

Are We Really Out of *Chulha* Trap: A Case Study from a District of Maharashtra

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ABSTRACT

Solid biomass fuel pollution is the largest energy related health risk globally and most important cause of ill-health for Indian women and girls. At 700 million cooking with open biomass chulhas, the Indian population exposed has not changed in several decades, in spite of hundreds of programs like improved chulhas, i.e. to burn biomass cleanly in advanced stoves. These 700 million of the poor were stuck in the chulha (open cookstove) trap for 25 years at least. Until recently, there were no special programs or efforts to accelerate growth of clean fuel in the population. Starting in the year 2015, the Government of India and Oil Marketing Companies that market LPG started three major programs to actively promote LPG to the poor, each pioneering, and relying heavily on social marketing and electronic bank accounts, biometric ID cards, and mobile phones (JAM). The first program Pahal, second, "Give it Up," and third, Pradhan Mantri Ujjwala Yojana (PMUY), starting from 2016 provided connections to 50 million households till 2018. This paper tries to analyze the penetration of LPG in rural area of Nagpur district of Maharashtra, and issues and challenges in switching to clean cooking fuel in rural areas of district.

Key Words: Biomass, house hold air pollution, Chulha trap, LPG, PMUY, Maharashtra

INTRODUCTION

Household air pollution is recognized as a significant source of potential health risks to exposed populations throughout the world. The major sources of household air pollution worldwide include combustion of fuels, tobacco smoke, ventilation systems, furnishings, and construction materials. These sources vary considerably between developing and developed nations. Worldwide most research into and control of indoor air pollution has focused on sources of particular concern in developed countries, such as Environmental Tobacco Smoke, volatile organic compounds from

furnishings and radon from Soil. [1] The most significant issue that concerns indoor air quality in household environments of developing countries is the exposure to pollutants released during combustion of solid fuels, including biomass (wood, dung, and crop residues) or coal used for cooking and heating.

Nearly half the world continues to cook with solid fuels such as dung, wood, agricultural residues and coal. In India, approximately 86.7% of rural households and 26.3% of urban households rely on solid biomass fuels for their cooking needs. [2] This practice can adversely impact respiratory health of individuals and local

forests and other environmental resources, as well as contribute to climate change. [3-8] When used in simple cooking stoves (mostly traditional Indian Chulha), these fuels emit substantial amount of toxic pollutants that include respirable particles, carbon monoxide, oxides of nitrogen and sulfur, benzene, formaldehyde, 1-3-butadiene, and poly aromatic compounds, such as benzo (α) pyrene. [9] In households with limited ventilation as is common in rural household of developing countries, exposures experienced by household members, particularly women and young children who spend a large proportion of their time indoors, have been measured to be many times higher than World Health Organization (WHO) guidelines. [10] According to WHO [11] indoor smoke from solid fuels ranked as one of the top ten risk factors for the global burden of disease, accounting for 4.3 million premature deaths each year. Household air pollution (HAP) arising from combustion of solid fuels for cooking is a major contributor to four of the top five causes of mortality and morbidity in India, and HAP is also a significant contributor to outdoor air pollution. [12-14]

In India, the most commonly used stove for cooking is the traditional mud stove called a 'Chulha' which has been adapted to burn all kinds of biomass fuels. When the solid biomass fuels are burnt in such stove, a major fraction of the fuel's available energy goes waste because of its low efficiency. Another problem associated with these cooking devices is their inability to vent smoke out of kitchen, which results in smoke being trapped in kitchen leading to building-up of indoor pollution levels that are high enough to cause serious health problems. [15] In context of the above cited concerns, to design and develop the most efficient, cost effective, durable and easy-to-use cooking device in India, the Department of Non-conventional Energy Sources (DNES), had initiated demonstration of improved cookstoves soon after its inception in 1982, followed by the launch of National Program on Improved Chulhas

(NPIC) in 1983 which ended in 2004. [16] The program had two primary aims, first to reduce demand on fuel wood to check widespread deforestation; and second, to improve health by removing smoke from kitchens. The program aimed to disseminate improved cookstoves in the community. A total of 33.8 million improved cookstoves were installed under this program with varying degree of success in different regions of the country. Some models had better acceptability than others in specific regions. Some states such as Haryana, Maharashtra and West Bengal of the country showed greater enthusiasm on the part of the users to adopt new designs. [17] For a variety of reasons the program brought a mixed bag of experiences. [18, 19] In 1992, the DNES was upgraded as the Ministry of Non-conventional Energy Sources (MNES) and continued to manage this program. In 2009, the ministry was renamed as Ministry of New and Renewable Resources (MNRE). The context of concerns over health, climate change and energy security, the Ministry of New and Renewable Energy (MNRE), Government of India launched National Biomass Cookstoves Initiative (NBCI) in December 2009 with the primary aim to increase the use of improved biomass cookstoves. [20] The initiative stressed upon setting up of state-of-the-art testing, certification, monitoring facilities and strengthening research & development (R&D) programs. Although there are far better biomass cookstoves than in the past, they have not progressed to the point that they are equivalent to gas in terms of reliability, flexibility, durability, efficiency, and cleanliness. Confirmatory evidence is that few, if any, women who have the option will change from gas to biomass, but many tens of millions do the reverse every year when given the chance. New biomass stoves are still coming, however, and we can hope that some will perform well enough over time in village households to be true competitors. [21]

