Solar Kiln Construction Guide - Introduction

Building a solar kiln for drying green, planked local timber educates children in woodwork, construction, project management, sustainability and local resources. It allows schools and others to use locally-sourced timber to produce a premium wood product which cannot be bought from mass-suppliers. All of this whilst using a system that is only reliant on solar energy, making it completely environmentally friendly.

The value of solar kilns

Wood for any indoor construction project, such as furniture, needs to be dried down to a moisture content of 10% or lower to avoid splitting or warping in use. Conventional kiln drying uses large amounts of energy, usually electricity, and as much as 66% of the energy goes into the drying process. Solar kiln drying uses at least 75% less energy, in fact if the kiln's circulating fans are run from solar panels the energy costs of the actual drying is reduced to 0%.

The value of local timber

The High Weald Area of Outstanding Natural Beauty has 27% woodland cover, nearly three times the national average. The woodland has been managed to produce timber for centuries and many rare species such as the dormouse, the pearl bordered fritillary and nightjars depend on its continued management. Sourcing and using local timber therefore benefits an important landscape and wildlife feature.

The High Weald has large quantities of useful small diameter timber, which is often just cut up for firewood. Hardwood species such as sweet chestnut, ash and oak, and softwood species such as pine, can easily be dried in a solar kiln during the spring and summer.

This guide outlines the process involved in building a solar kiln, based on a design used by The Skinners' School, Tunbridge Wells.

If you would like more information and advice on building a solar kiln, please contact Matthew Pitts at the High Weald Partnership T: 01424 723011 E: m.pitts@highweald.org. Matt can also help with sourcing planked, green timber and may be able to grant-aid the purchase.

We would like to thank Mark Moody and the students from Yr 7, 8, 11 and 12 of Skinners' School for trialing the design and providing tips for this guide. The project was supported by:

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1. Solar Kiln Construction Guide - Before You Start

Kiln capacity

A kiln constructed to the specifications in this guide will dry 450 board feet of one-inch-thick hardwood in 6 weeks or less of good weather, or 600 board feet of two-inch hardwood in 15 weeks. Note that solar kilns can only operate effectively for around 7 months of the year in the UK climate (March to September).

Budget

It will cost you approximately £800 to buy the materials to build the solar kiln. Filling the kiln with green, planked timber for drying will cost a further £300-£500, depending on your choice of wood.

Choosing the site

A solar kiln must be sited in the sunniest possible location, ideally facing directly south to maximise the amount of sunlight available for drying the timber. Avoid locations near trees and buildings which could cast shade and reduce the efficiency of the solar kiln.

Preparing the site

The ground at your chosen site must be level, or levelled if necessary. Ideally the kiln should be constructed on foundations to prevent rotting of the kiln itself. Pressure treated softwood sleepers make an ideal foundation. For the kiln dimensions in this guide two sleepers were cut in half and used for the foundations. The sleepers must be level and can be pinned in place if needed.

Constructing the kiln

The easiest way to build the kiln is in sections which are then joined together. The kiln is made from standard sheets of exterior plywood which have been treated with wood preserver. Marine plywood would be an ideal alternative but costs around twice as much.

The walls of the kiln are a double skin of plywood with sheep's wool insulation sandwiched between them. The whole kiln is insulated to maximise efficiency and reduce the drying time of the timber. Sheep's wool insulation is safe to handle without any special protective equipment and is more sustainable than using conventional rock wool insulation. The framing of the kiln walls is pressure treated softwood.

