

Household energy saving technologies	
Module 4:	Retained heat cooker (‘fireless cooker’ or ‘food warmer’)

FACTSHEET

Introduction:

The fuel consumption in the process of food preparation on a fire is not constant. A lot of fuel is required to heat up the content of a cooking pot. Once it is boiling, it only takes little energy to keep it hot and maintain the temperature at boiling point. Some foods like legumes, (sweet) potatoes, cassava, rice or green pawpaw etc. do not require any stirring. The content of the pot has to be heated once to the boiling point and then kept at simmering level on a little flame without having to open the lid of the pot. If you open the lid of the pot and stir the content, the temperature goes down quickly and more fuel is needed to get it back to boiling. The small fire basically replaces the heat that is lost to the environment through the surface of the cooking pot and the closed lid. If you don't use a lid, the heat loss will be even bigger and you more fuel.

How does a fireless or retained heat cooker work?

So there are two ways of maintaining the heat in the cooking pot: either by adding energy through a slow fire or by preventing the heat to escape from the cooking pot: instead of keeping the pot for a long time on a small fire, you can also wrap the cooking pot in an insulative cover (heat retainer = fireless cooker) which prevents the heat to leave the pot. The simmering process of the meal continues inside the wrapping. No further external heat supply is required. Based on the experience of the cook with cooking times of the specific foods, the food stays in the heat retainer (fireless cooker) until it is served.

Food can be kept warm even for up to 6 hours if people come back late home from the field or the market.

Or if visitors are expected and they don't come in time, the buffet can be kept warm, decorative baskets can be put directly on the table (see photo). It is not advisable to keep the food longer than six hours. Otherwise it might promote the growth of microorganisms in the food which puts the health at risk. The underlying principle of insulation is that air does not conduct heat as well as solid metal (e.g. a cooking pot), water or soil. The more insulated pockets of air you can create between the cooking pot and the outside, the more heat will be retained inside the pot.



Food warmers used to serve a buffet

Keep cooking with retained heat after removing the pot from the fire or simply keep food warm

Applicable for all fuel types (firewood, charcoal, paraffin, LPG, electricity etc.)

How to build a fireless cooker:

Insulation: These air pockets can be created with many local materials. But it is important that no moisture is in the wrapping, as water increases the heat conduction. You can use dry grass (hay), dry banana leaves, maize stems, vetiver grass, cotton wool, newspaper (if scrambled and not too compressed), old pieces of blankets etc. – the choice is yours. By using local materials, the fireless cooker can be constructed at no cost at all. Don't forget to build a top cover for the lid! Otherwise the heat disappears through the top. If a big plastic carrier bag is available, the pot can first be stowed in the carrier bag and the bag tied above the lid before the pot goes into the fireless cooker.

Cover: It is important to cover that "filling" with a dry, clean cloth so that no loose particles of the insulation materials can enter accidentally the cooking pot hence spoiling the food.

Container: This insulative material has to be fixed in a container to hold the material in place. This 'container' can have different shapes and can be made out of many materials: a hole in the ground (if dry), a carton box, a clay structure or an old basket or rusty bucket etc. The container must be big enough to accommodate the usual pot size plus two layers of insulation material (formula: diameter of the pot + 2 widths of a palm).

There are many possibilities how to construct a fireless cooker. In general, fireless cookers can be mobile assets or a fixed structure as part of the kitchen structure. Some examples are shown on the next page.

<p>1. Mobile fireless cooker for home use</p> 	<p>2. Carrier-basket for sales on market</p> 
<p>3. fireless cooker with clay container</p> 	<p>4. Stove and fireless cooker as "twin unit"</p> 
<p>5. plastic bag used to protect the cloth</p> 	<p>6. rusty old metal bucket put to new use</p> 

Because of the local conditions in Mulanje, the project mainly focused on mobile fireless cookers as most people do not have a kitchen. As insulation material, dried banana leaves are available in abundance and of no other use. The container can be a locally made basket which is no longer fit as a storage facility when the corners are broken. This otherwise disposed item can still suit the requirements as a fireless cooker. On the next two pages, the construction of such a fireless cooker is illustrated step by step with photographs.



<p>9: make the cushion using another cloth</p> 	<p>10: fold the leaves to the size of the basket</p> 
<p>11: tie the cloth with a knot to make a cushion, no banana leaves should stick out</p> 	<p>12: cook soaked beans for 15 minutes only on the fire (beans must be soaked over night)</p> 
<p>13: add the cut onions and tomatoes + salt</p> 	<p>14: put into the fireless cooker</p> 
<p>15: cover with the cushion and leave for 3 hours: the beans will be cooked and ready to serve!</p> 	<p>16: cook rice for only 2 minutes on the fire and leave in fireless cooker for 30 minutes and it will be ready</p> 

Several benefits can be observed through the use of the fireless cooker:

Benefit 1: saving fuel

The preparation times for food depend on many factors such as outside temperature, heat of the fire, size of the pieces in the pot, variety of the crops, quantities prepared etc. It is therefore not possible to give general information for boiling times and simmering times. In the following table, some examples of experiences collected in Mulanje (Malawi) are compiled as an indication of potentials. The figures are based on food quantities of one family of 5 members.

