Economics Bulletin

Volume 45, Issue 2

The influence of household amenities on LPG adoption in rural India

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Abstract

The article examines the role of household amenities in inducing the use of LPG for cooking. It observes better amenities significantly boost LPG usage. Despite a rise in LPG adoption, exclusive and universal dependence on LPG needs an improvement in both housing conditions and LPG access. Therefore, to realise exclusive LPG use, it is equally important to focus on improving household amenities along with widespread availability of LPG.

Citation: Vachaspati Shukla and Udaya S Mishra, (2025) "The influence of household amenities on LPG adoption in rural India", *Economics Bulletin*, Volume 45, Issue 2, pages 823-835
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Submitted: September 11, 2024. **Published:** June 30, 2025.

1.Introduction

Since the launch of the Pradhan Mantri Ujjwala Yojana (PMUY) on May 1, 2016, there has been substantial growth in LPG connections across India, with household coverage reaching 99.8 percent in 2021-22, according to the Ministry of Petroleum & Natural Gas. Despite this success, concerns remain as regard LPG becoming the primary cooking fuel. The NSS 78th round survey on the 'Multiple Indicator Survey 2020-21' reveals that while 62% of Indian households use LPG as their primary cooking fuel, there is a significant urban-rural divide—90.2% of urban households compared to only 49.6% of rural households.

Existing research on LPG use in India highlights two main themes: 1) the impact of LPG on health, environment, and education (Smith & Sagar, 2014; Debbi et al., 2014; Srivastava & Rehman, 2006; Bhattacharyya, 2012; Arora et al., 2020), and 2) the factors influencing LPG accessibility, divided into Household-Related Factors (income, education, awareness, and cultural practices) and Infrastructure and Policy Factors (supply chains, distribution networks, pricing, and subsidies) (Chindarkar et al., 2021; Choudhury & Desai, 2020; Aggarwal et al., 2018; Cabiyo et al., 2020).

Relying on the claim of the union government of India that 99.8 per cent of the households in India have LPG connection, accessibility is perhaps a non-issue. Additionally, evidence based on the household's survey data suggests that there is wide disparity in rural India across the social and income class in terms of using LPG as cooking fuel. Conventional socio-economic categorizations of households miss out on household amenities environment and its potential to induce LPG adoption. They largely include factors such as having separate kitchens, with access to running water source and sanitation services that can have a positive bearing on LPG use.

To realize universal and exclusive use of LPG, there is a need for a holistic approach of improving living environment along with provisioning of LPG. Such an approach should have simultaneous focus on improving living environment of the under privileged along with enabling access to LPG connections. While the entire architecture of LPG provisioning involves availability, accessibility and affordability, its adaptability is largely conditioned by the household environment. Alternatives to LPG may not be a choice under some conditions like urban living environment and similarly housing with ideal infrastructure may not necessarily be suitable for alternative fuel use. Hence, understanding adoption of LPG as cooking fuel in a universal scale need to be viewed not in isolation but with accommodation of housing environment.

2.Disparities in LPG Adoption Across Social and Income Groups

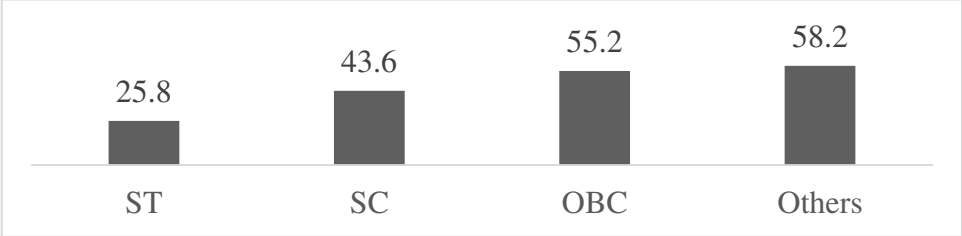
As urban households already exhibit high LPG usage rates, our discussion will primarily focus on rural households. Disparities across social groups and Income quintiles in various aspects of development are well-documented, and the use of LPG is no exception. Since the NSS household surveys do not collect information on household income, Monthly Per Capita Consumption Expenditure (MPCE) is generally used as a proxy for household income.