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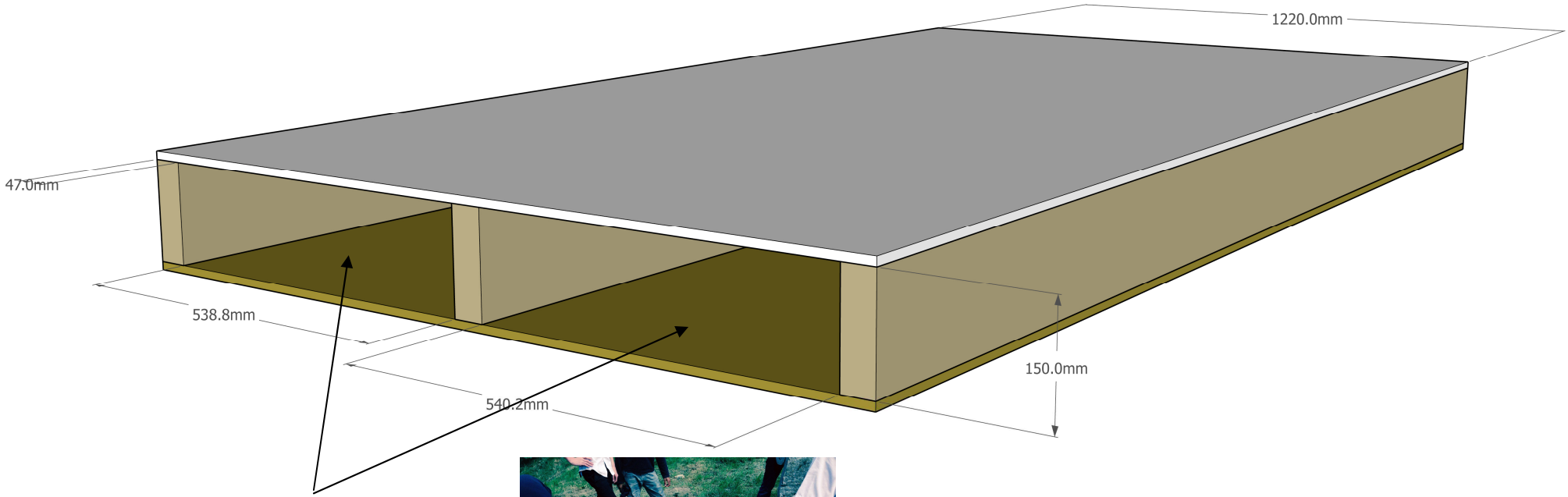
2. Solar Kiln Construction Guide - Helpful Hints

- Do not use heavier pieces of wood than necessary. Taking this into account, it is possible to make an effective, streamlined and cheap kiln.
- Wood should be accurately pre-measured or pre-cut when ordered to save time and hassle in the production process.
- A metal, attic fan is necessary, anything lighter weight will not withstand the heat.
- Different ages of children can work on the kiln together, as they each bring different skills and will gain different things from it.
- A project manager that doesn't have 100% of their time committed to teaching is useful, as is having someone from the High Weald AONB Partnership to sign it off when it is finished.
- The project should be finished within a term as students and teachers will become too busy to complete the project in a new term, particularly if it is after the Summer holidays.
- For more information on how to build a solar kiln http://owic.oregonstate.edu/solarkiln/plans.html, http://forestandwildlifeecology.wisc.edu/sites/default/files/pdfs/publications/60.PDF

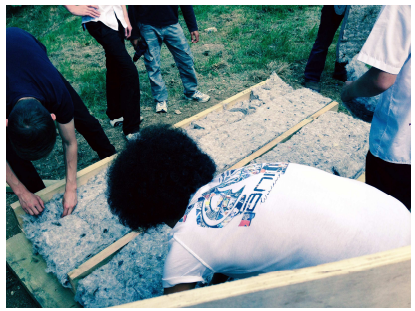
Please refer to the solar kiln materials list and construction guide documents for dimensions.

3. Solar Kiln Construction Guide: Floor

- Use two sheets of plywood and 3 joists.
- Put insulation between the joists before the second sheet of plywood is screwed into place.
- Place the floor on top of the sleeper foundations.



