

# MANUAL FOR MAKING A BOX SOLAR COOKER

## What is solar cooking?

A solar cooker is a renewable energy technology that uses the heat energy from the sun to cook food.

## Types of Solar Cookers

Two types of solar cookers have been demonstrated in the Pacific region.

- The parabolic solar cooker is concave in shape and the reflective metal surface captures the sun's rays and focus it to one point under a pot. The effect is similar to cooking on an open fire or stove.
- The box solar cooker is designed to reflect the sun's rays into an insulated black box with a transparent lid. The reflected rays heat the air trapped in the box sufficient to cook food. Cooking with a box type solar cooker is similar to cooking in a standard oven but cooking takes a longer period of time.

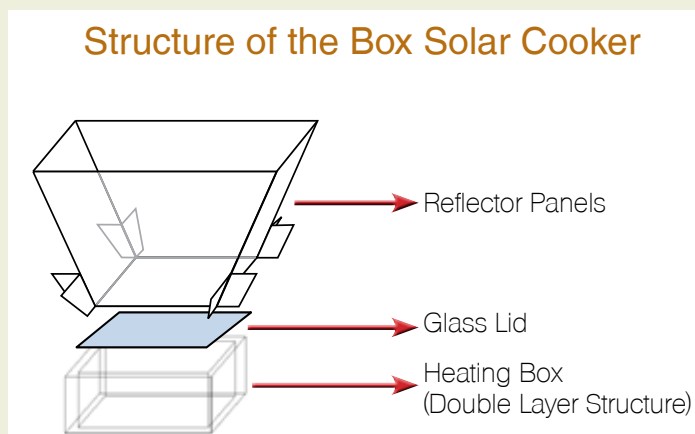
## Background Information

The manual was originally developed by Ferris University in collaboration with SOPAC and is the result of a series of solar cooking demonstrations in Kiribati and Tuvalu. The manual has been tested during training carried out by Ferris University and the Energy Planning Unit of the Ministry of Public Works and Utilities in Kiribati. As part of the project the original manual has been adapted to take into account material and components that are available in the Pacific region. The correct cutting of the plywood and care in construction will contribute to good performance of the box solar cooker.

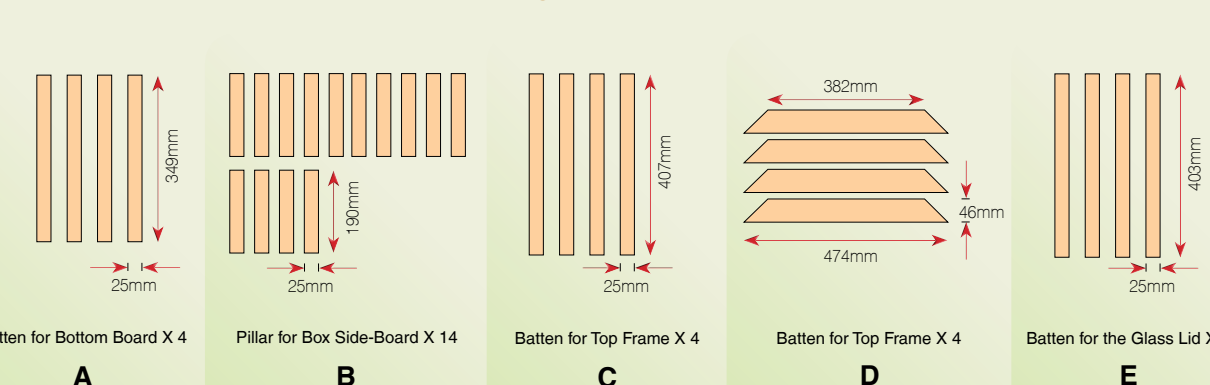
## Materials Required

Material	Required size	Quantity
Plywood	2400 mm x 1200 mm x 4 mm thickness	1 piece
Timber	Cross - Section (W x H): 25 mm x 25 mm 46 mm x 25 mm	8 metres 2 metres
Glass	383 mm (L) x 383 mm (W) x 3 mm thickness	1 piece
Black Paint	Spray can or Paint can	400 ml
Silicon/Plastic tube	7 mm diameter	2 metres
Galvanised Nails	25 mm length and 45 mm length Diameter - 2 mm	½ kg
Silicon Adhesive Sealant	300 ml (black cord is the best)	300 ml
Long Hinge and Screws	To fix glass lid to heating box	2 Long Hinges ½ kg Screws
Mirror sheet/ Aluminium Foil	For reflector panel	4 metres
L- Shaped Metal fixtures	For the top of the heating box for closing glass lid	4 pieces
Insulation	Glass fiber or wool or saw dust or paper	as required
Bolt and Nut	50 mm bolt with fitting nuts	4 sets
Binding Wire	As required	2 metres
PVA Wood Glue	As required	1 small tin

