

## Effectiveness of Pradhan Mantri Ujjwala Yojana towards Sustainable Living for Indian Households

<sup>1</sup>Aruna Kumar Dash, <sup>2</sup>Debajani Sahoo

<sup>1</sup>Associate Professor, Department of Economics, ICAI School of Social Sciences, IFHE University

<sup>2</sup>Professor, Department of Marketing & Strategy, IBS Hyderabad, IFHE University

**Abstract:** In this study, we attempted to critically examine the effectiveness of Pradhan Mantri Ujjwala Yojana (PMUY) in Indian households. This study is relevant to the contemporary world as it addresses critical issues such as public health, environmental sustainability, and social equity. By encouraging the adoption of LPG instead of traditional biomass fuels, PMUY greatly decreases indoor air pollution, leading to improved health outcomes for women and children. It also supports environmental goals by minimizing deforestation and carbon emissions. Furthermore, the program empowers women by freeing up time previously spent on fuel collection, thus enhancing their economic opportunities. The findings of this paper could provide important guidance for improving policies and institutions that facilitate a socially inclusive shift to cleaner energy in rural communities.

**JEL Classification:** I18, I21

**Keywords:** Air pollution, Clean Cooking, Transition to LPG, Health Awareness, Women empowerment, Rural households, Pradhan Mantri Ujjwala Yojana

### 1. Introduction

Around 2.3 billion people worldwide use inefficient stoves powered by kerosene, biomass, and coal resulting in considerable household air pollution and associated health hazards (World Health Organization (WHO), 2023). The majority of these individuals are poor and reside in low- and middle-income countries. According to the WHO in 2023, household air pollution led to 3.2 million deaths in 2020, including more than 237,000 deaths of children under five, mainly in low- and middle-income countries. In 2018, the WHO reported that 3 million households lack access to clean fuel, emphasizing the need for a swift energy transition. Household air pollution is linked to non-communicable diseases like stroke, heart disease, COPD, and lung cancer, emphasizing the need to improve indoor air quality. The utilization of clean fuels and technologies is vital for minimizing household air pollution and safeguarding health.

Over 800 million people in India rely on traditional solid fuels like wood, dung cakes, and coal for their cooking needs (WEO, 2017). Additionally, nearly 688 million people still do not have access to clean cooking solutions (IEA, 2018). Traditional solid cooking fuels are popular in rural areas due to affordability and accessibility, but they also have environmental and health costs due to large-scale smoke production, household pollution, and respiratory diseases and disorders for women and children. In India, the majority of households utilize firewood, cow dung, or agricultural leftovers because these are readily available, rather than adopting cleaner fuel for cooking owing to the cost involved. Gathering fuel poses a significant risk of musculoskeletal injuries and consumes a substantial amount of time for women and children, which hinders their access to education and other productive activities (WHO, 2023). Women and children are at risk of injury and violence in less secure environments while gathering fuel. Women and small children spend a large amount of time collecting firewood, and it is possible that the usage of solid fuels will have an impact on children's education and academic achievement.

In many developing countries, household sources that burn fuels such as firewood and cow dung are major contributors to air pollution (Liu et. al, 2016, GBD-MAPS, 2018). The use of solid fuel for cooking in underdeveloped nations is linked to negative environmental and health impacts. The Sustainable Development Goals (SDGs) have recognized the importance of universal access to affordable, reliable, and modern energy services, as one of their seven targets set by the United Nations Development Programme (UNDP) for 2030. According to the 2011 Census of India, 63% of rural households rely on firewood for cooking, while 23% use crop residue and cow dung. Many households are returning to traditional fuels due to their easier availability, lower costs, challenges in refilling cylinders, and a lack of information (Kar et al. 2019; Swain and Mishra, 2020). The use of cleaner energy is crucial for promoting sustainable and inclusive development, which is currently facing alarming trends (Mishra and Behera, 2016). The Pradhan Mantri Ujjwala Yojana (PMUY), launched by Prime Minister Narendra Modi in 2016 was initiated to address the critical issues of indoor air pollution and health risks associated with traditional solid fuel cooking practices, which encompass wood, charcoal, dung, agricultural residues, and coal. The core principle of the PMUY is "Mahilaon Ko Mila Samman, Swacch Indhan-Behtar Jeevan" ("Respect for Women, Clean Fuel, Better Life"). These practices have a long history of being linked to health issues. The scheme's core objective is to mitigate these risks by providing free LPG connections to households in economically deprived areas (Pillarisetti et al., 2019). It focuses especially on the empowerment of women and the improvement of overall household well-being by improving the living standards of rural women by providing affordable cleaner fuel, reducing air pollution, improving health and sanitation, and empowering their livelihoods through behavioral changes. These traditional fuels lead to indoor air contamination,

resulting in serious respiratory issues and other health problems, especially for women and children who spend considerable time near the cooking area.

The shift from traditional cooking fuel to LPG is anticipated to decrease carbon emissions and enhance the health of rural populations, especially women and children (Barua and Agarwalla, 2018; Swain and Mishra, 2020) thereby enhancing public health. The PMUY scheme has offered free LPG connections to 37 million women living below the poverty line, facilitating their transition to clean household energy and benefiting a total of 95.9 million customers as of April 1, 2023 (The Ministry of Petroleum and Natural Gas, 2023). One reason for limited LPG consumption is, of course, poverty in developing nations. Even though LPG is subsidized in India, the cost can still be significant for poor households. Factors such as wealth, income, fuel cost, education, gender dynamics, and individual preferences significantly influence household fuel choices (Behera et al., 2017; Muller and Yan, 2018; Rahut et al., 2020). These factors interact in complex ways, affecting families' health and well-being. Understanding these factors is crucial for developing effective policies promoting cleaner energy options, thereby enhancing the overall energy efficiency of households.

The study reviews previous research on PMUY implementation, identifies challenges, and proposes recommendations, aligning with India's commitment to sustainable development and environmental conservation goals. It promotes cleaner LPG fuels, reducing deforestation, air pollution, and carbon emissions, contributing to global climate change efforts in India. The literature findings demonstrate India's proactive approach to socio-economic challenges but also enhance its reputation as a responsible global player. India ranks 5<sup>th</sup> globally with a 3.38 trillion economy, according to the World Bank. Governments are prioritizing green growth as a crucial sustainable development strategy to achieve a 5 trillion economy. The PMUY is a flagship initiative designed to contribute to three of the 17 global sustainable development goals. Goal 3 emphasizes good health and well-being, Goal 7 focuses on ensuring access to affordable and clean energy, and Goal 13 promotes climate action. The present study results are crucial for policymakers and researchers to assess public health and well-being in government initiatives, guiding future decisions and program enhancements for beneficiaries' health and financial aspects.

