

A MANUAL

# SGP Energy Efficient Cook-stove



Empowered lives.  
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SGP The GEF  
Small Grants  
Programme

A UNDP-GEF SGP Publication

## SGP Energy Efficient Cook-stove: A MANUAL

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### UNDP-GEF SMALL GRANTS PROGRAMME PAKISTAN

House #144, Defense Officers Housing Society,  
Phase -1, Near Defense Park, Hyderabad Sindh

**Telephone:** +92-22-2108073

**Email:** masood.lohar@undp.org

**Website:** www.sgppakistan.org

 [facebook.com/GEF.SGP.Pakistan](https://www.facebook.com/GEF.SGP.Pakistan)

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# Contents

06	Preface
07	Drawbacks of a traditional Cook-stove
08	Qualities & Benefits of SGP Energy Efficient Cook-stove
09	How Does SGP Energy Efficient Cook-stove Work?
10	Specifications of SGP Energy Efficient Cook-stove





## Preface

UNDP-GEF Small Grants Programme Pakistan has been working on the energy efficiency, low- carbon energy efficient housing and cooking for decades. In the floods of 2010-11 we realized that the biggest problem for the displaced people was how to cook food. Because the traditional mud stoves got destroyed and there was no enough dry land in the immediate vicinities to establish new cook-stoves.

Similarly, because of fast shrinking of the forest cover the fuel-wood cost has risen to the record steep level, in some cases even almost equal to the food prices. This challenge was taken very seriously by UNDP-GEP SGP Pakistan and we started working on a prototype cook-stove which would be metallic, portable, highly energy efficient, insulated to make it user-friendly and with chimney to keep indoor environment smoke free. The experiments made in the backyard of our offices and after several failed attempts to come up with the perfect version, it took us one year to produce the present model of energy efficient cook-stove.

The energy efficient, portable, smokeless, and metallic and heat entrapping technology is considered to be "revolutionary" in the field of improved cook-stoves. The design of the stove ensures complete combustion of biomass and is tested for thermal efficiency of 35-40%. The heat entrapping technology allows for two burners to heat simultaneously. The body of the stove is made of galvanized iron metallic steel and is insulated in order to reduce the external heating of the metallic body. The insulated metallic stoves can yield a reduction in fuel wood consumption of up to 60%. Moreover, it is adaptable to local food practices in Pakistan and can easily be transported from indoors to outdoors on times of extreme weather events.

Following the successful launch of the stove, UNDP-GEF SGP has distributed 7000 stoves among the poor and vulnerable households in different regions of Pakistan. Besides, hundreds of local community members have been trained for the proper installation and maintenance of these metallic stoves. With the greater success of the model, now it is available for mass scale use in Pakistan as well as in other developing countries of the world.

To ensure perfect installation and maintenance of the stoves, UNDP-GEF SGP has prepared this comprehensive manual. We do hope that this manual would greatly serve in the large scale use and maintenance of SGP energy efficient cook-stove. Feedback of the readers and users of the manual would always be welcome.

**Masood Ahmed Lohar**

National Program Manager

UNDP-GEF Small Grants Programme

## Drawbacks of a traditional cook-stove

Pakistan has one of the highest deforestation rates in the world, estimated to be 0.2% to 0.5% annually. This accounts for a 4-6% decline in its wood biomass per year. The world average of forest per capita is 1.0 hectares, while Pakistan has the average of 0.05 hectares. The decline in natural forests is attributed greatly to the dependence of majority of the rural population (72%) on fuel and construction using wood.

Cooking in Pakistan is the main energy consuming practice and consumes about 44% of total energy. In Pakistan, 72% of rural population is dependent on fuel wood for cooking and day-to-day household consumption. The annual biomass consumption is equivalent to around 17 million tons of oil, which suggests that Pakistan's dependency and consumption of biomass is overwhelming.

Along with the environmental consequences of deforestation, the extensive use of fuel wood poses serious health concerns, particularly for women and children. Emissions from the stoves contribute to pollution and poor indoor air quality. In a recent study by the American Chemical Society's Journal of Environmental Science & Technology (2013), it was found that traditional stoves significantly contribute to pollution and poor indoor air quality. Further, they increase the risk of disease and death from inhaling of soot and other hazardous materials in the smoke.