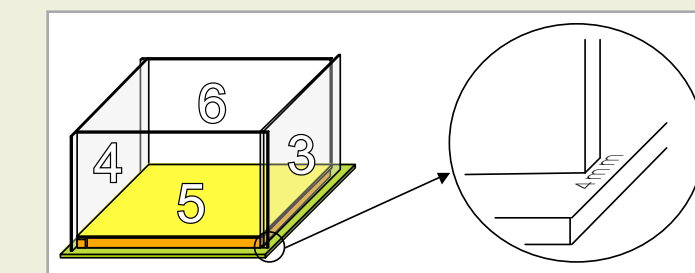
Tools required
Electric/Hand Saw (wood)
Electric/Manual Drill
Hammer
Gloves and safety glasses
Screw Driver, Pliers
Scissors, Pencil
Carpenters Square Ruler/Tape



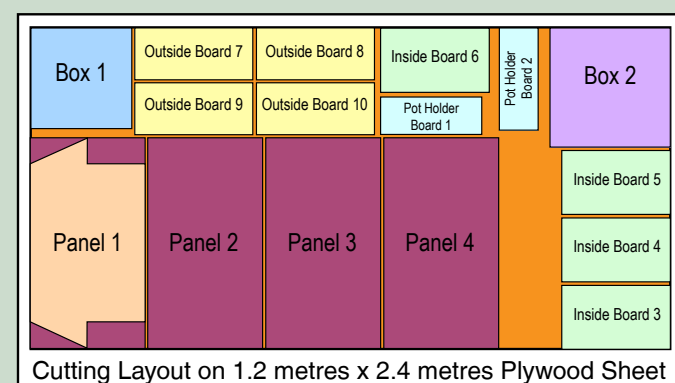
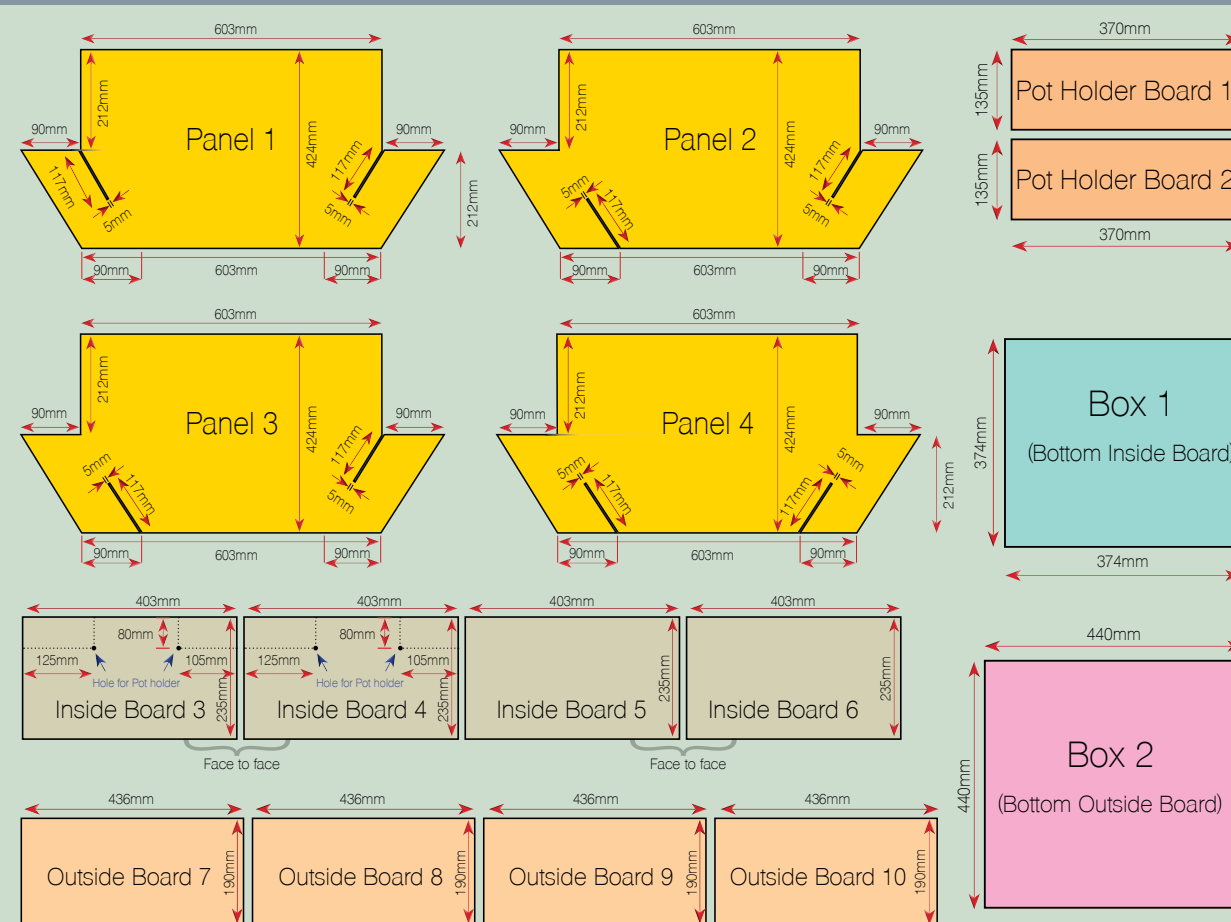
## Timber required for the Heating Box



