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How to use the Mayon Turbo Stove

Creating Ecological Solutions to Energy, Fibre and Food Production Challenges
Des Solutions Écologiques aux défis des secteurs agricole, forestier et de l'énergie

Features of the stove

- ***High efficiency and clean combustion:*** high quality, swirling flames are created from the twin primary air injectors and the extended inner cone with secondary air holes
- ***Economical***: In the rural Philippines, average annual cooking costs and stove purchase is approximately $10US for the MTS, compared to $60-97 US for cooking with purchased firewood, charcoal and LPG.
- ***Fast boiling:*** 1 litre of water can boil in 7-8 minutes
- ***Convenient to use:*** tapping to introduce new fuel is required only about every 5-10 minutes
- ***Low fuel consumption:*** Approximately 2.5 sacks/family/week of rice hull
- ***Portable and lightweight:*** All steel construction, weighing approximately 2.5 kg.
- ***Safety***: An improved holder with a ring structure provides excellent pot stability

Fuel

Although many fuels can be used in the stove, rice hull is the most common choice (Table 1). Hulls can be obtained from most rice mills often for just the cost of transport, but sometimes for a small fee (₱ 1-2/sack). Rice hulls can also be collected from mobile rice mills. To collect the hulls, lay a tarpaulin on the ground and bag the hulls into sacks. *Once home, store the hulls in a dry place as they are difficult to burn when wet.*

Stove location

A Mayon Turbo Stove can be used both indoors and outdoors:

When outdoors, ash is easily disposed of and smoke exposure is minimized. When cooking outdoors, it is best to be in a sheltered location as windy conditions make lighting difficult and cooking less efficient.

Indoors, airflow is more easily controlled, but ashes become messy and air quality can be affected. If cooking indoors, use the stove in a well-ventilated location with a chimney if possible, as smoke from household cooking can cause respiratory and eye diseases. Care should be taken not to disturb or inhale the ashes. One kitchen design option is to place the stove on a grated counter, allowing ashes to fall through the grate and be collected in a fireproof container outside of the house. Ashes can be used as a soil conditioner, fertilizer, cleaning instrument for pots and pans, and ant repellent (eg. sprinkled around the base of eggplants).

Proper Maintenance of the Stove

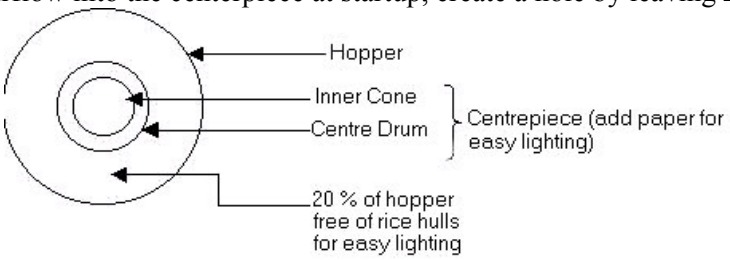
The stove has an estimated lifespan of 2-3 years for the Carbon Steel Model and 3-4 years for the Model with a Stainless Steel inner drum. However, if you want your stove to last it is important to treat it well. Here are a few tips to help you maximize your stove's lifespan:

- *The stove should be stored in a dry location to prevent rusting.* Storing your stove inside is always best but outside in a well-covered location (where it won't be exposed to the rain) is also sufficient.
- To clean the stove use a *dry* rag and wipe the surface*, DO NOT use water.*
- DO NOT sit on the stove, or put excessive weight or pressure upon the stove.
- DO NOT bang the stove excessively.

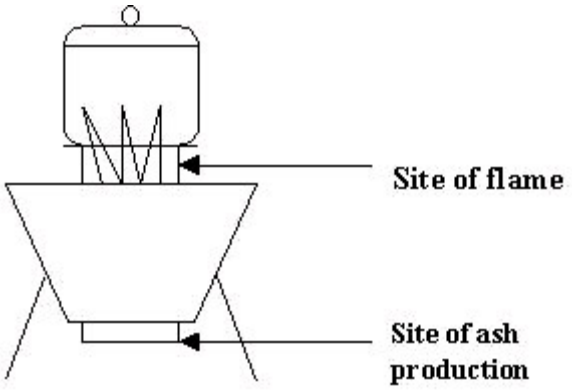
\Note: The inner cone is exposed to the highest temperatures and generally wears out earlier. The inner cone however can be replaced to extend the life of the stove.

Lighting the stove

1. Fill the stove with rice hull approximately half way up the hopper. Take care not to fill the entire space between the inner cone and outer drum (as this will lead to smoke formation during the burning process). To facilitate airflow into the centerpiece at startup, create a hole by leaving 20% of the hopper free of hulls.



2. Drop a small amount of burning paper, wood shavings or fronds into the inner cone and watch for the rice hull to ignite to a glowing red colour. If the rice hull is cold or somewhat damp (eg. a morning start in the rainy season) it may require supplementary starter (such as kerosene) to be added to get the rice hull properly ignited. Continue to drop starter into the inner cone until a steady flame and draft is created. W*atch and wait for the rice hull to catch fire*.
3. When the stove is well lit, the ignited rice hulls will turn a glowing red colour (usually after about 1 minute). The air opening from the outer fuel bin to the centrepiece can then be filled in with rice hull and the cooking pot placed on the cooker. *Make sure the rice hull combustion is well underway before filling the remaining gap with rice hulls and putting the pot on the stove.*
4. If the rice hull is just ignited and then the cooker immediately goes out, fresh rice hull should be exposed again on the surface to ease the restarting process.



