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Clean Cooking for Cleaner Air

LPG and Beyond in the Indo-Gangetic Plain

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CEEW researchers consulted biogas users extensively for insights on cooking with this fuel type.

Image: iStock

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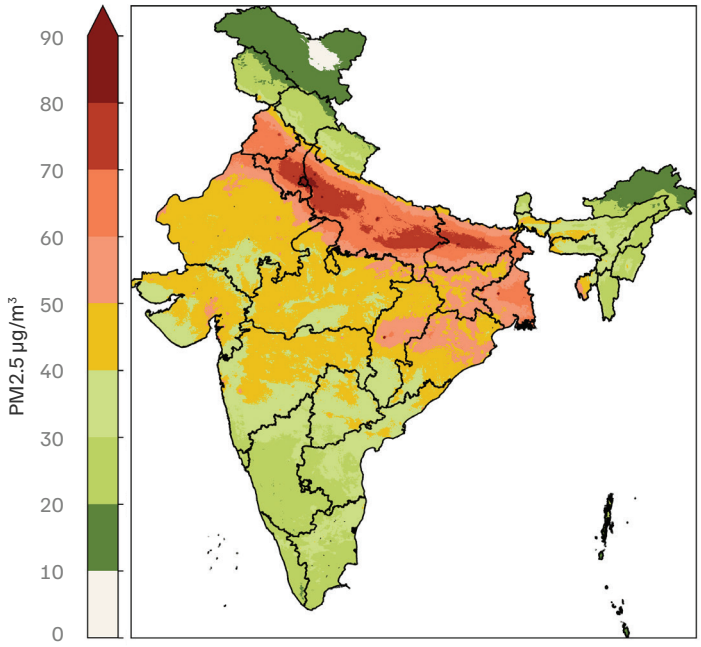
Executive summary

The Indo-Gangetic Plain (IGP) is India's most polluted region. Large parts of the IGP had annual mean PM2.5 levels above 80 µg/m^3 in 2019 (Venkataraman et al. 2024), more than twice India's annual National Ambient Air Quality Standard (NAAQS) of 40 µg/m^3 (CPCB 2009) and more than 16 times the World Health Organization (WHO) annual guideline of 5 µg/m^3 (WHO 2021). Figure ES1 illustrates the spatial distribution of annual mean PM2.5 concentrations across India in 2023, highlighting the concentration of pollution in the IGP. Against this backdrop of persistently high pollution around the year, hourly PM2.5 levels have exceeded 500 µg/m^3 during extreme episodes (Agarwal et al. 2024). Household burning of firewood and other solid fuels for cooking, heating and lighting is a major source of these PM2.5 emissions in the IGP, particularly in winter (Venkataraman et al. 2024). It also contributes to household air pollution (HAP), exposing household members directly to harmful smoke (Chowdhury et al. 2019; Chatterjee et al. 2023).

Despite being one of the major contributors to ambient air pollution, cooking has remained largely absent from mainstream discussions on air quality in India. This biomass burning is a major health and economic challenge.

Figure ES1. The IGP region had the highest annual PM2.5 concentration in India in 2023



Source: Authors' analysis from SatPM2.5 (Satellite-derived PM2.5), 2023 Washington University (2025).

Because PM2.5 emissions are not limited to administrative boundaries such as state, municipal, or panchayat, city- or state-level interventions are insufficient: **the challenge is regional and it requires a broader, airshed-level intervention to move kitchens to sustained clean cooking fuel use.**

The Government of India (GoI) introduced the Pradhan Mantri Ujjwala Yojana (PMUY) in May 2016 to provide economically weaker households with free LPG connections. Access to LPG has expanded, but it has not translated into sustained use. The IGP, home to about 9 per cent of global and 40 per cent of India's population (Centre for Science and Environment 2025), is one of the poorest regions in the country. Financial, supply, and behavioural barriers continue to limit the sustained use of LPG and other clean fuels such as electric cooking and biogas (Kar et al. 2024; Auddy and Das 2026; Das et al. 2026; Kar and Gill 2026). High population, deep socio-economic deprivation, and poor air quality are a triple burden, making air quality improvement not merely beneficial but imperative. **Solving the clean cooking problem is not only a health and economic imperative but also an environmental one as cooking fuel decisions in millions of Indian kitchens shape air quality at the national scale.**

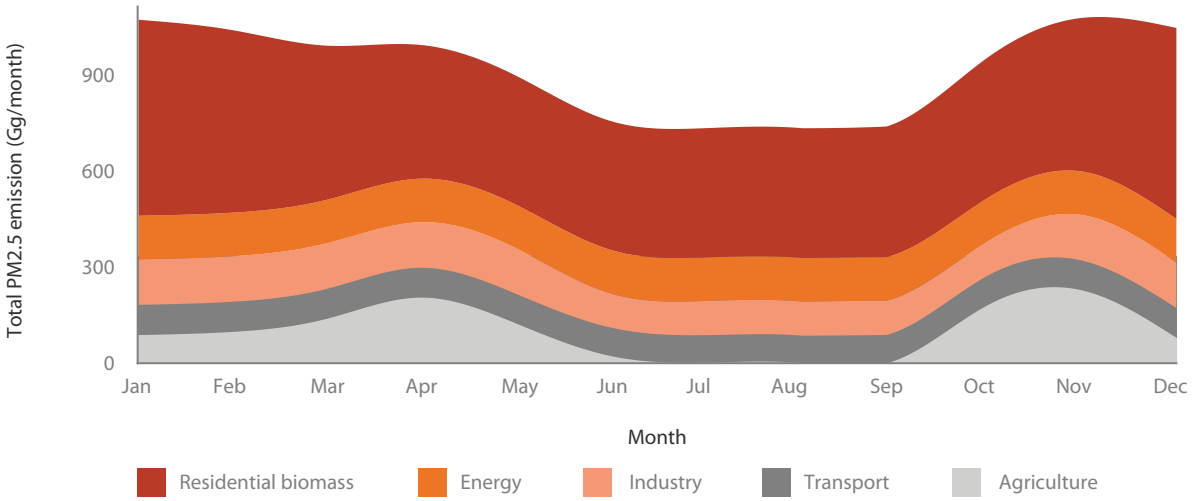
Also, while PMUY has anchored India's clean cooking transition over the past decade (Box 1), this progress has rested on an imported fuel. LPG consumption fell by about 8 per cent in January–June 2026 compared with the same period in 2025 (PPAC 2026b). A scarce and costlier LPG makes low-income households, including PMUY beneficiaries, more likely to revert to polluting fuels such as firewood and kerosene, reversing a decade of progress. Households outside the PMUY are even more exposed because they pay the full or higher informal-market price for LPG: in a CEEW survey across ten cities, only about 4 per cent of LPG-using migrant workers were PMUY beneficiaries, and 79 per cent relied on informal connections (Auddy et al. 2026). Extending PMUY to these groups is therefore the first step towards protecting and building on these gains.

At the same time, India faces a genuine dilemma: greater LPG use by PMUY beneficiaries, in place of firewood, would improve air quality and health outcomes but raise import bills and risk supply exposure to conflict zone.

Key findings

- **Our scenario-based analysis finds that, in 2025 alone, PMUY led to a reduction of around 15 per cent of residential PM2.5 emissions and around 4 per cent of residential black carbon (BC) emissions across India.** Against a conservative counterfactual, India's LPG sales without PMUY would have been 34 million metric tonnes (MMT) lower. The scheme also displaced nearly 510 million tonnes of firewood between FY 2016-17 and FY 2025-26, avoiding an estimated cumulative total of approximately 4,963 kilotonnes (kt) of PM2.5 and 132 kt of BC emissions over the decade.
- **Cooking accounts for at least 36 per cent of primary PM2.5 emissions in the most polluted airsheds of the IGP.** Venkataraman et al. (2024) divide India into eight bands by annual mean PM2.5 concentration. The most polluted parts of the IGP, stretching from Punjab in the west through Haryana, Delhi, Uttar Pradesh and Bihar to West Bengal in the east, fall into the two highest bands (80–110 and 110–140 μg/m^3). In both, cooking is the single largest individual source of primary PM2.5 emissions (authors' analysis of data shared by Venkataraman et al.). These findings underscore the importance of transitioning away from polluting cooking fuels as a central component of airshed-level air quality management in the IGP.

Figure ES2. At an all-India level, the residential sector accounts for a large share of the total PM2.5 emissions throughout the year



Source: Authors' analysis using data from Venkataraman et al. 2024.
Note: Gg/month means gigagrams per month; 1 Gigagram = 1,000 tonnes = 1,000,000 kg.

Recommendations

This research proposes a supplementary policy to directly target and reduce the PM2.5 contributions from the residential sector across the IGP in a phased approach. The recommendations are listed below:

1. Expand the PMUY to include vulnerable population groups

First, oil marketing companies (OMCs) and the Ministry of Petroleum and Natural Gas (MoPNG) should undertake targeted identification and PMUY enrolment drives in urban informal settlements, where households use biomass for cooking or purchase LPG cylinders from the informal market. The PMUY connection would allow them access to LPG refills at a lower cost and help them transition towards exclusive usage.

For rural regions, OMC-level data or local distributor networks can provide information about villages with low penetration or low LPG refills. The drive would identify eligible households for priority enrolment or conversion into PMUY.

The enrolment should proceed in phases, beginning with the urban poor in million-plus cities (MPCs) in the National Capital Region (NCR), expanding to other major urban regions in the IGP, and finally extending to all rural regions of the IGP.

2. Provide PMUY beneficiaries a winter subsidy

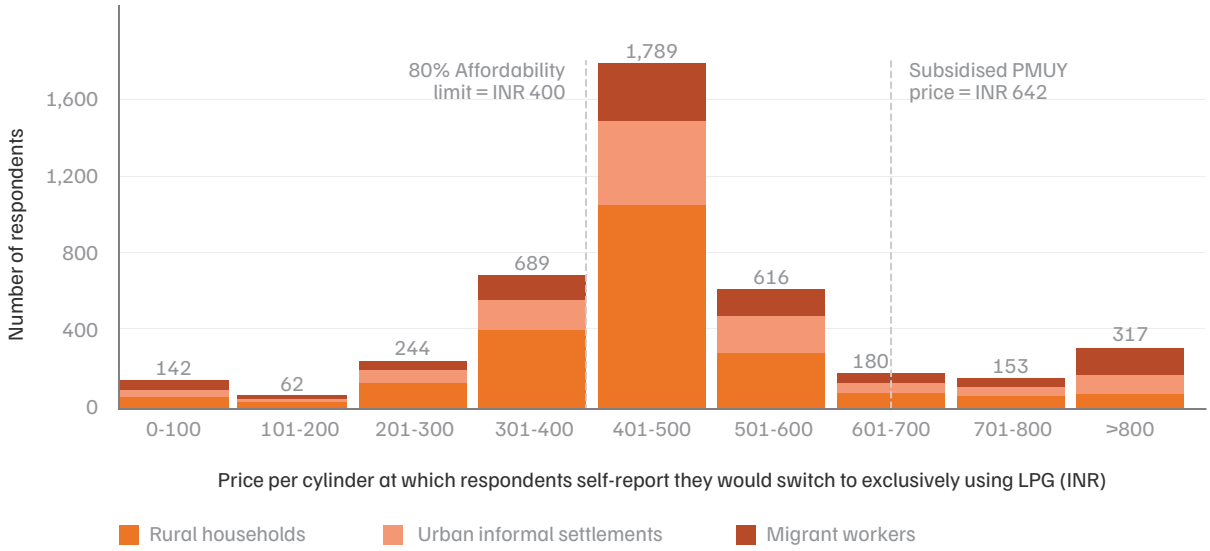
To use LPG exclusively, a typical household needs 7-8 LPG cylinders per year (Kar et al. 2019; Mani et al. 2021). Accordingly, over the six winter months (October–March), when pollution levels are elevated across the IGP, a household would need at least four cylinders. Currently, the MoPNG provides a subsidy of INR 300 per cylinder to PMUY consumers[1] capped at four cylinders annually. **We recommend an air quality improvement–linked top-up subsidy of INR 200 per cylinder for 4 cylinders during these six winter months** for the IGP states.

We assume INR 600 as a reference price for a PMUY-subsidised LPG cylinder, reflecting price fluctuations between INR 553 and INR 642 over the past year. The proposed additional winter subsidy of INR 200 would bring this illustrative price to INR 400 per cylinder. A CEEW survey found that 80 per cent of respondents self-reported willingness to use LPG exclusively at this price (Figure ES3) (Das et al. 2026; Borgohain et al. 2026; Auddy et al. 2026). At the present retail price of INR 942 in New Delhi (as of 30 September 2026), however, the effective price, after the PMUY and the additional subsidy, would be INR 442.

