

## Household Energy Use and Electricity Access in India: Patterns and Inequalities Across Regions and Sectors

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### ABSTRACT

Access to modern, clean energy sources such as LPG and electricity is central to India's inclusive economic development. Adoption of clean and modern energy is vital in achieving Sustainable Development Goal 7, i.e., 'ensuring access to affordable, reliable, sustainable and modern energy for all'. Over the past decade, India's energy policies have expanded electricity connections and promoted the widespread use of clean cooking fuels like LPG. However, dependence on traditional fuels such as wood, coal, and cow dung persists in some areas across states, regions, and sectors. This paper provides a descriptive assessment of household energy use and electricity across India using the National Family Health Survey (NFHS-5), 2019-21. The study explores the proportion of the population that relies on traditional fuels (such as firewood, dung cakes, crop residue, coal, and charcoal) and modern fuels (LPG, piped natural gas, biogas, and electricity) for cooking at national, regional, and sectoral, and state levels. The study further examines the proportion of the population with access to electricity for lighting purposes, raising questions about the barriers, such as affordability, infrastructure, or awareness, that hinder universal access. The findings show near-universal electrification across India, with 96.8% of households having electricity. The findings also reveal significant heterogeneity in fuel use across geography and settlement type. While modern fuel adoption has expanded, traditional biomass remains prevalent in rural areas and in several eastern and northern states, highlighting the need for tailored interventions.

**Keywords:** Clean Energy, Economic Development, Sustainable Development, LPG, Traditional Biomass.

### Introduction

Energy access is central to inclusive development, health and productivity. Residential energy in India is mainly used for lighting and cooking. Access to electricity for lighting enables education, communication and income-generating activities, while access to clean cooking fuels reduces exposure to household air pollution and saves time for other productive activities. Over the past decade, India's energy policies have expanded electricity connections and promoted the widespread use of clean cooking fuels like LPG. However, dependence on traditional fuels such as wood, coal, and cow dung persist in some areas across states, regions, and sectors. This paper provides a descriptive assessment of household energy use and electricity across India using the National Family Health Survey (NFHS-5), 2019-21. The findings show near-universal electrification across India, with 96.8% of households having electricity. The best-performing state is Goa with 100% household electrification, while even the lowest-performing large state, Uttar Pradesh, records a high 91.06% electricity access rate, reflecting substantial improvements in national electrification. However, access to clean cooking fuels is not complete. Only 56.2% of households in India use clean fuels for cooking, with a significant difference between urban and rural areas. In urban areas, 89.1% of households use clean cooking fuels, whereas in rural areas the percentage drops to 41%. The dispersion further widens in inter-regional comparisons. 51.1% of households in the northern regions still use traditional fuels, whereas only 18.1% of households in the

southern region do so. Adoption of modern fuels varies considerably across states. The highest shares of modern fuel use are observed in Delhi NCR (about 0.91), followed by Goa (around 2.9% traditional fuel use) and Chandigarh (4.61%), indicating very low reliance on biomass fuels in these areas. In contrast, several states remain highly dependent on traditional fuels. The largest shares of households relying on traditional fuels are found in Jharkhand (69.44%), Meghalaya (68.93%), and Chhattisgarh (67.38%).

The remainder of the paper is structured as follows. The next section presents a review of the literature on clean cooking fuels and their developmental significance. This is followed by a description of the data source and the methodological framework. The subsequent section discusses the empirical results and key findings. The penultimate section outlines the policy implications arising from the analysis, and the final section concludes the paper.

### Literature Review

The transition to clean energy in developing economies such as India is not merely an environmental objective but a fundamental development imperative. At the household level, energy use is closely tied to health, productivity, gender outcomes, and overall welfare. A large body of literature establishes that reliance on traditional fuels such as firewood, dung cakes, and crop residues is associated with low-quality living conditions, adverse health outcomes, and constrained economic opportunities (Sharma & Dash, 2022).