The global burden of disease study (2012) reveals that 4 million people die every year from being exposed to smoke from traditional cook-stoves. The smoke also increases the chances of childhood pneumonia, cardio-vascular disease, chronic lung disease, chronic obstructive pulmonary disease. Women are at a higher risk of these diseases as well as physical problems linked to collecting and carrying fuel wood because they are responsible for not only the collection of fire wood, but also the preparation of meals.

In the backdrop of the negative impact of the traditional stoves, it was critical to come up with a unique design of energy efficient cook-stove. The urge of preventing deforestation, environmental degradation, negative impact on the health of poor communities especially women were certainly a driving force behind the painstaking experiments by the dedicated team of UNDP-GEF SGP, which ultimately resulted in the creation of the energy efficient portable metallic cook-stove.





## Qualities and Benefits of SGP Energy Efficient Cook-stove

There are a number of qualities which make the SGP Energy Efficient cook-stove different from the traditional stoves in use in Pakistan and other parts of the world. Some of the positive qualities of the SGP cook-stove are as under:

### Efficiency

- SGP cook-stove is an easily portable and improved cook-stove which reduces fuel-wood consumption. The stove has two burners to heat simultaneously. It is a portable, metallic, improved biomass cook-stove made of GI Sheet.
- The design ensures complete combustion of biomass. The cook-stove is tested for thermal efficiency of 35%.
- The cook-stove facilitates in clean cooking practices and reduces health risk amongst the rural households and families.
- The cook-stove is designed in a way that its use results in reduced use of firewood as well as reduced indoor air pollution and carbon emission.
- The body of the cook-stove is made up of galvanized iron metallic steel, insulated in order to reduce the heating of metallic body of the stove.

### Social Benefits

- Use of the cook-stove reduces drudgery of women and children of rural areas (due to reduced fuel-wood use) by reducing time spent and distance traveled for fuel-wood collection.
- It's use also results in reduction in firewood requirement and helps in spending more time in productive activities such as education and employment etc.
- Use of the cook-stove results in improved overall health (particularly prevention in the diseases related to respiratory system) of women and children by reducing smoke in the kitchen.

### Environmental Benefits

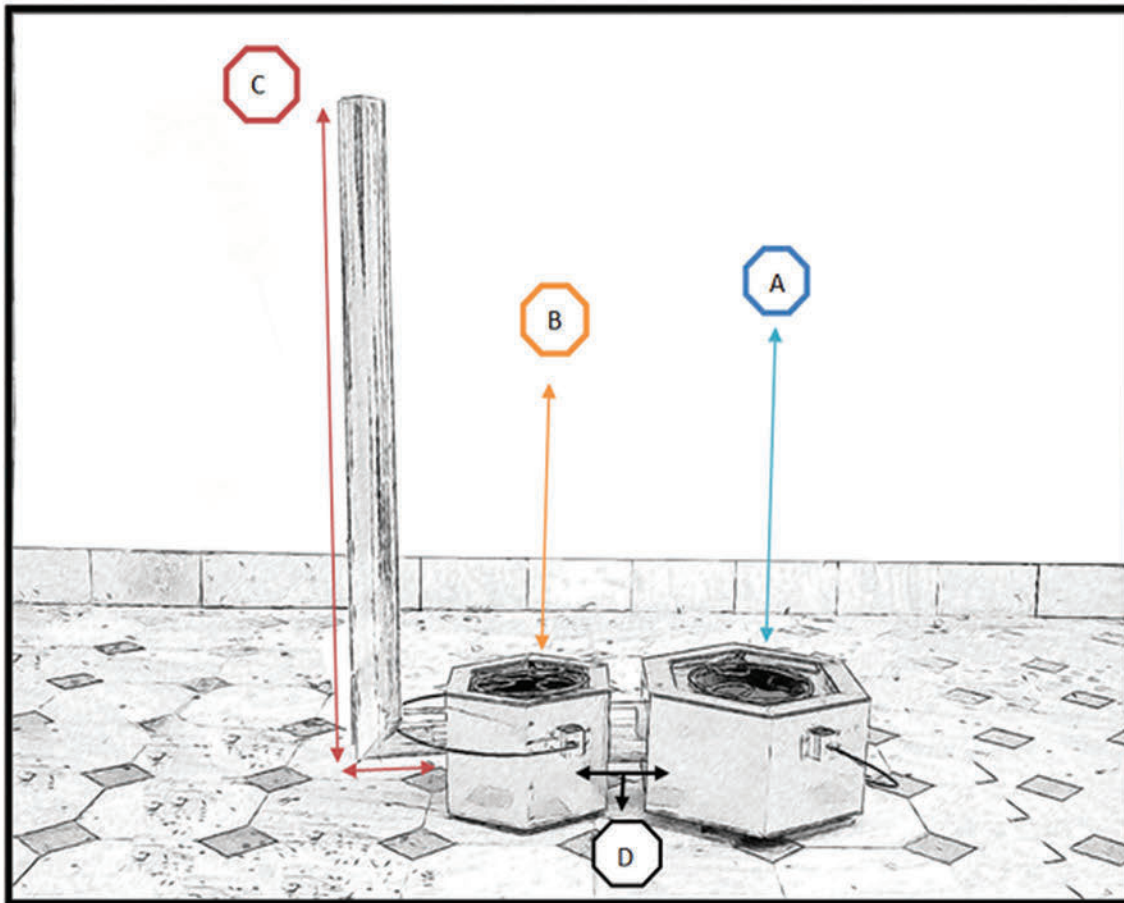
- Use of the cook-stove improves the local environment by reducing the rate of forest degradation/deforestation.
- Conservation of the forests will not only reduce non-renewable biomass demand, but will also reduce soil erosion and loss of biodiversity.
- Use of the cook-stove reduces the greenhouse gas emissions.

