

Low Energy Cooking

Part 1 – Using Conventional Gear
Efficiently and Haybox (Stored
Heat) Cooking



By Nev Sweeney

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1.0 Introduction

Cooking your freshly harvested, organically home grown veggies requires energy – somewhere between 5% and 20% of the household energy budget depending on where you are and who you read. So after going to all that trouble to grow food that does not waste energy on pesticides, herbicides, fertiliser, transport and packaging it is worth working out how to cook it using the minimum energy and as sustainably as possible.



This section looks at a number of ways of doing this, and some of these ideas (like the haybox cooker) are well tested, having been around for a couple of hundred years or more. Others, like the solar oven (to come later) have a more recent lineage. Most can be built and repaired at home, often out of recycled materials but you will find it handy to have a number of these around, like a rocket stove for when the sun isn't shining and a solar oven for when it is.

I have made all of the items here that can be home produced and if I can do it, anybody can! The main point though is to understand the principle and then apply it to the materials you have at hand. Just because I made it this way or that doesn't mean that is the only way, keep your mind open and experiment, and above all else, have fun!

2.0 Using conventional cooking gear efficiently

On the stove-top

Use the minimum amount of energy while cooking by bringing the pot to the boil on high then turning it down to low so it simmers rather than boiling vigorously.

Electric hotplates can be turned off a few minutes before the food is finished cooking so that the cooking is finished off by the heat remaining in the coil.

The area underneath gas burners or electric hotplates should be kept clean and shiny so more of the heat will be reflected back up onto the base of the pot.

When using electric hotplates make sure the bottom of the pot or pan is flat and has not warped, so that the energy from the hotplate is transmitted directly to the pan and not lost to the surrounding air, likewise ensure that the pot fits the size of the hotplate or burner so that no energy is wasted around the edge.

Thick walled, high quality cookware makes most efficient use of heat by distributing it better around the food being cooked; this allows a lower heat setting to be used. A tight-fitting lid also allows more efficient heat use by retaining steam within the pot.

One- pot meals using a large pot and dividers or a steaming basket can be used to cook a number of different vegetables on one burner or hotplate.

Under the Grill

The grill cooks quickly and cheaply and can be further speeded up by lining the grill pan with aluminium foil. Best use of the grill can be made by combining foods which can be cooked this way such as tomatoes and mushrooms to be served with grilled meat.

In the Oven

Make the best use of the oven's high energy consumption by cooking several courses or meals at the one time; an apple pie as dessert after the roast dinner or a number of casseroles, one for eating and the rest for freezing. If it is not possible or desirable to cook a number of dishes at once in the oven then increase the size of the one you do cook and use the leftovers as a base for another meal, for the next day's lunch or to freeze.

As with electric hotplates, ovens retain heat after they have been turned off, so turn your oven off 10 minutes before the end of cooking time and allow the stored heat to finish off the cooking free of charge.

Except for bread, cakes and pastries the oven should not be preheated, especially where the cooking time is an hour or more.

Check that the seal on your oven door is working by inserting a piece of paper between the oven and the door, if the paper remains in place when the door is shut the seal is fine. If not, it is letting the hot air out and wasting energy so the seal should be replaced. The oven door should be opened as little as possible during cooking.

Baking dishes of glass or ceramic ware make best use of the heat and allow the oven temperature to be set 10°C lower. Similarly dark or blackened bread tins are more effective for bread baking.

To make the best use of cheaper cuts of meat they should be tenderised by marinating the night before in a little lemon juice or wine, which can reduce cooking time by up to 30 minutes.

Make sure that any meat which has been frozen is fully thawed before being put into the oven; if this is not done, particularly on large cuts of meat, the cooking time can be doubled or more.

2.1 Cooking with the lid on

In many situations then cooking on top of the stove we don't think about it, but leave the lid of the pot off, whether it is so we can see what is going on, to prevent it from boiling over or because that is just the way we cook, we leave the lid off. There are, however, some situations where leaving the lid on can allow a reduction in the energy used to cook our food by as much as 75%!

During cooking, steam rises from the food and takes with it a proportion of the heat energy we are putting in with gas or electricity or whatever to cook the food. By keeping that steam and energy in the pot with the food we can reduce the amount of heat energy we need put in to cook a given amount of food. We can take advantage of this salvaged heat by reducing the amount of heat input applied to cook the food, or reducing the time taken to cook the food, or both.

In many cases you won't need to buy anything new, just use your existing cooking apparatus in a new and more efficient way. There are other environmental benefits which will follow too –

- Some of these techniques can be used to replace cooking under the grill or in the oven and both of these methods use more energy than cooking in a frying pan.
- By keeping the lid on you reduce spatter and mess to an absolute minimum so cleaning the stove top becomes quicker, easier and does not require a battery of chemical cleaning agents.

Now that I have your interest, on with the show! –

Lid-On Frying

For this technique it is best to have a heavy bottomed frying pan, to disperse the heat evenly, with a close fitting lid. My preference is stainless steel but enamelled cast iron works really well too (I must admit I distrust non-stick and aluminium cookware) the good ones can be expensive but will last a lifetime.



This technique is suitable for meat, fish and vegetables. For example, chicken pieces (free range of course!) can be cooked this way by putting a small amount of oil in your frypan. Place your chicken pieces skin side down, place the lid on the frypan and putting it on high heat until the chicken starts to sizzle, then turn the heat down to medium high for 10 minutes, then turn the pieces over for another 5 to 10 minutes and viola!

Steak can be done in a similar fashion (ours is local grass and fed, occasionally we feel evil enough to buy some). Assuming your steak is 2.5cm thick and you want it medium, place the steak(s) in the pan on high heat with the lid on for 2 minutes, then remove the lid and turn, cook for another 2 minutes. Now leave the steaks to rest with the heat source turned off but the lid of the pan still on for two minutes. This is only a guide and you should experiment with the technique until your steaks come out how you want them.

For vegetables, cut up 450 grams of mixed (preferably home grown, but at least organic) veggies so the pieces are about the same size, place them in the pan and add a splash of oil (we use Aussie olive oil for cooking) and cover. Place the pan over high heat and once the veggies start to sizzle, cook for one minute, toss the pan (while holding onto the lid of course) to redistribute the veggies every minute or so for about 5 minutes then remove from the heat. Bung in a bit of soy sauce or vegetarian oyster sauce (made from mushrooms), toss well and away you go. This technique is sort of a cross between stir frying and steaming your veggies and is very energy and nutrient efficient.