Field interactions have also consistently shown prices at or below INR 500 as an informal affordability threshold among PMUY households.

[1] As of June 2026, the number of cylinders eligible annually for PMUY subsidy has been restricted to 4 cylinders.

Figure ES3. At a price of INR 400, 80% of respondents self-report that they would move to exclusively using LPG for their cooking needs



Source: Authors' analysis from CEEW survey data (Das et al. 2026; Borgohain et al. 2026; Auddy et al. 2026).
Note: (a) Data presented are drawn from a larger CEEW survey (~ 4,000 households) on Willingness-to-pay (WTP) for LPG use among migrants, urban informal settlements, and rural households. (b) Households that did not use LPG during the survey were asked about their WTP to start using LPG in the future as an exclusive fuel for cooking. (c) The 80 per cent affordability limit is the 20th percentile of the WTP responses. (d) During the survey, between November 2024 and January 2025, the retail price of an LPG cylinder (14.2 kg) was ~INR 803 (considering retail price for Delhi). If we consider a PMUY subsidy of INR 300, the effective subsidised price of LPG is INR 503. Presently, the average retail price has increased to INR 942, following 3 price increments: INR 50 price hike in April 2025, INR 60 price hike in March 2026, and INR 29 price hike in June 2026. As a result, the subsidised price for PMUY users is ~INR 642.

If the GoI continues to restrict the PMUY subsidy to four cylinders, imposed during the West Asia crisis, we recommend that the state governments in the IGP provide a subsidy equivalent to the present PMUY subsidy of INR 300 per cylinder for at least two cylinders during the six non-winter months (April to September). This would make primary use of LPG affordable, while also delivering health and environment gains.

As a pan-India policy, this subsidy can be geography-neutral, and **any airshed where the annual average of PM2.5 breaches a specific standard, for example, 60 µg/m^3 (i.e., 1.5 times India's annual NAAQS of 40 µg/m^3), the winter subsidy would be applicable.**

Additionally, to manage fiscal risk from global price volatility, the winter top-up should be fixed at INR 200 per cylinder and not linked to changes in the retail price. This keeps the fiscal outlay predictable even if the retail price of LPG rises further.

3. Make provision for a capital subsidy for the purchase of e-cooking devices

The 2026 crisis in West Asia underscores the urgent need to diversify India's cooking energy mix. As the higher use of LPG—to encourage a lower use of firewood in the winter months—raises the import bill, efforts should be made to introduce electric cooking and other clean cooking fuels.

We recommend that the MoPNG take the initiative to transition the 25,000+ LPG distributors into clean cooking hubs. OMCs should procure BIS-certified e-cooking devices in bulk and supply them to distributors, who would stock and sell them to consumers.

At the household level, **any PMUY household can opt to purchase an e-cooking device from its LPG distributor at a discounted cost, conditional on permanently giving up two of its MoPNG-subsidised cylinders a year.** At the current MoPNG entitlement of four cylinders a year, the household would receive two subsidised cylinders a year. In the IGP states, if these households buy their two subsidised cylinders during the winter months (October–March), they will also be eligible for the INR 200 top-up per cylinder, and they remain eligible for any state government-funded cylinder schemes on the same terms as other PMUY households. If 20 per cent of all PMUY households that use four or more cylinders a year opt in[2], the subsidy saved and under-recoveries avoided would total about INR 2,500 crore a year, which would be net savings for the OMCs and the exchequer, once the device cost is recovered.

4. Reimagine the LPG subsidy as a fuel- and technology-neutral subsidy for clean cooking

While LPG remains the mainstay for India's clean cooking fuel journey (Kar et al. 2023), high reliance on a single fuel exposes vulnerable populations to price volatility, supply shocks, and possible rebound to solid fuels (Ali 2025; Shukla 2026).

The conflict in West Asia triggered temporary and localised LPG shortages across India and highlighted the fragility of its clean cooking transition because, historically, almost two-thirds of the country's LPG demand has relied on imports from West Asia, routed through the vulnerable chokepoint of the Strait of Hormuz (Lok Sabha 2026, Kar and Auddy 2026).

Several consumers have already shifted to electric cooking amid the LPG shortage. However, electric cooking has its own set of scale-up challenges: deliberate investments are required in household electric wiring and kitchen infrastructure, induction-compatible cookware, and targeted financial support for low-income households (Auddy and Das 2026). India's clean cooking mix must, therefore, diversify and government financial support should in principle be technology neutral. The GoI has fast-tracked PNG installations - installing connections for 5.8 lakh new households in March 2026 alone (Economic Times 2026). However, PNG will not offer the most relevant transition pathway from LPG, especially for socially and economically marginalised urban informal settlements and rural areas.

Here, biogas offers a third pathway, especially in the IGP, similar to India's dairy-dense corridors like Gujarat, Punjab, Rajasthan, Maharashtra, Tamil Nadu, and Uttar Pradesh. There are approximately 40 million cattle-rearing households in India with three or more animals, which are well-suited for a transition to biogas (Jain et al. 2026); yet, adoption remains below 1 per cent, held back by high upfront capital costs of INR 35,000–50,000 per biodigester. Shifting only 25 per cent of these households (10 million households) could save up to INR 2,000 crore annually in LPG under-recovery (Kar and Gill 2026).

The current PMUY subsidy is fuel-specific and traditionally tied to LPG. India should now reimagine a technology-neutral clean cooking subsidy that enables beneficiaries to choose between the various available fuel pathways based on local resource and infrastructure availability and household preferences. For the IGP in particular, such a redesign would not only ensure better air quality and health, but also reduce imports, and improve energy security.

Since the IGP is the most polluted airshed in India, this Policy Brief is directly targeted at it. In principle, however, the recommendations are largely airshed-neutral - they would apply equally to any airshed experiencing worsening air quality.

[2] PMUY consumers use 4.8 cylinders a year on average (PPAC 2026a). Since the average is above four, a substantial share of PMUY households is likely to use four or more cylinders a year, though some use fewer. We therefore take 20 per cent as a conservative assumption for the share of PMUY households that both use four or more cylinders a year and opt in to the scheme.

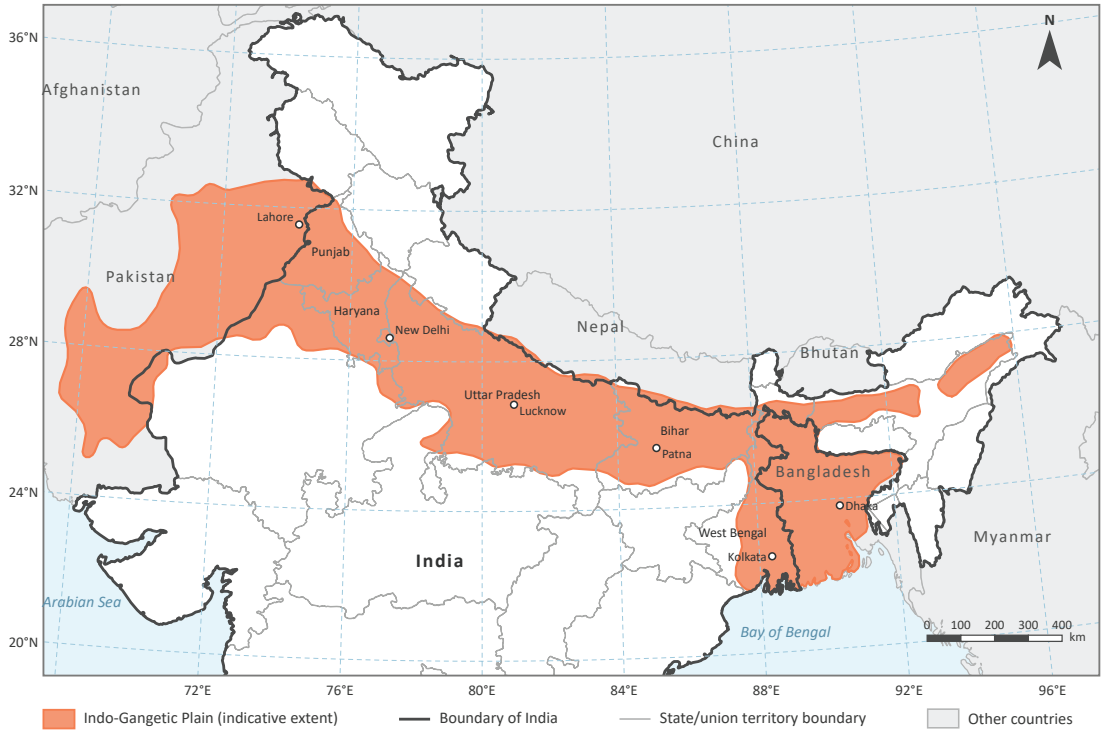
1. What is the extent of the air pollution problem in the Indo-Gangetic Plain?

In India, air pollution is now the second leading risk factor for early deaths. Deaths attributable to air pollution accounted for around 18 per cent of all deaths in India in 2019 (India State-Level Disease Burden Initiative Air Pollution Collaborators 2021), and numbered more than 2 million in 2023 (HEI 2025).

Poor air quality affects the economy through direct pathways, such as premature mortality and work absences due to illness, and indirect pathways, such as reduced productivity at work, lower consumer footfall and spending, and reduced asset productivity. Air pollution is also associated with significant economic loss: Indian businesses are estimated to lose INR 7 lakh crore (equivalent to 3 per cent of India's gross domestic product) due to air pollution every year (Clean Air Fund 2021).

Within India, the Indo-Gangetic Plain (IGP) is the most polluted stretch of land and the most concerning pollution hotspot (Figure 1). Due to the unique geographical features of this region, this 'giant valley' traps a significant amount of particulate matter (Dey et al. 2020).

Figure 1. Extent of the Indo-Gangetic Plain, a low-lying alluvial plain bounded by the Himalayas to the north and the central Indian highlands to the south



Source: Authors' analysis based on Survey of India (2026), Lehner and Grill (2013), Mapzen (2026) and Natural Earth (2026).

Note: The extent of the Indo-Gangetic Plain is indicative. It has been generalised from land at or below 300 metres elevation with low local relief, within the river basins of the Indus, Ghaggar-Hakra and Ganga-Brahmaputra-Meghna, and the Hooghly delta. Boundaries of India are as per the Political Map of India, Thirteenth Edition (Survey of India 2026).

Annual average PM2.5 concentrations across several IGP states exceed both India's annual NAAQS of 40 micrograms per cubic metre (μg/m^3) (CPCB 2009) and the WHO annual guideline of 5 μg/m^3 (WHO 2021). Large parts of the IGP had annual mean PM2.5 levels above 80 μg/m^3 in 2019 (Venkataraman et al. 2024). During extreme pollution episodes, hourly PM2.5 levels even exceed 500 μg/m^3 (Venkataraman et al. 2018; Agarwal et al. 2024). However, extreme exceedance pockets are limited to Bihar, Uttar Pradesh, and Punjab (Venkataraman et al. 2024).

The IGP is also one of the poorest regions in the country. Bihar and Uttar Pradesh—two of the most populous states in the IGP—rank among the poorest in the country, according to the National Multidimensional Poverty Index report. The poverty rate is 34 per cent in Bihar and 23 per cent in Uttar Pradesh (NITI Aayog 2023a).

The IGP is also home to nearly 9 per cent of the global population and 40 per cent of India's total population (Centre for Science and Environment 2025). The high population, deep socio-economic deprivation, and poor air quality creates a triple burden - making improvement in air quality not only beneficial but imperative.

2. Airshed-level governance is important in solving air pollution

Emissions of PM2.5 are not confined to the administrative boundaries of states or even municipalities and panchayats within state boundaries, and so city-level interventions are insufficient to address the issue (Suryanarayanan and Rafiuddin 2026); for example, Delhi would find it extremely difficult to solve its persistent wintertime pollution through localised measures. A broader, airshed-level intervention is required to manage the air quality (Ghosh et al. 2023; Guttikunda 2024; Venkataraman et al. 2024; Ghosh and Krishna 2024; Suryanarayanan and Rafiuddin 2026). These airshed level interventions also have localised benefits—in Delhi, for example, airshed-scale mitigation could lower PM2.5 concentrations by 30 per cent (Nandi et al. 2026).

A model of this kind of regional management already exists for a limited geography within the IGP: the Commission for Air Quality Management in National Capital Region and Adjoining Areas (CAQM) was established to coordinate and implement pollution control measures in the NCR and adjoining areas (CAQM 2026). A similar, unified management approach is necessary for the IGP, which the government recognises as behaving like a 'giant single airshed' during certain times of the year (Rajya Sabha 2023).

