

**A Report**  
**On**  
**Implementation of Improved Biomass Cookstoves**  
**and Related Services in Jharkhand State**

**Submitted by**



**SPRERI**  
Striving for Excellence

**Sardar Patel Renewable Energy Research Institute**

**Submitted to**



कल्याण विभाग की इकाई

**Jharkhand Tribal Development Society**

**July 2019**

**Jharkhand Tribal Development Society (JTDS)** has been registered under the Societies Registration Act of 1860, primarily to implement tribal development projects of Government of Jharkhand, Government of India and multilateral organizations after the termination of the earlier project. For implementation of the new Jharkhand Tribal Empowerment and Livelihood Project (JTELP) it has been established 14 Project Management Units (DPMUs)/Offices in the districts where the project activities has been carried out and a State level Project Management Unit (SPMU)/Office at Ranchi. The JTDS program seeks to develop and implement a replicable model that ensures household food security and improves livelihood opportunities and overall quality of life of the tribal population based on sustainable and equitable use of natural resources.

**Sardar Patel Renewable Energy Research Institute (SPRERI)** is an autonomous and not-for-profit organization, working as a Non-Governmental Organization (NGO). It is recognized by the Department of Scientific and Industrial Research (DSIR), as a Scientific and Industrial Research Organization and it is part of the consortium formed under the Indian Council of Agricultural Research (ICAR) – an autonomous organization under the Department of Agricultural Research and Education (DARE), Ministry of Agriculture and Farmers Welfare, Government of India. SPRERI is a renowned renewable energy (RE) research institution working in development of solar and bio energy technologies for rural areas and MSME sector. SPRERI is recognized for centre of post graduate research by many universities and academic institutions across Gujarat.

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## Executive summary

Solid fuels holds a major share in rural cooking energy basket. According to census 2011, 65% of Indian population still using solid fuels to meet their cooking energy requirements and majority of such population reside in rural areas. In rural areas, solid fuels especially wood, predominantly utilize for cooking in the C-type chulhas, which are highly inefficient ( $\eta_{th} = 8-12\%$ ) cooking devices. Under a demonstration project sponsored by International Fund for Agricultural Development (IFAD) and supported by Jharkhand Tribal Development Society (JTDS), the Sardar Patel Renewable Energy Research Institute (SPRERI) has distributed 1000 nos. of family size improved biomass cookstove (190-NDS-L) in four districts viz. Pakur, Godda, Sahebganj and Dumka of Jharkhand. Pahariya community of Jharkhand are the main beneficiaries of this project.

Two surveys (pre and post-implementation) were conducted to identify socio-economic status and evaluate cooking energy use pattern of Pahariya community. Main socio-economic findings include; a) 95% of survey beneficiaries were living in kachha houses, b) the average family size consist 5 members, c) 71 % families have only one room in their house, d) The livelihood of Pahariyas mainly depends on agriculture. The cooking energy usage data shows that; a) C-type and inline chulhas (2 plot mud stove) are popularly used cooking devices by the beneficiaries b) some of the survey beneficiaries obtained LPG connection from Ujjwala Yojana, but only few are using it due to lack of awareness to use LPG, high upfront cost of refilling i.e. ₹730/Cylinder (14.2kg), distant supply points and social inertia.

After implementation of improved biomass cookstoves, the average wood consumption and breakfast cooking time has reduced from 16 kg to 9.5 kg, and 95 minutes to 70 minutes respectively. A significant reduction in the fuelwood consumption found among all the sample beneficiaries. The reduction in wood consumption could have a direct impact on the beneficiaries through; a) reduction in drudgery during wood collection, b) availability of time for livelihood generation activities.

Implementing improve biomass cookstoves in larger scale with creating awareness among rural populace have potential to avoid tons of biomass used as fuelwood, reduction in indoor air pollution and ultimately reducing drudgery to rural communities. Direct switching from solid to clean cooking fuels might not be possible for Pahariya community due to economic, social and geographical constraints for a time being, but using improved biomass cookstove could certainly help in the transition from solid fuels to clean cooking fuels.

## Introduction

As per census 2011, around 65% of Indian population depends on solid fuels to meet cooking energy demand. A major share of such population resides in rural areas, and mainly use C-type chulhas for cooking (Chandramouli, 2011). C-type chulhas are highly inefficient ( $\eta = 8-12\%$ ) cooking devices and produces high smoke during operation. Under a demonstration project sponsored by International Fund for Agriculture (IFAD) and supported by Jharkhand Tribal Development Society, the Sardar Patel Renewable Energy Research Institute (SPRERI) has distributed 1000 nos. of family size improved biomass cookstove (190-NDS-L) in four districts viz. Pakur, Godda, Sahebganj and Dumka of Jharkhand. The aforementioned four districts are part of Santhal Paragana, which is home to significant population of pahariya community of Jharkhand (FE Online , 2017). Pahariya comes under the Particularly Venerable Tribal Group (PVTG) and are the beneficiaries under this project (Satyam, 2017). The Pahariyas reside in the mountains (Pahar) and mostly use C-type chulhas for cooking activities.



Figure 1: Map of area of implementation

Table 1: Details of district wise cookstoves distribution

S.No.	District	Taluka/Block	Nos. of cookstove
1	Godda	Boarijore , Sunderpahari	300
2	Sahebganj	Borio, Karmatand	200
3	Pakur	Amarapara, Littipara	400
4	Dumka	Gopikandar, Masaliya	100

## Approach and methodology

The main objective of this project is to evaluate the impact of improved biomass cookstoves (IBCs) on cooking energy pattern of pahariya families. The project activities mentioned below in Figure 2.

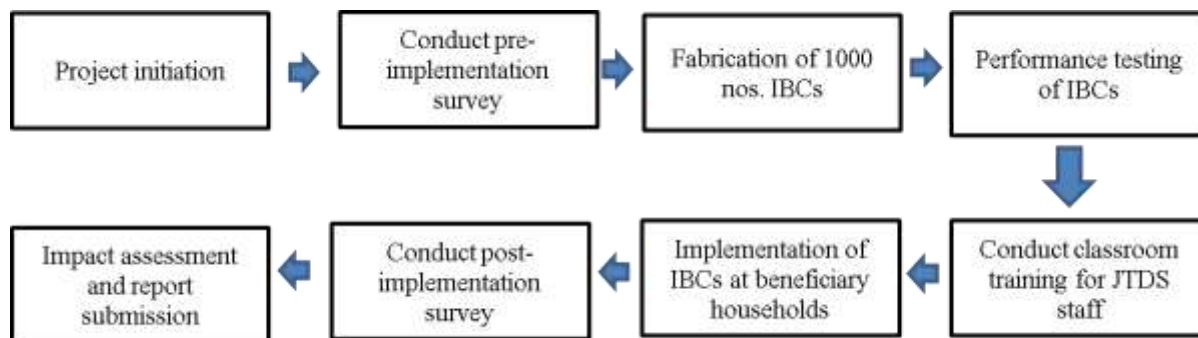


Figure 2: Flow diagram of project activities

The improved biomass cookstoves were fabricated from two manufacturers M/s Technocraft, Faridabad (Serial No. 1- 400) and M/s Yashwant Scientific Industries, Vadodara (Serial No. 401-1000). The performance testing of cookstoves conducted on premises of M/s Tecnocraft Faridabad on 16/01/2019, and after successful testing, the cookstoves were dispatched to designated locations of each district, as mentioned in the Table 1. The performance testing sheet attached in Annexure I.