Sheep's wool insulation is placed between the joists



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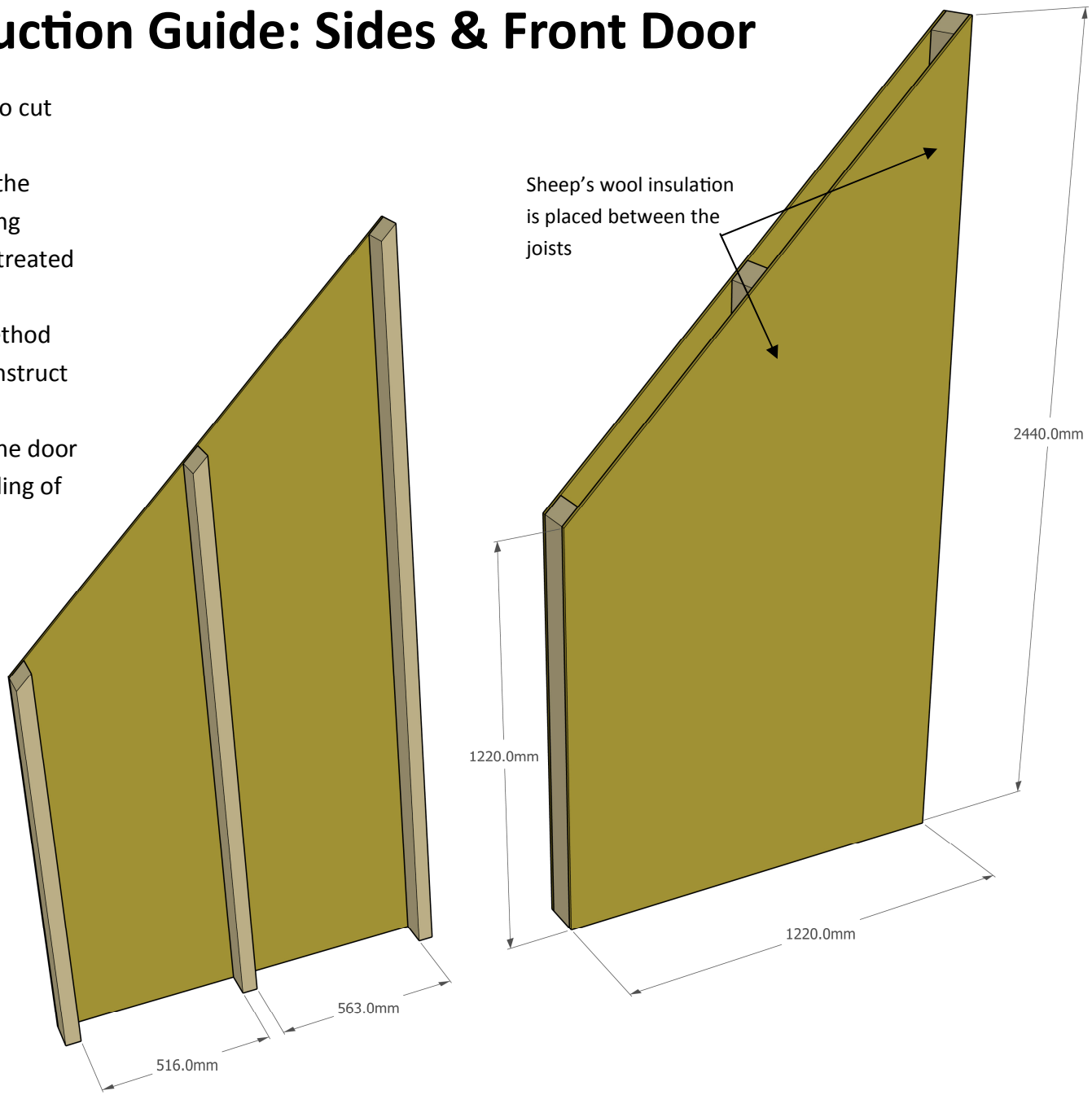
4. Solar Kiln Construction Guide: Sides & Front Door

