

Fuel for Progress: Pradhan Mantri Ujjwala Yojana (PMUY) and Rural India

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Abstract:

The aim of this research study acts as a guide to assess the PMUY scheme as a sustainable pathway by prioritising sustainability to engage the actions for achieving the numerous SDGs, specifically Goal 1 (No Poverty), Goal 3 (Good Health and Well-being), Goal 5 (Gender Equality), Goal 7 (Affordable and Clean Energy), and Goal 13 (Climate Action). The Inquiry in this study begins with the qualitative Investigation of human experiences with regard to the PMUY scheme with respect to the aforementioned specified SDGs. Furthermore, a quantitative investigation was performed with the help of an explorative approach to find out various factors and a descriptive approach to evaluate and analyse the identified variables concerning the attainment of selected SDGs. The seventeen Sustainable Development Goals (SDGs) were established by the United Nations (UN), and as a result, human beings are attempting to traverse the sustainable pathway. Meanwhile, the Pradhan Mantri Ujjwala Yojana (PMUY) Scheme was launched as a green initiative with the objective to provide clean cooking fuel, such as Liquefied Petroleum Gas (LPG), accessible to the deprived rural households, which were habituated to traditional fuel having adverse effects on the health of the society as well as affecting the environment. With the help of a survey schedule, data was collected by the researcher from the top three poor districts and 10 Villages from each district of Northern rural region of India. The various statistical techniques, such as correlation, regression and ANOVA, were applied to test the formulated hypotheses. The study's outcome is insightful for accomplishing the UN SDGs in an effective way. The study also helps stakeholders such as the government and policymakers in carving out effective policies and strategies to improve the efficiency of the PMUY Scheme.

Keywords: PMUY, SDGs, Rural Household, Poverty, Gender Equality

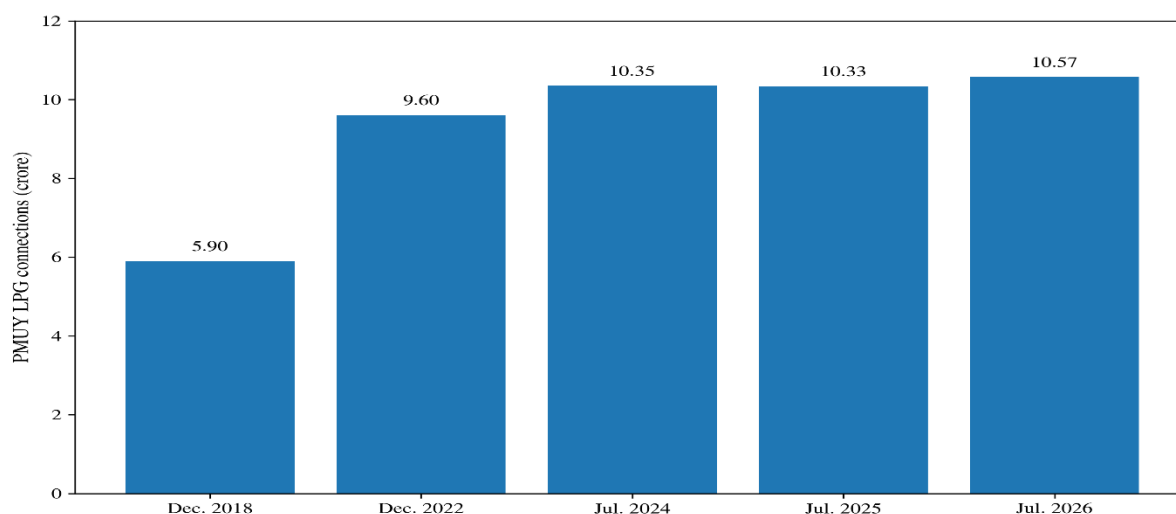
1 Introduction:

The human beings in this mortal world have thrived through substantial progress in terms of industrialisation, urbanisation, the green revolution, and now marching in the direction of digitisation. As they voyage through these progressions, the most vital aspects of sustainable and survival approaches are neglected and are not used in the proper way, thus the universe exhibited its vengeance in profuse means. The humanity, in the present digitalised world, as they are verging on "Type-I civilisation", are in dire necessity to have well-matured development that imbues sustainability into their behaviour and plan of actions. As a result, the United Nations (UN) proposed "17 Sustainable Development Goals (SDGs)" (UN, 2015), which serve as guidelines for humanity to ensure that human behaviour and environment coevolve into a single self-sustaining system. It appears that the progress is not in line with the strategy of the United Nations for the SDGs fixed targets by the year 2030, necessitating a lot more emphasis towards SDGs attainment. Despite the slow pace of development towards attaining sustainability, various challenges have forced humanity to endure a period of extraordinary change. The United Nations, in the year 2015, along with its 193 member states, approved the 17 interconnected SDGs to create a more just, liveable, and peaceful world by 2030. India is dedicated to achieving the target set

