



## SWOT ANALYSIS OF CLEAN FUEL PROGRAMME INITIATIVE IN INDIA

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**ABSTRACT:** Cooking is an important aspect to human lives. A sizable portion of India's population still relies on biomass fuels, such as wood, animal wastes, and agricultural residues, to meet their energy needs for cooking. According to the 2011 census, 67.3% of the Indian population used biomass fuel for cooking. Also, the cooking devices used had poor thermal efficiency and posed a severe threat to health due to unclean combustion. Clean cooking fuels are a highly cost-effective health intervention and household's energy-behavior indicates the economic development of a country. The past few decades have seen immense efforts by the Indian Government to introduce improved cookstoves and other cleaner cooking fuels; however, most of these interventions have largely failed to bring the much-needed transition. Learning from past experiences, the Government of India initiated the National Biomass Cookstoves Initiative (NBCI) in the year 2009. This program uses a different approach based on the changes that have taken place in society and technology over the years. In "Pradhan Mantri Ujjwala Yojana" (PMUY), the government provided gas connections to a total of 50 million poor households (from 2016 to 2018). Piped Natural Gas (PNG) connections have reached more than 11% of households annually with a goal of 20 million by early next decade helping to move LPG to rural areas. In the present paper, Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis has been done on clean cooking programs to determine the extent to which the new program is likely to ensure access to clean cooking energy for all.

**Key words:** - Biomass fuel, National Biomass Cookstove Initiative, PMUY, Improved Cookstove, SWOT, India.

### 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 Chulah), 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 (a) 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 [12,13,14].

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 yojana (PMUY) which is underway now, will provide connections to a total of 50 million poor households by 2019 and has reached 20 million already by April 2017. 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.

Since the NBCI has completed 12 years and PMUY more than 5 years, it is worthwhile to assess the program using the analysis of strengths, weaknesses, opportunities and threats (SWOT) to draw an analytical profile. This would help identify gaps and threats in the program so that the same could be utilized to improve the program's performance throughout the country

#### **Strength**

- **Multiple stakeholders**

There are many actors in the household energy sector in India. They include governmental agencies, oil marketing companies that market LPG, Non-Government Organizations (NGOs), research institutes, multinational organizations, donor agencies, etc. NBCI is being implemented through R&D/academic institutions. Besides this, the State Nodal/Implementing Agencies, State Departments of Education through District Coordinators of MDM Scheme, District Level Officers of Anganwadis, District Coordinators/Officers of Tribal/Scheduled/Backward Caste Hostels and similar departmental agencies where cookstoves could be employed. Also, the NGOs, manufacturers, business development organizations, etc. engaged in the implementation of renewable energy projects at the grass-root level are part of the program.

#### **Huge market potential for clean fuel**

Despite rapid urbanization, about 70% of Indians still reside in rural areas. Most villagers still depend predominantly on traditional fuels to meet their energy needs. The use of biomass fuels like wood, dung cake, and crop residue is widespread in rural areas. According to the 2001 census, 74% of Indian households relied on biomass as their primary cooking fuel, which has come down to 67% according to the latest Census conducted in 2011. So, the target population is still above 50% of Indian households.

- **Multiple Choice of Clean Fuels**

GOI promotes many clean fuels to give the users a basket of choices from which they can pick the stove that meets their needs the best in terms of the variety of cooking practices, fuels, and levels of affordability.

Both engineering and non-engineering parameters are now taken into consideration in designing appropriately improved cookstoves. The majority of cookstoves in the market are tailored to provide a more advantageous cooking

experience without requiring any fundamental change in user cooking habits

- **Indirect benefits of Clean Fuels**

The use of solid biomass fuels for cooking is the largest source of HAP in India, particularly in rural areas where more than 85% of the households still depend on biomass for their daily cooking needs. It is now widely recognized that improved energy services at the household level can reduce child mortality rates, improve maternal health. It reduces the time and the transport burden on women and young girls for cooking and fuel collection to have more time for education and other productive works<sup>26</sup>. It is also recognized now that effective household energy programs can lessen the pressure on fragile ecosystems<sup>27</sup>.

