Key Learnings from Electric Cooking Programs

Regional Knowledge Seminar
Harnessing Electric Cooking to Solve the Clean Cooking Challenge in Asia and the Pacific

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Electric stoves as a solution for household air pollution: Evidence from rural India

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WHO recommends annual average concentration of PM2.5 to which people are exposed should not exceed 5 g/m³, and that the 24-hour average should not exceed 15 g/m³ on any day. The average outdoor concentration of PM2.5 in the study villages was 127 g/m³. Furthermore, there are large spikes in kitchen concentrations during cooking hours. In most households and on many days, these levels rise to more than 1000 g/m³.

We collected minute-by-minute data on electricity availability, electric induction stove use, and kitchen and outdoor particulate pollution in a sample of rural Indian households for one year. Using within household-month variation generated by unpredictable outages, we estimate the effects of electricity availability and electric induction stove use on kitchen PM2.5 concentration at each hour of the day. Electricity availability reduces kitchen PM2.5 by up to 50 g/m³, which is between 10 and 20 percent of peak concentrations during cooking hours. Induction stove use instrumented by electricity availability reduces PM2.5 in kitchens by 200-450 g/m³ during cooking hours.

EconPapers: Electric stoves as a solution for household air pollution: Evidence from rural India (repec.org)
% share of Population with access to clean cooking in selected countries in Asia-Pacific and Sub-Saharan Africa

- Vietnam
- Bhutan
- Thailand
- World
- India
- Mongolia
- Philippines
- Myanmar
- Nepal
- Sri Lanka
- Bangladesh
- Kenya
- Nigeria
- Ethiopia

Environment for Development and CECFEE (ISI, Delhi) undertaking a cross-country study on challenges for upscaling electric cooking in different countries based on primary stakeholder interactions and secondary data (MTF and others).
Energy Efficiency Services Limited planning to initiate market-based interventions for Solar based Induction cooking solutions by leveraging Carbon financing for a financially and environmentally sustainable market model.

Both on-grid and off-grid solutions have been developed for rural households with and without electricity.

Double burner induction stoves are also been considered for households with sufficient connected load and have capacity to pay

Demand and supply estimations have been undertaken
Cost and benefit estimations have been undertaken.

**Electric cooking pilots with digital MRV** have been initiated with support from Aspire program of FCDO and International Cooper Association.

Recently, EESL has done a tender for 20000 induction stoves.  
**Bureau of Energy Efficiency** in India is undertaking large scale procurement of induction stoves and several state governments are implementing different programs.
Anganwadi is a pre-nursery institution in India for early childhood development and care run by Government of India under Women and Child Development. Anganwadi Workers are currently cooking with LPG.

Energy Management Centre, Kerala is undertaking AnganJyoti Program where they are providing Induction along with utensils to anganwadis. In Initial phase about 3000 anganwadis are targeted. Some 400 will also get solar rooftop system. In full scale up all 33000 anganwadis will be targeted.

Program has already been implemented in 2 districts.
CECFEE, ISI is undertaking monitoring and evaluation of the Program
Key Barriers/Enablers for Electric Cooking Adoption

- Affordability
- Availability of Alternative Fuels
- Concerns about Safety, Convenience, Durability & Behavioral Resistance
- Access to Finance
- Quality of Electricity Supply
- Quality of Electric cooking appliances
- After-sales Services
- Institutional Setup

Possible Solutions
Affordability

A1. Boiling performance 
A2. Roasting performance
A3. Frying performance
B1. Ability to modulate
B2. Ability to deliver
capability
C1. Operating expense
C2. Capital cost of the device
D1. Smoke and soot emissions
D2. Stability of the device
D3. Possibility of using with a range of fuel types
D4. Possibility of using with multiple load simultaneously
D5. Process of ignition
D6. Process of fuel efficiency
D7. Energy efficiency
F1. Energy efficiency
F2. Durability
F3. Service support to users

Bars extending through the red dotted line indicates a high priority

PREFERENCE INDEX

Sundarbans, India (GIZ and KPMG, 2019)
- Operating expense & capital cost are the topmost Preferred Cooking Service Parameters
- Households reported lesser usage of induction stoves after their meters were changed from the fixed fee to unit meters
- Poor households (Antyodaya) having no access to biomass and cowdung, have to buy firewood/cowdung and even LPG (particularly during rainy season) from the market

Uttar Pradesh, India (ASPIRE* and ICA**, 2023)
- High cost of electricity supply in mini-grid areas is a major deterrent
- Retailers’ interviews revealed that the price is one of the major factors that influences consumer’s buying decision apart from brand sensitivity and appliance size parameters.

Myanmar (KPMG, 2021)
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*Accelerating Smart Power and Renewable Energy (ASPIRE) is a bilateral programme being implemented by the UK Government Foreign Commonweal th and Development Office (FCDO), in association with the Ministry of Power and Ministry of New and Renewable Energy, Government of India. KPMG is the implementation advisor to FCDO in relation to the ASPIRE programme.
**International Cooper Association
Availability of Alternative Fuels

Households using electricity as primary source of cooking are observed to mostly stack with collected firewood followed by charcoal and purchased firewood in grid areas.

