

## Advances and Challenges: A Study of PMUY and Its Effects on Rural Households

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### Abstract:

The present study examines the impact of the Pradhan Mantri Ujjwala Yojana (PMUY) on LPG adoption, girls' education, and women's empowerment in rural India. Despite the government's efforts to provide free LPG connections to low-income households, the intended objective has not been duly fulfilled, in letter and in spirit. Using an explanatory sequential mixed-methods approach, a field survey and focus group discussions were conducted in three villages across Madhya Pradesh and Uttar Pradesh, engaging 67 PMUY beneficiary households.

Findings reveal that while LPG use is primarily limited to short-duration cooking, solid fuels continue to dominate household energy needs. LPG refill access remains time-consuming and costly, requiring male assistance, which affect the man-days resulting restricts consistent usage. Nevertheless, LPG adoption has reduced indoor air pollution and eased cooking and fuel collection burdens, especially for women and girls, indirectly enabling improved school attendance. However, broader socio-economic and cultural barriers mitigate a direct effect on girls' school enrollment and academic outcomes. The study underscores that while PMUY has positively influenced health, empowerment, and convenience at the household level, achieving sustained LPG adoption and educational benefits requires addressing refill affordability, supply logistics, and deep-rooted social norms.

**Keywords-** *Pradhan Mantri Ujjwala Yojna*, LPG connections, clean energy, solid fuels, crop residues, girls' education,

### Introduction:

Access to clean energy is indispensable for a dignified life; yet, thus far, a great deal of the world's population faces challenges in procurement of clean energy. While progress has been made in achieving the United Nations

Sustainable Development Goal 7 of universal access to clean and affordable energy by 2030, persistent inequalities still exist (UNDP, 2015). Cooking fuels, for example, vital for human life's basic necessities, are still inaccessible for many,

particularly in developing and underdeveloped regions.

Throughout the years, a number of policies have been introduced to reduce the dependence on traditional cooking stoves in India, though most failed in achieving their goal (Khandelwal et al., 2017). In October 2009, the Indian government launched the *Rajiv Gandhi Gramin LPG Vitrak Yojana* (RGGLV) to promote LPG, and set up distributors in remote areas. But, a mere six years later, in 2015 this scheme was discontinued, despite having supplied over 1.62 million households with LPG in its run.

The *Pradhan Mantri Ujjwala Yojna* (PMUY) program was launched on May 1, 2016, by the Ministry of Petroleum and Natural Gas of India, from the Ballia district of Uttar Pradesh. Its main intended beneficiaries were women who faced health risks from cooking with traditional stoves, and had to travel long distances for collecting firewood. Under PMUY, a deposit-free LPG connection is provided to the adult women of the household. The government covers the cost of various items, including the security deposit for the cylinder, pressure regulator, safety hose, DGCC booklet, and installation charges, amounting to a maximum of Rs 1600 per connection (Ministry of Petroleum and Natural Gas, 2023a).

As of the Ministry's Official Report, there are 95 million PMUY beneficiaries, of which 84 million households have refilled at least once in the 2021–22 period (Ministry of Petroleum and Natural Gas, 2023b). In 2021, Prime Minister Narendra Modi launched PMUY 2.0 in Mahoba, Uttar Pradesh. The Union Budget for FY 21-22 allocated provisions for an additional one crore LPG connections under the PMUY. This initiative aims to provide deposit-free LPG connections to low-income families who were not included in the previous phase.

Ujjwala 2.0 promised to deliver the first refill and a hotplate free of charge to beneficiaries, streamlining the process with minimal paperwork for enrollment. Migrants would not need to submit

ration cards or address proof; a self-declaration will suffice for both family and address proof. Ujjwala 2.0 aimed to achieve the Prime Minister's vision of universal access to LPG. The Government has also approved a targeted subsidy of INR 200 to all PMUY beneficiaries, which is credited directly to the beneficiary's bank account starting from March 2023 (CCEA, 2023).

