Challenges and opportunities to promote electric cooking in India

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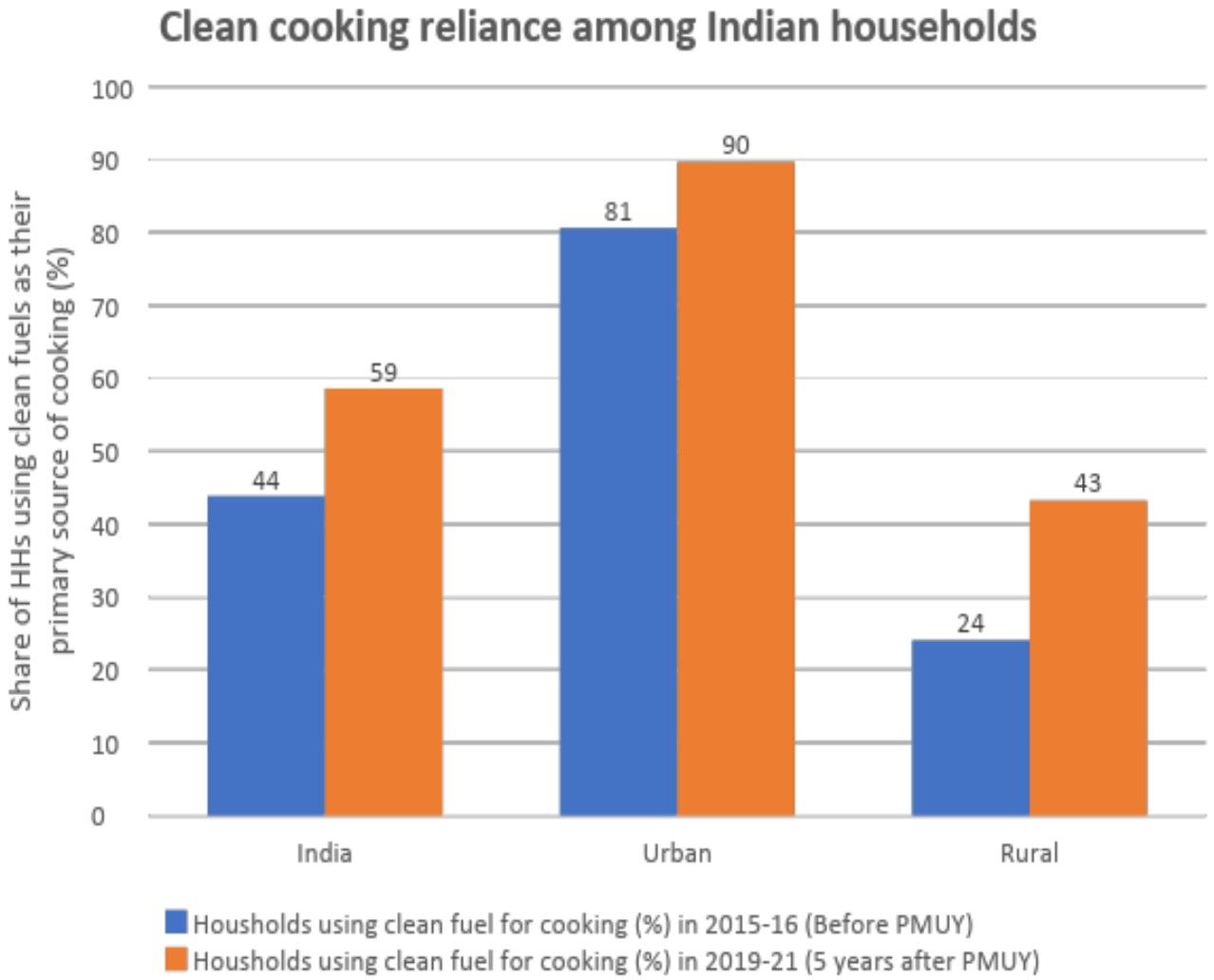
India’s clean cooking energy access story (Cooking fuel mix)

Indian households largely rely on open flame cooking and only 0.6% households rely on eCooking

- 59% Indian HHs use clean fuels as their primary source of cooking **(most of them use LPG)** (NFHS-5, 2019-21). Rest 41% of Indian HHs still depend primarily on solid fuels for cooking (57% in rural India).[1]

- Around **0.64% Indian HHs use electricity as their primary source** of cooking, even though it is cheaper and cleaner than LPG