To understand cooking energy use pattern and impact of the cookstove on the lives of beneficiaries; two survey (pre-implementation and post-implementation) were conducted in the selected villages of aforementioned districts. In the pre-implementation survey, major emphasis were given to identify the socio-economic and cooking energy pattern of the beneficiaries. The methodology followed during pre-implementation survey mentioned in Figure 3.

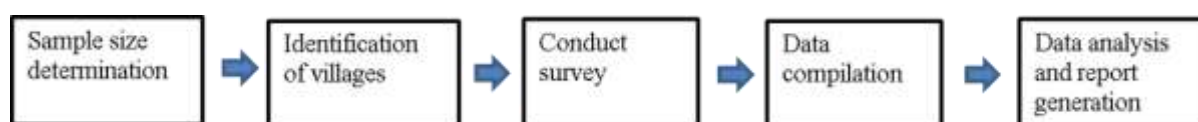


Figure 3: Methodology selected for pre-implementation survey

### Sample size determination

Using statistical inference, a sample size of beneficiaries was calculated to get representative sample of pahariya community in Jharkhand. From t-tables, at 95% confidence interval and 5% error, the sample size should be 385 (Israel, 1992). In this exercise, it was planned to survey more than 400 beneficiaries in the pre-implementation phase, so that various set of analyses could be performed on the dataset and the findings can be useful in implementing projects for larger populations as well. 436 Beneficiaries are surveyed during the pre-implementation survey exercise. The villages surveyed are mentioned in the Annexure II.

Formula used to calculate the sample size:

$$n_0 = \frac{Z^2 * p * q}{e^2}$$

Where,

$n_0$  = Sample size

Z = Z-score value of respective confidence interval

p = Estimated proportion of an attribute that is presented in the population

q = 1-p

e = Margin of error (5%)

Post implementation survey were conducted 3 months after the distribution of cookstoves to the beneficiaries, to evaluate impact on cooking energy pattern of beneficiaries. Pre and post-implementation survey formats are enclosed in the Annexure III and IV respectively.

For conducting the survey exercise, SPRERI has collaborated with Department of Energy Engineering, Central University of Jharkhand. Four M.Tech students from Central University of Jharkhand were part of this exercise with SPRERI team, detail of the survey team mentioned in Table 2.

Table 2: Details of the survey team

S. No.	Name of Surveyor	Details
1	Er. Ashutosh Negi	Programme Officer (SPRERI)
2	Nishit Kumar Singh	M.Tech Student (CUJ)
3	Vivek Prasad	M.Tech Student (CUJ)
4	Rajat Xalxo	M.Tech Student (CUJ)
5	Santosh Kumar Rajak	M.Tech Student (CUJ)

### Classroom Training Program

A classroom training program for JTDS district/ block officials and field level associates was organized at Pakur on 07/03/2019 to provide them basic information about cooking technologies and role of improved biomass cookstoves in minimizing the nuisance caused by C-type chulhas. Findings of pre-implementation survey on socio-economic status and cooking energy use pattern of beneficiaries also presented during the classroom training program.



Figure 4: Class room training program at Pakur



The cookstoves were transported to designated locations after completion of the classroom training program, and distributed among the beneficiaries through respective blocks. Pictures of distribution are mentioned in Figure 5.



## पहाड़िया समुदाय के बीच धुंआ रहित चुल्हा वितरण



चुल्हा सौंपते विधायक।

**बोरियो/संवाददाता।** झारखंड आदिवासी विकास संस्था (जेटीडीएस) द्वारा सिटीजन्स फाउंडेशन कार्यालय में शनिवार को करघाटाई, कबड़ा व आवरी पहाड़ के संघड़ी पहाड़िया आदिम जनजातियों के बीच बोरियो विधायक साला मरांडी ने धुंआ रहित चुल्हे का वितरण किया। इस मौके पर सिटीजन्स फाउंडेशन कार्यालय से परियोजना समन्वयक कृष्ण मोहन श्रीवास्तव, जेडर ऑफिसर सोनी युग्, व समुदायक उत्प्रेरक राजकुमार राजक, सुरज राजक, अरविंद पंडित, साहिल मरांडी सहित अन्य मौजूद थे।

Figure 5: Improved biomass cookstove distribution to beneficiaries

### Brief overview of SPRERI-TECH Improved biomass cookstove (190-NDS-L)

Improved biomass cookstove is a modified cooking device uses fuelwood, agri-residue, and briquette for cooking applications. In C-type chulhas, there are generally no provision for air supply, which causes incomplete combustion and leads to smoke formation and higher fuelwood consumption during cooking. To overcome this issue, primary (4 Nos.) and secondary (20 nos.) holes provided in the SPRERI-TECH improved biomass cookstove which leads to almost complete combustion of fuelwood. This stoves emits ~80 % less emission and uses ~50 % lesser biomass during cooking compared to C-type chulhas. An operation and maintenance manual, provided to beneficiaries for imparting the basic information about the usage of cookstove to beneficiaries. A copy of the manual is enclosed in Annexure V.



Figure 6: SPRERI-TECH improved biomass cookstove with wood type

**Performance parameters:** The performance parameters of the SPRERI – TECH improved biomass cookstove are mentioned below in Table 3.

Table 3: Performance Parameter of SPRERI-TECH 190-NDS-L

S. No.	Performance Parameter	Value
1.	Thermal efficiency	25.95%
2.	Carbon monoxide (CO)	2.95 g/MJ <sub>d</sub>
3.	Total particulate matter (TPM)	216.64 mg/MJ <sub>d</sub>
4.	Power output	1.90 kW

:

## Result and discussions

After the distribution of cookstove to the beneficiaries in March 2019, a post-implementation survey exercise conducted 3 months later in May 2019. Around 50% of the pre-implementation survey beneficiaries were contacted for post-implementation survey to evaluate their experience with the improved biomass cookstoves.

As mentioned earlier, socio-economic and cooking energy use data are collected from in-person interviews of the beneficiaries. In the next sub sections a detailed discussion on socio-economic status and a comparative assessment of pre and post implementation survey findings are presented.

### Socio-economic status

Pahariyas community generally resides in small hamlets. Major share of the population is illiterate and for livelihood, they mainly depends on agriculture and animal husbandry. It is important to mention that with the increase in urbanization, Paharia people from villages near towns also started working as daily labours. Brief details about socio-economic status of the Pahariya community discussed in the following sub sections:

- A) **House type:** As shown in the Figure 7, 95% survey beneficiaries owned kaccha houses which are predominantly made by stone and clay. The roof of the houses are made by mangalore tiles, wood sticks and leaves. The houses owned by the beneficiaries are shown in Figure 8. Few pakka houses also found in the surveyed villages, which were constructed under Indira Aawas Yojna or Birsa Munda Aawas Yojna.