Recent research suggests that providing clean cooking fuels to all can be a highly cost-effective health intervention. [22] In addition, collection and use of solid fuels for cooking increases the drudgery and adversely impacts time use by women. [23, 24] To promote clean cooking fuels in 2015, Government of India and the 3 oil marketing companies that market LPG in India started three major programs to actively promote LPG to the poor, each pioneering, and relying heavily on both sophisticated social marketing and (JAM) electronic bank accounts, biometric ID cards, and mobile phones. The first program, Pahal, shifted to paying subsidy fuel payments into people's bank accounts and thus all LPG is now sold at international rates in the market, greatly reducing diversion of LPG to the non-household sector. The second, "Give it Up," persuaded middle-class households to give up their subsidies to connect the poor. The third, pradhan Mantri Ujjwala yojna (PMUY) which is underway now, provided connections to a total of 50 million poor households by 2018. In addition, although starting from a small base, PNG connections have been growing at more than 11% annually with a goal of 20 million by early next decade. [25] Each of these frees up LPG to be moved to rural areas and reduces the LPG import burden.

Despite being an industrialized state, over 78% of rural households in Maharashtra state in India use firewood as principle cooking fuel. [26] LPG (43.4 %) and firewood (42.6 %) are the main sources of fuel for cooking. The proportion of households reporting use of firewood for cooking was 68.9 % in rural areas. The percentage of households depending on firewood and chips for cooking exceeds 50% in almost all districts. This paper tries to find out if the objective of PMUY of disbursing connections and tackling the adverse health effects of using traditional solid fuels is achieved or not. It also tries to identify the issues and challenges for

switching over to cleaner fuels in a rural area of Nagpur district.

METHODOLOGY

The study was carried out in the rural area of Nagpur district in the state of Maharashtra. The study used the stratified random sampling technique. The stratification was done at three levels – district, tehsil (block) and village to identify the study area. District Nagpur has fourteen blocks, out of which Katol was selected randomly for the study which has 82.38% biomass fuel use according to Census 2011. Twenty villages were then selected from the block based on their distance from the block headquarter. The survey was conducted at two levels, viz., individual and household. The study population was rural women cooks using different types of fuels for cooking and the community. 450 households were selected for collecting primary data on several household parameters like socio-economic, demographic, and housing characteristics. The information on type of fuel, method of procurement, type of stove in use, availability of separate kitchen, cooking practices, reasons for not using clean fuels was collected. Economic condition of the household was assessed from overall standard of living and annual income. The data was coded and analyzed using SPSS version IBM 21.

RESULTS

Demographic and household characteristics

Majority of the houses surveyed were *semi-pucca* (42%) and *kutchra* (36.2%) with low to medium income. (Table I) The average annual income per household was Rs 33,770/, while the average household size is approximately 6 people. Majority of the respondents were literate with (62.4 %) studying upto middle level school. The main occupation of the household being agricultural labourers and also owing small piece of agricultural land. Majority of the household (79.1 %) were having kitchen attached to main living area, with tiles as roof and no ventilation in the roof. Walls of

the houses were made of mud (49.3%) and bricks (36.7 %) with no windows (42.5 %) or having one window(45.3%).

