



Guide for the construction of improved FTT smoker in Myanmar



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**Introducing improved FTT smoking technology
for rohu fish smoking, Kale Township, Sagaing
Region, Myanmar**

**Guide for the construction of
improved FTT smoker in Myanmar**

**Myanmar Sustainable Aquaculture Programme
(MYSAP)**

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Table of Contents

ACKNOWLEDGEMENTS	1
1. INTRODUCTION - FAO THIAROYE SMOKING TECHNOLOGY	2
2. CONSTRUCTION OF THE FTT KILN	2
2.1 MATERIAL SELECTION FOR THE KILN	4
3. FABRICATION OF METAL PARTS	12
3.1 GUIDE FOR METAL WORK MATERIAL SELECTION.....	13
3.2 LID FABRICATION.....	16
3.3 SMOKING RACK – STEEL.....	18
3.4 SMOKING RACK – WOODEN.....	20
3.5 FAT COLLECTION TRAY.....	23
3.6 FURNACE BOX.....	27
4. REFERENCES.....	36

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Support the sustainable intensification of the aquaculture sector, thereby realizing its potential for food security, nutrition and sustainable livelihoods.

MYSAP is promoting small-scale aquaculture and improved human nutrition in three townships in Shan State and the Sagaing Region of Myanmar through its inland component MYSAP Inland which is being realized by WorldFish under a GIZ grant agreement. The two improved FAO FTT Thiaroye smokers constructed and tested with smokers in Kale Township, Sagaing Region, Myanmar were funded by the inland component of MYSAP.

The authors wishes to express their thanks to the staff of MYSAP Inland and of the NGO Ar Yone Oo for their support in the field and for enthusiasm of the collaborating rohu smokers Daw Vuli from Pyin Khone Lay Village and U Lala from Nat Gyi Kone Village without whom this document could not have been produced.

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GUIDE FOR THE CONSTRUCTION AN FTT IMPROVED SMOKER IN MYANMAR

1. INTRODUCTION - FAO THIAROYE SMOKING TECHNOLOGY

The FAO-Thiaroye Processing Technique (FTT) is a proven fish smoking technology that originated in Africa and was later introduced to Asia and the Pacific. The FTT was developed by Food and Agriculture Organization (FAO) and the National Training Centre for Fisheries and Aquaculture Technicians (CNFTPA) in Senegal to address identified shortcomings of existing African fish smoking kilns (FAO, 2017). The technology has gained popularity as a proven technology and has been disseminated to Asian and Pacific countries.

The introduction of FTT to smokers of the Indian major carp species rohu (*Labeo rohita*) in Kale Township of the Sagaing Region of Myanmar has been adapted to suit specific local conditions.

- The kiln was comprised of two identical compartments, but without the indirect smoke generator of the original design. All other components like the smoking racks and the fat collection trays were the same as the original design (Ndiaye et al, 2014). The kiln walls were constructed with two rows of clay bricks that retain heat inside the kiln chamber.
- The furnace was slightly modified with the insertion of a tin sheet on the wire mesh to retain the wood embers longer. This was done because the rohu smokers in Kale Township of Myanmar, burn a unique combination of fuel wood and sawdust, which are predominately *Dipterocarpus turbinatus*. The tin sheet was used to prevent sawdust from falling through to the bed of the furnace.
- The drawings were changed from metric to imperial units, with which the people in Myanmar were more familiar.
- Additional wooden trays were also added to give extra processing capacity to suit daily processing demand.

This construction guide outlines the construction steps specific to Myanmar. As part of the same international consultancy, a separate guide for the operation and testing of the FTT smoker was also produced entitled, *FTT smoker operation and testing protocol guidelines*.

2. CONSTRUCTION OF THE FTT KILN

The housing component of the FTT consists of two identical compartments with smoking racks at the top and oil trays positioned in the middle. The kiln was constructed with clay bricks which were locally available. Ideally the kiln should be built with a roof to provide shade and to allow operation during rain and bad weather. A reinforced 3 inch thick concrete layer floor should be constructed as the base for the kiln. The kiln construction also requires the fabrication of metal parts as well.

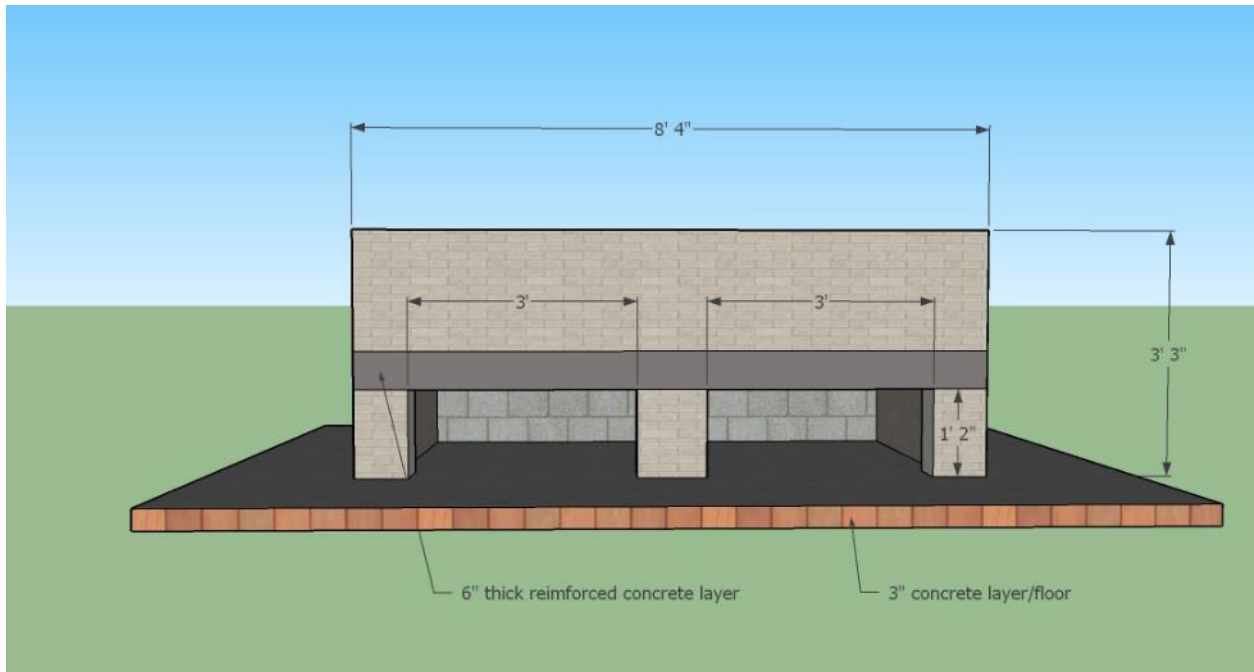


Figure 1: 3D image of the FTT kiln (front view)