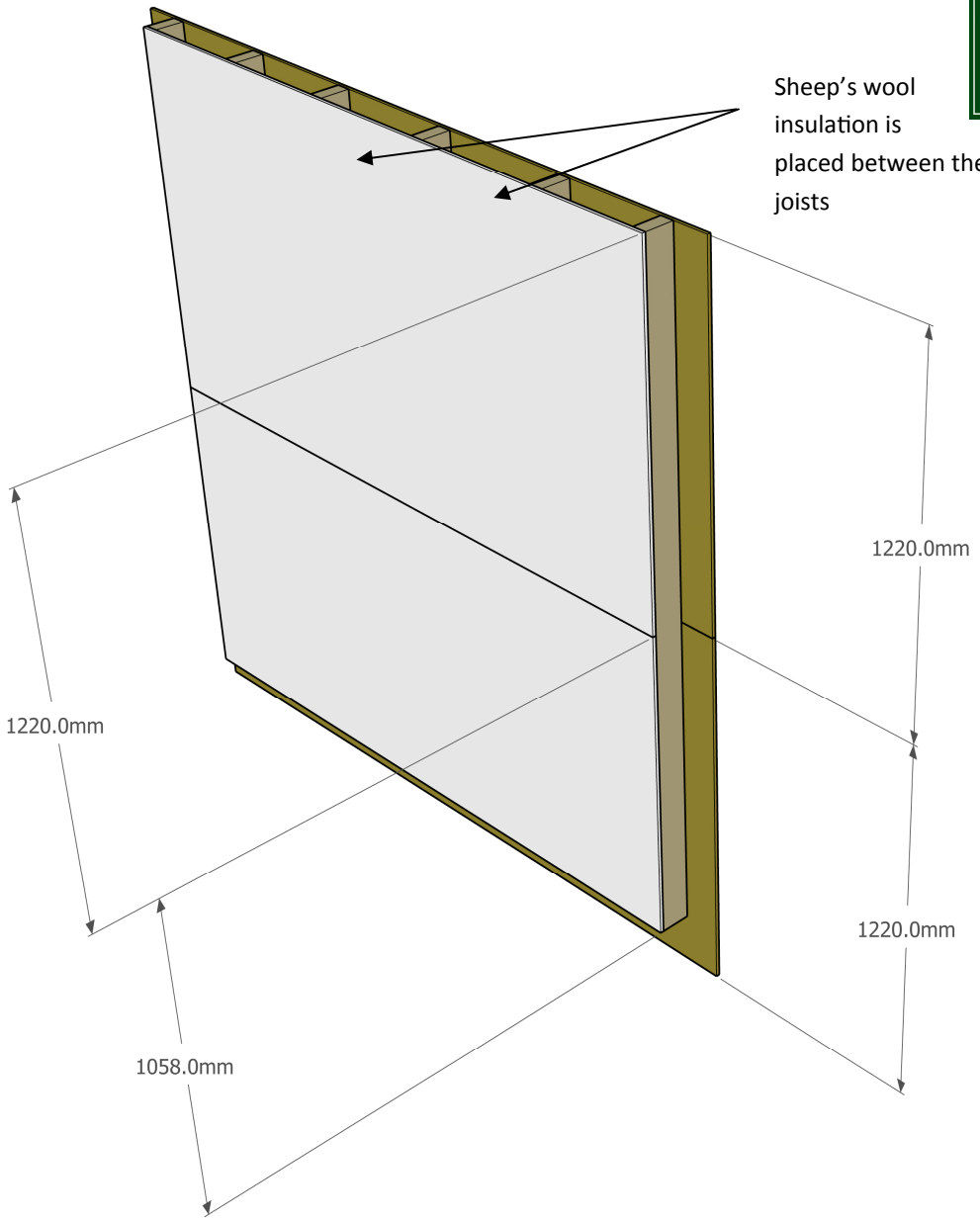
- Use a circular saw with a fixed guide to cut the plywood sheets for the sides.
- Construct the two sides of the kiln in the same way as the floor, apart from using smaller joists of 45x100mm pressure treated softwood.
- Use the same overall construction method for the front door as you would to construct the sides.
- Attach handles to each end to allow the door to be removed for loading and unloading of the kiln with timber.