- **Issues of Cookstove safety**

In the new designs of cookstoves, precautions have been taken against sparks and burns. Equal importance is given to stability against tilting while stirring the food during cooking, especially in the portable stoves. Therefore, the new, improved cookstoves are safer as compared to the previous models.

**Opportunity for employment generation at the local level**

Involving the local community in various operational aspects of the cookstoves in the new program offers immense possibilities for their participation and entrepreneurship in the program, especially for women through self-help groups. The community gets a sense of ownership as they are involved in various aspects of the program

**Weakness**

- **Lack of Awareness**

Research suggests that rural people are not concerned about cooking fuels and deforestation issues, mainly due to a lack of awareness. Householders are often unaware of the detrimental health and environmental effects of smoke from traditional cooking practices.

Therefore, they lack the knowledge of the health benefits from improved cooking stoves, especially to women and children. Recently, a pilot study conducted in three Indian states reported that only 14% of households believed that adopting a clean stove could alleviate the adverse health effects of traditional cooking.

- **Socio-Cultural Factors**

Despite changes in the program, certain strong cultural factors prevent widespread use of efficient cookstoves. They include traditional cooking practices, and other benefits such as space heating by conventional cookstoves, and slow cooking when the women are out in the fields. It is essential to ensure that the improved cookstoves allow women to continue with their traditional cooking practices. The current program may not be able to overcome these forces. Multiple stakeholders. While many levels of stakeholders are seen as strengths to the program, they also make the program's administration cumbersome and fragmented. Coordination with all the concerned stakeholders is a challenging task for the implementing agency.

- **Financial implications**

Although improved stoves save money in the long run, the initial investment required for a really clean stove may prevent poor people from purchasing it. Where communities were required to pay the full cost of the improved cookstoves, the price was reported as an important barrier among poorer households<sup>28</sup> [Sesan, T.A., 2012.]. In the pilot study conducted in three states of India, the majority (63%) of randomly selected households cited cost as the least desirable aspect of the improved cookstoves<sup>29</sup> [Jessica, J., et.al 2015]. Although consumers are willing to adopt new cooking approaches, the product must be cost-competitive with existing solutions such as LPG stoves<sup>30</sup>

- **Slow switch-over to cleaner fuels**

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.' However, in many rural areas, households often employ 'multiple models' of stove and energy use, and fuel substitution is often partial. As a result, the full benefits of "clean" stoves are not achieved. As per the 2001 census of India, biomass fuel use in households was nearly 74%, which came down to 67% in the 2011 census. [Census, 2001 & 2011] While conversion to modern fuels has accelerated in urban areas, populations in rural areas have remained slow in moving away from solid fuels.

#### Opportunities

- **Huge market potential**

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- **Opportunities for public-private partnership**

The clean fuel Initiative opens up opportunities for applying the public, private partnership (PPP) model at all levels. If such alliances are implemented effectively, it can provide an opportunity for all stakeholders such as Government, industry, academic institutions, and social sector to benefit from each other's expertise and resources. Micro-institutions such

as NGOs, creditors, and retailers can also be vital for delivering improved cookstoves in India

- **Raised public awareness**

There is an increased awareness of air pollution and its health impact in India due to epidemiological research and greater media exposure. Therefore, there is a widely felt need for providing cleaner cooking options to improve household air quality in rural households at an affordable price.

#### Threats

- **Slow progress of the program**

Better from the earlier program, yet the development of the programs has remained slow so far. The country's NBCI's Initiative seeks to provide nearly 166 million improved cookstoves to households currently using solid biomass fuel, which was too ambitious). Though the overall cookstove market size in India is vast, the easiest consumer segment to target would be mid and high-income biomass fuel users. A big challenge would be rural biomass fuel users who could make up about 85% of the market as they do not have a habit of paying for fuel (as biomass is freely available in rural areas.