## 2. Review of Literature

Growing global awareness of clean fuels, particularly in terms of pollution and health risks, has resulted in ongoing initiatives to switch to electricity and LPG as a fuel for domestic purposes. As a result, there have been several government initiatives and research in developing nations. According to the literature, the use of solid fuels in homes significantly impacts health outcomes, especially in children. For example, Edwards and Langpap (2012)

used survey data from Guatemala and reported a greater incidence of respiratory infections among children from homes who used firewood. Similarly, research utilizing Indian data indicated that household air pollution caused by fuel consumption is connected with low birth weight, increased neonatal death, and mortality among children under the age of five. Hanna et al.'s 2016 laboratory studies suggest that high-quality cooking stoves can reduce indoor internal contamination, improve health, and reduce greenhouse gas emissions in emerging economies, thereby enhancing overall health. The study aimed to judge the impact of improved cooking stoves on indoor internal contamination, health, and greenhouse gas emissions. Women who cook with solid biogas fuels (SBF) and mixed fuels show reduced lung function and a higher incidence of respiratory symptoms as stated by Kaur-Sidhu et al. (2019). The research aimed to measure the effect of using SBF and mixed fuels on women's lung health, examine the prevalence of respiratory issues, and identify associated health risks. The study highlighted that cooking with solid biogas fuels and mixed fuels is linked to poorer lung function and a higher occurrence of respiratory symptoms in women. The study underscores the importance of promoting cleaner stove fuels and enhancing household ventilation to mitigate health risks. Their conclusions suggest that women who use AUTOGAS for cooking enjoy better lung function and respiratory health. Therefore, expanding clean fuel initiatives like PMUY, while addressing obstacles to adopting clean fuels for household energy, is recommended. Studies indicate that higher household air pollution increases the likelihood of health issues like respiratory problems and blood pressure (Akru et al. 2018; Jagger and Shively, 2014; James et al., 2020). Numerous researchers found that promoting LPG usage has a positive health externality for women (Pillariseti et al, 2019, for Maharastra; Sharma et al., 2019, for Chhattisgarh and Jharkhand; Mall, 2019 for Bihar; Angoori and Kumar, 2023 for Haryana.

Meenatchi and Manvendra (2023) study focused on financial inclusion and women's empowerment in Tamil Nadu in enhancing women's economic empowerment and financial well-being in the region and highlights their financial literacy and decision-making ability. Yadav's 2020 study evaluated the impact of PMUY on the socio-economic status of women living in traditional houses in rural areas. The research aimed to evaluate how the PMUY scheme has empowered women by improving their health, time management, and financial conditions. It focused on the health benefits of transitioning from traditional fuels to AUTOGAS, highlighting reductions in indoor air pollution and related health issues. Ultimately, Yadav provided policy recommendations to enhance the effectiveness of the PMUY scheme, aiming for sustainable empowerment and improved quality of life for rural women. The PMUY scheme notably empowered women by plummeting the time and effort needed for fuel collection and cooking, granting them greater convenience and control over household energy resources. Additionally, women experienced socio-economic paybacks, that encompass improved health from reduced indoor internal contamination, increased

time for productive activities, and enhanced financial savings. The program was deemed effective in improving women's life standards by providing a cleaner and more reliable stove fuel option, thus contributing to their overall empowerment and well-being.

Chowdhury and Desai (2021) revealed that rural Indian children whose families rely on free water and cooking fuel had an adverse educational outcome. They concluded that males had worse mathematics scores due to increased psychosocial fragility caused by a lack of mother supervision. Childhood disadvantages may lead to a worsening of outcomes among adolescent boys. Therefore, using cleaner energy sources is crucial for achieving inclusivity, sustainability, and an improved standard of living (Mishra and Behera (2016)).

### **3. Observations and findings related to the Relevance**

With progress and industrialization, domestic cooking expertise has evolved from outdated methods to more contemporary ones (Cowan,1976). Modern household cooking techniques have replaced more conventional ones as a result of progress and industrialization (Cowan, 1976).The study aimed to document the technological evolution of household cooking methods, assess the impact of this shift on cooking practices and household efficiency, and analyze the socio-economic and environmental implications of adopting modern cooking technologies. Through a historical review, the study traced the transition from traditional methods, such as open fires, clay stoves, and charcoal cooking, to modern technologies like gas stoves, electric ranges, and microwave ovens. Case studies from various regions highlighted how different societies have embraced these changes, while surveys and interviews provided data on the adoption and effects of modern cooking technologies. The findings revealed significant technological progress, with modern cooking methods leading to increased efficiency, enhanced safety, and greater convenience in the kitchen. The shift to modern cooking technologies has also had socio-economic impacts, including reduced household labor and changes in cultural practices related to food preparation. Additionally, while modern technologies have generally improved indoor air worth and health results by reducing pollution, the environmental impact of energy consumption and waste remains a concern. Cowan (1976) concluded that the evolution from traditional to modern household cooking technologies has brought about noteworthy developments in cooking efficiency, safety, and convenience. The study highlighted the benefits of technological advancements while also noting the need for ongoing consideration of environmental and health impacts associated with modern cooking methods. Vietnam has seen a remarkable transition, increasing its use of cleaner stove fuel from 13% to 64% between 2000 and 2018.

The global shift from traditional fuels to cleaner energy sources is progressing, but at a slow pace. Research by Omer (2008) and Kaygusuz (2012) highlights that while reliance on traditional fuels is decreasing, the adoption of fully hygienic fuels is lagging. Between 2000

and 2018, global use of clean cooking technologies rose from 26% to 63%, with Vietnam seeing a significant increase from 13% to 64%. Despite this progress, barriers such as high costs, insufficient infrastructure, and limited availability of cleaner fuels and adequate safety measures hinder broader adoption.