### Economic and Technological Benefits

- Employment opportunities for local communities involved in training of the cook-stove users, undertaking periodic maintenance and post lifetime replacement as well as reduced expenses on the purchase of fuel-wood.
- The cook-stove is an introduction of new technology to the rural communities
- Knowledge transfer to trainers including technicians with regard to training to users as well as maintenance of system etc.

## How Does SGP Energy Efficient Cook-stove Work?

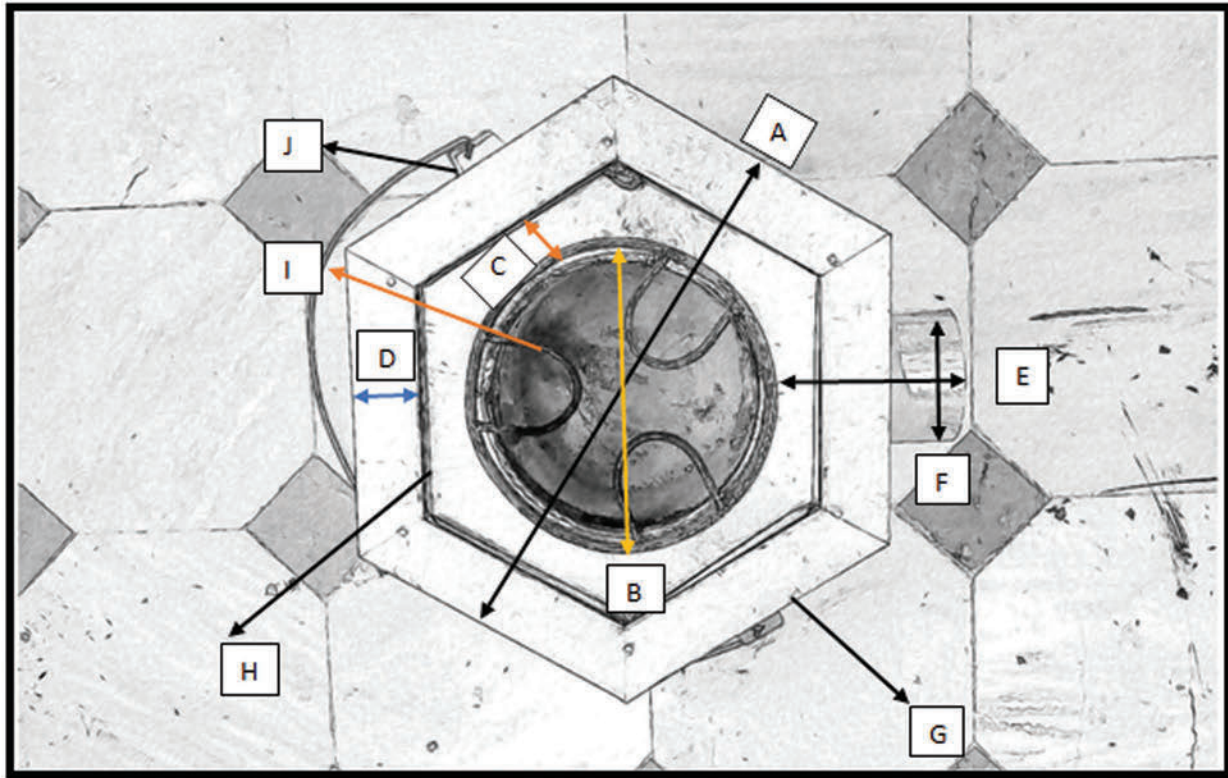
- The cook-stove has two burners, smoke exhaust pipe and glass wool (heat insulator).
- The fuel wood is placed in the stove through the Burner A.
- The heat and smoke from Burner A is transmitted through the interconnected pipe, which provides heat for burner B.
- Burner B is not using extra fuel wood for cooking but rather receives the heat coming from burner A.
- The excess smoke is sent through the smoke exhaust pipe C.
- The body of the cook-stove is made of galvanized iron metallic steel and is insulated in order to reduce the external heating of the metallic body.
- The amount of smoke emitted through the exhaust pipe is considerably less compared to the open air traditional mud stoves.