forth in the UN Agenda 2030. To attain the SDGs, the Indian Government has launched several schemes to accomplish the objectives, such as Pradhan Mantri Awas Yojana (PMAY), Ayushman Bharat, and Swachh Bharat Abhiyan, to name a few. One of the schemes known as “Pradhan Mantri Ujjwala Yojana (PMUY) or Ujjwala Yojana” was launched in 2016 as a flagship scheme having an objective to provide clean cooking fuel such as Liquefied petroleum Gas (LPG) accessible to the deprived rural households which were habituated to use firewood, cow-dung, coal etc. as traditionally cooking fuels, having detrimental effects on the health of rural population as well as impacting the environment. In line with the UN Agenda 2030, PMUY necessitates the creation and development of a resilient society that functions in harmony with the environment is required for the future generation to come. To do so, it is crucial to prioritise the most vulnerable societal and industrial operations while also assuring global health and sustainable resource management (UNEP & IRP, 2020). The present Study seeks to put into context by offering guidance to the research and academic community, policymakers, investors, and government officials as to how to promote sustainability and accomplish the multiple SDGs. The present study gives specific attention to Goal 1 (No Poverty), Goal 3 (Good Health and Well-being), Goal 5 (Gender Equality), Goal 7 (Affordable and Clean Energy), and Goal 13 (Climate Action).

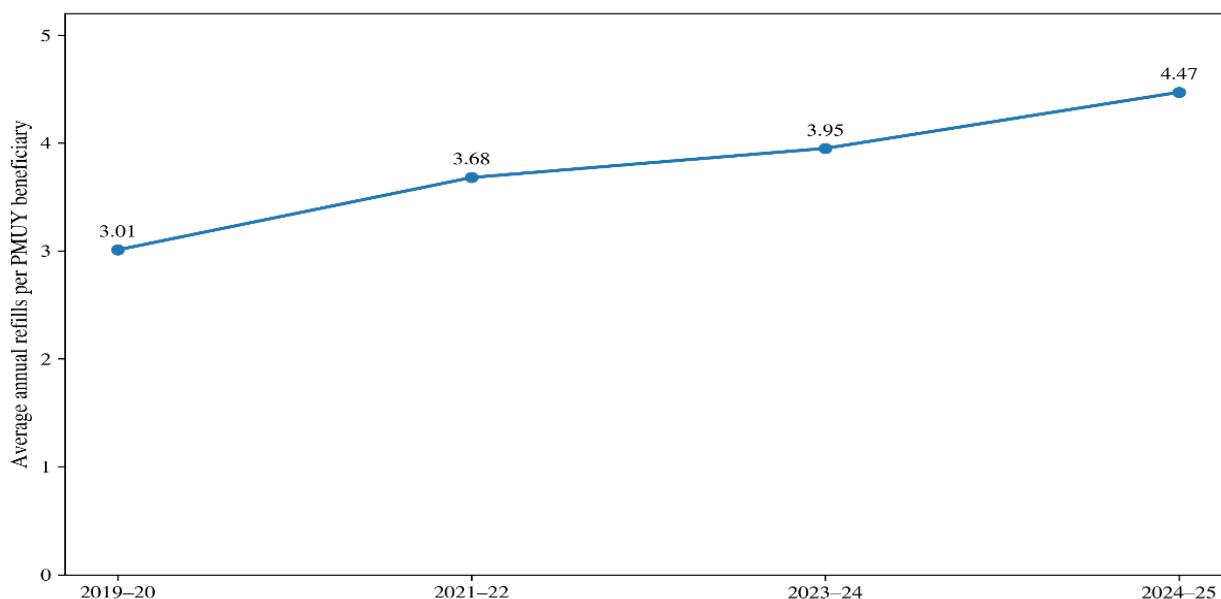
The significance of PMUY can be understood not only from the number of LPG connections created but also from its potential to facilitate a broader transition in household energy behaviour. The scheme has progressively expanded its coverage among economically vulnerable households, particularly by placing women at the centre of the clean cooking transition. According to the official PMUY portal, the scheme had released more than 10.57 crore LPG connections by July 2026, demonstrating the considerable scale of public intervention in expanding access to clean cooking energy. The expansion from approximately 5.9 crore connections in December 2018 to more than 10.5 crore connections in 2026 indicates that PMUY has moved beyond a limited welfare intervention and has become an important component of India's household energy transition.