As of March 2025, the average annual refill per PMUY beneficiary was 4.43 cylinders, an increase from 3.95 in 2023–24 and 3.01 in 2019–20. During FY 2024–25, an average of 12.6 lakh LPG refills were delivered daily to PMUY beneficiaries (PIB, GOI 2025). By providing cylinder under the PMUY, the program is expected to improve the lives of poor women who usually depend on firewood and biomass for household cooking, triggering a number of issues related to health and safety. A study in 2015 that measured the use of improved cookstoves in India, Bangladesh and Nepal found that women spend the equivalent of more than two weeks each year collecting firewood in India. Households using cleaner, more efficient cookstoves saved significant amounts of time and used less fuel than those using traditional stoves. Women who saved time reported spending more time to increase involvement in social and family activities, including spending time with children and monitoring their studies. The study found that on average, women spend approximately 374 hours every year collecting firewood in India. (Practical Action 2015). One significant achievement of the Ujjwala scheme is the issuance of LPG cylinders in women's names, recognizing and granting identity to women in countries where they otherwise struggle for it. Additionally, easier KYC guidelines and self-certifications have contributed to increasing women's independence.

### **Review of Related Literature:**

Regarding research on the different types of fuel and their respective impact on health, it was found that the use of solid fuels in homes significantly impacts health outcomes, especially in children. For example, Edwards and Langpap (2012) studied through the survey data from Guatemala

and stated a greater incidence of respiratory infections among children from homes who used firewood.

Furthermore, some research has sought to assess the impact of using solid biogas fuels (SBF) and mixed fuels on women's lung health, evaluate the occurrence of respiratory ailments, and identify related health risks. The findings indicated that cooking with solid and mixed fuels is associated with poorer lung function and a higher incidence of respirational symptoms among women. The study emphasized the necessity of promoting cleaner cooking fuels and improving household ventilation to reduce health hazards. It was further observed that women using Autogas for cooking exhibited better lung capacity and respiratory well-being. Consequently, the researchers advocated for the expansion of clean fuel initiatives such as PMUY, alongside efforts to overcome barriers to the adoption of clean household energy sources.

Balachandra (2011) presents a comprehensive examination of the intricacies about energy poverty in rural areas of India. The study brought attention to an imbalance in addressing energy access issues, where the focus on supply-side factors tends to overshadow the equally crucial consideration of demand-side aspects in academic research and policy formulation. Additionally, their vivid scrutiny of National Sample Survey Office (NSSO) data divulges limited progress in addressing energy poverty, particularly among rural households, as negligible improvement can only be witnessed after 23 years of implementing the first policy to address it. According to the author, this is evident from low access levels among rural households and especially in households in the lowest income strata and significant variations in modern energy access levels across states in India. The main reasons for the lack of access among poor rural households are poor policy formulation and implementation, lack of resources and infrastructure and high poverty levels across the country.

Alkon et al. (2016) conducted a comprehensive investigation using NSSO data from 1987 to 2010,

exploring the variation of energy cost burdens among Indian households and the relationship between household expenditure and access to modern energy sources. The findings shed light on the energy cost burdens faced by different states, revealing that those with modernized power sectors experience lower energy cost burdens. In contrast, rural households encounter increased energy cost burdens despite improved energy access, as their income growth does not parallel urban counterparts. The study identifies access to electricity and LPG as influential factors positively associated with energy expenditure, highlighting those other factors beyond household income, such as government policies and market dynamics, play a role in influencing the adoption of modern fuel sources.

In an early assessment of PMUY, Kumar and Singh (2017) found that the initiative greatly enhanced LPG penetration in rural regions, reducing reliance on biomass fuels. This transition improved indoor air quality and lowered respiratory ailments among women and children. The saved time from fuel collection was often redirected to income-generating work, thereby augmenting household income.

Environmental impacts were highlighted by Gupta et al. (2019), who found that LPG adoption under PMUY considerably curtailed household carbon emissions. The transition from biomass to LPG reduced deforestation and air pollution, promoting environmental sustainability. However, the authors emphasized the continued need for financial assistance and subsidies to ensure consistent LPG use among low-income households.

Rao and Kumar (2020) examined PMUY's implementation challenges, such as refill affordability, supply chain inefficiencies, and limited awareness of health benefits. Despite these hurdles, they concluded that the program positively influenced rural life quality and advocated for enhanced subsidy models and awareness drives. Mehta and Joshi (2021) studied shifts in household expenditure following LPG

adoption under PMUY. They identified PMUY as a key driver of rural economic well-being.

