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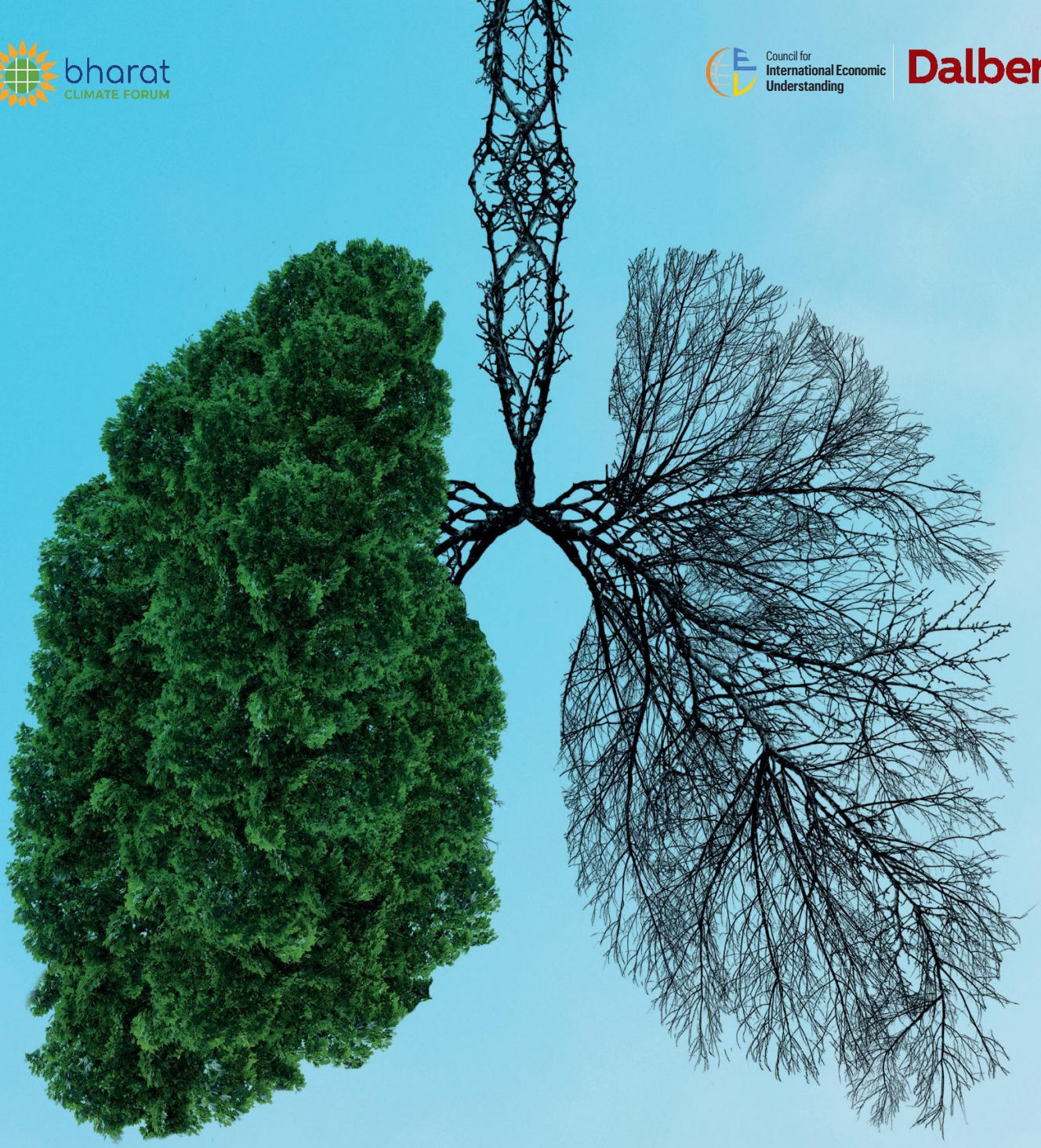