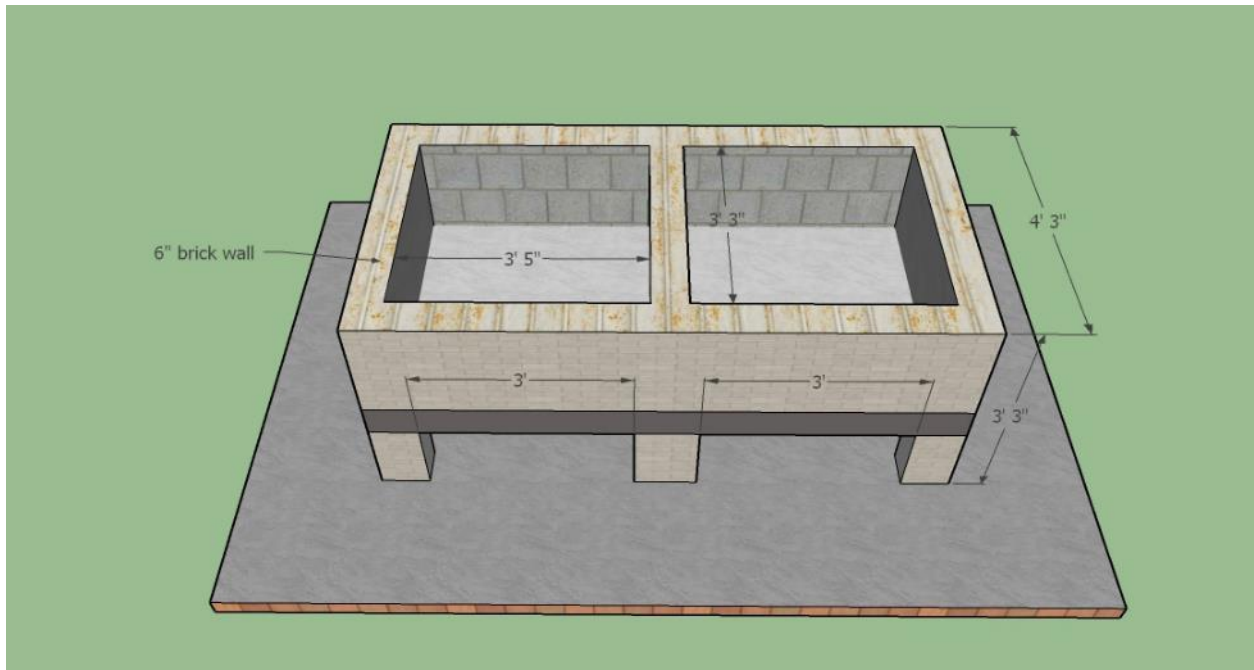


Figure 2: 3D image of the FTT kiln (side top view)

Table 1: Material list for a two-compartment FTT kiln

Material	Specifications	Unit	Unit cost (MMK)	Required quantity	Cost (MMK)
Rebar	# 3 size	Each	5,800	2	11,600
River Sand	Masonry grade clean	Cubic feet	800	23	18,400
Clay fired bricks	9" length x 3" height x 4.5" width	Each	130	620	80,600
Plywood sheet	4 feet x 8 feet	Sheet	12,000	1	12,000
Cement	50 kg	Bag	6,000	7	42000
Iron pipe	1/2-inch tube	Feet	8,000	8	64,000
Total (MMK)					228,600
Total (USD)					173

Table 2: Labor requirement (For a two-compartment kiln)

Type of labor	Number of days	Remarks
Skilled mason	04	The first day- brickworks up to the concrete layer.
Helper	04	Second day up to 3' .3" height. On the third and fourth day, complete the plastering and finishing works.

2.1 MATERIAL SELECTION FOR THE KILN

It is always advisable to use locally available building materials.

Clay bricks: 9" length x 3" height x 4.5" width. Well fired and solid.

Cement: Cements with strength class 52.5 or 42.5 is recommended. 50 kg bags were available in the market

Sand: Masonry grade river sand, free from dust, clay and debris.



Figure 3: Bricks in Myanmar (https://avax.news/fact/A_Brick_Factory_in_Myanmar.html)



Figure 4: Laying a 3-inch thick reinforced concrete base as the base for the kiln



Figure 5: Precise brick work according to the measurements is important from the beginning



Figure 6: Formwork mould for pouring the concrete mix into



Figure 7: Continue the brick works on top of the concrete reinforced beam



Figure 8: Proper brickwork is important for better finishing



Figure 9: Plastering the walls of the kilns



Figure 10: Place 4 pieces of rebar on the sides of the kiln wall to hold the fat collection tray in position inside the kiln chamber



Figure 11: Confirm that the oil tray can be moved smoothly lowered into position inside the kiln chamber



Figure 12: Check that there is enough space between the kiln chamber wall and the smoking racks / fat collection tray



Figure 13: The position of the smoking racks can be easily adjusted by having iron rebar or iron bolts inserted at different heights in the kiln wall



Figure 14: Fat collection tray under the smoking rack inside the kiln chamber



Figure 15: A piece of rebar or iron bolt can be used to fix the position of the smoking racks



Figure 16: A smoking rack positioned on the upper level of the chamber



Figure 17: The kiln chambers are covered with metal lids

3. FABRICATION OF METAL PARTS

The FTT has four main different metal parts.

- a. Lid: used to cover the top of the FTT kiln
- b. Smoking racks: used to place fish for smoking
- c. Fat collection tray: serve as collecting fat/ oil while cooking the fish and preventing direct flames and work as a heat distribution devise
- d. Furnace: holds firewood, sawdust and embers that generates heat for cooking and smoking of the fish.

3.1 GUIDE FOR METAL WORK MATERIAL SELECTION

Each material is recommended based on its use and durability.

- Angle iron - $\frac{1}{8}$ " x $1\frac{1}{4}$ " x $1\frac{1}{4}$ " inch: Used for making frames of the lid, smoking rack, and furnace.
- Flat tin sheet - Used for lid, fat collection tray and furnace. The following guide is provided for the easy selection of tin sheets.
 - ❖ Lid = 20 or 22 gauge (0.7 – 0.9 mm) this is suitable because thicker gauge tin sheet will make the lid heavy and difficult to lift or move.
 - ❖ Fat collection tray = 14 gauge (2.3 mm) tin sheet should be used. The fat collection tray is placed just above the furnace. If the tin sheet is too thin, it will be damaged by the flames over time.
 - ❖ Furnace: 14 or 16 gauge (1.8 mm) is recommended.



Figure 18: Tin sheets



Figure 19: Caster wheels



Figure 20: Stainless steel mesh



Figure 21: Iron tubes



Figure 22: Galvanized steel mesh

3.2 LID FABRICATION

Guide for material selection

Frame: Use angle iron $\frac{1}{8}$ inch x $1\frac{1}{4}$ inch x $1\frac{1}{4}$ inch

Cover: Use 20 or 22 gauge (0.7 – 0.9 mm) tin sheet

Handles: Weld two handles onto the lid cover for raising and lowering the lid.