Figure 1 shows that only 25.8% of Scheduled Tribes (ST) households in rural areas use LPG as their primary cooking fuel, the lowest among all social groups, highlighting a significant gap in adoption. In contrast, 43.6% of Scheduled Castes (SC) households use LPG, which is higher than ST households but still low compared to others. Other Backward Classes (OBC)

households have a higher LPG usage rate at 55.2%, indicating better access. The highest LPG adoption is seen among households classified as "Others (General Categories)", with 58.2%, likely to be influenced by their better socio-economic status.

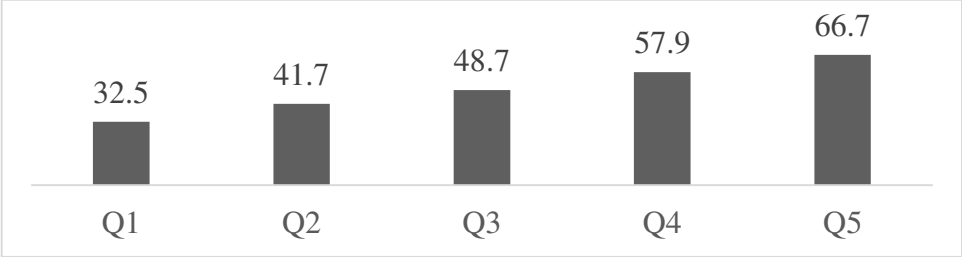
Figure 2 presents LPG usage among rural households by consumption quintiles. Only 32.5% of households in the lowest quintile (poorest) use LPG as their primary cooking fuel, rising to 41.7% in the second quintile. In the middle quintile, 48.7% of households use LPG, and this increases to 57.9% in the fourth quintile. The wealthiest quintile shows the highest adoption, with 66.7% using LPG.

Figure 1: LPG Adoption by Social Group in Rural India



Source: Estimated from unit level NSS 78th survey data on Multiple Indicator Survey (MIS), National Sample Survey Office, Ministry of Programme Implementation, Government of India

Figure 2: LPG Adoption by MPCE Quintile in Rural India



Source: Estimated from unit level NSS 78th survey data on Multiple Indicator Survey (MIS), National Sample Survey Office, Ministry of Programme Implementation, Government of India

3. Household Amenities and LPG Adoption

Conventional characterization often fails to capture the underlying mechanisms influencing the adoption of amenities like LPG. Such characterization often misses out the critical role of household environment and amenities that shapes LPG adoption patterns. A broader assessment beyond the common characterization of possible household attributes is necessary to comprehend the mechanism in play as regard adoption of LPG as the primary cooking fuel. Table 1 presents data on rural households using LPG as their primary cooking fuel, segmented by household characteristics such as housing type, access to mass media, water availability, sanitation, and kitchen facilities.

There is a significant difference in the likelihood of using LPG as the primary source of energy for cooking when comparing households with and without certain amenities. LPG usage is lowest among households in kutcha houses (21.1%) and marginally higher for those in semi-

pucca houses (22.3%). In contrast, pucca houses have the highest LPG usage at 56.6%, indicating a strong association between better housing and LPG adoption. Access to mass media also plays a significant role, with 59.7% of households with media access using LPG, compared to only 25.3% of those without it. Water availability shows similar trends: 58.3% of households with year-round water access within their premises use LPG, while only 34.4% of those lacking sufficient water do. Sanitation is another key factor. Households with exclusive toilet access show a higher LPG usage rate (55.5%), whereas those without any toilet facilities have the lowest (27.3%). Similar trends are seen in bathroom access, with 66.8% of households with exclusive bathrooms using LPG, while only 24.7% of those without bathrooms do. Kitchen facilities also matter: 82.9% of households with a kitchen equipped with a water tap use LPG, while only 36.6% of those without a separate kitchen do.