This broader governance strategy is already being operationalised: a 'joint committee' has been constituted to provide the government with specific airshed-level interventions (Rajya Sabha 2023; Vishnoi 2024). Further, through the National Clean Air Programme (NCAP), the GoI has directed states and union territories to develop state action plans based on an airshed approach (Rajya Sabha 2023).

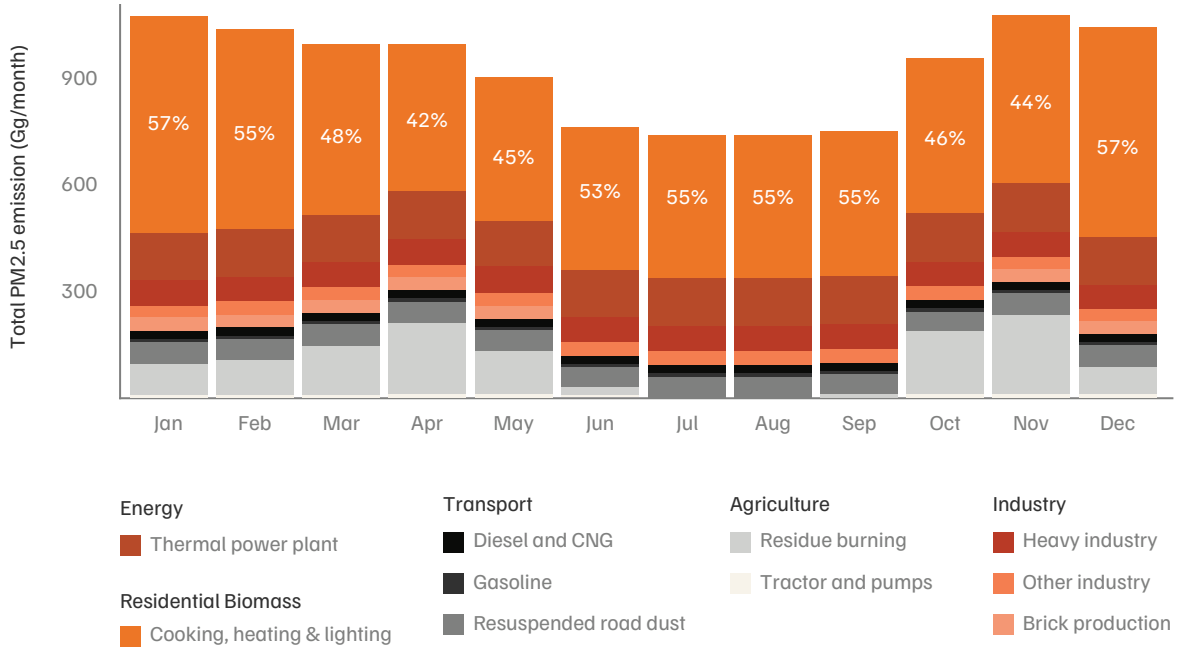
3. Residential biomass burning contributes significantly to air pollution in the IGP

Residential pollution, commonly referred to as HAP, originates from regular household activities–cooking, heating, and lighting–that use inefficient methods to combust traditional fuels. The 'polluting fuels' are biomass (firewood, wood, charcoal, crop residues, and animal dung/cow dung); coal, and kerosene (often used for cooking and lighting).

Cooking accounts for 80 per cent of total residential energy consumption, and the remaining 20 per cent is used for non-cooking activities, such as heating and lighting (Navinya et al. 2023). Research and related datasets rarely separate these activities, and so 'residential emissions' is commonly used as a stand-in (proxy) for cooking-related pollution.

Residential combustion contributes significantly to total PM2.5 emissions year-round in India and these emissions increase during winter months (Figure 2) (Venkataraman et al. 2024). The PM2.5 emissions generated from residential combustion have been consistently cited as the largest single source contributor–in terms of total raw emissions, ambient concentrations, or attributable mortality–in the IGP (Chatterjee et al. 2023; Conibear et al. 2018; Chowdhury et al. 2019).

Figure 2. Residential biomass burning contributes significantly to total PM2.5 emissions year-round in India and emissions increase during winter months



Source: Authors' analysis using data from Venkataraman et al. 2024.

Note: Gg/month means Gigagrams per month; 1 Gigagram = 1,000 tonnes = 1,000,000 kg.

Residential combustion is a major source of PM2.5 across the IGP, but studies measure it in different ways. Venkataraman et al. (2024) divided India into eight bands by annual mean PM2.5 concentration. The highly polluted parts of the IGP, stretching from Punjab in the west through Haryana, Delhi, Uttar Pradesh and Bihar to West Bengal in the east, fall into the two highest bands. Cooking is the single largest individual source of primary PM2.5 emissions in both of these bands, accounting for 36 per cent in the 80-110 µg/m^3 band and 49 per cent in the 110-140 µg/m^3 band (authors' analysis based on data shared by Venkataraman et al.). Some studies also model deaths attributable to ambient PM2.5. In Delhi, Uttar Pradesh and Haryana, where annual mean PM2.5 is above 95 µg/m^3, residential combustion accounts for 35-39 per cent of such deaths (Chatterjee et al. 2023). Further, a few studies also offer city-level analysis. In Delhi, for example, biomass burning accounted for 24 per cent of PM2.5 concentrations during the 2022-23 winter (Rajya Sabha 2025).

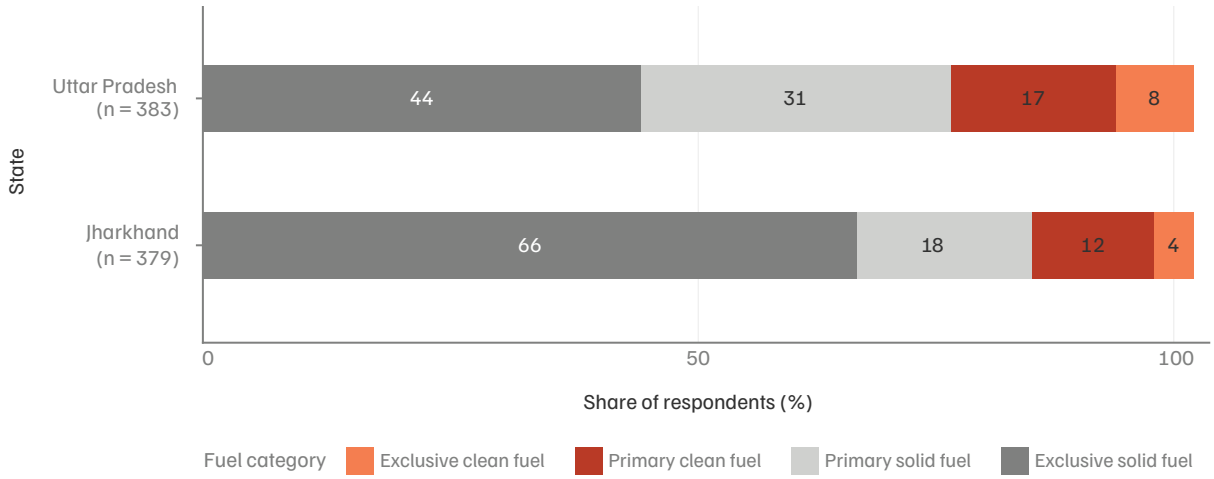
Current challenges with sustained usage of clean cooking fuel in the Indo-Gangetic Plain

The PMUY, launched in May 2016, has extended free LPG connections to more than 105 million women from economically weaker households (as of September 2026) (MoPNG 2026). While households using LPG have increased to 85 per cent in India, exclusive usage was only 47 per cent (Mani et al. 2021). PMUY beneficiaries use only 4.8 cylinders per year (PPAC 2026a); an average-sized household in India would require 7–8 cylinders (14.2 kg) annually if it cooks exclusively on LPG for all its cooking needs (Annexure A5) (Kar et al. 2019; Mani et al. 2021).

Rural regions in the IGP still heavily rely on solid fuels for cooking—states like Uttar Pradesh (44 per cent) and Jharkhand (66 per cent) have a very high proportion of people who still use solid fuels exclusively for their cooking needs (Figure 3). Fewer than 10 per cent of respondents from Uttar Pradesh and Jharkhand use clean fuels exclusively (Das et al. 2026). Only around 23 per cent of rural households surveyed use clean fuel exclusively (Das et al. 2026). Such cooking practices contribute significantly to the overall PM2.5 levels.

Affordability is cited as the most common barrier to sustained usage of LPG. In addition to affordability concerns, low home delivery rates are a significant barrier in the transition to exclusive use of clean cooking fuels (Kar et al. 2024; Das et al. 2026).

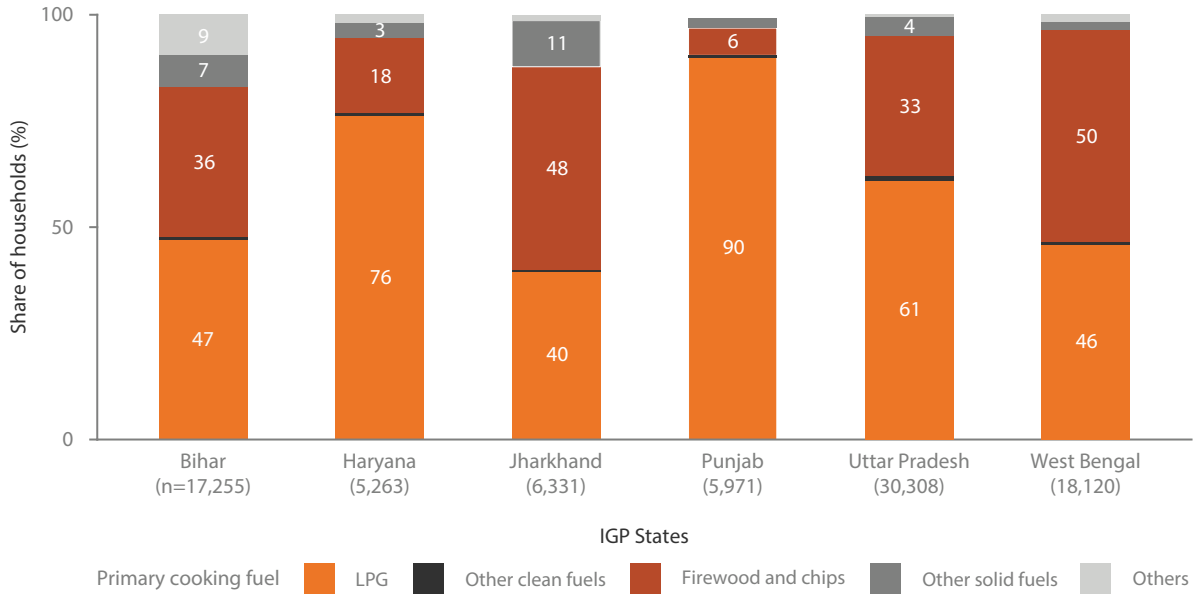
Figure 3. Uttar Pradesh and Jharkhand depend heavily on solid fuels for cooking



Source: CEEW survey of rural households in six states (Das et al. 2026).

Note: Clean fuels refer to LPG and electric cookstoves, while firewood, cow-dung cakes, and coal/ charcoal are classified as solid fuels.

Figure 4. The high use of solid fuels in the Indo-Gangetic Plain underscores affordability and supply barriers to a full transition to clean fuels



Source: HCES 2023-24 (MoSPI 2025).

Note: (a) IGP sample covers around 32 per cent of the total national sample. (b) Other clean fuels include electricity, and natural gas. For Uttar Pradesh the 1 per cent is for biogas. Other solid fuels include dung cake, kerosene, and coal.

Data from large-scale surveys such as the Household Consumption Expenditure Survey (HCES) 2023–24 indicate that some IGP states have made notable progress–LPG is used as the primary cooking fuel for 90 per cent of households in Punjab and 76 per cent in Haryana (Figure 4). However, others continue to lag in the transition to clean cooking fuels: Bihar (47 per cent), West Bengal (46 per cent) and Jharkhand (40 per cent) rely primarily on LPG (Figure 4) (MoSPI 2025).

Added to the rural problem, poor households residing in urban informal settlements, and several migrant workers living temporarily in cities also depend on biomass for their cooking needs or practise 'stacking' LPG with other solid fuels (Borgohain et al. 2026; Auddy et al. 2026). This is largely because they live in informal and unregistered settlements and often have limited knowledge of documentation requirements.