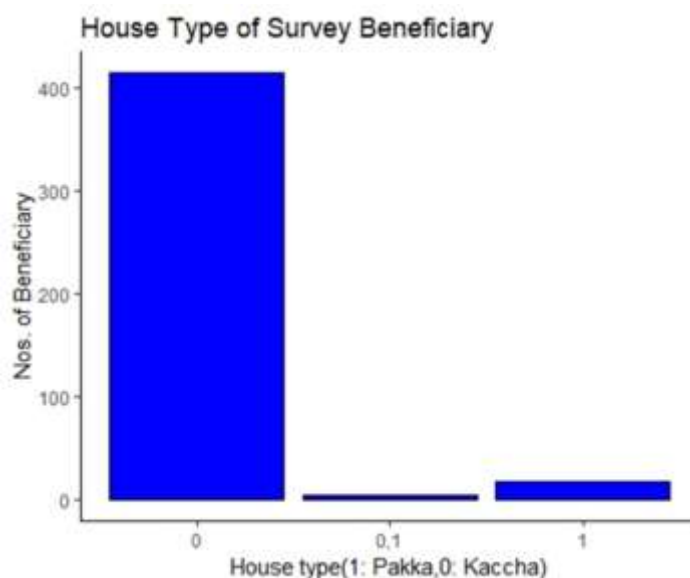


Figure 7: House type owned by the survey beneficiaries



Figure 8: Image of houses owned by the beneficiaries

B) **Educational qualification of beneficiaries:** In the Figure 9, educational qualification of the survey beneficiary has shown. 83% of the sample beneficiaries were found illiterate and only 13% have studied class 5<sup>th</sup> or higher.

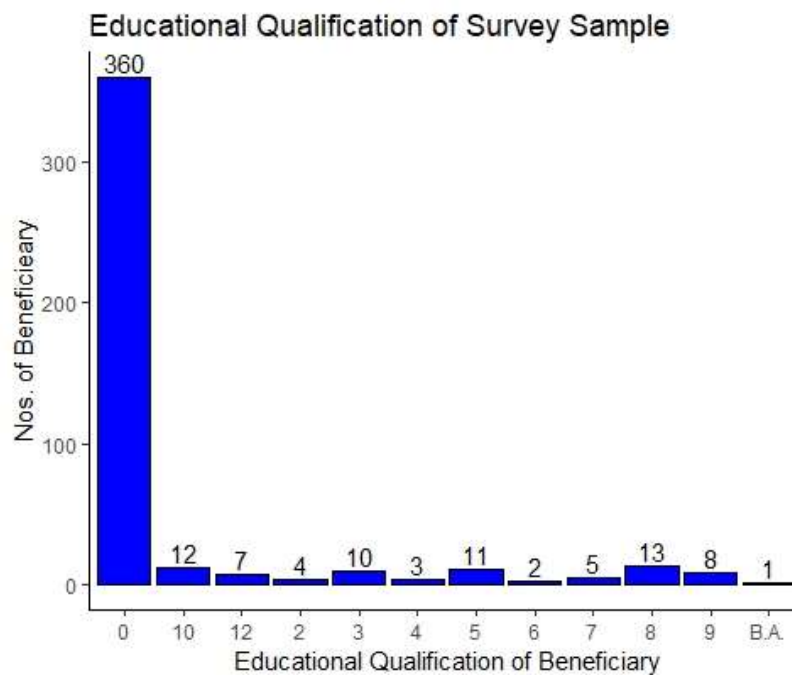


Figure 9: Educational qualification of survey beneficiary

C) **Window availability in the kitchen:** The houses owned by Pahariya community generally do not have windows in their kitchens. As shown in Figure 10, 87% survey participants don't have a single window in their kitchen, this might be due to traditional practices followed by Pahariya community during house construction.

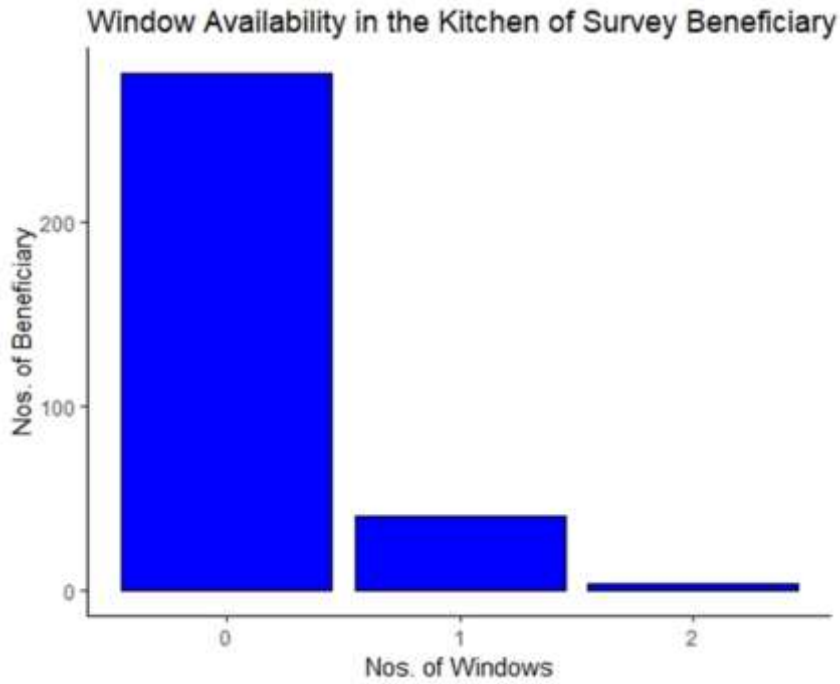


Figure 10: Window availability in the kitchen

D) **Main occupation of the beneficiaries:** Pahariya people reside in remote locations which restricts their options for livelihood generation. Figure 11 shows that 94% of the survey beneficiary responded farming as their main occupation which is mainly rain fed type. It is also evident from the figure, no survey beneficiary has engaged in poultry as main livelihood option and some of the Pahariyas living near towns started working as a daily labourer for meeting their financial needs.