Freshly Cooked Broccoli and Cauliflower Mix

Lid-On Boiling

When I first learned this technique I found it to be a bit counterintuitive, I always brought the water to a boil with the lid on, but once it had boiled it was a case of the lid comes off, the food goes in and you get it up to a rolling boil again until the food is cooked. I must admit that when the water boiled over because I left the lid on my response was to take off the lid rather than turn down the heat. Oops!

Anyway if you cook like me you can save yourself a fair bit of energy by turning the stuff you normally cook on a rolling boil down to a medium low heat and leaving the lid on. If you just cook at a low boil try leaving the lid on and turning the heat down to low and if you need to simmer turn the heat down as low as it can go and leave the lid on. This one simple technique can save you money and energy, with no loss of cooking time or efficiency. It works for veggies, pasta, grains and dried beans and poached chicken or red meat.

This technique can also be used to cook pasta or using the energy stored in the water, retained through leaving the lid on. Bring the water to the boil in the pot as you would usually and then toss in your pasta, replace the lid and re-boil the water. When the water starts to come back on the boil just turn the heat off and cook the pasta for the amount of time your normally would. The pasta will come out al dente and you will save lots of energy (= money).

So there you have it, a simple technique that can save you energy, time and money; it is good for the environment too and requires little or no extra equipment, just a behavioural change. Why wouldn't you give Lid-On cooking a go?

2.2 Cooking with a pressure cooker

Some other methods of fuel efficient cooking discussed in this section require only a small outlay on equipment, unfortunately this is not so with the pressure cooker which may cost over \$200 if bought new. While I am a fan of buying second hand where possible, in the same way you would think twice about buying a second hand toothbrush, a second hand pressure cooker may not be a bargain either.

Pressure cookers operate at high pressure (the name is a dead giveaway, eh?) and while a catastrophic failure is unlikely it would certainly ruin your day if it happened. The pressure cooker in question may be being passed on due to previous problems and if you don't absolutely know its history, give it a miss. Also, older types may not have all the safety features that the modern cookers have (ours has three separate systems to prevent overpressure) so for the sake of peace of mind, I suggest sticking with a new buy only. And read the instruction FIRST, not after all else has failed!

For the investment however, the pressure cooker does cook 66% faster than cooking at atmospheric pressure, with a subsequent saving in time, nutrients and energy, also no laborious preparation of food or equipment is required. If you are going to spend the

money anyway, go for a stainless steel model, it will last you a lifetime. I don't trust aluminium cookware generally but specifically for pressure cookers, stainless steel is much tougher and more forgiving of mistakes and rough use.

A pressure cooker works by allowing steam pressure to build up inside it to the tune of 70 to 105 kPa (10 to 15 PSI) above atmospheric pressure. At atmospheric pressure water boils at 100°C (212°F), no matter how long you boil it, but at 105kPa water boils at 120°C (248°F), so food can cook much more quickly. This allows the use of cheaper cuts of meat and ingredients that require longer cooking such as boiling chooks or dried beans. Dried beans can be cooked in 35 to 45 minutes in a pressure cooker and require no pre-soaking.

The main problem which can arise with pressure cookers is if the food swells up or foams up while cooking so that it blocks the pressure relief valve. To prevent this, the cooker should never be filled to more than two-thirds capacity and foods that have a tendency to foam, such as split peas, should be avoided.

It was in my mind to buy a large pressure cooker so that we could also use it for food preserving work (ie pressure canning) and while I am not sure of the where's and why for's, I have read that pressure cookers **SHOULD NOT** be used for



pressure canning. So I thought I would pass that little gem of information on, so you don't make the same mistake I did.

While they are a great way to save money, energy and nutrients if you are unfamiliar with the pressure cooker get hold of a good modern cookbook to help you through the initial stages of learning to use it.

2.3 Cooking with a wok



The Chinese cooking pan known as a wok has been in use in Chinese kitchens for somewhere around a thousand years and because of its cheapness, efficiency and versatility it deserves a place in more Australian kitchens. The traditional round-bottomed wok is adaptable to most heat sources such as the gas stove, rocket stove kerosene or LPG primus, methylated spirits camping cooker, wood burning fire or,

when a hole is cut into the plate, the family barbecue. The one power source it cannot be used on is the electric stove, but these days flat-bottomed woks are available for just this purpose.

Woks are very cheap in the Asian shops to be found in most large cities (ten to fifteen dollars each), so cheap you can afford to have more than one. They are available in a number of materials, the more common being aluminium, stainless steel, pressed mild steel and cast iron. I prefer the traditional pressed mild steel wok but the other types would be just as good.

The dish for which the wok shines over all other pans is the stir-fry, where all ingredients are cut up very finely and then cooked very quickly over high heat; this is economical on both energy and nutrients. Cooking in this manner is also different and a lot of fun! The Asian practice of using rice or noodles and vegetables in quantity and then using meat in small amounts as flavouring is also a trick worth learning. There are lots of good Asian cook books, but once you have mastered the basics it is a cuisine which allows a lot of improvisation.

When you buy your pressed steel or cast iron wok you will need to clean it then “season” it, to give it a protective non-stick surface. First wash the wok with thoroughly with hot water, detergent and soap pad to remove any antirust or oily coatings, rinse, then dry.

Now rub the inner surface with a thick layer of good quality peanut oil and heat the wok until the oil appears to steam or smoke. After 3-5 minutes remove the wok from the heat and allow it to cool; then wipe away excess oil. The wok is now ready for use. After the wok has been used to cook in, it should only be rinsed with hot water to clean it. If detergent and cleaners are used on the inside surface it will need to be re-seasoned before its next use. When the wok has been cleaned and before you store it away wipe a thin layer of peanut oil onto the inner surface to act as a rust preventative.

The only absolutely essential accessory for your wok is the round-nosed shovel like implement (called a 'churn', see above photo) used to move food around the inside of the wok. If you are flush with cash other handy bits to have are a wire ladle for removing deep-fried morsels from hot oil, a solid ladle, a bamboo steaming basket or two, an aluminium or chrome steel ring to stick the wok on when it's off the heat and, of course, chopsticks. These add-ons increase the versatility of your wok so that it can be used to steam, braise, deep-fry and shallow-fry as well as stir fry.