A: 1st Burner B: 2nd Burner C: Smoke Exhaust Pipe D: Aluminum Laminated Glass Wool (Heat Insulator)

# Specifications of SGP Energy Efficient Cook-stove

Figure 1: 1st Burner of the Cook-stove

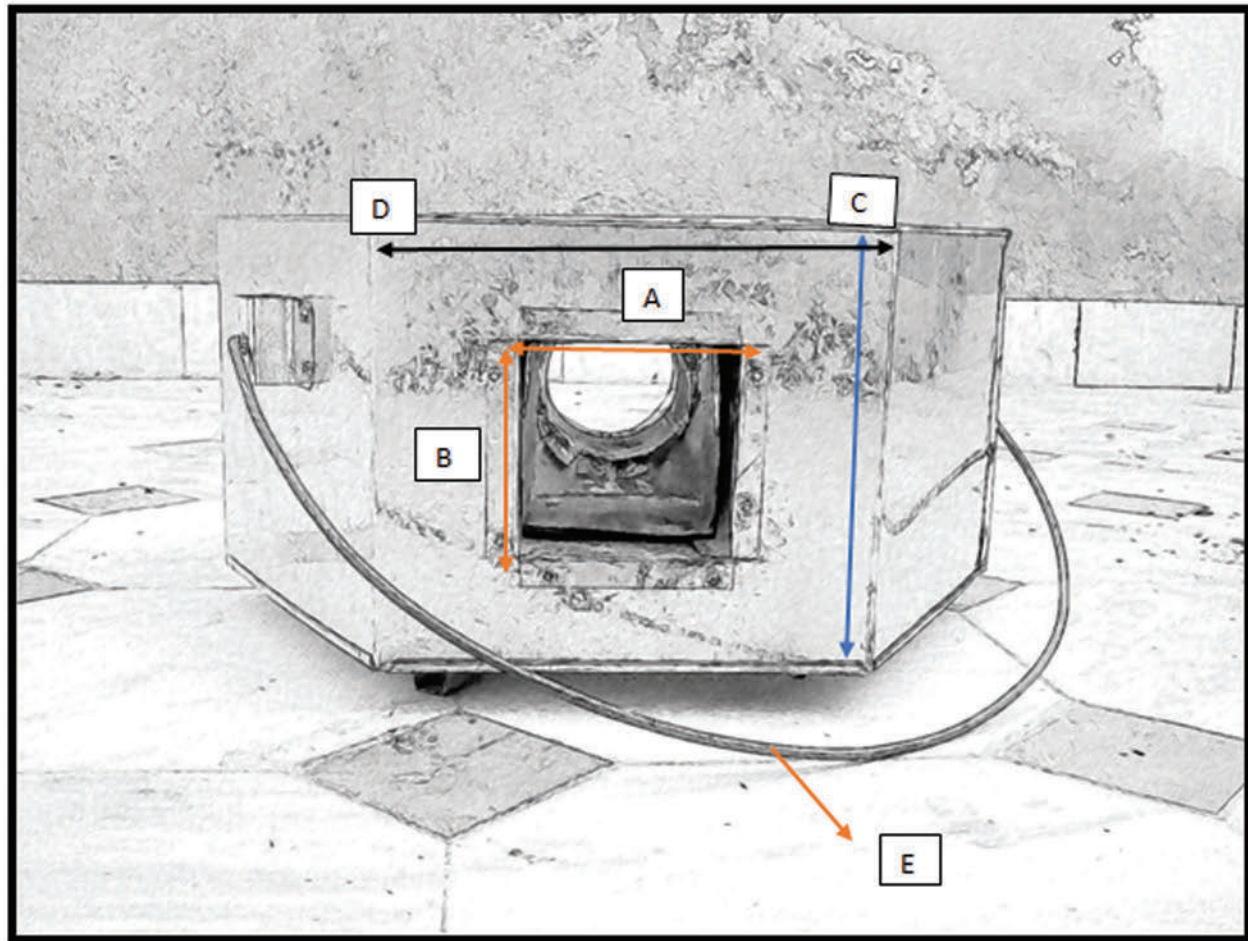


## Specification of 1st Burner

Sno.	Letter	Description	Size (Inches)	Thickness (Gauge)	Insulation
1	A	Diameter of 1st burner	16"		
2	B	Diameter of cup	8"	19	Aluminium laminated glass wool
3	C	Width of sheet 2	2"	19	Aluminium laminated glass wool
4	D	Width of sheet 1	2"	19	Aluminium laminated glass wool
5	E	Length of Interconnected pipe	3" inside	19	Aluminium laminated glass wool
6	F	Diameter of Interconnected pipe	3" dia inside. 5" dia outside	19 26	
7	G	Sheet 1	Outside	26	
8	H	Sheet 2	Outside	26	
9	I	Grating	As shown in figure 1	1/4"	
10	J	Handle	As shown in figure 1	3/16"	



