partnership with the inventor has broken the technical barriers of using a patented product for a common purpose rather than the individual inventor’s personal benefit.

Financial: This demonstration project’s approach was to split investment costs between the NGO and the users. At an initial stage of technology introduction, such an approach may be well justified since it reduces the risk to the bakers but they still have some incentive, having invested some funds, in making the best use of the oven. This co-financing of equipment during the pilot phase was made more valuable by the IDEA’s collection of baseline data, which made assessing impacts and benefits much more possible. It is a very good sign that in the expansion to 15 additional bakeries, the bakers took on a higher percentage of the costs (90%). Apparently, even though the monthly income of bakers is substantially less than the initial investment cost most bakers have access to capital for the up front payment, either via savings or bank loans.

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Informational

The project addresses informational barriers on two levels:

- **Increased awareness on the part of local bakers of the benefits of the converted paddy husk-powered oven.** This was achieved via the initial workshop and visit to the inventor's bakery. 94% of the 50 workshop participants wanted to try the ovens. This workshop allowed IDEA to accomplish two things at one time: identify good candidates for the pilot project, and raise overall awareness about the ovens so that should the project be scaled up there would be some level of demand already.
- **Helped facilitate access to patented information about the oven.** The inventor agreed to allow IDEA to conduct the pilot project without charging for patent rights he had already obtained, in IDEA's words "as a service to the nation." Therefore, IDEA as the implementing NGO may have played a key role in making this happen, since possibly otherwise the inventor would not have foregone returns on his patent rights. Perhaps IDEA's willingness to conduct a well-organized pilot project, to help ensure success, convinced the inventor give out his patented information freely.

Scaling Up

This project illustrates several good practices in planning for scaling up. They include:

- **Conducting a baseline study.** This is essential to gaining good data on project results later on. Collection of some baseline data should be incorporated into most kinds of projects, but especially those that seek to demonstrate the benefits of a new technology or process. This project collected baseline information about the number and size of bakeries and rice mills, the income levels of bakers, the amount of firewood currently used, and the amount of paddy husk produced. All of this information was critical to implementing the project

and to estimating size of the potential market for the ovens. It is also essential for evaluating the project's environmental and livelihood impacts.

- **Conducting an evaluation and assessment.** The project conducted a second workshop, including bakers, the SGP National Steering Committee, and government officials, to evaluate results and assess the potential for scaling up the project. The involvement of all key stakeholders in such a meeting is essential so that good decisions can be made about expansion. A decision was made to expand, including to another district.

One issue that will have to be assessed if the project is scaled up even further is the potential cost of paddy husk. Apparently, during the pilot project rice mill owners have offered paddy husk for free, only charging a minimal fee for delivery, if that. However, if large numbers of bakeries begin using paddy husk it seems unlikely that the rice mills would continue offering this husk for free. The possible price of paddy husk, therefore, should be considered in assessing the viability of implementing this project on a large scale, as well as the need for credit mechanisms for the purchase of the oven.

SOURCES CONSULTED

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