3.0 Cooking with stored heat

Theory and practice

The idea of cooking with stored heat has been around since medieval times, when they used to place their pre-heated cooking pots in a nest of hay, straw or dry leaves etc in a box or hole in the ground to finish cooking, thereby maximising fuel use. This practice continued in various guises and places up until the early part of the 20th century when, with advent of cheap electricity, we seemed to have forgotten about it. Hay box cookers, as they are sometimes called, did enjoy a revival in the late 70s to early 80s when the fuel crisis set in and you can find instructions on how to make them in the self-sufficient living books of the time. They are a great tool to help you live more sustainably so maybe there should be a revival of the haybox again now!

Why bother?

- As discussed above, you can save fuel used to cook you dinner from between 20% and 80% depending on the recipe and how long it would normally cook for, the longer the cooking required, the more you save.
- In line with saving fuel, unless you live on a bush block and only burn wood, whatever fuel you use you will have to pay for so you can also save money.
- Reduced fuel usage (gas or electricity) means reduction in greenhouse gas production as well so you are saving the environment too.
- Longer cooking at lower temperature means that you maximise nutrients and flavour in the food you are cooking.
- I don't know about you, but I get nervous about leaving appliances on while I am not home, so you can put you dinner on before you leave for work, as you would with a slow cooker, but with no external energy input you won't come home to a pile of smoking wreckage!
- They are cheap, easy and lots of fun to build
- The food can sit in the stored heat cooker forever and not get burned or overcooked.
- While they are ideal for winter soups and stews they will also reduce heat input into the kitchen in summer
- Surprise your friends & amaze family, they turn up expecting a feed and find nothing on the stove, after a few minutes worried conversation you can yell "Ta Daaaaaaaa!" and pull a fully cooked meal out of the stored heat cooker. (Yes, I do have a perverse sense of humour)

The Components

To build a stored heat cooker you need to have three basics; an outer container, insulation material of some description and the inner cooking pot.

The Outer Container

The outer container can be a Styrofoam Esky or recycled broccoli box, an old trunk, wooden box or barrel, in fact any container that is large enough to hold the pot and insulation and is airtight. Wooden boxes or barrels with cracks between the slats or staves will need to be lined with cardboard or aluminium foil to ensure they are airtight. If the material of the box is also a good insulator such as Styrofoam, so much the better. The outer container can also be made from fabric as the Wonderbox is, but more on that later.



One thing I have found is that if the outer container resembles a nice piece of furniture such as an ottoman, blanket box, wooden chest etc it is more likely to be given space inside the house and so more likely to be used. The original one I made out of an old esky (see article in this section) worked extremely well but suffered from the fact that it looked like crap, even after Linda gave it a coat of silver paint to spruce it up it just looked like a silver painted old crap esky. So starting out with a nice looking container is a good thing, if you can build it even better, but since I made my original one I have bugged the living daylights out of Linda by saying of every bit of furniture we see that is box-like “you could make a hay box cooker out of that!”

The Insulation

There are a whole stack of things you can use as insulation and some obvious (and less obvious) ones are listed below -

- Hay or straw
- Crumpled newspaper
- Polystyrene foam
- Vacuum
- Blankets / clothing
- Wood wool/shavings
- Sleeping bag
- Wool /Feathers
- Leaves
- Perlite
- Sugar cane mulch (AKA bagasse)

There are no doubt other materials not on this list that you have access to and that could be considered as insulation for a stored heat cooker, but there are a few characteristics that are worth thinking about before you make your decision. Obviously enough the insulation must be able to withstand cooking temperatures, at least 100°C should be allowed for and it should not pump out toxic fumes or fibres. On the face of

it, fibreglass (glasswool) would make a good choice, cheap, light and a great insulator, but it is nasty stuff to deal with so would not be a good idea.

Any insulating material should be able to be formed nice and snugly around the pot to reduce heat lost through convection and should be dry and able to be kept dry as insulation loses much of its insulating properties when wet due to conduction of the heat away through the water. Depending on the effectiveness of the insulation, it should be a minimum of 50 to 100mm thick (the exception here is when using a vacuum as the insulator, but that is difficult to home produce!). A very effective insulator like polystyrene foam need only be 50mm thick but the more traditional hay or straw should be 100mm thick as a minimum.

The Cooking Container

The pot could be made of a material that retains its heat well, such as Corning Ware, heavy stainless steel, well-seasoned or enamelled cast iron, or stoneware but if your cooker is efficient enough, the material of construction of the pot won't make that much difference. More important that the material of construction is the shape, it should have the smallest surface area per unit volume that you can manage. Of course the shape with the smallest surface area per unit volume is a sphere and spherical cooking pots are not that easy to come across, but the hint is short and squat like a billy not wide and flat like a frying pan.



The lid should also seal fairly well, have a lip so any condensing steam goes back into the pot and it should not have a steam hole as seems to be popular in pot lids these days. If the pot you wish to use is not perfect in the lid department but it is probably best to make up a bit of flour and water dough and use it to seal the rim and any steam holes the lid should have. I've tried this and it works really well.

Other Types of Stored Heat Cooker

There are commercial brand-name stored heat cookers on the market but the cheapest and most readily available commercial stored heat cooker is the wide mouth thermos flask, which uses a vacuum as the insulating medium. The vacuum flask makes a good cheap feed for one person and is portable so you could start it before going to work then take it to work for a hot, cooked lunch.

Interested in the idea but not sure if you want to go to all that effort? You can make an expedient stored heat cooker by preparing your dish as you would if you were going to

transfer it to a stored heat cooker and then wrap it up in a blanket or two and stuff it into an eski, polystyrene broccoli box or if nothing else is available and corrugated cardboard box. This will give you some idea how they work and it is a great idea if you get a blackout in the middle of cooking dinner!