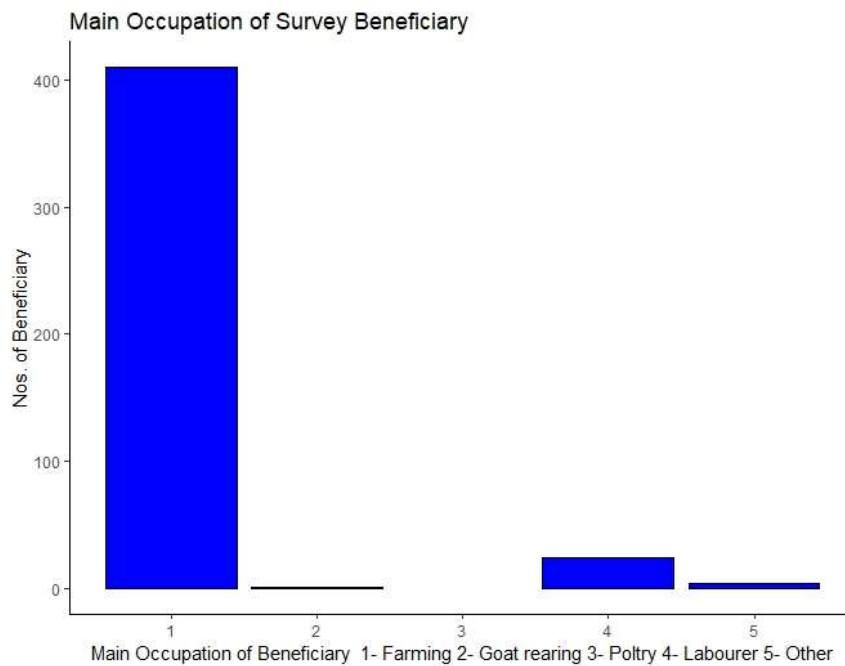


Figure 11: Main occupation of survey beneficiary

E) **Family size and rooms in house:** Pahariyas generally lives in kaccha houses. The average family size of survey beneficiary was 5 and ranges from 1 to 14 members. In Figure 12, number of rooms occupied by particular family size is presented. It is evident that majority of survey families, irrespective of the family size living in the houses consisting one room.

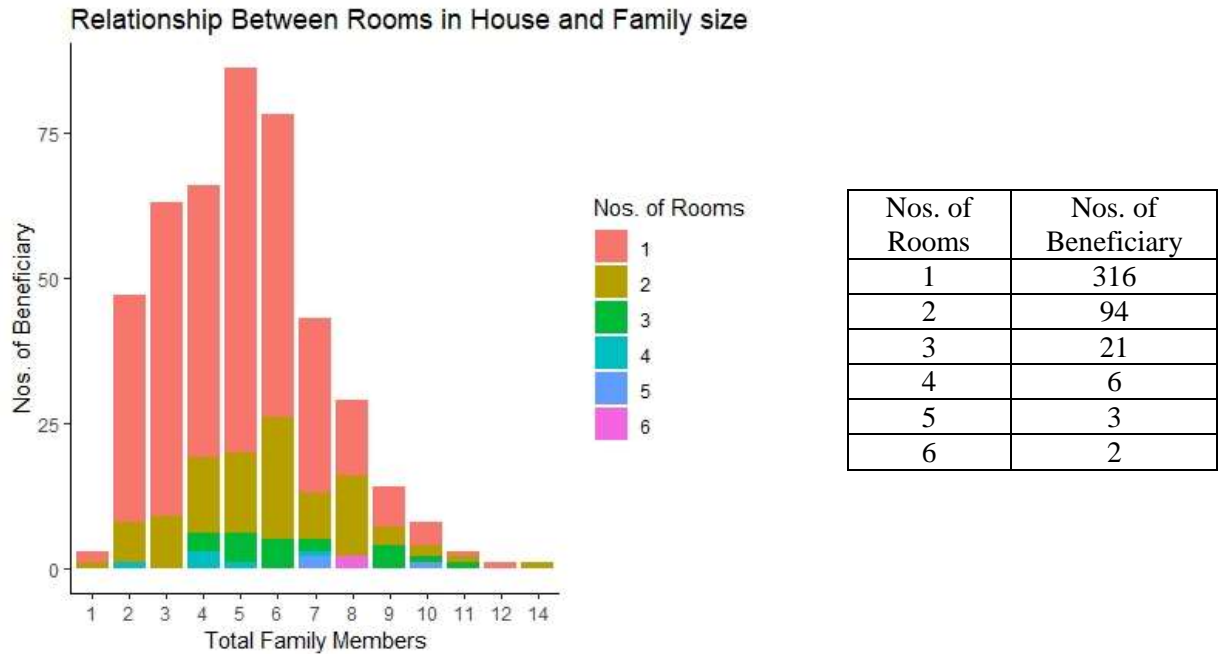


Figure 12: Relationship between family size and nos. of rooms in the house

### Cooking energy use status

Pahariyas are primitive tribal group of Jharkhand and mainly use long wood collected from nearby forest for cooking applications. Image of wood bundles shown in Figure 13.



Figure 13: Wood used for cooking

A comparative assessment of pre and post-implementation survey is presented below to evaluate the impact of improved biomass cookstoves on the cooking energy pattern of Pahariya community.

**A) Stove use for cooking:** During the pre-implementation survey, it was found that beneficiaries use variety of cooking stoves viz. C- type chulha, inline chulha, coal fired stove and LPG stoves. From Figure 14, it is evident that, C type chulha and inline chulhas holds maximum shares of cooking stoves used in the beneficiary households. Images of both C-type chulha and inline chulha are shown in Figure 15. Some beneficiaries have obtained LPG stoves through Ujjawala Yojana, but only a few were found using it regularly. The main reasons for not using LPG regularly includes lack of awareness to use LPG, high upfront cost of refilling i.e. ₹730/Cylinder (14.2kg), distant supply points and social inertia.

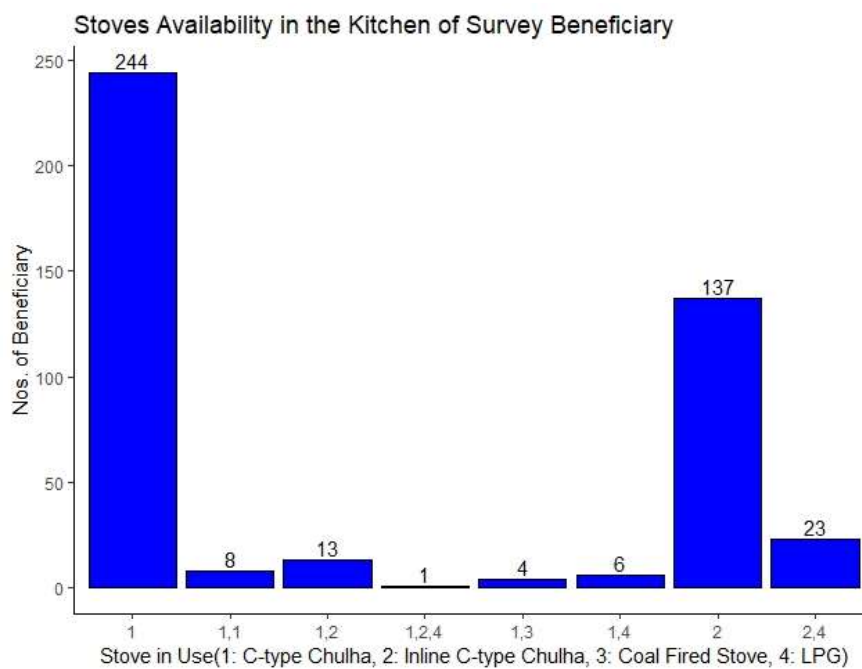


Figure 14: Type of stove use in cooking



Figure 15: Image of C-type and inline stoves

**B) Daily wood consumption vs distance of wood collection:** To evaluate how judiciously the beneficiaries using the biomass resources for cooking applications, a plot between daily wood consumption and wood collection distance shown in the Figure 16 . For bigger family sizes, the wood consumption per day found higher compared to smaller family sizes at same wood collection point distance.