Charcoal is widely used for affordable cooking in Myanmar, though prices vary. Firewood is typically collected free of charge from the environment.

Village Name | Per capita biomass consumption (in kg)
--- | ---
Kharosma | 1.578
Bikwajtpur | 1.533
Jura Dandu Pur | 1.350
Jayapur | 1.152
Sahapur | 1.125
Saray Arjun | 1.068
Krishnapur | 1.017
Hariharpur | 1.008

- Traditional cooking method is being reported to be used despite possessing an LPG connection
- Both LPG and Induction cooking methods being used simultaneously

- In mountainous regions, use of induction cooking is observed more as cost and effort to transport LPG is relatively high
- Electricity is available at subsidized rate (e.g. Himachal Pradesh) where hydro power generated electricity is predominant
Concerns about Safety, Convenience, Durability & Behavioral Resistance {1/2}

Ankita, stopped using induction after 2 months as she was noticing electric shocks after each incident of dal spillover.

Manju was given an induction stove with utensils. Within 2-3 days, Manju started cooking all her meals on the induction. But she stopped using after one month when demonstration utensils were taken away from her, and she was given monetary benefits to buy new ones.

- Teflon glass breakage, moisture collection, and circuit/wire burns in induction stoves are common complaints by customers.
- Some older people faced technology barriers when using induction cooktops.
Concerns about Safety, Convenience, Durability & Behavioral Resistance {2/2}

Absence of kitchen Slab: In the absence of a suitable kitchen infrastructure, households position their induction cookstoves either on the floor or on elevated surfaces closer to the ground which leads to reported damage to fans due to collection of dust and moisture.
Quality of Electricity Supply {1/2}

Poor condition of wiring (power plugs and switches)

- Those having adequate connected load required to run induction stoves cite issues like electricity supply shortages, involving 2-12 hours of daily outages with multiple disruptions, and voltage fluctuations, etc. for lesser usage of such appliances.
- Also, often there is no adequate connected load and wiring infrastructure to run electric cooking appliances.

Comparatively better wiring

- While low voltage problems are observed more in grid areas (aging grid), mini grid areas are characterized by supply shortages and limited connected load problems.
Quality of Electricity Supply {2/2}

Intervention:
Induction stoves with 2-year after-sales service warranty was promoted in one village. The village is divided into two sides by a concrete road (depicted below as A&B). The two sides get power supply from two different substations. Sustained electricity supply during cooking hours is ensured with the help of local DISCOM officials on the one side of the village (A).

<table>
<thead>
<tr>
<th>Side A of the village</th>
<th>Side B of the village</th>
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<tr>
<td>With reliable power supply</td>
<td>With unreliable power supply</td>
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Most of the households kept using the induction cookstove despite incidences of damage. Some got it repaired from the nearby retailers and some bought new ones.

Reliable and continuous power supply, coupled with the motivation of the household encouraged induction-based cooking on this side of the village.

Concrete road dividing the village

Post-intervention period

Most of the households on this side stopped using Induction cookstoves primarily due to the poor supply situation

Due to electricity supply challenges, households did not have any incentive to even repair their damaged induction stoves.
After-sales Services

- **Limited after sales services are present at regional level**
- **Repairing/copling mechanisms after breakdown** - Most of the households who reported a breakdown (predominantly due to voltage fluctuations and wear and tear) bought a new appliance or either repair on their own.
- **Some households however reported stopping of use of the specific e-cooking appliance all together.**

**Myanmar**
(KPMG, 2021)

- **Warranty/return policy**-
  - More than 50% of households across all sampled regions reported that the appliance came with no warranty or return policy.
  - Majority of retailers interviewed do not offer any warranties in order to simplify their operations, even when the warranty is available from the original supplier. Products are tested and demonstrated as well-functioning at points of purchase.
  - Average number of appliances reported to break down ranges between 1 to 3 across sampled regions.
Quality of Electric Cooking Appliances

Myanmar
(KPMG, 2021)

- The availability of low-quality electric appliances has led to market spoilage in Myanmar, making users wary of electric cooking appliances.
- Low-quality appliances increase the chances of faults and failures in the appliance and the possibilities of electrical shocks, and therefore, creating a negative perception of electric cooking appliances in general.

Quality assurance standards and safety certification

- During the stakeholder interactions it was found that suppliers and distributors are not aware of specific quality assurance regulation or safety certification and e-waste disposal regulation in Myanmar.
- Suppliers and NGOs further mentioned difficulties in competing with various low price but also low-quality products.
Access to Finance

MFIs avoid consumption financing and consider the ticket size for e-appliances to be too low for effective underwriting

➢ Small ticket size for e-cooking appliances: The MFIs and NGOs that were interviewed mentioned that it is rare for MFIs to be interested in financing consumer products in rural areas. Most MFIs in rural areas provide loans for productivity activities. Based on feedback from the MFIs, the ticket size for financing e-cooking appliances is also too small.