Yadav (2020) examined the impact of the Pradhan Mantri Ujjwala Yojana (PMUY) on rural women's socio-economic conditions. The study demonstrated that PMUY empowered women by improving health outcomes, optimizing time use, and strengthening financial stability. It highlighted the health benefits of shifting from traditional fuels to AUTOGAS, particularly in reducing indoor air pollution and related health issues. Yadav's findings culminated in policy recommendations aimed at enhancing PMUY's sustainability and its role in improving rural women's quality of life.

Chowdhury and Desai (2021) observed that rural children from the families who are dependent on free water and cooking fuel experienced poorer educational outcomes, with boys particularly showing lower mathematics scores due to diminished maternal supervision. Mishra & Behera, (2016) argued that early disadvantages could exacerbate adolescent vulnerabilities, stressing that clean energy adoption is crucial for inclusive growth, sustainability, and improved living standards. Gould and Urpelainen (2018) investigated the adoption of LPG as a clean cooking fuel in rural India through a survey of 8,500 households across six states. Using descriptive and correlational analysis, they found that fuel costs and the persistence of fuel stacking were major impediments to LPG adoption. Nonetheless, both users and non-users viewed LPG favorably.

Kapsalyamova et al. (2021) examined socio-economic determinants of household fuel choices, including access to natural gas, availability of free fuel, convenience, and multi-fuel use. Their results revealed that higher income and per capita expenditure significantly increased the likelihood of transitioning from solid fuels to LPG.

Chindarkar et al. (2021) explores the disposition of rural Indian households to pay for LPG, employing a probit model and leveraging data from the ACCESS 2018 dataset. The results

indicate that as the randomly assigned bid for the LPG cylinder increases, the probability of households opting for exclusive LPG use decreases for both LPG and non-LPG households. Moreover, the study also showcased that salaried employees are more likely to accept bid amounts for exclusive LPG use than other households, citing the influence of stable income in the energy transition. They also examined the factors influencing energy transition in Northern India. Their study found that wealth and assets, such as land ownership, the number of rooms in a house, and business ownership, are more strongly associated with the adoption of home solar systems than income. They also identified education as a crucial factor in facilitating energy transition.

The impact of LPG access on gender outcomes has been explored in studies by Su and Azam (2023) and Vyas et al. (2021). Using an instrumental variable approach with the data from the Time Use Survey by NSSO, Su and Azam (2023) found that while LPG use does not significantly affect the likelihood of women being the primary cook in the household, it does reduce the time they spend on cooking by reducing the cooking time. Additionally, the study highlights that LPG access positively influences women's employability. Similarly, Vyas et al. (2021), employing a mixed-method approach, concluded that patriarchal norms and attitudes prevalent in rural North India are the primary barriers to LPG adoption, even after the rollout of PMUY. These norms lead women to preserve cooking gas more often and encourage the continued use of solid fuels for cooking.

Several studies analyzed the impact of the PMUY on LPG consumption in India, such as Dabadge (2018), Swain and Mishra (2020), Gill-Wiehl et al. (2020), Ranjan and Singh (2020), Gill-Wiehl et al. (2022). Most of these studies are descriptive in nature or regional analysis. Ranjan and Singh (2020) analysed the impact of PMUY using data from the NSSO expenditure data and the Petroleum Planning and Analysis Cell (PPAC) report. The analysis reveals a notable decrease in

firewood consumption in rural areas since 2014. Furthermore, the study's findings suggest that, based on the PPAC report, there has been a 15 percent increase in the consumption of LPG. However, they also found that the number of inactive LPG connections has risen. According to the study, this phenomenon can be attributed to PMUY's success in expanding access to LPG but its relative failure to encourage consistent and sustained usage among its beneficiaries. Dabadge (2018), in their analysis, arrives at a similar conclusion, drawing upon information from the Petroleum Planning and Analysis Cell (PPAC) reports. They attribute the limited uptake in LPG refilling, even among those who gained access to LPG cylinders through PMUY, to the increased prices of LPG, including subsidised LPG cylinders.

Verma and Desai (2021) evaluated the long-term sustainability of PMUY and found that while initial LPG uptake was strong, sustained use depended on affordability and consistent access to refills. They recommended targeted subsidies, improved supply logistics, and continuous monitoring to maintain progress. Integrating PMUY with other rural development initiatives was also advised to maximize its impact. Chaudhary and Singh (2022) analyzed PMUY's gender and health dimensions, concluding that the scheme substantially improved women's lives by reducing exposure to indoor pollution and freeing time for productive pursuits. The health benefits extended to entire families, particularly in lowering respiratory diseases. They called for further studies to assess PMUY's effects across diverse socio-economic contexts.