PMUY did not scale-up in the Maharashtra as, the number of connections given in the whole Nagpur district till 2018 was only 12,000<sup>33</sup>. So, considering that Nagpur has 14 blocks, these numbers are less as compare to other parts of India. The findings also show widespread fuel stacking as shown by the works of other researchers. As a result, the full benefits of clean fuels are not achieved. Conversion to cleaner fuels in study areas has remained slow because the cost of fuel is the limiting factor<sup>34</sup>. For the BPL population to shell out Rs 700 per month is a big deal as they don't get the 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. The result corresponds to similar

findings from the PMUY study done by Ahmad N and a clean cooking alliance study in Karnataka

• **Inadequate coordination among key players**

Cookstoves have become a popular focus area for donor agencies on financing and supporting research. Still, the Government needs to ensure that the program's objectives may not get diluted due to the pressure of multiple agencies. Sometimes, administrative arrangements and the donor partner's requirements may work against market sustainability. In particular, short-term projects may not focus on sustainable use of improved technologies. This lack of proper coordination among donors, program coordinators, and stove users emerged as a barrier to creating sustainable change

• **Role clarity of different stakeholders**

As the program has multiple stakeholders, each stakeholder's roles and responsibilities must be clarified right in the beginning else; it would result in overlapping of work or missing some critical aspect altogether. Effective strategies to reduce the burden of HAP require commitments from various sectors. Though different ministries (e.g., health, environment, rural development, MNRE, housing, poverty alleviation, oil and natural gas, women and child development) aim to

**CONCLUSION:**

To address the HAP, the last few decades have witnessed many household energy initiatives taken by the Government of India. Still, the pace of switching over to clean fuel/stove has not been very encouraging. The SWOT analysis of the clean fuel program suggests that it contains several promising elements as it has incorporated the concerns raised in the previous programs. The lessons learned from earlier experiences can be the guiding force in implementing a successful household energy program. The present program has some limitations too. Therefore, the GOI and the

implementing ministry needs to develop its strategies to capitalize upon the program's strengths and opportunities and draw up action plans to minimize its weaknesses and threats. If appropriately implemented, the program can ensure access to clean and sustainable cooking energy in India.

**REFERENCES:**

- Spengler JD, Sament JM, Mccarthy F (2001) Indoor air quality handbook, Mccraw Hill New York
- Census of India, 2011. 'Houses, Household Amenities and Assets', Government of India. Retrieved 05/09/2017 from [http://www.devinfolive.info/censusinfo/dashboard/website/index.php/pages/kitchen\\_fuelused/Total/insidehouse/IND](http://www.devinfolive.info/censusinfo/dashboard/website/index.php/pages/kitchen_fuelused/Total/insidehouse/IND)
- Behrens A, Lahn G, Dreblow E, Nuñez-Ferrer J, Carraro M, Veit S. Escaping the vicious cycle of poverty: Towards universal access to energy in developing countries. Brussels:Centre for European Policy Studies; 2012. CEPS Working Document 363.
- Barnes DF, Floor WM. Rural energy in developing countries: a challenge for economic development. *Annu Rev Energ Environ* 1996;21:497-530.21
- Ezzati M, Kammen DM. Household energy, indoor air pollution and health in developing countries: Knowledge base for effective interventions. *Annu Rev Energ Environ* 2002;27:233-70.
- Fullerton DG, and Bruce N. Indoor air pollution from biomass fuel smoke is a major health concern in the developing world. *T Roy Soc Trop Med H* 2008;102(9):843-51.
- Edwards JHY, Langpap C. Fuel choice, indoor air pollution and children's health. *Environ and Dev Econ* 2012;17(4):379-406.