Recent global events have also impacted India's energy transition pathway and show how dependent India's clean cooking transition and energy security are on LPG imports. Before the war in West Asia, India imported about 60 per cent of its LPG, and about 90 per cent of these imports passed through the Strait of Hormuz (MoPNG 2026; Lok Sabha 2026). Its closure disrupted supply, and LPG consumption fell by about 8 per cent in January–June 2026 compared with the same period in 2025 (PPAC 2026b). When rising prices make LPG scarce or unaffordable to low-income households, which include PMUY beneficiaries, they are likely to switch back to polluting fuels such as firewood and kerosene. This poses a risk to air quality, health, and the gains of clean cooking transition that India has made in the past decade because of PMUY (for details refer Box 1).

Box 1. A scenario-based analysis to compare emissions reductions and construct the cleaner air dividend of the PMUY

Solid fuels, still used for cooking in India, remain the country's single largest source of household PM2.5 and black carbon (BC) emissions (Pandey et al. 2014; Venkataraman et al. 2018). The PMUY, by displacing the use of solid fuels in cooking, has improved energy access, gender equity and, to a significant extent—air quality (Sharma et al. 2019; Venkataraman et al. 2024). We estimate the emission reductions attributable to the PMUY over the decade between FY 2016–17 and FY 2025–26 relative to a counterfactual scenario in which the policy had not been implemented. The cylinder-equivalent benchmarks underpinning this analysis rest on three methodological references.

- First, useful cooking-energy requirements follow NITI Aayog's India Energy Security Scenarios 2047 (NITI Aayog 2023b), which set a representative rural household's need at about 8.6 MJ per day (roughly 3,100 MJ per year) and an urban household's at about 10.7 MJ per day (roughly 3,900 MJ per year).
- Second, we weight the per-household requirements to national figures using the Census 2011 rural-to-urban population split of 68:32. Using these two benchmarks, the national annual cooking energy demand is approximately 3,400 MJ per year.
- Third, on this basis, we derive primary LPG use–defined as a household using gas to meet at least half its cooking-energy need–to be four cylinders (each of 14.2 kg) a year; and we derive exclusive or near-exclusive use, defined as LPG meeting almost the entire need, to be eight refills a year at a national level.

The counterfactual is built on three assumptions.

- First, in the absence of the PMUY, and following the trend from FY 2012–13 to FY 2015–16, LPG consumer growth would have continued at the pre-policy average of 6.5 per cent per year.
- Second, without the financial support of the PMUY–waived security deposits, free first refill, instalment-based purchases–LPG coverage would have plateaued at 80 per cent of households because the remaining 20 per cent of rural households (those with monthly per capita expenditure below INR 2,500, per HCES 2022–23) (MoSPI 2024) would have faced a connection cost exceeding a fifth of their monthly household expenditure, making it impossible to adopt a new scheme without direct financial support.
- Third, in a policy scenario without the PMUY, as the LPG coverage increases, real-world LPG consumption does not increase at the same rate. We assume that as LPG reaches poorer households that use less gas, while established heavy users' consumption stays stable, the average consumption per household declines. To reflect this, the counterfactual applies a conservative downward adjustment of one kg of LPG per percentage-point increase in coverage beyond the FY2015–16 baseline average of 104 kg per household per year. The average consumption of 104 kg is derived from Petroleum Planning and Analysis Cell data (PPAC, MoPNG) of actual domestic sales of LPG (17.2 MMT) divided by the actual consumers (166 million) for FY2015–16 (pre-PMUY).

Together, these assumptions produce a counterfactual in which LPG sales reach approximately 22.9 MMT in FY 2025–26, against actual sales of 28.7 MMT. The gap of 5.8 MMT is attributable to the increase in consumption by PMUY beneficiaries.

We derive emission reductions each year from the difference in total cooking emissions from both LPG combustion and residual firewood use between the actual and counterfactual scenarios.

On this basis, we estimate that the PMUY has accelerated LPG adoption and thereby avoided cooking emissions of approximately 4,963 kilotonnes (kt) of PM2.5 and 132 kt of black carbon (BC) cumulatively between FY2016-17 and FY2025-26.

For FY 2025–26, our analysis estimates that PMUY avoided approximately 834 kt of $PM_{2.5}$ emissions and 22 kt of black carbon (BC) emissions from cooking. For context, the PAVITRA dashboard of the Center for Study of Science, Technology and Policy (CSTEP) estimates residential emissions in 2025 at approximately 4,800 kt for $PM_{2.5}$ and 600 kt for BC (CSTEP 2026). Using these estimates as reference benchmarks, our scenario-based analysis suggests that PMUY reduced residential $PM_{2.5}$ emissions by approximately 15 per cent and BC emissions by approximately 4 per cent relative to a counterfactual scenario without the programme. The comparison is indicative: the two estimates use different methods and emission factors, particularly for BC, and the CEEW analysis uses financial-year data (April–March), while the PAVITRA estimates are for calendar year 2025. For the detailed methodology, assumptions and calculations, see Annexure A1.

Source: Authors' analysis.

4. Recommendations to reduce residential biomass burning in the Indo-Gangetic Plain

Currently, no plan or policy focuses on managing PM2.5 emissions from the residential sector at the level of the IGP airshed. To reduce emissions from the residential sector overall, a supplementary policy that targets and reduces PM2.5 contributions from cooking-related emissions needs to be implemented. The policy levers have been explained below.

4.1 Expand the PMUY to include vulnerable population groups

The MoPNG and OMCs should identify migrant workers and households in urban informal settlements that rely, either primarily, or completely, on solid fuels for cooking and launch special enrolment drives to extend connections under the PMUY to those eligible.

Based on a CEEW survey (n = 108), we found that only 30 per cent of households in urban informal settlements in Delhi have a PMUY connection[3] though several others may be eligible—this identification and enrolment should be prioritised. For migrant workers, providing a secondary temporary connection for six months—which might mean extending the PMUY in the long run to single males, who are the majority of the migrating population (Auddy et al. 2026)—would also expand the coverage of the PMUY.

For rural regions, OMC-level data or local distributor networks can provide information about villages with low penetration or low LPG refills. Eligible households could be identified for priority enrolment into PMUY or conversion to PMUY from general connections if eligible. This would ensure higher use due to the subsidised prices.

The initial phases of enrolment should target vulnerable groups who reside in urban informal settlements in cities in the NCR—Delhi, Noida, Ghaziabad, Faridabad, and Gurugram—or migrants who have temporarily moved there for work. In the IGP states, the population projected in 2025 was over 171 million in urban areas and over 423 million in rural areas (Annexure A2). The next phase should target other urban regions in the IGP that face air pollution challenges, such as Patna, Kanpur, Lucknow, and Muzaffarpur. The final phase should extend the intervention to the rural regions in the IGP region.

Expanding coverage of LPG to migrants faces constraints that are different from households in urban informal settlements.

For households in urban informal settlements, the lack of secure tenure and formal proof of address keeps them outside standard verification processes, and documentation remains the primary obstacle (Borgohain et al. 2026). This calls for on-site assistance to facilitate enrolment, including support in producing alternative address verification and simplified connection procedures rather than relying on standard ration-card-based processes.

The picture for migrant workers has changed in the past few years as the PMUY 2.0 has substantially eased the paperwork burden and unavailability of documents is no longer the binding constraint—the residual gap is now one of awareness - as a result, enrolment is still very low, and only about 4 per cent of LPG-using migrant respondents were PMUY beneficiaries as per a CEEW survey in ten Indian cities (Auddy et al. 2026).

[3] The analysis, by CEEW, is based on data from a survey of more than 2,000 respondents in rural areas of 6 Indian states - Assam, Jharkhand, Maharashtra, Telangana, Uttar Pradesh, and Uttarakhand, and 2,000 respondents including, migrants, and urban informal settlements in 10 cities - Guwahati, Ranchi, Mumbai, Hyderabad, Lucknow, Dehradun, Delhi, Bengaluru, Ahmedabad, and Kolkata. CEEW surveyed 108 households in urban informal settlements in Delhi (Das et al. 2026; Borgohain et al. 2026; Auddy et al. 2026).

PMUY 2.0 allows migrant applicants to submit a self-declaration of family composition and address (mentioned in Annexure I of PMUY Self-Declaration Form) in place of a ration card, and connection processing now runs through the Common LPG Database Platform (CLDP), which performs real-time de-duplication against Aadhaar, bank account, and ration card details (MoPNG 2026). This narrows the practical documentation burden largely to Aadhaar seeding and know-your-consumer (KYC), and reduces the repeat distributor visits as well as the de-linking/re-linking that the ration-card-based verification system needed previously. For instance, when a woman migrates with her husband, while her mother-in-law retains a PMUY connection at the family's village address, the woman can complete the family-composition section of the self-declaration form at the city gas agency; the KYC record is then either approved directly or flagged for scrutiny, including a check on whether other declared family members already hold a connection elsewhere, before final approval.

Officials of OMCs report that they scrutinise documents more for migrant applications than general connections. Women labourers, and the wives of male migrant labourers, are less aware that a PMUY connection is available to them. Given this, **OMCs should develop a migrant-focused intervention that prioritises a multi-channel awareness campaign over providing enrolment assistance.** Possible interventions could include the following.

- using banners and posters in vernacular languages at high-visibility locations such as ration shops, community centres, municipal schools, and public transit hubs, make potential beneficiaries aware of the PMUY, eligibility criteria, and the self-declaration route;
- forging partnerships with non-governmental organisations and employers of migrant workers (contractors, labour camps, construction sites) and conduct door-to-door awareness drives explaining that migrants no longer need a ration card and can self-declare family composition; and
- informing migrant workers about enrolment drives and the subsidies available through SMS alerts.

Both groups—migrants and households in informal settlements may still benefit from a temporary PMUY connection option limited to 6 months per year per connection at their place of migration. This would enable registration for a secondary connection at the place of current residence, independent of the parent connection, without jeopardising domicile status at the home address. For urban informal settlements households, this addresses a genuine documentation gap; for migrants, it may be less necessary now that self-declaration exists, but it could still help those without any already existing family PMUY connection to link to.

4.2 Provide PMUY beneficiaries a winter subsidy

An average-sized household in India would require 7–8 cylinders (14.2 kg) annually if it cooks exclusively on LPG for all its cooking needs (Kar et al. 2019; Mani et al. 2021). Accordingly, over the six winter months (October to March), a household would use at least 4 cylinders for exclusive use.

Since 2023, the government has systematically reduced subsidised refills under PMUY from 12 cylinders to 9, and to 4 in June 2026. Currently, the government provides PMUY consumers a subsidy of INR 300 per cylinder—capped at 4 cylinders per annum[4]—signalling a clear imperative to contain the growing LPG import bill (PIB 2025a, Jayaswal 2026).

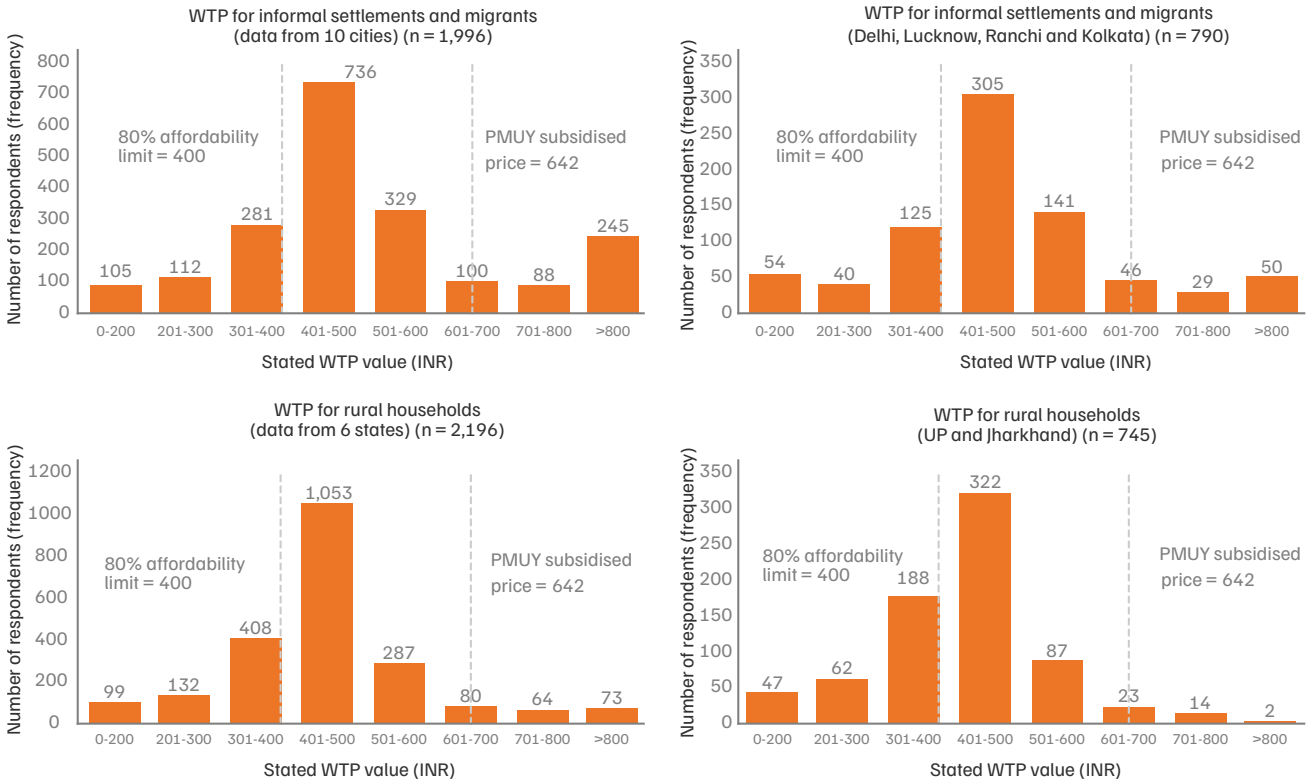
Estimates from a CEEW survey indicate that at least 80 per cent of migrants, households in urban informal settlements[5] as well as rural households[6] are willing to pay INR 400 to move to exclusive LPG usage year-round (Figure 5) (Das et al. 2026; Borgohain et al. 2026; Auddy et al. 2026). Field interactions have also consistently shown prices at or below INR 500 as an informal affordability threshold among PMUY households. Thus, at the current subsidised PMUY price of INR 642, **an additional subsidy of INR 200 reduces the affordability gap,** making clean fuel affordable and discouraging the switch to biomass in both urban and rural areas (Das et al. 2026).