Table 1: Proportion of rural household using LPG as primary source of energy for cooking

Household Characteristics	Proportion of household using LPG as primary source of energy for cooking
Housing structures	
Pucca house	56.6
Semi Pucca house	22.3
Kutcha house	21.1
Access to mass media	
Having access to mass media	59.7
No access to mass media	25.3
Water availability	
Having sufficient water within premises throughout years	58.3
Having Sufficient water out of the premises throughout years	39.2
Not Having sufficient water throughout years	34.4
Access to Toilet Facility	
Household having exclusive access to toilet facility	55.5
Household having access to toilet facility but not exclusive	43.3
No toilet facility	27.3
Access of the household to bathroom	
Exclusive Access to bathroom facility	66.8
Household having access to bathroom facility but not exclusive	48.8
No access to bathroom facility	24.7
Type of Kitchen	
Kitchen with water tap	82.9
Kitchen without water tap	55.4
No separate kitchen	36.6

Source: Estimated from unit level NSS 78th survey data on Multiple Indicator Survey (MIS), National Sample Survey Office, Ministry of Programme Implementation, Government of India

The better access to household amenities—such as permanent housing, media access, sufficient water, sanitation, and kitchen facilities—significantly boosts LPG adoption in rural areas. In contrast, poorer living conditions correlate with lower LPG usage, underscoring the link between socio-economic status and access to cleaner cooking fuels.

4. Computation of the Amenities achievement score

Following the method adopted in multidimensional poverty measurement, we have computed an achievement score for access to basic amenities. Each indicator is given equal weight. A score of 1 is assigned if a household has access to a particular facility, a score of 0 is given if the household is deprived of the facility, and a score of 0.5 is assigned if the household has partial access to any particular amenity (as shown in Table 2). The sum of these scores is then divided by the number of amenities considered, which is 6 in this case. Therefore, the value of the score varies between 0 and 1. A household will receive a score of 0 if it is deprived of all aspects of basic amenities, and a score of 1 represents full achievement in all aspects.

If x_{hij} is the achievement score of h^{th} household in i^{th} dimension in state j. Then A_{hj} : amenities achievement score of the h^{th} household in state j

$$A_{hj} = \sum_{i=1}^{n=6} \frac{x_{hij}}{n}$$

and AS_j: achievement score of state j

$$AS_j = \frac{1}{N_j} \sum_h A_{hj}$$

Where N_j is the number of households in state j.

Table 2: Computing the Amenities achievement score

Indicators	Achievement Score	
Housing structures	Pucca house	1
	Semi Pucca house	0.5
	Kutcha house	0
Access to mass media	Having access to mass media	1
	No access to mass media	0
Water availability	Having sufficient water within premises throughout years	1
	Having Sufficient water out of the premises throughout years	0.5
	Not Having sufficient water throughout years	0
Access to Toilet Facility	Household having exclusive access to toilet facility	1
	Household having access to toilet facility but not exclusive	0.5
	No toilet facility	0
	Exclusive Access to bathroom facility	1

Access of the household to bathroom	Household having access to bathroom facility but not exclusive	0.5
	No access to bathroom facility	0
Type of Kitchen	Kitchen with water tap	1
	Kitchen without water tap	0.5
	No separate kitchen	0

The distribution of rural household over the amenities achievement score is presented in table-3. This score represents how well rural households are equipped with essential amenities. The score ranges from 0.0 to 1.0, with higher scores indicating better access to amenities. The score is divided into five categories: 0.0-0.2: Very low access to amenities; 0.21-0.4: Low access; 0.41-0.6: Moderate access; 0.61-0.8: High access; 0.81-1.0: Very high access. The table-4 highlights the disparities in access to essential amenities across different Indian states. States like Kerala, Himachal Pradesh, and Punjab have a majority of households with high amenities scores, indicating better infrastructure and services. On the other hand, states like Jharkhand, Bihar, and Odisha show a larger proportion of households with lower amenities scores, suggesting challenges in providing basic amenities to rural populations.

