

# Adoption of Solar Equipment and Smokeless Chulhas: a Step towards Energy Conservation

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## Abstract

*The tradition of science and technology in India is very old. A renaissance was witnessed in the first half of the 20<sup>th</sup> century. Over the past 150 years, progress in science and technology has been a key driver of human and societal development, vastly expanding the horizons of human potential and enabling radical transformation in the quality of life enjoyed by millions of people. All innovations cannot be used by the population uniformly; there are only a few which are advantageous to the deprived, especially rural and tribal people.*

*A project was undertaken with financial support from the Department of Science Technology (DST), New Delhi. A tribal village, Aurwatand in Naugarh block of Chandauli District, was selected. Each household was provided with one solar lantern and one smokeless chulha. Repeated demonstrations were made and villagers were also counseled personally. From time to time, visits were made to ensure usage and solve any difficulties.*

*Repeated counseling resulted in 100% adoption of both smokeless chulhas and solar lanterns. After six months, data was collected and found that these two small things, a solar lantern costing Rs.4200 and a smokeless chulha cost Rs.200, Total amount Rs. 4400 only has brought a tremendous amount of change not only in their lives but in their thinking as well. Now villagers are giving solar lantern as a gift in the wedding of their daughters. This small investment of DST has changed the lives of villagers who are now living in a healthier environment, which is smoke-free, with fewer health hazards, less drudgery for women and better quality light without fossil fuel consumption, noise and pollution. It will also minimize deforestation which itself is a big achievement.*

*It is therefore suggested that the government provide these two items to the rural population at subsidized rates on an instalment basis.*

## Introduction

Pollution and energy crises are India's burning problems. Scientists all over the world have come up with several technological options to solve these

problems. Two that made their formal entry into Indian rural homes are solar energy equipment and smokeless chulhas.

As resources are limited, it is necessary to save environmental, forest and human resources. Various efforts by scientists, governments and industrialists in the past two decades have borne fruit, as people from all walks of life are now more aware of the benefits of solar equipment and smokeless chulhas but adoption of these has been slow. Efforts should be made to promote their adoption by more of the rural population. Hence the present study was undertaken with the following objectives:

- To study the socio-economic background of the respondents
- To expose the villagers regarding solar energy through demonstration of difficult solar equipment
- To demonstrate smokeless chulhas and solar lanterns.
- To provide one solar lantern and one smokeless chulha to each family of the selected village
- To analyze the impact of solar lanterns and smokeless chulhas on the life of villagers

## Methodology

The present study was conducted in village Aurwatand in Naugarh block of Chandauli District. It is a small village with 41 families and about 255 people. Different solar equipment and smokeless chulhas were exhibited and demonstrated to the villagers. The equipment included solar lanterns, solar home lights, solar street lights, solar dish cookers, solar box cookers and solar driers. They are still at the central place where the school is run to junior high school. Each family was given one solar lantern and one smokeless chulha and all villagers including men, women and adolescent girls and boys were trained in their use and maintenance through demonstration and participatory methods. Since it was a DST New Delhi-sponsored project, staff often visited the village and stayed there regularly, so any problems in the solar lanterns were either rectified or taken to the NEDA Center, Varanasi for repair. To observe the impact of the

solar lantern and smokeless chulha, a Structured Interview Schedule of two parts was conducted and data was collected and analyzed with the help of appropriate statistical tools.

**Result and Discussion-**

The findings of the study were discussed under the following points:

1. Socio -economic background information of the respondents
2. Impact of Solar Lanterns
3. Impact of Smokeless Chulhas

**1. Socio -economic background information of the respondents**

**Table 1 Socio economic Characteristics of the Villagers**

Characteristics	Categories	Frequency of Respondents (N=41)		Percentage	
		Male	Female	Male	Female
a. Age	Below 20	1	4	2.43	9.75
	21 – 30	10	17	24.3	41.46
	31 – 40	12	7	29.26	17.07
	41 – 50	5	6	12.19	14.63
	Above 51	13	7	31.70	17.07
b. Occupation	(Both Agriculture and Labour Work)	37		90.24	
	Migrated Labour	4		9.75	
c. Caste	Muslim & Yadav (OBC)	5 + 3 (8)		19.51	
	Harijan (SC)	6		14.63	
	Kharwar (ST)	27		65.85	
d. Land Holding	Landless	3		7.31	
	1 – 10 Bissa	5		12.19	
	11 – 20 Bissa	5		12.19	
	1 – 3.5 Bigha	23		56.09	
	4 – 7.5 Bigha	4		9.75	
	8 – 14.5 Bigha	1		2.43	
e. Religion	Hindu	36		87.80	
	Muslim	5		12.19	
f. Education	Illiterate	Male	Female	Male	Female
	Literate	27	33	65.85	80.48
g. Family Type	Nuclear	14		34.14	
	Joint	8		19.51	
h. Annual Income in Rs.	Up to 15 Thousand	35		85.36	
	16 – 20 Thousand	6		14.63	
	21 – 25 Thousand	2		4.87	
i. Size of the Family	Small (up to 3 members)	10		24.39	
	Medium ( 4 to 5 members)	29		70.73	
	Large ( 6 to 9 members)	2		4.87	
	Very Large (<9 members)	7		17.07	