**Table 1: Number of LPG Accidents that have taken place in PMUY Household**

Year	Oil Marketing Company(OMC)
2016-17	44
2017-18	194
2018-19	174
2019-20	173
2020-21	311
Total	896

**Source:** eparlib.nic.in.

Indian Oil Corporation, Bharat Petroleum Corporation, and Hindustan Petroleum Corporation are major oil marketing companies in India that supply LPG for cooking, playing a crucial role in distributing LPG to households and promoting cleaner cooking fuels. From Table 1, it is evident that the number of LPG accidents has risen since the launch of the PMUY scheme, with incidents increasing from 44 in 2016 to 194 in 2018. In the early years following the launch of the PMUY scheme, a high number of LPG accidents was anticipated due to people's lack of familiarity with LPG usage. The increase in LPG accidents might be because of an increase in the number of PMUY beneficiary. However, after two years, there was a noticeable decrease in accidents, indicating a positive trend for the PMUY initiative. Unfortunately, in 2020-21, the number of LPG accidents increased again, raising concerns. To enhance the effectiveness of the PMUY program, LPG service providers should focus on increasing awareness of safety measures.

The studies emphasize the role of inadequate policies and technological gaps as significant challenges. Recommendations for accelerating this transition include improved policies, technological advancements, and greater investment in infrastructure to support the adoption of cleaner fuels.

In 2018, only 15% of Sub-Saharan African households had access to clean cooking gas and associated technology (Watts et al., 2021). A study analyzed household surveys, national reports, and energy access databases. The findings revealed a significant reliance on conventional fuels, with barriers such as high costs, limited distribution infrastructure, and

lack of understanding. Economic constraints and poverty exacerbated these issues. Limited access to cleaner cooking methods has been connected to major health issues including respiratory and cardiovascular diseases, as well as environmental difficulties. The study suggests that improving access to cleaner stove fuels and technologies in Sub-Saharan Africa requires addressing economic, infrastructural, and educational barriers, through financial subsidies, infrastructure improvements, and awareness campaigns.

Gupta et al.'s 2020 study examined the impact of traditional fuel burning on air quality and health in specific regions. The research found that households using traditional fuels were exposed to higher levels of internal contamination, including particulate matter and toxins. Many women had low knowledge about these health risks, leading to high incidences of chronic cough, asthma, and heart-related problems. The study recommended increased educational initiatives, access to cleaner cooking technologies, and policy interventions to reduce trust in traditional fuels and improve indoor air quality. Raising women's awareness about these health risks is crucial for reducing the negative effects of internal contamination on their health.

Swain and Mishra's 2020 study examined the health impacts of indoor internal contamination on rural women and explored the potential of expanding AUTOGAS (liquefied petroleum gas) access to mitigate these issues. The research found that adverse indoor air smog significantly harms rural women's health, leading to chronic respiratory conditions and cardiovascular problems. Low AUTOGAS coverage in rural areas, with many households still using traditional biogas fuels, highlights the need for expanded coverage to reduce indoor internal contamination and improve health outcomes. However, barriers to adoption include high initial costs, limited infrastructure, and insufficient awareness of the benefits of AUTOGAS. The study recommends policy measures like subsidies, infrastructure development, and awareness campaigns to increase AUTOGAS adoption and counter the negative health effects of conventional cooking methods.

Chowdhury et al. (2019) found that reducing biogas use for cooking in India could reduce the population-weighted annual average exposure to ambient PM<sub>2.5</sub> by 17.5%. This reduction in PM<sub>2.5</sub> levels was linked to a 6.6% decrease in premature death, highlighting the direct health benefits of reduced exposure to air pollutants. The study also highlighted that transitioning away from biogas could improve air quality during high-pollution months like November and December. The shift to cleaner cooking technologies offers significant wellness benefits, including reduced rates of respiratory and heart diseases. The study underscored the importance of promoting cleaner cooking technologies and policies to improve air quality and public health, especially during peak pollution periods.

Brahmachari et al. (2019) studied gender dynamics in fuel use and decision-making in households, focusing on the roles of women and men in fuel-related expenditures and collection tasks. The study found that women are primarily responsible for collecting traditional fuels and preparing food, which requires time and effort. However, decisions about fuel expenditures are typically made by men, creating a disconnect between those who manage fuel collection and those who control financial decisions. This discrepancy can impact the adoption of cleaner cooking technologies, as the practical experiences and needs of women may not be adequately considered in expenditure decisions made by men. The study concluded that addressing gender dynamics in fuel-related tasks is crucial for encouraging the acceptance of neat cooking technologies and recommended more inclusive decision-making processes that consider the needs and experiences of both men and women.

The study by Kyayesimira & Florence (2021) highlights the vulnerability of women and girls to indoor internal contamination due to their cooking roles. The research found that women and girls experience higher levels of contamination from traditional fuels, leading to elevated pollutant levels in kitchens. This exposure is linked to health risks, including respiratory issues like chronic bronchitis and asthma. Key vulnerability factors identified include inefficient fuel use, poor ventilation, and prolonged cooking time. The study proposes mitigation strategies, including encouraging better cooking methods, enhancing kitchen ventilation, and raising awareness about indoor internal contamination's health impacts. The study concludes that women and girls are especially vulnerable to indoor air contamination because of their roles in cooking.

#### **4. Observations and findings related to the Effectiveness**

The PMUY in India aims to provide clean cooking fuel to millions of households, particularly those below the poverty line, by increasing access to liquefied petroleum gas, reducing biomass reliance, and improving indoor air quality. The scheme has empowered women, enhanced their role in household decision-making, and contributed to environmental sustainability by lowering deforestation rates associated with biomass collection. However, challenges remain, such as refill affordability and ensuring sustainable LPG use.

In rural Odisha, India, Swain & Mishrashek (2020) looks at recipient households' response to the PMUY regarding their real use of LPG and pinpoint the underlying players. The study found that education level and subsidy amount significantly influence LPG usage. However, general households show lower adoption rates. The research suggests a decrease in traditional cooking fuel use among beneficiaries, reducing carbon emissions.



Respondents under the PMUY have noted that LPG connections have significantly benefited women by enabling them to cook at home.