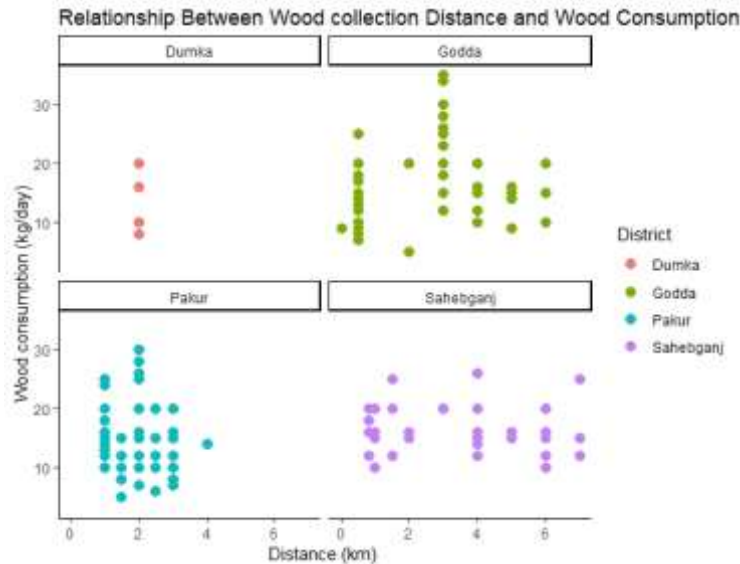


Figure 16: Relationship between wood collection distance and daily wood consumption

**C) Family size vs rice cooked in breakfast:** In the Figure 17, relationship between family size and rice cooked in breakfast is presented. The upward trend shows to increase in the rice consumption with increasing size of family, but for the similar family sizes variation in consumption pattern may be attributed due to; a) purchasing power of the family, b) number of children and elderly members in family, c) local food habits. The mean rice cooked in the breakfast was found 1.3 kg.

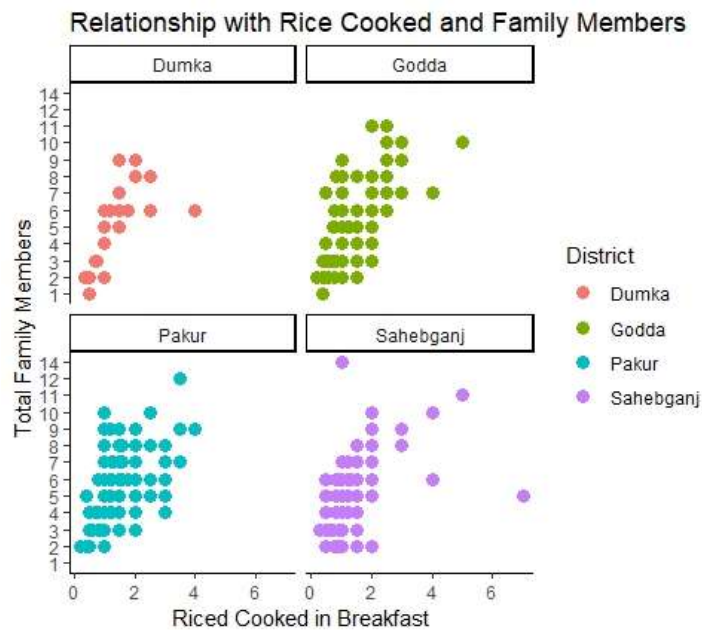


Figure 17: Rice cooked in breakfast and family size



**D) Time taken in cooking breakfast (before and after):** Cooking device have significant impact on the cooking time. The efficiency of the improved biomass cookstove is greater than 25% as compared to 12% of C- type chulhas. Rice is staple food of Pahariyas. As found during the survey, people generally cook two meals (breakfast and dinner) a day and both the times, usually rice and dal cooked by the beneficiaries. It is important to mention that almost similar quantity (rice and dal) of food cooked by beneficiary families. For simplicity, a comparative assessment of breakfast cooking time is presented in the Figure 18. A significant reduction in breakfast cooking time, before and after the implementation was found during pre and post implementation survey exercise. The mean breakfast time after implementation reduced to 70 minutes compared to 95 minutes of before implementation.

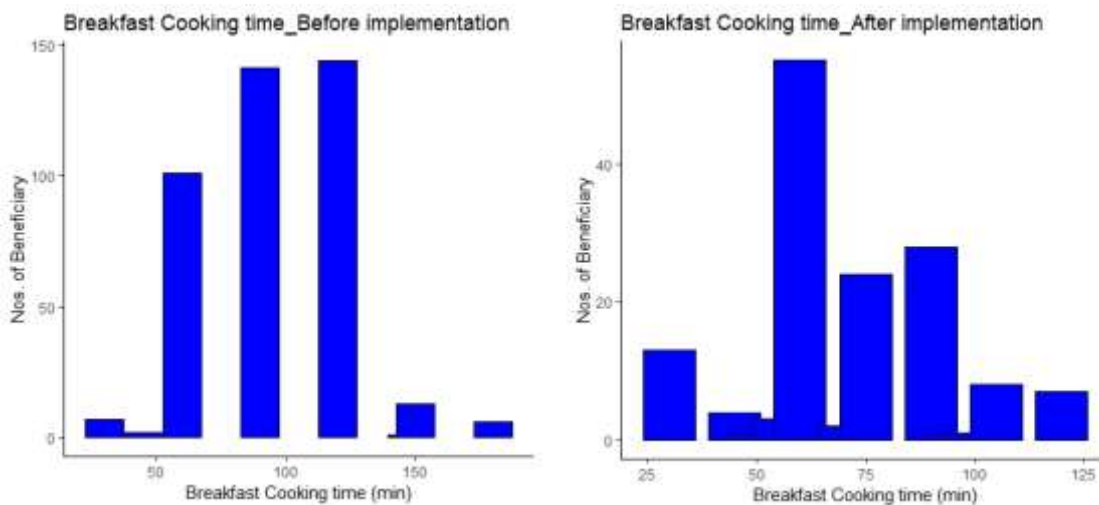


Figure 18: Breakfast cooking time before and after the cookstove implementation

**E) Family size and daily wood consumption (before and after):** Figure 19 shows daily wood consumption of a family before and after the implementation of improved biomass cookstoves.