Table No. 1 indicates that nearly half of the female respondents (41.46 %) were in the age group 21 to 30 years while 31.7% male respondents were above 51 years of age. The data also reveals an important finding that 90.24% respondents were working in

their fields and only 9.75% were migrated labour. It suggests that villagers move out only in forced conditions. The villagers' land holdings are very small except three or four families who have more than 8 bighas of land. Literacy levels in both males

and females are low; the Government needs to do more to provide education.

after two to three visits they began to interact. The following solar equipment was displayed and demonstrated.

**2. Impact of Solar Lanterns**  
**2a. Exposure of villagers to Solar Energy through Exhibition of Solar Equipment**

In the beginning of this research project the village community was reluctant and did not respond but

**2b. Demonstration of Solar Lantern**

To sustain their interest, detailed training was provided to the villagers at different levels. The method demonstration was used for creating awareness and imparting a functional knowledge of various solar equipment as well as repair and maintenance. As the solar equipment was placed in the school, all the children, women and men were able to participate in the training process. Solar equipment has useful advantages because there is no electricity available in the village.

Different foods were cooked in solar cookers in the school and repeated demonstrations provided functional knowledge of solar equipment to the villagers. All other equipment was placed in a centrally located school and used for live demonstrations

**2c. Utility and advantages of solar lanterns and its impact on monthly consumption of kerosene**

**Table 2 Distribution of families based on monthly consumption of kerosene in litres**

Sr. No.	Categories	Frequency of Respondents before using solar lantern (N = 41)	Frequency of Respondents after Using Solar Lantern (N = 41)
	Consumption up to 4 litres	7 (17.07)	29 (70.73)
	Consumption 5 to 6 litres	32 (78.0)	12 (29.26)
	Consumption 7 to 8 litres	2 (4.87)	-

Figures in parentheses indicate percentages.

From Table 2 it can be seen that before getting solar lanterns, consumption of kerosene oil was up to four

litres for 17.07% respondents which increased to 70.73% respondents after getting the solar lantern.

Consumption of five to six litres kerosene oil, by 78% respondents decreased to 29.26% respondents. There was an absolute decrease in the consumption of seven to eight litres kerosene oil by 4.87% respondents to nil. This proves that after the intervention of solar light, the consumption of kerosene oil decreased remarkably and ultimately saved money.

A solar lantern was distributed to each family in the village and one street light was installed in the centre of the village. The street light enabled the villagers to utilize their time especially after sunset to interact socially more and do Bhajan and Kirtans at night. During the rainy season, it was very convenient for them to leave their homes for the call

### Advantages of Solar Lanterns

of nature. Women were also seen worshipping their goddess at midnight in the forest.

#### 2d. Impact of solar lanterns on respondents

Because the whole village was below the poverty line, solar lanterns were provided to every family.

