

Simple Solar Homesteading



by LaMar Alexander H.E.S.
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Simple Solar Homesteading: self help

This book is for anyone who is thinking about or all ready living off grid and wants to learn how to build simple solar homesteading projects to make life easier. Included in this book are complete plans for several projects and all plans include pictures, step by step directions, cost and material list. Also included is an invaluable resource list for homesteaders to find just about anything they need under the sun.

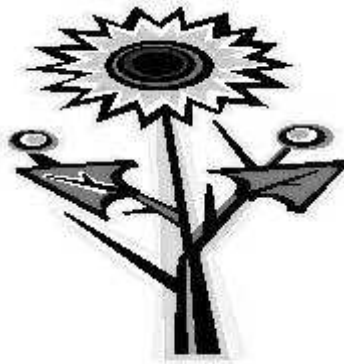
In this book you will learn how to build:

- 1. a sturdy solar cabin for under \$2000**
- 2. a solar panel and generator home energy system for under \$1000**
- 3. a solar composting toilet for under \$50**
- 4. a solar batch water heater for under \$50**
- 5. a solar food dehydrator for under \$50**
- 6. a super solar oven for under \$50**
- 7. a sturdy garden cart for under \$50**
- 8. a portable chicken tractor for under \$50**
- x. resource and vendor list for all kinds of great homesteading supplies**

LaMar Alexander is a certified Health Education Specialist and Self-sufficiency Consultant with many years working and teaching in these fields. He has dedicated his life to helping people around the world to live simple, safe and healthy lives. He lives on a 1 acre solar homestead near Utah's high Uintah mountains with his dogs Wally and Wilma.

Simple Solar Homesteading

LaMar Alexander H.E.S.



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Library of congress Cataloging-in-Publication Data

**Alexander, LaMar 1964-
Simple Solar homesteading
LaMar Alexander
P. cm.
Includes Index
ISBN 1438229364
EAN 9781438229362**

D E D I C A T I O N

To my mother and father who taught me to always be self-sufficient, my son T.J. who inspired me with his youthful exuberance, and my dogs Wally and Wilma who were always supportive even when things didn't go as planned.

A special thanks to the nay-sayers, scoffers, and people who lacked confidence in my plans and abilities to build my homestead for without you- I might just have given up on my dreams.

May the sun always shine on your little cabins!

INTRODUCTION

Hello folks, My name is LaMar Alexander and this is my book. I have always been interested in homesteading and solar power from the time I was a young boy. I grew up on my parents homestead which was passed down to my father from his father and is where I now live. This old homestead was built by people that knew how to live self sufficiently, not because it was a trendy thing to do, but because it was necessary to survive. My grandparents raised 11 children and my parents raised 9 children through 3 wars and the great depression. Homemade clothes, preserved food, gardening, and farming skills is what kept us all alive.

I became interested in solar power as a teen reading through my brothers Mother Earth News and Organic Gardening magazines. I was intrigued by how powerful the sun could be and how it could be easily harnessed to do work. Back then solar panels were just for the very rich but I did build a simple green house with my father and brothers and we learned to use hot caps and cold frames to extend growing seasons.

As I got older I wanted my own place so I rebuilt an old cabin that was on my fathers place and that started my interest in building simple small cabins to live in. I just couldn't understand, and still don't, why people would want to build big expensive homes that are hard to heat and cool and waste so many resources ?

I went away to college where I studied architectural and mechanical drafting for 2 years before deciding I wanted to be a teacher. I chose Health and Safety education for my specialty because I enjoyed helping others to be safe and healthy. I worked for several years as a risk manager for Utah State University and as a volunteer instructor for the American Red Cross where I served as the Health and Safety Services Director for all of Cache County. I spent another 10 years teaching health and safety classes in residential treatment programs for troubled teens. These experiences were excellent in shaping my beliefs that people want and need simple safe and healthy homes to be happy.

In 1989 I was faced with a life altering situation. I became ill and no longer able to pursue my teaching career. This resulted in depression and anxiety and the end result was a divorce and loss of my career and most everything I had worked for. I had hit bottom as they say, but luckily someone was there to put me back on the simple track again. That someone gave me a Mother Earth News magazine to read. I hadn't seen one in 15 years and I was immediately thrilled with all the new solar technology and ideas people had for living simply. This was what I wanted and needed, to get back to a simple homesteading way of life that allowed me to be self-sufficient and function within the restrictions of my physical limitations.

I still owned 1 acre of land my parents left me on the old homestead and with what little money I had, a bag full of clothes and an old car and I headed back to start my new simple homestead. I needed shelter fast so I designed a simple sturdy cabin that I could build by myself with locally available materials for under \$2000. There was no electricity on my property and it was too expensive to have brought in so solar power and a generator power system was my next project. I needed a septic system but didn't want to dig up a lot of ground for drain fields so opted for a solar composting toilet of my own design.

There was a water well near by but I wanted to be self sufficient so I also

designed a rain water catchment system and grey water recycling system. There was good soil to grow a garden so I designed a solar green house for food and solarium to help heat my cabin in winter. I decided to keep everything simple so a solar dish washer, clothes washer, and dryer took care of my cleaning needs.

I didn't just rush in and build these things, I did study other peoples ideas and then adapted and changed them for simplicity to meet my needs. I tried to keep everything simple and inexpensive so I could replace or duplicate it if needed. As I was building my projects I kept a journal and took pictures for my own future needs and because I thought someday someone else might want to start a simple homestead and could benefit from my experiences. Well that day has arrived!

I have reached the point in my life where I see a real need for people to get back to a simpler, safer and healthier way of life and I hope by sharing my plans and stories I can help others to achieve that better life. All the talk about global warming, housing market crash, Katrina damage and future over-population and pollution problems has made me a firm believer that if mankind is to survive we must simplify our lives and reduce the impact we are having on our planet. My designs for a simple homestead can be duplicated by anyone with a small amount of money, limited time and basic building skills.

I believe with all my heart that my life is much better and healthier because of my homestead lifestyle and I believe you will be happier, healthier and safer if you will simplify your life using just some or all of the ideas presented in this book.

Peace, and may the sun always shine on your cabin!

LaMar



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Disclaimer and warning!

The projects included in this book are NOT designed by an engineer or architect and are considered experimental. I, LaMar Alexander, will not be responsible for any harm that comes from the use or miss-use of the information in these plans. Always consult with your local building and health department before building any of these projects. Always wear appropriate safety equipment and follow all tool safety guidelines. If you do not have any building experience please get someone that does have experience to help you with these projects. As with any construction project there is a risk of serious harm and even death!

How to build a sturdy solar cabin for under \$2000

NOTICE: These plans are for a shed like structure that sits on unsecured deck block which may not be suitable for all locations especially in areas where tornadoes or extremely high winds are prevalent or on unstable ground. Consult with your local building agent or architect before building in these areas please.

TOOLS NEEDED: I used power tools but hand tools would work just fine. You need a saw, hammer, screw driver, drill, bubble level, tape measure, square, 6 foot ladder and extension ladder.

TIME REQUIRED:

I built my cabin completely by myself from start to finish in two weeks. I worked about 4 hours a day on weekdays and about 8 hours on weekends so figure about 80 to 100 hours total time. This could have been greatly reduced with two or more people working together!

APPROXIMATE COST: I built this cabin from all new materials at a cost of less than \$2000 (excluding windows, doors, and deck). You can use recycled material to save money or better material if you desire. I support our local small business people by buying directly from the small lumber mills and mom and pop hardware stores. The windows are double pane low e-glass and the doors are steel insulated which I got for nothing from a trailer that was being demolished. Use the best doors and windows you can find as they are real heat robbers if done cheaply! There is a material list at the end of the plans.

SKILL REQUIRED: If you have used power tools and built a shed or dog house you can probably handle this project. If you are not sure of your ability then please get help from someone with building experience.

STEP #1: pick a location

If you have your property already then you have probably picked a spot for the cabin. But before you start building I would offer this advice. The prettiest site near the river or high on the hill may not be your best place to build. Pick a spot that is protected from wind and flooding but gives you full southern exposure so you can take advantage of the solar features of your cabin.

For your foundation you will need 6 deck blocks that accept a 4 x 4 post available from your lumber store or any place that sells lumber for decks. If you want a permanent foundation then use pier tubes and concrete poured below the frost line and a 4x4 deck post pier. For these plans we will use the deck blocks.

Place the deck blocks on firm ground. If necessary, tamp the earth down solid with a big heavy log. You will need (5) 2 x 6 x 14 pine boards and (4) 2 x 6 corner braces for the frame. Screw the frame together with the mounting braces and place the frame on the deck blocks as shown here.



Now square your frame by taking a piece of string and a tack and place the string from one corner to the other cross corner. Mark where the string comes to the corner. Then do the same thing on the opposite corners. You will have to move corners in or out until you get a perfectly squared frame also adjust the deck block so they are directly under the frame corners ready for the 4x4s. If you skip squaring the frame your wall and roof panels will not fit without lots of trimming and waste so take the time to do this step correctly.

Step #2: Put in your 4x4 corner posts and floor joists

Now if your frame is square you can drop your 4x4x10 into the opening in the deck block and attach the frame to the post using 3 inch deck screws and 2 corner braces and (4) 20 penny spikes (see picture). I put my floor at 18 inches from ground level to allow access under the cabin if necessary and I suggest you leave some crawl space. Use your bubble level to level the post both directions but don't be too concerned if it's a little out of level at the top as this will be fixed when you attach the beams and sidewalls

Using floor joist hangers (ask your hardware person) place your floor joist on 16" centers. You shouldn't need to cut anything if you run the floor joists the same way your frame runs. One direction of the frame will be exactly 14 feet if you put your frame together as shown.



Tip: Rough cut lumber can be purchased directly from a lumber mill or find an old house or building being demolished and salvage the lumber for your cabin. Make sure recycled lumber does not contain live insects like termites and carpenter ants. Borax soap is a natural safe pesticide when applied to wood.

STEP #3: Install your floor support girder

I used a 6" round pole for my center support girder but any good strong pole or post can be used. If necessary use a 4x4. Lay the girder under your floor joist on top of three standard cement blocks spaced evenly under the floor. You will need to shim (place small pieces of wood) under the girder until the floor joists sit solidly on the girder. Then toe nail or screw the floor joists to the girder. This girder will support all the weight in the middle of the house so do this properly or your cabin will sag and could come off the deck blocks!



Tip: Cement blocks, pavers and old brick are discarded by the truckload when old commercial buildings and houses are demolished. Ask around and you can probably get these for free for the taking.

Step #4: Put in your floor braces and insulation

Because you will use 4x8 sub flooring I recommend a floor brace (2x4) placed 8 feet from one side of the frame. Put braces on center mark so you can attach your sub flooring directly to the brace. This way you will only have to trim one side of the sub flooring panels (see picture below for braces).

I used R19 insulation in my floor. You may not need insulation but I highly recommend it if you don't like cold floors in the morning. Notice that I placed the batts right on top of the floor joists and stapled them down. Some people say do it from the other side but because my floor will be completely enclosed there is no need and my way is much easier. I suggest laying heavy black plastic under the entire floor on the ground to act as a vapor barrier and help prevent radon gas build up.



Tip: Fiberglass Batt insulation is one type of insulation to use or you can use Styrofoam, or cellulose (shredded paper). For natural insulation consider dry straw which is fairly cheap in most rural areas if you ask around.

Step #5: Put on your sub flooring

I used 3/4 inch tongue and groove wafer board sub flooring. Its heavy and solid and won't sag under heavy feet. use a block and a hammer to tap stubborn sheets in place until the grooves match neatly. Use 1 1/2 inch deck screws every 12 inches to secure the flooring. You will need to trim out a 4 inch opening in each corner to fit around the posts. Save the trimmed pieces and fit them back around the post for a finished look. Trim off the flooring to fit smoothly on the frame. Save these scrap pieces as they make great shelves for inside the cabin!



Tip: A sub floor can be made of any good solid wood of equal thickness. You will probably paint or cover this floor with rugs or other material so use your imagination. Check with the local flooring installers and see if there is a home around that is having old hardwood flooring replaced and offer to help remove it for salvage.

Step #6: Install beams, sill plate, and wall studs

I used (4) 2x4s screwed together to make each of the cross beams. Measure the distance between the corner posts at the base and cut your beams to that length for a tight fit. Attach beams to corner posts at 8 feet from floor using metal L braces (see hardware person). Level the corner posts with your bubble level and you may need to push or pull them to get them level. Sill plates are 2x4s screwed to sub flooring and floor frame. Wall studs go on 16 inch centers between beams and sill plate. Toe nail or screw in place. Decide where your door and windows will be before putting in your wall studs!



Tip: Most glass and door installers give away or sell salvaged windows and doors. My recycled doors are steel insulated and were free from a glass shop. Try to get insulated solid core doors. Windows should be double pane with wood or vinyl frames if possible. Avoid single pane windows and cheap metal framed windows that leak.

Step #7: frame your doors and windows

When deciding where doors and windows go here's a little advice. Put most windows on south side to catch the sun in winter (I have 3) and few if any on the north side (I have 1) to avoid heat loss in winter. Because all windows and doors are different you should measure yours and make openings to fit. Most exterior doors are 36" x 6'6" but you may build your own any size. Frame the openings with 2x4s screwed to your wall studs.



Step # 8: Put on wall sheeting

I used exterior grade T111 plywood for my wall sheeting but clapboard or other material should work just fine. The walls are 8 feet high so just lean the panels up and screw them to the studs. I cut my door and window openings out after I attach the sheets using a power jig saw. (see picture above). Now is a good time to install your doors and windows if you have them. A little advice- hinge your doors to swing outwards to save room in the interior of the cabin.

NOTE: You may choose to install a vapor barrier such as tyvec or roofing felt under your wall sheeting. This is recommended in high wind, rain, and humidity locations but is not necessary in all locations and is not included in the material costs in these plans.

Step #9: Build your loft

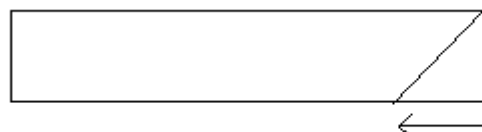
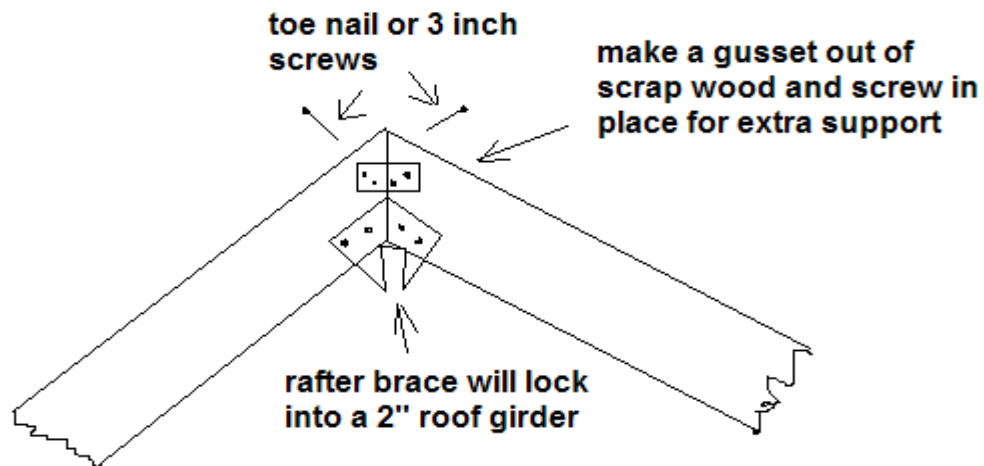
I assume you will want the loft as it doubles your interior space but you could leave it out or do a half loft as you want. I used 2 x 6 x 14s for the loft joists attached directly to the wall studs at 7 feet from floor with a second 2x4 brace placed under each joist for additional support. I used 5/8 wafer board for the flooring screwed every 12 inches for strength. Putting your loft floor at 7 feet high will give you 7 feet head room downstairs and 7 feet of head room at the peak in your loft. Decide where your loft access door will be. I suggest putting it in the center near an end wall so you don't bump your head climbing into the loft. A good size access door is at least 36" x 36" so you can get furniture upstairs. You can build a simple ladder out of two 2x4s and several 2x4 braces spaced about 2 feet apart and attached to the rails using 3 inch screws.



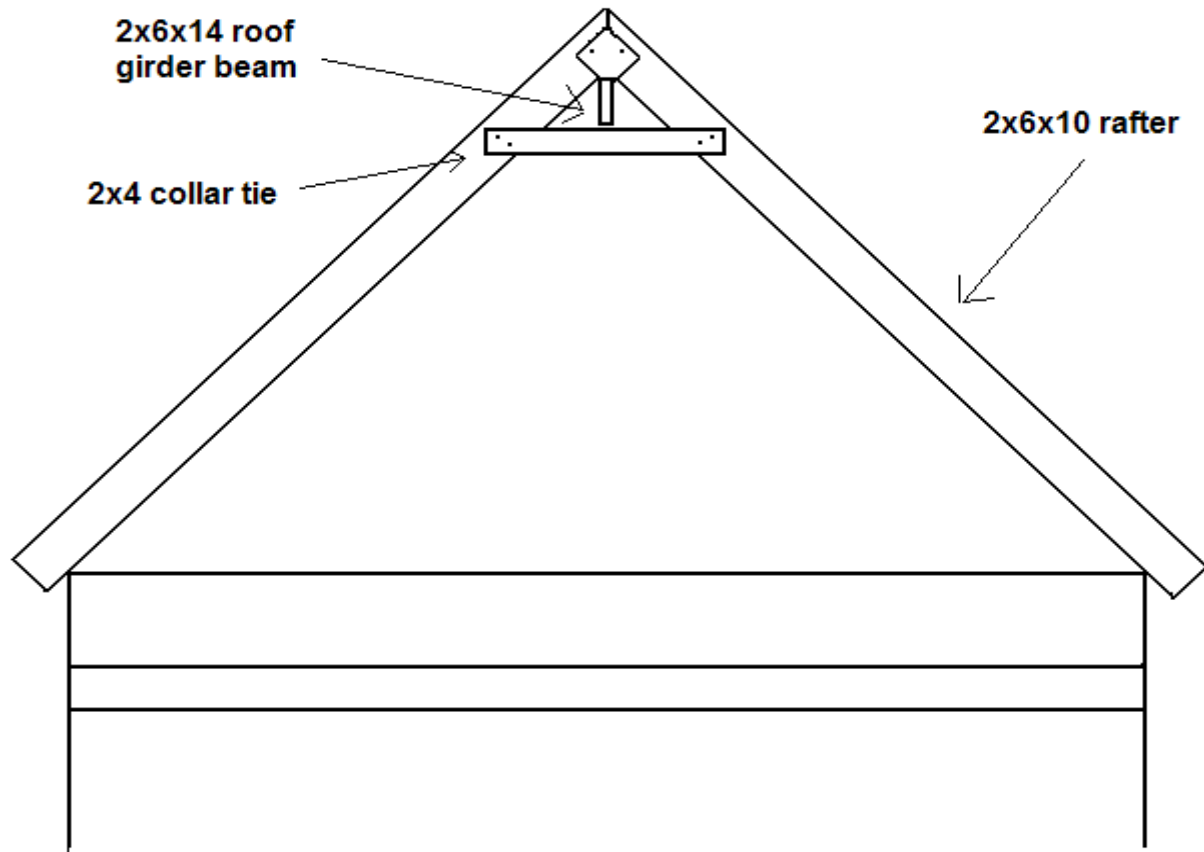
Tip: Attic space is usually wasted space but a loft will almost double your living area and is a great place to put a bedroom which is used primarily only at night for sleeping. Lofts usually stay warmer on winter nights as warm air rises.

Step #10: Build your roof rafters

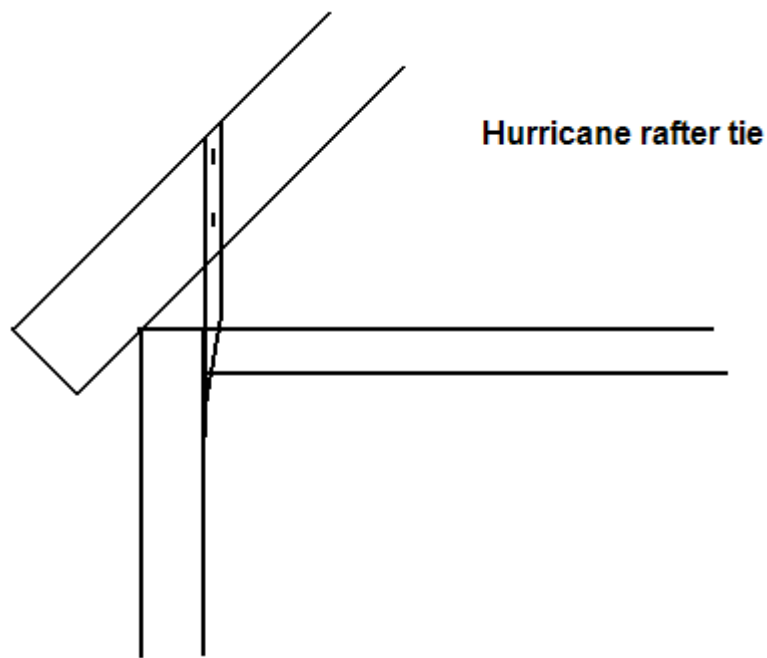
I used 2 x 6 x 10s for my rafters because that gives me a 5" overhang and 7 foot headroom at the peak. To make your rafters cut 4 1/2 inches angled to the corner of the rafter which is slightly more than a 45 degree angle. Toe nail or screw two rafter sides together to form a big V. Attach your rafter brace using screws (see hardware person). Rafter brace should accept a 2 x 6 or 2 x 8 inch girder. I also made a small gusset of scrap wood that I screw to each rafter for extra support while I put them in place.



Cut 4 1/2 inches off at an angle to corner to make the rafter angle



Here you can see how rafters sit on the roof girder and collar ties hold it all together



Here you see how the roof rafter is attached to the wall using a metal rafter tie



Here you can see the first rafter in place and window already framed and installed. Attach your end rafters directly to the 4x4 corner posts. Cut off the excess corner post that extends past the rafter with your skill or hand saw. Put a scrap 2x4 brace on this first rafter and attach it solidly to the loft floor or you may hear a big crash!