Getting the best out of your stored heat cooker

You can cook many standard recipes in your stored heat cooker, particularly if they are “wet” recipes like soups, stews, casseroles and the like so trawling through your recipe books for these and recipes designed for slow cookers and one pot dishes should net a whole stack of possibilities. There are some things to look at though in adapting the recipes for use with the stored heat cooker –

1. Multiply cooking times by 3 at least so that the food is cooked through. There will not be a continuous heat input during the cooking process and although there is plenty of heat put into the dish at the start as it slowly cools the time taken to cook the food fully extends. Having said that, even cheap cuts of meat cooked in the stored heat cooker will come out moist and tender every time because of that long slow cooking.
2. Reduce water in the recipe by 25%. The pot will be well sealed and without the continuous heat input driving off water you will find that you don’t need to put as much in to achieve the same consistency as you are used to.
3. Size the recipe so the pot is full, that way the maximum heat is stored in the food in the pot and it will retain its heat for the longest time, making for the most efficient cooking.

Using Your Stored Heat Cooker

OK, let’s say they you have built your cooker and found or developed a recipe to try out in it and you are ready to go, what next? First off, bring your pot to the boil using whatever heat source you have available. Gas or electricity is most likely but it adds to the fun if you have built a rocket stove or solar cooker of some description and that way you know that no fossil fuels at all have been burnt to cook your food.

When your pot has been brought to the boil you will need to keep it there for long enough to ensure that the heat gets right to the centre of portions of food that you are cooking, so that for something small like rice, five minutes on the boil might be enough but for larger food like, say, whole potatoes 15 minutes boiling would be required. Once the boiling time is completed seal up any steam holes or cracks with a flour and water dough and place the pot in the cooker. Leave the pot in the cooker for the calculated cooking time and remember NO PEEKING! It lets the heat and steam out, slowing down the cooking process.

Once the cooking time has elapsed remove your pot from the cooker and check the temperature, if the temperature has dropped down to cooler than you like, reheat before you serve it and then enjoy! If you have left the pot in a lot longer than you planned to it will not overcook but if it has cooled down to below 60°C, bring it to the boil and re-boil for 5 minutes or so just to make sure there are no problems with bacteria.



Other Uses

You stored heat cooker does have a few other uses that you can put it to, like making yogurt. Yogurt is simply made in your stored heat cooker by heating milk in the cooking pot to about 85°C for a few minutes then let it cool to 45°C, throw in a couple of tablespoons of natural yogurt or live culture and then place into your stored heat cooker and leave overnight. Add some fruit and (hush, hush) maybe a bit of sugar and you have homemade yogurt.

You and also use it to place bread dough in to rise in cold weather (if it is big enough), use it to keep food cold in hot weather. If your cooker is portable you can use it to keep food hot while travelling to give you a good hot meal on the road and if you have pots that fit your solar cooker, you can cook stuff during the day and then use the stored heat cooker to keep it hot until time for your evening meal.

Potential Difficulties

Like all technologies, this one is not a totally unmixed blessing, as with any slow cooker you can't decide you want to eat in half an hour, your meals must be planned to give you sufficient time to prepare them and then have them stay in the cooker long enough to finish the cooking time. The stored heat cooker's forte is not small meals, it is at its most efficient when you have the pots full, so if you are cooking for a crowd that's great but if not you may have plenty over to freeze for later! You also need to keep an eye on the insulating material, particularly if it is organic, as it can become damp with cooking steam and lose part of its insulating properties. The damp can also encourage bugs with the consequent smell and risk of contamination so air the cooker regularly and if in doubt replace the insulation.

3.1 A Stored Heat (Haybox) Cooker Made From Modern Materials



Haybox cooker - looking like a mild mannered esky

I first tried making a genuine hay box cooker many years ago out of straw, a pine box and a large glass casserole dish but it was not really successful. The main problem was that the casserole dish was too large so that you had to make too much food in one go, and there was not enough insulation between the casserole and the side of the wooden box. It was pretty pathetic and I gave up on the idea for a while.

It was Christmas 2002 and while wandering through a neighbour's garage sale I spied a large plastic esky, it looked well used, but it was intact and BIG (590mm x 370mm x 420mm high), so for the princely sum of \$5 it was mine! To turn it into a haybox cooker I then needed to work out what cooking pot/s to use what and insulation material to use.

Cooking Pots

I needed to work out the type of cooking pots to use. I had decided that the size of the esky would allow me to use two pots – a one litre and a two litre pot – so that I would have some flexibility depending on the number of people to be fed. The haybox cooker works most efficiently when the cooking pot is almost full of food.

As mentioned above another way to improve heat retention is to ensure that the cooking pots have the least possible surface area for the volume contained, this is a sphere – which is geometrically inconvenient for my purposes, so I settled on a couple of squat, enamelled steel billy cans. The lids of the cans also have a rim which ensures that condensation on the lid is returned to the pot.



The enamelling on both pots is a dark blue and the idea was that I could use my solar oven to heat up the food and then put it into the haybox cooker to complete the process. That was the theory and for the 1 litre pot it works fine, but I found that when I tried the 2 litre pot it is just a wee too big, and prevents the glass front from entirely closing, which in turn lets the heat out. Another fine theory blown to hell due to lack of attention to detail!

Insulation

The obvious answer here was “hay”, being a traditionalist of sorts, but hay has some disadvantages in that it is not so effective an insulator as some modern materials and it tends to absorb steam and odours during the cooking process which then cause it to grow bugs (yuch!). I wanted something that was light, low maintenance and an effective insulator. As luck would have it, a friend offered me an 1800mm x 900mm sheet of polystyrene foam that was 25mm thick and had been used as packing in a container, so I accepted it gratefully.

I still needed to cut it to shape and the classic way using a saw creates a hell of a mess with fine particles of polystyrene all over the place. So rather than do that I looked around to see if I could get hold of hot wire cutter, which makes a nice smooth cut with little or no little fiddly bits. After some searching I found a reasonably priced (\$25) battery powered unit available from Hobbyco in the city (Sydney). Its limitation was that it could only cut polystyrene sheet up to 35mm thick so this was not much of a problem with my stuff being only 25mm thick.



I cut two slabs to act as the bottom insulation and then a number of strips with holes in them to accept the cooking containers up to the level of their lids. Here the analogy breaks down! To use the rigid polyester foam over the tops of the cooking containers by carving out the correct size and shape was beyond my technology, so I remembered our family motto - “when all else fails – cheat!”. I bought some polystyrene beads, used for stuffing bean bags and made up a cushion by loosely filling an old flannelette pillowcase, which sits neatly on top of the cooking containers and acts as an insulator. I sewed the pillowcase closed, because anything less than an airtight seal and the beans escape and get EVERYWHERE!