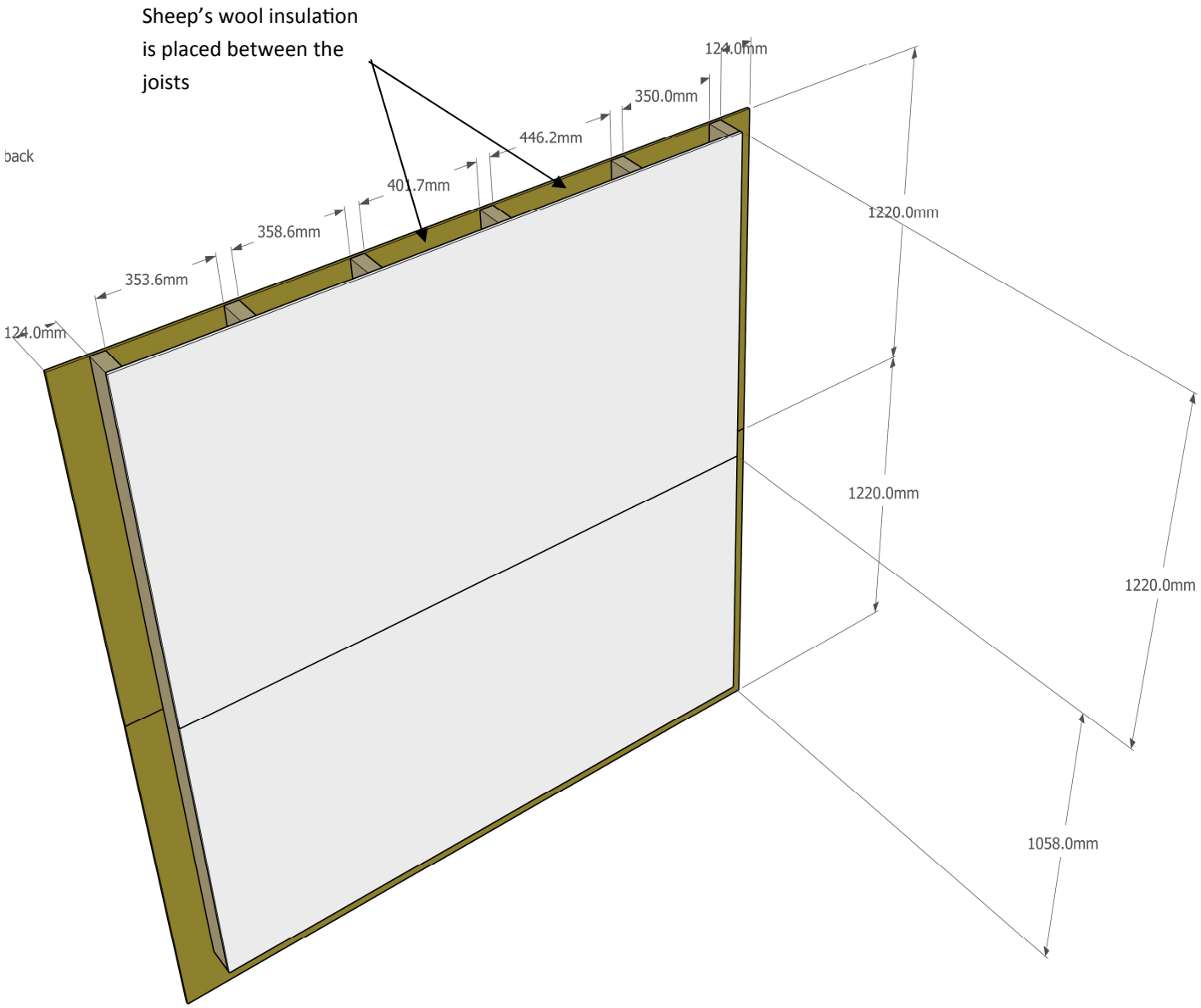
5. Solar Kiln Construction Guide: Back Diagram 1

- Use the same overall construction method for the back of the kiln as other sections.
- Cut three vent holes into the back of the kiln - two vents at the bottom and one at the top. These are designed to allow air to be drawn into the bottom of the kiln, up through the stack of drying wood, and out through the top of the kiln. You will need to cover the vent holes on the kiln with something like a plastic louvre vent.