[4] This decision was taken in June 2026.

[5] n = 790, for 4 cities in the IGP - Delhi, Lucknow, Ranchi, and Kolkata, and n = 1,996, for all 10 surveyed cities.

[6] n = 745, for 2 states in the IGP - Uttar Pradesh and Jharkhand, and n = 2,196 for all 6 surveyed states.

Figure 5. At a price of INR 400, 80% of all respondents self-report that they would move to exclusively using LPG for their cooking needs



Source: Authors' analysis from CEEW survey data (Das et al. 2026; Borgohain et al. 2026; Auddy et al. 2026).

Note: (a) Data presented are drawn from a larger CEEW survey (~ 4,000 households) on WTP for LPG use. (b) The top left plot is merged data for WTP from migrant workers and urban informal settlements households collected in 10 cities. Similarly, the top right is a subset of this across only four cities in the IGP region (Delhi, Lucknow, Ranchi, and Kolkata). (c) The bottom left plot displays the analysed data for WTP for rural households across six states, while the bottom right plot is a subset that includes only households in the IGP states of Jharkhand and Uttar Pradesh. (d) The 80 per cent affordability limit is the 20th percentile of the WTP responses. (e) Households that did not use LPG during the survey were asked about their WTP to start using LPG in the future as an exclusive fuel for cooking. (f) During the survey, between November 2024 and January 2025 the retail price of an LPG cylinder (14.2 kg) was ~INR 803 (considering retail price for Delhi). If we consider a PMUY subsidy of INR 300, the effective subsidised price of LPG is INR 503. Presently, the average retail price has increased to INR 942, following 3 price increments: INR 50 price hike in April 2025, INR 60 price hike in March 2026, and INR 29 price hike in June 2026. As a result, the subsidised price for PMUY users is ~ INR 642.

For the IGP states, **an air quality improvement-linked top-up subsidy of INR 200 per cylinder is recommended for 4 cylinders during the six winter months (considering the current subsidised price of INR 642 as on 30 September 2026).** While the subsidised price of one 14.2 kg cylinder has fluctuated between INR 553 and INR 642 in the last 1 year, we assume INR 600 as a reference point for the recommendation and suggest an additional subsidy of INR 200 (Das et al. 2026). This would bring the effective price of LPG during this period down to approximately INR 400 - 450. The 4 subsidised cylinders will be provided at a minimum gap of 25 days per household in the 6-month period to reduce misuse. For households that opt into the e-cooking scheme (recommendation described below), the top-up applies to their two remaining subsidised cylinders if purchased in winter. CEEW estimates suggest that the total cost of providing this additional winter subsidy to PMUY users only in all 7 states/UTs in the IGP (Delhi, Punjab, Haryana, Uttar Pradesh, Jharkhand, Bihar, and West Bengal) would be approximately INR 4,000 crore per year (detailed in Annexure A3) depending on the subsidy amount.

From a fiscal risk management perspective, **this top-up subsidy will be limited to a maximum of INR 200 even if the future retail price of LPG increases** further. The additional price will have to be absorbed by the consumers.

Further, if the central PMUY subsidy continues to be restricted to 4 cylinders, as imposed during the West Asia crisis, **it is recommended that the state governments of the IGP states provide a subsidy equivalent to the present PMUY subsidy of INR 300 per cylinder for at least 2 cylinders during the 6 non-winter months (April to September).** This would make primary use of LPG affordable and also deliver health and air quality gains. It is estimated that the cost to the state governments of providing a PMUY-equivalent subsidy of INR 300 on two additional cylinders for 80 per cent of the PMUY consumers would be INR 2,400 crore per year for the IGP states - which is equivalent to less than 0.1 per cent of the combined budget of these states (detailed in Annexure A4).

It is worth highlighting that LPG subsidies are politically sensitive, and may attract similar demand for subsidy from other sectors or geographies. It is, thus, recommended that the communication of such subsidy interventions explicitly link to the poor air quality in IGP during the winter months, as an **'interim measure'** to prevent biomass reversion. As a policy, this subsidy can be geography-neutral, and any airshed where the annual average level of PM2.5 breaches a specific standard, for example, 60 $\mu g/m^3$, the subsidy would be eligible.

4.3 Make provision for a capital subsidy for the purchase of e-cooking devices

Recent geopolitical events have exposed the fragility of India's clean cooking transition: the disruptions in the Strait of Hormuz had triggered temporary LPG shortages across India, as a result of supply chain disruptions. This is largely because almost two-thirds of the country's LPG demand relies on imports routed through this vulnerable chokepoint (Kar and Auddy 2026).

Further, India holds just 10 days' worth of LPG consumption as its strategic buffer (IEA 2026). This crisis underscores the urgent need to diversify India's cooking energy mix and accelerate the shift toward alternative, sustainable fuels like electric cooking, PNG, and biogas to ensure long-term energy security.

With the government and OMCs actively promoting alternatives like electric induction and solar cooktops (IOCL 2023) to reduce the nation's reliance on imported cooking fuel, LPG distributors can strategically pivot by promoting and selling e-cooking devices and related kitchen hardware. Electric cooking is uniquely positioned to step in and scale in the Indian cooking ecosystem.

We propose that the MoPNG take the initiative to transition the 25,000+ LPG distributors in India to clean cooking hubs by directing them to purchase BIS-certified e-cooking devices—induction cookstoves, infrared cookstoves, electric pressure cookers—stock these in-bulk, and sell them to interested consumers (Table 1).

Table 1. How to choose the right electric cooking device for Indian households

Appliance	Pro	Con
Induction cookstove	**Speed:** faster for cooking than traditional *chulhas* and even LPG	**Cookware limitations:** requires specific flat-bottomed, ferromagnetic utensils
Infrared cookstove	**Cookware compatibility:** works with any type of flat-bottomed heat-resistant cookware **Mimics a flame-based set-up:** preferred for Indian breads, tandoor items, etc.	**Lower efficiency:** less energy-efficient than induction cookstoves **Higher burn risk:** the cooking surface gets extremely hot and stays hot for a while after being turned off
Electric pressure cooker	**Highly energy-efficient:** electric pressure cookers are insulated and cook with pressurised steam	**Cooking limitations:** excellent for boiling, steaming, and stewing but not for frying or sautéing

Source: Authors' compilation from Rastogi et al. 2026, Jain 2025, Mani et al. 2026.

Note: Issues related to high upfront costs, grid infrastructure dependency, convenience of usage for migrant and urban informal settlements households, etc. are common to all e-cooking appliances, and hence, have not been highlighted in the table.

Our proposed business model is as follows. At the household level, any PMUY household can opt to buy an e-cooking device from its LPG distributor at a discounted price, conditional on permanently giving up two of its MoPNG-subsidised cylinders a year. A basic induction cooktop with a starter kit[7], priced at about INR 3,000[8], would cost the household INR 600 upfront (Figure 6). The MoPNG currently provides a subsidy of INR 300 per cylinder on the first four refills each year, so an opted-in household would receive this subsidy on its first two refills. If the MoPNG later raises the number of subsidised refills, an opted-in household would continue to receive two fewer than other PMUY households: for example, seven if the entitlement returns to nine. In the IGP states, if these MoPNG-subsidised cylinders are bought during the winter months (October to March), they will also be eligible for the INR 200 winter top-up per cylinder. We propose that opted-in households remain eligible for any state government-funded cylinder schemes on the same terms as other PMUY households.

OMCs and the exchequer would together recover the remaining INR 2,400 in about two years, through the direct PMUY subsidy saved (INR 300 per cylinder) and the under-recoveries avoided (INR 295 per cylinder)[9] on the two cylinders each household gives up. This comes to about INR 1,190 per household per year (INR 600 in subsidy saved and INR 590 in under-recoveries). If about 21 million households that use four or more cylinders a year, equal to 20 per cent of all PMUY households, opt in[10], these savings would total about INR 2,500 crore a year.

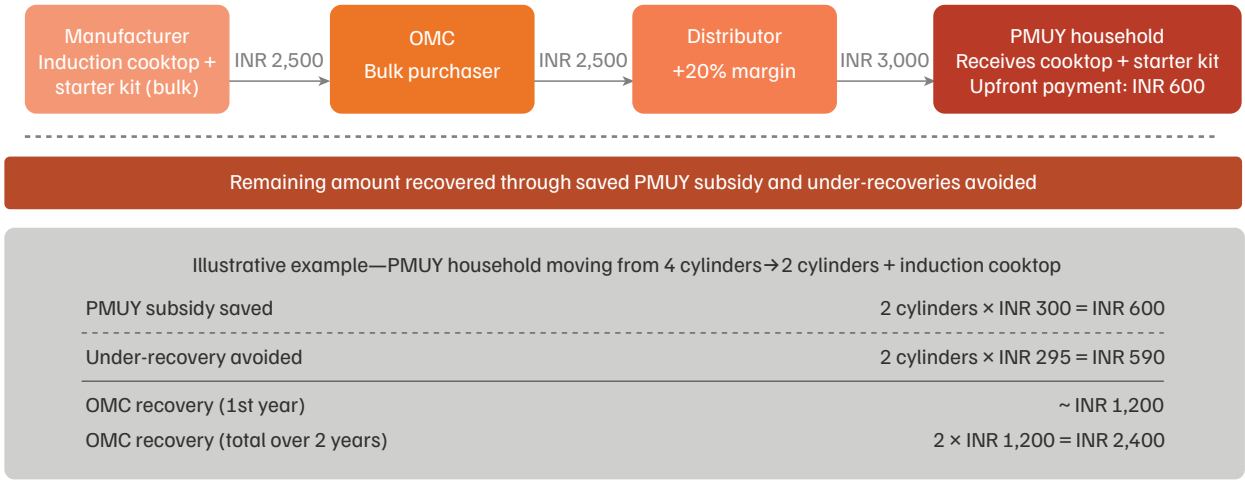
7 A starter kit includes one unit each of 3L cooker, pan, saucepan, and tawa.

8 The bulk procurement price for OMCs should be approximately INR 2,500. An additional 20 per cent over this bulk price, that is, INR 500, would be the distributor's margin (the margin that lets the distributor cover costs associated with transportation and logistics).

9 Under-recovery is the gap between the cost of supplying LPG and its regulated retail price, absorbed by OMCs and partly compensated by the exchequer. It averaged about INR 295 per cylinder in FY 2025-26. Since the West Asia crisis began, it has risen to about INR 700 per cylinder (Statesman News Service 2026). We conservatively assume INR 295 per cylinder throughout this brief. These savings assume that participating households replace two annual LPG refills with electric cooking, rather than purchasing the same refills without subsidy. In FY 2025-26, total under-recovery for OMCs was about INR 60,000 crore (Statesman News Service 2026; PIB 2025b), with the GoI and public sector oil companies absorbing INR 30,000 crore each. India consumed around 33 MMT of domestic LPG in FY 2025-26, of which 88 per cent (around 29 MMT) went to the residential sector (PPAC 2026a). The GoI and OMCs therefore absorbed about INR 295 per standard 14.2 kg cylinder.