Aironomics 2025

Unlocking India's Blue Skies Economy

Date: May 31, 2025 | **Location:** ITC Maurya, New Delhi

Fires We Can't See

Cleaning the Air in Indian Households

Context and rationale

Residential combustion is the single largest source of air pollution exposure in India, driven by the burning of biomass, firewood, and kerosene in homes for cooking, heating, and other energy needs. Household air pollution (HAP) alone accounts for an estimated 22% to 52% of ambient air pollution across the country.[1] Cooking and heating fuels contribute approximately 48% of India's total PM2.5 emissions, making this the single largest contributor to the nation's particulate pollution burden. The health impacts are severe—exposure to HAP indoors, at the point of emission, is linked to nearly 800,000 premature deaths annually in India, with an additional 300,000 deaths attributable to the outdoor pollution caused by these household emissions.[1]

Recognizing the scale of HAP, India has made remarkable strides in expanding access to clean cooking fuels, deploying large-scale policies and programs that leverage last-mile distribution, targeted subsidies, and direct benefit transfers. The Pradhan Mantri Ujjwala Yojana (PMUY) has been central to this effort, expanding LPG access to over 99% of households[2] in Delhi and 90% nationally, supported by an allocation of ₹7,680 crore for FY23-24.[3] Complementing LPG access, initiatives like the National Efficient Cooking Programme (NECP) have introduced induction stoves as viable alternatives, offering a 25-30% cost advantage over traditional cooking methods.[4] Delhi exemplifies policy success, with LPG distributors located within 1-3 km of all households, increased subsidies of ₹300 per cylinder, and direct benefit transfer mechanisms that minimize leakages and delays.[5]

Non-notified slums remain a critical blind spot in India's clean cooking transition, with 40–50% of households still reliant on solid fuels due to systemic exclusion.[6] These communities, often outside formal urban planning frameworks, face documentation barriers that prevent

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[1] Chafe, Z., Brauer, M., Cohen, A., & Apte, J. (2019). The contribution of household fuels to ambient air pollution in India: A comparison of recent estimates (Working Paper). Collaborative Clean Air Policy Centre (CCAPC).

[2] It is assumed that the majority of these households are notified households, since the eligibility criteria for PMUY includes the submission of the following documents - KYC, State-issued ration cards (or self-declarations in case of migrants), Aadhar cards, proof of address and bank account details. Non-notified households are unlikely to possess all of the above, and therefore might fall outside purview of PMUY.

[3] Ministry of Petroleum & Natural Gas, 2023.

[4] Energy Efficiency Services Limited (EESL). (2023, November 3). EESL introduces its groundbreaking National Efficient Cooking Programme (NECP). Electrical India.

[5] Press Information Bureau. (2023, October 4). Cabinet hikes LPG subsidy to Rs 300, cylinder to cost Rs 603 in Delhi.

[6] Council on Energy, Environment and Water (CEEW). (2020). Are India's urban poor using clean cooking fuels? Insights from urban slum households across six states.

them from accessing financial assistance via government programs and schemes such as LPG subsidies under PMUY. Coupled with volatile household incomes and a lack of formal service delivery channels, residents of non-notified slums remain locked into polluting fuels such as firewood, charcoal, and kerosene for their daily cooking and heating needs.