Table 3: Distribution of rural Household over the amenities achievement score

State	Amenities achievement score						
	0.0-0.2	0.21-0.4	0.41-0.6	0.61-0.8	0.81-1.0	All	Mean
Jammu & Kashmir	1.5	3.4	14.5	13.5	67.0	100	0.813
Himachal Pradesh	0.0	0.3	6.0	12.9	80.8	100	0.886
Punjab	0.1	0.5	6.6	12.7	80.1	100	0.884
Uttarakhand	0.5	2.1	12.9	24.7	59.8	100	0.791
Haryana	0.0	1.0	6.8	15.7	76.5	100	0.859
Rajasthan	6.8	12.4	19.8	23.6	37.4	100	0.648
Uttar Pradesh	4.7	15.4	32.5	23.1	24.3	100	0.591
Bihar	6.6	18.5	29.2	23.9	21.9	100	0.571
Assam	0.4	3.8	22.3	31.8	41.7	100	0.726
West Bengal	4.7	11.3	35.5	26.9	21.5	100	0.605
Jharkhand	14.9	28.0	38.2	10.8	8.1	100	0.438
Odisha	9.6	21.4	39.0	16.4	13.6	100	0.505
Chhattisgarh	3.1	10.6	35.2	33.2	17.9	100	0.604
Madhya Pradesh	8.3	18.5	34.3	21.3	17.6	100	0.546
Gujarat	3.1	9.3	18.5	18.6	50.5	100	0.714
Maharashtra	1.8	4.9	17.3	21.6	54.4	100	0.752
Andhra Pradesh	1.8	4.5	17.8	27.6	48.3	100	0.732
Karnataka	0.4	2.3	12.7	19.6	65.0	100	0.793
Kerala	0.1	0.2	1.8	6.9	91.2	100	0.928
Tamil Nadu	1.8	4.2	21.5	21.4	51.0	100	0.732
Telangana	0.7	2.0	9.3	25.9	62.1	100	0.786
India	4.3	10.9	25.1	22.3	37.5	100	0.660

Source: Estimated from unit level NSS 78th survey data on Multiple Indicator Survey (MIS), National Sample Survey Office, Ministry of Programme Implementation, Government of India

5. Amenities Achievement Score and Use of LPG

Table 4 provides data on the proportion of rural households using LPG as a cooking fuel, categorized by two variables: Amenities Achievement Score and Consumption Quintiles. The data shows that as the Amenities Achievement Score increases, the proportion of households using LPG also rises. Overall, in the lowest amenities score range (0.0-0.2), only 9.3% of all households use LPG, while in the highest amenities score range (0.81-1.0), 75.1% use LPG. For households in the lowest consumption quintile, LPG usage varies significantly depending on the amenities score range. It ranges from 8.6% in the 0.0-0.2 score range to 67.4% in the 0.81-1.0 score range. This wide disparity within the same economic group highlights the crucial role of access to basic amenities in determining LPG usage as the primary energy source for cooking. In the lowest amenities score range (0.0-0.2), there is relatively little disparity in LPG usage when comparing the lowest and highest consumption quintiles. Specifically, 8.6% of households in the lowest quintile use LPG, compared to 16.9% in the highest quintile. Thus, for a given consumption quintile, there is much greater variation in LPG usage when moving from the lowest to the highest amenities achievement score, compared to the variation observed when moving from the lowest to the highest consumption quintile within a given amenities score range.

Table 4: Proportion of rural household using LPG

Amenities achievement score	Consumption Quintiles					
	Q1	Q2	Q3	Q4	Q5	All
0.0-0.2	8.6	8.3	8.7	11.4	16.9	9.3
0.21-0.4	13.6	16.1	17.2	22.8	20.6	16.7
0.41-0.6	24.7	28.6	32.4	36.2	39.3	30.8
0.61-0.8	41.9	48.0	51.2	56.4	59.6	51.2
0.81-1.0	67.4	71.3	73.0	76.1	79.4	75.1
All	32.6	41.7	48.7	57.9	66.7	49.5