The importance of clean energy is most evident in the context of household air pollution. Traditional biomass combustion in inefficient stoves produces high levels of particulate matter and toxic pollutants, which are strongly linked to respiratory and cardiovascular diseases, premature mortality, and reduced life expectancy. Empirical evidence indicates that indoor air pollution disproportionately affects women and children, who spend more time in cooking environments. In India and other developing countries, millions of premature deaths are attributed to such exposure, underscoring the urgency of transitioning to clean fuels such as LPG, electricity, and biogas (Bruce et al., 2000; WHO, 2014; Sharma & Dash, 2022).

The broader significance of household energy choices lies in their aggregate implications. At scale, persistent reliance on traditional fuels undermines public health systems, contributes to environmental degradation through deforestation and emissions, and slows progress toward Sustainable Development Goal 7, which aims to ensure access to affordable, reliable, sustainable, and modern energy for all. Achieving this goal in India requires moving beyond infrastructure provision toward ensuring affordability, accessibility, and behavioural adoption of clean energy.

### Data Source

This study uses the National Family Health Survey (NFHS-5) (2019–21), India's nationally representative Demographic and Health Survey. NFHS-5 was conducted under the stewardship of the Ministry of Health and Family Welfare, with the International Institute for Population Sciences as the designated nodal agency. NFHS-5 was completed in 707 districts and provides state- and national-level estimates across population, health, and household characteristics. The survey follows a two-stage stratified sampling design, ensuring representativeness at national, state, and urban–rural levels. This study uses household-level information on primary cooking fuel and electricity access to analyse patterns of household energy use in India. NFHS-5 household sampling weights are applied to ensure nationally representative estimates.

### Methodology

The study adopts a descriptive analytical approach to examine patterns of household energy use and electricity access in India. Cooking fuels are classified into two categories following standard energy transition frameworks. **Traditional fuels** include biomass-based and polluting fuels such as wood, crop residue, straw, charcoal, coal, kerosene, and animal dung. **Modern fuels** include relatively cleaner and commercially supplied energy sources such as LPG, electricity, and biogas.

The analysis focuses on the percentage distribution of households using traditional and modern fuels, as well as the proportion of households with access to electricity. Estimates are presented at multiple levels of aggregation to capture spatial disparities. Specifically, results are reported for the national level, across four geographic regions (North, South, East, and West), states, and by sector (urban and rural households). The division of regions is based on the geographic location of the states, as shown in figure 1.