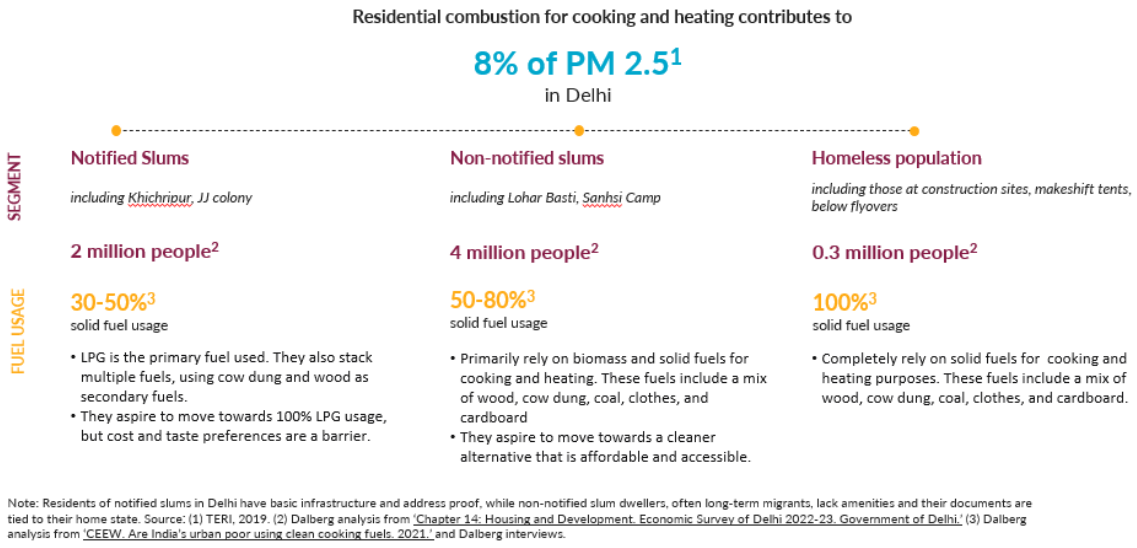

Figure 1: Distribution of solid fuel usage in Delhi

Even where clean cooking fuels are accessible, affordability remains a fundamental barrier to exclusive and sustained use among low-income households. Most urban poor families rely on volatile and seasonal incomes from daily-wage work in the informal sector, making the ₹1,000 cost per 14.2 kg LPG refill a significant financial burden. Further, residents are often unaware of alternatives to LPG, such as improved biomass or e-cooking devices (such as electric cookstoves). The high upfront cost of these cookstoves, ranging from ₹3,000 to ₹5,000, makes them unaffordable for many households.[7]

Even with improved access and affordability, deeply embedded cultural practices and household norms hinder exclusive adoption of clean fuels. The phenomenon of fuel stacking, driven by perceptions of LPG being unsafe, the dissatisfaction with the taste and perceived lower nutrient value of food cooked on LPG, significantly influence fuel choice. Many households strongly prefer using a traditional 'chulha,' citing familiarity with the stove and better alignment with their taste preferences.

Targeted financing innovations like carbon-linked subsidies and micro-loans offer scalable pathways to overcome affordability barriers in clean cooking transitions. Monetizing emission reductions from improved cookstoves and other e-cooking devices through carbon markets

[7] ASAR and CEEW. Barriers to access, adoption and sustained use of cleaner fuels among low income households: An exploratory study from Delhi and Jharkhand, India. 2023.

can subsidize upfront costs by 40–80%.[8] Bundling these products with micro-loans through NBFCs or MFIs, or offering pay-as-you-use models, further ease adoption friction. These mechanisms minimize the financial burden for daily-wage households, while enabling distributors to recover costs and scale operations sustainably.