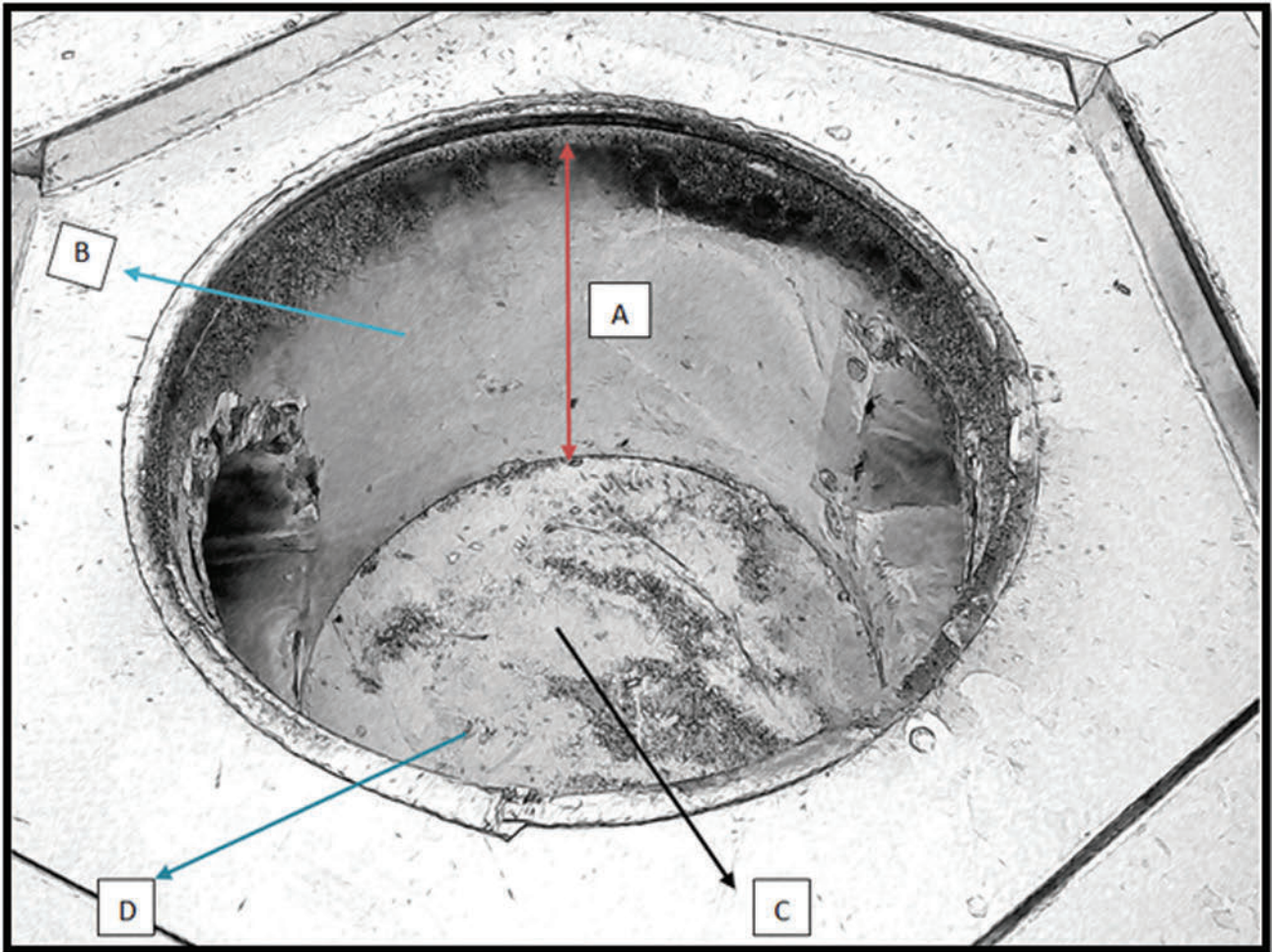
Figure 2: Cook-stove Door



## Specification of Cook-stove Door

Sno.	Letter	Description	Size in Inches	Gauge
1	A	Length of door	4"	Insulated double sheeted door with handle in lock
2	B	Hieght of door	5"	- do -
3	C	Hieght of 1st burner	8"	- do -
4	D	Length of Side of 1st burner	7"	- do -