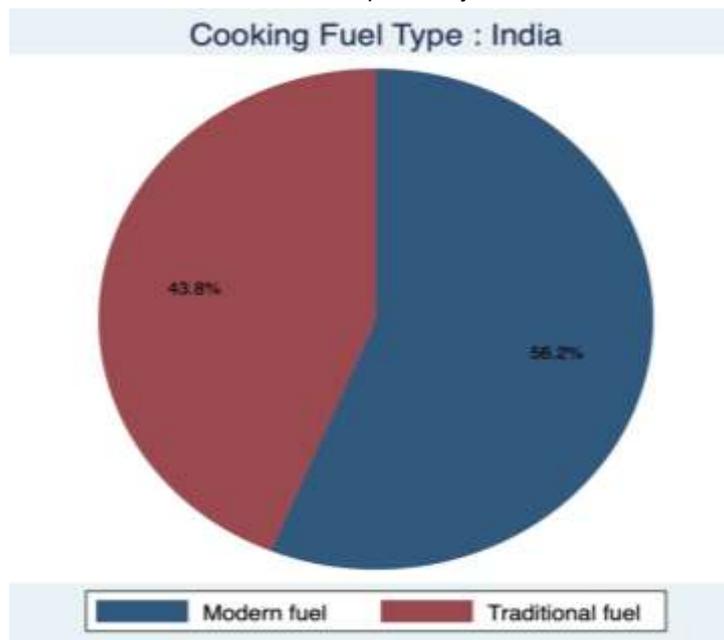


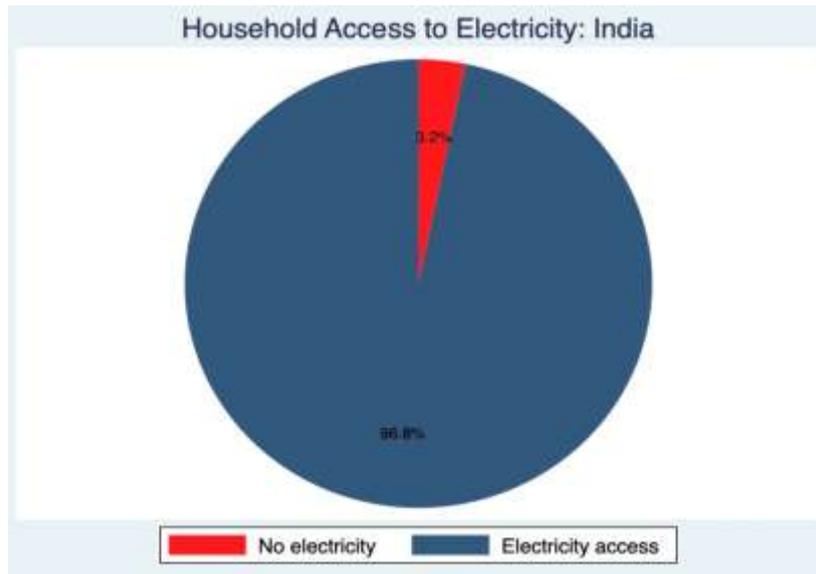
Figure 1: Division of States According to Geographical Regions

Results and Discussions

National Patterns and Sectoral Inequality

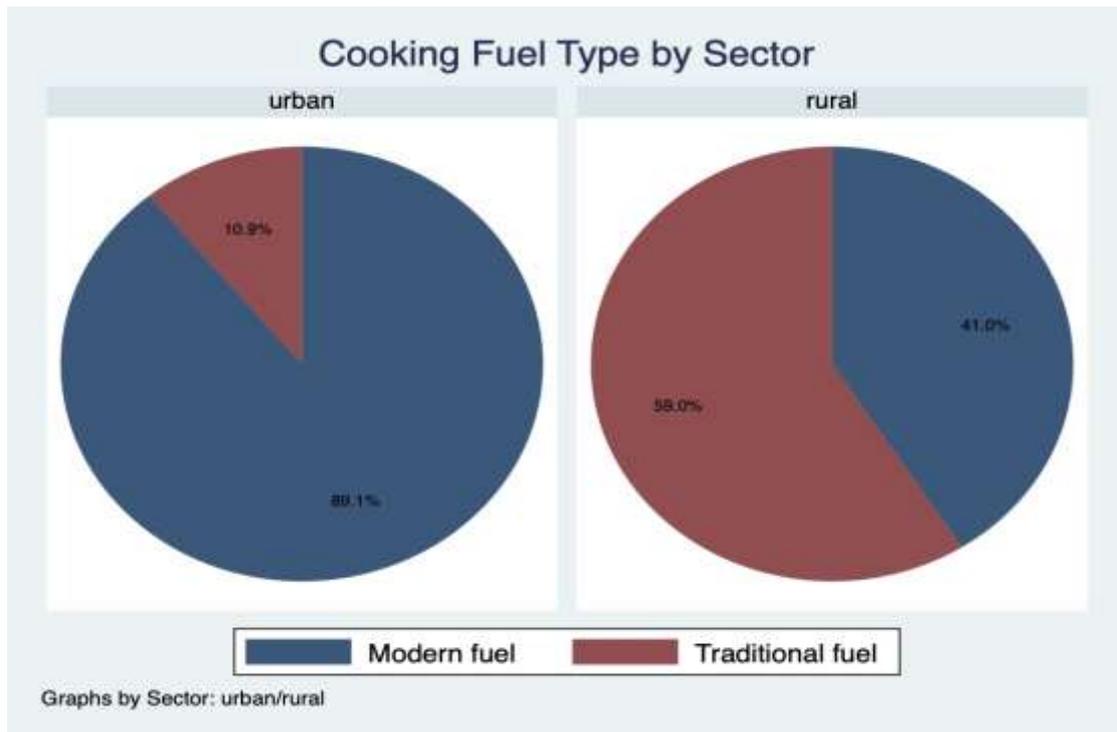
Figure 2 indicates that household electrification in India has reached near-universal levels, with **96.8% of households having access to electricity**. This access is almost complete in urban areas (**99.1%**) and remains high in rural areas (**95.7%**), reflecting substantial progress in expanding electricity infrastructure nationwide. In contrast, the adoption of clean cooking fuels remains considerably lower and exhibits pronounced sectoral disparities. Only **56.2% of households** use clean fuels for cooking, with a stark rural–urban divide: **89.1% in urban areas** compared to just **41% in rural areas**.