- Take the inside boards (Boards 3, 4, 5, and 6) one at a time and place them vertically and in line with the edge of the inside bottom board (Box 1). Where one of the vertical edges should align with adjacent side of the inside bottom board for the inside box (Box 1) and the other end 4 mm from the edge of the bottom board for the outside box (Box 2). Using PVA wood glue and 25 mm nails, fix the four inside boards to the frame separating the bottom boards.



## Illustration of Cutting Layout for Reflector Panels, Heating Box and Pot Holder Boards

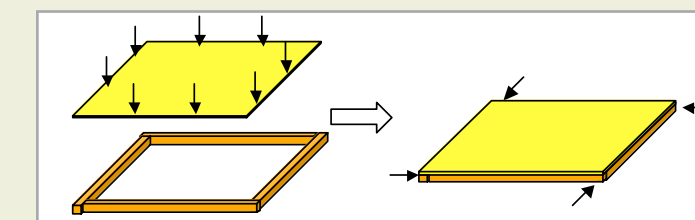


## Preparation of Materials

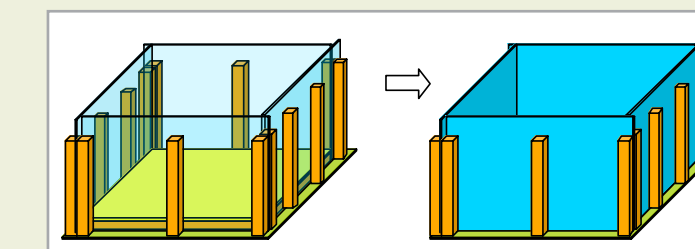
- Measure/layout and cut components on the 4mm plywood sheet as per diagram. Drill holes for the pot holders on inside boards 3 & 4 as depicted in the illustrations on the previous page.
- Cut timber battens to the required sizes as demonstrated in items A, B, C, D & E.

## Building the Heating Box

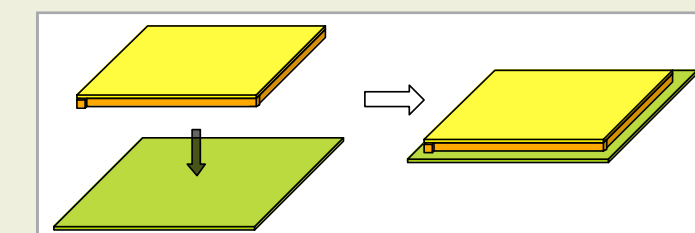
- Lay the four battens for the frames of the bottom board (A) out in a square; glue them to the bottom inside board of the heating box (Box 1) so they are flush with the outer edge of the bottom inside board. Nail the bottom inside board to the frames with 25 mm galvanised nails at 100 mm centres.



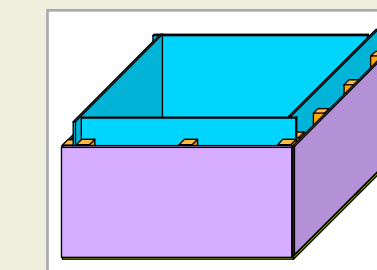
- Using 25 mm nails and PVA wood glue fix two (B) pillars for each corner and one each in the middle of inside boards 4 and 6. Fix two (B) pillars vertically to inside boards 3 & 5 so they are at the position of the pre-drilled holes to hang the pot holders.



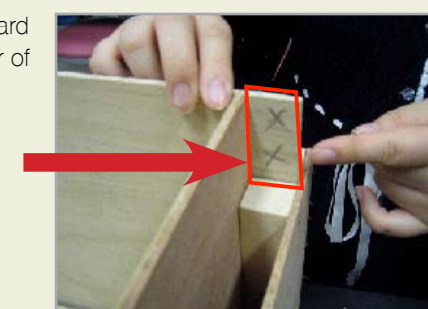
- Put insulation between the bottom inside board (Box 1) and the frame and position it on the bottom outside board (Box 2) with equal edge distances all around (33 mm). Glue and nail the outside bottom board to the frame using 25 mm nails at 100 mm centres.