One problem with the esky was that, in common with a lot of esky's nowadays, there is actually no insulation in the formed plastic top, I assume that the air gap in the lid is supposed to act as an insulator. I was not happy with this, so using a cut off funnel I persuaded a whole stack of the polystyrene beans to go into a moulding hole in the top. That was one tedious job, because the beans clearly did not want to go into the lid! Anyway once completed I sealed the hole with an (unused) industrial ear plug.

The haybox cooker was now completed.

Operation

The idea is to load up the cooking pot with your food in the same way you would a crock pot, this style of cooking lends itself to soups, stews and casseroles ie wet cooking so if you are after dry or crisp, this is not the way to go. Having filled your pots with ingredients and water up to about 25mm from the top, put it on the stove and bring it up to the boil, and boil for five minutes to 10 minutes to get the heat into the centre of any larger lumps of ingredient. Once it has been boiling for 5 minutes quickly transfer it to the haybox cooker, smooth down the insulating pillow and clamp on the lid. Leave everything undisturbed for 8 to 12 hours (No peeking!) and then open for a hot deliciously cooked meal. For more detail on how I cook with our hay box cooker check out the previous section.

To test our haybox cooker, I filled both containers and boiled them, transferring them straight to the cooker and then sealed it up. Early the next day, about 10 hours later, the 2 litre pot was still over 90°C and the 1 litre one was still above 85°C. The haybox cooker has served us very well, particularly during winter and I even used it to make a batch of my beef and veggie soup, a family favourite. I still looks a bit basic and I want to make a nice wooden box to go around it so that it looks like a piece of furniture rather than a well-used esky.....eventually!



3.2 A better alternative

My previous effort worked well, was cheap and easy to build, but had some shortcomings, I never did get around to building a nice wooden box for it to go into so it looks just like what it is, a crappy old esky, even after Linda gave it a coat of silver spray paint to tart it up for sustainable house day. Due to its crappy appearance it rarely made it into the house so it didn't get used as much as it should have and these things are great for saving energy. I just had to come up with something better!



To make things better I needed to do a couple of things differently –

1. Build the thing into a nice looking piece of furniture that didn't look out of place inside the house and could be located near enough to the cooking area to make it readily useable.

2. Instead of using a billy or two as the cooking vessel, build it around cooking pots that we regularly use anyway making it easier to work out the recipes etc.

After some serious looking I found a comparatively cheap blanket box with a padded top that you could sit on, it was covered with a dark vinyl material and fitted our “decor” reasonably well, so I got it.

Converting it to a stored heat cooker was easy, I used the sheets of waste polystyrene foam that I had gotten hold of while working for the concrete precaster and cut them to size using a more sophisticated hot wire polystyrene cutter. We got hold of the cutter from a craft/model supply place in Gosford and rather than having a thin wire strung between contacts it had a stronger electrically heated wire attached to a handle that you can just push into the polystyrene and start cutting.



I cut a couple of sheets and put them into the box as insulation for the bottom of the pots and then cut three more sheets to act as insulation around the pots. The box is long and narrow so it took two pots easily; I selected a stainless steel 3 litre pot and a Pyrex casserole of about 4 litres capacity, then placed them on a polystyrene sheet, traced around the bottom and then using the cutter, cut out a disk, leaving a hole the same size as the pot. I test fitted the pot into the hole and had to make a couple of minor cuts but the stainless steel pot fitted well. The Pyrex pot tapered from the bottom outwards to the top so it was a bit trickier but in the end I was able to get a reasonable fit.



Electric polystyrene cutter

To ensure that the holes were in the right place, I put the cut sheet on top of an uncut one and using a pencil, drew around the inside of the hole, transferring the outline to the uncut blank. I then pressed the hot wire cutter into service and cut around the pencil line, placed the two sheets on atop the other and test fitted the pots again. I followed this process a third time, making sure the pots fitted the entire profile of the hole, and then fitted the cut sheets into the box.



One pot fitted and one pillowcase in place

While most of the pots were now covered by the polystyrene foam sheets, the tops were still exposed so I got hold of a couple of pillow cases and filled them with polystyrene bean-bag beans and then Linda sewed them up. During that operation it is REALLY easy to spray beans all over the place and the staticy little things get into the strangest places. We found the best way to do it was to sew up the open end except for about 10cm or so, then put a wide mouthed jam funnel into the opening and sticky tape it in place and pour the beans in through there. That method resulted in the least amount of beans lost.



Using the jam funnel to fill a (red) pillowcase with beans

Showing the underside



In the event we got carried away and put too many beads in, there needs to be enough so that the tops are covered by at least 50mm of beans but not so much that the pillow case is too hard to conform to the top of the pots. We had to take out about a third of the beans that we had originally put in to get the fit right.

The new cooker is getting quite a bit of use and both containers have been used to make a number of meals, and it has been working so well that we talked about it with our eldest daughter and she thought it sounded great. We picked up an ottoman that was hollow inside and had a removable top and she and I made it into a stored heat cooker together. She has made several batches of “ottoman soup” and has found that it works really well.

The ottoman, ready to make ottoman soup!



3.3 Making a Fabric Stored Heat Cooker

I have always wanted to try out a stored heat cooker based on an insulation filled fabric bag. They are light and easily portable, cheap to make and from what I can gather work tolerably well. A friend of ours has one she keeps in a cane basket and it looks pretty good and she likes it. So we got together with some friends one Saturday afternoon and made one, it was lots of fun and we had a great time. I would recommend it as a great activity for friends and family and you get a stored heat cooker at the end of it.



The basic idea is that you cut out two circles of fabric, place one on top of the other and sew a small circle in the centre which becomes the bottom when filled with polystyrene foam bean bag beans. Then sew a dozen or more radiating lines from the central circle, out to the circumference of the circle. Fill each segment formed by the stitches with polystyrene beads and sew the open end shut. Sew on a draw string around the circumference of the circle and then draw it up tight around the pot you wish to cook in. Then make up a circular “cushion” filled with beans to sit on the top, inside the draw string, to prevent heat being lost through there.

Simple hey?