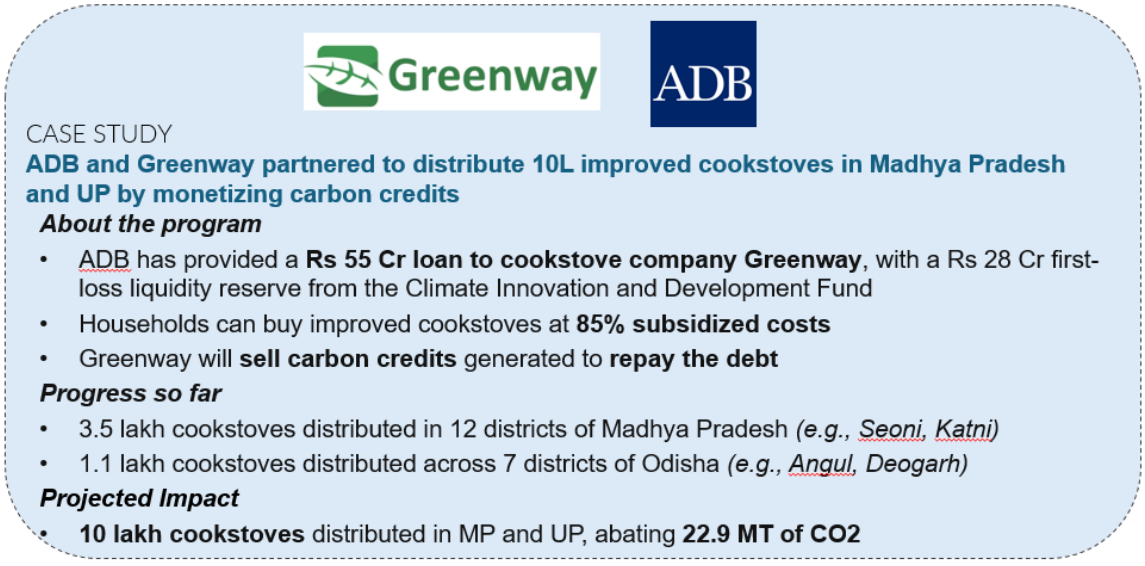

Figure 2: Case Study: Carbon credit monetization can help finance distribution of cookstoves at a subsidized cost. (Source: ADB, 2023)

Large-scale behavior change interventions, anchored in gendered distribution networks and community engagement, are critical to shifting entrenched cooking practices. Models like SEWA and ENERGIA demonstrate that women-led SHGs and female entrepreneurs can serve as trusted intermediaries, promoting clean cooking solutions, addressing cultural resistance, and supporting sustained adoption. Coupling distribution with awareness campaigns, peer-to-peer learning, and technology demonstrations can help address perceptions around safety, taste, and cooking efficacy, thereby reducing fuel stacking and increasing exclusive adoption of clean cooking technologies.

Scaling these solutions can unlock a significant economic opportunity in clean cookstoves — estimated at ₹10,000–12,000 crore in India, while delivering significant health and empowerment co-benefits for women.[9] This market growth, combined with financing and gender-inclusive models, can generate thousands of jobs in manufacturing, distribution, and maintenance. Cleaner fuels reduce women's exposure to harmful pollutants and free up time otherwise spent collecting fuel—up to 4–5 hours daily. Embedding women in distribution

[8] Calyx Global. (2023). Cooking up quality: Carbon credits from efficient cookstove projects face integrity issues worth fixing.
[9] Council on Energy, Environment and Water (CEEW). (2018). A roadmap for access to clean cooking energy in India. This economic opportunity is projected over a medium-term horizon. While the report does not specify an exact timeframe, such projections typically consider a period of 5 to 10 years, aligning with policy planning cycles and market development timelines.

networks further enhances adoption rates and supports their economic empowerment through livelihood opportunities.

This roundtable, "***Fires We Can't See: Cleaning the Air in Indian Households***", aims to bring together policymakers, private sector players, financiers, and community organizations to chart scalable pathways for reducing residential air pollution. The discussion will focus on advancing clean cooking solutions while addressing persistent challenges such as affordability gaps, behavioral resistance, and fragmented program delivery in urban settings.

Potential Opportunities and Challenges

- **India's clean cooking transition represents a ₹10,000–12,000 crore market opportunity by 2030, spanning stove manufacturing, distribution, servicing, and carbon financing:** Leveraging blended finance structures, carbon-linked subsidies, and gendered supply chains can unlock scale, particularly in low-income and peri-urban areas, while delivering strong co-benefits for health, climate, and women's economic empowerment.
- **Market-based distribution can drive last-mile access:** Leveraging LPG distributors, SHGs, and micro-entrepreneurs for clean cookstove and e-cooking devices sales can ensure affordability and service continuity, especially when paired with microfinance or pay-as-you-use models.
- **Gendered supply chains can accelerate adoption:** Women-led SHGs and female entrepreneurs can overcome cultural barriers and promote sustained use, while also generating livelihood opportunities—building on successful models like SEWA and ENERGIA.
- **Carbon-linked financing can reduce upfront costs:** Monetizing emission reductions from cleaner cookstoves and e-cooking devices through carbon markets (e.g., Gold Standard, Verra) can subsidize costs by 40–80%, making clean cooking solutions affordable for low-income households.
- **Integrating clean cooking into urban air quality plans can unlock scale:** Embedding clean cooking targets into NCAP and city air action plans allows cities to tap into additional funding sources, aggregate demand, and align interventions with PM2.5 reduction goals.