Source: Estimated from unit level NSS 78th survey data on Multiple Indicator Survey (MIS), National Sample Survey Office, Ministry of Programme Implementation, Government of India

A similar analysis of LPG use, considering both social group identity and the Amenities Achievement Score, reveals another important aspect of this issue. Table 5 shows the proportion of rural households using LPG as a cooking fuel, categorized by Amenities Achievement Score and Social Groups. The social groups include Scheduled Tribes (ST), Scheduled Castes (SC), Other Backward Classes (OBC), and Others (non-ST/SC/OBC groups). The percentages represent the proportion of households within each social group that use LPG, based on their Amenities Achievement Score.

In the lowest Amenities Score range (0.0-0.2), LPG usage is minimal across all social groups: only 4.1% of ST households, 11.6% of SC households, 11.5% of OBC households, and 12.8% of Others use LPG. In contrast, in the highest Amenities Score range (0.81-1.0), LPG usage is significantly higher, with 61.6% of ST households, 69.9% of SC households, 77.0% of OBC households, and 78.2% of Others using LPG.

This data highlights the significant disparities within each social group regarding LPG usage when comparing households with the lowest and highest Amenities Achievement Scores. For instance, among ST households, LPG use increases dramatically from 4.1% in the lowest score range (0.0-0.2) to 61.6% in the highest score range (0.81-1.0). A similar trend is observed across other social groups, underscoring the high disparity in LPG usage relative to the Amenities Achievement Score.

Table 5: Proportion of rural household using LPG

Amenities achievement score	Social Groups				
	ST	SC	OBC	Others	All
0.0-0.2	4.1	11.6	11.5	12.8	9.3
0.21-0.4	7.6	17.4	20.9	18.3	16.7
0.41-0.6	16.4	31.2	36.9	27.9	30.8
0.61-0.8	34.0	50.2	56.2	50.3	51.2
0.81-1.0	61.6	69.9	77.0	78.2	75.1
All	25.8	43.6	55.2	58.2	49.5

Source: Estimated from unit level NSS 78th survey data on Multiple Indicator Survey (MIS), National Sample Survey Office, Ministry of Programme Implementation, Government of India

The table-6 provides data on the proportion of rural households using LPG as a cooking fuel across different states in India, categorized by their Amenities Achievement Score. For each state, the table shows the percentage of rural households using LPG within each of the five Amenities Achievement Score ranges. In most states, the use of LPG increases as the Amenities Achievement Score improves. This suggests that better access to amenities is strongly associated with higher LPG usage. There is considerable variation between states in LPG usage across all score ranges. For example, states like Telangana, Tamil Nadu, and Andhra Pradesh have high LPG usage even at lower amenities scores, whereas states like Chhattisgarh, Odisha, and West Bengal have much lower LPG usage in the lower score ranges.

This illustrates a clear correlation between a household's Amenities Achievement Score and its likelihood of using LPG as a cooking fuel. States with better access to amenities generally have higher LPG usage across all households, but there are significant disparities between states.

The last column of table-3 presents the average amenities achievement score for Indian states. While comparing this with the LPG use presented in the last column of table-6, we observe that both are positively correlated. The value of Pearson correlation coefficient is 0.632 and significant at 1 % significant level.

Table 6: Proportion of rural household using LPG

State	Amenities achievement score					
	0.0-0.2	0.21-0.4	0.41-0.6	0.61-0.8	0.81-1.0	All
Jammu & Kashmir	0.0	10.3	27.5	42.3	60.2	50.8
Himachal Pradesh	0.0	0.0	27.1	36.8	45.2	42.9
Punjab	30.2	8.1	32.1	62.1	74.3	69.5
Uttrakhand	2.2	30.7	50.9	63.7	77.4	69.2
Haryana	0.0	6.9	22.6	38.0	61.9	54.9
Rajasthan	3.5	9.3	10.2	31.4	50.8	29.8
Uttar Pradesh	10.7	20.9	33.9	51.3	72.0	44.0
Bihar	17.1	23.2	40.1	64.5	79.3	49.9