Construction Steps:

- First, make the frame using angle iron (see Figure 23 and Figure 24).
- Then fix the tin sheet onto the iron frame. Weld two handles on opposite sides of the lid for opening and closing.
- Cut open 5" x 5" square holes as shown in the illustration and fix a 6"x 6" foldable cover sheet using a small hinge.
- The edges should be rounded to avoid injuries while handling.

Table 3: Material requirement for one unit of the lid

Material	Specifications	Unit	Unit cost (MMK)	Quantity required	Cost (MMK)
Angle iron	$\frac{1}{8}$ inch x $1\frac{1}{4}$ inch x $1\frac{1}{4}$ inch	Feet	450	24	10,800
Flat tin sheet	20 or 22 gauge (0.7 – 0.9 mm)	Sheet (4' x 8')	24,000	0.5	12,000
Steel flat iron	$\frac{1}{2}$ inch width	Feet	700	2	1,400
Hinge	3 inches	Each	800	1	800
Total (for one unit)					25,000
<i>Total (for one unit) USD</i>					<i>20</i>

Table 4: Labor requirement to fabricate one unit

Type of labor	Number of days	Remarks
Skilled welder	01	maximum 01-day
Helper	01	maximum 01-day

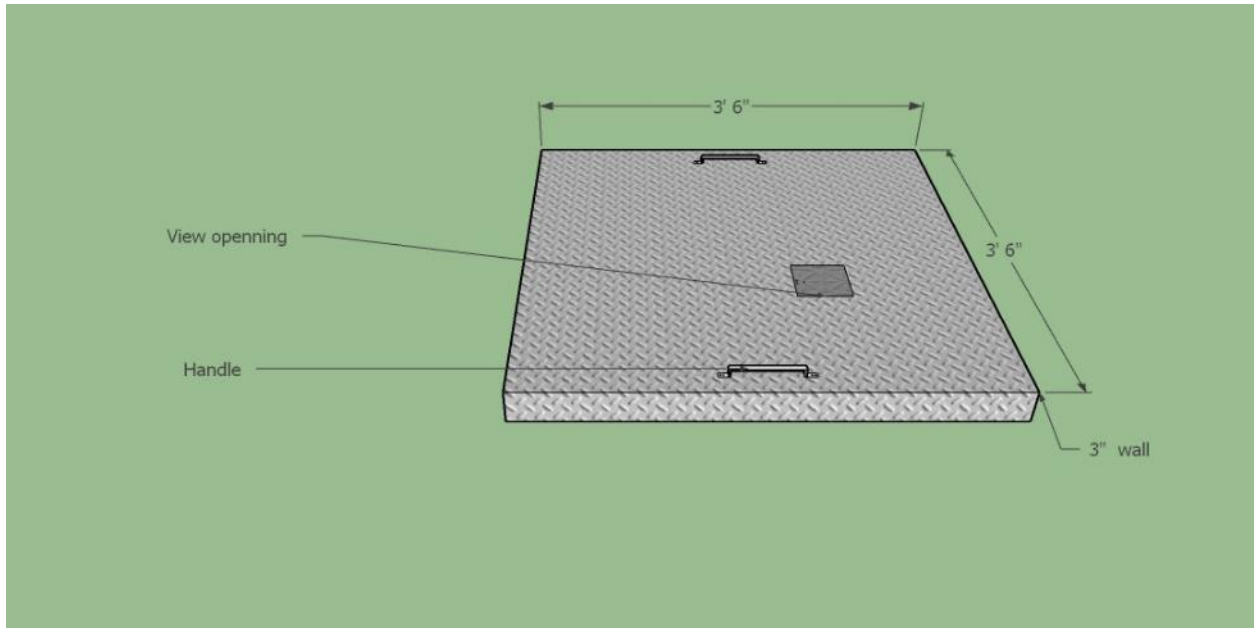


Figure 23: 3D view of the lid – Isometric view



Figure 24: The lid



Figure 25: A lid with holding handles

3.3 SMOKING RACK – STEEL

Material selection guide

Frame: Made with $\frac{1}{8}$ inch x $1\frac{1}{4}$ inch x $1\frac{1}{4}$ inch and weld the 1 inch width flat iron crossing each side

Mesh: $\frac{1}{2}$ inch x $\frac{1}{2}$ inch steel mesh

Construction steps:

- First, make the metal frame using the stainless angle iron.
- Fix the stainless-steel mesh to the frame.

Table 5: Material requirement for a smoking rack (metal)

Material	Specifications	Unit	Unit cost (MMK)	Quantity required	Cost (MMK)
Angle iron	1/8 inch x 1 1/4 inch x 1 1/4 inch	Feet	450	14	6,300
Steel flat iron	1 inch width	Feet	900	8	7,200
Steel flat iron	1/2 inch width	Feet	700	2	1,400
Stainless mesh	1/2 inch x 1/2 inch steel mesh	Linear feet	1,400	16	22,400
Total (for one unit)					37,300
Total (for one unit) USD					28

Table 6: Labor requirement for fabricating two smoker rack units (metal)

Type of labor	Number of days
Skilled welder	01
Helper	01

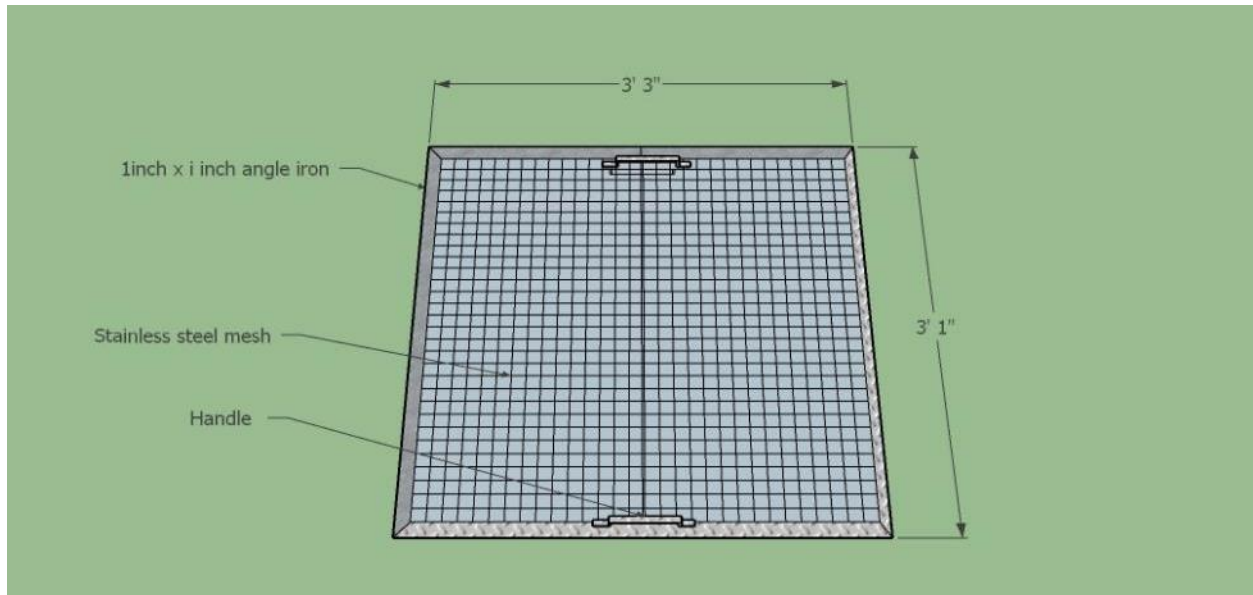


Figure 26: 3D view of the smoking rack – Isometric view

3.4 SMOKING RACK – WOODEN

Material selection guide

Frame: Made with class – 1 timber

Mesh: $\frac{1}{2}$ inch x $\frac{1}{2}$ inch galvanized/ stainless steel mesh is fixed

Construction steps:

- First, make the wooden frame using the class - 1 timber;
- Fix the stainless-steel mesh to the frame.