Figure 1: Expansion of PMUY LPG Connections



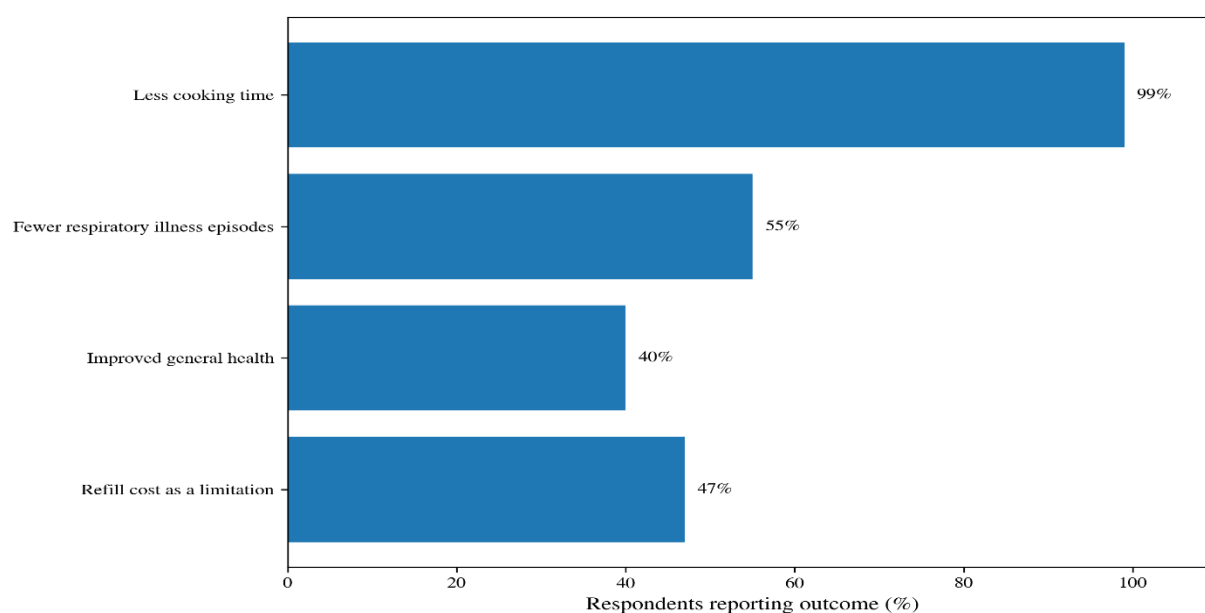
Source: Ministry of Petroleum and Natural Gas, Government of India (2026).

The expansion of LPG connectivity, however, should not be interpreted solely as an indicator of successful energy transition. The actual sustainability of the scheme depends on whether beneficiaries are able to use LPG regularly after receiving the initial connection. In this context, affordability, refill availability, household income, family size, awareness, and accessibility of LPG distribution networks become important determinants of sustained adoption. Government data indicate that the average annual refill consumption among PMUY beneficiaries increased from 3.01 cylinders in 2019–20 to 3.66 cylinders in 2021–22. More recent estimates indicate a further improvement, reaching approximately 4.5 refills in 2024–25. This gradual increase suggests an improvement in sustained LPG usage, although consumption remains an important policy concern when compared with regular LPG consumers.

Figure 2: Trend in Average Annual LPG Refill Consumption among PMUY Beneficiaries

Source: Ministry of Petroleum and Natural Gas, Government of India (2025).

From a health and social sustainability perspective, the transition from biomass-based cooking to LPG has implications that extend beyond energy access. Traditional fuels such as firewood, dung cakes and crop residues can generate substantial household air pollution, particularly affecting women who generally spend considerable time in cooking-related activities. Recent empirical evidence from a multi-state assessment of PMUY beneficiaries found that more than 40% of LPG users reported improvement in the general health of the primary cooking person, while approximately 55% reported fewer episodes of respiratory illness among themselves and their family members. Furthermore, around 99% of LPG users reported spending less time on cooking after adopting LPG. These findings strengthen the linkage between clean cooking access, health improvement and time savings, thereby establishing the relevance of PMUY to SDG 3 and SDG 5.

Figure 3: Reported Health, Time-Saving and Affordability Outcomes among PMUY Beneficiaries

Source: Sahu et al. (2024).

The gender dimension of PMUY is particularly important because the scheme is designed around adult women from poor households as the primary beneficiaries. By providing LPG connections in women's names, PMUY potentially strengthens women's participation in household energy decisions and reduces their exposure to smoke, heat and the physical burden associated with biomass collection and traditional cooking. The time saved through cleaner cooking can potentially be redirected towards education, paid employment, childcare, community participation and other productive activities. Thus, the scheme can be viewed as an intervention that connects energy access with women's welfare and empowerment rather than merely providing an alternative cooking fuel.

At the same time, the achievement of sustainable clean cooking requires attention to the distinction between access and sustained use. Providing an LPG connection removes an important initial barrier, but recurring refill expenditure may continue to constrain regular consumption among low-income households. Evidence from the recent multi-state assessment shows that approximately 47% of LPG users identified refill cost as a limiting factor, while more than 38% of surveyed LPG users had refilled their cylinders only zero to two times during the preceding six months. This indicates that the long-term effectiveness of PMUY depends not merely on increasing the number of connections but also on ensuring affordability, reliable supply, convenient distribution and continued behavioural adoption.

Therefore, PMUY can be conceptualised as a multidimensional development intervention linking energy access, poverty reduction, public health, gender equality and environmental sustainability. Its relationship with SDG 1 emerges through improved access to essential household energy services; its contribution to SDG 3 is associated with reduced exposure to smoke from traditional cooking fuels; its relevance to SDG 5 is reflected in the scheme's women-centred design and potential time-saving effects; SDG 7 is directly connected with access to cleaner household energy; and SDG 13 is linked with the broader objective of reducing dependence on traditional biomass fuels. Consequently, evaluating PMUY through the combined lens of these SDGs provides a more comprehensive understanding of its contribution to sustainable rural development.

In this context, the present study becomes particularly relevant because it moves beyond examining PMUY merely as a government welfare scheme and considers its broader implications for sustainable rural transformation. The study investigates beneficiaries' experiences and perceptions concerning poverty, health and well-being, gender equality, clean energy access and environmental sustainability. By integrating qualitative insights with quantitative analysis, the study attempts to identify the extent to which PMUY contributes towards selected SDGs and to determine the relationships among the identified dimensions. Such an assessment can provide evidence for strengthening the implementation of PMUY and for designing policies that ensure that clean cooking energy becomes not only accessible but also affordable, regularly used and sustainable for rural households.

