PEEDA
People, Energy & Environment Development Association

Wuppertal Institut

Understanding the Diffusion of E-cooking Solutions for Micro Enterprises in Rural Nepal

IMPRINT

This study was part of the interventions implemented within the WISIONS Innovation Lab Nepal. The overarching goal of the Innovation Lab Nepal is to strengthen the livelihoods of mountain communities of Nepal by applying sustainability solutions in the fields of energy access and landscape management in an integrative way. The WISIONS Innovation Lab is implemented in Nepal by a consortium of local organizations led by Winrock International Nepal and which comprises the collaboration with People, Energy & Environment Development Association (PEEDA) and RECOFTC Nepal.

The Innovation Lab Nepal is part of the WISIONS of Sustainability, which is an initiative led by the Wuppertal Institute for Climate Environment and Energy.

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EXECUTIVE SUMMARY

Study background and objective:

Nepal's rural commercial cooking sector continues to rely heavily on Liquefied Petroleum Gas (LPG) and biomass, despite the country's vast hydropower potential and improving grid reliability. The Government of Nepal has prioritized the use of locally generated electricity across all sectors. Although more than 95% of households now have access to electricity, the uptake of electric cooking (e-cooking) in commercial settings has so far been minimal. To date, most research and interventions have focused primarily on household-level adoption, leaving a significant evidence and experience gap for small businesses.

At the same time, sustaining Nepal's more than 1,800 micro-hydropower (MHP) plants in the mid-hills requires innovative approaches to increase electricity demand and secure their financial viability. Promoting the use of e-cooking solutions by local micro enterprises represents an opportunity to increase the productive use of the power generated by MHP plants. With its scalability and replicability across the mid-hill range, e-cooking provides a multidimensional intervention that links energy transition with sustainable mountain development.

To address these gaps and opportunities, an e-cooking intervention was implemented in Badigad and Nishikhola Rural Municipalities of Baglung district. The specific objective of the intervention was to promote adoption of electric cooking solutions in small tea shops, restaurants and hotels, in order to assess their practical suitability, operational efficiency, and user acceptance in the real-world settings.

Methodology adopted:

A baseline assessment and market assessment were conducted to evaluate electrical readiness, as well as market barriers and opportunities. Where necessary, wiring upgrades were carried out to ensure safety and adequate load capacity in the participating micro enterprises. They received hands-on training during live demonstrations on safe and efficient use of induction stoves. To ensure both commitment and sustainability, a structured subsidy model was offered as incentive to participate in the study. Appliances were distributed in two batches, first to nine enterprises and later to an additional eleven, allowing for staggered implementation and follow-up. Monitoring tools included cooking diaries and smart meters to capture both energy consumption and behavioral insights. Finally, an endline survey was conducted to measure financial impacts, user satisfaction and identify key adoption barriers.

Key Findings:

Despite the small sample size and limited time series data, the study demonstrates that e-cooking is technically feasible and operationally suitable for micro enterprises in Nepal, with most users integrating induction cooking for 60–90% of their operations. Participants reported major benefits including faster cooking times, smoke-free and cleaner working environments, and reduced LPG consumption, which also supports income generation for micro-hydropower

plants and contributes to lowering Nepal's LPG trade deficit. The tailored subsidy model based on participants Willingness to Pay (WTP) significantly improved affordability and uptake, while demonstrations and peer learning proved highly effective in building awareness and acceptance. Financial analysis showed that active participants achieved monthly fuel savings ranging from NPR 81 to NPR 2,000 (USD 0.58 to 14.3), which equates to a 20–40% reduction in LPG expenditure. Users with higher usage rates featured faster payback periods, indicating clear potential for financial viability.

At the same time, several challenges emerged that must be addressed for large-scale adoption. Many micro enterprises required wiring upgrades before installation, pointing to critical infrastructure gaps. Cookware compatibility limited the ability to prepare some popular dishes such as Chowmein, and the local availability of large-capacity commercial cookware and induction stove spare parts remained limited. Repair and maintenance services were also underdeveloped, posing risks to sustained adoption.