**Table 2: State and UT-wise LPG connections released under PMUY**

States and UTs	2016-2017	2017-2018	2018-2019	2019-2020	2021-2022	2022-2023	2023-2024	2024-25 (Till 30.07.2024)
Andaman & Nicobar Islands	1189	522	6178	4,547	811	46	383	1
Andhra Pradesh	63428	16616	262554	49,262	25,222	95,672	4,55,997	2,621
Arunachal Pradesh	NA	6362	32953	5,384	3,457	1,514	4,544	4
Assam	2	1128137	1707801	6,48,961	5,11,073	4,24,243	6,77,955	7,889
Bihar	2476953	2436197	2981636	6,43,107	16,13,210	6,39,296	8,85,019	11,384
Chandigarh	NA	NA	88	-	5	569	1,366	0
Chhattisgarh	1105441	846679	740584	2,96,736	3,73,735	1,44,003	2,93,324	16,620
Dadra and Nagar Haveli & Daman and Diu	3284	8356	2890	644	39	14	2,795	62
Delhi	516	161	73120	3,058	22,638	43,594	1,14,936	2,985
Goa	954	30	88	10	-	141	692	0
Gujarat	752354	516660	1252052	3,79,993	5,40,537	4,06,881	4,62,062	4,881
Haryana	278751	78361	323344	50,472	13,675	29,097	3,45,912	2,301
Himachal Pradesh	1601	28140	83177	23,048	2,058	2,525	10,089	14
Jammu & Kashmir	265787	107133	680098	1,88,317	9,415	7,110	25,324	307
Jharkhand	536912	666631	1701032	3,56,981	2,19,486	1,74,072	2,49,411	1,816
Karnataka	15840	893174	1913808	3,23,478	3,28,275	2,93,751	3,91,934	603
Kerala	11241	27152	171530	46,379	44,456	40,802	46,564	83
Ladakh				745	28	1	2	0
Lakshadweep	NA	134	156	-	10	14	61	0
Madhya Pradesh	2239821	1075351	3130613	7,08,815	7,95,859	2,92,462	6,05,761	15,611

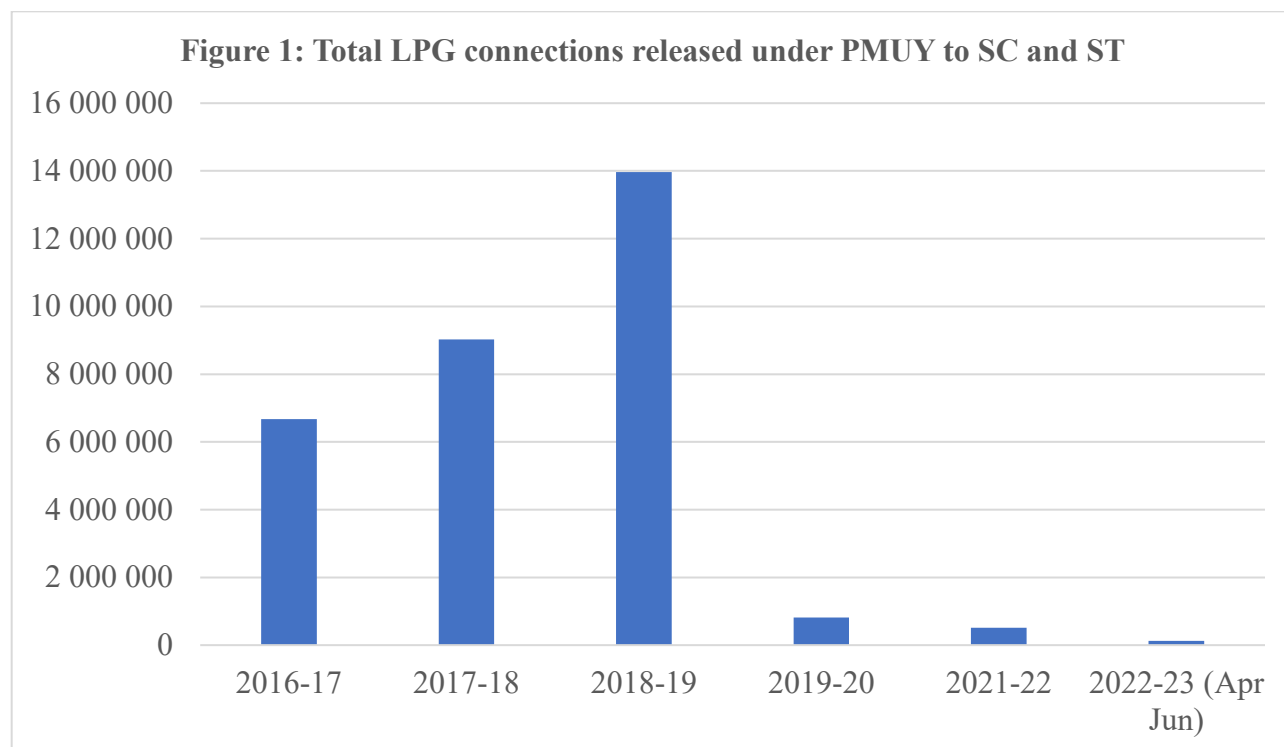
Maharashtra	858808	1018570	2186426	3,64,878	2,81,997	1,94,467	3,27,823	2,754
Manipur	25	32592	97760	26,221	22,025	23,691	22,970	129
Meghalaya	NA	36844	103467	10,433	22,628	41,847	1,01,774	1,315
Mizoram	NA	902	24879	2,337	1,523	3,962	2,436	5
Nagaland	NA	9225	40177	5,738	21,977	14,956	30,324	48
Odisha	1011955	1288380	1925954	5,14,096	4,55,549	1,37,729	2,26,972	2,773
Puducherry	760	1861	11568	203	655	616	4,485	0
Punjab	245008	137343	826611	15,256	17,132	48,514	75,928	0
Rajasthan	1722694	902940	3069891	6,73,000	2,64,503	3,10,247	4,51,692	7,100
Sikkim	NA	687	7111	954	3,707	1,341	6,116	27
Tamil Nadu	272749	745302	2122977	1,00,374	2,14,225	2,57,068	3,97,716	1,893
Telangana	41	NA	923800	1,48,480	40,198	41,845	32,890	311
Tripura	NA	46379	192014	33,495	5,827	11,673	31,959	1,075
Uttar Pradesh	5531159	954957	6476981	1793397	2000914	798372	1090440	116
Uttarakhand	113866	23574	215481	51,645	46,778	48,157	33,756	82
West Bengal	2520479	2536306	3005534	7,94,376	20,96,373	14,69,708	6,107	1,436
<b>Total</b>	<b>20031618</b>	<b>15571658</b>	<b>36294333</b>	<b>8264820</b>	<b>10000000</b>	<b>3523558</b>	<b>6327079</b>	<b>86130</b>

**Note:** No LPG connections were issued under the PMUY during the fiscal year 2020-21.

**Source:** Indian Oil Corporation Ltd, acting on behalf of the Oil Marketing Companies.

Over the past four years, the number of LPG connections under the PMUY program has shown an upward trend in states such as Andhra Pradesh, Delhi, Goa, and Haryana. Notably, Meghalaya has also demonstrated significant progress in its LPG connections under the PMUY initiative. We observed that PMUY connections have remained stagnant in states like Jharkhand, Karnataka, Kerala, and Manipur. Additionally, other states, such as Odisha and West Bengal, are experiencing a decline in PMUY connections which might be because of rising inflation.