If you want a look at the pattern, check out Appendix 1

This is how we made ours, in a bit more detail –

1. Get hold of the fabric you want to use. (You will need at least two and a half metres of cloth.)
2. It should be capable of putting up with contact with pots at 100°C so a natural 100% cotton fibre material is probably best, for the inside at least. Fold the material in half and draw a 95cm circle on the fabric by putting a pencil in the centre, tying string onto it and then place some tailors chalk or soap at the 100cm mark on the string. Using the pen as a pivot, draw the circle with the tailors chalk or soap.
3. Cut out the circle, this will give you two disks of cloth. Turn the cloth so that the “wrong Sides” are together so that the pattern side of the cloth will be visible from inside and outside the bag.

4. Choose the pot you will be using inside your wonder bag and place it directly in the centre of your circle. Trace around the bottom of your pot with the tailors chalk or soap so that you have a circle drawn in the centre of the cloth disks the same size as your pot. This will most likely give you a circle 150mm – 200mm diameter.

5. Sew the two disks together using the centre circle but leave about 50mm unstitched, then use this gap to fill the centre circle with polystyrene beans until it is 20-25mm thick. Then sew the 50mm gap closed to form a central disk.

6. Lay out the cloth disks on a flat surface and draw 12 lines with the chalk or soap from the central circle out to the circumference of the cloth disk so that they are roughly equal distance from each other.

7. Sew each line through both cloth disks from the circumference of the disk, into the central disk, forming 12 segments. Leaving a 2cm seam allowance fill each segment with bean bag beans. We found the easiest way to do this was to get hold of a 1 or 2 litre plastic or glass jug, pour the beans from the plastic bag into the jug then fill a segment using the jug(s). The 2 cm seam allowance will leave enough room to sew the segment shut. It works best if you fill one segment and then sew it shut before starting on the next one. Or the beans get EVERYWHERE!

8. Once all segments have been filled and sewn shut sew bias binding around the circumference of the bag. When we did ours the bias binding turned



Setting Out



A bag ó Beans

out to be about 35cm short, but rather than add on the extra, we simply hemmed it and it allowed us to pull in the top a bit tighter.

9. When the bias binding is in place, tie some cord or ribbon (we used thin ribbon) onto a safety pin and push it through the inside of the bias binding to form a draw string. It is just a case then of slowly working the draw string so that the edges of the segmented disk is drawn up into a cup shape around the pot to be used for cooking.



10. To make the top pillow cut out two disks of the same cloth as the cooker, a bit larger than the opening at the top of the cooker, ours came out at 260mm in diameter. Put the disks right side together and sew around the edge leaving 9-10 cm unsewn. Turn the sewn disk inside out so the fabric is right side out and fill with bean bag beans. Then sew the opening closed to stop the beans escaping.

Your wonderbag is now complete and ready to start cooking in!



3.4 Which Stored Heat Cooker is best for you?

For years we have used (and I have been fascinated by) fireless cookers which are called haybox cookers or stored heat cookers. They are used by heating up the food (usually soups, stews & casseroles etc.) using a conventional stove, wood heater, solar cooker or whatever. Then you place the preheated food into an insulated container of some description (the fireless cooker) and leave things alone for a few hours so the food cooks using the heat you originally pumped in. The insulation prevents the heat being lost to atmosphere or at least reducing the loss to a much slower rate, meaning you don't need to keep the pot heating on the stove. The technique saves energy and nutrients. A more in depth discussion of cooking with a stored heat cooker may be found above

We have a number of fireless cookers (there are several different construction techniques) and something I have always wondered is which is the most efficient, ie retains its heat the longest? So I did some research to find out.

Method

A number of our cookers would accept the same size pot so the test would be somewhat standardised but a couple would only take the pot designed to fit the cooker. With that in mind I filled the pots to be used up to the level which would be usual if they were to be used for cooking with tap water. I then brought the pot in use to a rolling boil. The pot full of boiling water was then transferred to the cooker being tested as fast as I could manage.

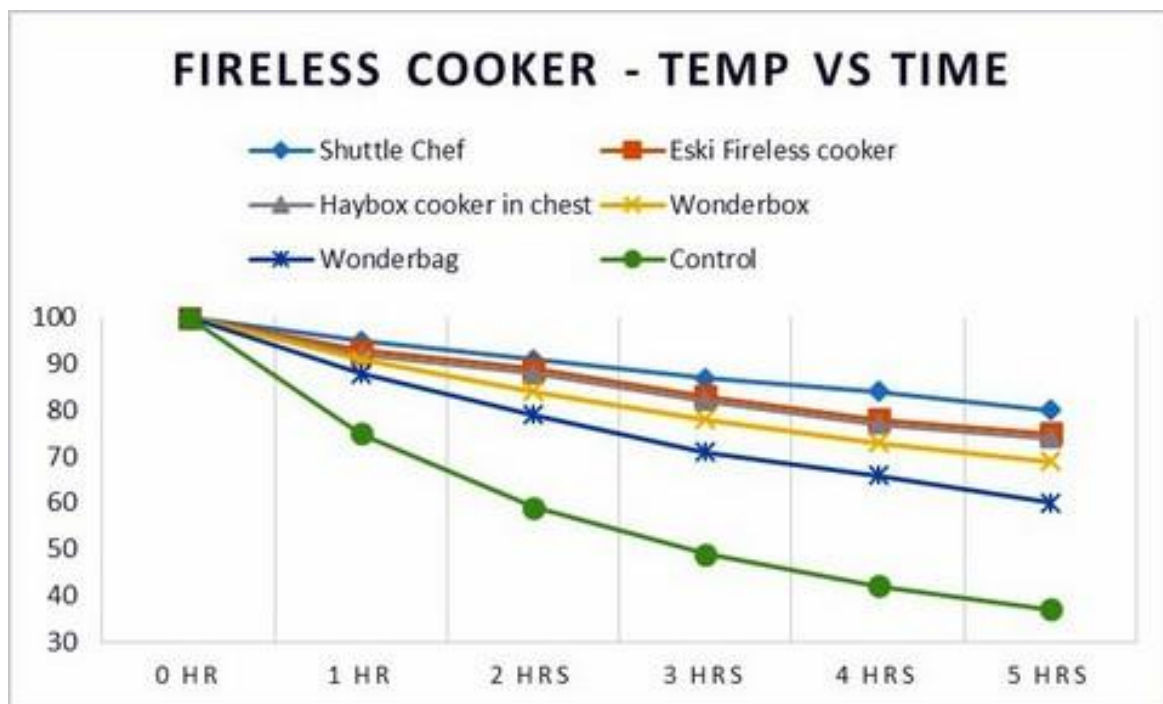
I would then take the temperature of the pot once an hour for the next five hours using a glass laboratory thermometer, removing the lid and cover (but not the pot from the cooker), and swirling the thermometer around until I got a steady reading. Once I recorded the reading for each hour that was pretty much it.