Table 7: Material requirement for one unit of wooden smoking rack

Material	Specifications	Unit	Unit cost (MMK)	Quantity required	Cost (MMK)
Class-1 timber	3 inch x 1.5 inch	Linear feet		18	
Class-1 timber	1 inch x 1.5 inch	Linear feet		18	
Stainless mesh	1 inch x 1 inch type mesh	Square feet		16	
Total					

Table 8: Labor requirement for fabricating two units of smoking racks (wooden)

Type of labor	Number of days
Skilled Carpenter	01
Helper	01

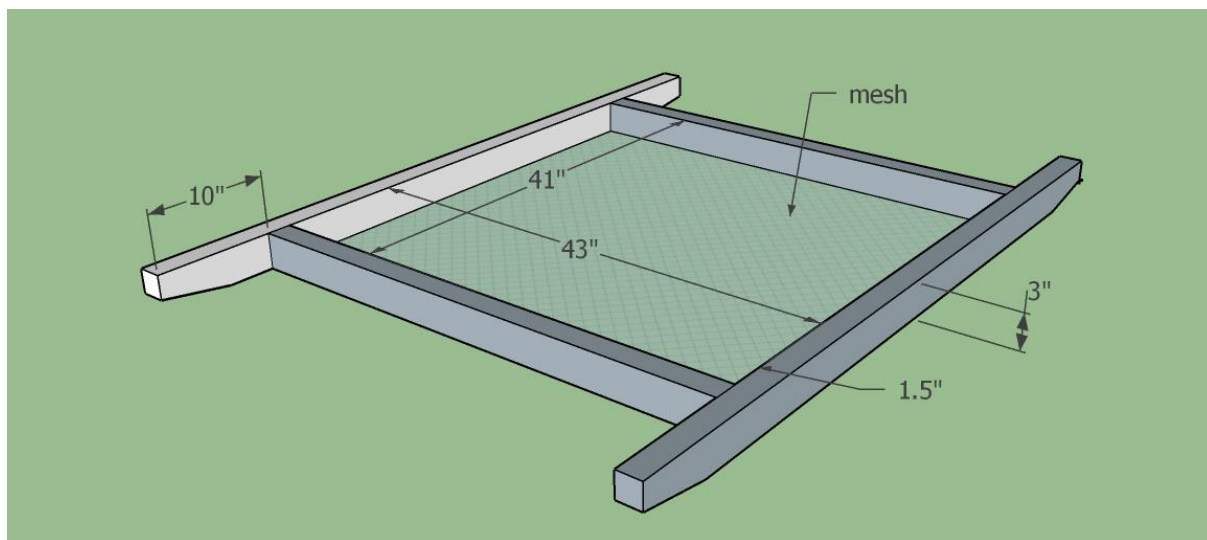


Figure 27: 3D view of the wooden rack



Figure 28: Wooden racks



Figure 29: Additional wooden trays for increased processing capacity



Figure 30: A wooden rack and Daw Vuli with near finished smoked rohu

3.5 FAT COLLECTION TRAY

Construction steps:

- First mark the six holes (2.5-inch radius) on the tin sheet. Each row should have three equidistant holes
- Cut out and remove the holes. Then, bend the outer upwards using a hammer and grind the edges until they are smooth
- Cut six circles, each 8-inch in diameter and make them into the cone shaped cap.
- Fix those cones shaped cup using $\frac{1}{2}$ -inch plate iron as shown in Figure 33. Each cone should be supported with three risers.

Table 9: Material requirement for one unit of fat collection tray

Material	Specifications	Unit	Unit cost (MMK)	Quantity required	Cost (MMK)
Flat tin sheet	14 gauge (2.3 mm)	Square Feet	1,750	22	38,500
Steel flat iron	1/2 inch width	feet	700	16	11,200
Iron pipe	1/2 inch galvanized	feet	450	1	450
Total (for one unit)					50,150
Total (for one unit) USD					38

Table 10: Labor requirement (to fabricate two units of fat collection trays)

