EMERGENCY COOKING METHODS

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Introduction

We are encouraged to store fuel, in addition to food, for a year. While it would be difficult to impossible to store enough fuel to heat even one room through winter, it may be possible to store enough fuel to cook for a year. Various methods of improving efficiency of utilization of fuel will assist.

Fuels

Different fuels are capable of producing different amounts of heat, based on their heats of combustion. The heat of combustion of various fuels is shown in the following table. Also shown is the ratio of the heat of combustion relative to that of gasoline (which, of course, you would NOT want to try to store!).

fuel	heat of combustion, kilocalories per gram	percent of heat of combustion to that of gasoline
gasoline	11.5	100%
kerosene	11.0	96%
propane	12.0	104%
paraffin	10.3	90%
peanut oil	9.5	80%
charcoal	7.2	63%
alcohol	6.4	56%
coal	4.4-7.5	38%-65%
wood	4	35%

The value for charcoal is for “pure” charcoal, not the briquettes you can buy. These contain additives to make them stick together in the manufacturing process, so their heating value will be somewhat less. (These additives end up as the grey powder that is left when briquettes burn.)

Fuel safety

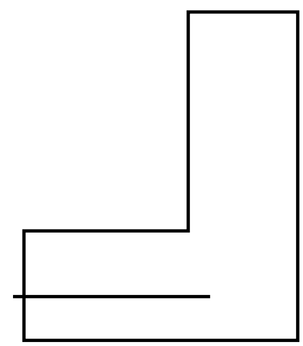
It is quite obvious that the liquid fuels are more dangerous to store than solid ones. Gasoline is particularly dangerous, and should not be considered. Alcohol also is very flammable. Kerosene is less flammable, but still would be risky to store, and it deteriorates with age.

The safest of the solid fuels are charcoal, wood and coal, though paraffin is nearly as safe.

Paraffin cannot burn unless melted and vaporized, which happens in a candle flame. It would only be a problem if your house caught fire, and then the amount you might have would not contribute much to the combustion of your house. Its high heat of combustion and relative safety makes it an attractive fuel for emergency cooking. It can be stored anywhere inside or out, even buried in the ground, and will not deteriorate with time.

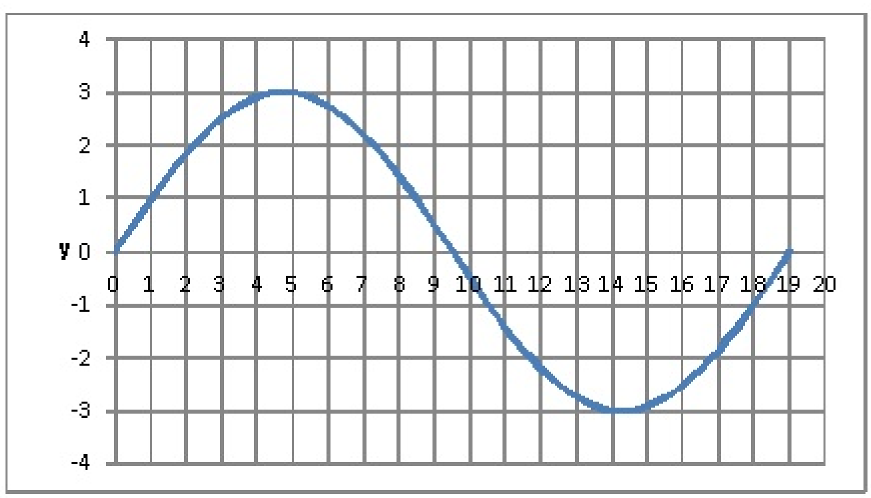
Cooking with charcoal, wood and coal

These fuels require special stoves with stove pipes leading outdoors if they are to be used indoors since they produce carbon monoxide because of incomplete combustion, and wood and coal produce smoke as well. Outdoors, in open fires, they are very inefficient, meaning that a relatively small percentage of the heat of combustion is actually absorbed by the food being cooked. However, a rocket stove burns these fuels quite efficiently.



The basic rocket stove design is shown in cross-section in the figure. It can be fabricated from "tin" cans, steel stove pipe, or bricks. Cans or stove pipe need to be surrounded with suitable thermal insulation. The horizontal line in the figure is the fuel tray. It is not essential, but helps combustion by providing an air path below the fuel. Many designs can be found on the Web.

I made my rocket stove using a 2' length of 6" stove pipe. The first thing to do was to cut it on a 45° angle so the two pieces could be arranged as shown in the figure. Do this cutting before closing the pipe! The cutting line can be easily determined. Tape two pieces of printer or writing paper together and draw a straight line lengthwise in the middle. Measure the circumference of the pipe with a tape measure. Place a mark every inch along this line for a length equal to the circumference of the pipe. Plot the following equation on this paper:



$$y = r \cdot \sin\left(\frac{2\pi \cdot x}{c}\right)$$

Here y is the distance from the horizontal line at a distance x along the line, r is the radius of the pipe, and c is the circumference. You can use Excel to calculate the points on the curve. This plot for a 6" diameter pipe is shown in the figure. If you have a millimeter ruler it is convenient to plot y in millimeters.