5	E	Handle		3/16"

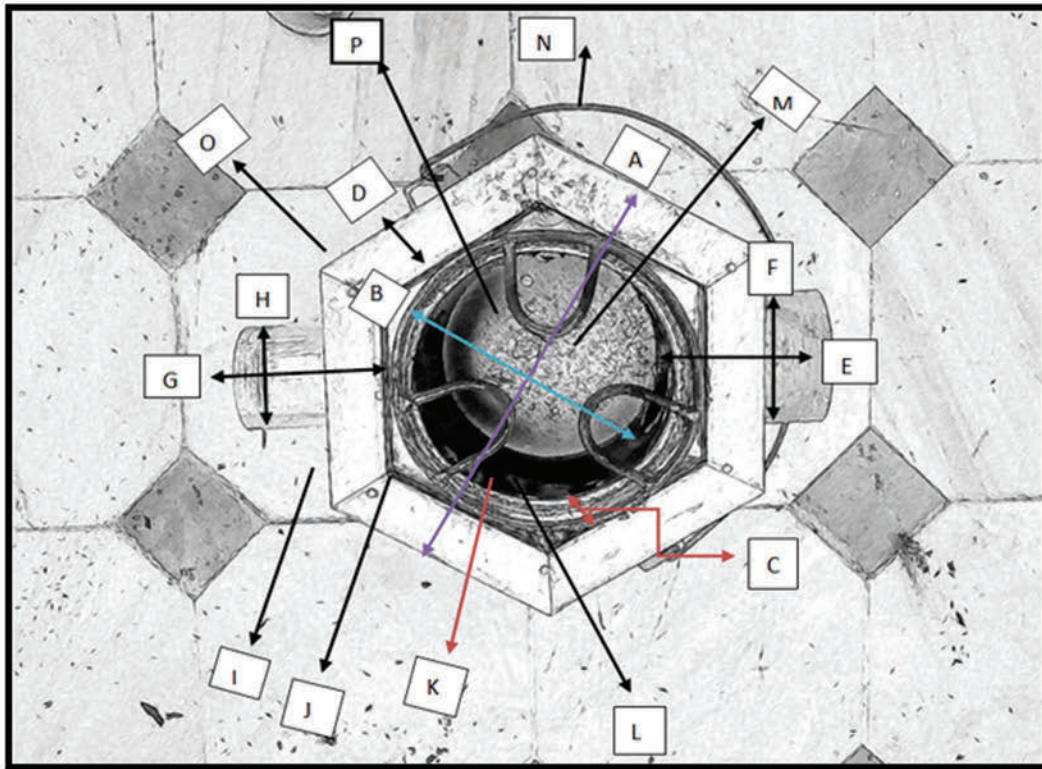
Figure 3: Burner Cup



## Specification of Burner Cup

Sno.	Letter	Description	Size in Inches	Gauge
1	A	Height of cup	7	19
2	B	Sheet 3 outer bottom		26
3	C	Cup bottom		19
4	D	Bottom insulation	3	Aluminum laminated glass wool insulation