The effectiveness of PMUY can be assessed through its impact on rural and backward tribal women's health and cooking practices, although challenges remain. The program offers subsidized LPG connections with the goal of decreasing dependence on traditional biomass fuels, which are associated with indoor air pollution and related health problems. Many beneficiaries have reported a decrease in respiratory problems and improved overall health since switching to cleaner energy sources. The following Figure 1 explains the details of PMUY beneficiaries to SC and ST.



**Note:** No LPG connections were issued under the PMUY during the fiscal year 2020-21.

**Source:** Indian Oil Corporation Ltd, acting on behalf of the Oil Marketing Companies.

As per Figure 1, the number of LPG connections issued under PMUY rose from 6,672,441 to 13,963,570 between 2016 and 2019, reflecting a remarkable growth of 109%. Since 2019, the issuance of LPG connections under PMUY to SC/ST beneficiaries has been declining, raising concerns about access for these communities. Only exceptions are Daman and Diu, Goa where LPG connections released under PMUY to SC and ST shows an increasing trend since 2019-20. As of December 1, 2021, a significant 35.1% of the beneficiaries enrolled in the Pradhan Mantri Ujjwala Yojana (PMUY) belong to Scheduled Castes (SC) and Scheduled Tribes (ST) categories<sup>1</sup>.

The convenience of using LPG has allowed women to save time on cooking, enabling them to engage in other productive activities. However, challenges such as high refill costs and limited availability remain. The long-term effectiveness of PMUY depends on addressing these barriers to ensure sustained use of clean cooking fuels, despite its initial success in raising awareness and adoption.

The effectiveness of PMUY is hindered by persistent barriers that prevent a complete transition to LPG usage. Traditional fuels are still prevalent in households due to high refill

<sup>1</sup><https://pib.gov.in/PressReleasePage.aspx?PRID=1782273>

costs, inconsistent gas supply, and cultural cooking practices. This undermines the program's health and environmental objectives. To improve the program's effectiveness, it's essential to ensure affordable, consistent access to LPG, provide ongoing support and education, and promote the economic benefits of complete fuel transition. Addressing these issues will enable PMUY to transform cooking practices and improve rural women's quality of life.

**Table 3: Funds allocated and funds utilized under PMUY(₹ in crore)**

Year	Funds allocated	Fund utilized	Remarks
2016-2017	2500	2500	Allocated funds fully utilized
2017-2018	2251.81	2251.81	Allocated funds fully utilized
2018-2019	3200	3200	Allocated funds fully utilized
2019-2020	3724	3724	Allocated funds fully utilized
2020-2021	9690	9235.42	Allocated funds are not fully utilized
2021-2022	1618	1568.61	Allocated funds are not fully utilized
2022-2023(Budget Estimates)	800	-	

**Source:** LOK Sabha unstarred question NO. 1896 scheduled for response on July 28, 2022, regarding fund allocation under PMUY. sansad.in.

Table 3 presents the year-wise funds allocated and utilized under PMUY. We found that from 2016 to 2019, the allocated funds were fully utilized, indicating the strong effectiveness of the PMUY initiative. However, from 2020 to 2022, the allocated funds were not fully utilized, raising concerns about the program's effectiveness.

### 5. Observations and findings related to the Efficiency

Gould and Urpelainen (2020) found that female-led homes are more likely to switch to AUTOGAS for cooking, compared to male-led homes. They used data from 8,563 houses to analyze the correlation between household factors and firewood and AUTOGAS use. They found that while AUTOGAS reduced firewood usage, fuel stacking persisted in the sample houses, and admittance and cylinder prices were negatively correlated with AUTOGAS use. The study highlights the importance of female decision-making in cooking decisions.

Singh and Dixit's 2019 study revealed that over 50% of developing countries rely on solid waste materials for cooking and household energy. They found increased gaseous contaminants in kitchens during cooking, linked to health hazards like deferred particulate matter and vaporous contaminants.

Abhishek et al.'s 2019 study found that 700 lakh impoverished women in Karnataka received bottled gas stoves within 35 months of the PMUY program. The study also highlighted the health risks of biomass fuels, comparing their use to inhaling smoke from 400 cigarettes per hour. Although enrollment in AUTOGAS increased, sales did not rise, suggesting that improved access has not fully reduced reliance on polluting renewable energy sources.

The PMUY has demonstrated mixed efficiency in achieving its objectives. While the program successfully facilitated access to clean cooking fuels for millions of impoverished women, the anticipated shift from traditional biomass fuels has been slower than expected. Observations show a considerable rise in the number of AUTOGAS connections, reflecting improved access and initial adoption. However, this increase has not been accompanied by a proportional rise in AUTOGAS sales, indicating that many women continue to cook using traditional fuels. Factors such as affordability, availability of refills, and ingrained cooking habits have influenced this persistence. Overall, while PMUY has made strides in providing cleaner energy, addressing these barriers is essential for maximizing its efficiency and fully transforming cooking practices among rural households.