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LIST OF ABBREVIATIONS

A	Ampere
DRE	Decentralized Renewable Energy
E-cooking	Electric Cooking
EPC	Electric Pressure Cooker
IL	Innovation Lab
km	Kilometre
LPG	Liquefied Petroleum Gas
MCB	Miniature Circuit Breaker
MHP	Micro hydro power
NDC	Nationally Determined Contribution
NEA	Nepal Electricity Authority
NPR	Nepalese Rupee
PEEDA	People, Energy and Environment Development Association
RM	Rural Municipalities
sq.mm	Square millimetre
USD	US Dollar
W	Watt
WTP	Willingness to Pay

1. INTRODUCTION

The WISIONS Innovation Lab (WISIONS IL), led by the Wuppertal Institute for Climate, Environment and Energy, is a transformative research approach aimed to promote sustainable energy and community development, particularly in rural areas. In Nepal, the WISIONS IL is being implemented by Winrock International in collaboration with PEEDA and RECOFTC Nepal to strengthen rural livelihoods by integrating decentralized renewable energy (DRE) solutions with sustainable landscape management practices in Baglung and Jumla districts.

As part of the WISIONS IL initiative, an e-cooking intervention was implemented in Badigad and Nishikhola Rural Municipalities of Baglung district (see Figure 1). The specific objective of the intervention was to promote adoption of electric cookstoves in small tea shops, restaurants and hotels, in order to assess their practical suitability, operational efficiency, and user acceptance in the real-world settings.

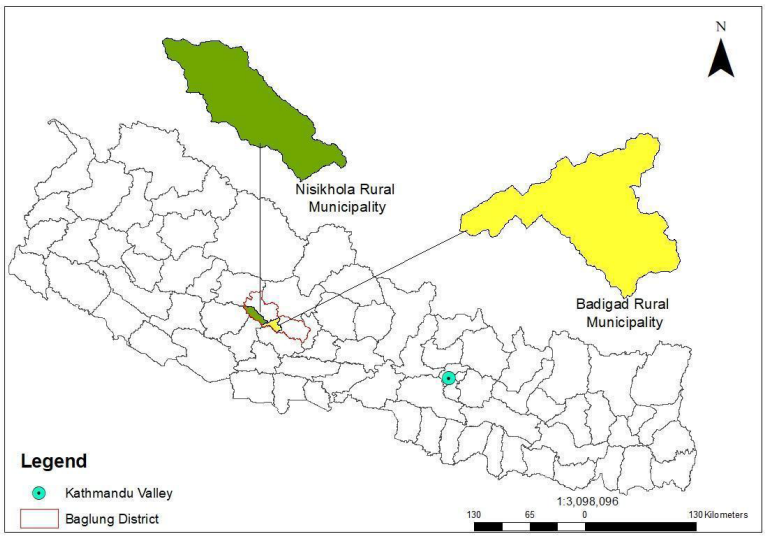


Figure 1: Location of the study area

1.1 RELEVANCE OF THE STUDY

The motivation for this study aligns with Nepal's urgent local needs as well as with its national and international commitments to clean energy transition, air quality improvement, and reduced dependence on imported fossil fuels such as Liquefied Petroleum Gas (LPG). Nepal's third Nationally Determined Contribution (NDC 3.0) sets an ambitious target of promoting e-cooking solutions for 2.1 million households and 15,000 institutions and firms by 2035[1], emphasizing e-cooking as a central strategy. With electricity generation already exceeding peak demand for much of the year, e-cooking presents itself as a technically, financially feasible and environmentally sustainable solution.

1 Government of Nepal. (2025). Nationally Determined Contribution (NDC) 3.0. https://unfccc.int/sites/default/files/2025-05/Nepal%20NDC3.pdf, p.3.

At the same time, the future of more than 1,800 microhydro power (MHP) plants operating in the country[2], and the rural livelihoods they support, remains uncertain. In Phase I and Phase II of the WISIONS IL, the project team assessed several MHP plants in Jumla and Baglung districts of Nepal. The assessment revealed key challenges, the most prominent being low utilization of MHP-generated electricity, limited income generation and the rapid expansion of the national grid. Although MHPs supply electricity to local households and micro enterprises, most of their daily energy needs continued to rely heavily on fuelwood and LPG, a pattern consistent with the national context. Also in this context the promotion of e-cooking is a promising strategy to increase local electricity demand from MHPs and to expand the productive use of electricity.

Yet, most research and projects to date have focused on household adoption, leaving a critical evidence gap in the commercial sector. This gap is particularly important given the significant energy consumption of small hotels and tea shops, which could serve as early adopters and demonstration sites for wider community adoption.