Step #11: Put in roof girder and install rafters

Use a 2x6x14 for your center roof girder. Screw it in to the first rafter brace and place a 2x4 scrap brace under the other end so it is level (use your bubble level to level the rafters and the girder). This step is easier with two people but I did it myself. Attach a collar brace to at least a couple of your rafters I put one on every 3rd rafter). A collar brace is just a 2x4 that lays under the girder and is screwed or nailed to both sides of the rafter for extra support.



Slide your rafters over the girder and lock them in place with screws through the girder brace. Rafters go on 16 inch centers. Attach the bottom ends of rafter to beams using metal rafter braces (see hardware person).



Tip: Installing rafters is really a two person job. I did this myself but it was not the smartest or safest way to do it. I highly recommend getting some help for this step of the construction.

Here's the roof with all rafters in place and windows framed and installed. Now its looking like a cabin!



Tip: If you built your loft first you can stand on this floor to install your rafters much easier and safer. If you are working from a ladder be VERY careful as rafters are heavy and unwieldy. Get some help with this step please!

Step #12: put on your roof sheeting

I used 5/8 wafer board but you could use 1/2 inch or another material such as pine boards. It is easier to slide panels on to roof from the ground and tack them in place and then go back up to loft to put screws in at 12 inch spacing.



Here's the cabin with roof sheeting installed. Notice the over hang. If you use 4x8 sheets you won't have to cut much and it will give you a 1 foot overhang on each end to shade the upstairs windows in the summer. I used 30 pound Tamko roofing felt and felt nails under my shingles. You can also use this under metal roofing if you decide to go that way. Put on a metal drip edge over the felt and under the shingles to prevent rain and ice from dripping under your eaves. You can attach a 2x4 to the front and rear overhang edge for a nice finished look and I cut a sheet metal triangle to cover the small gap at the peak and give it a unique finish.



Tip: I used asphalt shingles which are fairly cheap and widely available but if you want to catch rain water I would suggest a metal roof instead. The cheapest is the shiny corrugated metal roofs used on barns and sheds and it reflects sunlight to reduce

Step #13: Install your shingles

I used Tamco 30 year shingles because I was doing the job myself and they are easier to handle, but a metal roof would be great, If you have never installed shingles read the back of the package and follow the directions and you will do fine. Use some of your scrap lumber to enclose the rafter ends. I used the pieces of T1-11 left over from cutting out the doors. Just screw them to the rafter ends and bottom to enclose the roof.



At this point if your windows and doors are in your cabin is secure and you could start living in it. You will notice above that I used rough cut 1x6 lumber for my trim work around windows and doors. I get these for \$2.00 apiece at the lumber mill but you could use cedar fence boards or good pine if you desire. The next steps will be for the interior and are a matter of taste.

Step #14: Insulate walls and roof

I used R19 batt insulation but blow in would work. Go with the highest R value in your roof as that is where you will lose most heat in winter and gain it in the summer. If you have never installed insulation read the package and ALWAYS wear gloves, mask and eye protection.

Step #15: Put up interior wall material

I chose 5/8 inch drywall because its cheap and easy to work with but you could do paneling, bead board or something else. I would recommend using a material that has some fire resistance especially if you plan on having a wood stove! Just measure your walls and score the drywall with a razor knife. Give it a smack with your hand on the scored line and the drywall will break cleanly. You can clean up rough edges with a drywall rasp (ask hardware person). I don't even use seam tape on my drywall. Just cover screw holes and seams with a little drywall plaster, paint it and cover corners and seams with some kind of molding. I use cedar fence boards cut in half for nice looking trim work throughout the cabin.

Step #16: Decide on your floor plan

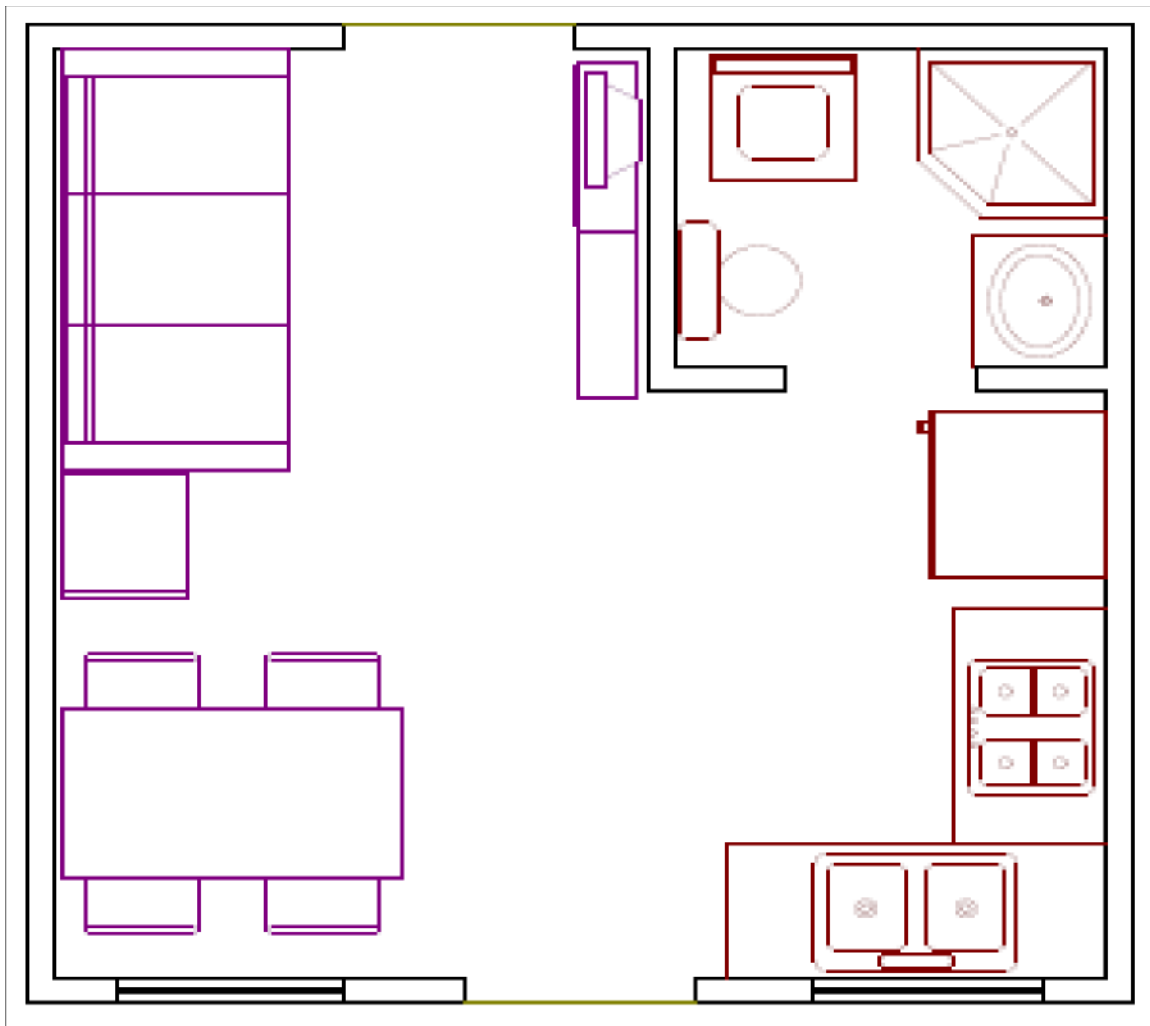
Because space is limited you will need to define your floor plan according to your specific needs. I chose to have a full size bathroom, kitchenette, dining area and living area down stairs and my bed room in the loft upstairs. I only had to build two interior walls to make my bathroom 6 foot by 5 foot, this left me approximately an 8 foot x 9 foot kitchen area, a 7 foot by 8 foot living area and a 6 foot by 6 foot dining area with a full 14 x 14 bedroom in the loft.



Tip: The interior of your cabin is an area where you can really save and be creative using recycled materials. I used recycled cedar fence boards for trim work. I have hardwood flooring that was purchased cheap because it was discontinued. Because the cabin is small I didn't need much paint so I scrounged together what was left over from other projects. Many building supply stores, floor covering stores, and retailers have discontinued or sample sales for products that they don't have enough of for a big home that will be perfect for your cabin.

Furniture stores sell scratch and dent stuff at reasonable prices or you can hit the yard sales and do some bartering. I traded cabin plans for a kitchen table, paid \$5 a piece for oak kitchen chairs, and was given a shower base that was too small for my brothers house.

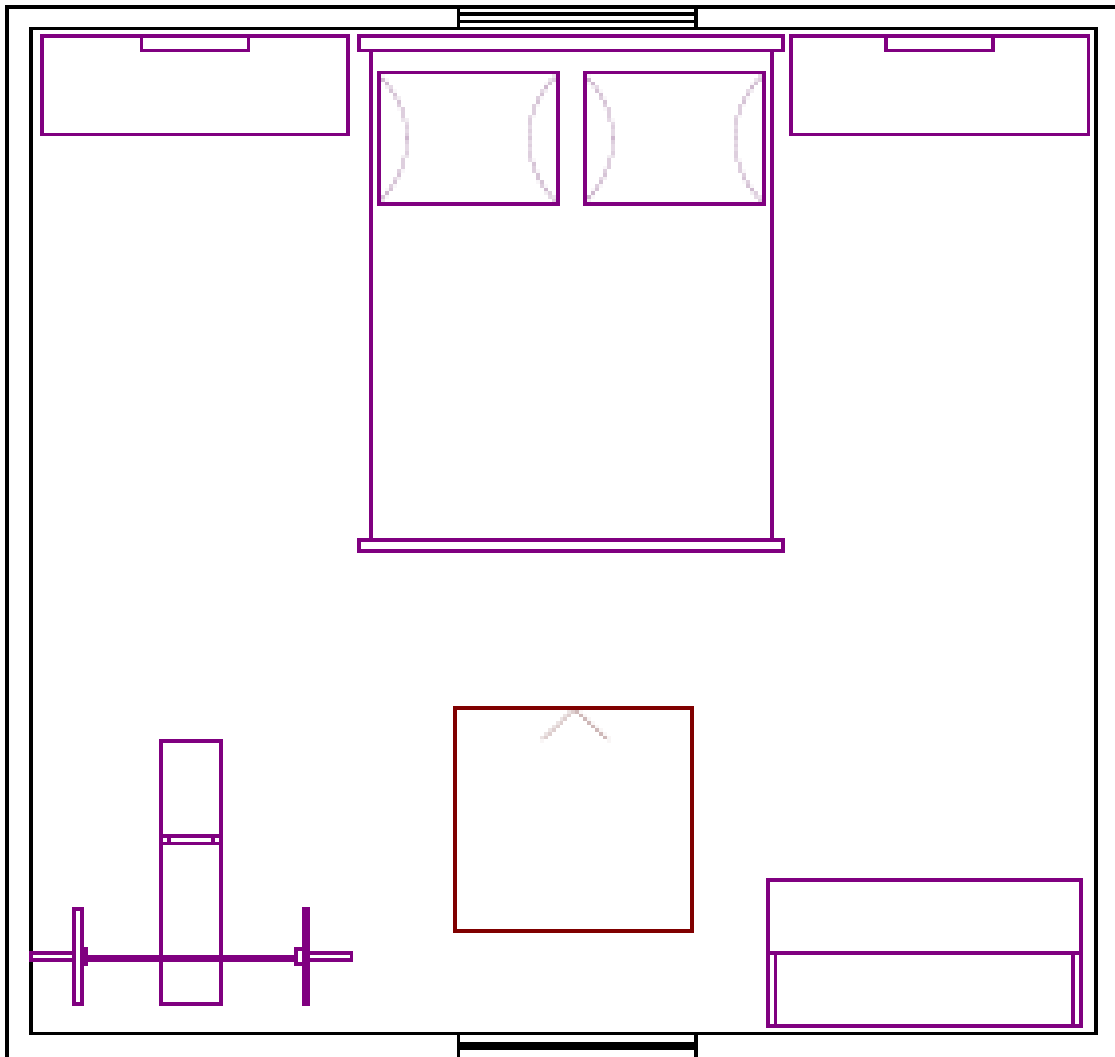
In my opinion a cabin or cottage looks best with antiques and craft items instead of plastic store bought cheap stuff. If your handy with tools then consider making log or twig furniture for your cabin, decorate with natural items like tree branches, shells, antlers, and rocks. Let your imagination run wild and create something unique!



Here you can see how I designed my main floor. There is a full corner shower, sink, stackable washer and dryer and a composting toilet in the bathroom. A propane fridge and stove and a sink in the kitchen. There is a 4 person dining area and a full size futon couch and entertainment center in the living area. The main floor is approximately 14x14 with 7 feet of headroom to the loft above.



Tip: If you already have furniture for your cabin measure it and see where it can best fit for your floor plan. I had a lot of “stuff” I had collected over the years and I had to decide what I really needed and what was necessary in the cabin and give away the stuff that wasn’t. I went from two large TV’s to one small flat screen tv. I went from a big desktop computer to a small laptop. My couch is a futon so guests have a place to sleep. I designed storage under my sink for a water tank. I chose an on demand water heater and stackable washer dryer to conserve space in the bathroom. Try to design your floor plan so you have areas for eating, sleeping, bathing but remember your space is limited and you will use most those areas for only a few minutes each day.



Here's my loft design. I have a queen size bed and two large dressers with mirrors on one wall. My desk and exercise equipment on the other wall. The box in the middle is the loft access door which is 36"x36" and a ladder slides under the bed when not in use. The loft is approximately 14x14 and has 7 feet of headroom to the peak.

Well that's it for the cabin plans folks, I have included other pictures of my own finish work so you can get ideas but don't be afraid to let your own style come through in you cabin. After all we are individualists that don't all want to live in the same style cabin right!



This is a picture from inside the loft



Here you can see how I finished the foundation. I used 5/8 wafer board painted grey to look like cement. Eventually I will rock the foundation with river stones. My trim work is all rough cut pine 1x6s I get directly from a small lumber mill up the road.



Here's my solarium porch. It is 8x14 and I used 2x6s for the floor, pine poles for the corners and, rough cut 1x6s for the decking. I used the same 30 pound felt and tamko shingles as on the cabin for the roof. The poles sit on 1x1 cement blocks to prevent rotting and termites.



And here's the final product. You can see my loft ladder through the door. It slides up out of the way in the day time. I will leave the outside unpainted because I like the weathered look, but you could stain or paint as desired.



Tip: According to new studies paints and stains do very little to protect wood from decay and because they have to be redone every few years it can be expensive and time consuming. Wood will age to a nice grey or brownish color if left untreated and there are many untreated barns still standing over a hundred years old. You can paint the trim a nice white if you want a little contrast.

If you are going to paint or stain consider some of the newer non-toxic environmentally friendly paints. Stain is easiest to apply and can be sprayed on with a cheap pump hand sprayer.

Material list for cabin

Foundation:

6 deck blocks @ 4.50 = \$27

3 concrete blocks @ \$3 = \$9

1 center pole girder \$7

total = \$43

Floor:

14 2x6x14s @ \$7.50 = \$105

6 4x8 t+g sheets @ \$15 = \$90

3 rolls R19 insulation @ \$24.00 = \$72 (optional)

total = \$267

Walls:

4 4x4 corner posts @ \$10 = \$40

65 2x4x8s @ \$3.50 = \$230

8 rolls R19 insulation @ \$24 = \$192

14 4x8 T111 siding @ \$15 = \$210

14 4x8 drywall @ \$12 = \$168

total = \$840

Loft/ceiling:

10 2x6x14s @ \$7.50 = \$75

6 4x8 5/8 wafer board @ \$12 = \$72

total = \$147

Roof:

24 2x6x10 rafters @ \$5 = \$120

10 4x8 5/8 wafer board @ \$12 = \$120

2 rolls roofing felt @ \$15 = \$30

6 squares tamko shingles @ \$49 = \$294

4 rolls R19 insulation @ \$24 = \$96

total = \$656

Misc:

screws and assorted metal hangers \$40

Grand total = \$ 1997.00

*** does not include tax, windows or doors. Some figures are rounded up for simplification. Costs are approximate based on local dealer discounts**

How to build a solar panel and generator power system for under \$1000

I needed a simple power system for my cabin and the local electric grid was not an option due to the high cost of bringing in poles and transformer to my remote location. Even if it had been available I would still have chosen solar because I do not want to be another drain on an already overwhelmed power grid that produces huge amounts of pollution and clouds our beautiful view with ugly poles and wires.

So my options were candles and lamps, solar, wind, hydro, and generator. I like my electric gadgets so some electricity was desired. Wind was not a viable option because we get less than 5 mile per hour winds most year round here (but if we did get wind I would go for it). No streams or rivers near the house ruled out hydro so my best choice was solar. Because we get days of poor sunshine I also opted for a small gas generator to handle the weak ray days and also to give me the higher watts necessary to run a microwave, clothes washer, and power tools. So here is how to hook up a small scale solar panel and generator system like the one I use.

How solar panels work: I won't go into a lot of scientific mumbo jumbo here but you need to know a few basic things about solar panel systems. Solar panels absorb sun light and convert it to electrical current. This current is DC or direct current unlike your house that is AC or alternating current. A typical home hooked to the AC power grid uses 220-230 volt power lines and 110-120 volt power lines to operate most AC equipment in the home. You can still use most of your AC appliances when you use a solar panel DC system but you will have to convert the DC to AC with a thing called an inverter. This inverter unit takes in DC and converts it to AC with only a small amount of power loss to operate the units cooling fan. Inverters come in all sizes and you should get one that will fit your needs (a good size is 400 watts).

The great thing about DC solar power is it can also be used to run a lot of DC appliances and gadgets that generally use less power than their AC equivalent. There are lots of DC appliances and you can run your home using only DC power if you want but I use a combination of AC and DC at my cabin and that is the system I will describe here.

How big of a system should I get ?

That depends a lot on what you want to run in your home. I believe in keeping things simple and small so the system I built uses a 90 watt solar panel system with 4 deep cycle batteries and a 400 watt inverter. This system provides enough power to run my 95 watt flat screen TV for about 4 hours a night plus my house lights which are fluorescent DC, my 12 volt water RV style water pump, and I can watch my portable 7

inch DVD player (also DC) for another 3 or 4 hours at night. On sunny days when the batteries are full I plug my laptop computer and cell phone charger in and let their batteries absorb the extra power from the panels. In the summer when there's extra sun for power I run a small DC fan continually in the day time to circulate air in the house and it uses the extra power my full batteries can't absorb.

For a small cabin like mine I would suggest starting with a system that has an 80 watt solar panel, 2 deep cycle batteries and a 400 watt or larger inverter. This will take care of your basic needs for lights and small appliances and for larger appliances you will use the generator. A good 400 watt inverter will cost you about \$50. See resource guide for inverter vendors.

Why a generator ?

Generators burn gas or propane to produce AC and DC current. If you operated one for all your power needs it would be extremely expensive and cause too much pollution. However, for limited use to operate large appliances like a washing machine, vacuum, and power tools the generator is a perfect companion for your solar panel power system. A smaller generator like the one I use will run about 10 hours on a gallon of gas- that's about 40 cents an hour to run my large appliances and tools and since I only run the generator about 30 minutes on an average a day I can use the generator for about a month for \$4.00. When I run the generator I always try to use it for double or triple duty. If I am running the microwave I also plug in the vacuum and vacuum the floors and the generator has a separate DC charger built in so whenever it is running it is also charging my batteries up which helps a lot in winter when the solar panels struggle to keep the batteries full. A good pull start 3500 watt generator that will run your big appliances will cost you about \$300 if you want an automatic start generator it will be closer to \$500. See resource guide for generator vendors.

What kind of solar panels ?

There are pros and cons to all solar panels but I would recommend panels with monocrystalline cells which generally outlast other cells and work better in low light conditions. Kyocera, Solar BP, and others all have good quality panels that will last an average of 30 years. You can find solar panel sources in the resource guide at the end of the book. A good 80 watt solar panel will cost you about \$450 (2007 prices) and you can find them for around \$400 if you shop around. you also need a power controller to keep the batteries from over charging. A small power controller for an 80 watt panel will be under \$50. See resource guide for vendors.

Where do I put the panels ?

Solar panels must face the direct sun which will travel in an arc across the southern hemisphere from east to west (unless your down under). The best way to determine placement is to stand outside at noon and see where the sun is in the sky. Aim the center of the panels at the sun and you won't be too far off from true south. You can place the panels on the ground, mount them to a shed or put them on your roof as most people do. Just remember they do have glass fronts and a slingshot, bb gun or rock flipped from a lawn mower can destroy a panel. Angle the panels at about 45 degrees to capture the winter sun and lower the angle in summer when the sun is higher in the sky.

Anchor the panels securely or they can become giant expensive kites in a strong wind. Avoid placing them anywhere they will be shaded. Even a tiny amount of shade on a panel can keep it from producing power.

Why deep cycle batteries ?

You could use standard 12 volt car batteries for power storage as I did when first starting out but a car battery isn't meant to be drained continuously as you will do running house appliances. Deep cycle batteries are made to handle deeper drains and faster recharges without failing. Car batteries will probably last around 5 years but a good deep cycle battery will give you 10 or more years of service. Deep cycle batteries will cost about 1/3 more than car batteries and get the type that has refillable cells so you can add distilled water as the batteries dry out (and they will dry out). I would start with 2 batteries and add more as needed. You can get deep cycle batteries at most large retailers for about \$65.00 so there's \$130 for batteries. See resource guide for vendors.