2 Literature Review:

Growing global concern for sustainability and development, particularly in relation to climate change and health risks, has intensified research and policy efforts aligned with the Sustainable Development Goals (SDGs), especially in developing nations. Within this context, access to clean energy, particularly clean cooking fuels, has emerged as a critical area of inquiry.

Several studies highlight the environmental benefits of transitioning to cleaner fuels. Sreeja et al. (2023), focusing on BRICS nations, examined whether the adoption of Liquefied Petroleum Gas (LPG) contributes to reducing environmental degradation. Their findings suggest that replacing traditional biomass fuels such as wood and dung with LPG can significantly mitigate environmental damage. Similarly, Andadari et al. (2014) demonstrated the success of Indonesia's fuel-switching program from kerosene to LPG, noting that adoption patterns were influenced by household size, income, and education levels. Kimemia and Anne Garn (2016) also reported positive outcomes of LPG interventions in South Africa, where a majority of beneficiaries continued using LPG and experienced improved living conditions.

At the same time, the adoption of clean energy technologies is shaped by multiple socio-economic and cultural factors. Zhang et al. (2023) found that income levels, access to infrastructure, cultural norms, and availability of

clean technologies significantly influence energy choices among rural households. Supporting this, Lu et al. (2020) identified that energy poverty in rural China disproportionately affects low-income, less-educated, and larger households, with poor housing conditions and limited access to modern energy sources acting as key determinants. Kumar et al. (2021) further emphasised that energy transitions in developing countries must balance immediate environmental concerns with long-term development goals, while ensuring equity and justice.

The vulnerability of communities to climate change also intersects with energy access. Haque et al. (2022) highlighted the challenges faced by South Asian populations, including increased extreme weather events, rising sea levels, and changing rainfall patterns. Their study underscored the importance of adaptive strategies to enhance resilience among vulnerable communities.

In the Indian context, a number of studies have examined policy interventions such as the Pradhan Mantri Ujjwala Yojana (PMUY). Yadav (2020) explored the scheme's impact on women's empowerment in rural Rajasthan, reporting improvements in decision-making, financial independence, and overall well-being, while also stressing the need for awareness and capacity-building initiatives. Patil (2021) investigated LPG adoption among tribal communities in Pune, identifying socio-economic, cultural, and logistical barriers affecting sustained usage. Aggarwal et al. (2018) contributed by developing a decision-support system to improve beneficiary identification under PMUY, enhancing the effectiveness of policy implementation.

Social inequalities also play a significant role in access to clean energy. Patnayak and Jha (2020) critically analysed caste, class, and gender dynamics in LPG adoption in India, revealing disparities in access and highlighting concerns related to energy justice. Kavaya et al. (2019) further emphasised the need to integrate gender perspectives into climate change mitigation policies, proposing a framework that combines gender analysis with responsive policy design.

Beyond household energy use, broader structural and market-related aspects have also been explored. Matthews (2014) examined opportunities and constraints in the clean fuel market across Sub-Saharan Africa, identifying inefficiencies in supply chains and pricing mechanisms. Similarly, Biscoff et al. (2012) analysed fuel-switching trends in Ghana, indicating a gradual shift towards LPG driven by changing economic and environmental considerations.

The progress toward health-related SDGs has also been linked with improved energy access. Shabnam et al. (2022), using National Family Health Survey data, assessed India's advancement toward SDG 3 targets, highlighting improvements in key health indicators such as maternal and child health, immunisation, and disease control, which are indirectly influenced by cleaner energy adoption.

Overall, the existing literature demonstrates that while clean cooking fuel initiatives like LPG adoption contribute significantly to environmental sustainability, public health, and social development, their success depends on addressing socio-economic inequalities, cultural factors, infrastructure gaps, and policy implementation challenges.

3 Research Gap:

Even though the Pradhan Mantri Ujjwala Yojana (PMUY) and its effects on many elements of energy access and women's empowerment have been extensively researched, there are still research gaps that must be filled in light of certain Sustainable Development Goals (SDGs) with respect to Goals 1 (No Poverty), 3 (Good Health and Well-Being), 5 (Gender Equality), 7 (Affordable and Clean Energy), and 13 (Climate Action), the following research gaps identified for PMUY:

Goal 1 – No Poverty: Only a small number of studies have precisely examined how PMUY affect economic growth and poverty reduction in the long run. The extent to which beneficiary households' access to clean cooking fuel through PMUY helps to reduce poverty, generate income, and enhance their standard of living could be the subject of further research.

Goal 3 – Good Health and Well-being: The extant literature shows that studies have been done on the health advantages of clean cooking fuel; more thorough studies are required to evaluate the direct health effects of PMUY on family members, particularly women and children. These investigations might look at the decrease in illnesses brought on by indoor air pollution, improvements in respiratory conditions, and enhancements to general health and well-being.

Goal 5 – Gender Equality: The benefits of PMUY on women's empowerment have been studied, but more research is needed to fully comprehend the long-term impacts on gender equality and women's agency. This entails that families and communities have changed along with social norms and power structures.