Cut along the plotted line. Wrap the resulting paper around the pipe, positioning it so that the distance from bottom of the curve to the end of the pipe is the desired height of the stove. In my stove this is 16". Use a marker to trace the cutting line. Cut along the line using tin snips.

Now you can close the two pieces of pipe.

Stitch the two pieces together using steel wire. Drill matched holes in both pieces near the edge to be joined and loop wire through them. I have four attachment points. It is not necessary to seal the joint since there will not be any pressure to force gases out the joint.

The fuel tray can be made out of a “tin” can. Cut out both ends, slit the can lengthwise, and flatten it out.

You will need to make an enclosure to finish the stove. I used 20" wide aluminum flashing, making a cylinder 12" in diameter and filling the space between the stove pipe and the surface wall with ordinary home fiberglass insulation.

The Dutch oven is one of the most versatile items for outdoor cooking, provided an adequate supply of fuel is available. It can be used for boiled dishes such as stews and soups, but it also can be used for baking bread, pies, cakes, pizza, etc. Many books on Dutch oven cooking are available.

The basic method of cooking with the Dutch oven consists of putting it in a low fire. If it is to be used for baking, a fire is also built on top, and the bottom fire must be very small to avoid burning the bottom of the bread or whatever. A good rule of thumb when using charcoal to bake in a 12" oven is to place 25 briquettes on top and 8 underneath. It should be quite obvious that a lot of heat is wasted using this method.

Cooking with paraffin

A single candle flame provides a little light, and a little heat. A single votive candle burns about 2.7 grams of paraffin per hour. This equivalent to about 33 watts based on the heat of combustion. For comparison, electric slow-cookers consume 100-200 watts on high, depending upon the size.

An efficient paraffin slow-cooker can be made easily using aluminum flashing available at hardware stores to make a shroud to keep the heat of the flames close to the pot.

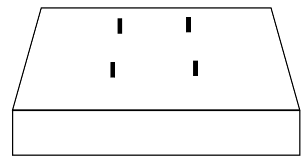
Caution: Smoke from candles, like all smokes, is carcinogenic. Candle and cooker wicks should be trimmed to avoid smoke. Also, the flame must not touch the pot, or soot will be

deposited and CO released.

Burner

Start with a large tuna or chicken or cat food can (4" diameter x 1 3/4" deep).

The paraffin may melt all the way to the bottom of the can during operation so it will be necessary to hold the wicks vertical.

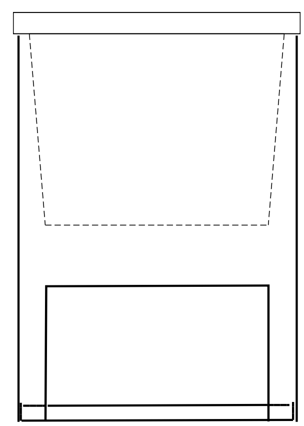


A wick holder can be made from 24 gage steel or copper wire using the gig shown in the figure. Drill holes in a wooden block that have a friction fit to 8 penny nails, and insert nails, extending about half an inch. Leaving an inch and a half or so, wind the wire around one of the nails with the turns close together, forming a tight coil. Take the wire to each of the other nails in turn and form coils. Cut the wire an inch and a half or so after the last coil, and twist this with the beginning segment. Pull the nails out, and adjust the tilt of the coils if necessary.

You can buy wicking, or make your own using COTTON string. The string should be stiff enough to stay vertical when held in the wick holders since it needs to remain vertical when the wax has all melted. Be sure to NOT use wicking with a lead wire (this is not on the market any more).

Position the wick holder loaded with wicks in the can, fill the can with liquid paraffin, and allow the paraffin to harden.

Candle slow cooker



Here is the frontal view of a slow-cooker built around the pot from a small 1.5 quart Rival crock pot. It was fabricated from aluminum flashing. A three wick paraffin burner provides about the same heating rate as the electric crock pot.

Operation

Light the wicks and place the burner in the shroud.

The heating rate will depend upon the amount of food and the number of flames. As a guideline, 3 flames will heat a quart of water to the boiling point in about 100 minutes.

Two flames will sustain the contents at the boiling temperature, but the boiling will be slight.

Three flames consume about 12 grams of paraffin an hour. At this rate, a single filling of the burner would last about 20 hours. A ten pound slab of paraffin would provide about 380 hours of cooking at this rate.

Cautions.

1. Do not leave the cooker going unattended for any length of time.

2. Do not use more than four wicks in an enclosed shroud. The wax may overheat and burn out of control.

Burners with more than 4 wicks should only be used with careful scrutiny and never enclosed in a shroud.

Paraffin sources

Suppliers can be found on the Web. Look for bulk quantities, typically 10 pound slabs and 60 pound cases. The January 2013 price is about $1.70 per pound.

Cooking with alcohol

Simple alcohol stoves can be made from aluminum soda and beer cans. These use either denatured ethyl alcohol, available in the pain department, or methyl alcohol.