Table no.1 Socio demographic Characteristics

Variable		Number (n=450)	Percent
Type of house	Pucca	98	21.8
	Semi-pucca	189	42.0
	kutchha	163	36.2
Age	<25	71	15.8
	25-34	68	15.1
	35-44	112	24.9
	45 and above	199	44.2
Education level of respondent	Illiterate	39	8.7
	Primary	66	14.7
	Middle	281	62.4
	Matric	16	3.6
	Senior secondry	40	8.9
	Graduate and Above	8	1.8
Type of fuel*	Biomass fuel	399	88.7
	Mixed fuel	229	50.9
	Other fuel	140	31.1
Income	<25000	122	27.1
	25001-35000	208	46.2
	35001-45000	120	26.7
	41,000-50,000	450	100.0
Occupation of respondent	Housewife	16	3.6
	Farmers/others	38	8.4
	Agriculture labourers	396	88.0
Kitchen in house	Yes	387	86.0
	No	63	14.0
Type of kitchen	Cooking inside living room	32	7.1
	Attached to main living area	356	79.1
	Semiopen/Outside house	62	13.8

*Multiple answers, Total may not be 100

Fuel characteristics

Physical access to LPG (44.9%) is there but 50.9 % of the population is using mixed fuel that is gas and wood, crop residue, dung cakes as main source of fuel and only 10 % of the population is using LPG alone for their energy requirement. Out of the 202 households which had gas connection, only 40 households got gas under PMUY, 8.89% of the sampled population. Most important fuel for cooking is Gas as 52.4 % population uses it but they also use wood (47.6%). Primary cooking-related fuel source was wood with a mean overall household consumption of 5 kg per day. Dung was used less frequently than wood, and accounted for 21.6 %. Kerosene is used in (12.0%) households. Interestingly gas is used for making tea and vegetables and chapattis were made on chulha. Wood is used by all for heating water, during winter and making animal feed. (40.4%) of the household gather wood and 27.3 % buy it from market. Majority of the households (88.0%) are gathering fuel once or twice a

week and 67.6 % respondents spends 2-3 hours time for gathering is. (56.9%) women gather fuel while men (40.4%) also contribute in the task.

Threes stoned traditional stove is dominant (81.1%) in majority of the houses. These chulah has no chimney and three stones/bricks are plastered to form U shape with a outlet for fuel supply. 99.3% of the household were not having any type of smoke extraction method .No household was using improved chulha .Many households (40.7 %) were using kerosene stove as secondary stove. Kerosene stoves were not used as primary stoves in the study area, but were used in few households at the time of scarcity of other fuels especially on rainy days. Most of the study households used multiple cookstoves. Though the traditional clay/ brick cookstoves remained the primary stoves for cooking the major meals of the day, other stoves including kerosene and LPG were used as secondary stoves. Although many of the households studied had an LPG connection, the LPG

stoves were mostly used for making tea and quick snacks or breakfast and for cooking vegetables. These were also used at times when there were guests at home and there was not enough time to light the firewood in the traditional cook stove.

Awareness about Health Effects

Most of the women in the households studied seemed to have achieved a sort of comfort level with the smoke produced from the burning of biomass fuels as despite of 96.7 % of the study population were aware of the detrimental effects of smoke on women’s health like irritation to eyes (95.3 %), cough (87.3%) and chest illness (23.8%) ,they are using wood for cooking.(Table no-2).They were less aware about the ill effects of smoke on small children as they are mostly with mothers in kitchen.

Table No. 2 Effect of fire on women’s health

	Number	Percent
Effect of fire on Health	433	96.2
No Effect	3	.7
Don’t know	14	3.1
Total	450	100.0
Total		100.0

Reasons for not using cleaner fuels.

The average cost of an LPG cylinder in the state was Rs. 700 and one cylinder lasts for almost 2 months if it is used regularly to cook complete meals for about 4 people in the household. Since LPG is not affordable for all households, therefore its usage remains limited. 42.2 % of the population cannot afford the cost. For BPL population to shell out 700 Rs per month is a big deal as they don’t get subsidy. Many villagers find gas too costly as 43.9% of the population uses biomass as it is freely available and in any case they have to burn it (Table no-3). Another reason for not using gas is that the distributors vehicle comes once in a week and if the cylinder somehow could not be refilled, then they have to wait for next eight days or get it refilled from block headquarters (kondhali) which is far away. In some villages the connection is from Katol which doesn’t have distributors in village, villagers have to get it refilled from block headquarters, this is cumbersome for many.

Table No. 3 Reasons for not using clean fuel for cooking

Reason for not using gas for cooking	Number	Percent
High cost of re-fill	190	42.2
Freely available biomass	193	42.9
Travel lot of distance for refill	67	14.8

Table 4 Determinants of Fuel Choice

		Biomass users		Biomass Non- users		p Value
		No.	Percent	No.	Percent	
Type of house	Pucca	85	21.3%	13	25.5%	0.70847
	Semi-pucca	170	42.6%	19	37.3%	
	Kutchha	144	36.1%	19	37.3%	
Age	<25	63	15.8%	8	15.7%	0.32
	25-34	59	14.8%	9	17.6%	
	35-44	95	23.8%	17	33.3%	
	45 and above	182	45.6%	17	33.3%	
Income	<25000	117	29.3%	5	9.8%	0.00
	25001-35000	187	46.9%	21	41.2%	
	35001-45000	95	23.8%	25	49.0%	
	41,000-50,000			0	0	
Cost of Fuel	No spending	184	46.1%	9	17.6%	.000
	Cylinder	69	17.3%	15	29.4%	
	All other	146	36.6%	27	52.9%	