### 3. Impact of Smokeless Chulha on Respondents

#### 3a Distribution of households according to time spent on cooking daily

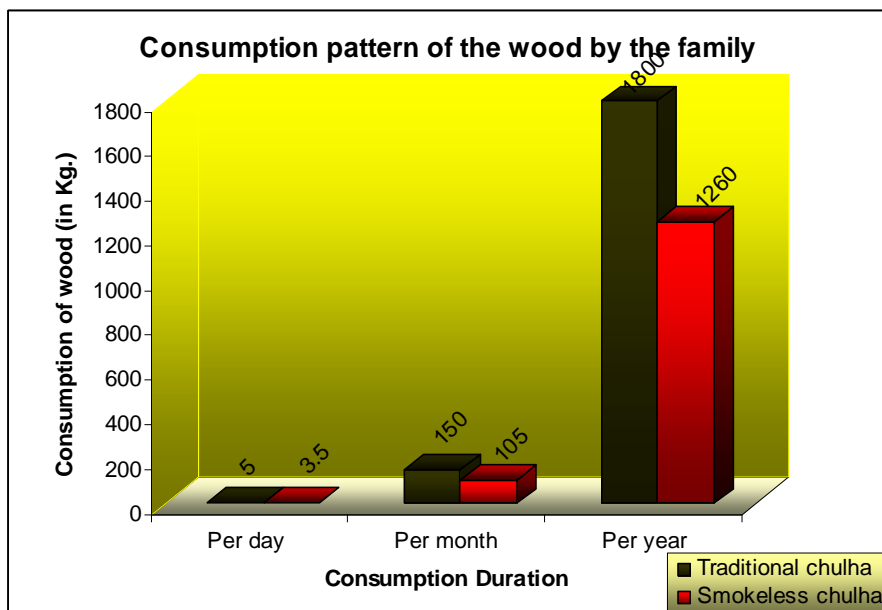
Sr.No.	Category	Frequency of households(N=41)	
		Traditional Chulha	Smokeless Chulha
1	1 - 2 hours	00	05
2	2 - 2.5 hours	00	09
3	3 - 3.5 hours	00	27
4	3.5 - 4 hours	12	00
5	4 - 4.5 hours	15	00
6	4.5 - 5 hours	10	00
7	5 - 5.5 hours	04	00
	Total	41	41

Table 3a reveals that smokeless chulhas decreased the time spent in cooking daily.

#### 3b Consumption pattern of wood by families

Sr.No.	Categories	Traditional chulha	Smokeless chulha
1	Per day	5	3.5
2	Per month	150	105
3	Per year	1800	1260
	<b>Total</b>	<b>1955</b>	<b>1368.5</b>

The above table reveals that after using smokeless chulha there is a slight change in the consumption of wood by each family per day, per month and per year.



### 3c Comparative consumption pattern of wood (per year) in Traditional Chulhas and Smokeless Chulhas

Sr.No.	Category	Consumption Per year(Kg.)
1	Traditional chulha	738
2	Smokeless chulha	516.6

Table 3c shows that the consumption of wood (per year) in Traditional Chulhas is greater than for Smokeless Chulhas