**Figure 2: Cooking Fuel and Electricity usage in India**

These findings underscore that, while electrification has largely been achieved, the transition to clean cooking energy remains incomplete and uneven. The extent of these sectoral disparities in both cooking fuel use and electricity access is further illustrated in Figures 3 and 4, respectively. National averages can mask large subnational disparities, and one needs to look at disaggregated levels for a clearer picture of the actual situation. Therefore, the following sections focus on regional and state-wise disparities of clean household energy access.



**Figure 3: Cooking fuel usage by sector**

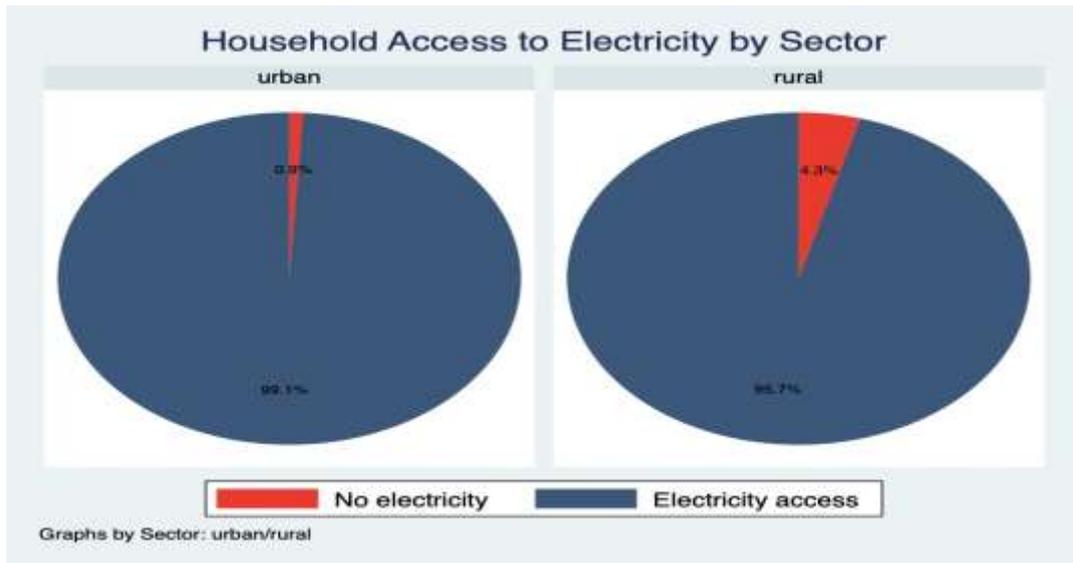


Figure 4: Electricity usage by Sector

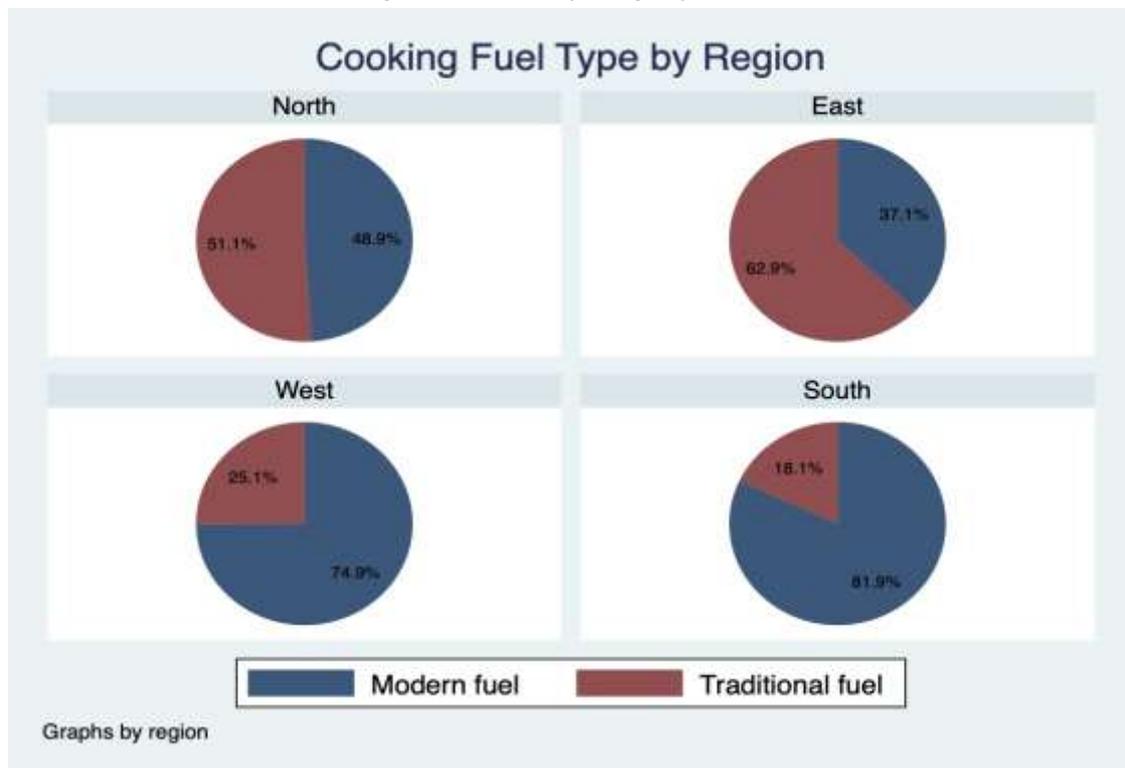


Figure 4: Cooking Fuel: Regional Variation

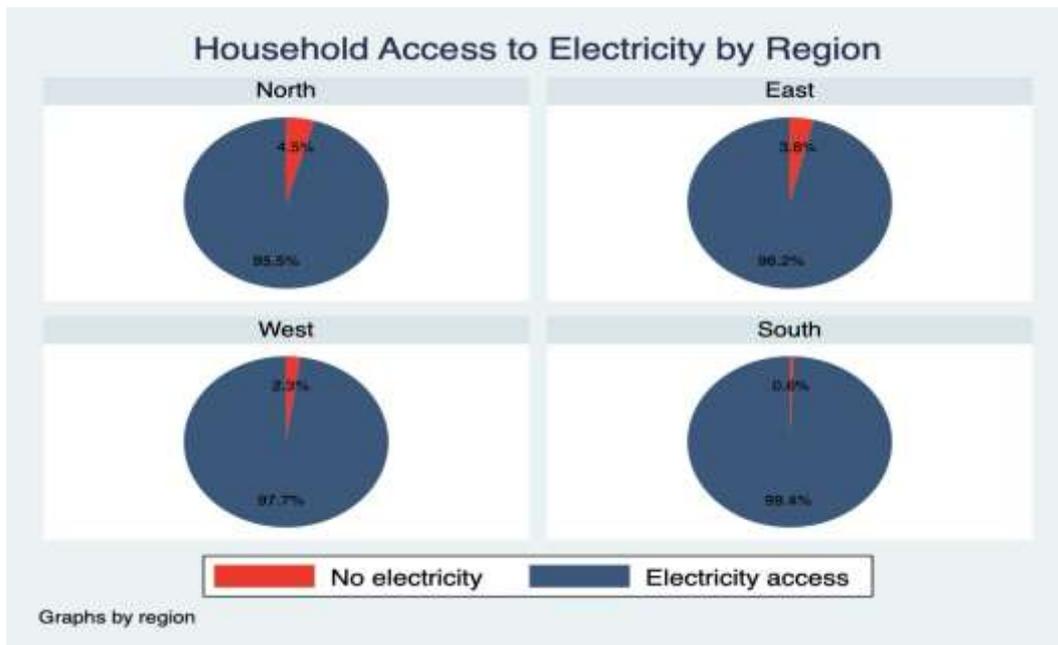


Figure 4: Cooking fuel: regional variation

#### Regional Patterns

The regional distribution of household energy use (Figure 4) reveals substantial disparities in access to modern cooking fuels across India. The Eastern region emerges as the poorest performer, with only **37.1% of households** using modern cooking fuels, indicating a continued reliance on traditional biomass. This is followed by the Northern