Goal 7 – Accessible and Clean Energy: The literature provides an abundance of knowledge, but there is still a need to assess the long-term viability and affordability of LPG as a clean cooking fuel for PMUY recipients. Studies could examine alternative renewable energy options, examine the financial viability of continuing to use LPG, and assess how well subsidy programs ensure affordability.

Goal 13 – Addressing Climate Change: Even though the PMUY scheme aids in the fight against global warming by reducing the usage of solid fuels and reducing greenhouse gas emissions, additional research is required to determine the exact environmental advantages. Studies may concentrate on calculating the reductions in carbon emissions, examining the volume of deforestation and biomass consumption, and assessing PMUY's overall environmental sustainability. The above-mentioned research gaps point to the need for further in-depth and focused research that particularly examines the effects of PMUY on Poverty reduction, health outcomes, gender equality, accessibility, and climate action. A more complete understanding of the program's success and connection with the pertinent SDGs results in filling the research gaps, looking into how gender dynamics within families and communities have changed, along with social norms and power structures.

4 Objectives of the Study:

The proposal's main goal is to integrate PMUY with the UN SDGs and take advantage of its potential to propel sustainable development in India. PMUY assist in achieving several SDGs, including Goal 1 (No Poverty), Goal 3 (Good Health and Well-Being), Goal 5 (Gender Equality), Goal 7 (Affordable and Clean Energy), and Goal 13 (Climate Action), by providing clean cooking fuel, promoting renewable energy sources, and empowering women. From each of the afore-mentioned SDGs, the following are the Objectives for the proposed study.

- I. To know the importance of PMUY scheme in eliminating poverty level from rural regions of India.
- II. To analyse the effectiveness of PMUY in enhancing the health condition and well-being of rural people.
- III. To know the gender equality and women empowerment in the light of PMUY scheme.
- IV. To analyse PMUY's success in providing affordable and clean energy in rural regions of India
- V. To examine the impact of PMUY with respect to climate change in rural India.

5 Research Methodology:

The present study is qualitative, exploratory and descriptive research. The qualitative research method is used initially as it is commonly used to describe a social phenomenon which primarily answers "Why?", "How?" and "What way?" of any research questions. In doing so, qualitative research attempts to understand the nature of human experiences with regard to the PMUY scheme related to the set SDGs objectives. The exploratory research is carried out to find out the various factors concerning the selected 5 SDGs for the present study. The descriptive research is helpful in evaluating and analysing the identified variables, and examining the various hypotheses developed for the said study. The survey for the study consists of the top three poor districts of Bihar with the maximum rural population. Bihar is one of the state which represent among the highest number of household connections after UP and West Bengal (Ministry of Petroleum and Natural Gas report 2023).

No other state in India has more than one-third of Its Population living in multidimensional poverty except Bihar. Bihar has consistently been one of the poorest states in India [Niti Ayog report]. Sample collected from 10 Villages and forty households from each district. The samples were collected through stratified sampling. Three Districts, Sheohar, Araria and Sitamarhi, were taken on the basis of the top three most backward and poor districts, and 10 villages were chosen with the maximum population from each district.

- 1) Sheohar $40 \times 10 = 400$
 2) Araria $40 \times 10 = 400$
 3) Sitamarhi $40 \times 10 = 400$
 Total = 1200 Households

To accomplish the objectives mentioned in the present study, various statistical tools and techniques were employed to test the hypotheses which include chi-square test, Cronbach's alpha, correlation, regression, and ANOVA with the help of SPSS software.

6 Target group:

The target group was identified based on the following criteria:

- I. Sample Size: A total sample of 1,200 respondents was selected for the study.
- II. Target Segment: The study focused on households using LPG (Liquefied Petroleum Gas).
- III. Geographical Coverage: The study covered the three poorest districts of Bihar. From each district, the ten most populous villages were selected for inclusion in the study.

7 Analysis and Interpretation:

7.1 Objective I: To understand the role of PMUY in eradicating the poverty.

The PMUY impacts rural poverty alleviation by delivering over 10 crore free LPG connections serving women from free LPG connections and providing a targeted subsidy of Rs 300 per 14.2 k9. cylinder.

The PMUY helps reduce poverty in rural India by shifting households from traditional biomass to clean LPG cooking fuel.

Overall, Ujjwala Yojana addresses poverty not just through direct Subsidy but by improving health, time and economic opportunities for rural people living below the poverty line, especially women.

Table 1: Age distribution of the respondents

Age	Frequency	Percent
20-25	395	24.6
26-31	256	21.3
32-37	371	30.9
38 or more	278	23.2
Total	1200	100.0

Table 1 presents the age distribution of a sample population of 1,200 individuals, categorised into four age groups. The largest proportion of the population falls within the 32-37 age range, making up 30.9% of the total sample. The second-largest group is the 20-25 age range, representing 24.6% of the population. This indicates a significant representation of young adults. The age group of 38 or more is closely behind, which accounts for 23.2% of the total. Lastly, the 26-31 age range has the smallest representation, comprising only 21.3% of the population. While still a notable portion, this group is less prevalent compared to the others.