### 3d Utility and Advantages of Smokeless Chulhas

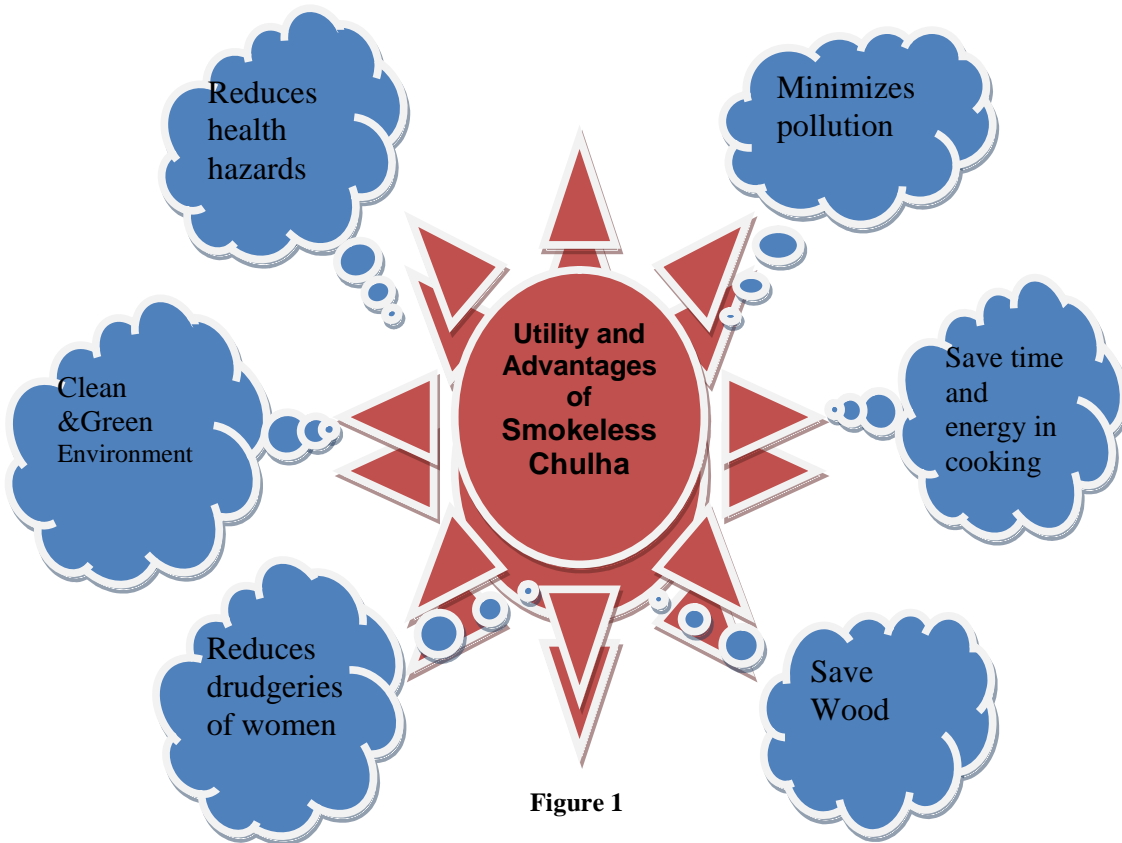


Figure 1

### 3e Impact of Smokeless Chulhas on Respondents

It increases the efficiency and productive hours of respondents; it reduces their drudgery and health hazards. It also provides a clean and green environment free from smoke and saves wood as well as kerosene.

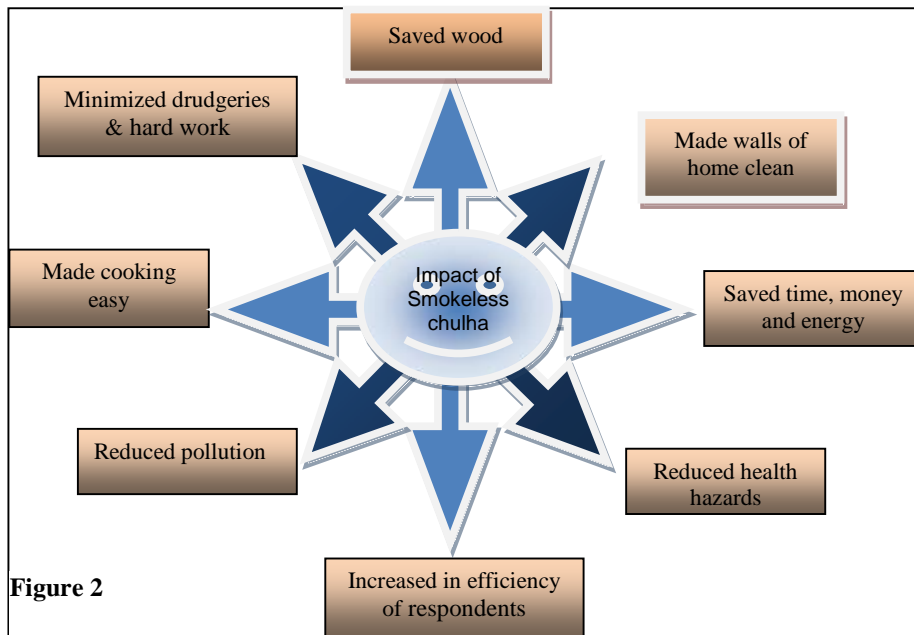


Figure 2

### Summary and Conclusions

The study reveals that the majority of respondents were 21 to 30 years of age with 1.35 bighas of land and were engaged in agriculture and seasonal labour and were below the poverty line having an annual income up to Rs.18484 or less. The majority of respondents belonged to the Schedule Caste and Schedule Tribes and nuclear families with large family sizes. They were Hindus and illiterate.

The study also shows that Solar Lanterns and Smokeless Chulhas are beneficial for rural households. Life in villages starts at sunrise and finishes at sunset as there is no electricity. Even if there is electricity, these ST and SC villagers are not fortunate enough to have an electricity connection. Hence provision of solar lanterns was a great gift for them as they could get light for 5 to 6 hours uninterrupted. The whole family could make use of the time from 6.00pm to 10.00pm and early morning 4.00am to 5.30am. The children who could not study earlier during the night were very happy with this.

While the children studied, their parents did their household or other work. It saved money that had been used on between 4 and 8 litres of kerosene per family per month.

Similarly smokeless chulhas reduced drudgery for women and their families, who used to go quite far to collect wood. The consumption of wood decreased 30% roughly and time spent on cooking was also saved by 30 to 35%. These chulhas were smoke free with fewer health hazards. Hence these two items proved highly useful and villagers should be encouraged to purchase and use them.

### Acknowledgement

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