- **Only 0.32% of HHs use biogas as their primary fuel for cooking** in India (NFHS-5, 2019-21)



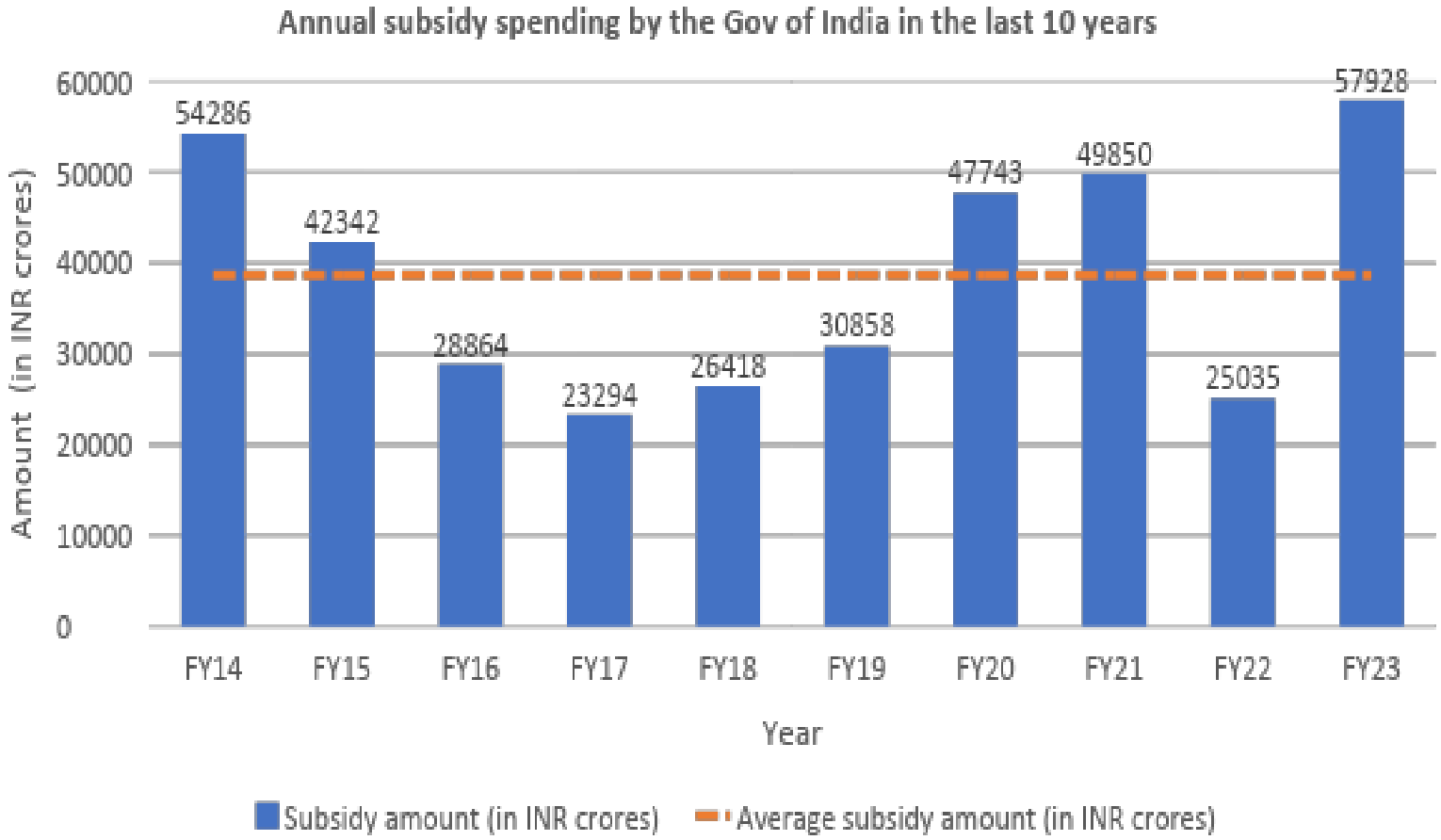
India’s reliance on LPG for clean cooking has come with high costs

GoI provided **INR 40,000 crore (~USD 5 billion) every year** as LPG subsidies (direct+indirect) in the last 10 years, majorly for the following 4 items:

1. **Subsidising LPG consumption** through DBTL
2. **LPG access** through PMUY. PMUY led to increase in LPG coverage from 62% in May 2016 to ~100% in 2023 in India.
3. Keeping LPG market price for domestic consumers below the actual cost (GoI provided compensation to the OMCs for the loss).
4. GST concessions & custom duty exemptions

The actual subsidy support could further increase significantly in 2024 due to recent subsidy announcements.