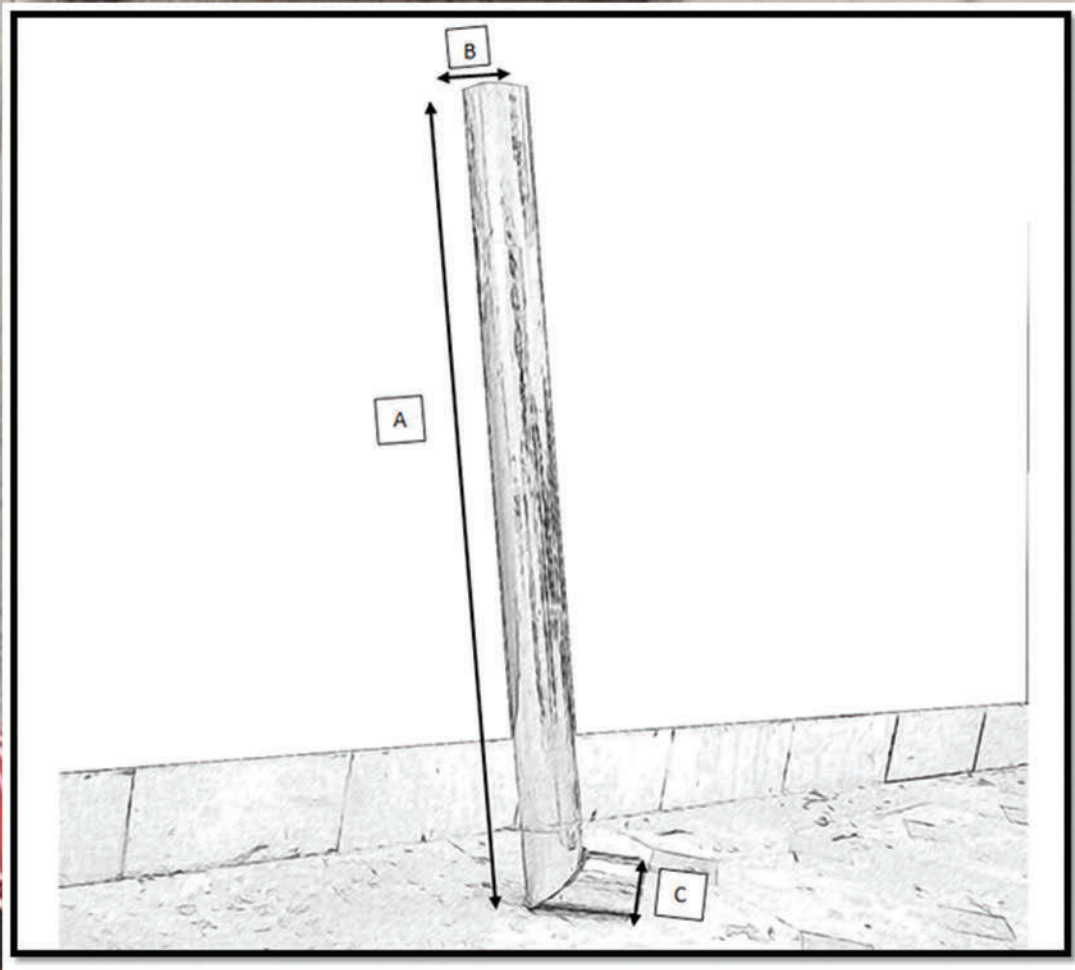
Figure 4: 2nd Burner



## Specification of 2nd Burner

Sno.	Letter	Description	Thickness In/ft	Gauge
1	A	Diameter of 2nd burner	12"	
2	B	Diameter of fuel cup	6"	
3	C	Width of sheet 2	3"	
4	D	Width of sheet 1	3"	
5	E	Length of interconnected pipe	6"	
6	F	Diameter of interconnected pipe	3"	Bend insulated with chimney
7	G	Length of chimney	9ft	
8	H	Diameter of chimney (internal /external)	3/5"	Inside/Outside
9	I	Sheet 1	26g outside	26
10	J	Sheet 2	26g outside	26
11	K	Height of cup	7"	
12	L	Sheet 3 inside		19
13	M	Bottom of cup		19
14	N	Handle		3/16"
15	O	Height of 2nd burner	9"	
16	P	Grating	As per figure 4	1/4"