Assam	15.1	12.4	11.8	37.6	63.4	41.6
West Bengal	3.1	4.4	11.8	21.5	50.2	21.5
Jharkhand	6.9	13.2	27.2	36.6	66.8	24.5
Odisha	3.5	7.7	17.7	31.4	69.0	23.5
Chhattisgarh	0.0	2.5	6.0	16.4	39.1	14.8
Madhya Pradesh	5.2	7.3	16.2	29.4	59.6	24.1
Gujarat	15.0	16.9	31.5	52.9	80.1	58.2
Maharashtra	9.9	29.7	49.1	62.7	84.8	69.8
Andhra Pradesh	26.5	45.3	61.7	86.6	91.7	81.7
Karnataka	35.2	22.2	71.3	82.8	92.7	86.2
Kerala	0.0	0.0	18.0	40.5	62.2	59.8
Tamilnadu	28.2	45.3	67.4	78.6	92.6	81.0
Telangana	34.6	79.3	83.5	94.6	98.9	95.5
Total	9.3	16.7	30.8	51.2	75.1	49.5

Source: Estimated from unit level NSS 78th survey data on Multiple Indicator Survey (MIS), National Sample Survey Office, Ministry of Programme Implementation, Government of India

6. Factor affecting the use of LPG among rural households

A binary regression model has been estimated to examine the factor influencing the use of LPG among rural households in India. The logit model is a widely used econometric approach for analysing binary outcomes, such as LPG usage (whether a household uses LPG or not).

$$Y_i = \begin{cases} 1, if\ \ household\ i\ uses\ LPG \\ 0, otherwise \end{cases}$$

The regression model is defined as follows

$$Log\left(\frac{P(Y_i=1)}{1-P(Y_i=1)}\right) = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + ... + \beta_k X_{ki}$$

- $P\ (Y_i = 1 | X_i)$ is the probability that household ***i*** uses LPG, given the explanatory variables X.
- $X_1, X_2, ..., X_k$ represent the independent variables
- β_0 is the intercept, $\beta_1, \beta_2, \ldots\ldots\ldots, \beta_k$ are the coefficients to be estimated.

The model incorporates demographic, socio-economic, occupational, land possession, education, social group, and state fixed effects to examine how different factors impact the likelihood of LPG use. The coefficients (B values) represent the log-odds change associated with each variable, while Odds Ratio indicates how much the odds of using LPG increase or decrease relative to a reference category. A positive coefficient suggests a higher probability of LPG adoption, whereas a negative coefficient suggests a lower probability.

The logistic regression model was evaluated using various appropriate statistics. The Likelihood Ratio Chi-Square test (LR χ^2 = 60,365.346, df = 42, $p < 0.001$) confirmed that the independent variables significantly improve the prediction of LPG adoption compared to a null model. The -2 Log Likelihood value (140,270.84) suggests a reasonable model fit. The Cox & Snell R^2 (0.341) and Nagelkerke R^2 (0.454) indicate that the model explains approximately

34.1% to 45.4% of the variance in LPG adoption, demonstrating strong predictive capability. However, without state fixed effects, the Cox & Snell R^2 (0.244) and Nagelkerke R^2 (0.325) suggest that the model explains only 24.4% to 32.5% of the variance. This comparison underscores the importance of accounting for state-level variations in the analysis. Incorporating state fixed effects enhances the model's predictive power, leading to a more precise understanding of LPG adoption patterns across different states.

The coefficient for female-headed households and age of the household head is not statistically significant, indicating that gender and age does not have a substantial effect on LPG adoption. The social category of the household is significantly and negatively related to LPG use. ST households are 0.45 times less likely to use LPG compared to the General category. Similarly, SC households are 0.84 times less likely, and OBC households are 0.86 times less likely to adopt LPG than the General category households. Although OBC households face a disadvantage, their likelihood of using LPG is higher than that of ST and SC households. This indicates that historically marginalized communities continue to face significant barriers to clean cooking fuel adoption, most likely due to economic constraints, accessibility issues, and traditional cooking practices.