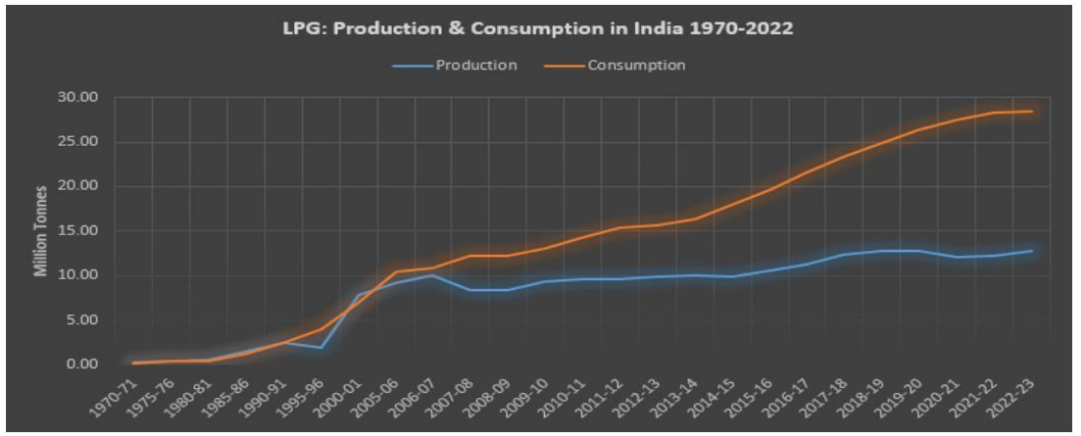
Promotion of eCooking can significantly reduce the subsidy expenditure!!!

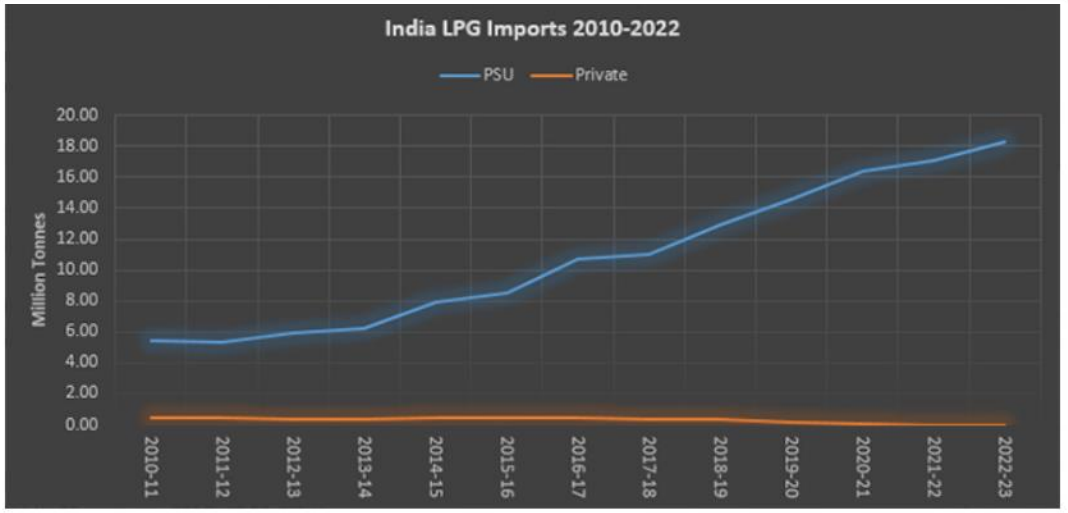


Why India needs to explore other clean cooking alternatives?