region, where **48.9% of households** use modern fuels, suggesting that nearly half of the population still relies on traditional cooking fuels. In contrast, the Western and Southern regions demonstrate significantly higher transition rates, with **74.9% and 81.9% of households**, respectively, relying on modern cooking fuels. The Southern region, in particular, stands out as the best-performing region in terms of clean cooking fuel adoption.

A similar regional pattern is observed in electricity access (Figure 5); however, the differences are considerably narrower in magnitude. Electricity access is high across all regions, reflecting substantial progress in electrification. The Northern region records **95.5% household access to electricity**, while the Eastern region performs slightly better at **96.2%**. The Western region reports **97.7% access**, and the Southern region again leads with **99.4% of households having access to electricity**.

#### State-wise Results

Table 1 tabulates state-wise access to electricity and clean cooking fuels. State-level evidence reveals a striking contrast in electricity access and clean cooking fuel adoption across India. Electricity access is nearly universal in most states, with several states such as Goa, Punjab, Chandigarh, and Kerala reporting access rates above 99%, indicating substantial progress in electrification. Even relatively lower-performing states such as Uttar Pradesh (91.06%), Meghalaya (91.94%), and Assam (92.58%) demonstrate high coverage, suggesting that electricity access has reached near saturation levels across the country.

Table 1: State-wise access to electricity and clean cooking fuel

States	Access to Electricity(%)	Access to Clean Cooking Fuel(%)
Jammu & kashmir	99.26	67.29
Himachal pradesh	99.46	47.30
Punjab	99.68	75.16
Chandigarh	99.85	95.39
Uttarakhand	99.60	57.49
Haryana	99.62	56.09
NCT of delhi	99.87	99.09

Rajasthan	98.14	39.45
Uttar pradesh	91.06	47.87
Bihar	96.31	36.75
Sikkim	99.29	76.79
Arunachal pradesh	94.79	51.79
Nagaland	98.56	43.20
Manipur	98.09	71.19
Mizoram	98.13	83.29
Tripura	98.19	43.84
Meghalaya	91.94	31.07
Assam	92.58	39.64
West bengal	97.48	38.29
Jharkhand	94.37	30.56
Odisha	97.01	34.61
Chhattisgarh	98.79	32.62
Madhya pradesh	98.42	39.27
Gujarat	97.55	64.93
Dadra haveli and daman & diu	99.66	77.10
Maharashtra	97.80	79.60
Andhra pradesh	99.45	83.72
Karnataka	99.12	78.06
Goa	100.00	97.21
Lakshadweep	99.78	57.27
Kerala	99.61	71.92
Tamil nadu	99.35	84.27
Puducherry	99.87	94.14
Andaman & nicobar islands	97.58	80.02
Telangana	99.59	92.20
Ladakh	99.44	75.28