The employment status of the household head also significantly influences LPG adoption. Households with a salaried-employed head are 1.34 times more likely to use LPG when compared with self-employed households. Casual worker households are the ones less likely to adopt LPG, which could be due to affordability concerns. Non-working households too are 1.78 times more likely to adopt LPG in contrast with the self-employed households, possibly due to alternative income sources or government subsidies.

Higher education levels of the household head has a positive bearing on the probability of LPG adoption. Households where the head has a graduation degree or higher are 2.54 times more likely to use LPG than those with an illiterate household head. Similarly, households with a higher secondary education level are twice as likely to use LPG. Those with secondary, upper primary, and up to primary education also have a higher likelihood of LPG adoption compared to illiterate households. The likelihood of using LPG increases as the education level of the household head rises**.**

Land possession has a negative relationship with LPG use. Compared to landless households (reference category), households owning land are less likely to use LPG. The likelihood of LPG adoption decreases as landholding size increases, with the odds of using LPG being 0.62 times less likely for households with 2.01 - 3.01 hectares of land and further 0.67 times less likely for those owning more than 4 hectares. This suggests that larger size land owning household have dependence on traditional biomass fuels available on their land as an alternative discouraging use of LPG.

Monthly per capita expenditure (MPCE), a proxy for economic hierarchy of household bears a strong positive association with LPG adoption. In the regression estimates, MPCE is used in its log-transformed form Ln(MPCE)) and is statistically significant, with an odds ratio of 2.581. This implies that a one-unit increase in log-income Ln(MPCE) leads to a 1 increase in the odds of using LPG. In other words, higher income levels are strongly associated with a greater likelihood of LPG adoption, likely due to improved affordability and access to clean cooking fuel.

The Household Achievement Score, which measures the basic amenities a household has access to, is also a significant determinant of LPG adoption. With an odds ratio of 2.058, a one-unit increase in the Household Achievement Score more than doubles the likelihood (by 105.8%) that a household will adopt LPG as the primary cooking fuel. This indicates that

households with better access to essential amenities are significantly more likely to use LPG, reflecting the role of improved living standards in clean energy adoption.

The model includes state fixed effects, with Bihar as the reference category, as LPG use in rural Bihar is comparable to the national average for rural India. Selecting Bihar as the reference state allows for a clear comparison of how different states perform relative to the broader rural Indian context, highlighting regional disparities in LPG adoption. States with positive coefficients, such as Telangana, Karnataka, Andhra Pradesh, Tamil Nadu, and Maharashtra, indicate a stronger likelihood of LPG adoption compared to Bihar. In contrast, Jammu & Kashmir, Punjab, Uttarakhand, Haryana, Rajasthan, Uttar Pradesh, Assam, West Bengal, Jharkhand, Odisha, Chhattisgarh, Madhya Pradesh, Gujarat, Himachal Pradesh, and Kerala have negative coefficients, suggesting that rural households in these states are less likely to use LPG as a primary cooking fuel. Overall, Southern states (except Kerala) exhibit higher LPG adoption, while Central (except Maharashtra) and Eastern states have lower adoption rates, reflecting regional disparities in access, subsidy implementation, and traditional fuel reliance.