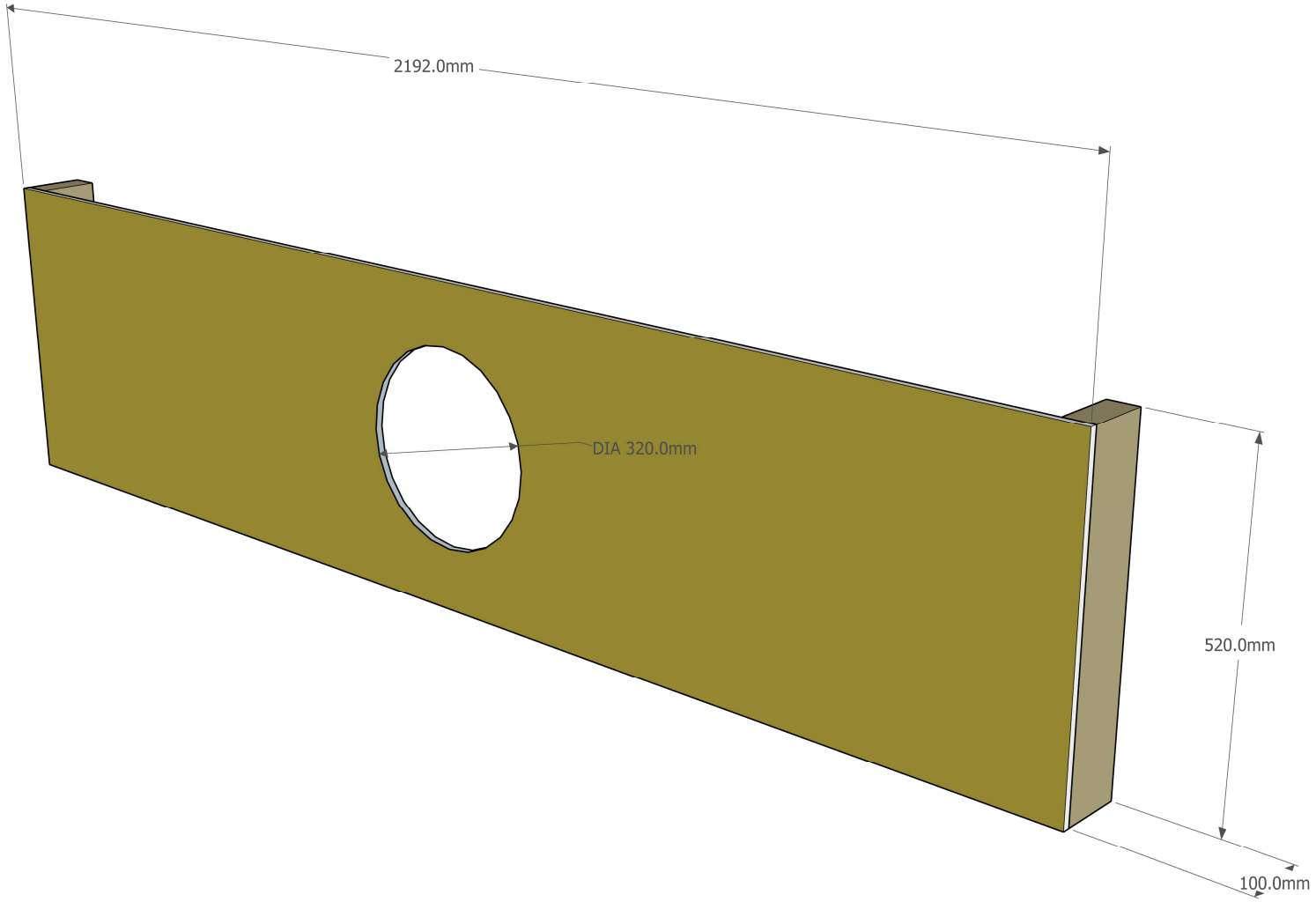
Vent holes situated on the back of the kiln