The control consisted of taking the most used pot up to boiling, then leaving it to cool sitting in the open on the (unused) stove. All the tests were carried out at roughly the same time during the day in the middle of an Aussie winter. I figured winter would be a worst case scenario and the most likely time when the soups and casseroles usually cooked in the fireless cooker would be in demand.

The temperatures quoted are relatively accurate, but not necessarily correct in an absolute sense. If you wish to use the numbers to work out which of the cookers are most efficient, ie retain their heat the best, then it works. Due to the need to remove the lid to get the reading (a no-no in stored heat cooking!) the results probably understate the real numbers if the pots were left undisturbed until the end of the cooking time.

Results

Item	0 hr	1 hr	2 hrs	3 hrs	4 hrs	5 hrs
Shuttle Chef	100	95	91	87	84	80
Eski Fireless cooker	100	93	89	83	78	75
Haybox cooker in chest	100	92	88	82	77	74
Wonderbox	100	91	84	78	73	69
Wonderbag	100	88	79	71	66	60
Control	100	75	59	49	42	37

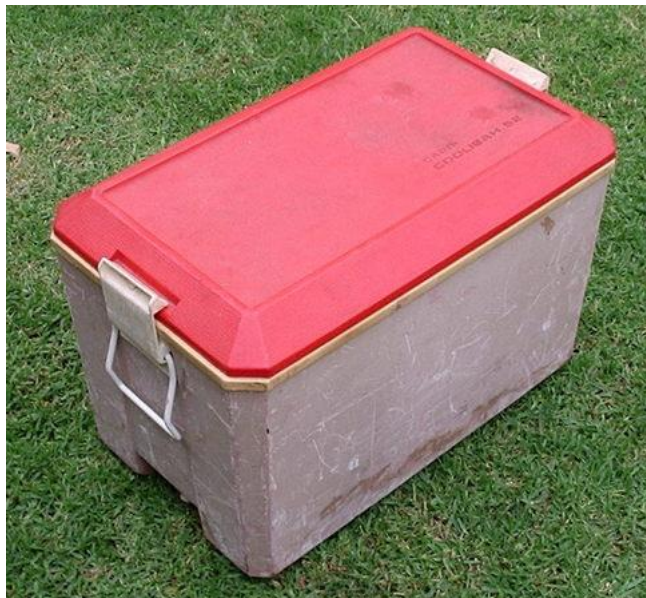


Comments

Shuttle chef – This is a commercially produced cooker made by Thermos which uses a vacuum as its insulating medium. As you can see it works pretty damn well but is also very costly to buy. Current price (July 2014 - the 6 litre version with 1 full size and two half size pots) is around \$500.



Eski Fireless cooker – By contrast this one cost me almost nothing to make, based on a second hand plastic eski cooler box bought at a garage sale for \$5, salvaged polystyrene sheet, a couple of billy cans I had floating around etc.



Cooker in wooden chest

– The biggest cost of this one was the piece of furniture which I bought to construct the cooker in, the main insulating medium is salvaged polystyrene sheet. Add in a couple of pots from the kitchen and a couple of pillowcases full of polystyrene bean bag beans and there you have it. It sits inside and is ready to use whenever we need it.



Wonderbox – is not a box at all! It consists of two fabric bags filled with polystyrene bean bag beans. A pot sits inside a bottom “cushion” and the top cushion goes over the pot so that the pot has insulation all around it. While not being as effective as the others listed above, it is very light and portable as well as being easy and cheap to make.



Wonderbag – This one is two large disks of cloth with polystyrene balls sewn in and the whole contraption drawn up around a pot with a drawstring. There is a small insulated cushion which fits over the top of the pot to complete the insulation surrounding the pot. In a similar way to the wonderbox it is very light and easily portable, but takes a bit more skill to make.



Conclusion

All of the stored heat cookers work pretty well. The Shuttle Chef is the most efficient but also the most expensive. If you want an efficient cooker to use at home either of the box style cookers will work. If you need your cooker to be more portable then a wonderbox or wonderbag is your thing.

4.0 Final Thoughts

Using your existing cooking gear more efficiently is a no cost way of saving both energy and money, so there really is no downside, although it can be surprisingly difficult to change existing habits. In this case, however, there can be considerable payoff so it is really worth the effort for yourself, your family and for the planet.

There is some time, effort and cash involved in building your own stored heat (haybox style) cooker, but it will also be worth it in the end. My suggestion is to have a go at making one of the cheaper and easier to make designs about and give it a go. With a little bit of effort you will find that it is easy to integrate it into your existing kitchen routine. If you use a slow cooker/crockpot on a regular basis you are already half way there.

If you have bothered to download this eBook and then read through it this far then you clearly have an interest in using less energy to cook your food, and all you need to do now is turn that interest into action!

5.0 References and Resources

Cooking more cheaply

The Thrifty Cookbook (476 ways to eat well with leftovers) – Kate Colquhoun – Bloomsbury Publishing (UK) 2009 ISBN 978 1 4088 0081 2 – Contains some good basic data about how not to waste food as well as simple stuff like stock, making your own bread and jams plus Pizza! A smattering of international recipes from the Middle East, India and South East Asia. Probably not much new if you are an accomplished cook but a great resource if you are new to the game.

The Credit Crunch Cookbook – Katy Denny (Exec. Editor) – Octopus Books (UK) 2009 ISBN 978 0 600 61977 2 – Covers waste not, want not, basic budget meals for light, main and sweet, gourmet touches on the cheap and low cost eat-in recipes for Italian, Mexican, Indian, Thai and Chinese. Some of the recipes in these cheapo books can be a bit rough (unless you like lots of offal) but they are really good in this one. Good tips on cost cutting too.