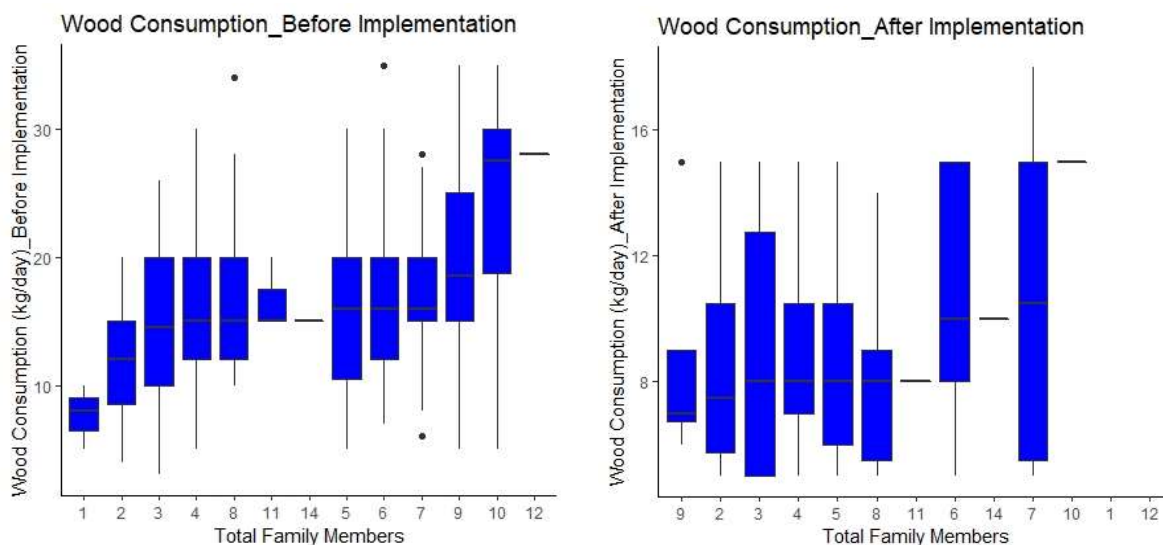


Figure 19: Family size and daily wood consumption before and after implementation

The box plots are arranged in the ascending orders of median wood consumption of a particular family size. Before the implementation of the cookstoves, the mean fuelwood consumption found 15 kg per day which reduced to 9.5 kg per day after the implementation of improved biomass cookstoves. The reduction in wood consumption could directly benefit the families through, a) reduction in drudgery in wood collection, b) availability of more time for livelihood generation activities.

**Box. 1** Financial and environmental benefits of improved biomass cookstove over C-type chulha in the JTDS project

From survey data:

A) Average family size = 5 members

B) Average wood consumption with C-type chulhas = 16 kg

C) Average wood consumption in improved biomass cookstove = 9.5 kg

**Financial benefits:**

Cost of wood in market: ₹ 3 /kg

Daily monetary savings in wood: ₹ 3 /kg x 6.5 kg = ₹ 19.5

Monthly savings: ₹ 19.5 x 30 = ₹ 585,

**Annual savings: ₹ 585 x12 = ₹ 7020 per household**

Annual saving (for 1000 IBCs) = ₹ 7020000

**Environmental benefits:**

Wood saved per day: 6.5kg

Annual wood saving: 2.37 tons per household

Total annual wood savings (for 1000 IBCs) = 2370 tons

**Nos. of trees saved annually\* = 790 trees** (1 mature tree = 3 tons of biomass)

Annual CO<sub>2</sub> emission mitigated: 4.34 tons per households using IBCs

**Annual CO<sub>2</sub> emission mitigated (for 1000 IBCs) = 4345 tons of CO<sub>2</sub>**

\*The above mentioned numbers in the box are theoretically estimated values.

**F) District wise changes in wood consumption pattern (before and after):** The wood consumption pattern changes significantly after the implementation of improved biomass cookstove in all the beneficiary districts. It is evident from Figure 20, that there is wide variability found in the daily fuelwood consumption among the

beneficiary families in both pre and post implementation surveys. This may be attributed due to :

- a) Judicious usage of fuelwood by some of the families.
- b) Variation in fuelwood collection point distnace.
- c) Usage of LPG by some of the beneficiaries.

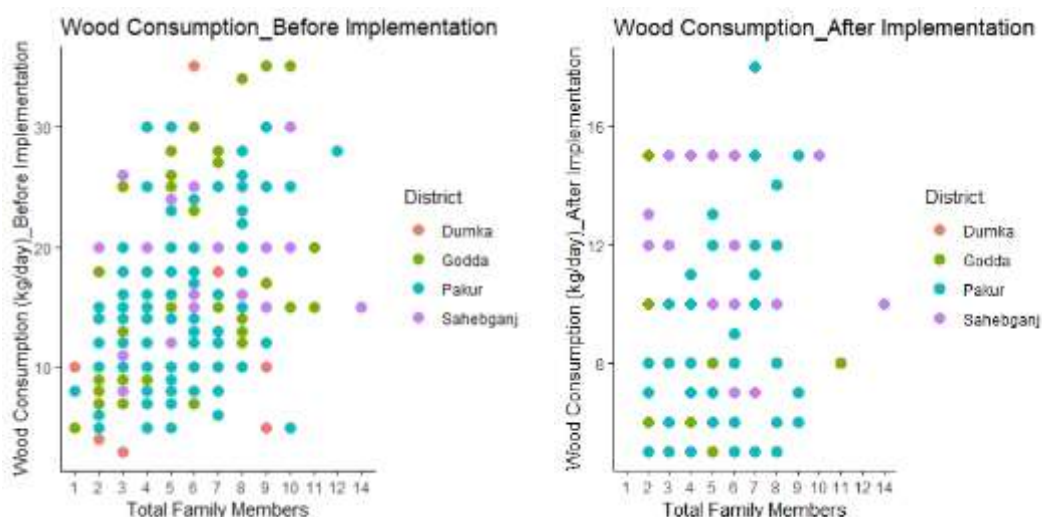


Figure 20: District wise wood consumption before and after implementation of IBCs

### Feedback Received from user on improved biomass cookstove (IBC)

1. It took lesser time to cook food in IBC compared to C-type chulha.
2. Less wood consumption compared to C-type chulha.
3. Lesser smoke generation compared to C-type chulha.
4. Lesser irritation in eyes during cooking than before.
5. IBC is not suitable for cooking Bajara-bhaat and Makai-bhaat.

### Observation by survey team

1. In almost every family one family member used to go out for wood collection.
2. In one room houses, the issues of indoor air pollution is severe.
3. Wood sold in the market at ₹ 2-3/kg.
4. Drinking water issue is also a major problem faced by the beneficiaries.

## Conclusion

There has been significant reduction found in daily fuelwood consumption and cooking time in post implementation findings compared to pre-implementation survey. The survey results indicates that there are noticeable changes in the cooking energy use pattern of the beneficiaries after the implementation of improved biomass cookstoves.

Switching to clean cooking options (gaseous fuels) from solid fuels might take a longer time for Pahariya communities due to social, economic and geographical constraints. By that time there must be a transitioning cooking technology that can reduce the negative impacts of C-type chulhas. The results showed that improve biomass cookstove could play significant role in this transitioning process and have potential to save tons of biomass annually with reducing drudgery to rural men/women in fuelwood collection and usages.

## Future Plan

In is evident from the survey results that, single and double pot chulhas are mainly used for cooking activities by the Pahariya community of Jharkhand. In this regard, SPRERI would like to play active role in reducing drudgery to the rural communities by implementing SPRERI-TECH single and double pot improved biomass cookstoves in the remaining areas of Jharkhand state.