**Table 4: State and UT-wise Number of PMUY Customers taken not more than 3 Refills**

State and UTs	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021	2021-2022
Andaman & Nicobar Islands	1182	1592	6291	10280	4170	6656
Andhra Pradesh	62493	52649	316943	262929	129368	222990
Arunachal Pradesh	NA	5413	29161	27502	16565	27576
Assam	2	1072612	2496338	2714598	2088514	2909080
Bihar	2065751	3415861	6629564	5443164	3419531	5961781
Chandigarh	NA	NA	58	22	10	39
Chhattisgarh	1092995	1814686	2566556	2650128	2269230	2858162

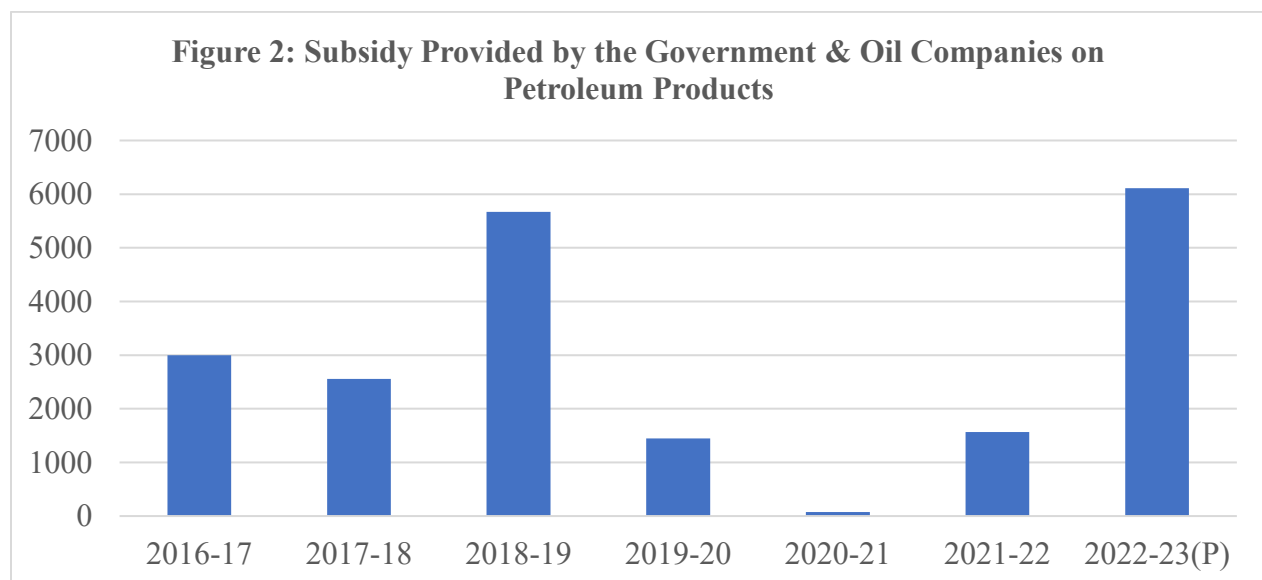
Dadra and Nagar Haveli and Daman and Diu	3247	9722	14050	10158	6951	5944
Delhi	323	272	46247	12357	5455	35207
Goa	849	618	966	559	293	426
Gujarat	586910	807383	2080718	1629442	1028839	1702645
Haryana	181587	143333	503760	271921	134734	232293
Himachal Pradesh	1408	23494	92950	85391	34675	72010
Jammu and Kashmir	245589	280057	971064	994418	749422	869901
Jharkhand	530012	1017979	2664378	2592790	2020819	2622546
Karnataka	14791	771290	2488686	1951526	906789	1530278
Kerala	10858	32073	185369	166022	71251	155490
Ladakh	1891	2175	9262	7553	5615	6823
Lakshadweep	NA	134	268	242	162	114
Madhya Pradesh	2081655	2789814	5964813	5724019	4268176	5654119
Maharashtra	837548	1449315	3689794	2960931	1528134	2326156
Manipur	25	25288	89057	73132	42088	73281
Meghalaya	NA	33896	121631	115995	96250	125029
Mizoram	NA	858	16242	12163	4195	9733
Nagaland	NA	7710	37735	39326	25700	53284
Odisha	900601	1859946	3899553	3766137	2455355	3612844
Puducherry	712	1863	10451	4394	1692	3668
Punjab	227308	219659	949650	623282	254516	441292
Rajasthan	1427341	1890267	5098050	4348937	2628763	3318456
Sikkim	NA	600	6096	3907	2605	8800
Tamil Nadu	265829	825484	2674924	1985505	1013326	1659017
Telangana	40	28	877345	785800	455879	639268
Tripura	NA	44722	210842	207969	145633	185207
Uttar Pradesh	4501571	4201277	11011672	9308995	5170821	8809322
Uttarakhand	90732	72709	275039	214958	106700	200916
West Bengal	2311497	3833965	7017501	6465033	3343164	7153580
Total	17444747	26708744	63053024	55471485	34435390	53493933

Source: www.data.gov.in

Table 4 illustrates an increasing trend in the number of households refilling more than three LPG cylinders from 2016 to 2019. However, in 2020, the number of households refilling three cylinders saw a significant decline, likely due to the COVID-19 pandemic. Many agricultural workers faced vulnerabilities such as job loss, reduced income, and heightened fear, contributing to this decrease. In 2021, the number of refills returned to the same level as in 2019.