Type of labor	Number of days
Skilled welder	04
Helper	04

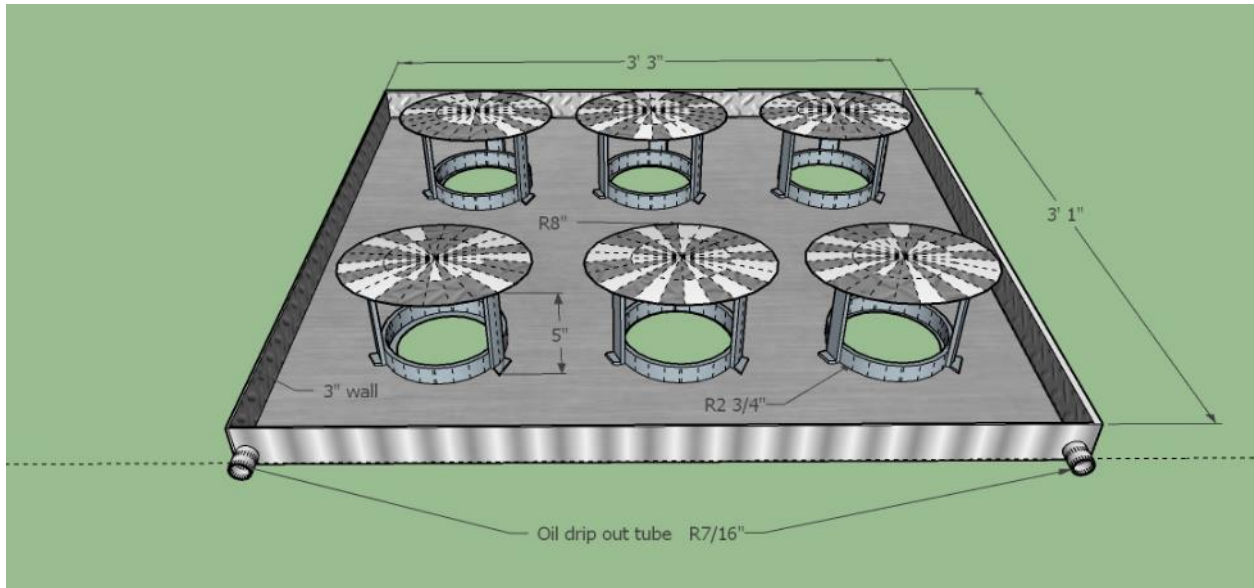


Figure 31: 3D view of the fat collection tray – Isometric view

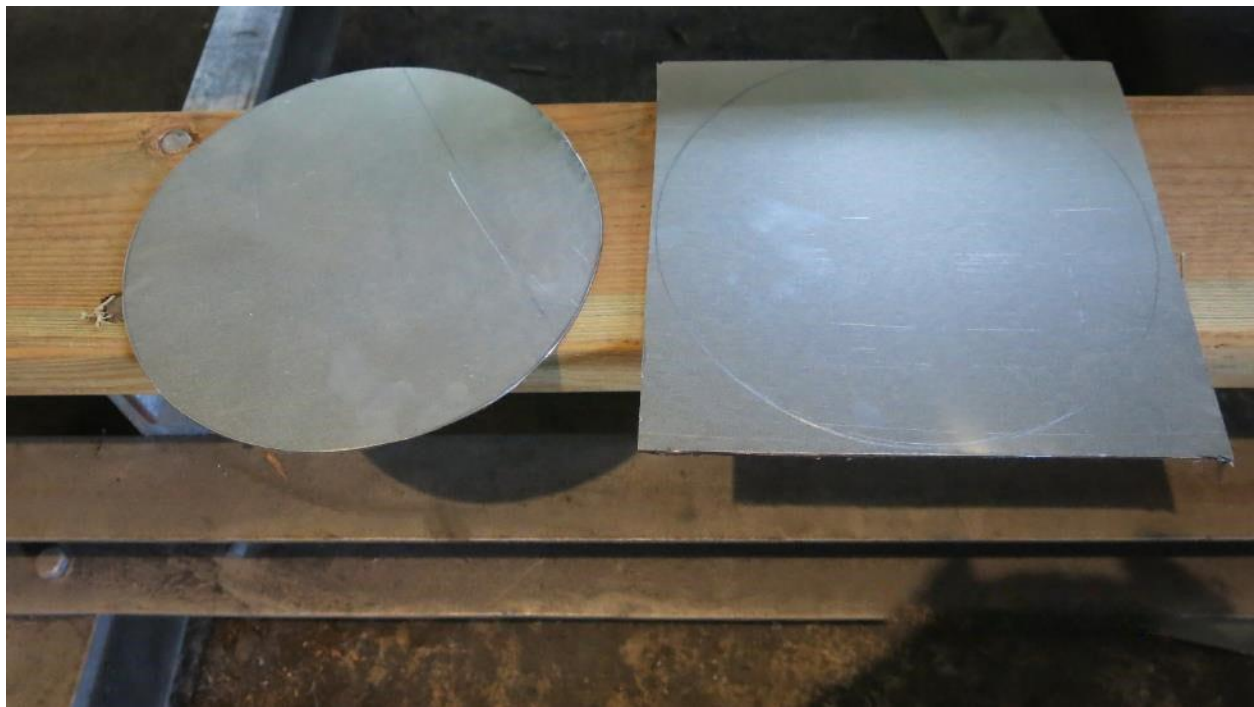


Figure 32: Cone shaped cap



Figure 33: Well-fixed coned shaped caps



Figure 34: Fat collection tray with coned shaped cap

3.6 FURNACE BOX

Construction steps:

- Fabricate the furnace box (2'11" x 2'2" x 10.5") with the 16-gauge (1.8 mm) tin sheet
- Cut remove and 1'8" x 2' hole from the bottom of the box where fuelwood ash will fall
- Make the air tubes using ½ inch iron tubes as shown in the Figure 37 and Figure 38 and fix the inlet to the front side
- Fix the ash pan to the bottom of the furnace using an angle iron (Figure 36 and Figure 42)
- Weld the caster wheels onto the four corners
- The push/ pull handle is made with 1-inch iron tube. The handle should be waist height for easy operation.

Table 11: Material requirement for furnace

Material	Specifications	Unit	Unit cost (MMK)	Quantity required	Cost (MMK)
Caster wheel	2 1/2-inch size iron made	each	3,000	4	12,000
Flat tin sheet	16 gauge (1.8 mm)	sheet (4'x8')	41,000	1	41,000
Angle iron	1/8inch x 1 -1/4-inch x 1 -1/4 inch	feet	450	24	10,800
Steel mesh	1/2-inch x 1/2-inch steel mesh	Square feet	1,400	10	14,000
Iron pipe	1-inch galvanized pipe	feet	800	8	6,400
Iron pipe	1/2-inch galvanized pipe	feet	450	9	4,050
Steel flat iron	1/2-inch width	feet	700	2	1,400
Total (for one unit)					89,650
<i>Total (for one unit) USD</i>					67

Table 12: Labor requirement for one unit of furnace

Type of labor	Number of days
Skilled welder	03
Helper	03

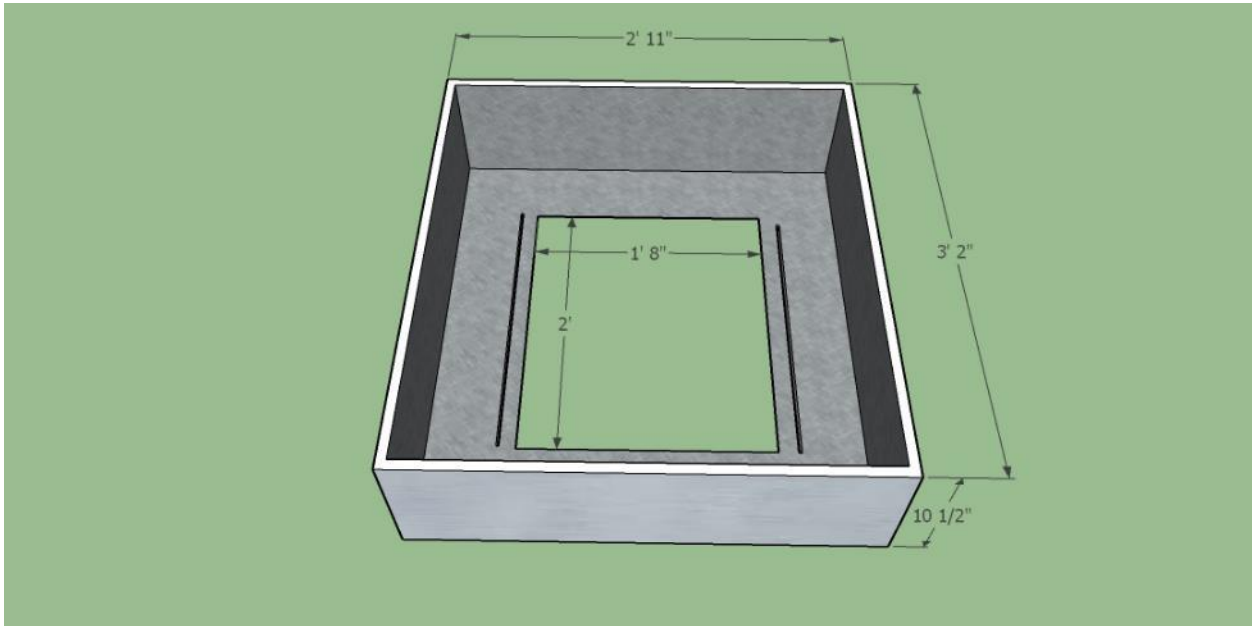


Figure 35: 3D view of the metal box for a furnace. The opening for the ash pan is in the middle of the box.