food	Traditional boiling time on fire	Preparation in fireless cooker		Saving boiling time on fire
		Boiling time on fire	Simmering time in fireless cooker	
Legumes like Beans, Peas etc.	3-4 hours (=240 minutes)	15 minutes	3 hours (= 180 minutes) (if soaked)	225 minutes
(Sweet) potato, cassava, yam, bananas etc.	45 minutes	5 minutes	45 minutes	40 minutes
Green pawpaw	40 minutes	5 minutes	45 minutes	35 minutes
Rice	30 minutes	2 minutes	35 minutes	28 minutes
Chicken, meat	depends	15-20 minutes	2.5 hours	

As a general rough estimation, the boiling time on fire can be reduced to 10% of the traditional boiling time. The simmering time in the fireless cooker should be at least the same time as the total traditional boiling time.

Apart from the fuel saving due to the reduced boiling time, even the initial heating time can be reduced. Cooking in the fireless cooker requires less liquid as evaporation is reduced. Hence less water has to be heated up to the boiling point.

A nice way of demonstrating the insulation properties is to pass the cushion-cover around and ask people to hold it with both hands, placing them flat on either side of the cushion: one hand will feel the hot side of the cushion, that was inside the fireless cooker, the other hand will feel the cool side that was outside. It is still the same cushion people are holding in their hands but the temperature is different. This demonstrates that the heat from the cooking pot was not able to travel through the cushion to escape to the outside, but that it was retained inside the fireless cooker. This is then how the cooking job gets done without additional fire.

Some foods take a long time to cook. Particularly legumes (e.g. beans) have to stay sometimes up to 5 hours on the fire before they are ready for consumption. Many households can no longer afford the cost of firewood these preparations require and stop eating them. As a consequence, a lot of readily available protein at household level is not utilized but sold off.

From a nutrition point of view, this is a very serious problem. Giving up well performing local sources of proteins is a huge set-back on the road to better food security. A retained heat cooker can assist to overcome the shortfalls of the traditional food preparation.

How to cook rice with the fireless cooker:

Measure the rice you want to cook with a cup or any other container. Then measure the water that you need to cook the rice so that it comes out well done to the point. This amount of water can vary a little bit depending on the type of rice you are using, as broken rice will normally absorb more water than a hard-boiling long-grain rice. The amount of water will also depend on how you prepare it before cooking:

If you wash the rice before cooking, then measure 1,5 cups (parts) of water for every cup (part) of rice that you have measured.

If you have clean rice and you don't wash it, then you measure 2 cups (parts) of water for every cup (part) of rice that you have measured.

Make sure that if you have filled the cup up to the brim with rice, you also fill the water up to the same level in the cup.

To find out the suitable amount of water it takes a bit of experimenting. It also depends how you prefer the rice to come out.

Select a cooking pot with a lid that closes well and that fits into your fireless cooker.

Take the quantity of water you measured and bring it to the boil in the way you usually do it (with oil, salt, whatever other spices or condiments you want to add). If you add the rice once it is boiling, you wait until it is starting to boil again and then count 2 minutes (TWO minutes only).

Then remove the cooking pot from the fire and put it into the fireless cooker. If you have, you can use a plastic carrier bag that is big enough to accommodate the cooking pot entirely, this will protect your cloth inside the fireless cooker from the soot of the cooking pot. If you tie the plastic bag over the lid it will prevent vapor to escape from the cooking pot into your insulation material, thus keeping it dry.

Then cover the pot tightly with the cushion-cover of the fireless cooker. Keep checking the outside of the fireless cooker if you feel any heat. If the outside feels a bit warm, it means that the insulation material is too thin in that place and that there is heat escaping from the cooking pot. You will later on have to fix the filling of the insulation material in the areas where the heat was escaping to seal the leak and in future keep the heat inside.

After 30 minutes the rice should be done.

If you are demonstrating this to a group, you can first ask people to come forward and touch the outside of the cushion before you remove it. Ask them what they feel. They will tell you normally that they can't feel any heat. Then take off the cushion and ask people to touch the cooking pot. They will go with the same confidence that they have just touched the cold cushion and touch the hot cooking pot. Normally they will be very surprised to feel the pot being hot.

Take off the lid of the cooking pot for everybody to see how the rice has come up.

Benefit 2: Less wastage of food

Food can not get burned in the fireless cooker as it is off the flames while simmering. Hence, the danger of spoiling food with too much heat is avoided.

Especially with rice, the rice normally does not get burnt, as there is no fire any longer.

Benefit 3: Less labor required for food preparation

When boiling food for several hours, one person must permanently control the fire. This demands a lot of labor which could be used otherwise in the garden, field or other household work if the food would be simmering in the fireless cooker. This is important particularly if labor is a shortage factor (e.g. female headed households).

Benefit 4: Reduced loss of nutrients in the preparation process

Some nutrients get destroyed if they are too long exposed to high temperatures. As the food warms up without flames, the nutrients are less likely to be transformed into less valuable substances.

Cooking temperatures are lower in the fireless cooker so that especially vitamins that are sensitive to heat like Vitamin A and C are preserved better.