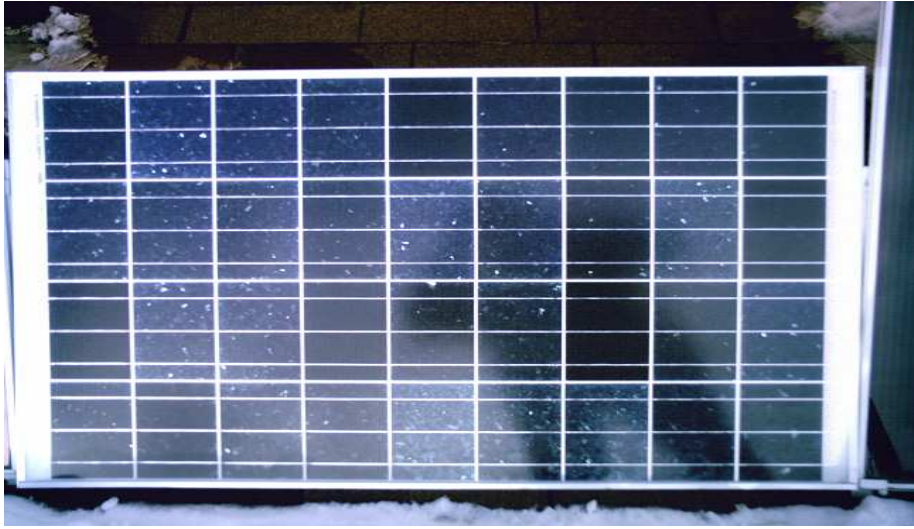
COST: That's \$450 for an 80 watt panel, \$50 for the power controller, \$300 for the generator, \$130 for the batteries and \$70 for the inverter. So for under \$1000 you can have a simple solar panel and generator power system to handle all you basic electricity needs. As your needs grow you can add more panels and batteries but most people go overboard when buying these so live with the small system and you will learn to adapt to high and low power swings in your life.

This small power system will force you to turn off appliances like TVs and go outside and work in the daytime which is what you wanted from your homestead lifestyle anyway isn't it ?

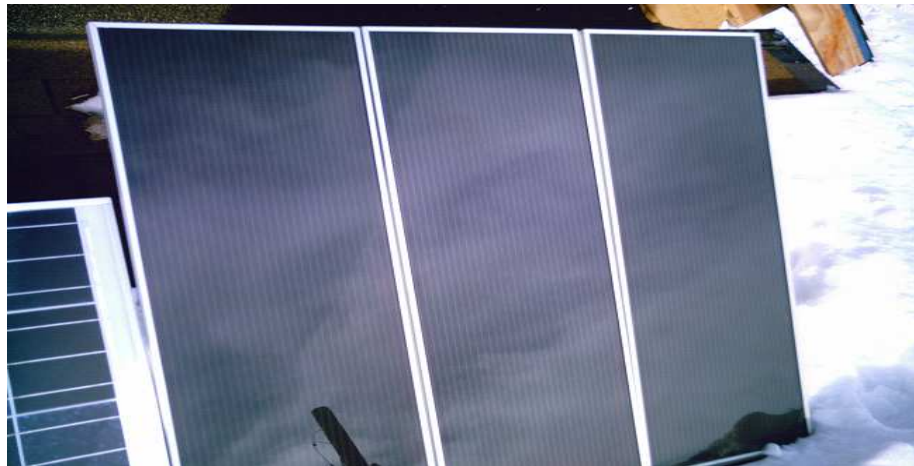
Here is a picture of my Solar panel array on my roof. The panel in the middle is a Kyocera 80 watt purchased new in 2007 for \$399. I also have two 45 watt no name Chinese panels on each side which I added later. I have to get out on the roof once in awhile to wipe off dust or snow but other than that there is no maintenance involved. Always face panels towards true south and place them so they are protected and not shaded.



Here's my solar panels



This is a Kyocera 80 watt panel purchased new for \$399 in 2007



This is a 45 watt (3@ 15 watt) no name Chinese panels purchased from Harbor Freight for \$179 in 2005

Here is my battery array. I have 3 deep cycle 12 volt batteries all over 5 years old and still running strong. I keep the batteries outside in a protected wood box which I can cover with insulation in winter to keep batteries warmer. Just like your car battery when it gets cold the deep cycle batteries can lose 50% or more of their power so keep them warm in winter and cool in summer. Keep a bottle of distilled water around to refill battery cells (see manufacturers guidelines) and use a little white lithium grease on the terminal posts to prevent corrosion, Always wear gloves and goggles when moving or working on batteries as they contain acid and never store batteries in a house as they release dangerous fumes.



Here is my HOSCO charge controller. It will handle 250 watts and I like it because it has idiot lights that tell me if the panels are working and batteries charging.



Tip: Many electrical and phone companies discard good deep cycle batteries after a set number of years and these may be available cheap. Golf courses may be able to sell you 6 volt batteries at a discount because they buy so many. Always recycle your old batteries when you buy new batteries. Never put them in the trash!

Here's my 400 watt inverter. It has a low battery warning beeper, a green light and red light charge indicator and two 110 volt outlets. These units have built in fans to cool themselves down but should be kept outside near the batteries as they can produce electro magnetic resonance that may be dangerous if you stay in close proximity too long. Use a good quality heavy duty outdoor extension cord to run the power into the cabin and attach a good fused power strip with an off switch to plug in your various electronic appliances and gadgets. That way when the inverter beeps that your batteries are getting low you can just turn off everything at the power strip instead of shutting down each appliance or gadget.

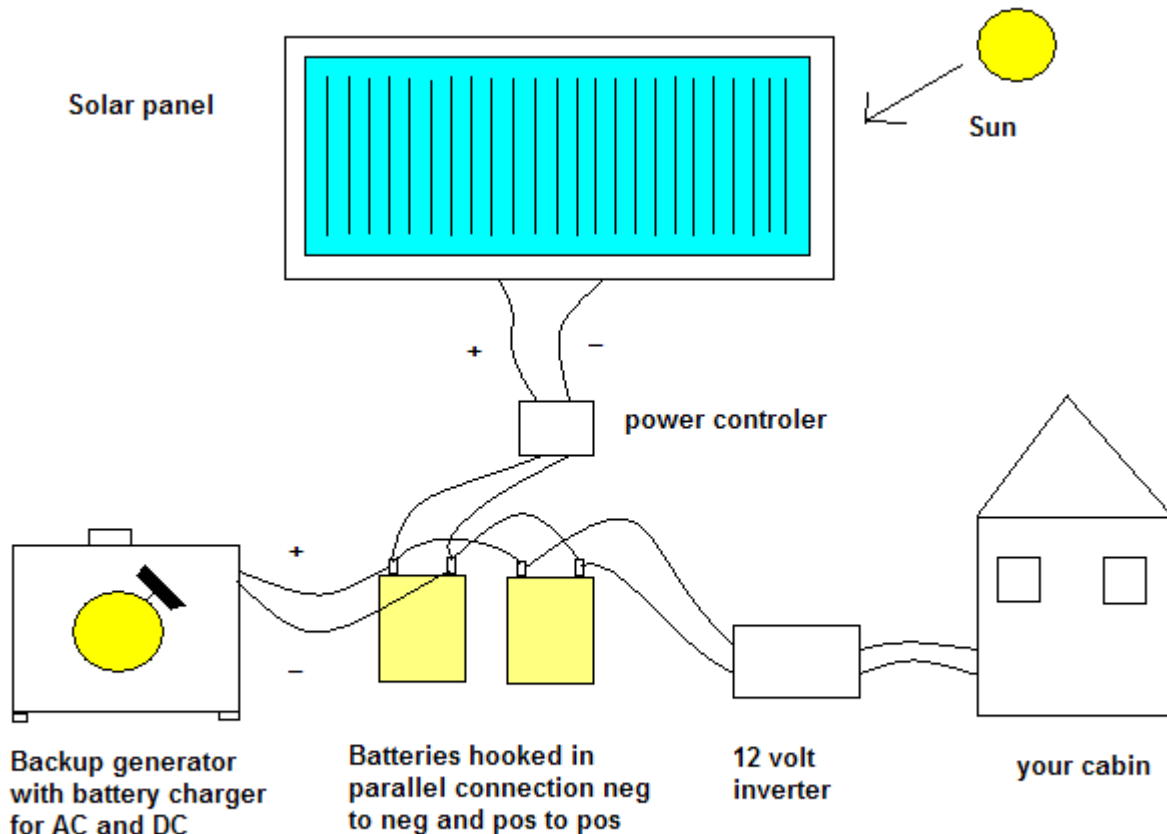


Here's my generator. Its a Champion 1500 watt pull start and I use it about 30 minutes a day to run my microwave, vacuum, and power tools and it helps recharge my batteries every time it runs. When getting a generator look for one with overhead valves (less noisy), a low oil shut down (prevents damage), and a built in 12 volt recharger (to assist recharging your batteries). My generator is 3 years old and still starts with just a few pulls. The key to keeping a generator in good running condition is to keep it oiled and run it for a little while every day or every other day as a generator that sits around will drain fluids back into the reservoirs so the engine will be dry and harder to start each time its started.



For wiring use only good quality heavy duty outdoor extension chords from your generator and inverter. I also use these to make direct DC wiring from the battery to my house. Use a 12 volt fuse block and only use good quality 12 volt appliances. I use DC lights and I have DC plugs which are car cigarette lighter style plugs in a couple of places so I can plug in DC appliances in my cabin. You can get these plugs at most automotive parts dealers or radio shack.

Here is a basic off grid solar panel system diagram. Batteries should be hooked in parallel for 12 volt power but may be hooked in series for 24 volt inverters. You must match the power required for your inverter. Parallel hook up is negative to negative and positive to positive battery terminals and series hook up is negative to positive battery terminals.



With this system you can easily add on more panels and storage batteries if your power demands change.

Here is an average day of power use for my system

Lights- about 2 hours throughout day
TV- 2 to 3 hours a day
Radio- 3 hours a day
Laptop computer- 1 hour a day
electric razor- 5 minutes a day
12 volt water pump- 1 hour a day
Misc. gadgets- 1 hour a day
microwave- 1/2 hour (generator)
vacuum- 15 minutes (generator)
Washing machine- 1 hour 2 loads once a week (generator)

My low watt lights and appliances

In order to best utilize your off grid solar system you need to choose appliances and lights that are energy efficient.

LIGHTS: For lights I use low watt fluorescent and a few halogen (12 volt) rv style lights. You can run all my lights in the cabin for the same amount of watts one 60 watt incandescent would require!

TV: For a TV I use a 13 inch lcd flat screen which only uses about 70 watts. Compare that to a standard 13 inch TV that uses 250 - 300 watts or more.

COMPUTER: For a computer I use a laptop lcd that can be recharged for portability and uses less than 25 watts when running. An average desktop tower computer will eat up 150 - 300 watts.

RADIO/CD/DVD: I have a 12 volt radio cd player and a 12 volt 7 inch DVD player with a rechargeable battery for portability. These use about 20 watts compared to an average stereo that uses 150 watts. I use high quality headphones when I want to hear my music and movies in high def. and it gives me the surround sound experience.

WATER PUMP: I use a 12 volt shurflo water pump designed for RV use. It gives lots of pressure and is self actuated on demand so it won't run unless I turn on the faucet or shower. These use about 70 - 100 watts when running. An average AC water pump will use 300 -400 watts

You can determine your power usage by looking at the back of most appliances and finding the watts used on the unit. Multiply that number by the number of hours you will use the appliance in a day and add up all the appliances you will use in a day. Your battery bank must be able to handle that amount of watts and still stay 1/2 full or you will drain the batteries. If you want to run more gadgets you will need more panels and more batteries but if you plan ahead you can alternate days when you run high watt use appliances. Some appliances need lots of cranking watts to get started like washing machines and microwaves so these should be run off the generator and not the battery inverter as you would drain your batteries too quickly.

Average Power Consumption of Common Appliances

Appliances Watts Appliances Watts

Blender 300	Refrigerator (20 cf.) 150
CB radio 5	Satellite dish 30
CD player 35	Sewing machine 100-500
Ceiling fan 10-75	Table fan 1-25
Clock radio 1	Toaster 800-1500
Coffee maker 800-1200	TV: 25" color 150
Computer 80-150	TV: 19" color 70
Dishwasher 1200-1500	TV: 12" B&W 20
Dryer (elec.) 4000	Vacuum cleaner 200-1200
Dryer (gas) 300-400	VCR 40
Elec. blanket 200	Waffle iron 1200
Elec. clock 3	Washing machine 500
Evap. cooler 300-1000 ½"	Drill 900
Frying pan 1200 7¼"	Circ. saw 750
Furnace blower 300-1000	
Garage door opener 350	
Lights:	
Garbage disposal 450	100W Incandescent 100
Hair dryer 900-1500	60W Incandescent 60
Iron 900-1200	25W Incandescent 25
Laptop 20-50	25W Comp.flourescent 28
Microwave 600-1500	15W Comp.flourescent 18
Printer: laser 300-475	42W Halogen 42
Printer: ink jet 60-75	

If I lived on grid with unlimited power the only thing I would do different is probably waste power by leaving appliances running like the TV and radio. Living with solar power just means being more responsible for conserving you electricity and it makes me healthier if I have to stop watching TV and go outside and do something!

Well, that's how I produce power for my house folks, I hope you can use the information to build your own system. Start small and add panels and batteries as you really need them and you will find you really can get by with a small power system and your life will be healthier and happier as a result.

How to build a solar composting toilet for under \$50

Typical composting toilets fail for two reasons, too cold and too wet. I have designed a solar assisted composting toilet that reduces these problems and speeds up composting by 2/3 the usual time.

NOTICE: I am not an engineer and these plans are experimental and probably do not meet health codes so build and use at your own risk!

Cost: You can buy two sheets of wafer board, (4) 2 x 4s, a roll of clear plastic , a roll of black plastic, and a 3 foot piece of black 3 inch pvc pipe for about \$30 or you can scrounge around any construction dumpster or garbage dump and find most of your material for free!

Time: I built the composter and dug two small pits in about 3 hours

Skill: If you can cut a straight line, hammer a nail and dig a hole you can build this composter

How it works:

A composting toilet is simple unit designed to let natural micro-organisms do their job in breaking down waste into a substance called compost. These micro-organisms occur naturally in all good soil, Human feces and urine is not much different than animal feces and urine which has been used for decades to raise nitrogen levels on farmland and increase crop growth.

The composter is actually two components. The first is the waste receptacle or toilet which can be as simple as a 5 gallon bucket with a toilet seat or as beautifully designed as your imagination provides. What matters is only that it can be easily carried and is large enough to hold enough waste so emptying is done about once a week. A 5 gallon bucket with a sturdy handle will take care of a 3 person family for that need. I suggest building two of these so you can swap the empty for the full one when emptying. If you don't want to build one you can purchase a porta-potty or camp toilet at any sporting goods store.

The second component of the solar composting toilet is a pit lined with plastic to hold the waste and keep it from seeping into the ground and a box that can collect and hold the sun's heat inside. The reason for the solar box is to increase the temperature of the

waste so the micro-organisms which are only active above 50 degrees can do their job more effectively. Most store bought composting toilets either require an indoor storage tank or a heater to keep micro-organisms from going dormant in cool temperatures. With a solar composting toilet you won't need electricity to heat the unit or a tank inside your home to hold compost. About 90% of human waste is urine which is sterile water and when you eliminate this through evaporation there is very little solid waste left to break down by the micro-organisms. The solar composting toilet will raise the temperature of the waste and this quickens the evaporation of the moisture leaving only a small amount of solid waste that the micro-organisms can quickly consume and turn into safe odorless fluffy compost that can safely be used as fertilizer around fruit trees and flowers. The secure compost box also provides protection from flies and animals getting into compost and causing a mess.

How safe is human manure ?

There is some debate over the safety of using human manure on plants that will be eaten. Generally speaking if you and your family are healthy and have no communicable diseases then your waste will be safe for use on non-vegetable plants, but if strangers will be using your toilet you should take precautions to not use waste that could be contaminated with disease. I always recommend wearing a mask, gloves and eye protection when stirring the compost pit or handling human manure, and to be safe, only use human compost on non-edible plants and not on your vegetable garden. I also recommend having two pits and allowing the waste in a full pit to sit undisturbed and covered by clear plastic for 1 year before using the compost as this gives the micro-organisms time to completely break down the waste.

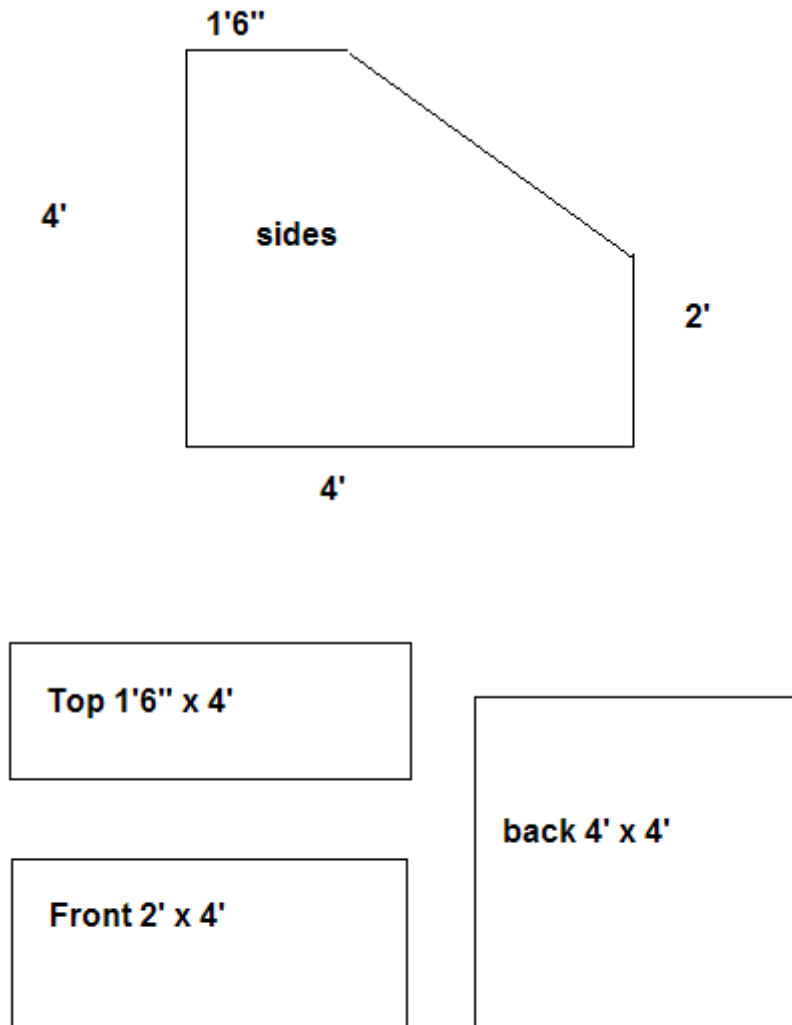
Step #1: You will need a portable toilet such as the ones sold at sporting goods stores. A porta potty works well and that's what I use or you can build your own out of a 5 gallon bucket and a toilet seat. You will be dumping this into your composter probably twice a week so get something you can handle and carry comfortably. Some people use sawdust or sphagnum moss sprinkled on their toilets to absorb moisture and reduce odors and this is fine to use and won't effect the composter in these plans but **DO NOT** use cleaning products or dump anything into your toilet that might kill the micro-organisms necessary for the composter to work.

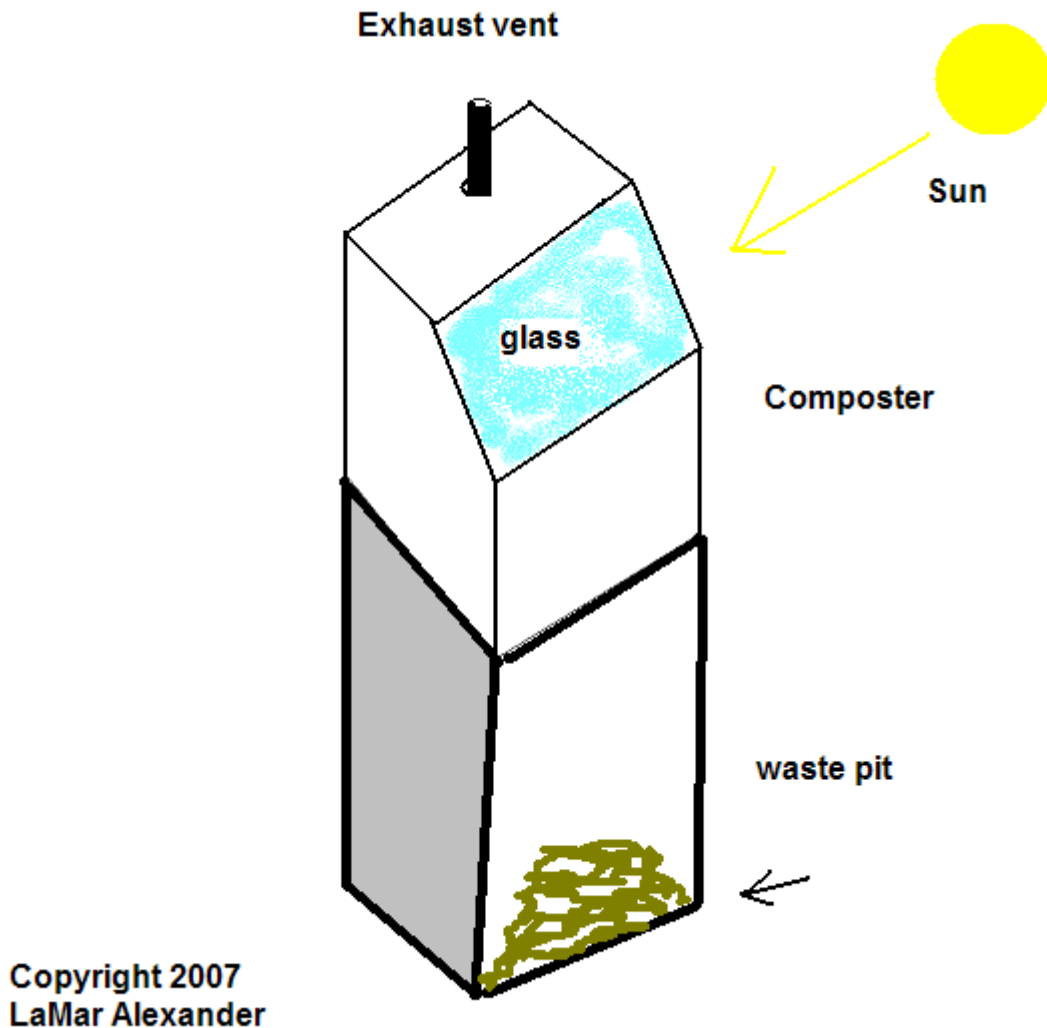
Step #2: Dig 2 compost pits

You will need pits about 3 feet by 3 feet by 3 feet deep. Line them with cement block or brick and line that with several layers of black plastic sheeting. I suggest you build in an area that won't flood, a safe distance from the house, and below your water well. Don't put it where animals or people are likely to fall in!