- Pachauri S, Jiang L. The household energy transition in India and China. *Energy Policy* 2008;36(11):4022-35.
- Ezzati M, Kammen DM. Household energy, indoor air pollution and health in developing countries: Knowledge base for effective interventions. *Annu Rev Energ Environ* 2002;27:233-70.
- Bruce, N.; Perez-Padilla, R.; Albalak, R. Indoor air pollution in developing countries: A major environmental and public health challenge. *Bull. World Health Organ.* 2000, 78, 1078–1092.
- WHO 2018 <http://www.who.int/news-room/fact-sheets/detail/household-air-pollution-and-health>
- IHME. (2017). Global Burden of Disease Results Tool. Retrieved January 23, 2018, from <http://ghdx.healthdata.org/gbd-results-tool>
- IIPS and ICF. (2017). National Family Health Survey (NFHS-4) 2015-16: India. Mumbai: IIPS: International Institute for Population Sciences and ICF.
- IIT Bombay, HEI, IHME. (2018). Burden of Disease Attributable to Major Air Pollution Sources in India
- Parikh, J. and Laxmi, V., Biofuels, Pollution and Health Linkages: A Survey of Rural Tamilnadu, *Economic and Political Weekly*, 2000.November 18-24, pp. 4125-4137.
- Ministry of Non-conventional Energy Sources, 1997. National program on improved chulhas. Administrative approval 1997-1998, New Delhi, Government of India
- Barnes, D. F., Kumar, P., Openshaw, K., 2012. *Cleaner Hearths, Better Homes: New Stoves for India and the Developing World*, Oxford University Press, New Delhi, India.
- Aggarwal, R.K. and Chandel S.S., Review of Improved Cookstoves Programme in Western Himalayan State of India, *Biomass and Bioenergy*, Volume 27, Issue 2, August 2004, pp. 131-144
- Kishore, V.V.N., and Ramana, P.V., Improved cookstoves in rural India: how improved are they? A critique of the perceived benefits from the National Program on Improved Chulhas (NPIC), *Energy*, Volume 27, Issue 1, 2002,pp. 47-63
- Ministry of New and Renewable Energy, 2010. New Initiative for Development and Deployment of Improved Cookstoves: Recommended Action Plan Final Report Prepared by Indian Institute of Technology Delhi and The Energy and Resources Institute, MNRE, New Delhi, Government of India
- Smith, K. R., & Sagar, A. D. Making the clean available: Escaping India's Chulha Trap. 2014,*Energy Policy*, 410-414.
- Prayas. (2018). Fuelling the transition: Costs and benefits of modern cooking fuels as a health intervention in India.
- Desai, S., & Vanneman, R. India Human Development Survey -II (IHDS-II) 2011-12. Ann Arbor MI2016: ICPSR36151-v5
- Parikh J, : Hardships and health impacts on women due to traditional cooking fuels: A case study of Himachal Pradesh, India *Energy Policy* 39 (2011) 7587–7594
- Update, N. (2016, March 16). Cabinet approves Pradhan Mantri Ujjwala Yojana – Scheme for Providing Free LPG connections to Women from BPL Households . Retrieved from [http://www.pmindia.gov.in/en/news\\_updates/cabinet-approves-pradhan-mantri-ujjwala-yojana-scheme-for-providing-free-lpg-connections-to-women-from-bpl-households](http://www.pmindia.gov.in/en/news_updates/cabinet-approves-pradhan-mantri-ujjwala-yojana-scheme-for-providing-free-lpg-connections-to-women-from-bpl-households)

- World Health Organizations, 2004. Indoor Air pollution, Household Energy and Millennium Development Goals
- United Nations Development Programme, 2005. Energy Services for the Millennium Development Goals
- Sesan, T.A., 2012. Navigating the limitations of energy poverty: Lessons from the promotion of improved cooking technologies in Kenya. *Energy Policy*, 47, 202–210
- Jessica, J., Lewis, Bhojvaid, V., Brooks, N., Das, I., Jeuland, M. A., Patange, O., & Pattanayak, S. K., 2015. Piloting Improved Cookstoves in India, *Journal of Health Communication: International Perspectives*, 20: sup1, 28-42, DOI: 10.1080/10810730.2014.994243
- Gupta S., Saksena S., Shankar R. & Joshi V. 1998, Emission factor and thermal efficiency of cooking biofuels from five countries. *Biomass and bioenergy*, 14(5-6), 547-559.
- Joon, V., Chandra A., Bhattacharya M., 2009. Household energy consumption pattern and socio-cultural dimensions associated with it: A case study of rural Haryana, India, *Biomass & Bioenergy*, volume 33, issue 11, pp. 1509 – 1512
- CRISIL. (2016). Assessment report: Primary survey on household cooking fuel usage and willingness to convert to LPG
- FLDI. (2016, May 18). Letter from the Federation of LPG Distributors of India to Joint Secretary (M), MoPNG .
- FLDI. (2016a, July 4). Letter from Federation of LPG Distributors of India to Joint Secretary (M), MoPNG.