➢ Scalability and sustainability concerns: In addition, the project is perceived as non-recurring for MFIs, as the borrowers may not need another loan after the loan for e-cooking appliance expires.

Myanmar
(KPMG, 2021)

Uttar Pradesh, India
(ASPIRE* and ICA, 2023)

MFIs are bundling home loans with induction stoves. In Biswapur, woman associated with SHG reported that to construct her house she required 40000 Rs loan. She got a loan from MFI but was required to buy 1200 w induction at 2500 Rs. Her house had connected load of 1 KW and she had very poor electricity supply, it was never used by her.
We need decentralized models which can run on their own with initial seed money provided to women/targeted groups for scaling clean cooking in remote regions.
## Possible Solutions/Recommendations

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<th>Barriers/Enablers</th>
<th>Solutions</th>
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<tr>
<td><strong>Demand Side</strong></td>
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| **Affordability** | ✓ Adopt differential pricing strategies/discounts for rural areas  
✓ Promote innovative financial credit mechanisms (post-paid instalments or pay as you go models and On-bill financing)  
✓ Carbon credit financing on usage of such appliances |
| **Availability of Alternative Fuels** | ✓ Households already using LPG can be easily targeted by bridging the information gap on cost parameters  
✓ Increase prices or regulation of alternative fuels to account for their true social costs |
| **Concerns about Safety, Convenience, Durability & Behavioral Resistance** | ✓ Develop messaging targeted appropriately at different consumer segments and for different appliance options  
✓ Conduct cooking demos campaigns & local cooking competitions to publicise benefits of e-cooking and facilitate uptake and raise awareness about these issues  
✓ Continuous engagement with the beneficiaries otherwise sustained usage cannot be achieved. Onboarding of local institutions for decentralized efforts.  
✓ Liaison with suppliers to provide appliances especially customized as per regional households’ requirements. *For Example, in Uttar Pradesh, India we found that*  
  ✓ Knob features should be avoided as it leads to water seepage  
  ✓ Ceramic glass should be preferred over Teflon glass for more durability and low maintenance  
  ✓ Multiple cooking options to cater variety of user cuisines  
  ✓ Induction power coil diameter should be as per the utensils size usually owned in user households |
### Possible Solutions

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| **SUPPLY SIDE** | ✓ Engage DISCOMS and local electricity authorities to achieve better results for such programs and ensure availability of electricity especially during times of cooking  
✓ Improve grid and mini grid infrastructure through investments  
✓ Provide consumers advanced notice of power cuts  
✓ Optimized load scheduling, time of day tariffs |
| Quality of Electricity Supply | ✓ Promote quality e-cooking appliances  
✓ Bundle product and maintenance services  
✓ Develop effective after sales service networks  
✓ Incentivise local retailers to provide the services  
✓ Ensure proper mechanisms to address customer grievances such as maintaining a customer helpline |
| After –sales Services | ✓ Adopt globally recognized standards as a cost-effective measure to promote good quality electric appliances  
✓ Ensure to promote only energy efficient electric cooking appliances  
✓ Implement adequate regulations regarding safety & quality issues along with requirements such as strict labelling of the products  
✓ Improve national quality infrastructure especially in the context of confirmatory assessment bodies (laboratories, inspection bodies and certification bodies.)  
✓ Enable awareness about quality assurance regulations & standardisation practices across suppliers |
## Possible Solutions

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<td><strong>ENABLING ENVIRONMENT</strong></td>
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| Access to Finance      | ✓ Ensure digital literacy of financial tools  
✓ Ensure adequate financial access across all regions with a special emphasis on modern means of financing such as mobile money  
✓ Incentivize low or zero interest financing with RBF payments                                                                 |
| Institutional Set Up   | ✓ Devise a national clean cooking strategy with clear and measurable goals in consonance with various policy measures  
✓ Engage local institutions to provide continuous support to achieve sustained usage  
✓ Review mandates of each ministry in line with their technical & financial capacities to avoid overlapping of responsibilities, and build regulatory capacity of those agencies  
✓ Integrated approach for communications to include other ministries such as health, environment, rural development etc.  
✓ Liaising with market players in policy formulation/implementation                                                                                  |
Payment Cards served as an awareness tool

Interestingly, majority of the households citing upfront cost as the major reason for not adopting an electric cooking appliances initially, were willing to buy later when shown the payment cards with details on parameters like price, photo, energy consumption, device features like wattage, hobs, capacity, brand etc.
**LPG:** With an annual consumption of 8 cylinders at a rate of INR 900 per cylinder, the annual expenditure of an Indian household on cooking fuel would amount to INR 7200.

**Electricity:** As per Niti Aayog*, the electricity consumption attributed to cooking, taking into consideration the efficiencies of Induction cookstoves, approximately corresponds to an average utilization of 7 MJ/day or 1.94 kWh/day. When considering the cost of INR 7.5 per unit of electricity, it is estimated that an average Indian household spends approximately INR 5400 on electricity for cooking purposes.

Thus, an Indian household transitioning from LPG to electricity-based cooking would realize savings of approximately INR 1800 annually.

*link for the document is [cooking.pdf](niua.org)
Thanks