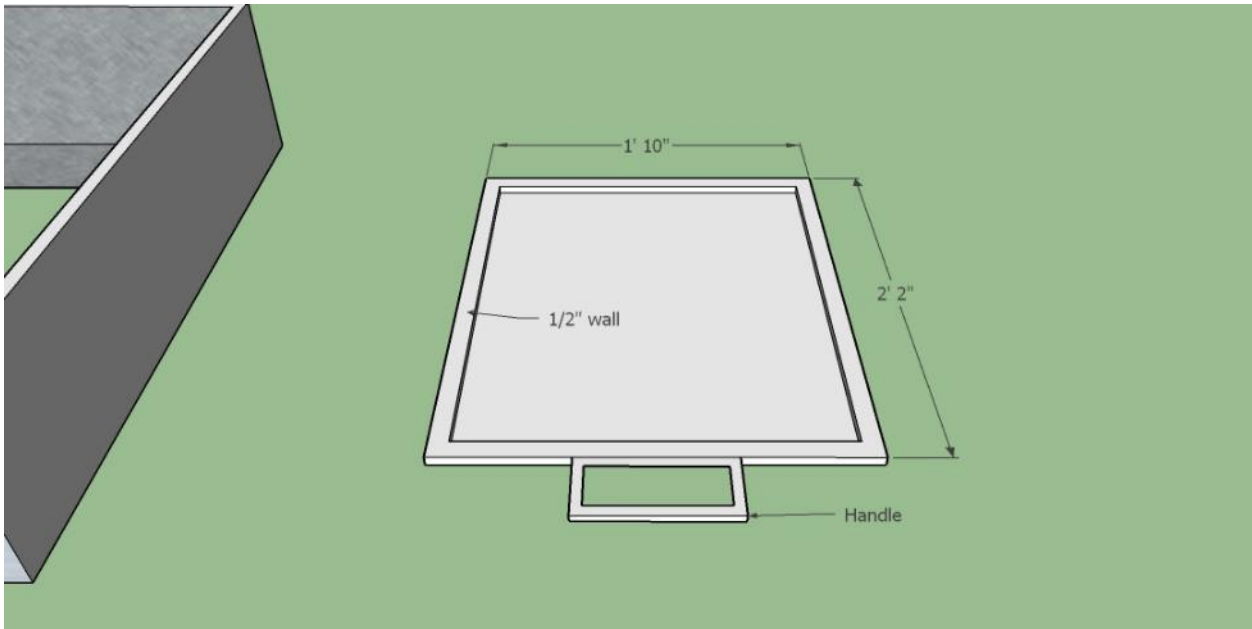


Figure 36: 3D view of the ash pan

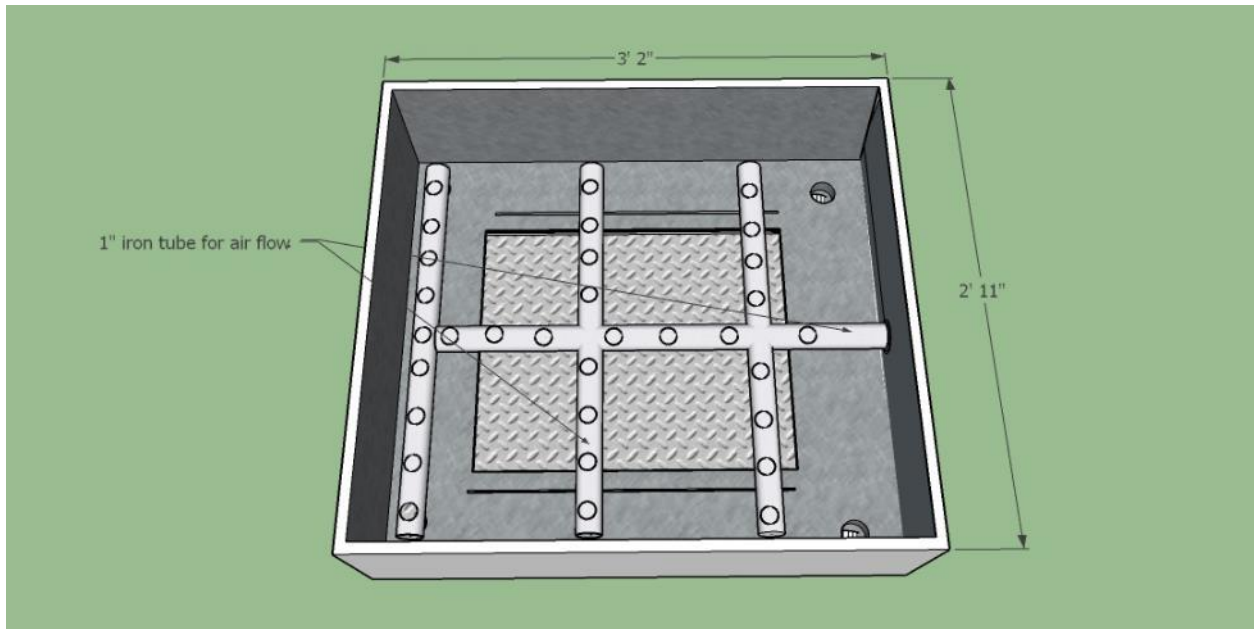


Figure 37: 3D view after ash pan and air tube (side view)