Table 7: Logistic Regression Estimates of the Determinants of LPG Use

Variable	Coefficient	Standard Error	Wald Statistic	p-value	Odds Ratio
Gender of Household Head					
Female	-0.026	0.021	1.573	0.210	0.974
Age of Household Head	0.001	0.001	1.599	0.206	1.001
Social Groups (Ref: General Category)					
Scheduled Tribe (ST)	-0.779	0.024	1079.673	0.000	0.459
Scheduled Caste (SC)	-0.174	0.021	71.778	0.000	0.840
Other Backward Class (OBC)	-0.148	0.018	69.719	0.000	0.863
Education of Household Head (Ref: Illiterate)					
Up to Primary	0.195	0.017	127.034	0.000	1.215
Upper Primary	0.332	0.020	275.074	0.000	1.394
Secondary	0.555	0.022	618.389	0.000	1.741
Higher Secondary	0.705	0.028	642.471	0.000	2.024
Graduation & Above	0.932	0.034	763.159	0.000	2.540
Employment Status of Household Head (Ref: Self-employed)					
Salaried	0.290	0.025	132.526	0.000	1.336
Casual Worker	-0.191	0.018	116.824	0.000	0.826
Non-Working	0.164	0.021	61.361	0.000	1.178
Land Possessed (Ref: Landless)					
0.02 - 0.41 ha	-0.147	0.021	47.762	0.000	0.863
0.41 - 1.01 ha	-0.376	0.025	227.099	0.000	0.686
1.01 - 2.01 ha	-0.386	0.025	230.329	0.000	0.680
2.01 - 3.01 ha	-0.480	0.030	257.533	0.000	0.619
3.01 - 4.00 ha	-0.407	0.036	127.605	0.000	0.666
Greater than 4 ha	-0.418	0.030	187.836	0.000	0.659
Achievement Score	0.722	0.006	15262.675	0.000	2.058
Ln (MPCE)	0.948	0.041	537.177	0.000	2.581
State Fixed Effects (Ref: Bihar)					

Jammu & Kashmir	-1.302	0.057	515.710	0.000	0.272
Himachal Pradesh	-2.297	0.061	1418.206	0.000	0.101
Punjab	-0.980	0.049	407.517	0.000	0.375
Uttarakhand	-0.716	0.060	143.056	0.000	0.489
Haryana	-1.412	0.047	896.620	0.000	0.244
Rajasthan	-1.609	0.035	2098.908	0.000	0.200
Uttar Pradesh	-0.449	0.025	318.212	0.000	0.638
Assam	-1.114	0.036	982.251	0.000	0.328
West Bengal	-1.982	0.034	3359.549	0.000	0.138
Jharkhand	-0.745	0.048	238.954	0.000	0.475
Odisha	-1.105	0.039	808.534	0.000	0.331
Chhattisgarh	-1.671	0.059	808.233	0.000	0.188
Madhya Pradesh	-1.178	0.036	1084.348	0.000	0.308
Gujarat	-0.486	0.037	168.208	0.000	0.615
Maharashtra	0.099	0.031	10.519	0.001	1.104
Andhra Pradesh	0.909	0.039	536.134	0.000	2.483
Karnataka	0.956	0.040	566.258	0.000	2.602
Kerala	-1.758	0.044	1632.200	0.000	0.172
Tamil Nadu	0.719	0.037	379.435	0.000	2.053
Telangana	2.449	0.078	995.783	0.000	11.581
Constant	-5.339	0.135	1572.540	0.000	0.005
Number of observation	144993				
LR chi2 (42)	60365.346				
Prob > chi2	0.000				
-2 Log likelihood	140270.84				
Cox & Snell R Square	.341				
Nagelkerke R Square	.454				

Source: Estimated from unit level NSS 78th survey data on Multiple Indicator Survey (MIS), National Sample Survey Office, Ministry of Programme Implementation, Government of India

8. Conclusion

This paper aimed to analyze the influence of basic household amenities on the use of LPG as the primary cooking energy source. Our findings suggest that as household amenities score improve, so does the likelihood of using LPG. Interestingly, when compared with MPCE (Monthly Per Capita Expenditure), the amenities score proved to be a more significant determinant of LPG usage. Despite the steady increase in LPG use across Indian households, the goal of universal use of LPG for cooking remains elusive. While efforts are being made to expand LPG access, achieving full reliance on it will require addressing factors beyond just provisioning and availability. The exclusive use of LPG is closely associated with overall housing conditions, particularly kitchen infrastructure, which needs to be factored into policy initiatives. Therefore, to realize the goal of exclusive LPG use, it is essential to pursue the dual

objectives of improving both household amenities and access to LPG. Therefore an intervention in isolation needs imagination of potential attributes beyond the intervention itself.

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