Ashraf and Tol (2024) evaluates the impact of the Pradhan Mantri Ujjwala Yojana (PMUY) on LPG accessibility among poor households in India. Using Propensity Score Matching and Difference-in-Differences estimators and the National Family Health Survey (NFHS) dataset, the Average Treatment Effect on the intended Treated is a modest 2.1 percentage point increase in LPG consumption due to PMUY, with a parallel decrease in firewood consumption. Regional

analysis reveals differential impacts, with significant progress in the North, West, and South but less pronounced effects in the East and North East. The study also underscores variance across social groups, with Scheduled Caste households showing the most substantial benefits, while Scheduled Tribes households are hardly affected. Despite the PMUY's initial success in facilitating LPG access, sustaining its usage remains challenging. Policy should emphasise targeted interventions and address regional and community-specific disparities for the sustained usage of LPG.

Sahu et al. (2024) analysed the impact of the PMUY on health benefits and quality of life. Using descriptive statistics to evaluate a survey of 2366 PMUY beneficiary households, the study found that 72 percent of these households use LPG as their primary cooking fuel. Additionally, the study concluded that 44 percent of the sample households reported a decrease in respiratory-related illnesses, highlighting the positive health outcomes associated with the programme. This study also found that the refill cost is hindering the sustained usage of LPG.

Similar evaluation of programmes aimed at reducing the energy poverty was conducted by Calzada and Sanz (2018) on Fondo de Inclusión Social Energético (FISE) program in Peru and Andadari et al. (2014) on fuel switching program in Indonesia. Calzada and Sanz (2018), using a propensity score matching technique to create a comparable group, found that the FISE programme was effective in encouraging the replacement of traditional stoves with LPG cooking stoves, thereby reducing the time spent on cooking activities in Peru. Meanwhile, Andadari et al. (2014) analysed the government program to substitute LPG for kerosene in Indonesia and found that the switch from kerosene to LPG led to an increase in the price of both kerosene and LPG, which eventually led to fuel stacking, with a rise in the consumption of both electricity and traditional biomass fuels. However, the overall impact of the program in reducing energy poverty is very minimal for the program.

In conclusion, while the prevailing literature effectively underscores the importance of policies like the Pradhan Mantri Ujjwala Yojana (PMUY) within the Indian context, it is essential to acknowledge the predominant descriptive nature of most evaluations, often reliant on reports from the Petroleum Planning and Analysis Cell (PPAC). This reliance on descriptive assessments may hinder the establishment of a robust causal link to PMUY's impact. Researches also indicate that earlier women and children, especially girls, spend one to two hours each day collecting fuel from nearby forests, an activity that not only consumes valuable time but also exposes them to various safety risks. This situation raises critical questions about the broader implications of fuel collection responsibilities on girls' welfare and development. When girls are relieved of this daily burden, it becomes important to examine whether the newly available time contributes to improved educational outcomes, including higher school enrollment and increased study hours. Additionally, the transition from traditional biomass fuels to cleaner alternatives such as LPG is expected to yield significant health benefits by reducing indoor air pollution and related respiratory issues. If these health improvements are substantial, it is essential to explore whether they further influence school attendance and academic achievement. Understanding these linkages can provide valuable insights for policy interventions aimed at enhancing both educational and health outcomes for girls in rural communities.

#### **Research questions:**

- Does PMUY increase girls' school enrollment in rural households?
- Does PMUY reduce girls' unpaid household work and increase study time?
- Do health improvements from reduced indoor air pollution explain changes in attendance and achievement?

#### **Methodology:**

The present study adopts an explanatory sequential mixed-methods design, a widely used

approach within mixed-methods research. The quantitative phase involved the use of a survey questionnaire to know the fuel adoption & usage, changed the amount of time she spends on fuel collection, girls' education outcomes, health & indoor air pollution proxies and household expenditures. The qualitative phase focused on examining changed cooking practice, visible change in girls' daily practice, perception of family members towards new fuel, any incidents where reduced fuel collection affected girls' safety or freedom to attend school. The population of this study comprises of all the PMUY beneficiaries of Raisen and Barabanki district.