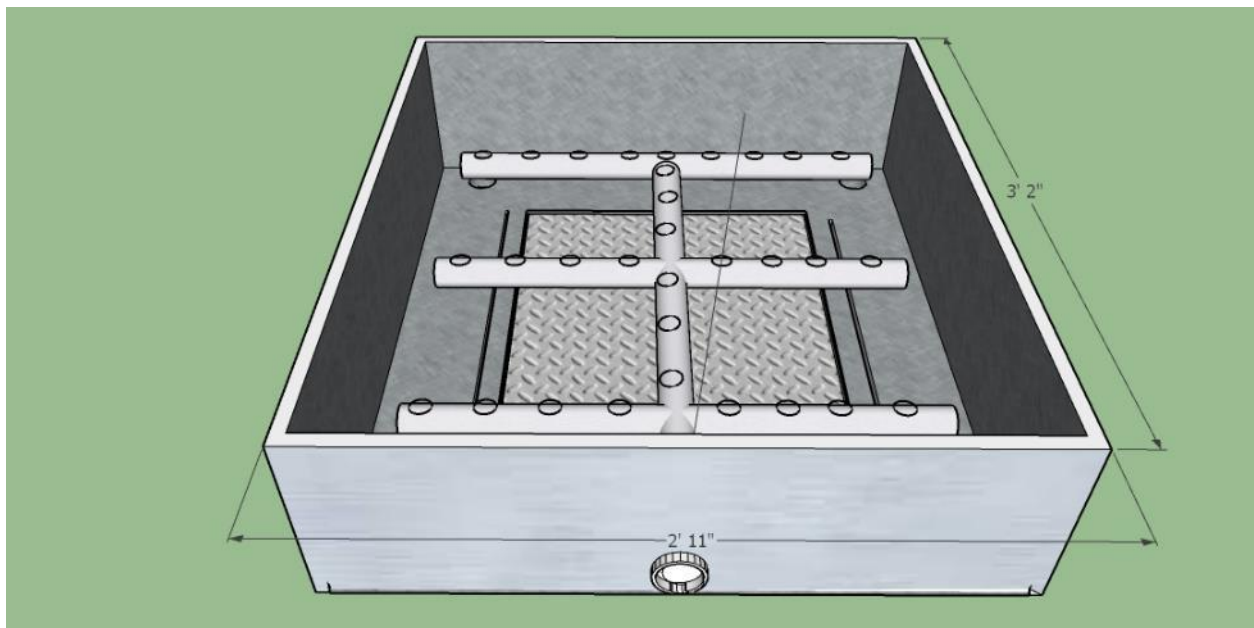


Figure 38: 3D view after ash pan and air tube (front view)

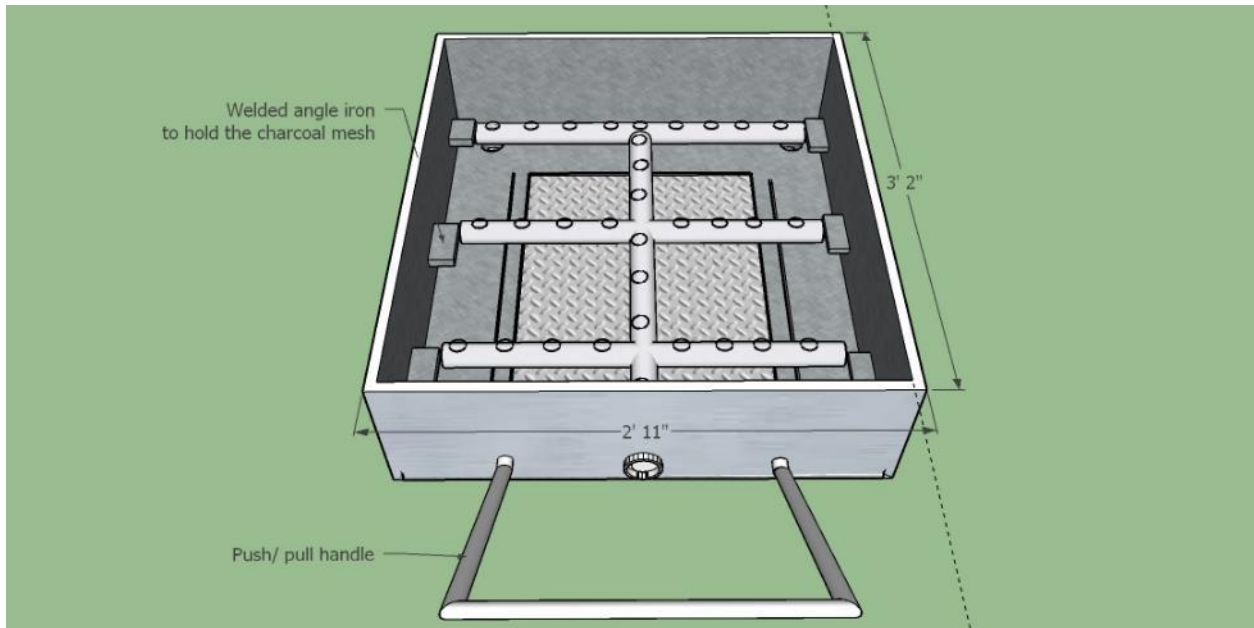


Figure 39: 3D view after ash pan and air tube with handle (front view)

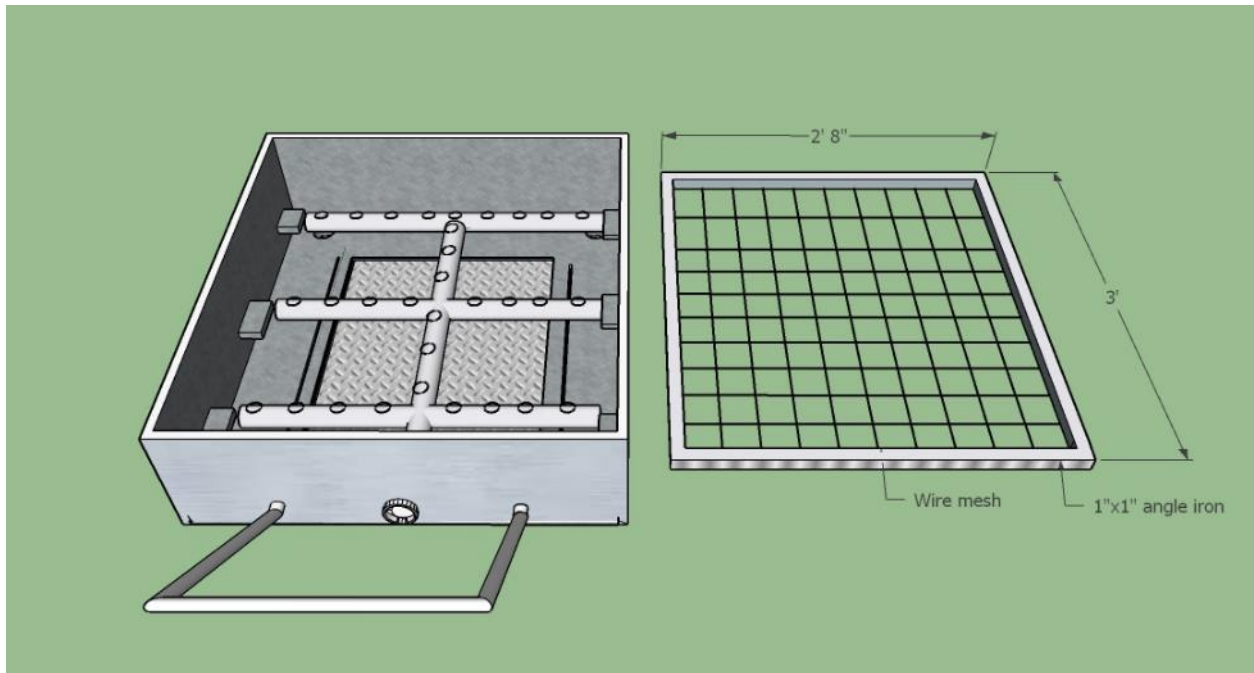


Figure 40: 3D view of the ember/charcoal mesh (front view)