6. Solar Kiln Construction Guide: Back Diagram 2

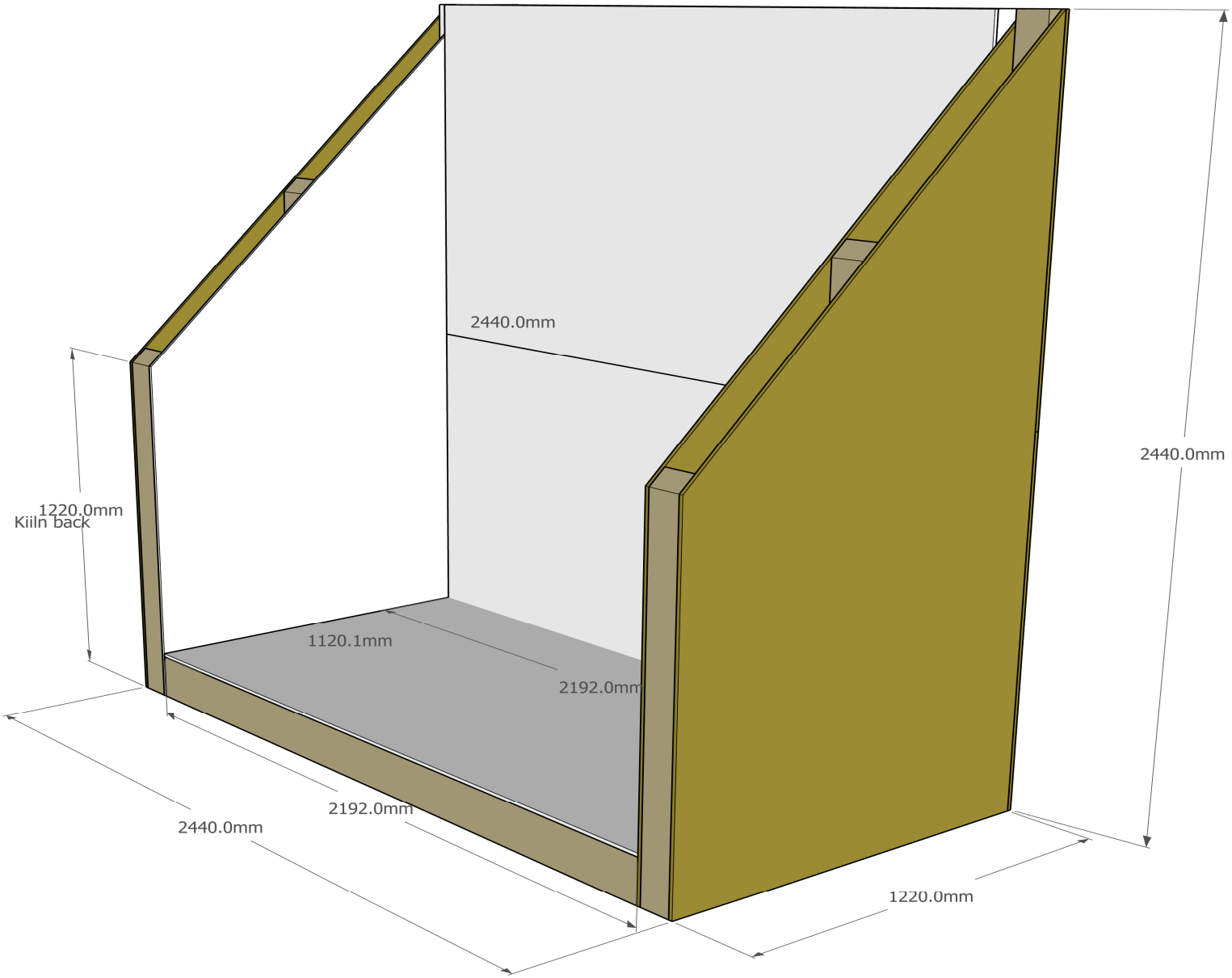


7. Solar Kiln Construction Guide: Construction of Baffle for Placement of Solar Fan



- Construct the baffle out of a smaller, single piece of plywood with a circular hole cut right in the centre.
- Place the solar extractor fan attached to a baffle, just in front of the top vent.
- Attach the solar fan into this hole.
- Screw the baffle to two wooden brackets on each side of the wall of the kiln. This leaves the fan suspended in front of the top vent of the back of the kiln.