In contrast, access to clean cooking fuels shows considerable variation and remains significantly lower. Urbanised and economically advanced regions such as Delhi NCR (99.09%), Goa (97.21%), Chandigarh (95.39%), and Puducherry (94.14%) exhibit very high adoption of clean fuels. However, several states, particularly in the eastern and northeastern regions, lag behind, including Jharkhand (30.56%), Meghalaya (31.07%), Chhattisgarh (32.62%), Odisha (34.61%), and Bihar (36.75%). This divergence indicates that while India has largely succeeded in expanding electricity infrastructure, the transition to clean cooking energy remains uneven and strongly influenced by regional and socioeconomic factors

### Policy Implication

India has largely established the foundational infrastructure required for universal household energy access. The policy focus must now **shift from expanding connections to ensuring quality, reliability, and sustained usage** of modern energy services. In the case of electrification, this requires prioritising improvements in supply reliability, voltage stability, and effective grievance redressal mechanisms, particularly in rural and peri-urban areas where service interruptions can constrain productive use and limit the feasibility of electric cooking (Sedai et al., 2021).

Similarly, while significant, the expansion of LPG connections has not fully translated into sustained clean fuel use. Addressing the **affordability of LPG refills** remains critical, especially for low-income and rural households. Bridging this affordability gap is essential to reduce reliance on traditional biomass fuels and promote the exclusive use of clean cooking energy.

The persistence of high dependence on traditional fuels in states such as Jharkhand, Odisha, Chhattisgarh, and Meghalaya highlights the need for **region-specific policy interventions**. These may include strengthening last-mile LPG distribution networks, implementing targeted behaviour change campaigns to raise awareness about the health risks of household air pollution, and promoting alternative clean cooking solutions such as electric cooking in areas with reliable electricity supply. Such interventions are particularly relevant given the substantial health burden associated with the use of solid fuels, as highlighted by the World Health Organisation (WHO, 2025).

Overall, a transition toward modern household energy systems in India requires a coordinated policy approach that integrates infrastructure development with affordability, reliability, and behavioural dimensions of energy use.

### Conclusion

The analysis provides clear evidence that India has made substantial progress in expanding household energy access, particularly in achieving near-universal electricity coverage across states. High levels of electrification, even in relatively lower-performing regions, reflect the success of recent public policy initiatives in strengthening energy infrastructure and ensuring broad-based access. However, the transition to modern cooking fuels remains incomplete and uneven, with significant variation across states, regions, and sectors. While highly urbanised areas exhibit high adoption of clean fuels, several states in eastern and northern regions rely heavily on traditional biomass, indicating persistent structural and socioeconomic constraints.

The coexistence of widespread electricity access and continued dependence on traditional cooking fuels highlights the multidimensional nature of household energy use in India. In particular, the pronounced rural–urban divide suggests that access alone is insufficient to ensure a complete transition to modern energy, as affordability, availability, and sustained usage remain critical determinants. Regional disparities further reinforce the need for geographically differentiated policy approaches.

Overall, the findings underscore that India is undergoing a gradual but incomplete transition toward modern household energy systems. Continued policy efforts to enhance affordability, improve supply chains, and promote sustained adoption of clean cooking fuels, especially in rural and lagging regions, will be essential to achieving inclusive energy access.

India has laid the core infrastructure and delivery architecture for universal electricity access; the next step is to deepen *quality and sustained use*. There is a need to improve the adoption of clean cooking gas, which can be achieved by increasing affordability for people, strengthening supply chains, and providing last-mile support, especially in poorer, rural, and eastern/northern regions.

### Limitations

NFHS records only the primary cooking fuel used by households and therefore does not adequately capture the complexity of fuel use behaviour. In practice, many households engage in fuel stacking, simultaneously using multiple fuels for different purposes, and seasonal switching based on availability and cost. The survey also does not provide information on the quantity or intensity of fuel consumption, which limits the ability to assess the depth of reliance on traditional versus modern energy sources.

Similarly, electricity access in NFHS is measured in terms of availability or connection status, rather than the quality and reliability of supply. It does not capture important dimensions such as hours of supply, outage frequency, or voltage stability, all of which are critical for the effective and productive use of electricity, including the transition toward electric cooking.

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