1.2 OBJECTIVE

This study aims to test and evaluate the practical suitability, efficiency, and user acceptance of e-cooking solutions for commercial use in rural Nepal. Applying an action research approach, the study involved micro enterprises[3], such as tea shops, restaurants and hotels, in order to assess the performance of e-cooking technologies and electricity usage patterns in everyday operating conditions. The findings will inform policymakers, development agencies, and market actors in designing strategies that accelerate the uptake of appropriate e-cooking solutions in the commercial sector.

2 Water and Energy Commission Secretariat. (2022). Energy Sector Synopsis Report 2021/2022. http://wecs.gov.np/source/Energy%20Sector%20Synopsis%20Report%2C%202022.pdf, p. 38

3 The participants in this action research are small businesses such as hotels, restaurants, tea shops, and a local chowmein factory, each employing fewer than 10 staff members. For simplicity, throughout this report, these businesses are collectively referred to as micro enterprises.

2. METHODOLOGY

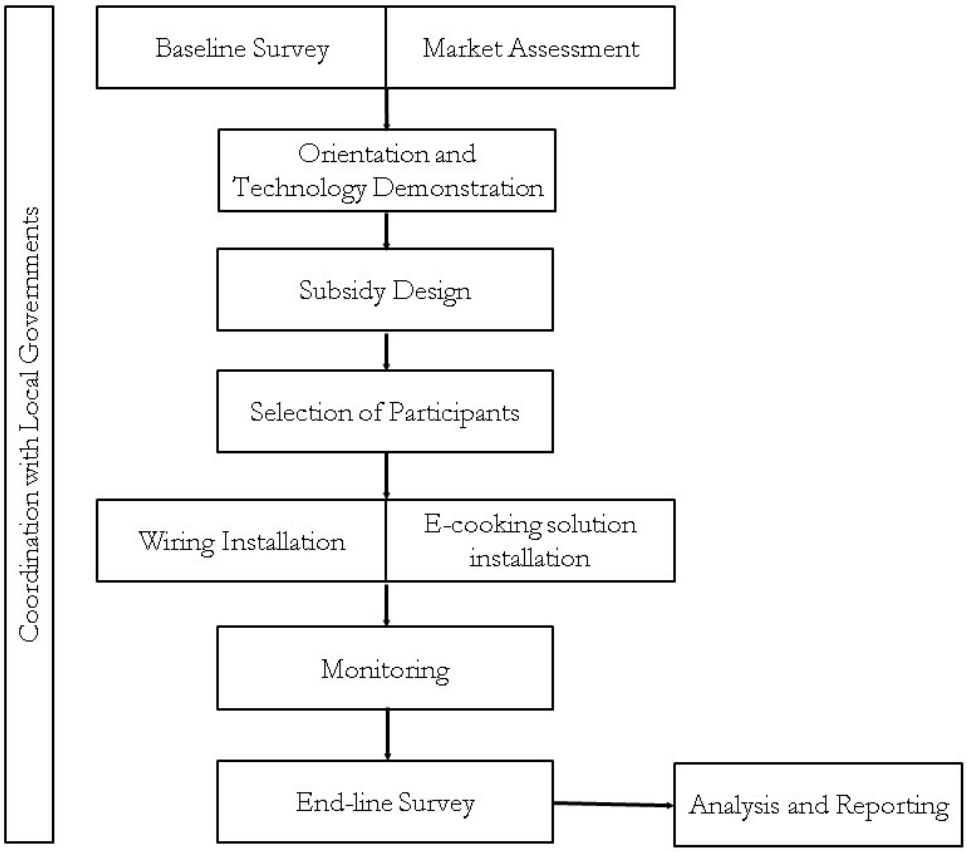


Figure 2: Flowchart of the applied methodology

The project's methodology followed a sequential, needs-driven process designed to ensure technical readiness, effective implementation, and evidence-based evaluation. The process is represented by the flowchart in Figure 2 and comprises the following steps:

2.1 BASELINE SURVEY

A baseline study was conducted to assess the existing cooking practices of the identified target groups. The study gathered detailed information on the types of dishes prepared and their frequency on a daily basis, the types of cooking fuels and stoves in use, and the corresponding fuel consumption rates on a monthly and annual basis. In addition, the assessment documented the types of cookware utilized, the status of electricity connections, and the condition of internal wiring systems. The study also documented the willingness of the target groups to participate in the intervention. The survey was taken by the research staff visiting a sample of tea shops, restaurants and hotels followed by a direct interview. A questionnaire was prepared for the interview in the data collection tool Kobo toolbox.