## VI. Observations and findings related to the Sustainability and Monitoring mechanism

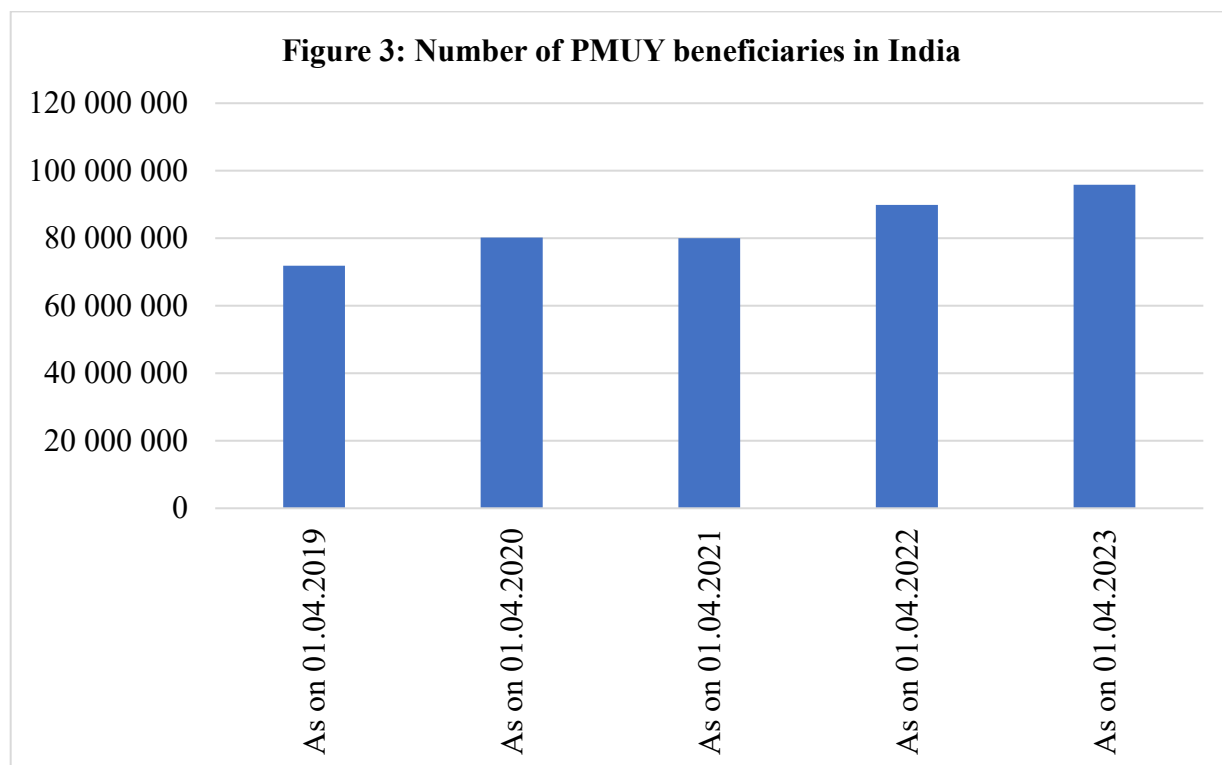
The Ujjwala program aims to increase accessibility to LPG, but its sustained use remains a challenge due to cultural beliefs and beliefs about traditional fuels. Addressing these factors is crucial for sustainable LPG use. Women, who are the primary users of cooking fuel, should be educated about the pollution and health impacts of traditional fuels, which could facilitate a transition to cleaner fuels. Women who utilize cleaner fuels like LPG should comprehend the comprehensive advantages of LPG usage. Raising awareness about the health hazards of traditional cooking fuels is essential for achieving Sustainable Development Goals (Kaur-Sidhu et al., 2019). In order to make PMUY programme more effective Indian Government enhances the subsidy amount.



**Source:** mopng.gov.in  
mopng.gov.in

Figure 2 illustrates that the Government of India's contribution in subsidies for the PMUY scheme rose from ₹2,999 crore in 2016-17 to ₹6,110 crore in 2022-23. However, the subsidy amount decreased between 2019-20 and 2021-22 due to the effects of the COVID-19 pandemic and its aftermath.

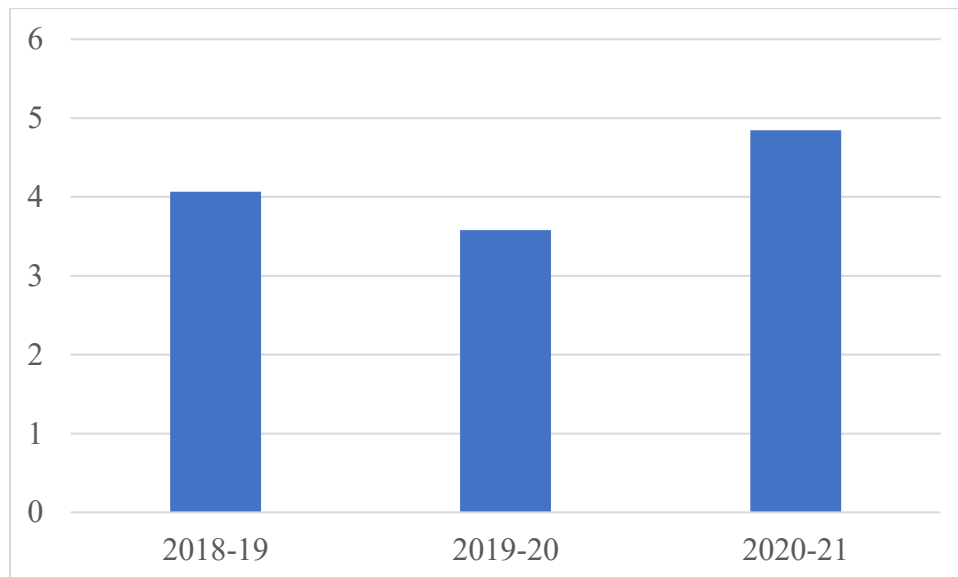
It is imperative to augment the capacities and inclinations of individuals to embrace the exclusive utilization of LPG through diverse initiatives. Even with the Ujjwala program's rise in accessibility, long-term LPG use is still difficult. The price of LPG is not the only factor influencing biomass uses for cooking; cultural customs and beliefs also play a role. It is important to address these cultural concerns if LPG is to be used continuously. Given that women are the main consumers of cooking fuel, it is important to ascertain whether they are aware of the harmful effects that traditional fuels have on their health. This knowledge might make the switch from conventional to cleaner cooking fuels easier. Women who utilize cleaner fuels, such as LPG, must recognize and comprehend the advantages associated with LPG use. Achieving sustainable development goals requires increasing public understanding of the health risks associated with traditional cooking fuels (Kaur-Sidhu et al., 2019).



**Source:** Public Sector Oil Marketing Companies.

Figure 3 shows the number of PMUY beneficiaries was 7,18,97,609 in April 2019 which increased to 9,58,59,418 in 2023. It is noteworthy to mention here that the average growth of the number of PMUY beneficiaries in India is 7.57% from 2019 to 2023, which is more than India's economic growth.



**Figure 4: Average LPG refill consumption of PMUY beneficiaries**

**Source:** pib.gov.in . Compiled by authors.

Figure 4 illustrates the average LPG refill consumption among PMUY beneficiaries, which demonstrates an overall increasing trend, with the exception of the year 2019-2020. This decline may be attributed to the economic challenges posed by the COVID-19 pandemic. If the average LPG refill consumption among PMUY beneficiaries continues to rise in the future, it would indicate the effectiveness of the PMUY program in promoting long-term sustainability.