Chi-square test was applied to identify the association of Bio-mass fuel users with various socio-economic factors. Age of respondent does not have significant effect on the fuel choice. Generally older female prefer traditional fuels than the younger ones. The level of education is another significant factor associated with

bio-mass fuel. The dwelling status also has no statistical significant association on the adoption of fuel. In the surveyed villages, around 42% of household has semi-pucca dwelling indicating no constraints on fuel use pattern and storage of fuel. Occupation of the respondent has no significant effect on choice of fuel. Income level of the

respondent has showing a highly significant association with Biomass fuel (p value =0.00). Cost of fuel has highly significant association among the biomass users. Result indicates that economic factors are more dominant when it comes to choice of fuel.

DISCUSSION

For the success and sustainability of any smoke reduction programme, it is important to make the cook realize about the adverse effects of cooking smoke. In poor household, where the stove is located in an enclosed area in the house with no ventilation at all, smoke was trapped in this enclosed area. The women who were cooking in these households were more exposed to household air pollution compared to the women with open cooking. People in study area are aware of the detrimental health effects of smoke from traditional cooking practices and still they are using mixed fuel. The rural and the urban households have different criteria for fuel switching and factors like affordability, convenience, availability, awareness and social values play significant roles in such decisions. As income increase, households generally switch-over to cleaner and more efficient fuels for their domestic energy needs, i.e., move up the 'energy ladder' in urban areas. However, in the study area, households often employ a 'multiple model' of stove and energy use and fuel substitution is partial. [27,28] As a result full benefits of "clean" fuels are not achieved. Conversions to modern fuels in rural areas have remained slow in moving away from solid fuels. They site traditional cooking practices, and other benefits such as slow cooking when the women are out in the fields. Availability and affordability of the bio mass fuels hampers the switching over to cleaner fuels. Under PMUY scheme, the plan of converting subsidy in to loan comes across as a good option initially because of not having to pay a single penny while taking the LPG connection but, as soon as the consumers realise they're not receiving any subsidy on the gas cylinder, they become careless about

taking the next cylinder. So this one time assistance to BPL family by the government is giving a greater push towards use of cleaner fuel but however the affordability still remain core issue as the bio fuel is cheaply available, unless the BPL family develops the capacity of using cleaner fuel. [29] Similar findings are also reported from other states in media. [30,31] Under the PMUY scheme, consumers who receive the facility of LPG gas connections also think that wood and cow-dung cakes should be used up before the gas stove is lit. Also, the assumption that they don't have to separately spend on wood and cow-dung the way they have to on a gas cylinder keeps them wary of the idea which in the long run will prove beneficial to them. The PPAC-commissioned study had identified that the distance to the LPG distributor and long waiting time to get a refill are barriers to adoption of LPG. [32] It has been documented that the community in general are not aware of Government schemes and paper work which need to be done is big hindrance for ujjwala yojna in study area. Villagers also pointed that there are errors in beneficiary identification processes [33, 34] in BPL category. The penetration of clean fuel was low in the study area and as such the numbers of connections given in whole Nagpur district till 2018 are only 12,000. [35] So considering that Nagpur has 14 blocks, these are less as compare to other parts of India. The one reason for this could be the district was not high priority district in the programme. The other objective of the PMUY scheme that of health benefits is not achieved as people are not using the gas connection solely.

CONCLUSION

Last few decades have witnessed many household energy initiatives taken by the Government of India to address the HAP, but the pace of switching over to clean fuel/stove has not been very encouraging. It is fair to conclude that the objective of providing connections to poor households is broadly being achieved.

However, the real social objective of a scheme such as PMUY can only be achieved if households not only get LPG connections but use it for most, preferably all, their cooking needs on a sustained basis. Converting connections to sustained use requires overcoming a few barriers, such as affordability, reliability, accountability and viability. [35] High refill price of LPG is a big barrier to using it. So, Government has to device ways to promote sustained use of LPG, while awareness campaigns do strengthen behavioural intent to use LPG, the health benefits of using clean fuels needs to be imbibed in the minds of people for sustained use of LPG. Health department is not involved in the PMUY scheme at any level, the health workers can be involved in the awareness campaign in the community. The pregnant women can be told about the benefits of LPG use for cooking when she comes for ANC registration to get population out of chulha trap.

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