2.2 MARKET ASSESSMENT

A market assessment was done to evaluate the overall readiness of the commercial sector for marketing e-cooking solutions. The assessment was undertaken in Burtibang, Hatiya, and Kharbang which are the busiest market area of western Baglung. It involved examining the availability of various e-cooking appliances relevant to local needs, including induction stoves, infrared stoves, electric pressure cookers, and microwave ovens, as well as suitable cookware. A key component of this evaluation was also to gauge the market's potential for providing after-sales services and support for these e-cooking solutions.

The findings from the market assessment and the baseline study served as a critical reference point for designing and implementing the e-cooking intervention and for evaluating its impacts thereafter.

2.3 ORIENTATION AND TECHNOLOGY DEMONSTRATION

Technology demonstrations were carried out in the major market centres (bazaar areas) of the project site. A total of eight market locations were selected for these demonstrations: Kharbang, Khaular, Khara, Khala, Bhimgithe, Jugjakhola, Jhiwakhola, and Putalibazar. These are the locations where most of the local hotels and restaurants are concentrated.

In each location, the demonstration was conducted in a local hotel. After seeking consent from the hotel owner, e-cooking appliances were temporarily installed, and other potential participants from the surrounding area were invited to participate in the demonstration. A standardized demonstration script was used to ensure consistency across locations.

Figure 3: Cooking demonstration at a local hotel in the Baglung district

2.4 SUBSIDY DESIGN

Following each demonstration, a series of queries were applied to the participants in order to assess their willingness to provide own financial contribution in order to acquire the e-cooking solutions suitable for their business and participate in the testing phase of the project. Past experiences in similar programs, have shown that when appliances are given away for no cost, participants tend not to value or properly utilize them. In some cases, this even leads to over-demand, with

households or businesses trying to acquire multiple units without genuine intent to use them.

To avoid such inefficiencies and ensure both commitment and sustainability, a structured subsidy model was introduced based on the responses of the participants. Under this model, users were provided a subsidy of 70% of the cost of a suitable e-cooking solution or NPR 7,000, whichever was lower. This design helped reduce the financial burden on research participants while ensuring that they made a meaningful contribution to the project. The subsidy mechanism was also intended to prevent enterprises requiring higher-value appliances from receiving disproportionately large subsidies. By doing so, the approach struck a balance between affordability and accountability, fostering participant ownership while keeping e-cooking solutions financially accessible.

2.5 SELECTION OF PARTICIPANTS

The target participants for the intervention were hotel and restaurant owners, as the e-cooking appliances were intended for commercial use in food service establishments. The selection was carried out in two batches:

Batch 1: During the demonstration phase, restaurant and hotel owners from the respective market areas were invited to attend. Those who showed interest were then consulted individually to confirm their participation and agree on a) the appliance package that would be most suitable for their daily menu and b) the level of their financial contribution to acquire the corresponding package. This initial group formed the first cohort of adopters.

Batch 2: Following the demonstrations and through ongoing engagement by the field facilitator, additional restaurant and hotel owners expressed interest after observing the appliances in use by their peers. These participants were then supported in joining the program, expanding the reach of the intervention through a snowball effect driven by peer learning and local trust.

This two-batches approach ensured that participants were both informed and motivated, and it allowed for organic growth of participation based on visible impact and user feedback.

2.6 WIRING INSTALLATION

During baseline assessment, electrical infrastructure of all participating micro enterprises was assessed. For those whose wiring systems did not meet the required standards an standard package of electrical upgrade was conceived and installed, in order to the safe and efficient use of e-cooking appliances of 1900W. The standard setup included:

i. Copper wiring of at least 2.5 sq. mm
ii. MCBs (Miniature Circuit Breakers) rated at 15A
iii. Sockets rated at a minimum of 16A

This standard setup was provided as part of the overall incentive package. This helped reduce the financial burden associated with adopting e-cooking solutions, especially for those needing infrastructure improvements.

Two trained technicians, one from Nisikhola and one from Badigad, were mobilized for all electrical tasks. They were responsible for upgrading internal wiring, installing proper MCBs and sockets, and ensuring safe connections between the e-cooking appliances and the main supply board.