High reliance on LPG presents various risks for India creating a need to explore alternative solutions (such as eCooking)

- LPG imports are rising ~65% of India's LPG use comes from imports (in 2022-23) as compared to 49% in 2016-17 [1]
  - Exposes Indian consumers (who are already facing affordability barrier) to international fluctuations in oil prices.
  - Increasing LPG dependence will further accentuate import dependence
- Difficulty in ensuring doorstep delivery of LPG refills for all the consumers – only half of the HHs in rural India receive doorstep delivery of LPG refills.
- LPG is a fossil-fuel and it does not align well with India's long-term net-Zero commitments





Research Objective and Methodology

- Capturing insights into the usage patterns and perceptions about eCooking devices in both urban and rural areas.
- **Detailed qualitative interviews with rural and urban HHs in different geographies**

Study Area**Sample Specifications**	Uttarakhand, Punjab, Rajasthan, Karnataka, and Delhi
Type of study	Detailed qualitative Interviews with rural and urban HHs
Sample Size	n=100 (25 urban HHs and 75 rural HHs) (HHs from different types of socioeconomic strata in all the geographies, including urban slum HHs)

Key findings from the interviews

eCooking perception in urban cities vs rural areas

- Urban HHs living reported positive experiences with eCooking usage (especially, in states with lower electricity tariff)
  - E-cookstoves can be used to cook most of the meals (with some exceptions such as *Chapati* or *Baingan ka bharta*)
- As per the e-cookstove users in urban cities:
  - E-cookstoves cost in the range between ₹ 1500 to ₹ 2800 (limited affordability barrier in urban metropolitan cities)
  - It is **convenient and safe** to use compared to LPG
  - The food tastes similar to that cooked on LPG
- Due to the power supply of 20+ hours everyday for most part of the year, it is an effective clean cooking solution in the urban areas
  - However, consumers also highlighted that in summers, the frequency of power cuts increase, especially during peak hours, which can affect its usage frequency (and consumer perceptions).
- In rural areas, very few HHs are even willing to shift to eCooking:
  - Poor situation of power supply & high cost of eCookstoves + utensils are highlighted as the most important concerns
  - Lack of awareness about advantages of eCooking and about its operations & maintenance
  - Perception about eCooking as being complex and difficult to operate (mental barriers)

Factors influencing the decision to switch to e-cooking in urban cities

Key findings:

- **Moving to a new place** either for studies or employment plays a key role in opting for eCooking for students and young professionals (difficulty in getting an LPG connection)
- While for families, **they purchased eCookstoves as a backup to LPG**.

- There are multiple other reasons for preferring e-cookstoves in urban cities:
  - Difficulty in porting the LPG connection (primarily applicable for people coming from other states)
  - Incentives given for electricity use (such as *Gruh Jyothi* scheme, which provides free electricity up to 200 units for every residential household of Karnataka)
  - Low maintenance and easy operation

What are the challenges faced by eCooking consumers?

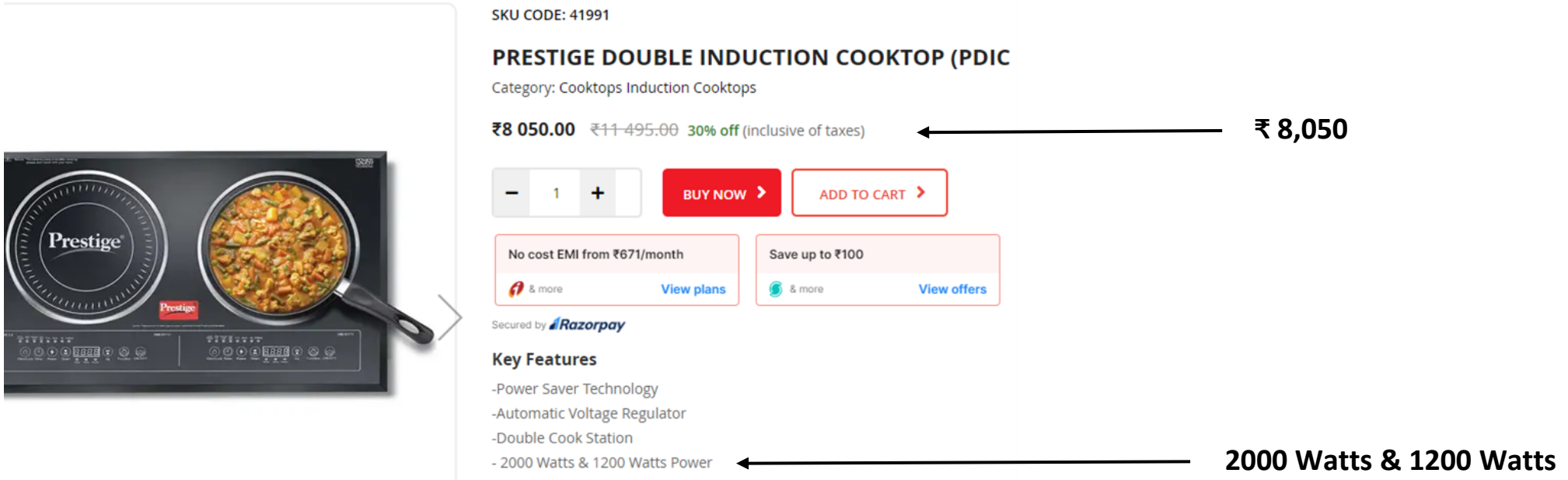
1. eCooking *may* remain as a backup with single heating unit

Key findings:

- Even though eCooking is more efficient than LPG (higher thermal efficiency), time taken to cook a single meal is relatively higher due to a single heating unit.