Step #3: Build your solar composter

You will need two sheets of 4x8 plywood cut to these dimensions. Attach the walls together using 2x4s and deck screws. Make your window out of single or double pane glass or just use a couple layers of clear plastic stapled to the box as I did. Cut a round hole in the top and run a 3 foot piece of black pvc pipe up for a vent. Yes it has to be black as this absorbs heat from the sun and warm air rises making the chimney pull air through quickly. This vent pipe is where the excess moisture will evaporate and also reduces any smell that might come from the composting material.





Step #4: Insulate the compostor with foam sheets (you can get used ones in packing crates) as this will help hold the heat in in winter. Place the compostor over your compost pit and face the window into the south sun.

Sep # 5: Add compost

Just tip the compostor onto its back and dump in your toilet waste.

Put in a little sawdust and a couple handfuls of soil to start the action. Then tip the compostor back over the pit and leave it alone. In the day time the sun will heat that compostor up to high temperatures and the water will evaporate from the waste material. The bacteria and micro-organisms will break down the solids and within a few days you will have a small amount of nice clean smelling fluffy compost left in the pit. Keep adding waste as you create it.

Step #6: When your pit is about 1/2 full of compost stop emptying waste into the pit for a week and let the micro-organisms finish composting. You can stir the compost easily with a clam digger or shovel to get the top waste into the pile deeper. Use your second pit for waste disposal and put your composter over the second pit. Keep the first pit covered with some clear plastic and place rocks around the edges or cover it with an old wood pallet and clear plastic until it is ready to be used. This compost can be used around fruit trees or other non-vegetable plants. Always wear gloves and wash thoroughly when handling any compost material.

Tips: Try to minimize water in waste and do not put any cleaning products in the pit as it will kill the bacteria. You can add kitchen waste but do not put in meat scraps or things hard to break down. In the winter surround composter with straw bales and throw an insulating blanket over it at night or on super cold sunless days to preserve heat. You may still get some freezing on very cold days but the solar composter will heat back up on sunny winter days and the micro-organisms will go right back to work creating compost. It beats the heck out of an outhouse!



Tip: some toilet papers are so full of perfumes and binders that they do not decompose well. Try to get toilet paper that is environmentally friendly. Usually the cheaper toilet papers are better because they decompose faster.

Cleaning products for your toilet are expensive and they are anti- bacterial which means they kill the good bacteria necessary for decomposing waste. If you want to control odor in a composting toilet sprinkle a little sawdust, pine shavings, peat moss, or dried leaves every time it is used.

Sanitary napkins etc. should not be disposed of in a composting toilet. Avoid putting in anything that will not be composted quickly or may kill bacteria or create a health issue.

How to build a solar batch water heater for under \$50

WHAT IS A BATCH HEATER ?

A batch heater as its name implies only heats a quantity of water to be used and then the water is replaced as needed. I only need a few gallons of hot water at any time to be used for washing dishes or taking a shower so a batch heater works better for me than one of those complicated roof top panels.

HOW DOES IT WORK ?

A batch heater is simply an insulated box covered by glass or clear plastic that holds a container of water to be heated by the sun. When the sun shines through the glass its heat is absorbed by the water and you have hot water within a few hours in direct sunlight, even in winter!

HOW IS IT BUILT ?

I will give you directions for a small one use batch heater and a larger batch tank heater.

Small use batch heater

Step #1: build an insulated box

I used cedar fence boards for my batch heater. Screwed together with deck screws and insulated with left over Styrofoam from a packing crate. A good size is 2 feet by 4 feet. Line the inside of the box with aluminum foil to reflect the sun's rays at the water containers.

Step #2: cover the box with glass or clear plastic

I had a couple of old single pane windows sitting around so I used those. I mounted them to the box with a couple of hinges so I could open and close the box easily. You could make a simple frame out of 2x2s covered in clear plastic if you don't have a window to use.

Step #3: Put in your water containers. I built the box big enough to hold six 2 liter bottles so I have enough for two days before refilling.

I use 2 liter plastic soda bottles and I spray paint the back side black to help absorb the heat. Any clean glass or plastic bottle should work.

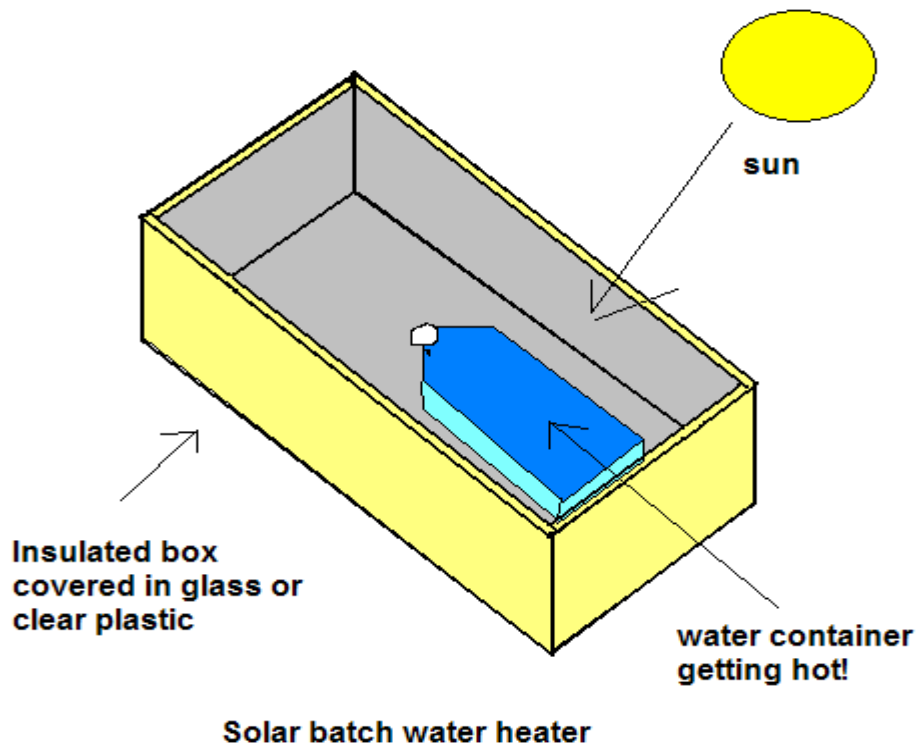
Step #4: Put the batch heater in the sun

I place the batch heater on a bench angled into the direct sunlight and within 3 hours the water is hot enough (sometimes too hot) to wash dishes or take a shower with. I can take out 1 or 2 bottles at a time and use and refill them quickly. The water will stay warm until late evening and may freeze in winter nights but the sun will thaw and heat it right back up the next day.

Well that's all there is to it!

I like the convenience of grabbing a hot bottle of water to put in my dishpans and because I use only 2 gallons of water to shower in I can mix my hot water into my cold water to get just the right temperature. This system works especially well for small use and I don't have to worry about pipes freezing and bursting as happens with big systems.

Here's a simple picture to show you my design:



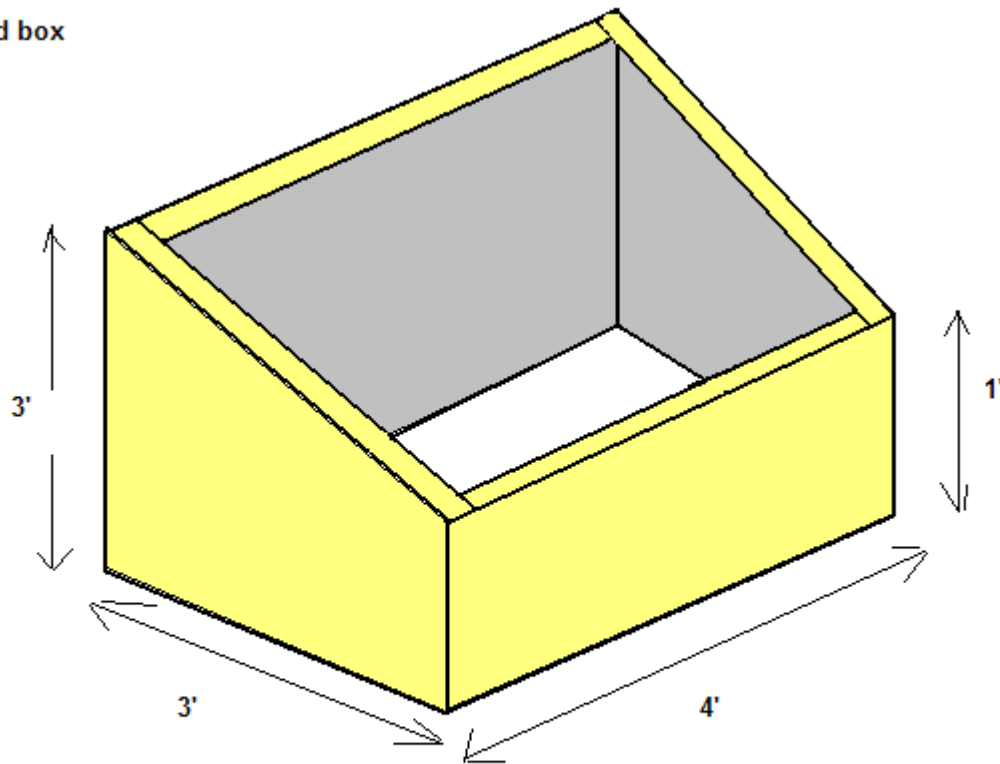
WARNING! The water in these containers can reach scalding temperatures so handle with care and do not allow children to handle or open containers.

Large batch heater

Step #1: get a metal tank- old water heater tanks work great as long as they do not leak. Empty out any hard water deposits and replace the anodes if gone or to badly deteriorated. Spray paint the tank flat black to absorb heat.

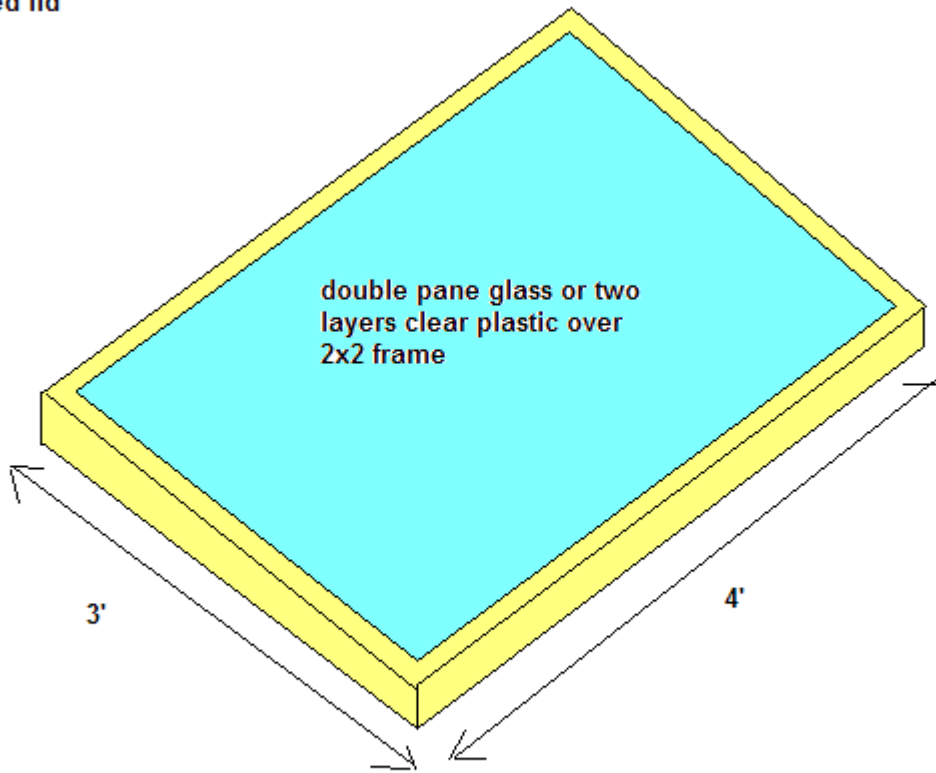
Step # 2: Build an insulated box. The dimensions will vary with the size of tank you are using but here's my dimensions. Use Styrofoam, polystyrene or batt insulation, old carpet pad, or cork board and insulate all walls and the bottom of the box. Cover the insulation with aluminum foil shiny side out to focus the sun's rays onto the tank.

Insulated box

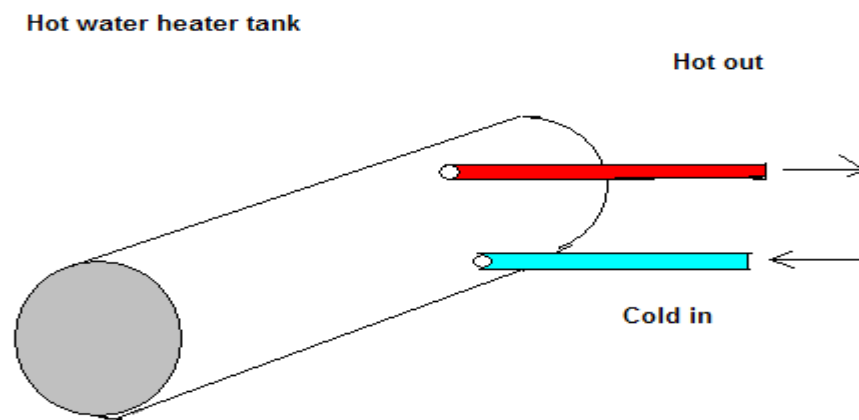


Step #3: Build the lid. I used 2x2s and an old double pane window but you could use two layers of clear plastic wrapped around the frame and stapled in place.

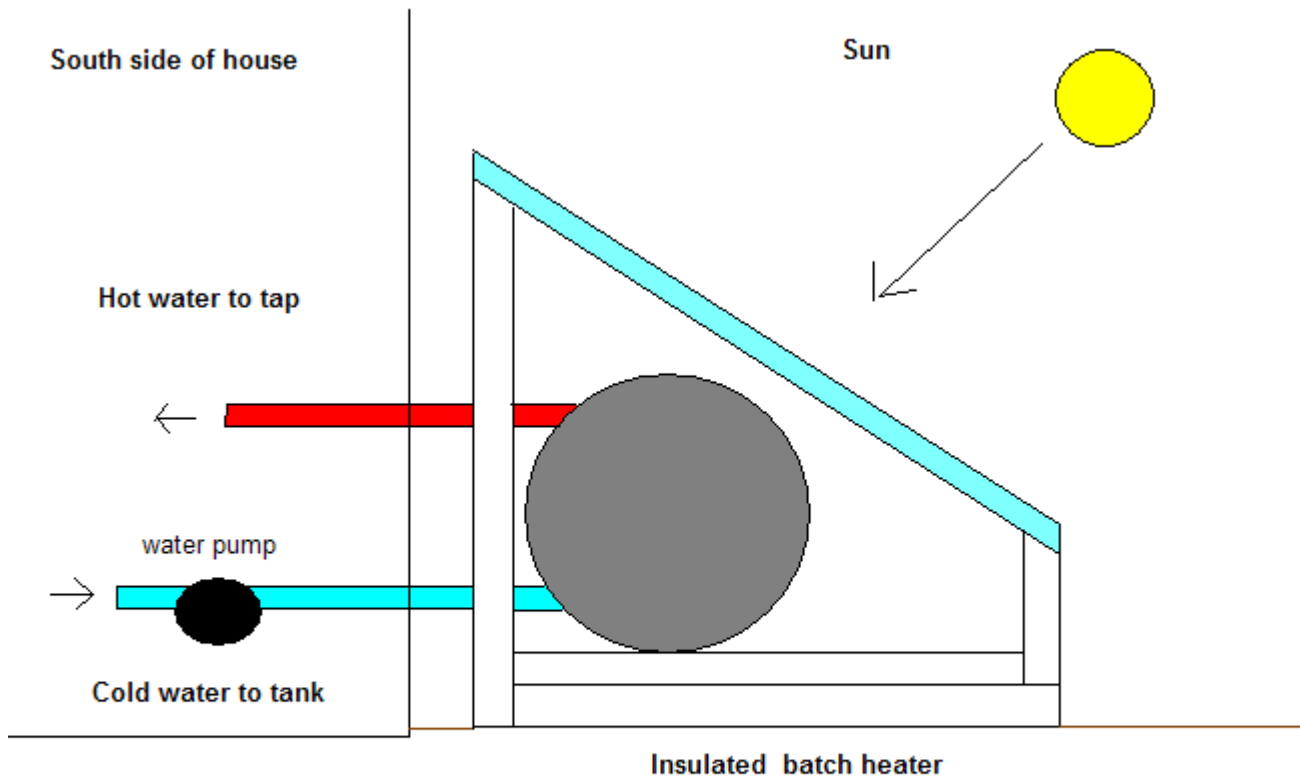
Hinged lid



Step #4: Install your tank in the box with one outlet higher than the other. The upper outlet will be the hot water outlet and the lower will be the cold water inlet. I used pex pipe for my inlet and outlet because its flexible but you could use any metal pipe just remember to insulate both pipes to prevent freezing and heat loss.



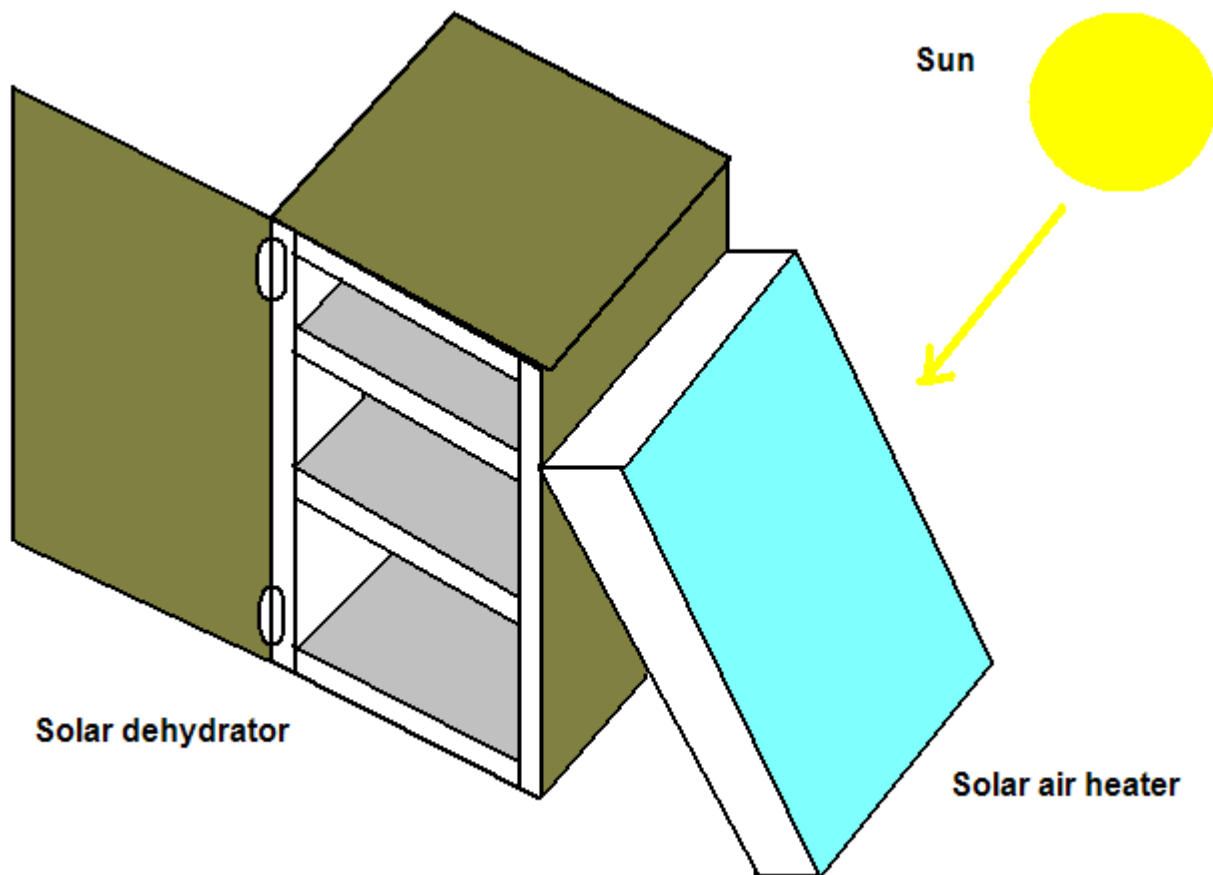
Step #5: Hook it into your water system. I use a 12 volt dc pump that pumps cold water into the tank when it senses the water being drawn out through a tap. Insulate both inlet and outlet pipes to prevent freezing and heat loss.



HOW IT WORKS: Place the box and tank so it gets full southern exposure and within 3 or 4 hours the tank water should be warm or hot. When you turn on your hot water tap the pump will push cold water in to the tank and hot water out to the tap. This tank usually will not freeze overnight even in winter unless you get 2 or 3 days without any sunshine but pipes are more vulnerable to freezing. If using this batch heater in winter I suggest covering it at night with thermal blanket to prevent heat loss. Many people use these for seasonal use and drain the tank in winter.

Caution! This water may be scalding hot so be careful and monitor children. Cover the box with an insulating blanket on cold nights to hold the heat inside.