Figure 21: SPRERI-TECH double pot improved biomass cookstove

## Acknowledgment

We would like to thank all the district/block officials of JTDS, engaged during pre and post-implementation survey of the beneficiaries. Furthermore, we are also grateful to IFAD for funding this project. We are thankful to Dr. Samdarshi (Head, Department of Energy Engineering, Central University of Jharkhand) for their kind cooperation in delegating the four M.Tech students for survey work.

## References

- Chandramouli, D. C. (2011). *Houses, Household Amenities and Assets Data 2001 - 2011*. Retrieved from <http://censusindia.gov.in>: [http://censusindia.gov.in/2011-Common/NSDI/Houses\\_Household.pdf](http://censusindia.gov.in/2011-Common/NSDI/Houses_Household.pdf)
- FE Online . (2017, April 6). *Know all about the Paharia tribe PM Modi wants to uplift to make 'New India'*. Retrieved from [financialexpress.com](http://financialexpress.com): <https://www.financialexpress.com/india-news/know-all-about-the-paharia-tribe-pm-modi-wants-to-uplift-to-make-new-india/617716/>
- Israel, G. D. (1992). *Determining Sample Size*. Florida: Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida.
- Satyam, K. (2017). Quality of Life of Elderly Mal Paharia in Jharkhand. *Asian Journal of Multidisciplinary Studies*.

# Annexure I

## Inspection of SPRERI-TECH Cookstove (190-NDS-L)

Inspection Date: 16<sup>th</sup> Jan 2018

Serial no. of cookstove chosen for testing and inspection 376

### Checklist

- |  |   |                             |
|--|---|-----------------------------|
| 1. Dimensioning of cookstove as per drawing (Annexure I)   | Yes <input checked="" type="checkbox"/> | No <input type="checkbox"/> |
| 2. Certificate of SS material  | Yes <input checked="" type="checkbox"/> | No <input type="checkbox"/> |
| 3. Cookstove performance in the specified thermal efficiency range (23-27%) as mentioned in the agreement (Annexure III) | Yes <input checked="" type="checkbox"/> | No <input type="checkbox"/> |
| 4. Manual  | Yes <input checked="" type="checkbox"/> | No <input type="checkbox"/> |
| 5. Nameplate   | Yes <input checked="" type="checkbox"/> | No <input type="checkbox"/> |
| 6. Warranty card   | Yes <input checked="" type="checkbox"/> | No <input type="checkbox"/> |

We hereby declare that, cookstove is as per design and its performance is within acceptable efficiency range.

~~For NDS~~

Signature [Signature]  
Name Ashok Anand.  
Designation Bipal Dochte  
PMU, DOW

For SPRERI

Signature [Signature]  
Name ASHUTOSH NEGI  
Designation Program Officer

For TECHNO CRAFT

Signature [Signature]  
Name V. K. Shrivastava  
Designation Partner

## Annexure II

**Table: List of villages surveyed during the exercise**

<b>District</b>	<b>Block</b>	<b>Village</b>
Godda	Sunderpahari	Chandana
		Langodih
		Sabalpur
		Barnadi
	Boarijore	Adro
		Lutibahiyar
Sahebganj	Boriyo	Karmatand
		Kabda
	Taljhari	Burasi pahad
		Dangtok pahad
Pakur	Amarapara	Sajanipara
		Pairpara
		Gorpara
		Bagpara
		Barabaska pahar
		Mandaro pahad
		Mandaro santhali
		Margama
		Pusarvitta
	Littipara	Bara kachana
		Bara chaktam
Dumka	Gopikandar	Kasaipahar
		Badapather

## Annexure III

### SARDAR PATEL RENEWABLE ENERGY RESEARCH INSTITUTE

Post Box No. 2, Near BVM Engineering College, Vallabh Vidyanagar Gujarat, India-388120

#### Improved Biomass Cookstove (IBC) Pre-implementation Survey

Form No.....

Date.....

#### (A) General information:

1. Name of the beneficiary:..... 2. Age:.... years
3. Village:.....Block:..... District:.....
4. Educational qualification of beneficiary:..... 5. Gender: M / F
6. Farming experience:..... years 7. Monthly expenditure (₹):.....
8. No. of family members:..... Male:.... Female:.... Child:... 9. Mobile number:.....
10. Main occupation:..... 11. Secondary livelihood source (if any):.....

#### (B) Supplementary information:

12. House type: Pakka / Kachha 13. No. of rooms in house:....
  14. No. of windows in kitchen:... 15. Ventilation (If any): Yes / No
  16. Type of roof in kitchen: RCC / Mangalore / Asbestos / Other
  17. Height of roof:.....feet 18. Availability of electricity: Yes / No
- (If No, what are the alternative lighting source: Kerosene lamp / Solar lantern / Other battery operated gadgets)
19. Study hours of children:..... hrs / day

#### (C) Cooking energy use details:

Parameter	Cooking device type		
	C - type chulha	Coal fired stove	Other (LPG / Kerosene stove/ Biogas etc)
Stove in use			
Number of stove			
Place of stove (Inside / outside)			



Mobility of stove (Movable / fixed)			
Way of feeding ( Top / side)			
Chimney for smoke out	Yes / No		
<b>Fuel consumption for cooking with cooking time</b>			
Tea			
Breakfast			
Lunch			
Dinner			
<b>Fuel usage for cooking</b>			
Wood (kg / day)			
Coal (kg / day)			
Agricultural-waste (kg / day)			
Dung cake (kg / day)			
LPG (bottle / year)			
Other			
Wood collection time / day..... hrs	Wood preparation time / day ..... hrs		
Dung-cake collection time / day..... hrs	Dung-cake preparation time / day..... hrs		
<b>Cost of fuel for cooking</b>			
Wood (₹ / kg)			
Coal (₹ / kg)			
Agri-waste (₹ / kg)			

Dung cake (₹ / kg)				
LPG (₹ / bottle)				
Other (₹ / kg)				
<b>Emission during cooking</b>				
Breakfast				
CO				
PM				
Lunch				
CO				
PM				
Dinner				
CO				
PM				
<b>Health related problems</b>				
Irritation in eyes	Breathing problem	Cold & Cough	Dizziness	Any other health issues
Yes / No	Yes / No	Yes / No	Yes / No	
<b>Any other observation:</b>				

Name of observer

Signature of beneficiary

Signature with date

## Annexure IV

### SARDAR PATEL RENEWABLE ENERGY RESEARCH INSTITUTE

Post Box No. 2, Near BVM Engineering College, Vallabh Vidyanagar Gujarat, India-388120

#### Improved Biomass Cookstove Post-implementation Survey

Form No.....

Date.....

SPRERI-TECH cookstove serial no.:.....

Manufacturer:.....

#### (A) General information:

1. Name of the beneficiary:..... 2. Age:.... years
3. Village:..... Block:..... District:.....
4. Educational qualification of beneficiary:..... 5. Gender: M / F
6. Farming experience:..... years 7. Monthly expenditure (₹):.....
8. No. of family members:..... Male:.... Female:.... Child:.... 9. Mobile number:.....
10. Main occupation:..... 11. Secondary livelihood source (if any):.....