The following web site has extensive information about fabricating and using these stoves.

http://zenstoves.net/BasicPressureBurner.htm

These stoves are made from the bottoms of two cans. A taller section is the base and a shorter section is the burner. The burner has several burner holes and three small filler holes of the same size near the center of the burner. These holes can be drilled with a 1/16" drill or punched with a push pin. **Caution: Do not make the filler holes any larger than 1/16", as the stove may explode. A flame cannot propagate through a 1/16" hole, but is can through a 1/8" hole.**

The traditional fabrication method can be difficult. The problem is that both cans have the same diameter, and the burner section has to fit inside the bottom section. This means that the bottom section has to be expanded.

I made an expander as follows. I drilled a 1/4" hole in the bottom of an empty soda can and inserted a length of 1/4" copper tubing through that hole, extending just beyond the bottom and a few inches above the top. I then filled the can with cement. Plaster of Paris would work as well. The cement or plaster makes the can rigid.

Next I cut a 2" section from the bottom of a can and forced it all the way onto the cement filled can. Finally, I epoxied a sports ball inflation needle into the upper end of the copper tubing.

The bottom section of a stove is expanded by forcing the expander into it. It is removed by connecting a tire pump to the inflation needle and pumping air in. The stove section will come off violently and can be dented as it bounces around, so I like to aim the expander out over the lawn as I pump.

Even with the expanding, you probably will need "shoehorn" to get the burner in place. This is a half inch wide strip of aluminum cut from a can.

Finally, seal the burner in with JB Weld high temperature epoxy, conveniently applied with a toothpick.

The fuel needs to be pre-warmed before enough vapor will emanate from the holes to burn. You can use a suitable lid or make a shallow round dish from aluminum foil. Place the stove in this and add a milliliter or so of alcohol. Light this, and soon your stove will be burning. A nice thing about alcohol is that the flame will not deposit soot if it contacts the pot.

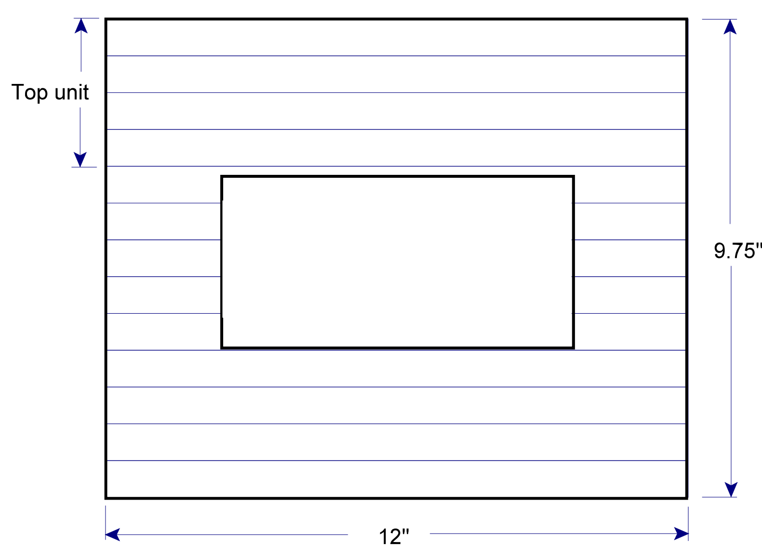
I developed a simpler method of construction shown in the following:
https://www.youtube.com/watch?v=12pEhst4F9M

Fuel-free cooking – solar cooking

Solar cooking is finding more widespread use in third world countries where fuel is scarce. A broad range of designs has been developed. See, for example,
http://solarcooking.wikia.com/wiki/Solar_Cookers_World_Network_%28Home%29

Energy conservation: the *kochkiste* – retained heat cooking

Energy consumption for cooking can be minimized by using retained heat methods. Several years ago a German friend of ours described the *kochkiste* (cook-box) used in Germany during times of scarce fuel. The box was filled with sawdust which was isolated from the pot by waterproof oil cloth. The pot full of food was brought to a boil in the morning and placed in the box and covered with the upper half, also filled with sawdust sealed behind oilcloth. In the evening the food would be cooked and hot for supper. A wide range of designs of homemade and commercial retained heat cookers can be found on the Web.



I built a small *kochkiste* around a 1600 ml stainless steel pot I purchased at REI. The handle folds over the top and is locked down, making a compact unit that can be easily insulated. It is about 7" in diameter and 3.5" high.

I cut 13 one foot on a side squares from a sheet of 3/4" thick foam insulation available at building supplies stores. I cut circular holes in 5 squares to fit the pot. I trimmed the foam to fit the handles of the pot and lid. I made the cover out of luan underlayment plywood, and bonded the pieces to the foam using PL Premium adhesive, which comes in a caulking gun tube. A schematic cross-section is shown in the figure.

To test the *kochkiste* I filled it with water and heated it to boiling. Eight hours later the water temperature was 169º F, piping hot.

Conclusion

The above is quite abbreviated out of necessity. If you wish to receive more information, feel free to contact me at dlj25@verizon.net.