Table 2: Table 1: Gender distribution of the respondents

Gender	Frequency	Percent
Female	689	57.4
Male	511	42.6

Total	1200	100.0
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In Table 2, the gender distribution of a population sample of 1,200 individuals shows that 57.4% are female (689 individuals) and 42.6% are male (511 individuals). This table shows that the majority of respondents are women, which is significant in the context of the Pradhan Mantri Ujjwala Yojana (PMUY).

PMUY is a government initiative designed primarily to benefit women, particularly those from Below Poverty Line (BPL) households, by providing them with clean cooking fuel (LPG connections). The scheme targets women because traditional cooking methods using biomass lead to significant health issues, especially for women who are typically responsible for household cooking.

The fact that 57.4% of the sample population is female suggests that a large portion of the intended beneficiaries are represented in this data. This is a positive indicator in the context of PMUY, as it demonstrates that women who are the key focus of the program make up the majority. This suggests the potential success of outreach and participation among women in this population.

However, the 42.6% male representation should not be overlooked. Although the scheme primarily targets women, LPG access benefits entire households, including men, by improving the overall health of family members and reducing environmental degradation. Therefore, this gender distribution reflects the broader impact of PMUY on families and communities, even though women remain the central beneficiaries. In summary, the higher female proportion aligns well with PMUY's objectives, indicating that women, the key demographic, are well-represented and likely to benefit from the scheme.

Table 3: Distribution of the Respondents based on Household Size

Household Size	Frequency	Percent
1-5	596	49.7
6-10	591	49.3
11 or more	13	1.0
Total	1200	100.0

The majority of households (59.7%) consist of 1-5 members. These smaller families likely consume less fuel overall, but the transition to LPG under PMUY significantly benefits them in terms of health, convenience, and time savings. Women in smaller households may have more flexibility in adopting LPG as the cooking fuel of choice and may benefit from reduced fuel costs and health risks associated with traditional cooking methods.

A nearly equal proportion of households (48.3%) consists of 6-10 members. Larger households typically have higher fuel consumption due to cooking for more people. PMUY's provision of free LPG connections to these families is crucial, as it can help reduce the amount of time and effort spent collecting traditional fuels and improve indoor air quality for the entire family.

Although a small percentage (1%), households with 13 or more members may face significant challenges in fuel usage. These large families are likely to have high cooking fuel demands, making the transition to LPG particularly impactful. By reducing their reliance on traditional fuels like wood or cow dung, PMUY can bring substantial health and environmental benefits to these households, despite their lower representation in the sample.

Table 4: Distribution of the Respondents based on Occupation

Occupation	Frequency	Percent
Student	266	22.2
Homemaker	338	28.2
Service	314	26.2
Self-employed	116	9.7
Other	166	13.8
Total	1200	100.0

Homemakers form the largest group (28.2%) in this sample, and they are the primary beneficiaries of PMUY. These women are typically responsible for household cooking, often using biomass fuels such as firewood, cow dung, or coal. By switching to LPG, homemakers benefit from reduced indoor air pollution, improved health, and saved time, which they can use for other productive activities. PMUY directly targets this group, improving their quality of life by easing their daily burdens.

The service sector, comprising 26.2% of the population, includes individuals who work outside the home, either in formal or informal jobs. By reducing the time spent on cooking and fuel collection, LPG adoption under PMUY could allow service workers to focus more on their jobs or other professional activities, improving household efficiency and potentially raising incomes.

Students account for 22.2% of the population. While they may not be direct beneficiaries of the scheme, they stand to gain indirectly from the improved household health and living conditions brought about by LPG usage. Many students, especially in rural areas, belong to households where women cook using traditional fuels, and PMUY's provision of LPG can create a healthier home environment, free from the dangers of indoor pollution, which could positively impact their academic performance and well-being.

Self-employed individuals make up 9.7% of the population. The Other category (13.8%) includes individuals involved in varied occupations. PMUY addresses a critical need for clean fuel, improving both the health and economic potential of women across multiple occupations, aligning well with the scheme's goals of female empowerment and public health enhancement.

Table 5: Distribution of the Respondents based on Education

Education Qualification	Frequency	Percent
High School	31	2.6
Intermediate	92	7.7
Graduation	198	16.5
Masters	451	37.6
Other	428	35.7
Total	1200	100.0

A large portion of the sample is well-educated, with 37.6% holding a master's degree and 16.5% having completed Graduation. Higher educational attainment is often associated with better awareness and understanding of the health risks related to traditional biomass cooking fuels. These individuals may be more informed about the benefits of switching to LPG, making them more likely to embrace PMUY and spread

awareness within their communities. They can play a key role in promoting clean cooking fuels, particularly among less educated or rural populations.

The Other category, accounting for 35.7%, could represent a mix of vocational training, informal education, or illiteracy. This group may include individuals with limited access to formal education, especially in rural areas where traditional cooking methods are more common. PMUY's outreach and educational campaigns become critical for this segment to ensure they understand the health benefits of LPG and can access the scheme. Special efforts may be needed to make information and LPG access available to this group. Individuals with lower levels of formal education, such as high school (2.6%) and intermediate education (7.7%), may face barriers in accessing or understanding the full benefits of PMUY.