- The outside boards (Boards 7, 8, 9, and 10) should now be fixed to the pillars (B) which are attached to the inside boards. Use both the PVA wood glue and 25 mm nails to fix the outside boards one at a time to the pillars (B). Pack insulation tightly between the inside wall of the box and the outside wall of the box.

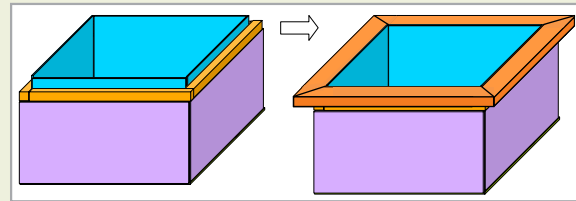


- Where the outside board on one side overlaps the side board on the adjacent side (shown in the diagram) in each corner of the box is cut away with the hand saw.

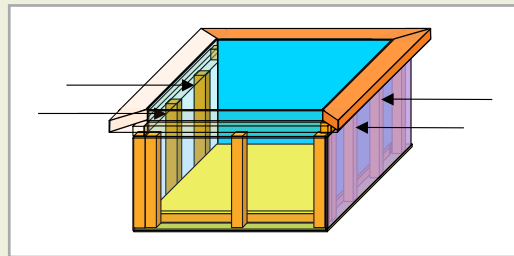




9. Fix four (C) battens to the top of the outside boards so that they are flush to the outer side of the outside boards by using glue and reinforce it from the side using 25 mm nails. Fix four (D) battens to the top of the heating box so that they are flush with the top of the inside board using 45 mm nails. Do not put the nails through the walls of the inside box.



10. To fix the Pot Holder Boards 1 & 2 inside the heating box, use the pre-drilled holes in inside boards 3 & 4 as reference to drill holes through the pillars placed in Step 6. Insert the bolts into the holes which would hold the pot-holder boards (see Step 17). The diameter of the holes should be same as that of the bolts.



11. Paint the heating box black. Black is the ideal colour as it retains the heat inside the box.

### Making the Reflector

12. Glue the mirror sheet to the reflector panels (Panels 1, 2, 3 and 4). Use water-proof glue. When you glue the mirror sheet on the reflector panels, use a wet towel to slowly spread the mirror sheet over the glue to prevent the mirror sheet surface from tearing.



13. The silicon/plastic tube is used as a sealant to make a tightly-closed box. Cut the tube to the right length with scissors and insert one side of it between the inside board and top frame battens (D) of the heating box. Use 25 mm nails or glue the tube to the top of the frames.



14. The reflectors are joined together through a cutting at the corners of each reflector. Panels 1 & 4 are placed opposite to each other and 2 & 3 on the opposite sides of the heating box. The reflectors are placed at angle of about 30 degrees to the heating box.

### Making the Glass Lid

15. The glass for the lid is already cut to the right size (383 mm x 383 mm) will have a reinforced wooden frame which you can make. Cut a notch in the middle 5 mm wide and 5 mm deep in the battens for the lid (E) as shown in the picture below. Put silicon adhesive sealant into the notch and insert the glass carefully. Join the battens together using a L-shaped metal fixture at the four corners of the glass lid frame.



16. The glass lid is fixed to the top of the heating box with two long hinges. A locking latch for the lid can be invented and is fixed to the heating box. It would be used to close the glass lid firmly onto the silicon tube (an example is shown in the picture).



### Making the Pot Holder

17. Make 2 holes on the four corners of the pot holder boards 1 & 2 using an awl or drill (the diameter of the hole should be 2 mm). This pot-holder hangs on the bolts like a swing using a 400 mm length of wire. Put the wire through the holes and make an isosceles triangle (120mm x 120 mm x 115mm) as shown in the picture.



18. Fill any gaps between the inner box panels with the silicon adhesive sealant. This is necessary to ensure an air-tight box to avoid heat loss making an effective heating environment.



### Steps in using a Box Solar Cooker

- Use when the weather is good, sunny and not too windy;
- Put the solar cooker on a flat area with no shading and adjust to correct orientation to the sun;
- Put your pot (ideally with black colour) with food on the pot holder and close the glass lid;
- Adjust the solar cooker every 15 – 30 minutes to get maximum sunlight into the box until food is cooked; and
- Take out the pot with cooked food using safety gloves/ pot mitt.

### How to maintain your Box Solar Cooker

- Put the Solar Cooker inside when not in use;
- Wipe the reflectors with soft tissue or warm cloth after use; and
- Protect the glass lid from falling objects.

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Manual for Pacific Island Countries



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