Solar air food dehydrator For under \$50



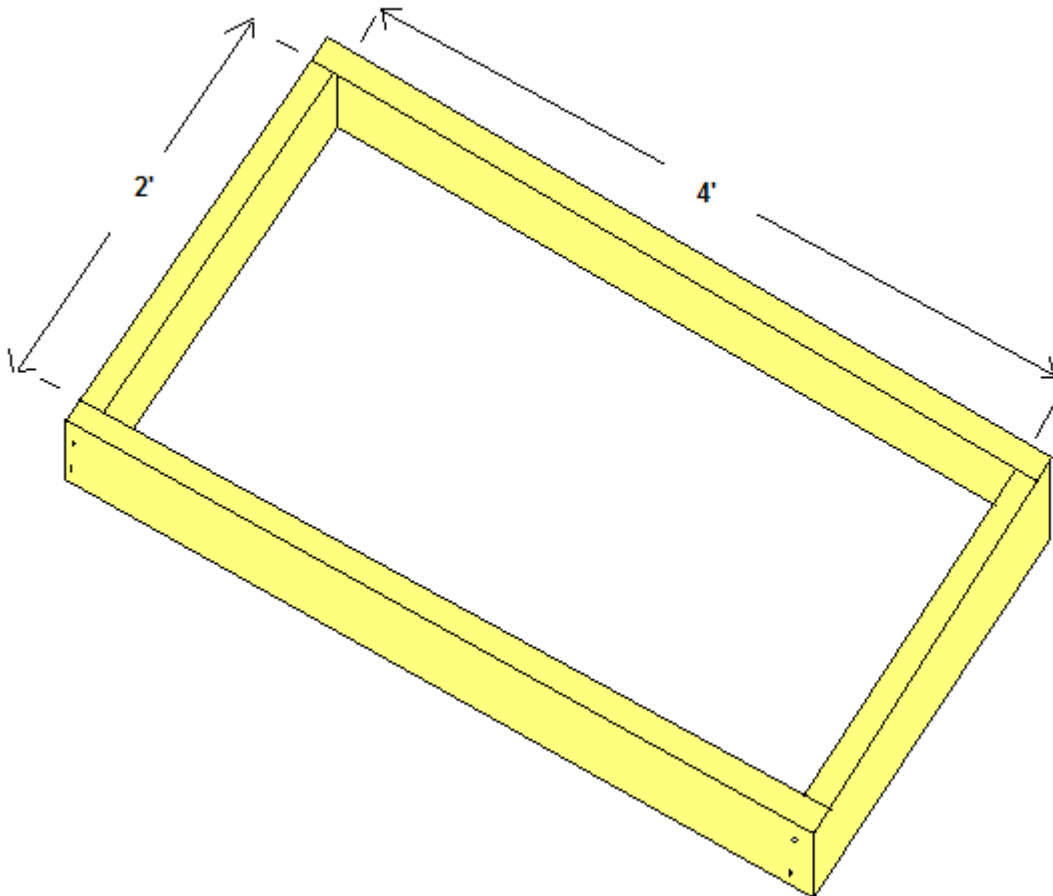
This is a great project that can be used to dry your summer vegetables and fruits (not recommended for meat).

First I will give directions for building a simple solar air heater and then we will build the dehydrator.

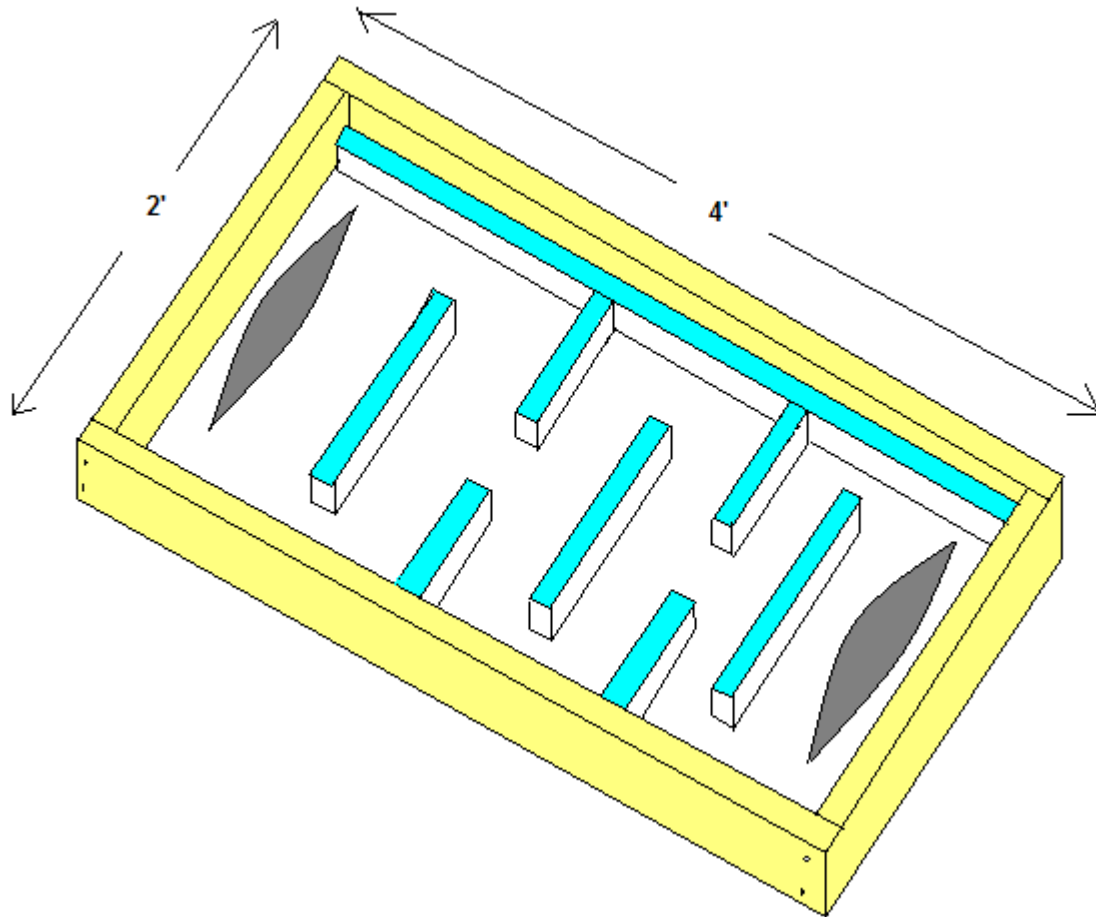
The air heater is basically a shallow box that holds a metal corrugated roof panel painted black. The box is covered by glass or clear plastic and has an air inlet at one end and an air outlet at the other. When placed in the sun the solar rays will penetrate the glass and heat the metal panel. This heat is then transferred to the air in the box. Warm air rises and exits the box and cool air is pulled in and this is called a thermal siphon reaction. By creating a diversion in the air's travel path we can keep the air in the box a little longer so it gets quite hot (300 - 400 degrees) on very sunny days. That's a lot of heat, and when the box is attached to your dehydrator you can effectively dry foods.

Materials: You will need two 2x4x8, one 4x8 wafer or plywood sheet, one 2x4 metal corrugated roof panel, one 1x2x8, flat black spray paint, handful of 1 inch wood screws, tube of caulk, small length of flexible vent duct, and either a 2x4 piece of clear glass or clear plastic. You may have most of these materials sitting around but even purchased new you can get it all for under \$50. Glass works best and most window shops have old storm windows they sell or give away if you ask around.

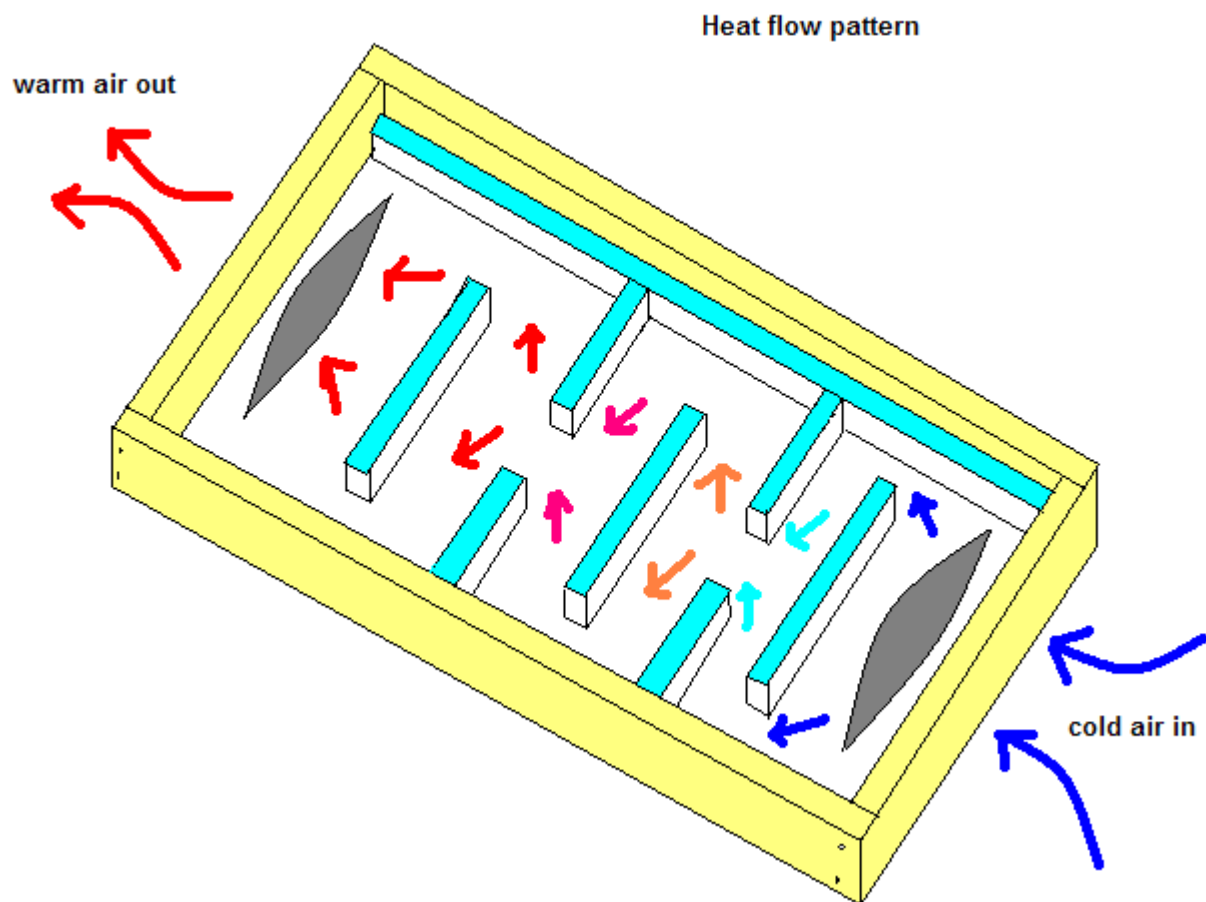
Step #1: build your box out of 2x4s as shown using wood screw. Note the inside dimensions must be 2x4 or fit your corrugated panel.



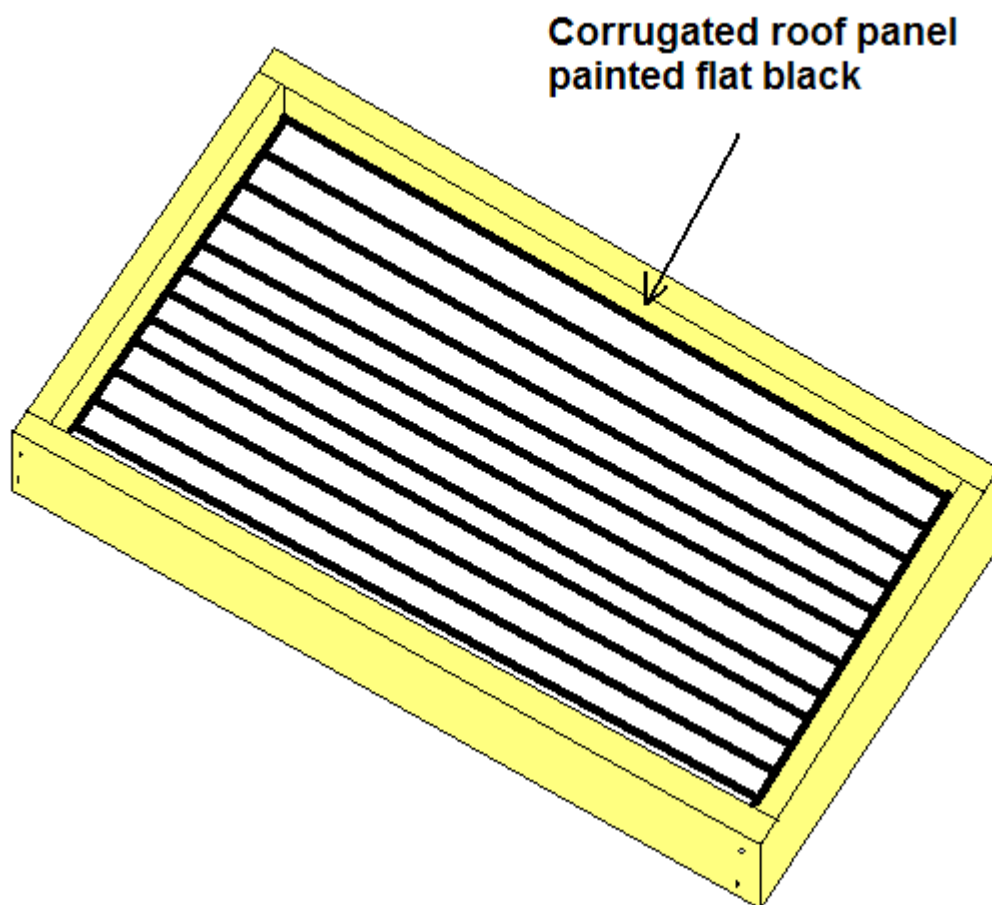
Step #2: Attach the back made of plywood and the braces made of 1x2s, Seal the inside edges with caulk to prevent air leaks. Cut a vent opening in the back panel that is the same diameter as the flexible vent duct you are using. Cover the bottom vent hole with screen to prevent insects entering.



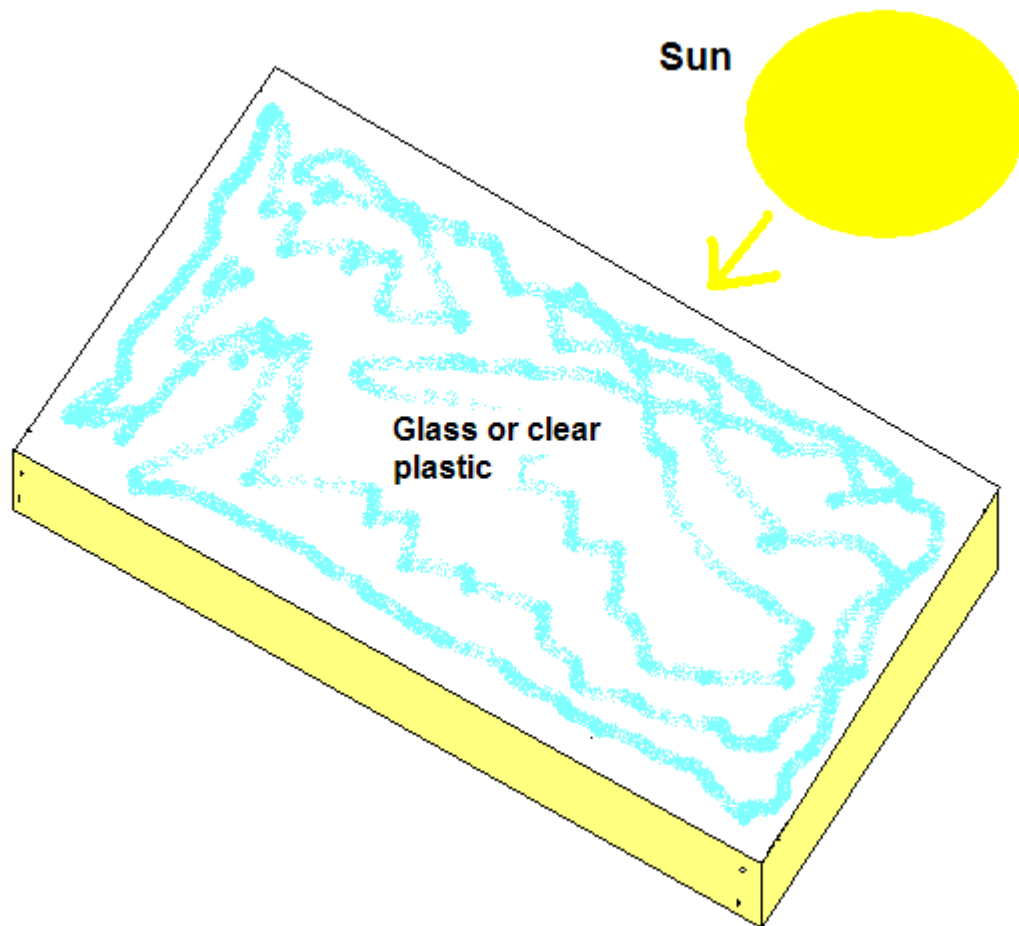
This drawing shows air movement through the solar air heater:



Step #3: Paint the corrugated metal panel flat black and install it in the box. Seal all edges with caulk.



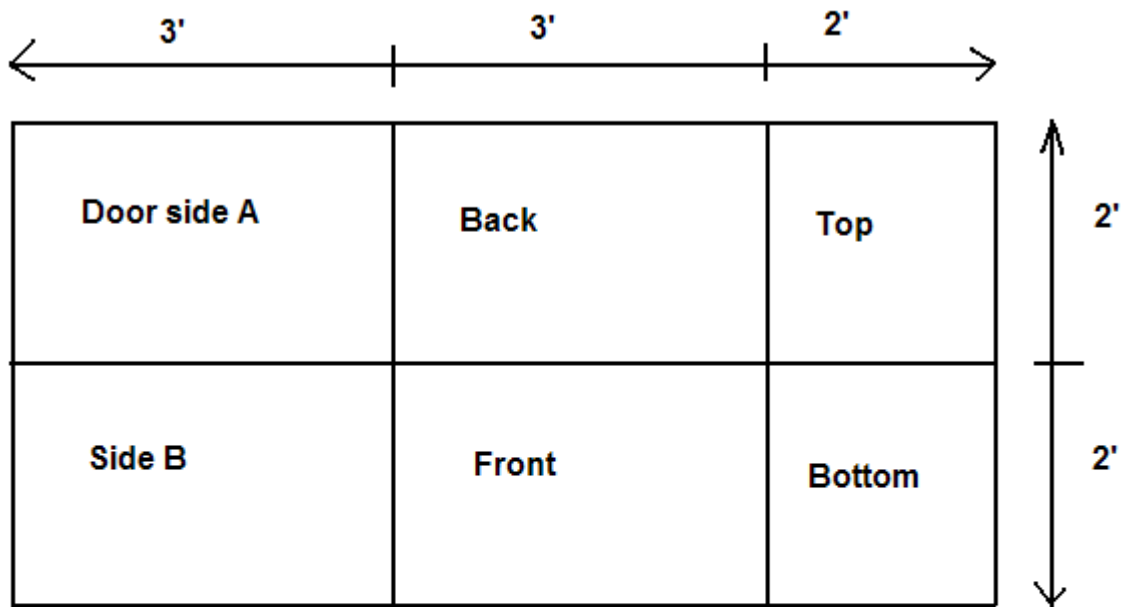
Step #4: Cover the box with your glass or clear plastic and seal all edges with caulk.



That's all there is to a solar air heater. If you place this facing the direct sun within just a few minutes you will feel warm air flowing out of the top of the heater. Now we need a dehydrator with food racks to capture that warm air and dry some food!

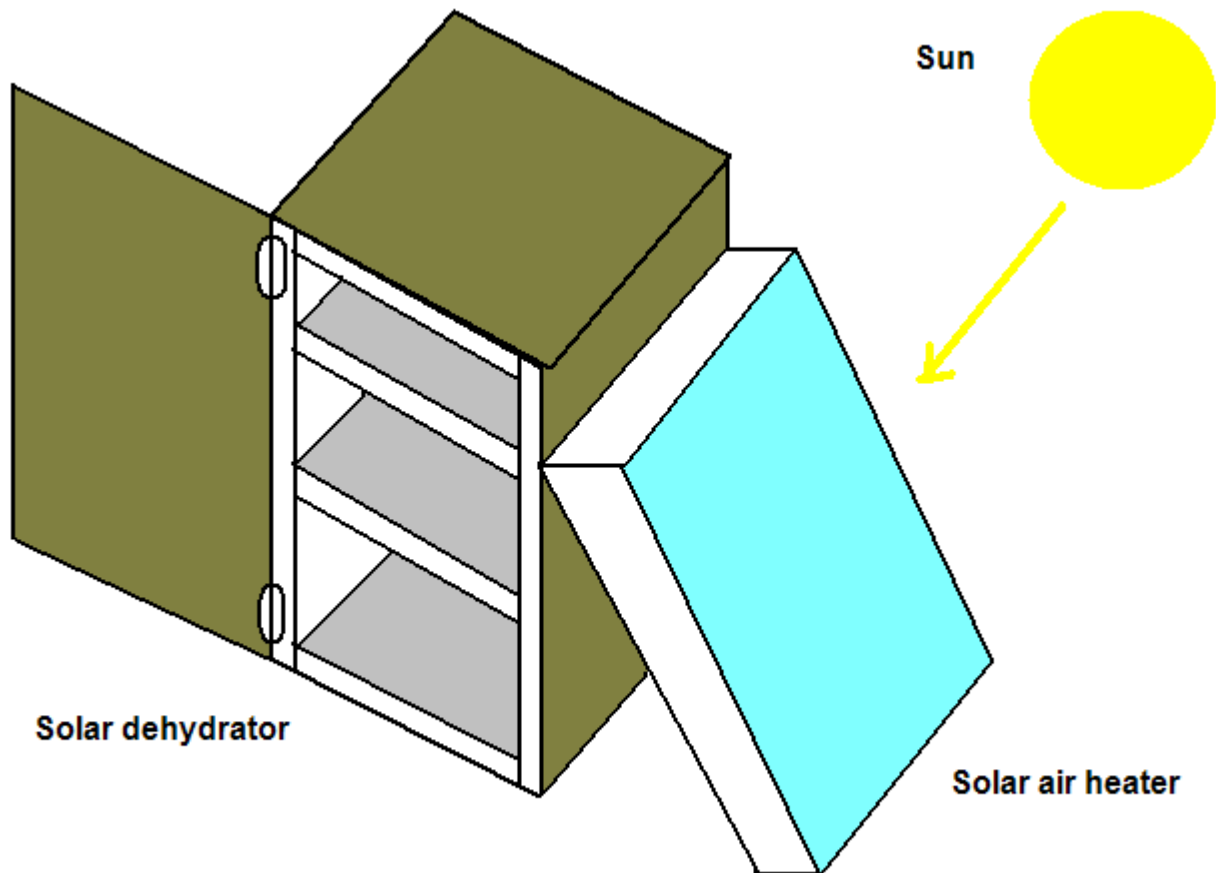
Materials: You will need a 4x8 sheet of plywood or wafer board, two 1x2x8, some wood screws, tube of caulk, roll of fine mesh screen, and two small hinges.