Recommendation:

- Need to explore the possibility of promoting electric cookstoves with energy-efficient double heating units (which is currently very expensive and comes with a total power rating of more than 3kWh).



2. Lack of flame-based cooking

- **Key finding:** Foods that require flame (such as *Chapatis* or *Baingan bharta*) cannot be cooked on the e-cookstove without modifications.
- **Recommendations:** Need R&D to figure out ways to deal with the perception of flame-based cooking
    - In the short run, need to explore accessories that may enable grilling (eg. *roti* grill) on e-cookstove.

3. Operation & maintenance challenges associated with eCookstove

Key findings:

- New utensils (which are often more expensive) are required for e-cookstoves, which is seen as an extra cost by them, and sometimes acts as a barrier to eCooking adoption.
- Even though users are comfortable using the e-cookstove, it still takes time for them to get acquainted with the temperatures for specific cooking activity.
    - Induction cookstoves provide different buttons for different temperature settings
- Three respondents mentioned that their e-cookstove broke down. But, only one gave it for repairing while the other two bought a new one.

Recommendations:

- Need to promote the manufacturing of **standard utensils** which are compatible with all cooking appliances (e-cookstoves, gas burners)

- To ensure all e-cookstoves have multiple modes (eg. boiling milk, deep fry etc.) for particular cooking activity (with pictures)

- Improve after-sales service network and educate users on repair options even after the warranty expires

4. E-cooking is emission intensive

Key findings:

- Scientific literature suggests that eCooking has higher emission intensity as compared to LPG and PNG
  - Yet, greening of grid presents significant opportunities to decarbonize India's cooking system in the long run

Cooking Fuel	Emission factor by Fuel Type
LPG (kg Co2e/kg)	2.91
PNG (kg Co2e/kg)	2.69
Electric Cooking (kg Co2e/kWh) (2021-2022)	0.71
Electric Cooking (kg Co2e/kWh) (2026-2027)	0.52

Cooking Fuel	Emission per year by Fuel Type (Kg Co2 per year per Household)
LPG	330.58
PNG	290.52
Electric Cooking (2021-2022)	691.54
Electric Cooking (2026-2027)	506.48

Short to medium term recommendations:

- Prioritise eCooking in states with higher RE penetration (lower emission intensity of electricity)
- Club eCooking with GoI's rooftop solar scheme (*PM Surya Ghar Yojana*)
- Continuous R&D on making e-cookstove highly energy efficient improving its power saving capacity (which can compensate for higher emission intensity)

Source: LPG, PNG- Decarbonising the Cooking Sector, CSTEP, Electric Cooking- CEA

Way forward

- Prioritise and incentivize eCooking adoption in urban India in short to medium run
    - It will free up significant LPG subsidies, which can be used to promote clean cooking alternatives in rural India
- Need to explore the possibility of promoting eCookstoves with energy-efficient double heating units (which is currently very expensive and comes with a total power rating of more than 3kWh).
- Focus on R&D to develop innovative solutions to address consumer perceptions around flame-based cooking.
    - In the short term, exploring compatible accessories like roti grills can be explored/experimented.
- Promote the manufacturing of standard utensils which are compatible with all cooking appliances (e-cookstoves, gas burners etc.) like “microwave-oven safe” plastic 

- To ensure all e-cookstoves have multiple modes (eg. boiling milk, deep fry etc.) for particular cooking activity
- Improve after-sales service network and educate users on repair options even after the warranty expires
- Continuous R&D on making e-cookstove highly energy efficient improving its power saving capacity (which can compensate for higher emission intensity) **- Longer term solution**
    - Prioritise eCooking in states with higher RE penetration (lower emission intensity of electricity) **- Short term solution**.
    - Club eCooking with GoI’s rooftop solar scheme (*PM Surya Ghar Yojana*) – **Short to medium term solution**

Thank You!