7.2 Objective II - To examine the effectiveness of PMUY in enhancing the health condition and well-being.

The PMUY plays an important role in transforming rural health across India by providing free LPG connections to rural households. The scheme replaced traditional cooking fuel & chuhas, dung, wood and coal. This shift significantly reduced indoor air pollution, which was a major cause of lung diseases, eye infections, and tuberculosis among children and women in rural areas. With cleaner cooking fuel, families now spend less on treating smoke-related illness and on hospital visits, easing their financial burdens. The time saved from collecting firewood and dealing with health issues is also being used for rest.

In this way, PMUY not only improved the quality of life inside the home but also reduced health expenditure and overall improvement in quality of life.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.705	.497	.496	.63510

Predictors: (Constant), Health condition and Wellbeing

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	323.880	1	323.880	808.450	.000
	Residual	327.270	1198	.273		
	Total	651.150	1199			

Dependent Variable: PMUY

Predictors: (Constant), Health condition and Wellbeing

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.870	.078	.705	11.050	.000
	Health Condition and Well-being	.688	.023		29.100	.000

Dependent Variable: PMUY

The regression model shows that the Pradhan Mantri Ujjwala Yojana (PMUY) has a significant positive impact on enhancing the health condition and well-being of beneficiaries. The strong R value (0.705) indicates a solid relationship, and with 49.7% of the variance in health and well-being explained by the model, PMUY appears to

be effective in achieving its goals. The Beta value of 0.705 indicates a strong positive effect of health condition and well-being on PMUY effectiveness.

The t-value of 29.100 is very large, and the significance value (p-value = 0.000) is less than the commonly accepted threshold of 0.05. This means that the relationship between health condition, well-being, and PMUY effectiveness is statistically significant. In simpler terms, the health condition and well-being strongly and significantly affect PMUY effectiveness.

7.3 Objective III - To study the gender equality in the light of PMUY.

PMUY drives rural development by providing cleaner cooking fuel and universal household electrification, which improves health, empowers women and boosts economic productivity.

The PMUY has been instrumental in expanding clean energy access in rural India by providing free LPG connections to poor households. It shifted millions of families from traditional biomass to LPG, ensuring reliable and affordable cooking fuel. This improved energy access has directly supported rural development.

In short, PMUY links energy access to better health, women's empowerment and economic progress, making it a key driver of rural development.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.768	.590	.589	.60312

Predictors: (Constant), Gender Equality

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	768.500	1	768.500	1720.334	.000
	Residual	533.802	1198	.445		
	Total	1302.302	1199			

Dependent Variable: PMUY

Predictors: (Constant), Gender Equality

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.642	.078	.768	8.210	.000
	Gender Equality	.852	.023		36.210	.000

Dependent Variable: PMUY

$R = 0.768$ suggests a strong correlation, which means gender equality plays a crucial role in enhancing the success of PMUY. Gender equality explains 59.0% of the variance in PMUY's effectiveness ($R^2 = 0.590$), indicating that gender-focused policies or outcomes are integral to PMUY's success.

The model's fit (as shown by the Adjusted R^2) is strong, reinforcing that gender equality is an essential predictor in understanding how well PMUY achieves its objectives.

The results suggest that gender equality significantly drives PMUY's effectiveness. By promoting gender equity, PMUY can likely achieve more successful outcomes, particularly in improving the social and economic well-

being of women. This makes gender equality a moral imperative and a practical strategy for enhancing the success of social welfare programs like PMUY.

10.4 Objective IV - To analyse PMUY's success in providing affordable and clean energy.

The PMUJ promotes gender equality by putting the LPT connections directly in the name of a woman from a poor household. This gives women ownership of a household asset and greater decision-making power.

This scheme is a big step towards social inclusion of poor people. The women are saved from collecting and using unclean fuel, and they are getting more time at their disposal for other activities due to an easy & faster way of cooking through LPG.

In this way, PMUJ addresses energy poverty and health burden that disproportionately affect women, helping them gain health, time, dignity, and economic independence.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.782	.611	.610	.56120

Predictors: (Constant), Affordable and clean energy

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	398.200	1	398.200	1880.189	.000
	Residual	253.600	1198	.212		
	Total	651.800	1199			

Dependent Variable: PMUY

Predictors: (Constant), Affordable and clean energy

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.495	.072	.782	6.875	.000
	Affordable and clean energy	.781	.020		39.050	.000

Dependent Variable: PMUY

$R = 0.822$ indicates a strong positive correlation between "Affordable and Clean Energy" (your independent variable) and the dependent variable (likely a measure of PMUY success). $R^2 = 0.611$, which means that approximately 61.1% of the variation in the dependent variable (PMUY success) can be explained by the independent variable (Affordable and Clean Energy). The large F-value and extremely low p-value (0.000) confirm that the predictor variable (Affordable and Clean Energy) plays a crucial role in determining PMUY's effectiveness.

The analysis suggests that the provision of affordable and clean energy plays a significant role in the success of the Pradhan Mantri Ujjwala Yojana (PMUY). With a strong correlation ($R = 0.782$) and 61.1% of the variance in PMUY success explained by this factor, it is evident that affordable and clean energy is a key driver in the program's effectiveness. While the model demonstrates a solid fit, there may still be other influential factors that were not captured in this analysis. Nevertheless, the results underscore the importance of continuing efforts to ensure access to affordable and clean energy for maximising the benefits of PMUY.