Step #1: Cut your plywood as shown.

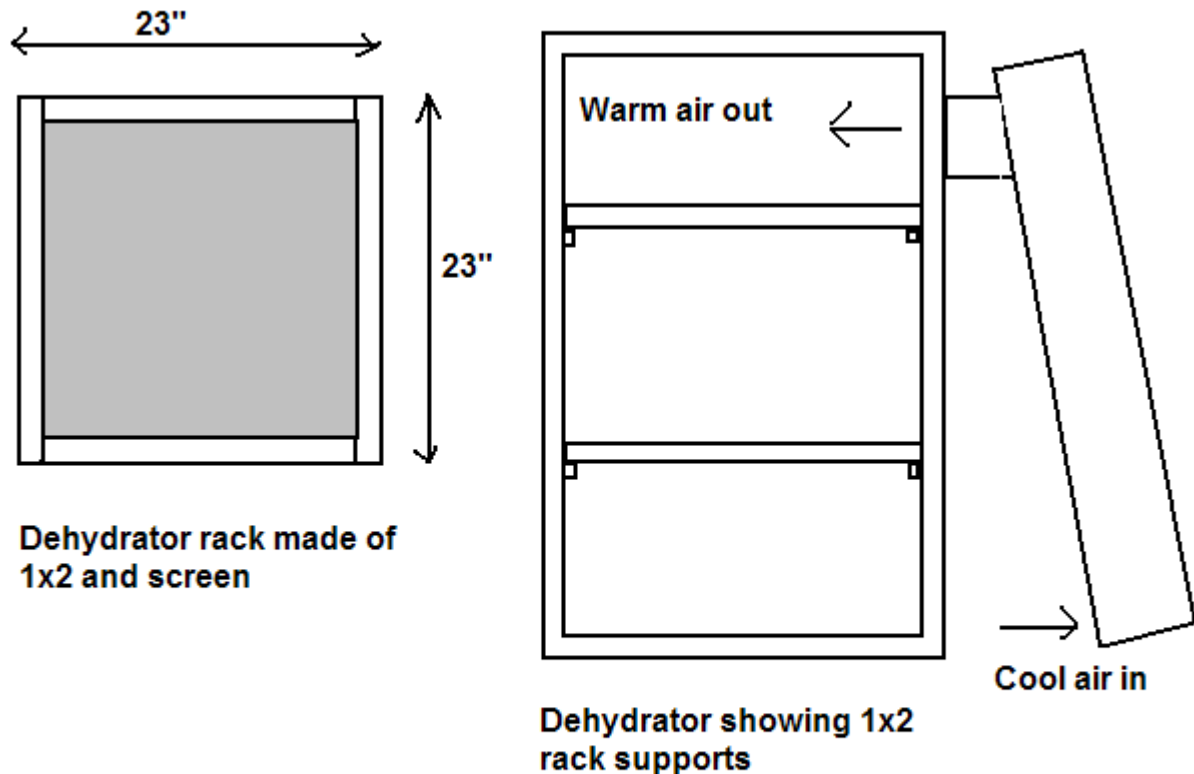


4 x 8 plywood or wafer board

Step#2: Build you 2x3 box using 1x2 braces. seal all interior edges with caulk to prevent air leaks. Attach the door panel with 2 small hinges.



Step #3: build your food racks out of 1x2 cut to these dimensions and cover with fine mesh screen. Install rack supports made out of 1x2 pieces.



Step #4: Connect the solar air heater to the dehydrator using wood scraps or flexible vent duct. Cut a hole in the side of the dehydrator where you want the solar air heater to enter. This hole should match the diameter of the hole and flexible vent duct you are using. Install duct and seal edges with caulk.

You are now ready to dehydrate some yummy vegetables or fruits. Place the air heater in direct sunlight and place your foods to be dried on the screen racks. Leave space around foods for air circulation. Close the door and don't open it again for 4 hours or you will let out valuable heat. Most foods will be dry in 4 hours on warm sunny days but especially wet foods or low light days may take longer. Dried foods can be safely stored in any clean sealed bottle and do not require refrigeration. This dehydrator works excellent for me and I enjoy dried apples, bananas, grapes, apricots, cucumbers, squash chips, tomatoes, and more..... so enjoy!

How to build a solar oven for under \$50

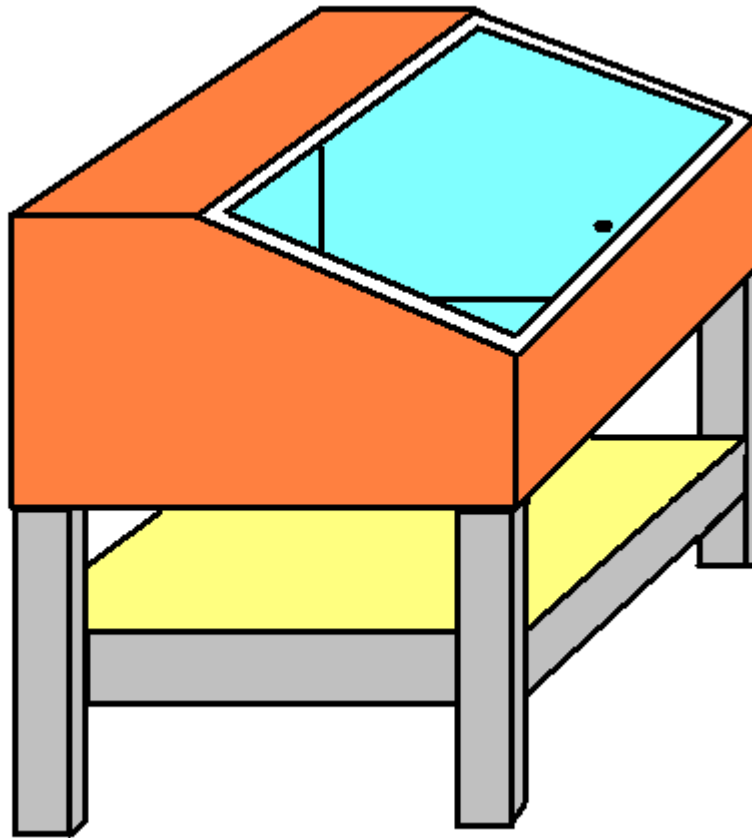
If your cabin is in an area that gets at least 4 hours of good sunshine a day then you might like to build this inexpensive multi-use solar oven. This oven can be used to slow cook various meals from stews to meats, re-heat cooked foods, and heat water. It can be built from new or salvaged materials and best of all it costs less than \$50 to build and can be used year round.

When I first moved into my cabin I didn't have any propane appliances and I cooked on my woodstove. This works fine in a pinch but being single and working in the day meant coming home to a cold woodstove and a long process to fetch wood, light a fire and wait for it to heat up enough to cook a meal. I also like a nice hot sink of water to wash off the days dirt or wash a small load of dishes. I designed this solar oven to take advantage of the sun and be multi-purpose for both cooking and heating water. I would fix up a stew, casserole, or meat dish and place it in the oven before leaving for work and by the time I got home in the late afternoon it would be cooked and ready to eat. Along with my food dishes I placed a couple of 2 liter water bottles in the oven and these would be very hot by the time I got home and just right for a wash off and do my few dishes.

How it works: The oven is a simple box angled to collect the sun's rays through a top of clear glass or plastic. The inside of the box is insulated and covered with shiny aluminum to bounce the sun's rays around inside the box. Food containers in black metal dishes will absorb the heat in the box and slow cook. Water in 2 liter jugs will heat up to above 100 degrees. The inside of the oven temperature will average about 100-120 degrees on sunny days and this can be increased to 300-350 degrees using the reflectors as described.

Here is the solar oven without the reflectors attached:

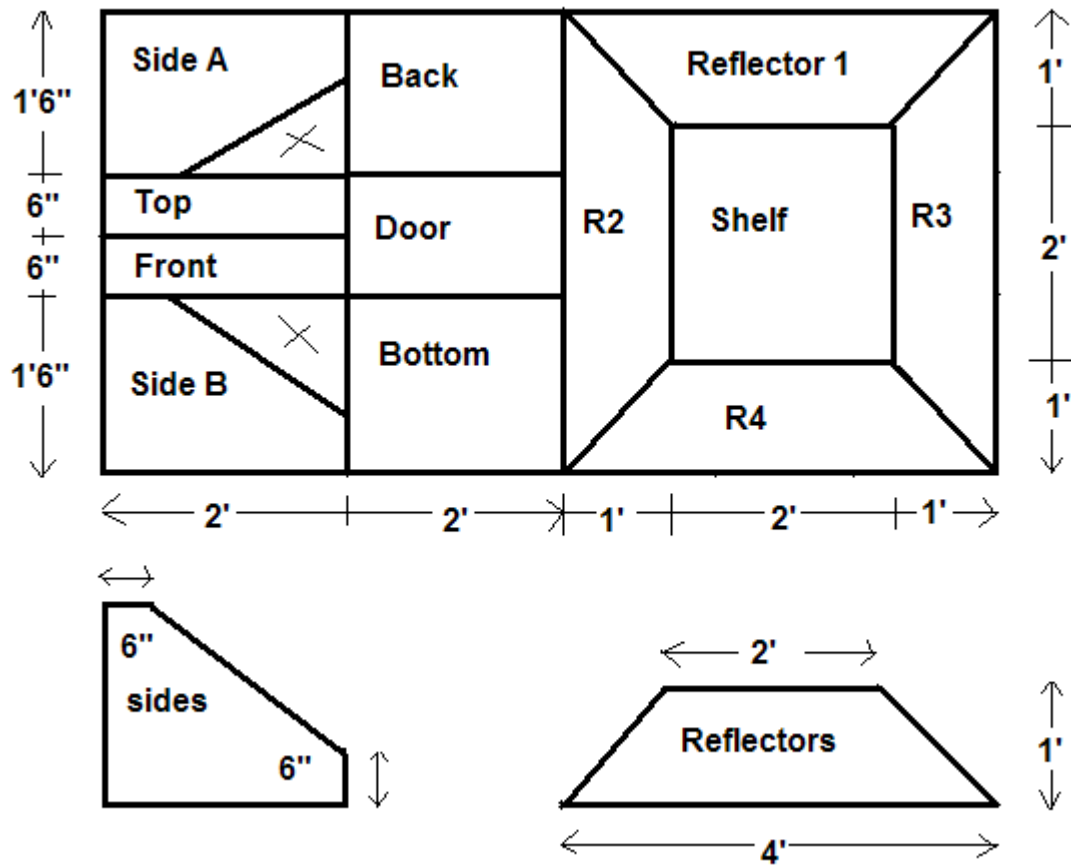
Solar Oven



The solar oven is 2 feet deep, 2 feet wide, and 1 1/2 feet tall. This is a good size for a small family but you may want to increase size if you cook a lot of food. The oven is designed to be free-standing but you could easily attach this to the south side of your house and cut a door through the back panel to allow you to access the oven directly from kitchen. The oven could also be built without legs making it easily portable for camping or travel.

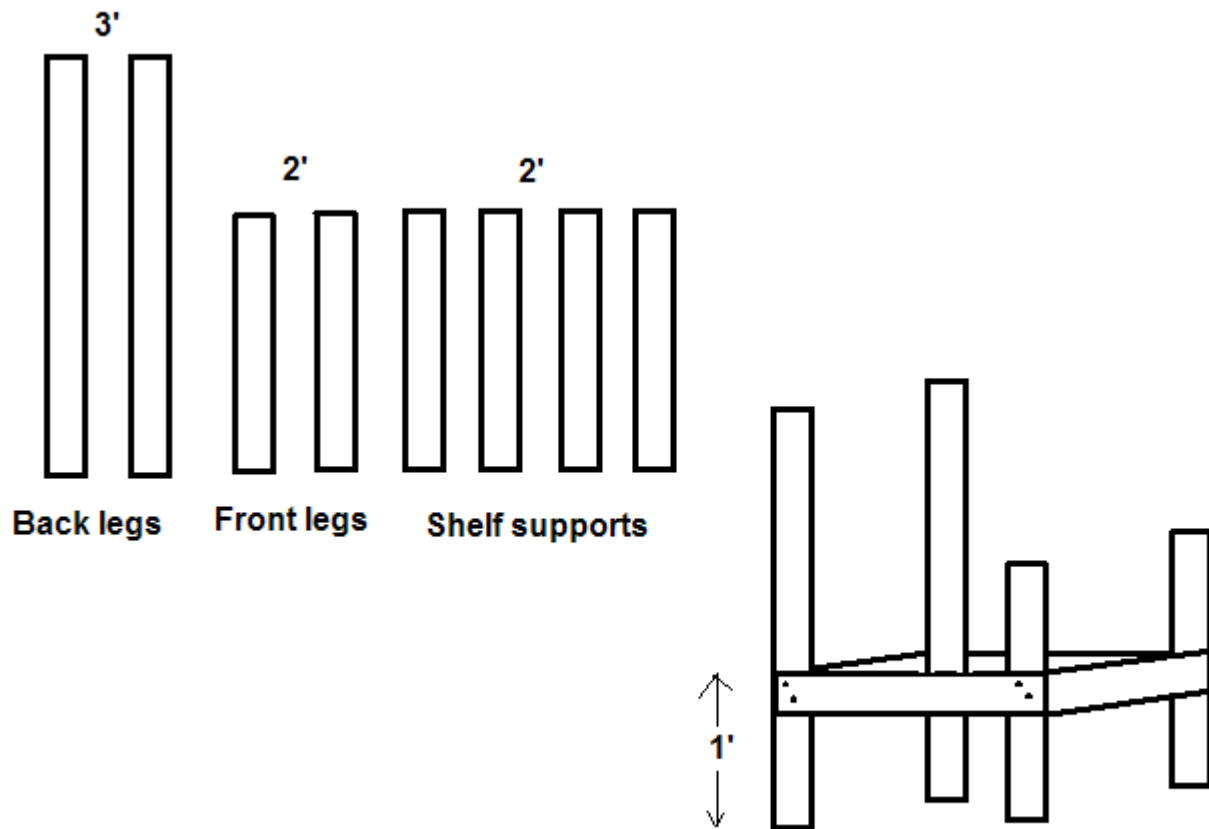
Materials: You will need one 4x8 sheet of plywood or wafer board, two 2x4x8s, a 1 foot 6 inch x 2 foot piece of glass or clear plastic, some Styrofoam insulation to fit inside (salvage from packing crates or use old carpet pad or cork board), a couple rolls of heavy duty aluminum foil, a handful of wood screws, and a tube of caulk.

Step #1: Lay out your oven design and cut the pieces out of the 4x8 sheet using a hand or power saw as shown here:



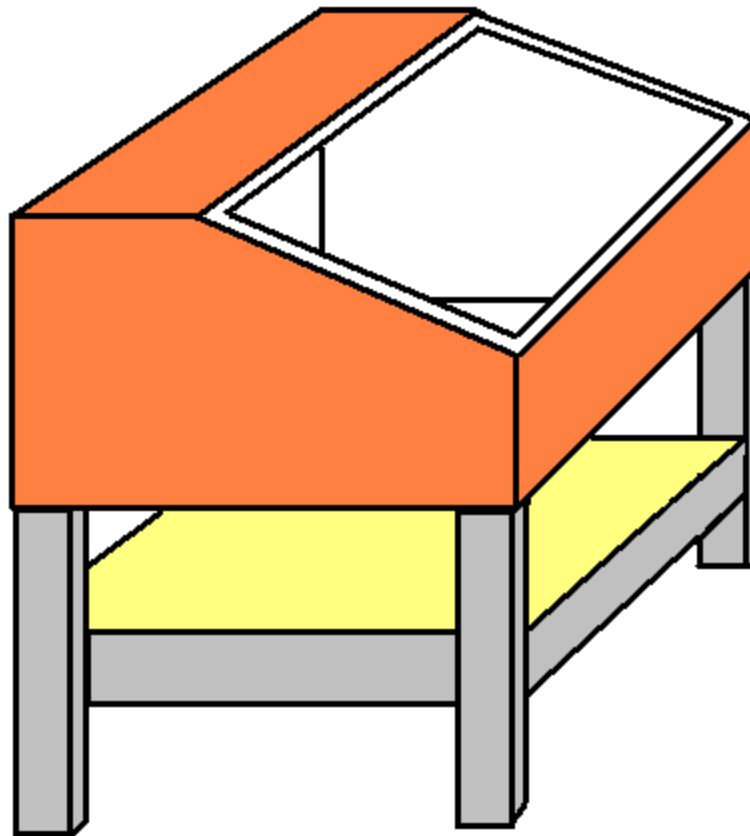
Note: The reflectors and shelf are optional

Step #2: Cut a 2x4x8 into the lengths indicated here and attach together using wood screws to make a frame and legs for the oven:



Step #3: Attach sides, back , front, top bottom and shelf to the frame using wood screws. Caulk all inside joints as shown here:

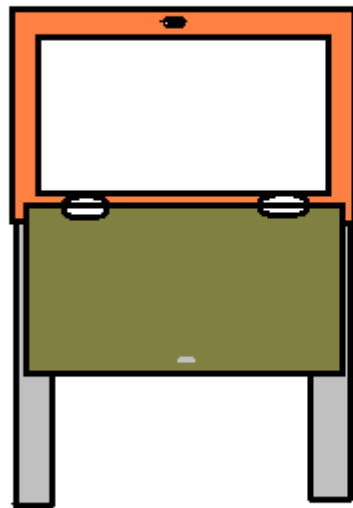
Solar Oven



Step #4: Insulate the entire oven box with styrofoam, cork, or carpet pad and line the interior with aluminum foil. I used old styrofoam from packing material but any material that will add insulation even cardboard could be used. Staple or tape the aluminum foil so it makes a nice clean reflective surface on all interior walls.

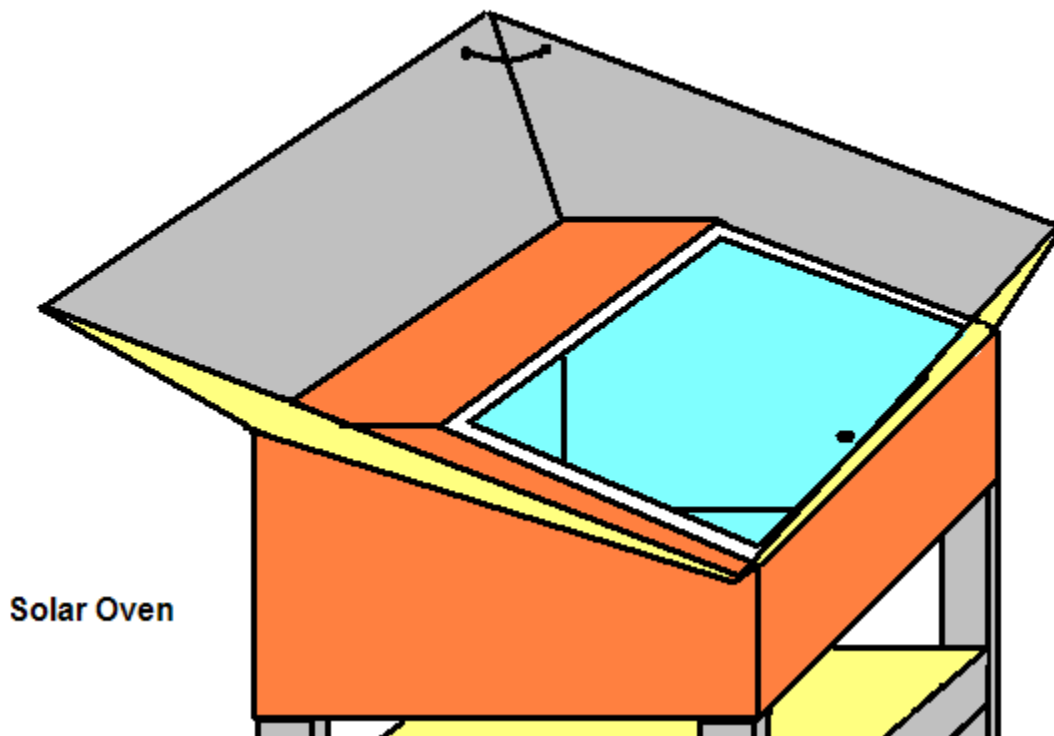
**Step #5: Build your lid. This can be made out of a single piece of glass or plastic or an old window you have sitting around or you can use two layers of clear plastic sheeting stapled to the box if that's all you have. Seal all edges with caulk and tape.
THE OVEN MUST BE COMPLETELY AIR TIGHT OR YOU WILL LOSE VALUABLE HEAT!**

Step#6: Cut a 1 foot by 1 foot 6 inch oven door in the back panel and using a couple of small hinges attach the oven door so it covers the opening. This door will be used to insert your food and water dishes. Make sure the door seals tight and add a small latch to keep it sealed.