#### **Sample:**

The study was conducted in two (Makodiya, & Kharwai), villages of Raisen and Konagaon of Barabanki district. 67 households were contacted. They were selected through random sampling technique.

#### **Tools of the study:**

To know the impact of PMUY on the cooking practices, girls' education, girls' safety, perception of the family members towards new fuel a semi-structured questionnaire was prepared focusing on the pre-conceived objectives of the study.

#### **Data Collection:**

Data collection was made through door-to-door survey and focused group discussion with the family members and teachers of the schools in the villages. Respondents were motivated to speak their heart freely, fairly and frankly

#### **Analysis and Discussion**

Adopting a qualitative research approach, a field survey was conducted in three villages, two from Madhya Pradesh and one from Uttar Pradesh, based on the objectives outlined earlier. The primary objective of the study was to examine the extent of reliance on LPG among beneficiaries of the Pradhan Mantri Ujjwala Yojana (PMUY). For this purpose, the researcher inquired about the number of LPG refills procured annually. The findings revealed that nearly half of the respondents (48%) obtained only five to six refill

cylinders in a year, while merely seven percent reported using seven to eight refills annually. Most households relied on LPG mainly for preparing tea or for quick, short-duration cooking.

Respondents reported that refilling LPG cylinders was a time-consuming task, often taking an entire day. They had to travel long distances to reach the distribution agency, as the agency's supply van visited the nearby village only twice a week. The process required the assistance of male family members and a two-wheeler, which further disrupted the household's man-day calculations and daily routines.

The next question explored was whether households continued using solid fuels. All (100%) respondents answered in the affirmative. They commonly used dung cakes, crop residues, and firewood. None of the participants reported purchasing firewood from the market; instead, they collected it from nearby forests or their surroundings. Many respondents from Makodiya and Karvahi villages mentioned using *nauranga* wood. Upon further inquiry, it was identified as *Lantana*, a wild, invasive shrub that is considered poisonous and generally avoided by animals. Apart from this, crop residues and animal dung remained the most frequently used fuels. Respondents explained that crop residues serve as a crucial fuel source; since they cannot burn these residues in the fields, they bring them home for domestic use. Similarly, in India, a number of researchers found that household air pollution caused by fuel consumption is associated with low birth weight, increased neonatal death, and mortality among children under the age of five. 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).

When asked about the situations in which they preferred solid fuels, many respondents stated that LPG was used primarily for short and quick cooking, while all other regular cooking activities continued on the *chulha* using solid fuels. They shared that LPG refilling was not only costly but also time-consuming and difficult to access.

Poverty emerged as a major barrier preventing a complete shift towards clean cooking energy. In some households, women reported that male members complained about the taste of food cooked on LPG or in pressure cookers, which also influenced their cooking choices. Similarly, Vyas et al. (2021), employing a mixed-method approach, concluded that patriarchal norms and attitudes prevalent in rural North India are the primary barriers to LPG adoption, even after the rollout of PMUY. These norms lead women to preserve cooking gas more often and encourage the continued use of solid fuels for cooking.

Most respondents prepared *rotis* on the traditional *chulha*. Larger families, in particular, preferred solid fuels due to higher cooking demands. Existing literature supports the link between household air pollution and heightened health risks, including respiratory disorders and elevated blood pressure (Akru et al., 2018; Jagger & Shively, 2014; James et al., 2020). Several studies also highlight the positive facets of promoting LPG use, especially for women's health and well-being (Pillariseti et al., 2019 for Maharashtra; Sharma et al., 2019 for Chhattisgarh and Jharkhand; Mall, 2019 for Bihar; Angoori & Kumar, 2023 for Haryana).

Despite these challenges, women expressed satisfaction with the availability of LPG. They reported several positive changes in their daily lives: cooking had become more convenient, and cleaning utensils had become easier. Moreover, LPG reduced exposure to smoke, which previously polluted the surroundings and made kitchens and household items dirty. Dash and Sahoo (2024) found that by adoption of LPG instead of traditional biomass fuels, has decreased 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.

When the respondents were asked about the household member primarily responsible for

collecting fuel, a significant number stated that young girls and female members bore this responsibility. In households that reared animals, dung cakes were prepared exclusively by women. Fuel collection from nearby forests was also carried out mainly by women and girls.