5. If the stove goes out while cooking it is almost always because of lack of fuel. If tapping to introduce new fuel does not immediately restart the fire, the opening between the outer fuel bin and centrepiece can be reopened. Usually the glowing embers will restart the cooker if an air draft and fresh fuel are present. The stove can also be restarted as indicated in steps 1-3 above.

Note: The stove is easiest to start when the rice hull is dry and warm. Starting the stove early in the morning or in rainy weather may take extra patience and practice. *With proper ignition technique, kerosene does not need to be used as a fire starter.*

Cooking with the stove

1. As the fire develops, the rice hull will initially produce a yellow-orange flame. This will gradually shift to a light yellow color after 3-5 minutes. Swirling flames should be observed with vortexes forming between the air injectors inside the combustion chamber. This flame will slowly become near colourless.

2. Supplementary fuels such as small pieces of wood, dried coconut husks, peanut shells and corn cobs can be placed in an upright position in the inner cone. These fuels should be added in small quantities as they can make the cooker smoky if too much fuel is added. To use sawdust, peanut shells, or coffee shells, mix them with rice hulls in the outer fuel bin.

3. The burning fuel eventually produces a grey or white ash at the bottom of the centerpiece. To allow the entry of new fuel, tap the stove about every 5-10 minutes. This is best performed when the fuelbed (the rice hull inside the inner cone) is beginning to turn to a grey colour as the energy is released from the hull. Periodically (about every 12-15 minutes) some of the rice hull ash can also cleared away from the bottom of the ashpan with a cooking utensil or stick to enable new fuel to be introduced. *Take care however not to release burning ash as this can extinguish the fire if the burning fuelbed is removed.*

4. Periodically check the ash build-up around the ash pan and remove the ash from under the ashpan by flattening or clearing it away with a cooking utensil or stick. *Too much ash build-up under the ash pan can cut off the airflow feeding the fire and cause the fire to go out.*

5. The cooker is designed to be relatively smokeless once it is lit. As long as fuel remains to be burnt it should not smoke. Most smoke will occur during the start and at the finish of the cook.

Solving Smoke Problems:

- If the flame is *dark yellow* with some smoke you are adding too much fuel. Stop tapping the stove to allow the rice hull to complete the combustion process and the smoke should disappear. Smoke mainly occurs when too much carbon-rich fuel is added to the centre cone (i.e. coconut shells, leaf matter, etc.).

- If a small amount of smoke begins to appear after an *extended* period of cooking you, need to introduce more rice hull. If this is your problem, the rice hull inside the inner cone will likely be a grey colour, a sign that you are running out of fuel. Rice hull can be introduced by tapping the side of the stove with a stick, using sufficient force so as you can visibly see the rice hull go down the sides of the hopper.

- If the flame dies out and a lot of smoke is produced you are most likely out of fuel. To introduce more fuel to the inner cone keep tapping the hopper till the flame has reignited or till you can see unburned rice hull inside the inner cone when looking down from above. If you do have a smoke problem and have fuel, the flame has most likely been suffocated; check to make sure that rice hull ash or an object is not blocking the air injectors pipes under the ash pan.

6. The heat output of the stove is controlled in several ways:

   - If cooking rice, reduce the supply of rice hull towards the end of the cooking session

   - The pot can be suspended on a hook above the flame to decrease the amount of heat reaching the pot.

   - A thin metal plate can be place on top of the centerpiece, between the pot and the flame. This also reduces the flame contact with the pot.

   - Burning more carbon rich fuels such as coconut shell and firewood will increase the heat output of the stove and reduce tapping frequency when extended boiling is required for cooking large seeded beans or meat.

7. Refill the cone with rice hull and other fuels as required to ensure a steady supply of ignitable material.

8. After an extended period of cooking, rice hulls touching the centrepiece can ignite or turn black and smoke excessively. These small surface fires can be covered with new rice hull or buried in the unburned hulls. It is best to keep the fuel bin about half full and add additional fuel as required.

9. Near the end of the cooking period, reduce the rice hull supply in the outer fuel bin. When finished cooking, open up the airspace between the outer fuel bin and centerpiece and ignite the residual rice hull. These practices will minimize the waste of rice hull and reduce smoke exposure in the household.

10. Ashes should be disposed of with care to avoid inhaling them.

Table 1: Alternative Fuels for the Mayon Turbo Stove

Type of fuel	Use	Advantages	Disadvantages
Rice hull	Multipurpose Bulk Fuel	• Easy to access and handle	• Best used in a well-ventilated area
Wood	Supplementary Fuel	• Sustained heat output • Requires less attention	• Can be smoky upon ignition
Coconut husks	Supplementary Fuel	• Sustained and hotter burning	• Can be smoky upon ignition • Bulky fuel
Corn cobs	Supplementary Fuel	• Sustained and hotter burning	• Can be smoky upon ignition • Bulky fuel
Charcoal	Supplementary Fuel	• Sustained heat output • Requires less attention	• High cost • Bulky fuel
Kerosene	Fire Starter	• Helps to ignite cold/wet fuel	• High cost • Releases noxious fumes