Recent research indicates that providing clean cooking fuels can be a cost-effective health intervention (Prayas 2018; Smith and Sagar 2014). Additionally, the collection and use of solid fuels for cooking increase the drudgery and negatively impact women's time use (Desai and Vanneman 2016; Desai et al., 2010). Household air pollution from the use of polluting fuels increases susceptibility to non-communicable diseases and may exacerbate the risk and severity of COVID-19 infections. Consequently, there is an urgent need to expand sustainable energy solutions globally (Ravindra et al., 2021).

The study emphasizes the need for policies to counter emerging barriers to prevent a return to traditional cooking fuels during the transition to cleaner alternatives. To sustain long-term health and environmental benefits, the government should implement short-term emergency response plans similar to those used in other crises. The recommendations provided in this study could help formulate strategies for managing current and future pandemics, and other disruptions to fuel supply, economic stability, or mobility.

The PMUY's sustainability depends on its ability to provide clean cooking fuels, address economic, environmental, and social factors, and ensure reliable LPG supply chains. It should also educate users on safe fuel handling and promote health benefits from clean cooking. Integrating renewable energy solutions and supporting local infrastructure can enhance PMUY's long-term viability. By fostering community involvement and addressing rural needs, it can contribute to a sustainable energy future.

## VII. Recommendations

Clean cooking affordability isn't just about income or the cost of fuels. It involves a range of factors, including gender differences, urban-rural disparities, and individual perceptions of what affordability means. These elements are essential to understanding the broader context of access to clean cooking solutions. In developing countries, solid fuels like coal and firewood are frequently used for cooking and heating, which has detrimental consequences on indoor air quality and public health. Both governments and international organizations have long been working to tackle this issue.

Enhancing awareness and education is crucial, with health awareness campaigns focusing on the risks of solid fuel use and training programs for cleaner cooking technologies. Improving accessibility and infrastructure by developing robust supply chains and investing in distribution and storage infrastructure is essential. Targeted interventions should address geographical disparities through region-specific policies and pilot projects. Regular monitoring and evaluation through surveys and impact assessments can help track the progress and effectiveness of Ujjwala Yojana.

Prioritizing domestic awareness campaigns on the health and environmental benefits of LPG and the drawbacks of traditional fuels is crucial for the successful transition. These campaigns should emphasize the immediate and long-term benefits of LPG, such as reducing indoor air pollution, minimizing deforestation, and decreasing time spent collecting firewood. Social acceptance is crucial for the adoption of LPG in rural India, with women playing a key role. Since women are key participants in the adoption of LPG in rural areas of India, their engagement and empowerment are essential. Local panchayats (village councils), NGOs, and community-based organizations (CBOs) play an integral role in fostering this engagement. They are well-positioned to educate and support women in making informed choices about cleaner cooking fuels, driving widespread acceptance. Ensure continuous engagement with women, as primary users of cooking fuel through local organizations and leadership structures. Utilize local panchayats, NGOs, and CBOs to educate and assist communities in the transition to LPG, ensuring culturally sensitive and localized approaches. Address the logistical and financial challenges by ensuring the affordability and accessibility of LPG in rural areas, possibly through subsidies or micro-financing options Implement

feedback mechanisms to track the progress of adoption, addressing concerns or obstacles that may arise during the transition phase.

PMUY's focus on women should be expanded to include children and the elderly, who are equally at risk of respiratory ailments from solid fuel pollution. Research should analyze the health outcomes of these groups to create a more comprehensive view of the scheme's benefits. Collecting accurate health data on all household members exposed to solid fuel emissions will help policymakers refine environmental and public health interventions, improving the overall effectiveness of PMUY. Targeted campaigns could focus on educating all vulnerable groups about the health risks of traditional fuels and the benefits of sustained LPG use, ensuring a lasting impact on public health.

The availability of LPG in rural areas relies on a robust supply chain, but challenges like logistical issues, inadequate distributor networks, and high transportation costs affect affordability and consistency. Research is needed to evaluate the infrastructure supporting PMUY and identify last-mile delivery gaps. Incentivizing local entrepreneurs and distributors is crucial for efficient delivery at affordable rates, especially for low-income households. Strengthening the supply chain and ensuring sustainable business models is essential for regular access to LPG. The consistent use of LPG in rural communities requires behavioral change, overcoming cultural attachment to solid fuels like wood or cow dung. The government should invest in pilot projects to assess regional barriers and challenges. These projects can evaluate strategies like financial incentives, awareness programs, and distribution models, and identify the most effective ones in different geographic or cultural settings. For instance, some regions might benefit from mobile refill centers or community-based LPG distribution models, while others require more education on solid fuel health risks. Effective coordination and communication among these stakeholders are crucial to ensure smooth implementation and reach the intended beneficiaries. Efficient supply chain management involves logistics, transportation, inventory management, and timely distribution to prevent stockouts, while robust technological infrastructure is crucial for tracking beneficiary data and LPG distribution. Digital platforms, databases, and monitoring systems are crucial for transparency, fraud prevention, and accurate record-keeping, while training and capacity building are vital for LPG distributors, government officials, and beneficiaries. Distributors and beneficiaries need to be educated on safe LPG usage and maintenance, and regular monitoring and evaluation are crucial for progress assessment and policy adjustments. Focusing on these strategies can accelerate the transition to LPG ensuring cleaner energy and improved health outcomes in rural Indian communities.

### VIII. Conclusion

The PMUY scheme in India has provided LPG connections to millions, but its long-term success depends on affordability, consistent supply, and behavioral change. By offering free LPG connections and financial assistance for the first cylinder and stove, the scheme not only empowers women but also addresses issues related to air pollution and deforestation. Its successful implementation has significantly increased LPG coverage, particularly in rural areas, while facing challenges such as supply chain management and user awareness. Key recommendations include strengthening supply chain infrastructure, reducing refilling costs, and implementing awareness campaigns. Investing in pilot projects, coordination among stakeholders, efficient logistics management, and digital monitoring systems are crucial for transparency and accountability. Continuous training and regular evaluation will enhance the scheme's sustainability and impact in rural areas. WHO, 2018 has praised the PMUY scheme. The PMUY is designed to supply clean cooking fuel, specifically LPG connections, to Below Poverty Line (BPL) households in India. This initiative not only enhances the health and safety of women but also reduces dependence on traditional and hazardous cooking methods, contributing to environmental sustainability.

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