When asked about safety concerns during fuel collection, most women counter-questioned, "What else can we do?" One woman remarked, "Women are not safe anywhere. Living in a male-dominated society makes this quite natural." It was evident that many women had accepted their hardships as fate, believing that nothing could be done to improve their situation and that they were expected to live with these challenges.

The researcher then asked whether the adoption of LPG had changed the amount of time women spent on collecting fuel or cooking. Almost all households responded affirmatively. They felt that their lives had improved to some extent. For small or quick cooking, most households relied on the gas stove. However, it was observed that many women, especially those managing larger families, still continued to use solid fuels willingly.

When teachers from the village school were asked whether the shift to LPG had affected students' attendance and academic achievement, they shared a long list of concerns. They said, "Absenteeism is not related to fuel collection. There are many other reasons. During the sowing season, attendance is abysmally low, and during the harvesting season, the situation is almost the same. When families visit relatives or receive guests, children forget they are even enrolled in school." One teacher added that education is not a high priority for these families.

Another teacher said, "Don't assume they stay home due to illness. They don't. They come to school even with severe coughs and colds. But during paddy transplanting, all of them will be in the fields." One teacher sympathetically remarked, "It is essential for their survival. If they don't work, who will?"

When teachers and household respondents were asked how the time saved from reduced fuel

collection and cooking was being used, they said that the time required for these tasks had indeed decreased with the introduction of PMUY. However, some teachers felt that this "free" time was not being utilized for studies at all. Children lacked role models, and neither the students nor their families were career-oriented.

A teacher in Konagaon noted that boys are mostly concerned about obtaining a driving license after passing their Class VIII exams, as driving is a common occupation, and most households have at least one member working as a driver. The school is meant a stepping stone to achieve the driving license. Some students, especially girls, are quite capable academically and have the potential for a promising future, but they do not set long-term goals.

Indeed, PMUY has improved household conditions by providing clean cooking fuel, reducing the time spent on household chores like fuel collection, especially by young girls. Other than reducing the physical burden of fuel collection, through decreasing long-term fatigue and allowing them more time to spend on other activities, it also indirectly enables girls to participate more regularly in school. This shift may encourage higher school enrollment among girls, given that they now have more time to spare. Patel and Sharma (2018) explored PMUY's socio-economic implications for rural women and reported that access to clean cooking fuel improved their health and reduced the toil associated with firewood collection. The initiative also had positive effects on children's education, as mothers could devote more time to supporting their studies. Additionally, women's participation in community and economic activities increased, fostering gender equity.

But, as per the data and discussion with teachers, there did not seem to be any direct bearing of the matter on enrolment. Research studies indicate enhanced women empowerment and positive social changes in rural areas under PMUY, thereby resulting in a general advocacy for increase in opportunities, including education for girls. However, the magnitude of the effect

depends on refill affordability and sustained LPG use. Inconsistencies in LPG adoption may limit the full potential of PMUY's impact on enrollment. These probable effects of PMUY collectively indicate that the scheme positively influences girls' education indirectly by reducing household burdens and health risks while promoting a better study environment and empowerment in rural households.

### Conclusions:

For seeking the ground realities, a field survey was conducted in the three villages which highlights the complex realities of LPG adoption under the Pradhan Mantri Ujjwala Yojana. Nearly half of the beneficiary households use LPG for limited and short-duration cooking, the continued reliance on solid fuels remains widespread due to affordability, accessibility, cultural preferences, and patriarchal norms. Time-consuming LPG refilling processes and associated costs further discourage full transition.

However, LPG adoption has brought notable improvements in daily life, particularly for women, by reducing smoke exposure and easing cooking and cleaning tasks. It also lessens the physical burden of fuel collection, especially for girls and women. As it was theorized that it will indirectly support better school attendance and potential educational opportunities. But it was found other than fuel collection a number of other social and economic factor restrained school attendance. Despite these positive shifts, broader socio-economic factors and entrenched cultural practices still limit a direct and substantial impact of PMUY on school enrollment and sustained LPG usage.

In sum, PMUY contributes meaningfully to improving household health, women's empowerment, and household convenience but requires complementary measures addressing costs, access, and social attitudes to fully realize its potential in transforming energy use and education in rural India.

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