#### (B) Supplementary information:

12. House type: Pakka / Kachha 13. No. of rooms in house:....
  14. No. of windows in kitchen:.... 15. Ventilation (If any): Yes / No
  16. Type of roof in kitchen: RCC / Mangalore / Asbestos / Other
  17. Height of roof:.....feet 18. Availability of electricity: Yes / No
- (If No, what are the alternative lighting source: Kerosene lamp / Solar lantern / Other battery operated gadgets)
19. Study hours of children:..... hrs / day

#### (C) Cooking energy use details:

Parameter	Cooking device type			
	C - type chulha	Coal fired stove	Other (LPG / Kerosene stove / Biogas etc)	SPRERI-TECH Improved biomass cookstove
Stove in use	Single / Inline			
Number of stove				

Place of stove (Inside / outside)				
Mobility of stove (Movable / fixed)				
Way of feeding ( Top / side)				
Chimney for smoke out	Yes / No			
<b>Fuel consumption for cooking with cooking time</b>				
Tea				
Breakfast Rice Dal Other				
Lunch Rice Dal Other				
Dinner Rice Dal Other				
<b>Fuel usage for cooking</b>				
Wood (kg / day)				
Coal (kg / day)				
Agricultural-waste (kg / day)				
Dung cake (kg / day)				
LPG (bottle / year)				

Other				
Wood collection time / day.....hrs		Wood preparation time / day ..... hrs		
Distance from nearest forest or fuelwood collection point :				
Dung-cake collection time / day..... hrs		Dung-cake preparation time / day..... hrs		
<b>Cost of fuel for cooking</b>				
Wood (₹ / kg)				
Coal (₹ / kg)				
Agri-waste (₹ / kg)				
Dung cake (₹ / kg)				
LPG (₹ / bottle)				
Other (₹ / kg)				
<b>Emission during cooking</b>				
Breakfast				
CO				
PM				
Lunch				
CO				
PM				
Dinner				
CO				
PM				
<b>Health related problems</b>				
Irritation in eyes	Breathing problem	Cold & Cough	Dizziness	Any other health issues
Yes / No	Yes / No	Yes / No	Yes / No	

**Feedback for improved biomass cookstove:**

**Any other observation:**

Name of observer

Signature of beneficiary

Signature with date

## Annexure V



SPRERI  
Striving for Excellence



JTDS



LIFAD  
Enabling the rural poor  
to overcome poverty

### स्पेरी-टेक उन्नत चूल्हा

मॉडल : 190-NDS-L

संचालन एवं रख रखाव निर्देश पत्रिका



उन्नत चूल्हा मूलतः एक आधुनिक उपकरण है। यह चूल्हा लकड़ी एवं अन्य बायोमास ईंधन को कम प्रदूषण के साथ कुशलतापूर्वक जलाता है। अधिकांश ग्रामीण इलाकों में C-आकार के मिट्टी के चूल्हे का उपयोग प्रचलित है। उन्नत चूल्हा C- आकार के चूल्हे की तुलना में ५० प्रतिशत कम ईंधन का उपयोग एवं ८० प्रतिशत कम प्रदूषण उत्सर्जित करता है।

स्पेरी टेक. उन्नत चूल्हा (१९०-NDS-L), नवीन और नवीकरणीय ऊर्जा मंत्रालय (MNRE) से मान्यता प्राप्त है। इस चूल्हे में ग्रामीण इलाकों में अधिकांशतः प्रयुक्त की जाने वाली लम्बी लकड़ियों को जलाने के लिए सतह पर ईंधन डालने के लिए भी प्रावधान दिया गया है। उन्नत चूल्हे को कुशलतापूर्वक उपयोग करने के तरीको का विस्तृत वर्णन निम्नलिखित है।

#### उपयोग किये जाने वाले ईंधन का विवरण

- ईंधन प्रकार : लकड़िया (छोटी एवं लम्बी), बायोमास ब्रिकेट (वाइट कोल), धान/गेंहू एवं अन्य कृषि अवशेष।
- ईंधन आकार : २ इंच से कम चौड़ाई।
- नमी की मात्रा : बेहतर परिणाम के लिए कम नमी वाला ईंधन प्रयोग करें (< १०%)।

#### राख निकालने के लिए प्रावधान

उन्नत चूल्हे के उपयोग के समय थोड़ी- थोड़ी देर में (सामान्यतः हर आधे घंटे में) चूल्हे की जाली के नीचे दी गयी स्टील की लीवर को दाईं तथा बायीं ओर घुमाये। इससे चूल्हे में जमा राख नीचे गिर जाएगी। यह प्रक्रिया दोहराते रहें।

#### क्या करें

- चूल्हे का उपयोग शुरू करते समय जाली के नीचे दिए गए वायु छिद्रों को खुला रखें।
- लम्बी लकड़ियों का उपयोग करें।
- चूल्हा बंद करते समय बाकी बचे हुए ईंधन को निकाल दें।
- राख निकालने के लिए जाली के नीचे दिए गए स्टील लीवर को दाईं/बायीं ओर घुमाये।

#### क्या न करें

- उन्नत चूल्हा बंद करते समय चूल्हे में पानी न डालें।
- अधिक नमी वाला बायोमास ईंधन का उपयोग न करें।

#### संचालन निर्देश

- बायोमास ईंधन को सतह पर दी गयी खिड़की से ही चूल्हे में डालें।

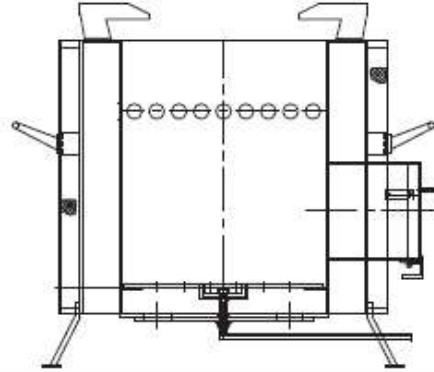
२. जाली के नीचे दिए गए वायु छिद्रों को खुला रखे।
३. ५-१० मिनट पश्चात जब ईंधन अच्छी तरीके से जलने लगे, तब बर्तन को चूल्हे के ऊपर रखे।
४. जाली के नीचे दिए गए वायु छिद्रों को आवश्यकता अनुसार खोले/बंद करे।



### उन्नत चूल्हा उपयोग करते समय निम्नलिखित सावधानिया रखें

उन्नत चूल्हा उपयोग करते समय निम्नलिखित सावधानिया रखें

१. उन्नत चूल्हे का उपयोग करते समय छोटे बच्चों को दूर रखें।
२. उन्नत चूल्हे का उपयोग करने के पश्चात, बची हुई राख को बाहर निकाल दें।
३. उपयोग के पश्चात उन्नत चूल्हे को सुरक्षित स्थान पर रखें।
४. उन्नत चूल्हे को बारिश के पानी से दूर रखें।



### अधिक जानकारी के लिए सम्पर्क करें:

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