Figure 5: Chimney

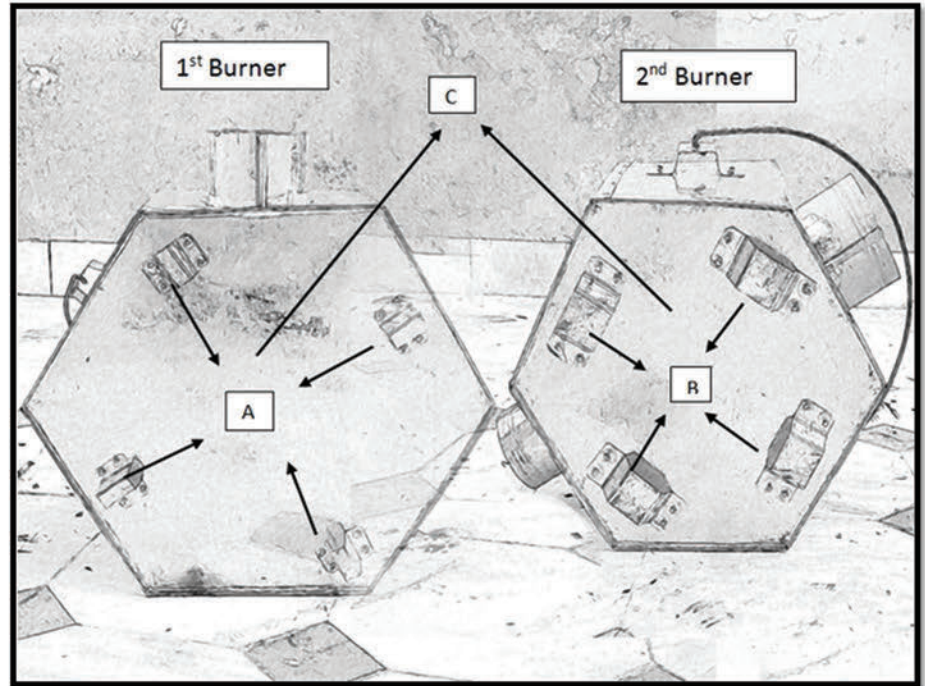


### Specification of the Chimney

Sno.	Letter	Description	Thickness In/ft	Gauge
1	A	Length of chimney	9'	Inner/outer (19/26)
2	B	Diameter of chimney	3"/5"	Inner/outer (19/26)
3	C	Diameter of interconnected bend	3"/5"	Inner/outer (19/26)



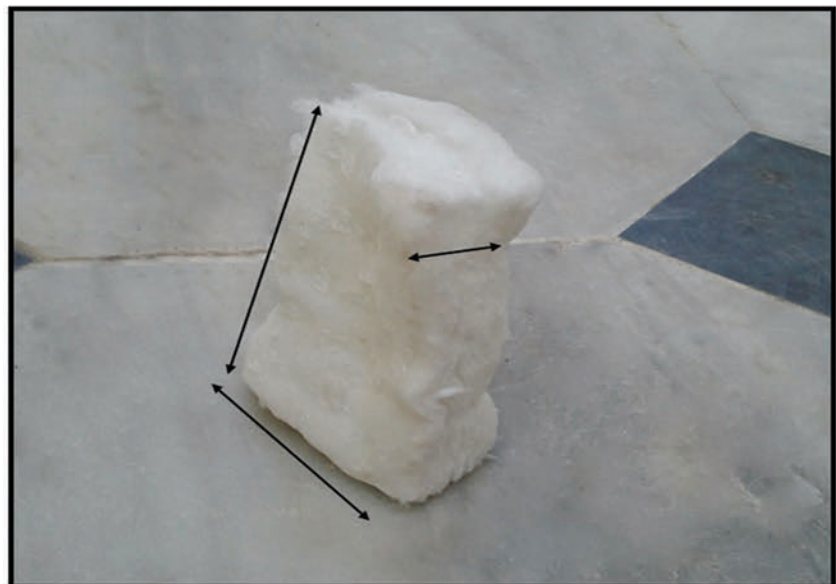
Figure 6: Bottom of the Cook-stove



### Specification of the Cook-stove Bottom

Sno.	Letter	Description	Height of toes in inch
1	A	Toes for 1st burner	1"
2	B	Toes for 2nd burner	2"
3	C	Gauge of bottom	26 gauge

Figure 7: Aluminum laminated Glass Wool (Heat Insulator)





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House #144, Defense Officers Housing Society, Phase -1,  
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Telephone: +92-22-2108073 | Fax: +92-22-2108074

Email: [masood.lohar@undp.org](mailto:masood.lohar@undp.org) | Website: [www.sgppakistan.org](http://www.sgppakistan.org)  
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