Back of oven
showing oven door
placement

That's all there is to the construction of the basic oven. This unit will work great to slow cook food and heat water but if you want a really hot oven for faster cooking then add the optional reflectors. Reflectors should be attached to oven using hinges so they can be folded down when the oven is not in use. A small eye and hook latch will secure each reflector at the corners in the upright position. Cover each reflector with shiny aluminum foil or you could use mirrors if you want even better sun reflection. **BE ADVISED- THE SUN REFLECTING OFF THESE REFLECTORS CAN CAUSE BURNS AND EYE DAMAGE!**



HOW TO USE OVEN: prepare your food dish in a black pan (cast iron works excellent) and cover with a black lid. Vegetables and meats should be cut into small pieces or strips for best results. Put in a little cooking oil to keep things from sticking. Soups and casseroles cook especially well in the oven. Place the dishes in the center of the oven where they will get the most reflected sunlight. Allow 4 hours of direct sun to cook most foods and 6 hours in low light conditions. Check foods with an oven thermometer before eating to be sure it is fully cooked. Water can be heated in a pan or I use 2 liter plastic jugs. Spray paint the outside black to absorb more heat. **BE CAREFUL THIS WATER CAN REACH SCALDING TEMPERATURES, NEVER ALLOW CHILDREN TO OPEN HOT CONTAINERS OR USE THE OVEN!**

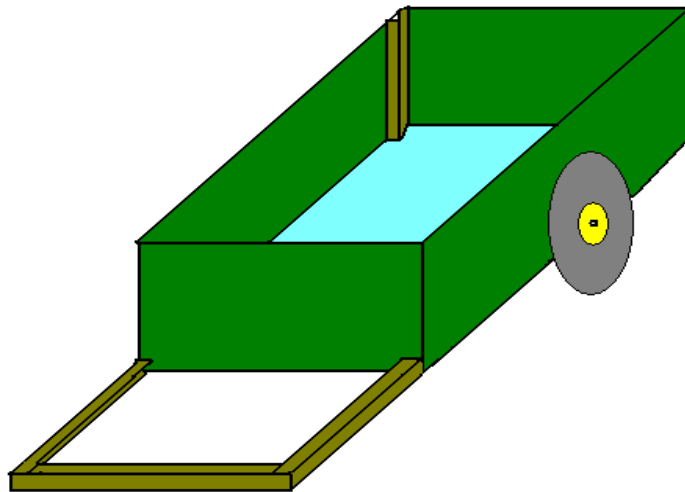
Now go build one and enjoy the food and free energy you have created!

Garden Cart Plans

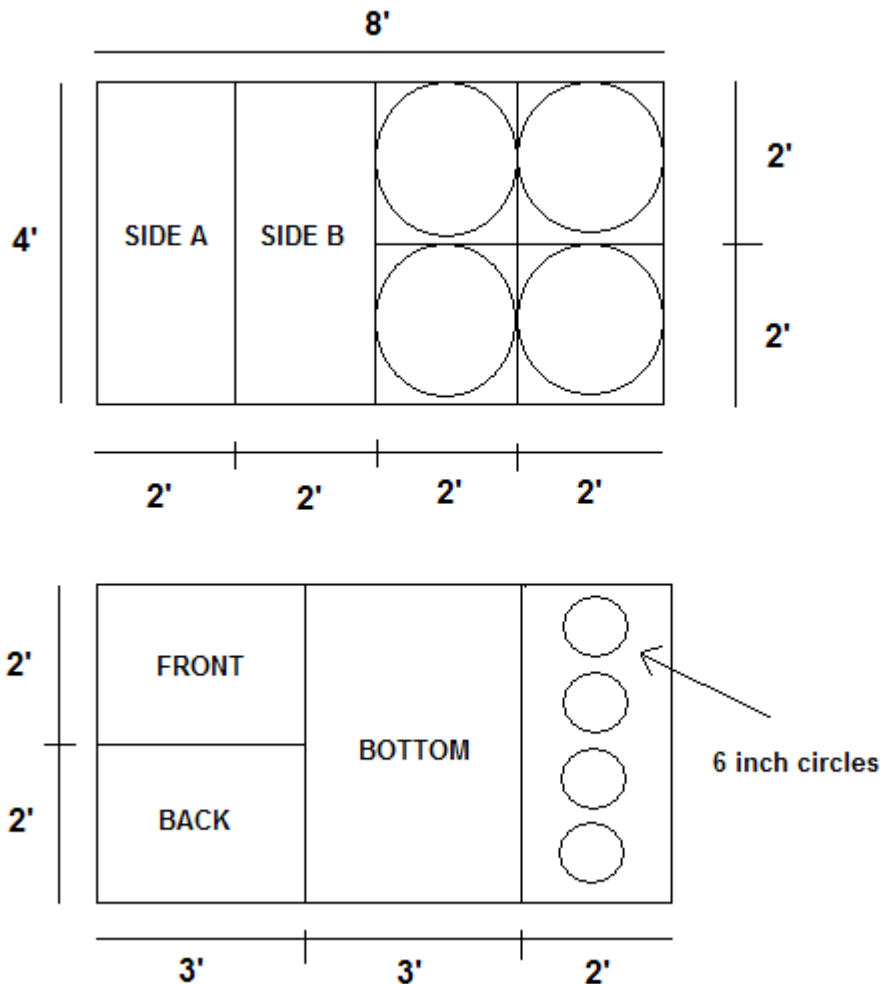
This simple to build sturdy Garden Cart will be useful to move lots of stuff around your yard or homestead. I use mine for moving bales of hay, rocks, rolls of wire, leaves, firewood and a multitude of other stuff. I find it much more useful than a standard wheelbarrow because it holds much more and its box shape is better for stacking things like wood and bales. It can be tipped and the rear panel removed for easy unloading. Best of all it can be built for under \$50 !

Materials: I used cheap wafer board for my Garden Cart but if you want to spend a little more any good outdoor plywood will work. You will need two sheets of 1/2 inch 4 foot by 8 foot plywood or wafer board. Wafer board cost \$12 per sheet or \$24 for two. You will also need four 2x4x8 pine studs at \$4.00 the cost is \$16 for four. You will need a 1/2 pound of 1 inch deck screws at \$2.00, twenty 3 inch deck screws at \$2.00, two 6 inch gable screws for the axles at \$1.00, and 4 large washers that will slide over gable screws at \$1.00 . You will also need some wood glue at about \$2.00 That's a total of \$48.00 not including tax. While not necessary you may want to make a rubber tire to protect your wood wheels and you can make this out of any old piece of garden hose you can find.

Tools: You could use hand tools but I used a power drill driver , Jig saw, skill saw, and wrench.



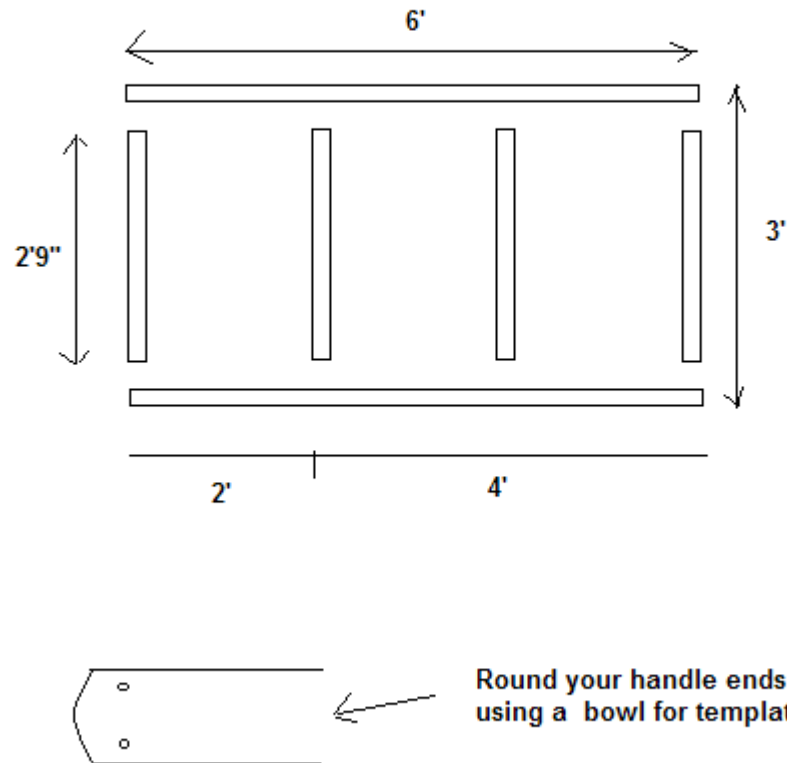
Step #1: Lay out your 4x8 panels and using a straight edge and tape measure lay out your design for cutting as shown here:



Step #2: To draw the wheel circles I used a piece of string 2 feet long attached by tack to the center of the 2x2 board and swing it around in an arc with a pencil attached to the other end. After you have one good circle you can use it as a template for the other circle wheels. Make sure the wheels are round or your cart will wobble when rolled. I used a round bowl approximately 6 inches in diameter to draw the wheel hubs.

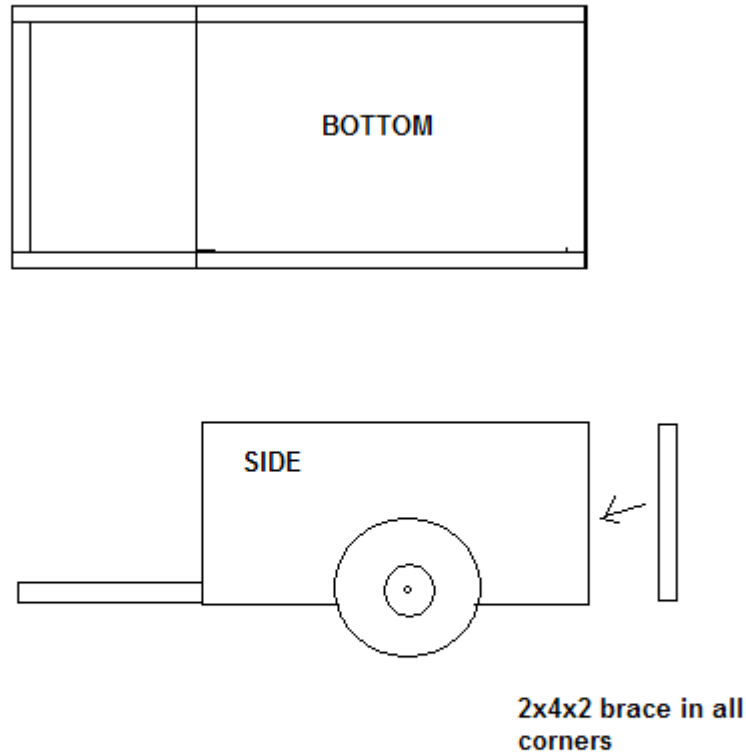
Step #3: Cut out your parts using your jig saw being careful to keep wheels round.

Step#4: Build your Cart frame from your 2x4s as shown:



Step # 5: Cut your 2x4s with the skill saw and attach the sides to the supports using two 3 inch deck screws at each joint. if you have some wood glue I would put some on each joint for additional support. I used a bowl to make the handle end of my cart round so it won't dig into the dirt or my hips when moving the cart.

Step #6: Attach the cart bottom to the frame using the 1 inch deck screws. Then the sides, and back. Use 2x4x2 brace in each inside corner of the cart. Slide the front panel into the cart behind the 2x4 brace so it can be removed for dumping.

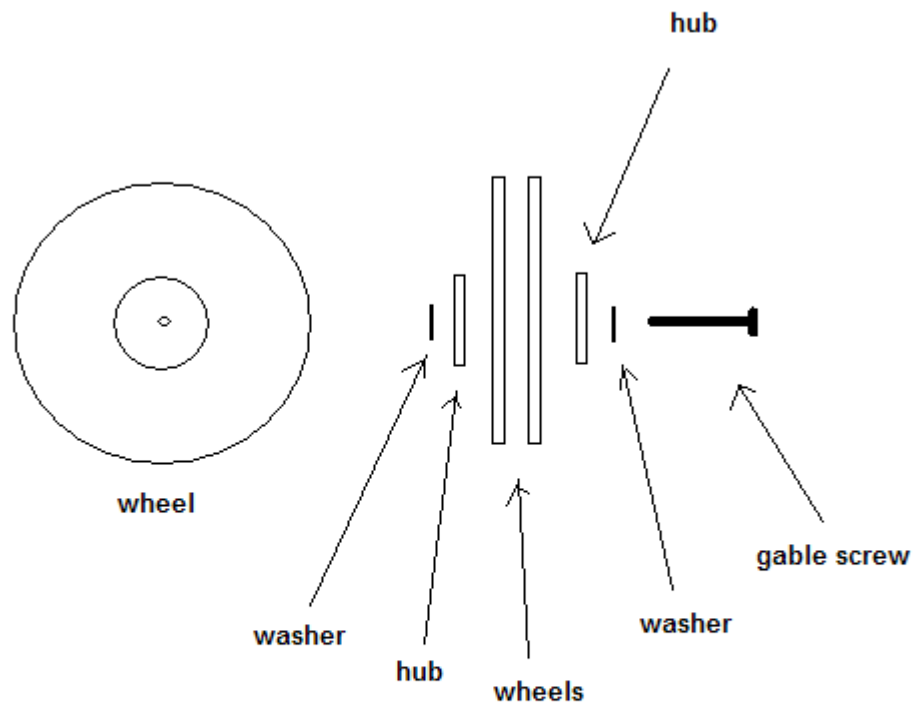


Step #7: Drill a pilot hole into the center of the cart at the bottom edge where the center brace meets the side brace. This hole should be slightly smaller than the gable screw that you will use for the wheel axle.

Step #8: Attach two wheel circles together with glue and 1 inch deck screws to form one thicker wheel. Do this again for the other wheel.

Step #9: Place a 6 inch hub cut out in the center of both wheels on both sides as shown. Use glue and one inch screws to attach the hubs.

Step #10: Drill an axle hole through the center of the wheel hubs for both wheels. This hole should be the same diameter as the Gable screw you are using. To big and the wheel will wobble.

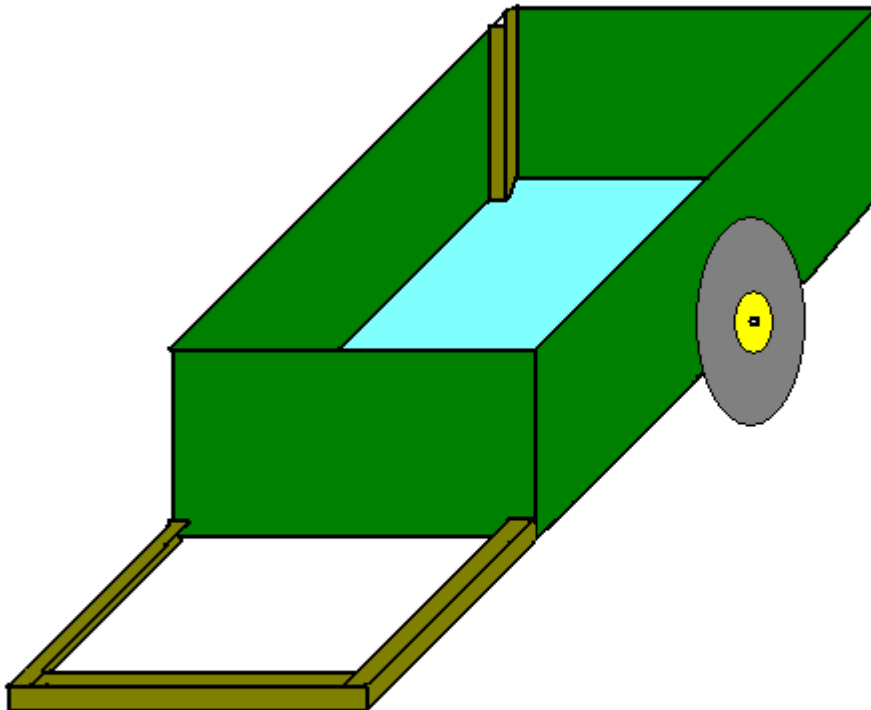


Step #11: Attach the wheels to the cart as shown above. Use an open or socket wrench to screw in the gable screw through the wheel into the frame. Tighten the screw fully to slightly compress the washer. Don't worry about the wheel not turning. It will be tight at first but will loosen up quickly with use.

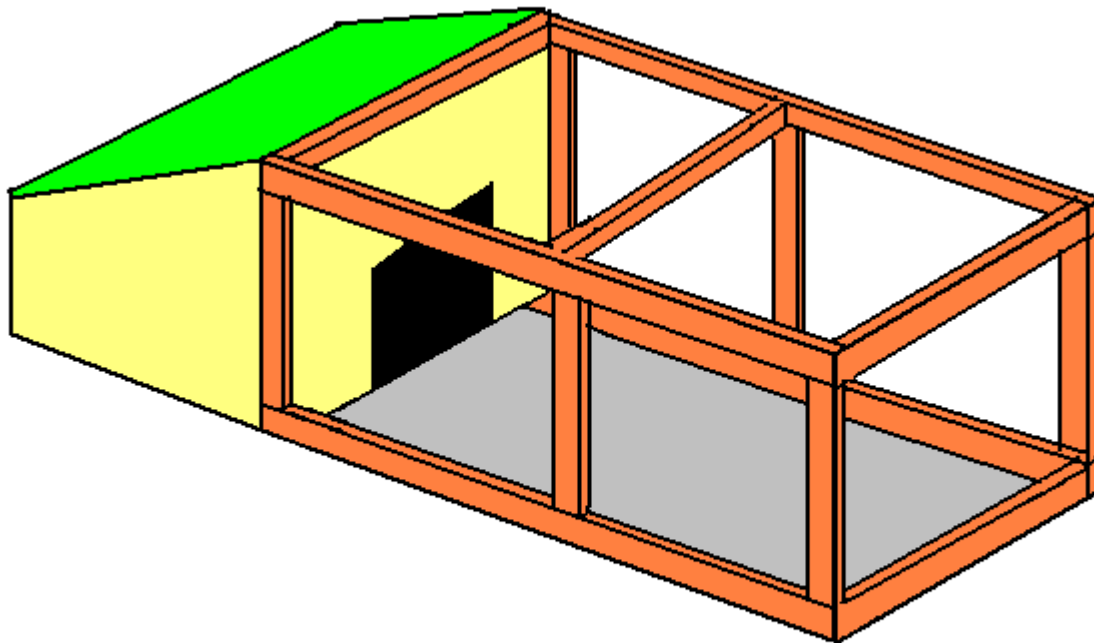
Step #12: This step is optional but if you want to make a rubber tire to go around your wheel you can make them by simply cutting an old rubber garden hose. The hose should be 8 feet long for each wheel. Slice the hose in a straight line from one end to the other and open up the cut and slide it over the wheel to act as a tire. You can attach the ends of the hose to the wheel with a couple of 1 inch deck screws and some glue.

Step #13: Also optional, I suggest you paint your cart with a good outdoor weather proof paint to protect the wood surfaces. Don't forget to do the wheel edges as this area will absorb water from the ground first.

Well, that's all there is to making this simple sturdy cart. If you build it I am sure you will be very pleased with all the work it will handle. Good luck!



How to build a Portable Chicken Tractor For under \$50



Portable Chicken Tractor

What is a portable chicken tractor ?

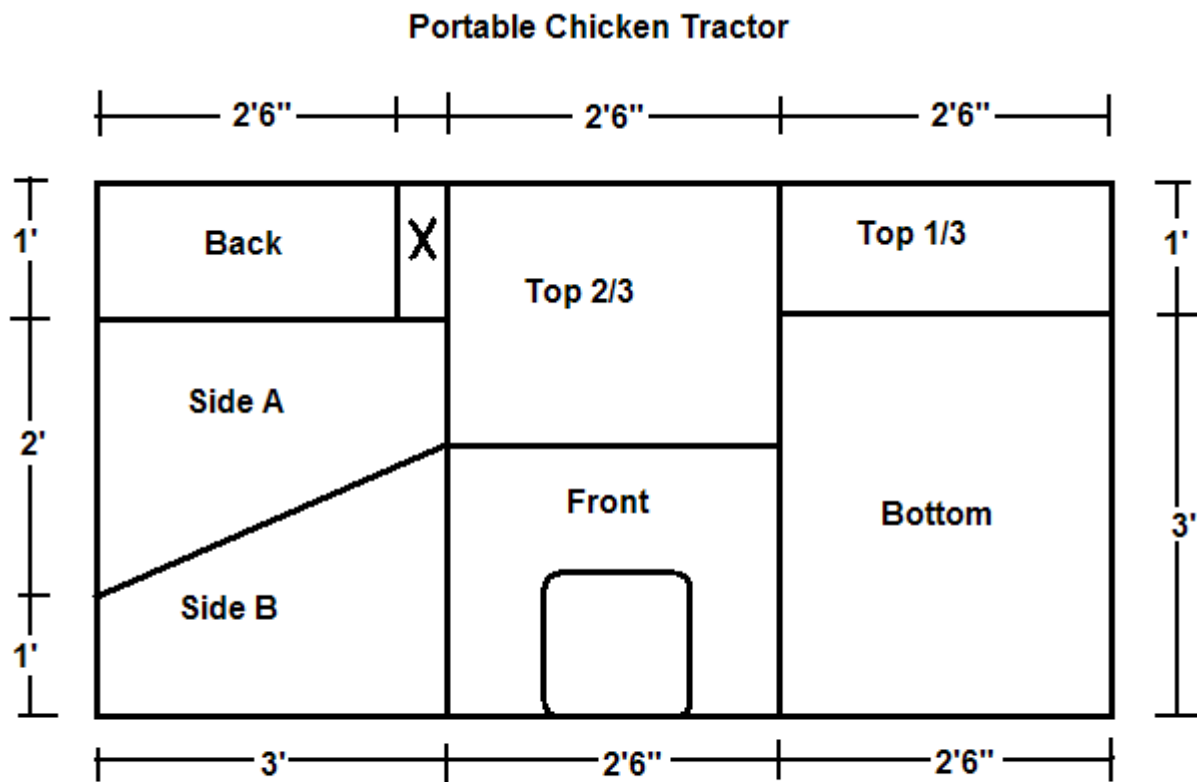
If you have ever raised or been around chickens you know they can devour their weight in bugs and grasses and do a great job of tilling the soil with their constant scratching for food. When you build this simple portable chicken tractor you will be able to harness this power and make it possible to free range your chickens while keeping them safe from predators.