10 PMUY consumers use 4.8 cylinders a year on average (PPAC 2026a). Since the average is above four, a substantial share of PMUY households is likely to use four or more cylinders a year, though some use fewer. We therefore take 20 per cent as a conservative assumption for the share of PMUY households that both use four or more cylinders a year and opt in to the scheme. This is 20 per cent of the ~105 million PMUY households, i.e., 21 million. Each such household saves INR 1,190 a year, so the total annual saving is 21 million × INR 1,190 = INR 2,499 crore, i.e., nearly INR 2,500 crore a year. In the first two years, these savings repay the device cost; from the third year onwards, they are net savings.

Figure 6. The discounted e-cooking model may offset LPG usage and has the potential to avoid LPG under-recoveries (for illustrative purposes only)



Source: Authors' analysis.

Note: (a) The starter kit includes one unit each of 3L cooker, pan, saucepan and tawa. (b) The procurement price will vary depending on bulk procurement units decided by the OMCs. It is important to note that all figures presented above —including device prices, procurement costs, upfront contributions, and subsidy withhold periods—are illustrative and intended solely to demonstrate the financial viability of the proposed model. Real-world figures will depend on multiple factors, including but not limited to: bulk procurement volumes and competitive tendering outcomes; manufacturer and supplier pricing; BIS certification and quality compliance costs; logistics, last-mile distribution, and storage costs; the financial capacity and WTP of PMUY beneficiaries across different geographies; prevailing LPG subsidy rates and their revision over time; and the administrative and operational costs borne by OMCs and distributors in implementing the scheme.

From the third year, once the device cost has been recovered, this becomes a net saving for the OMCs and the exchequer. This low upfront payment would ensure that even the poorest households are not left behind in the e-cooking transition. To ensure maximum adoption, the government should offer PMUY beneficiaries multiple types of e-cooking device choices based on affordability and income levels. For more expensive models, the discount would remain capped at INR 2,400, with the household paying the difference upfront; this discount is recovered from the subsidy saved and the under-recoveries avoided on the two cylinders given up each year, over two years. It should be noted that while this model works for a typical PMUY household currently using four or more cylinders a year, for households using three or fewer, the discount on the device will be only partly recovered or not recovered at all (calculations shown in Table 2). However, this shortfall may be offset over time, provided enough high-consumption households opt in for the capital subsidy on the e-cooking device: each household using four or more cylinders that joins the scheme, draws two fewer subsidised cylinders every year, and these savings continue long after its own device is paid for in the first two years.

Table 2. How the cost recovery plays out across different PMUY consumer categories

Current LPG use (cylinders a year)	LPG use after opting in for the e-cooking scheme	Subsidised cylinders per year, before → after	PMUY subsidy saved (over 2 years)	Under-recovery avoided (over 2 years)	Total saved (over 2 years)	Share of INR 2,400 device balance recovered (over 2 years)
0	0	0 → 0	0	0	0	0
1	1	1 → 1	0	0	0	0
2	2	2 → 2	0	0	0	0
3	2	3 → 2	INR 600	INR 590	INR 1,190	~50%
4	2	4 → 2	INR 1,200	INR 1,180	INR 2,380	~100%
5 or more	2 fewer (2 subsidised, rest at full price)	4 → 2	INR 1,200	INR 1,180	INR 2,380	~100%

Source: Authors' analysis.

Note: (a) The reduction of two MoPNG-subsidised cylinders a year applies only to households that opt in. Households that do not opt in keep their entitlement of up to four subsidised cylinders. (b) Opting in reduces a household's MoPNG-subsidised entitlement by two cylinders a year, from four to two at the current cap, so every cylinder beyond its second refill is now bought at full price. We assume the household cooks with the electric cooktop instead of buying those full-price cylinders, up to a limit of two cylinders a year. Each such cylinder is now purchased at full price of INR 942, at which cooking the same meals on the cooktop may cost slightly less. A household using three cylinders a year therefore cuts its LPG use by one cylinder, and a household using four or more cuts it by two. We conservatively cap the reduction at two cylinders, i.e., about 250 kWh of electricity a year, because power supply and preferences for flame-based cooking may impose a practical limit on how much of a household's cooking an induction cooktop can take over. Households using two or fewer cylinders a year keep all their cylinders subsidised and are assumed to keep their LPG use unchanged; for them the e-cooktop is over and above the two subsidised cylinders they are entitled to. These are scenario assumptions, the results of which may be tested and analysed as pilot projects - they are not observed effects. (c) The PMUY subsidy is INR 300 a cylinder. The under-recovery is INR 295 a cylinder, the FY 2025-26 average. (d) Where total savings fall short of the INR 2,400 balance (i.e., the first four rows, and marginally, by about INR 20, in the last two rows owing to rounding), the shortfall is met by the government. The case for doing so rests on cleaner air and better health, not on fiscal savings.

The e-cooking model serves two goals, energy security and cleaner air, and it serves them differently in the two halves of the PMUY population. The scheme should therefore be open to both.

For households using four or more cylinders a year, the cooktop mainly replaces LPG. That serves energy security, through fewer imported cylinders and a smaller under-recovery bill. As Table 2 shows, it pays for itself within about two years. Its contribution to cleaner air is modest, because these households already cook mostly on a clean fuel.

For households using fewer than four cylinders, the cooktop mainly replaces the traditional chulha, not the cylinder. It saves little or no LPG, and so generates little or no fiscal return. Yet this is where the policy brief's goal is decided. These low-use households, often the poorest, still burn biomass that impacts household and ambient air in the IGP during winter months. The gain from moving them from biomass to clean fuels does not stay limited to the household alone. Smoke from one chulha is breathed by the neighbourhood, so every kitchen that stops burning biomass contributes to cleaner air across

the IGP airshed. That makes clean cooking, at the margin where biomass is still burned, a public good. A ledger that counts only subsidy and under-recovery savings will undervalue it.

The return also shows up in the wider economy. HAP alone was linked to 0.61 million deaths in India in 2019 (India State-Level Disease Burden Initiative Air Pollution Collaborators 2021). Fewer days lost to illness, fewer caregivers kept at home and fewer deaths in working age are the most direct route from clean cooking to productivity. Time is a second route. Cooking on electricity, and not having to gather fuel, frees hours mostly for women and children. How those hours are used varies by household and local labour market, so we treat time savings as a benefit to the household rather than as a predictable gain in paid work. Limiting the scheme to high users would therefore fund the device where it does least for air quality and productivity, and withhold it where it does most. It would also turn a clean-cooking programme into a benefit for the better-off within PMUY. An e-cooking device beside two subsidised cylinders gives a low-use household a second clean option for the cooking it now does on the chulha. **That is the clean cooking stack this policy brief argues for: LPG and electricity together, displacing biomass, not one clean fuel replacing another. OMCs should therefore encourage every household that opts in to keep using its two subsidised cylinders**. In the IGP states, if these two subsidised cylinders are purchased during the winter months (October–March), they will also be eligible for the INR 200 winter top-up. This keeps the household's LPG use concentrated in the months when air pollution peaks, while the e-cooking device carries more of the cooking for the rest of the year. The reduction of two cylinders applies only to the MoPNG PMUY subsidy; opted-in households remain eligible for any state government-funded cylinder schemes on the same terms as other PMUY households.

For low-use households, the government's contribution should be understood as payment for a public good, not as a shortfall to be absorbed. Where realised savings fall short of the device cost, the government should compensate the OMCs, either through a dedicated add-on or within the existing mechanism for compensating LPG under-recoveries. Like the winter top-up proposed above, this is spending to keep households off biomass, and its return is counted in cleaner air, better health and lost output recovered.

On the supply-side, a targeted scheme for performance-linked incentives for e-cooking devices such as induction cookstoves can incentivise domestic producers to scale-up production, drive down costs, and reduce import dependence. Under such a scheme, a manufacturer achieving sales of a particular threshold of devices would receive a production-linked incentive of, say, 4–6 per cent (similar to the Production Linked Incentive (PLI) Scheme for White Goods) on the incremental turnover over a 4–5 year period (DPIIT 2026). Wherever possible, distributors of LPG should piggyback on their existing network of Urja Devis for consumer demonstration, warranty support, and sales of other utensils compatible with e-cooking. Local, trained technicians could assist consumers in minor repairs.

4.4 Reimagine the LPG subsidy as a fuel- and technology-neutral subsidy for clean cooking

LPG has been proven to be the most scalable interim model for clean cooking (Kar et al. 2023). However, reliance on a single fuel could expose critically vulnerable populations to price volatility—as LPG prices are linked to global crude oil prices—and, based on the experience in Ghana and Senegal, a potential rebound to solid fuels (Ali 2025). Thus, it is important to move 'beyond LPG' and promote a cleaner cooking fuel stack.

Due to the shortage of LPG in early 2026, **several consumers have already shifted to e-cooking as a substitute (Paramasivam 2026).** While the transition to e-cooking has strained the supply of electrical appliances and driven up the prices of induction cookstoves, as supply scales up, and LPG availability stabilises eventually, prices are expected to smoothen. However, electric cooking has its own set of scale-up challenges: deliberate investments must be made in household electric wiring and kitchen infrastructure; induction-compatible cookware must be made available; and financial support must be targeted at low-income households (Auddy and Das 2026).

To ensure energy security in the long term and insulate the country from LPG import crises in the future, **the government has aggressively fast-tracked PNG installations**—in March 2026 alone, new connections were installed in 5.8 lakh households (Economic Times 2026). Further, authorities have even directed that LPG supplies may be discontinued for households that refuse to switch to PNG in areas where pipeline connectivity is already available (Kar and Auddy 2026). However, PNG will not offer the most relevant transition pathway from LPG, especially for urban informal settlements and rural areas, because it requires extensive infrastructure—a network of underground pipelines, compressor stations, and distribution grids—that is capital-intensive and financially viable only at high population densities.

Taken together, these recent developments—the rapid expansion of PNG, uptake of e-cooking, and the emerging potential of biogas (Box 2)—point towards a fundamental shift in how India thinks about its clean cooking policy, especially in light of the recent crisis in West Asia.

In its current form, the PMUY subsidy is fuel-specific and instrumentally tied to LPG. **India should reimagine the PMUY subsidy as a clean cooking subsidy that is fuel-agnostic as well as technology-agnostic** as that would enable eligible beneficiaries to choose—based on local resource availability and household preference—the clean cooking solution most appropriate to their needs, whether that is LPG, e-cooking, or other clean fuels.

Box 2. Biogas as a cooking fuel for India's dairy belt

Biogas may offer India a significant opportunity to insulate itself from potential market volatility. This is more relevant for the IGP and India's dairy-dense corridor—concentrated primarily in Gujarat, Punjab, Rajasthan, Maharashtra, Tamil Nadu, and Uttar Pradesh. Further, India has ~40 million cattle-rearing households with three or more animals (Jain et al. 2026)—these regions can leverage the organic waste generated to provide a reliable source of cooking fuel. If all these households shifted to biogas, the country could displace up to 4 million tonnes of LPG every year. At standard conversion parameters, a household with three cattle can generate enough biogas to displace roughly 100 kg of LPG annually, about seven cylinders, sufficient to meet a typical rural household's annual cooking energy needs. If even 25 per cent of eligible households made this transition, it could save up to INR 2,000 crore annually in LPG under-recovery (Kar and Gill 2026).

Yet, adoption of biogas remains marginal: fewer than 1 per cent of rural households currently use biogas as a primary cooking fuel (Kar and Gill 2026). The real barrier is upfront capital cost: a prefabricated 2–3 cubic metre biodigester costs INR 35,000–50,000. Even with MNRE's 30–40 per cent capital support under the National Bioenergy Programme (2021–2026), households face a residual burden of approximately INR 20,000 (MNRE 2022; Kar and Gill 2026). The entry of private players (such as Sistema.bio, Sintex, and Vaayu-Mitra) has improved the financial viability of rural projects through innovative funding mechanisms such as corporate social responsibility (CSR), philanthropy, and carbon credits. This transition should now be further supported by add-on subsidies equivalent to LPG to reduce the upfront cost for biogas installations. For a PMUY household, the subsidy and under-recovery per cylinder comes to ~INR 600. This amount for 4 cylinders a year comes to about INR 24,000 per household over 10 years, enough to cover 50 per cent of the cost of a small prefabricated biogas unit that will run for 15–20 years (Kar and Gill 2026). The remaining 50 per cent could be paid by the consumer.



Biogas in rural India may offer another alternative to LPG as a cooking fuel.