The \$21 Challenge – Fiona Lippey & Jackie Gower – Simple Savings International P/L (AUS) 2009 ISBN 978 0 9806533 0 4 – They have developed a process whereby you use the stuff you have in your cupboards and can only spend \$21 per week of new stuff, the idea being that it helps you focus on the important stuff while saving heaps of money. Lots of good cheap recipes as well as a section on using up excess/leftovers effectively. They have a website about the process - <http://www.simplesavings.com.au/>

Table Tucker – Penina Petersen – Hachette Australia (AUS) 2009 ISBN 978 0 7336 2444 5 – This is another “system” but is very environmentally friendly in its approach. The principles are cooking with seasonal ingredients, grow your own veggies, bulk buying, shift old habits and eat less meat, reduce waste, water and energy consumption and embrace earth happy ideas. LOTS of good info on menu planning and lots of good recipes. They also had a website but it no longer seems to be active.

Champagne Life on a Beer Budget – Maree Wrack – Champagne Life Beer Budget (AUS) 2011 ISBN 978 0 9807070 0 7 – Nary a recipe to be seen on this one. It is more about savvy shopping, ideas to help you save in your approach to food buying and cooking, decluttering and getting control of your outgo. The website referenced in the book no longer works.

The Pauper’s Cookbook – Jocasta Innes – Penguin Books (UK) 1971 ISBN 9780711235618 (was re-issued recently). The book has over 250 recipes covering the standard stuff, leftovers, quick dishes based on pantry stuff, money saving extras and living off the land, special occasion dishes and dieting on the cheap. There are also sections on menu planning and kitchen equipment. Recipes are a bit out of date (liver kebabs???????).

The New Pauper's Cookbook – Jocasta Innes & Kate Harris – Random House (UK) 1992 ISBN 0 09 175434 8 – Similar to the above with additions of sections on Pasta Faster and Veggies for vegetarians. There is still plenty of offal but there are more international recipes and no sign of liver kebabs.

Good Food on a Budget – Georgina Horley – Penguin Books (UK) 1969 ISBN 978 0233961644 – This little paperback has over 500 pages of recipes and information. Lots of information about equipment and setting up a kitchen, basic operations about baking and other kitchen processes, buying vegetables and cutting up meat, all the basic stuff is there. The majority of the rest of the book is recipes set out by month, which would need to be turned around by 6 months for southern hemisphere to hit the season's right. Some recipes are a bit out of date but at least there is nothing about liver kebabs.

Penny Pincher's Cookbook – Sophie Leavitt – Lancer Books (US) 1973 ISBN 7254 0172 9 – There are a series of "hints" at the back and front of the book, the rest being divided up into recipes for cereal and bread, eggs, soups, meat, fish, vegetables, salads and desserts. There is also a small section on herbs and spices. There are no "international" recipes, just American home cooking with the odd weirdo thrown in like peanut soup.... It is a small paperback.

The Money Saver's Cookbook – Geri Tully – Tower Publications (US) 1970 ISBN N/A – This is another small paperback, not much background just a series of recipes based around meat, poultry, fish, casseroles, leftovers, sausage canned meat and fish, vegetables, rice variations and desserts. There are a couple of pages at the back on suggested kitchen equipment.

The Complete Hassle Free, Money-Saving Kitchen Handbook – Diana Walton & Hilda Kassell – Signet (US) 1974 ISBN 978-0451058607 – This is also a book of techniques rather than recipes. There are sections on spending less at the supermarket, food preparation, using herbs and spices, getting over difficulties like running out of an ingredient and what to substitute, how to use the freezer and other stuff on food storage. There is also a section appliances, partying on the cheap, cleaning up and growing plants from pits and seeds. No a lot of info in each section but interesting nevertheless.

The Thrifty Gourmet – Ann Marshall – Angus & Robertson (AUS) 1974 ISBN 0 207 12453 1 – This is a small book (77 pages) and a little bit dated but it has some good ideas as well. It is divided into ideas on how to economise, then recipes and ideas for breakfast, soup, hogget and lamb, beef and veal, liver and kidneys (!!!!) working with a tough chook, fish, sausages and sundries. There is also a small section on entertaining on a budget and desserts.

Beating the Cost of Cooking – Mary Berry –Independent Television Books (UK) 1975 ISBN 0 900 72737 3 – From (a much younger looking) Mary Berry of "The Great British Bake-off" fame. She starts put talking about setting up your kitchen and what equipment is required, then talks about making the most of food covering how to shop

then making meat, fish et. Go further. She then gets into the recipes around starters, meat and fish, pasta cheese and eggs, rice and vegetables. She also has sections on one-pot meat cooking, cooking with left overs, puddings, cakes and biscuits. Mostly good recipes with a few weirdo's thrown in like cream of lettuce soup.

The Next-to-Nothing Cookbook – Helen Harrison – Bay Books (AUS) 1982 ISBN 0 85835 564 7 – This one is mostly recipes, lots of sections with a few recipes in each section. Sections include soup, meat, stews and casseroles, spicy dishes, fish, cheese and eggs, beans and cereals, vegetables and salads, dressings, sauces and herbs, sweets, cakes and biscuits. There is also a section on party treats and lollies and one on household management which talks about left-overs, being thrifty and rescuing cooking disasters.

Better Meals for Less – George Cornforth – Review and Herald Publishing Association (US) 1975 ISBN 978 0 3855 2909 9 – The book starts with a chapter on food and nutrition in general then goes on to provide recipes for meat “analogues”, bread, soup, legumes, nuts and eggs, vegetables, salads, fruit and simple desserts. It has some “interesting” recipes such as nut meat a la king but the recipes are healthy as well as vegetarian.

The Green Kitchen – Richard Ehrlich – Kyle Cathie Ltd (UK) 2009 ISBN 978 1 85626 804 2 – This one is a really good book for cooking more sustainably with techniques and recipes for cutting energy use, saving money and reducing waste. The techniques (with accompanying recipes) covered include lidded cooking, microwave cooking, pressure cookers, no-cook cooking and cooking for multiple meals. There are also sections on equipping a green kitchen, greener cleaning and reducing waste. Lots of great information, this is a great little book.

Appendices

Appendix 1 – Fabric stored heat cooker pattern