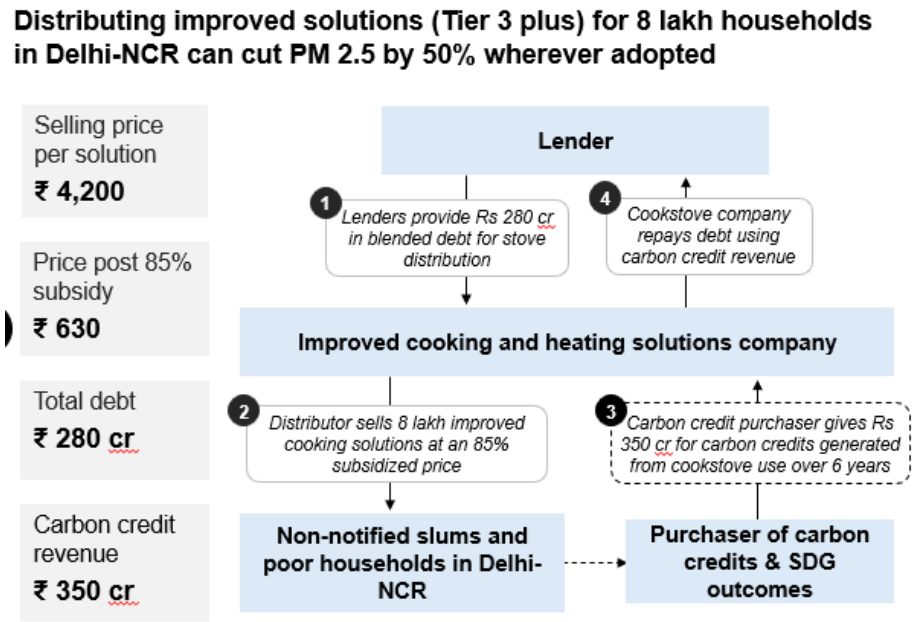

Figure 3: Financing model for distributing subsidized cookstoves in Delhi-NCR through carbon credits.

At the same time, certain key challenges must be addressed to realize these opportunities:

- **Fragmented program delivery and limited urban focus hinder clean cooking adoption at scale:** While national programs like PMUY focus on rural LPG access, urban slums—especially non-notified settlements—often fall outside the purview of formal schemes, leading to coverage and service delivery gaps.
- **High recurring costs and fuel stacking dilute the transition to clean fuels:** Even when LPG connections are available, the high cost of refills (~₹1,000 per cylinder) drives households back to solid fuels, resulting in fuel stacking. This undermines exclusive adoption of clean cooking and limits pollution reduction.
- **Behavioral resistance and low consumer awareness limit sustained adoption:** Cultural preferences, taste perceptions, and unfamiliarity with improved technologies (like electric cookers or induction stoves) slow behavioral shifts, even when affordable solutions exist.
- **Carbon market dependency creates revenue uncertainty for stove distributors:** Financing models tied to carbon credits face risks from fluctuating carbon prices and complex verification processes, making it harder to rely on these as stable revenue streams.

Key Focus for Discussion

This session will explore:

- What are the **systemic barriers** preventing clean cooking initiatives from reaching non-notified slums and peri-urban areas?

- What are the **most effective strategies to overcome behavioral resistance** and fuel stacking in urban low-income communities, and how can awareness campaigns or behavioral nudges be better designed for sustained adoption?
- What role can **technology innovation** (e.g., smart metering, remote monitoring) play in enhancing usage tracking, ensuring sustained adoption, improving the effectiveness of clean cooking programs, and improving air pollution outcomes? Are there **examples of business models or partnerships**—between LPG distributors, SHGs, and micro-entrepreneurs— that have proven effective in last-mile distribution of clean cooking solutions, and how can these be scaled in urban slums?
- What **role** can **private sector players**—such as stove manufacturers, carbon market players, and financial institutions—play in creating sustainable supply chains for clean cooking solutions?

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