8. Solar Kiln Construction Guide: Construction without Doors or Roof



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9. Solar Kiln Construction Guide: Roof & Painting

Constructing the Roof

- Screw softwood battens to both sides of the kiln to which the roof, built from clear polycarbonate roofing sheets, can be screwed to.
- Screw in the roofing sheets with sheet fixing screws specifically designed to stop water entering the kiln.
- Once the roof is in place the solar panel can be placed on the top of the kiln and wired to the fan and a leisure battery.
- The solar panel trickle charges the battery and the fan is run directly from the battery. A temperature sensor can be added into the solar panel circuit which controls when the fan switches on and off.

Painting the Kiln

- Once the main structure of the kiln had been constructed, the entire inside of the kiln can be painted with an oil based matt black paint. This will stop water penetrating the plywood and helps the kiln absorb more heat from the sun, improving the efficiency of the kiln.
- Spray the outside of the kiln with several coats of wood preserver to protect it from the effects of water.

Solar Kiln Materials List & Indicative Prices (July 2014)

Material	Item dimension/suppliers	Metres required	Quantity	Indicative unit price	Indicative Total Cost
Exterior ply sheets	1200 x 2440mm 1/2" thick		14	£16.99	£237.86
Timber	2 x 4" (Metric 47x100mm) 25 lengths of 2.4m & 8 lengths of '1.2m	69.6		£1.57	£109.27
Timber 2x6"	2.4m lengths	7.2		£2.61	£18.79
Ecoroll Thermafleece	http://www.ecomerchant.co.uk/catalogsearch/result/?q=ecoroll+sheepswool#sthash.89vkhPgc.dpbs	17.28	2	£47.67	£95.34
Screws 5x50mm	http://www.screwfix.com/search?search=goldscrew-plus-countersunk; http://www.diy.com/departments/ariel-sheet-fixing-pack-of-10/35451_BQ.prd		1	£4.49	£4.49
Screws 6x90mm	http://www.screwfix.com/search?search=goldscrew-plus-countersunk		1	£6.27	£6.27
Matt black oil paint 2.5 litre	http://www.amazon.co.uk/Blackfriar-Litre-Metal-Exterior-Interior/dp/B0091CZSNC		2	£19.98	£39.96
Softwood sleepers	http://www.tate-fencing.co.uk/products/sleepers.htm measuring 200 x 100 x 2400mm		2	£20.40	£40.80
Clear PVCU corrugated sheet - 3000mm x 700mm	http://www.wickes.co.uk/Clear-PVCu-Corrugated-Sheet-3m/p/240154 or www.diy.com/departments/clear-polycarbonate-roofing-sheet-3000mm-x-700mm/35429_BQ.prd	3M	4	£10.49	£41.96
Solar power gable ventilator fan, home roof vent cooling & 29W mono solar panel	http://www.ebay.co.uk/itm/Solar-Power-Gable-Ventilator-Fan-Home-Roof-Vent-Cooling-29W-Mono-solar-panel-/301150386874?ssPageName=ADME:X:AAQ:GB:1123		1	£130.00	£130.00
Wood preserver	http://www.diy.com/departments/ronseal-wood-preserver-5l/81393_BQ.prd		1	£27.98	£27.98
Metal gate handles	http://www.ebay.co.uk/itm/Door-Handle-Large-200mm-8-Pull-Garden-Gate-Shed-Black-Free-P-P-/180927021018		2	£5.99	£11.98
Roofing screws (packet)	http://www.wickes.co.uk/Wickes-Fixings-For-Corrugated-Sheets-Pack-100/p/164037		1	£17.49	£17.49
Eaves fillers for corrugated sheets (pack of 6)	http://www.wickes.co.uk/search?text=eaves+filler+corrugated+sheets&x=8&y=6		2	£6.49	£12.98
Louvre vent cover	http://www.screwfix.com/p/map-vent-gas-louvre-vent-white-229-x-229mm/6204d		2	£1.69	£3.38
Total costs of building solar kiln					£798.55
Stocking the kiln with green wood	Purchase from timber yards in the High Weald http://www.woodnet.org.uk/woodlots/				£300-£500