Acronyms

BC	black carbon
BIS	Bureau of Indian Standards
FY	financial year
GoI	Government of India
HAP	household air pollution
HCES	Household Consumption Expenditure Survey
IGP	Indo-Gangetic Plain
INR	Indian rupee
LPG	liquefied petroleum gas
MMT	million metric tonnes
MNRE	Ministry of New and Renewable Energy
MoPNG	Ministry of Petroleum and Natural Gas
NCR	National Capital Region
NITI Aayog	National Institution for Transforming India
OMC	oil marketing company
PM2.5	fine particulate matter with an aerodynamic diameter of 2.5 micrometres or less
PMUY	*Pradhan Mantri Ujjwala Yojana*
PNG	piped natural gas
PPAC	Petroleum Planning and Analysis Cell
UT	union territory
WTP	willingness to pay

References

Agarwal, Prerita, David S. Stevenson, and Mathew R. Heal. 2024. "Quantifying the Dominant Sources Influencing the 2016 Particulate Matter Pollution Episode Over Northern India." Environmental Science: Atmospheres 4 (5): 655–69. https://doi.org/10.1039/d3ea00174a.

Ali, Sabna. 2025. "GECF Expert Commentary: Tackling Clean Cooking in Sub-Saharan Africa—The Role of LPG." Gas Exporting Countries Forum, March 2025. https://www.gecf.org/Events-Conferences/Events-HH/ArticleID/297/GECF-Expert-Commentary-Tackling-Clean-Cooking-in-Sub-Saharan-Africa-The-Role-of-LPG.

Auddy, Surya Shekhar, and Rahul Das. 2026. "India Wants Households to Shift to E-Cooking. But Are Our Kitchens Ready?" Deccan Herald, June 15, 2026. https://www.deccanherald.com/opinion/india-wants-households-to-shift-to-e-cooking-but-are-our-kitchens-ready-4039456

Auddy, Surya Shekhar, Varian Crasto, and Abhishek Kar. 2026. Understanding Clean Cooking Fuel Usage Among Migrants: Evidence from Willingness to Pay Surveys in 10 Indian Cities. New Delhi: Council on Energy, Environment and Water. https://www.ceew.in/publications/migrant-workers-lpg-access-india.

Borgohain, Hladinee, Adya Sharma, Rahul Das, and Abhishek Kar. 2026. Are Clean Cooking Fuels Reaching India's Urban Poor? Access and Willingness to Pay Across 10 Indian Cities. New Delhi: Council on Energy, Environment and Water. https://www.ceew.in/publications/clean-cooking-fuels-in-Indian-urban-slums.

Center for Study of Science, Technology and Policy (CSTEP). "PAVITRA: Air Pollution Management and Intervention Tool for India." Accessed August 6, 2026. https://pavitra.cstep.in/.

Central Pollution Control Board (CPCB). 2009. National Ambient Air Quality Standards. Notification, November 18, 2009. New Delhi: Ministry of Environment and Forests, Government of India. https://cpcb.nic.in/uploads/National_Ambient_Air_Quality_Standards.pdf.

Chatterjee, Deepangsu, Erin E. McDuffie, Steven J. Smith, Liam Bindle, Aaron van Donkelaar, Melanie S. Hammer, Chandra Venkataraman, Michael Brauer, and Randall V. Martin. 2023. "Source Contributions to Fine Particulate Matter and Attributable Mortality in India and the Surrounding Region." Environmental Science & Technology 57 (28): 10263–75. https://doi.org/10.1021/acs.est.2c07641.

Chowdhury, Sourangsu, Sagnik Dey, Sarath Guttikunda, Ajay Pillarisetti, Kirk R. Smith, and Larry Di Girolamo. 2019. "Indian Annual Ambient Air Quality Standard Is Achievable by Completely Mitigating Emissions from Household Sources." Proceedings of the National Academy of Sciences 116 (22): 10711–16. https://doi.org/10.1073/pnas.1900888116.

Clean Air Fund. 2021. "Air Pollution and Its Impact on Business." Clean Air Fund. https://s40026.pcdn.co/wp-content/uploads/01042021_Business-Cost-of-Air-Pollution_Long-Form-Report.pdf

Commission for Air Quality Management. 2026. "Home Page." Government of India. Accessed September 27, 2026. https://caqm.nic.in/.

Conibear, Luke, Edward W. Butt, Christoph Knote, Stephen R. Arnold, and Dominick V. Spracklen. 2018. "Residential Energy Use Emissions Dominate Health Impacts from Exposure to Ambient Particulate Matter in India." Nature Communications 9 (1): 1591. https://doi.org/10.1038/s41467-018-02986-7.

Das, Rahul, Anwesha Sarma, and Abhishek Kar. 2026. Subsidised, Not Sustained: Rural Cooking-Fuel Usage Trends in Six Indian States. New Delhi: Council on Energy, Environment and Water. https://www.ceew.in/sites/default/files/ceew-clean-cooking-fuels-rural-lpg-survey.pdf.

Department for Promotion of Industry and Internal Trade (DPIIT), 2026. Ministry of Commerce and Industry, Government of India. "Production Linked Incentive Scheme (PLI) for White Goods." Accessed October 8, 2026. https://www.dpiit.gov.in/offerings/schemes-and-services/details/production-linked-incentive-scheme-pli-for-white-goods-ITOyYDNtQWa

Dey, Sagnik, Bhavesh Purohit, Palak Balyan, Kuldeep Dixit, Kunal Bali, Alok Kumar, Fahad Imam, et al. 2020. "A Satellite-Based High-Resolution (1-Km) Ambient PM2.5 Database for India over Two Decades (2000–2019): Applications for Air Quality Management." Remote Sensing 12 (23): 3872. https://doi.org/10.3390/rs12233872.

Centre for Science and Environment 2025. "Slow murder continues: Black Deposits that cannot be removed." November 10, 2025. https://www.downtoearth.org.in/air/slow-murder-continues-black-deposits-that-cannot-be-removed

Economic Times. 2026. "India Looks to Turn LPG Import Crisis into Push for Piped Gas." April 4, 2026. Accessed April 15, 2026. https://economictimes.indiatimes.com/industry/energy/oil-gas/india-looks-to-turn-lpg-import-crisis-into-push-for-piped-gas/articleshow/129968279.cms.

Ghosh, Shibani, and Bhargav Krishna. 2024. "Managing Air Quality: Answer Is in Airsheds." Hindustan Times, October 28, 2024. https://www.hindustantimes.com/opinion/managing-air-quality-answer-is-in-airsheds-101730054618357.html.

Ghosh, Shibani, Bhargav Krishna, and Abhinaya Sekar. 2023. Regulating Air Quality at an Airshed Level in India. Working Paper. New Delhi: Centre for Policy Research. https://cprindia.org/workingpapers/regulating-air-quality-at-an-airshed-level-in-india/.

Guttikunda, Sarath K. 2024. "Designating Airsheds in India for Urban and Regional Air Quality Management." Air 2 (3): 247–57. https://doi.org/10.3390/air2030015.

Guttikunda, Sarath, and Nishadh Ka. 2022. "Evolution of India's PM2.5 Pollution Between 1998 and 2020 Using Global Reanalysis Fields Coupled with Satellite Observations and Fuel Consumption Patterns." Environmental Science: Atmospheres 2 (6): 1502–15. https://doi.org/10.1039/d2ea00027j.

Health Effects Institute. 2025. State of Global Air Report 2025. October 2025. https://www.stateofglobalair.org/resources/report/state-global-air-report-2025.

India. Lok Sabha. 2026. "Unstarred Question No. 757: Impact of West Asia Conflict on LPG Supply and Prices." Answered by Suresh Gopi, Minister of State, Ministry of Petroleum and Natural Gas. July 23, 2026.

India State-Level Disease Burden Initiative Air Pollution Collaborators. 2021. "Health and Economic Impact of Air Pollution in the States of India: The Global Burden of Disease Study 2019." Lancet Planetary Health 5 (1): e25–38. https://doi.org/10.1016/S2542-5196(20)30298-9.

Indian Oil Corporation Limited (IOCL). 2023. Sustainability Report 2022–23. New Delhi: Indian Oil Corporation Limited. https://iocl.com/uploads/IOCL-Sustainability-Report-2022-23.pdf.

International Energy Agency. 2026. Clean Cooking in Africa 2026: Progress Report. World Energy Outlook Special Report. Paris: IEA. https://iea.blob.core.windows.net/assets/1d4e0b2e-1db0-45ab-873d-fe22354a9aa7/CleanCookinginAfrica2026-Progressreport.pdf

Jain, Abhishek, Nikita Tank, Aastha Bafna, Ruchira Goyal, Chandan Jha, Stuti Manchanda, Madhumita Srinivasan, Rohan Gupta, Sara Haris, Arti Agarwal, and Apoorve Khandelwal. 2026. Cattle and Community in a Changing Climate: Sustainable Pathways for India's Dairy Sector. New Delhi: Council on Energy, Environment and Water. https://www.ceew.in/publications/what-is-the-impact-of-climate-change-on-india-milk-production

Jain, Purva. 2025. India's Clean Cooking Strategy: E-Cooking as the Next Frontier. Washington, DC: Institute for Energy Economics and Financial Analysis. https://ieefa.org/sites/default/files/2025-10/India's%20clean%20cooking%20strategy-%20E-cooking%20the%20next%20frontier%20%20(1).pdf.

Jayaswal, Rajeev "Govt Reduces Subsidised LPG Cylinders under Ujjwala Yojana from 9 to 4." Hindustan Times, June 9, 2026. https://www.hindustantimes.com/india-news/govt-reduces-lpg-subsidy-under-pmuy-to-4-per-year-101780945348024.html.

Kar, Abhishek, and Surya Shekhar Auddy. 2026. "Shifting from Gas to Electric." The New Indian Express, March 16, 2026. Accessed April 14, 2026. https://www.newindianexpress.com/opinion/2026/Mar/16/shifting-from-gas-to-electric.

Kar, Abhishek, and Bigsna Gill. 2026. "Biogas Could Be an LPG Hedge in India's Dairy Belt." Deccan Herald, May 6, 2026. https://www.deccanherald.com/opinion/biogas-could-be-lpg-hedge-in-indias-dairy-belt-3992775.

Kar, Abhishek, Sunil Mani, Adya Sharma, Surya Shekhar Auddy, Shruti Sharma, Paras Bhattarai, and Rahul Das. 2024. Improving India's Clean Cooking Fuel Supply: Recommendations to Enhance Last-Mile LPG Accessibility. New Delhi: Council on Energy, Environment and Water. https://www.ceew.in/sites/default/files/how-can-india-improve-clean-cooking-fuel-supply-and-carbon-neutral-lpg-accessibility.pdf

Kar, Abhishek, Shonali Pachauri, Rob Bailis, and Hisham Zerriffi. 2019. "Using Sales Data to Assess Cooking Gas Adoption and the Impact of India's Ujjwala Programme in Rural Karnataka." Nature Energy 4: 807–14. https://doi.org/10.1038/s41560-019-0429-8.

Kar, Abhishek, Roshan Wathore, Arunabha Ghosh, Shruti Sharma, Emily Floess, Andrew Grieshop, Rob Bailis, and Nitin Labhasetwar. 2023. Promoting the Use of LPG for Household Cooking in Developing Countries. T20 Policy Brief. https://t20ind.org/wp-content/uploads/2023/07/T20_PolicyBrief_TF4_PromotingLPGInTheGlobalSouth_New.pdf

Krajnc, Nike. 2015. Wood Fuels Handbook. Pristina: Food and Agriculture Organization of the United Nations. https://www.bioenergy.org.nz/documents/resource/Reports/wood-fuels-handbook-fao.pdf.

Lehner, B., and G. Grill. 2013. "Global River Hydrography and Network Routing: Baseline Data and New Approaches to Study the World's Large River Systems." Hydrological Processes 27 (15): 2171–86. https://doi.org/10.1002/hyp.9740.

Mani, Sunil, Shalu Agrawal, Abhishek Jain, and Karthik Ganesan. 2021. State of Clean Cooking Energy Access in India. New Delhi: Council on Energy, Environment and Water. https://www.ceew.in/sites/default/files/ires-report-on-state-of-clean-cooking-energy-access-in-india.pdf.

Mani, Sunil, Gunjan Kohli, Shruti Sharma, Gaurav Limaye, and Abdurahman Alsulaiman. 2026. India's Clean Cooking Shift: Scaling Non-Fossil Fuel Solutions. Winnipeg: International Institute for Sustainable Development. https://www.iisd.org/system/files/2026-02/india-clean-cooking.pdf.

Mapzen. 2026. "Terrain Tiles." Registry of Open Data on AWS. Accessed November 16, 2026. https://registry.opendata.aws/terrain-tiles/.

Ministry of New and Renewable Energy. 2022. Central Sector Scheme Biogas Programme (Detailed Implementation Guidelines). Government of India, November 2022. https://biogas.mnre.gov.in/public/downloadables/MNRE%20Biogas%20Prog%202021%20to%202026%20%20dated%2002_11_2022.pdf.