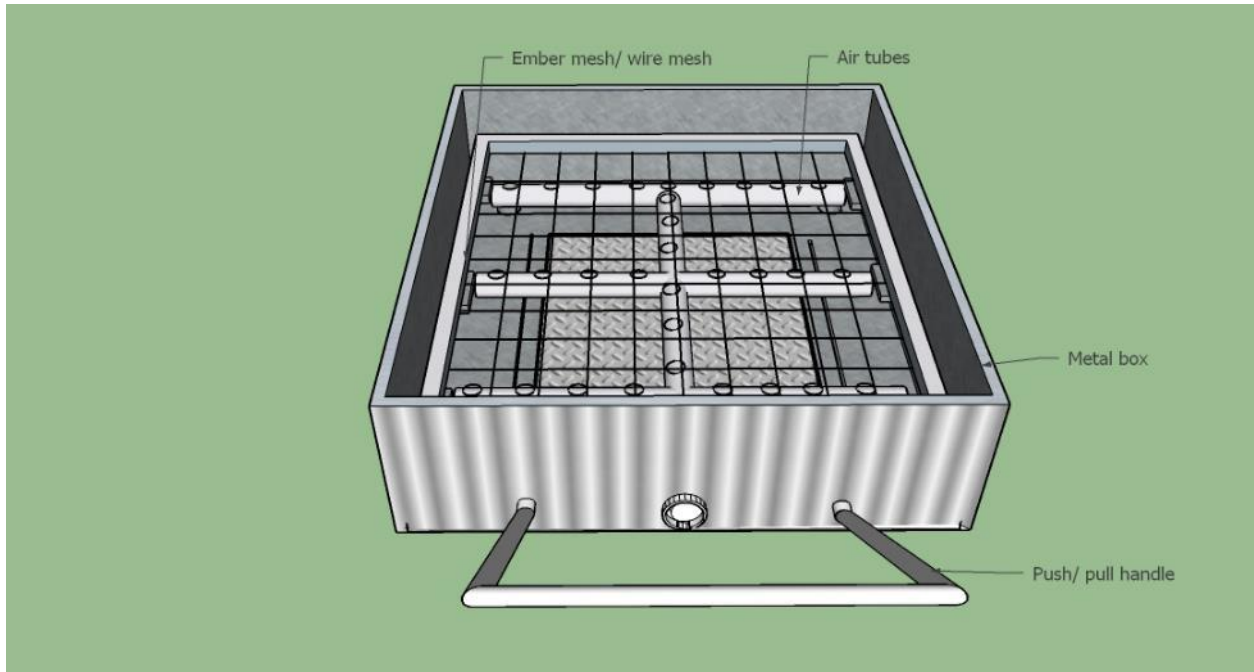


Figure 41: 3D view of the furnace (front view). The ventilation tube simply lets the airflow in the furnace.

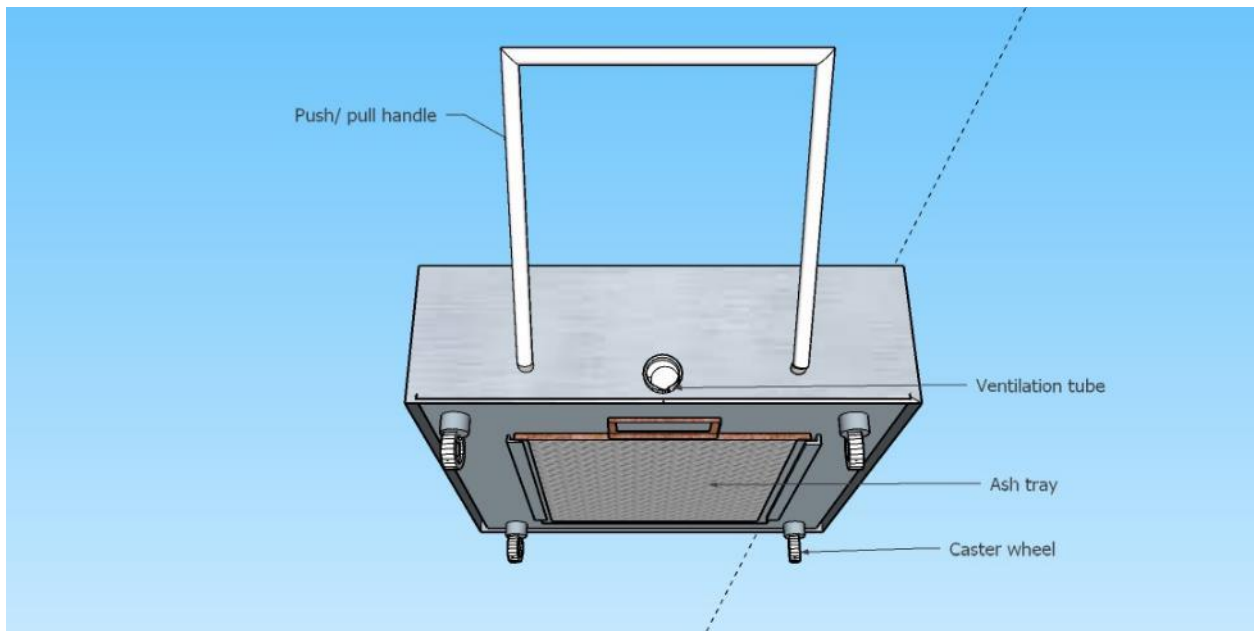


Figure 42: 3D view of the furnace (bottom view)



Figure 43: Furnace box



Figure 44: Opening for the ash tray



Figure 45: Fixing the air tubes



Figure 46: Join the air tubes properly



Figure 47: Fixing the ember/charcoal tray.



Figure 48: Fix the ember/charcoal tray just on the top of the air tubes giving enough space for fuelwood



Figure 49: Bottom of the furnace



Figure 50: Making ember before smoking

Table 13: Summary of the cost of the FTT components

Item	Number of units	Unit cost (MKK)	Cost (MMK)	Cost (USD)
FTT Kiln	1	228,600	228,600	173
Smoking lid	2	25,000	50,000	40
Smoking Rack (metal)	2	37,300	74,600	56
Smoking Rack (wooden) (assumed the cost is same as the metal rack)	4	37,300	149,200	112
Fat collection tray	2	50,150	100,300	76
Furnace	2	89,650	179,300	134
Total material cost (rounded value)			941,400	700

Labor cost for all construction is assumed as 1/3 of the material cost (MMK 941,400 *1/3) = MMK 313,800 / (USD 700*1/3) = USD 233.

This is a rough estimation and the numbers may change according to local conditions¹.

4. REFERENCES

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¹ To be calculated based on cost of the wooden racks.