10.5 Objective V - To analyse the impact of PMUY with respect to the climate change.

The PMUY contributes to climate action by promoting the shift from biomass fuels like wood, dung and clean LPG for cooking. This reduces the burning of solid fuel, which cuts down emissions of black carbon, CO₂ and other harmful greenhouse gases that contribute to climate change.

From Environmental poing of view, it protects forests and biodiversity. In rural areas, cleaner LPG means less indoor and outdoor air pollution, improving overall air quality.

SO PMUJ supports both climate mitigation by lowering emissions and environmental protection by conserving forests and reducing pollution.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.620	.384	.383	.72650

Predictors: (Constant), Climate Change

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	263.800	1	263.800	744.633	.000
	Residual	424.500	1198	.354		
	Total	688.300	1198			

Dependent Variable: PMUY

Predictors: (Constant), Climate Change

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.165	.088	.620	13.239	.000
	Climate Change	.587	.025		23.480	.000

Dependent Variable: PMUY

The correlation coefficient $R=0.620$ indicates a moderate positive correlation between the PMUY program and the climate change metrics analysed. This suggests that as the implementation of PMUY progresses, there is a tendency for improvements in climate-related indicators, such as reductions in emissions or pollution levels. The ANOVA table assesses the overall significance of the regression model, evaluating whether the independent variable (in this case, PMUY) significantly predicts the dependent variable (climate change metrics).

The ANOVA results demonstrate that the Pradhan Mantri Ujjwala Yojana significantly explains the variability in climate change metrics, as indicated by the high F-statistic and the very low p-value. This statistical significance provides robust support for the hypothesis that PMUY contributes meaningfully to climate change outcomes. These findings highlight the importance of the PMUY program in promoting cleaner energy solutions and mitigating the adverse effects of climate change.

8 Conclusion and Future Direction

This study provides valuable insights into the socio-economic empowerment of women through the implementation of the Pradhan Mantri Ujjwala Yojana scheme. Through a comprehensive analysis of various parameters, it is concluded that the PMUY scheme has had a notable impact on several aspects of women's lives in rural communities. The scheme has significantly influenced positive behavioural changes in cooking practices, enhanced economic well-being, and contributed to increased financial independence among women. Furthermore, it has provided opportunities for skill development and entrepreneurship, contributing to women's active involvement in their communities. Additionally, the PMUY scheme has played a crucial role in reducing gender-based disparities, improving health outcomes, and enhancing overall safety and well-being in kitchens and homes. However, there is still room for improvement in certain areas, such as ensuring the effectiveness of clean cooking fuel in reducing accidents and burns, and addressing any remaining challenges in economic opportunities and health outcomes. Overall, the findings underscore the importance of continued support and investment in initiatives like the PMUY scheme to further empower women and promote inclusive socio-economic development in rural areas.

The PMUY is a big step towards social inclusion of poor people. The women are saved from the drudgery of collecting and using unclean fuel and they are getting more time at their disposal for other activities due to the easy and faster way of cooking through LPG. The women are also getting involved in other financial decisions of the family, like ordering for LPG refills, maintaining a bank account for subsidies, etc. The nation as a whole is benefiting due to reduced air pollution, a clean environment and a healthy society. Though this one-time assistance to the BPL family by the government is giving a greater push towards the use of cleaner fuel, the affordability will remain a core issue, as the biofuel is not cheaply available unless the BPL family develops the capacity to use cleaner fuel.

The research study on the Pradhan Mantri Ujjwala Yojana (PMUY) as a green initiative holds significant relevance for society at large. The following are some key points highlighting the relevance of the study for Society: the study is able to evaluate how PMUY affects household health outcomes. The program can promote the health and well-being of individuals and families in society by encouraging the use of clean cooking fuels like Liquefied Petroleum Gas (LPG) and lowering indoor air pollution and related health problems. The socio-economic advantages of PMUY, such as reducing poverty and promoting economic empowerment, can be studied. By making clean cooking fuel accessible, the program lessens the financial burden associated with buying traditional fuels, enabling households to redirect funds toward other critical needs, education, or income-generating activities, promoting socioeconomic development. The study's focus on gender empowerment can have a positive impact on society. By examining the role of PMUY in enhancing gender equality and women's empowerment, the research can shed light on the social, economic, and decision-making improvements experienced by women beneficiaries. This contributes to a more equitable society and fosters inclusive development. The study can assess how PMUY would affect the environment, notably in terms of lowering reliance on solid fuels and reducing greenhouse gas emissions. The program addresses climate change issues, encourages the use of clean cooking fuels like LPG, and lessens deforestation and its corresponding ecological effects. The usefulness of PMUY in reaching marginalised communities, such as tribal or rural populations, might be investigated in the study. The study's assessment of the program's inclusiveness and effects on these communities can help to advance social inclusion, lessen inequalities, and make sure that everyone in society benefits from access to clean cooking fuel. The adoption of clean cooking fuels by families can be studied in terms of its behavioural components and motivators. The study can offer insights into encouraging behavioural change and causing a social shift toward cleaner and more sustainable energy sources by studying the factors influencing the adoption and continued usage of LPG.

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