Ministry of Petroleum and Natural Gas (MoPNG). n.d. "Pradhan Mantri Ujjwala Yojana." Government of India. Accessed October 6, 2026. https://www.pmuy.gov.in/.

Ministry of Petroleum and Natural Gas (MoPNG). n.d. "Self-Declaration for Family Composition and Address for Release of New Connection under PMUY (for Migrant Only)." Annexure I. Pradhan Mantri Ujjwala Yojana. Accessed October 6, 2026. https://pmuy.gov.in/documents/Annexure_I_new.pdf.

MoSPI (Ministry of Statistics and Programme Implementation). 2024. Household Consumption Expenditure Survey: 2022–23. NSS Report No. 591. New Delhi: National Statistics Office, Government of India.

MoSPI (Ministry of Statistics and Programme Implementation). 2025. Survey on Household Consumption Expenditure: 2023–24. NSS Report No. 592. New Delhi: National Statistics Office, Government of India.

Nandi, Indranil, Dilip Ganguly, Gazala Habib, and Sagnik Dey. "Delhi Cannot Clean Its Air Alone: Airshed-Scale Mitigation Outperforms Local Controls Even under Unfavourable Winter Meteorology." Clean Air Vol 2 (2026): 27. https://doi.org/10.1038/s44407-026-00065-6

Natural Earth. 2026. "Admin 0 – Countries, 1:10m." Accessed November 16, 2026. https://www.naturalearthdata.com/downloads/10m-cultural-vectors/10m-admin-0-countries/.

Navinya, Chimurkar, Taveen S. Kapoor, Anurag Gupta, Pradnya Lokhande, Renuka Sharma, S. V. Laxmi Prasad, S. M. Shiva Nagendra, et al. 2023. "Heating and Lighting: Understanding Overlooked Energy-Consumption Activities in the Indian Residential Sector." Environmental Research Communications 5 (4): 045004. https://doi.org/10.1088/2515-7620/acca6f.

NITI Aayog. 2023a. National Multidimensional Poverty Index: A Progress Review 2023. New Delhi: NITI Aayog, Government of India. https://www.niti.gov.in/sites/default/files/2023-07/National-Multidimentional-Poverty-Index-2023-Final-17th-July.pdf

NITI Aayog. 2023b. India Energy Security Scenarios (IESS) 2047 V3.0. Government of India. https://iess2047.gov.in/_/theme/documents/IESS_v3_one_pagers.pdf.

Pandey, Apoorva, Pankaj Sadavarte, Anand B. Rao, and Chandra Venkataraman. 2014. "Trends in Multi-Pollutant Emissions from a Technology-Linked Inventory for India: II. Residential, Agricultural and Informal Industry Sectors." Atmospheric Environment 99: 341–52. https://doi.org/10.1016/j.atmosenv.2014.09.080.

Paramasivam, Praveen. 2026. "Induction Stoves Fly off Shelves in India as Gas Shortage Fears Spark Panic Buying." Reuters, March 12. https://www.reuters.com/business/energy/induction-stoves-fly-off-shelves-india-gas-shortage-fears-spark-panic-buying-2026-03-12/.

Petroleum Planning and Analysis Cell. 2026a. Oil and Gas Snapshot of States. Edition 4. Ministry of Petroleum and Natural Gas, Government of India. https://ppac.gov.in/all-whats-new.

Petroleum Planning and Analysis Cell (PPAC). 2026b. "Domestic Consumption of Petroleum Products (P)." Ministry of Petroleum and Natural Gas, Government of India. Accessed November 17, 2026. https://ppac.gov.in/consumption/products-wise.

Pradhan Mantri Ujjwala Yojana (PMUY). 2025. "Eligibility Criteria for Pradhan Mantri Ujjwala Yojana (PMUY)." February 6, 2025.

Press Information Bureau (PIB). 2025a. "Cabinet Approves Continuation of Targeted Subsidy for Pradhan Mantri Ujjwala Yojana Consumers for 2025–26 at INR 12000 Crore." Government of India, August 8, 2025. https://www.pib.gov.in/PressReleasePage.aspx?PRID=2154117.

Press Information Bureau (PIB). 2025b. "Cabinet Approves Rs 30,000 Crore as Compensation to Public Sector Oil Marketing Companies for Losses in Domestic LPG." Government of India, August 8, 2025. https://www.pib.gov.in/PressReleasePage.aspx?PRID=2154118.

Rajya Sabha. 2023. "Airshed Based Approach to Check Air Pollution." Unstarred Question No. 831, answered July 27, 2023. Ministry of Environment, Forest and Climate Change, Government of India. https://sansad.in/getFile/annex/260/AU831.pdf?source=pqars

Rajya Sabha. 2025. "Surge in Air Pollution." Unstarred Question No. 2315, answered March 20, 2025. Ministry of Environment, Forest and Climate Change, Government of India. https://sansad.in/getFile/annex/267/AU2315_J1fiHA.pdf?source=pqars

Rastogi, S., N. Satsangi, K. Singh Kunwar, and K. Juyal. 2026. Multifuel Study: India. Modern Energy Cooking Services. https://mecs.org.uk/wp-content/uploads/2026/03/Multifuel-Study-India.pdf.

Sharma, Shruti, Chandrashekhar Singh, Christopher Beaton, Ashutosh Sharma, Laura Merrill, Tara Laan, Anna Zinecker, and Lucy Kitson. 2019. Gender and Fossil Fuel Subsidy Reform in India: Findings and Recommendations. GSI Report. Winnipeg: International Institute for Sustainable Development. https://www.iisd.org/system/files/publications/gender-fossil-fuel-subsidy-reform-india.pdf.

Shukla, Apoorva. 2026. "Back to the 'Chulha': Is LPG 'Crisis' Pushing Kitchens Back to Coal and Wood?" Times Now, March 14, 2026. https://www.timesnownews.com/india/back-to-the-chulha-is-lpg-crisis-pushing-kitchens-back-to-coal-and-wood-article-153832858.

Statesman News Service. 2026. "LPG Cylinder Price in India among World's Lowest despite Rs 1600 Supply Cost and Rs 700 Loss per Refill." The Statesman, June 7. https://www.thestatesman.com/india/india-keeps-lpg-cylinder-price-among-worlds-cheapest-despite-rs-1600-supply-cost-and-rs-700-loss-on-every-refill-amid-global-crisis-1503602793.html

Survey of India. 2026. Political Map of India. Thirteenth Edition. Scale 1:4,000,000. Dehradun: Survey of India, Department of Science and Technology, Government of India. Accessed November 16, 2026. https://surveyofindia.gov.in/pages/political-map-of-india.

Suryanarayanan, Uday, and Mohammad Rafiuddin. 2026. How Can India Tackle Air Pollution with an Airshed-Level Approach? Lessons from Global Experiences. New Delhi: Council on Energy, Environment and Water. https://www.ceew.in/sites/default/files/what-is-an-airshed-airshed-management-and-regional-air-quality.pdf.

Urban, Jessie, Jaden Berger, Yamungu Botha, Gloria Boafo-Mensah, Joan Khalifa, Aubrey Mkwate, Ferdinand Tornyie, Kofi Ampomah-Benefo, Patience Agbedor, Nathan Bogonko, Samuel Bentson, and Nordica MacCarty. 2025. 'Quantifying the Efficiency and Fuel Consumption of Cooking with Traditional Wood and Charcoal Stoves in Malawi, Ghana, and Kenya'. Environmental Science & Technology 59 (32): 16913–22. https://doi.org/10.1021/acs.est.5c03702.

Venkataraman, Chandra, Abhinav Anand, Sujit Maji, Neeldip Barman, Dewashish Tiwari, Kaushik Muduchuru, Arushi Sharma, et al. 2024. "Drivers of PM2.5 Episodes and Exceedance in India: A Synthesis from the COALESCE Network." Journal of Geophysical Research: Atmospheres 129 (14): e2024JD040834. https://doi.org/10.1029/2024jd040834.

Venkataraman, Chandra, Michael Brauer, Kushal Tibrewal, Pankaj Sadavarte, Qiao Ma, Aaron Cohen, Sreelekha Chaliyakunnel, et al. 2018. "Source Influence on Emission Pathways and Ambient PM2.5 Pollution over India (2015–2050)." Atmospheric Chemistry and Physics 18 (11): 8017–39. https://doi.org/10.5194/acp-18-8017-2018.

Vishnoi, Anubhuti. 2024. "Centre Sets Up Panel to Address Air Pollution in Indo-Gangetic Plain." Economic Times, October 7, 2024. https://economictimes.indiatimes.com/news/india/centre-sets-up-panel-to-address-air-pollution-in-indo-gangetic-plain/articleshow/114022308.cms.

Washington University in St. Louis. 2025. "SatPM2.5 (Satellite-Derived PM2.5)." Atmospheric Composition Analysis Group. Accessed December 24, 2025. https://sites.wustl.edu/acag/surface-pm2-5/.

World Bank. 2023. Striving for Clean Air: Air Pollution and Public Health in South Asia. Washington, DC: World Bank. https://doi.org/10.1596/978-1-4648-1831-8.

World Health Organization (WHO). 2021. WHO Global Air Quality Guidelines: Particulate Matter (PM2.5 and PM10), Ozone, Nitrogen Dioxide, Sulfur Dioxide and Carbon Monoxide. Geneva: World Health Organization. https://www.who.int/publications/i/item/9789240034228.

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Low-carbon industrialisation & circularity
Security of fuels of the future
Quality of life
Green economy & livelihoods
Sharing lessons from India

SELECT POLICY ENGAGEMENTS

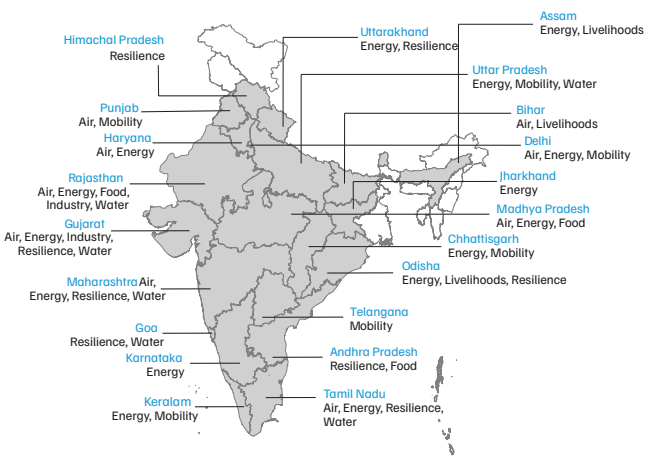
NATIONAL/INTERNATIONAL

2011 | National Water Resources Framework
2014 | 175 GW renewables target
2015 | International Solar Alliance
2016 | PM *Ujjwala Yojana*
2017 | *Saubhagya Scheme*
2019 | *India Cooling Action Plan*
2021 | Net Zero by 2070
2022 | *Mission LiFE*
2022 | *National Bioenergy Programme*
2022 | E-waste (Management) Rules
2023 | G20 Green Development Pact
2023 | *National Green Hydrogen Mission*
2024 | Green Steel Taxonomy
2024 | *PM Surya Ghar Yojana*
2025 | *National Critical Mineral Mission*
2025 | Rajya Sabha Guidelines on Crop Residue Burning
2025 | India's Carbon Credit Trading Scheme (CCTS)
2025 | IFSCA's Framework for Transition Bonds
2026 | Disaster Risk Index for 16th Finance Commission
2026 | India's NDC 3.0
2026 | India's Scenarios towards Viksit Bharat and Net Zero

STATE

2022 | *Rajasthan Organic Farming Mission*
2022 | *Jharkhand State Solar Policy*
2022 | *Uttar Pradesh Vidyut Sakhi programme*
2023 | *Rajasthan Renewable Energy Policy and Green Hydrogen Policy, 2023*
2023 | *Uttarakhand Solar Policy*
2025 | Green Odisha Initiative
2025 | *Maharashtra Climate Action Plan 2.0*
2025 | *Delhi Clean Air Action Plan*
2026 | *Delhi EV Policy 2.0*
2026 | Bihar Promotion of New and Renewable Energy Sources
2026 | Gujarat Integrated Renewable Energy Policy and Green Hydrogen Policy
2026 | *Uttarakhand Mukhyamantri Saur Swarojgar Yojana*
2024-26 |
Directives of Commission on Air Quality Management
Net Zero Roadmaps (BH, GJ, TN, UK)
Agroforestry Roadmaps (AS, MH, OD)
140+ Heat Action Plans (GJ, MH, OD, TN)
Treated Used Water Reuse Plans (MH, UP)
Flood Risk Mitigation Plans (GJ, MH)

21 STATES SUPPORTED





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