How it works: This portable pen is big enough to hold 3 big chickens or 4 small bantams, a nest box for eggs, and a water container. The attached run gives your chickens access to fresh green food and bugs that happen to come too close. The tractor is light enough that one person can easily pick it up from the front and drag it to a new spot every few days to give the chickens a new spot to eat and scratch. Chicken manure is good for soil and the chickens will till up the soil making it better for growing things. Your chickens will be happier, safer, and healthier. With free range food your eggs will taste better, and your chicken food bill will be less.

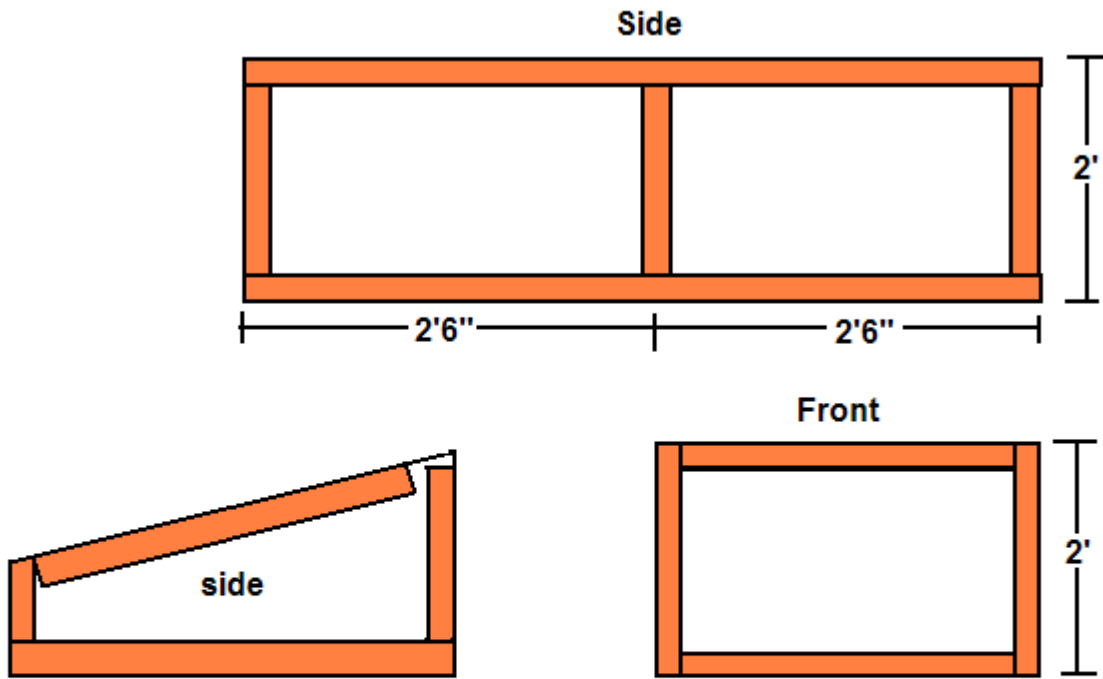
Do I need a rooster: Chickens will lay eggs without a rooster and roosters can be a nuisance bothering the hens and wanting to fight and crow but if you want fertilized eggs then you will need one.

Materials needed: One 4x8 sheet plywood or wafer board, Five 2x4x8s, a couple of heavy duty hinges, a roll of chicken wire, and a handful of wood screws. These materials can be purchased new for under \$50 or scrounge around and recycle some materials.

Step #1: Lay out your tractor house as shown and cut out parts with a jig saw or hand saw:



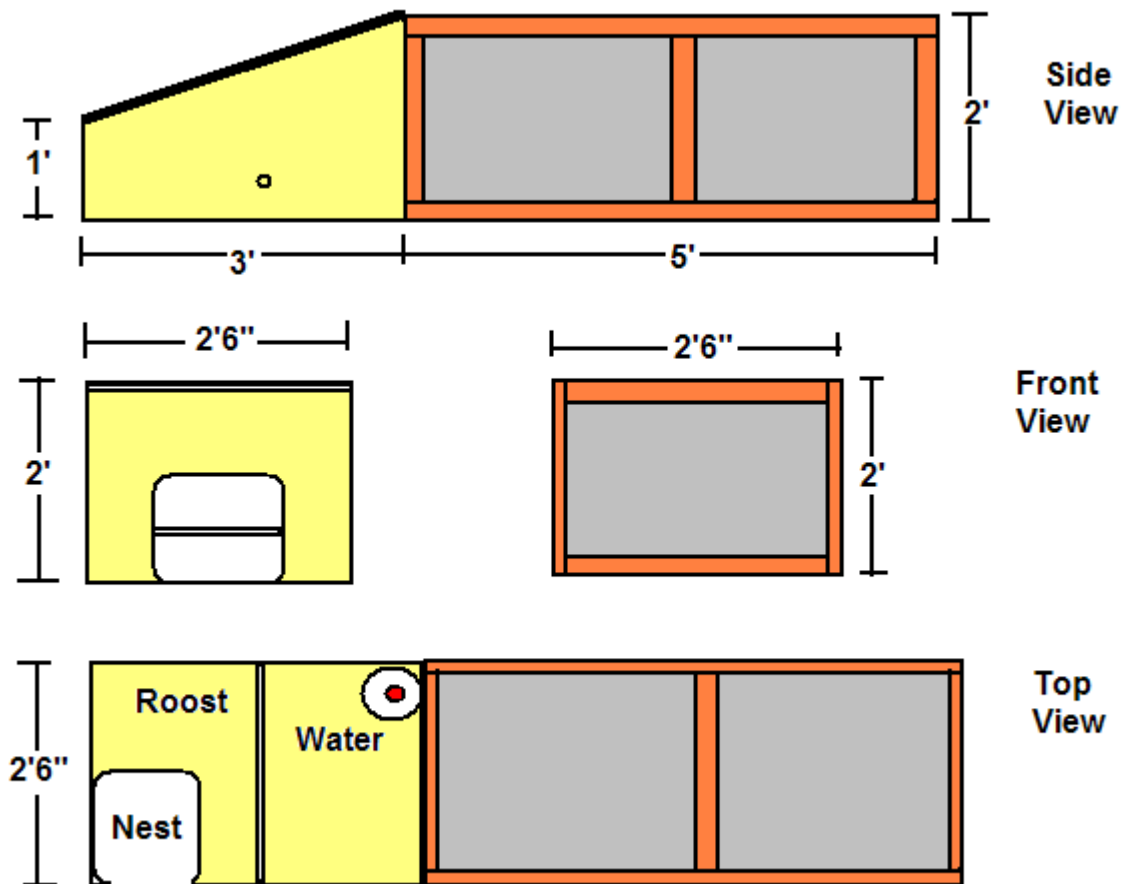
Step #2: Cut your 2x4s and build your frame as shown here:



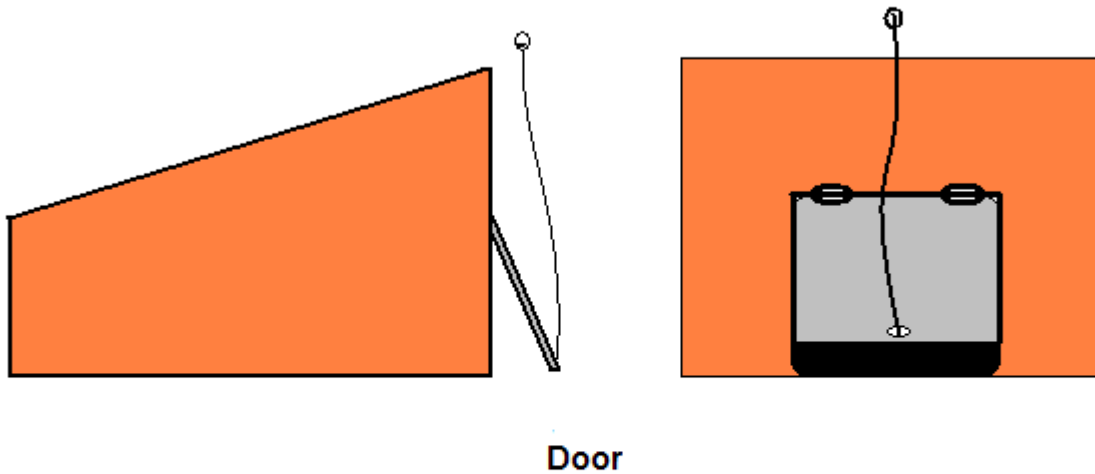
2x4 braces inside chicken house

Step #3: Build your tractor run and tractor house as shown here. Attach the front panel of the house to the run with wood screws the roof top 2/3rds panel is attached to the chicken house with screws. The roof top 1/3 panel is attached only with hinges so it can be opened to collect eggs and feed and water chickens.

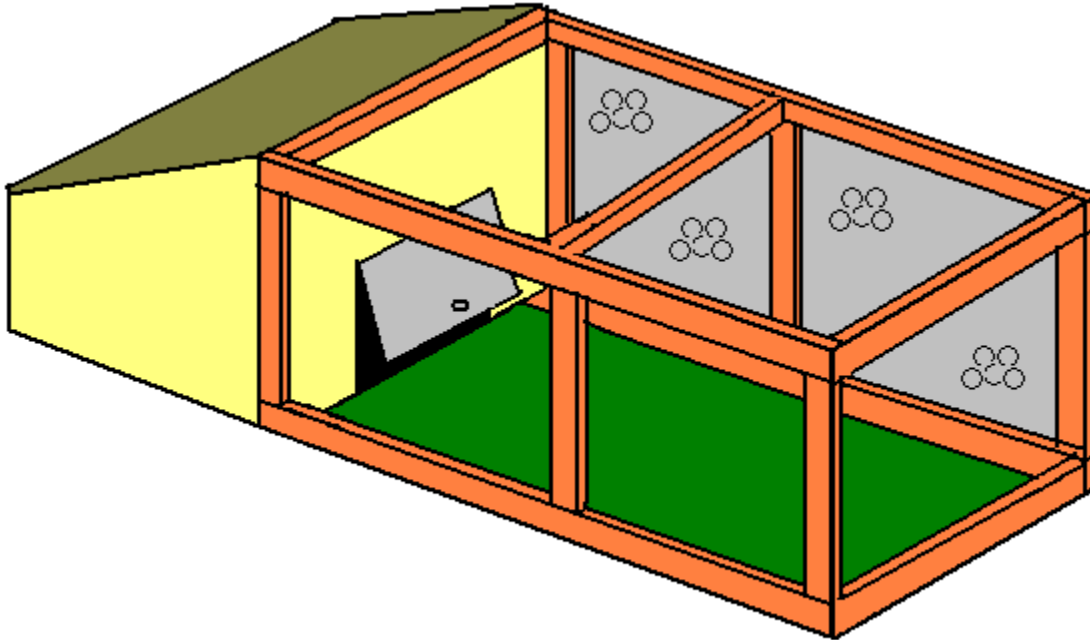
Install a roost about 8 inches from the floor of chicken house and install a nesting box filled with clean straw or shavings.



Step #4: cut a 1 foot by 1 foot door in the front. Re-attach this cut out piece using two small hinges. Attach a piece of heavy twine to the bottom edge of the door and run it up through the top of the run and attach it to the wire. You can then open or close the door by pulling the string to let chickens in or out as you please.



Step #5: Enclose tractor run with chicken wire. I used 1 inch opening wire but you could use larger or smaller. If you are concerned about predator animals getting to your chickens I would suggest enclosing the bottom of the run as well as the sides and top. You can use some staples to secure the wire and snip off loose wire ends around the run to protect chickens from injury.



Portable Chicken Tractor

That's all there is to building this portable chicken tractor. Just keep your chickens well fed and watered and 3 hens will average 2 eggs every day. When the chickens have eaten most of the grass in their run just shoo them back into the house and drop the door, then grab the tractor by its front edge and drag it to another green spot. I move mine about once a week. If you can find a couple of old lawnmower wheels you can attach them to the rear corners of the tractor and this will make moving the tractor even easier. Now go build it!



Rocky and the girls rate the portable chicken tractor A++

A few notes on raising chickens:

Chickens are probably one of the easiest of homestead animals to raise requiring very little care and providing a bounty of benefits including eggs, meat, feathers, tilling power and manure. Chickens are very capable of taking care of themselves if allowed to free-range and will rarely leave their yard if you feed them at the same place and about the same time each day. You must provide a safe place to roost at night and clean fresh water.

The portable chicken tractor I designed will let your chickens free-range for bugs and fresh grasses and keep them from scratching the ground bare. It also provides them a safe place to get away from predators.

Eggs are a very nutritious food and useful for cooking. Eggs do not need to be refrigerated and will generally stay fresh for several days stored at room temperature. DO NOT scrub eggs under water or you may force bacteria through the egg shell. Wipe the eggs off with a slightly damp cloth. Collect eggs twice a day if possible and do not allow eggs to build up or chickens may break and eat them. Egg shells are made of calcium so give your chickens some extra calcium to get stronger egg shells. You can add a little Oyster shell grit to their feed to provide calcium. Also chickens have a gizzard that grinds their food so allow them access to small rocks and sand. Young chicks need chick food and laying hens need laying mash and all chickens like fresh greens, bread, garden wastes, old fruit, and of course- bugs!

RESOURCES AND VENDORS

SOLAR PANELS:

There are many good brands of solar panels and most are very efficient but I like Kyocera brand for durability and price. I have purchased these panels and several solar items at good prices from this company. They also provide quality batteries, power controllers and inverters.

Northern Arizona Wind and Sun
<http://store.solar-electric.com>

Generator:

There are many brands of good generators but I have used a champion brand for about 4 years with good results. I recommend either the 1500 watt or 3500 watt pull start unit for backup power.

Checker Auto
<http://www.partsamerica.com/Default.aspx>

Propane Fridge and stove:

I use a propane fridge and stove. I recommend the Danby brand fridge and stove from this company:

LEHMAN'S
<http://www.lehmans.com/>

Propane Furnace:

A good brand of furnace is glowarm. These units are 99.9% efficient and do not require venting. They come in 20,000 or 30,000 btu and can be purchased for propane or natural gas hook up.

GLO WARM
<http://www.generatorsets.com>

On demand water heater:

I use an on demand propane water heater and they are great for cabins. Here is a good source for Rheems brand tankless water heaters.

On demand water heaters
<http://www.hotwatersource.com>

Composting Toilets:

Here's a website that shows you how to build a simple composting toilet and how to safely use humanure:

HUMANURE

<http://www.jenkinspublishing.com>

Solar water heaters etc:

Here are a few web sites for other solar and homesteading projects that I really like.

BUILD IT SOLAR

<http://builditsolar.com>

MOTHER EARTH NEWS

<http://www.motherearthnews.com>

Solar Home Products

<http://www.solarhome.org>

ADDITIONAL PICTURES

Here's some more pictures of the cabin and my little homestead



This is Browns draw about 5 minutes from my house

I live in Utah at the foot of the high Uintah mountains. You can see the mountains behind the lake in the picture. I spend a lot of time fishing, exploring and camping in those mountains. I have a small camp trailer but still prefer a tent or sleeping bag under the stars. There are lots of deer, elk, and rabbits for hunting and many fishing streams, rivers and lakes in the area, also pheasants and quail. The area is still fairly remote but as always people are moving closer all the time. Much of the land around me is on the Ute Indian reservation so hopefully it will stay wilderness and not become too populated in my lifetime.



Wally and Wilma want to go hunting

Wally is black lab and border collie and the smartest dog I have ever owned. He can talk and says three words clearly - walk, out, and no. Wilma is full black lab and very hard headed. She can smell food buried 3 feet in snow or underground. They are used for hunting and protection and have chased away many predators of the two and four legged variety. These dogs are my kids now that mine are grown and we spend most days taking long walks and chasing rabbits. They are waiting for me to take them walking in the picture above.



The kitchen with propane fridge and stove

I use a Danby propane fridge that uses about 1 gallon of propane a week. The oven and sink are out of a 1964 RV camp trailer that was being trashed. They were hardly used and saved me a lot as they were free if I removed them. I have shelves under the sink and stove and open shelves on the wall. The butcher block island is on wheels so I can make the kitchen bigger or smaller as I need. You can see a butternut squash from my garden on the shelf ready to cook- yum!



Sink and cabinets

I have a small (700 watt) microwave that I run once in awhile to heat leftovers. It is only run off my generator and I also run the vacuum at the same time. You can see the sun comes in very bright through the kitchen window and I enjoy looking out that window when washing dishes. Under the sink is a 25 gallon water tank and a 12 volt dc water pump hooked to the sink and shower.



Dining area for 4 people

I don't entertain much, but when people visit I have a 4 person dining area for eating and playing games. The table was a trade for helping a neighbor with a cabin design. The chairs are solid oak and bought for \$5 a chair at a swap meet. I try to trade or barter for stuff rather than buy new as this saves money and recycles good furniture that might otherwise end up in a landfill. Walls are painted drywall with cedar fence board trim (cheap). The unit next to the table is a double door storage pantry. If you want a woodstove in your cabin it could go in the corner or where the pantry sits.



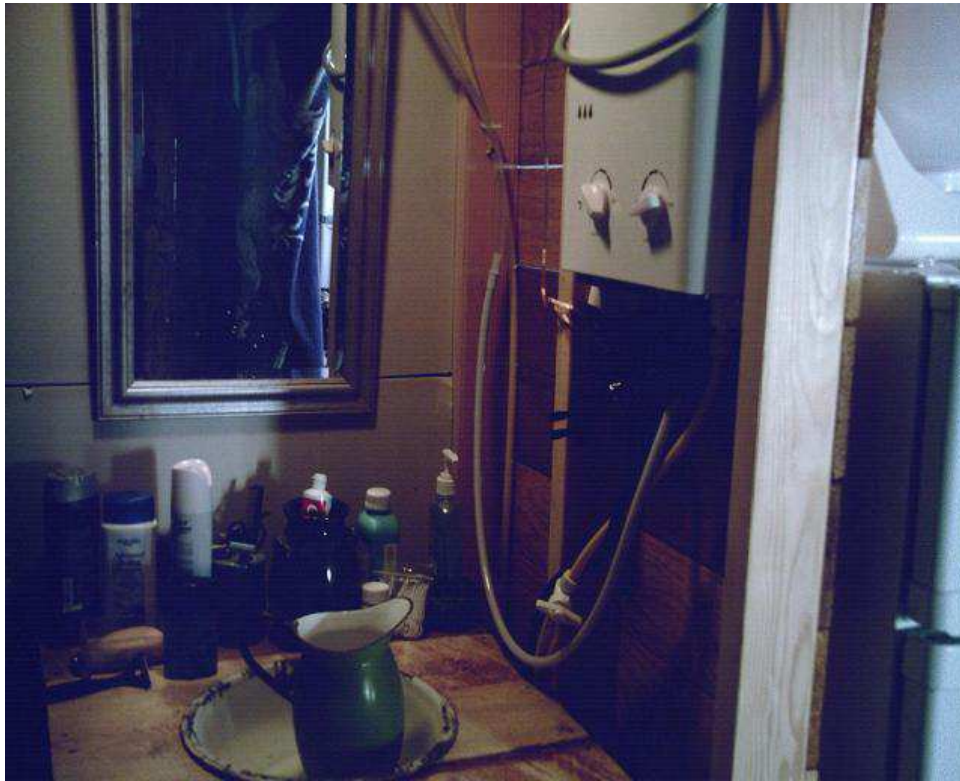
Living room with futon couch for guests

The couch converts to a full size bed for guests. I have shelves above the couch for my books and stuff. The back door is behind that quilt because its winter and that north side of the house can get mighty cold. The quilt helps insulate the door from our cold winters. This door goes to my backyard right now, but if I ever need more room I can build on a simple shed roof addition to expand the cabin.



My TV and propane furnace

I play guitar and record my songs on the karaoke player you can see. I am my own entertainment usually, but I also have a flat screen lcd TV, portable DVD and stereo. The propane furnace is a ventless glowarm 20,000 btu and 99.8% efficient. It keeps the cabin nice and cozy and uses very little propane.



The bathroom sink and water heater

I use an old style wash basin and pitcher because I recycle my greywater. The basin can be lifted out and poured on my house plants or recycled into my porta-potty for flush water. I try to recycle all greywater from the shower and sinks for plants and other uses.



My on demand water heater

This is an ecotemp on demand water heater that I purchased on Ebay for \$120. It uses two D batteries to ignite the pilot and heats my water almost instantly.



View into the bathroom

You can see my shower stall base and curtain through the doorway. I used old cedar fence boards for a lot of my trim work as they look like they would come out of an old cabin and they didn't cost much at all. That thing on the fridge is a wonder wash hand powered clothes washer purchased for \$49 and I use it for washing small loads of clothes when I don't want to run the big washing machine.



View of kitchen and dining area

I built my doors to open outwards to save interior space. The screen door is inside the house and this allows me to open the front door and keep the screen door closed. In the summer that front door and the rear door are always open so I get a nice cross breeze through the house. There is no air conditioning except windows and doors and I have never been uncomfortably warm even in 90 degree weather. The front porch provides a nice shady spot to relax and cools down the breeze that comes through the front door.



Bathroom walls being built

The bathroom is 5x6 and houses a shower, sink, composting toilet and stackable washer/dryer. If you want a bathtub instead of a shower there is room but you would need to store the washer/dryer somewhere else, perhaps in an outside shed or on the porch. You can also see my back door with the nice leaded glass window which was recycled. Notice the 2x4 stud walls and ceiling rafters are all on 16 inch centers.



Front of cabin under construction

Here's the front of cabin under construction. You can see through to the window in the back door. The trim work is all rough cut 1x6 pine boards purchased for \$2.00 apiece at a small lumber mill up the road. Windows are double pane E glass and the doors are steel insulated and all were salvaged for free from a trailer being torn down. lots of people are glad to give these things away because otherwise they have to pay to have them removed and hauled away.



A water pump windmill

This water pump wind mill belongs to a friend and is used to pump irrigation water from his pond to his garden and animals. We don't get a lot of wind here so I haven't invested in a windmill but if you do get a lot of wind this is the way to go!



My tomato plants in old planters



My steel horses at hitching post



Side view of cabin and propane tank



View of porch and my kayak



Big spring lake where I go fishing



Pokey and Blaze the horses

Simple Solar Homesteading



**Well that's it folks, hope you enjoy the pictures and plans
and may the sun always shine on your little cabin!
LaMar**