2.7 E-COOKING SOLUTION INSTALLATION

The installation of e-cooking appliances was carried out only after ensuring that the participating enterprises met the minimum wiring and electrical safety requirements.

The installation was conducted following the two-batches approach. The first batch included nine micro enterprises, while the second batch involved eleven micro enterprises. The appliances were distributed based on each participant's specific cooking needs, as agreed with them during the selection phase.

Participating enterprises were able to select their desired e-cooking solution, which formed part of the incentive package, based on their needs. As all enterprises had low-to-moderate cooking requirements, a 1900-watt household-sized induction stove was provided, along with induction-compatible utensils tailored to the types of food typically prepared. These utensils included pressure cookers, milk pans, kadhai (wok for frying), and momo steamers, customised to the menu of each participant.

Field technicians ensured that each appliance was installed in a suitable cooking space and that dedicated power sockets for the appliance were in place. Demonstrations were also conducted during the installation to familiarize users with the basic operation and safety procedures of the appliances.

All installations were carried out in coordination with local field facilitators and technicians from Badigad and Nisikhola, ensuring that local capacity was utilized and strengthened in the process.

2.8 MONITORING

To gather information on the user experiences, a structured monitoring and feedback process was implemented. This included the collection of usage data via cooking diaries, smart meters and regular follow-ups with participating Enterprises.

Each participating user was requested to maintain cooking diaries during two time periods: before the installation (pre-intervention) and after the installation (post-intervention). The pre-intervention diaries documented the types of dishes prepared, cooking methods used, frequency of cooking, and the fuels involved. The post-intervention diaries recorded any changes in fuel usage, appliance operation, and cooking behaviour following the adoption of e-cooking. Each diary covered approximately one week of data.

The usage of induction stoves and daily electricity consumption were monitored using A2EI smart meters. These meters were installed alongside the e-cooking

solutions. Meters installed during the first phase remained in the field for over two months (28/04/25 - 01/07/25), while those installed in the second phase were in place for about one month (08/06/25 – 01/07/25).

In addition to timestamps, the meters recorded various electrical parameters of the induction stoves such as voltage, current, power, power factor, and energy consumption at one-minute intervals. The data were transmitted to the cloud via cellular networks.

2.9 END-LINE SURVEY

An endline survey was conducted to evaluate the adoption experience of the participant micro enterprises. The primary objective was to assess user satisfaction, identify challenges, measure and compare the induction usage and understand how cooking practices had adapted over time.

The survey was carried out approximately one month after the second batch of installations. It targeted all participants who received e-cooking packages during the project. A structured questionnaire in Kobo toolbox was used to collect data on frequency of appliance use, perceived benefits, operational challenges, reliability of electricity supply, and the suitability of the utensils provided.

The endline survey also captured feedback on specific appliances, such as induction stoves and compatible utensils, and explored whether the users intended to continue using them in the future. Questions were designed to identify the practical enablers and barriers to sustained adoption of e-cooking in commercial settings. The information gathered through the endline survey played an important role in assessing the overall effectiveness of the intervention and refining recommendations for future scale-up.

2.10 DATA ANALYSIS

All data throughout the intervention were collected and processed at enterprise-level, except for market assessment and the overall coordination with local governments. Information from the digital survey tool Kobo Toolbox, data from the cooking diaries and datasets generated by the smart meters were transferred to Excel, where they were cleaned, organized and prepared for analysis. The data were systematically reviewed to enable descriptive and comparative analysis across the participating enterprises. All records were anonymized before reporting.

2.11 COORDINATION WITH LOCAL GOVERNMENTS

Throughout the WISIONS IL project, regular coordination with local governments was maintained to ensure alignment with existing and upcoming policies and interventions, and to obtain their views on, and support for, the project. This included pre-intervention meetings, efforts to access registration data of micro enterprises (which was not maintained), support from elected representatives in reaching out to enterprises, and sharing updates through informal meetings, workshops and similar activities in anticipation of scaling up efforts in the future.

3. RESULTS AND OBSERVATIONS

3.1 FINDINGS OF THE BASELINE SURVEY

3.1.1 SURVEY SAMPLE AND POPULATION

A total of 58 small and medium-sized hotels and restaurants located along the Mid-Hill Highway in Badigad and Nisikhola Rural Municipality were surveyed. The selection of survey participants was based on random sampling in each of the main bazars that are located along the Mid-Hill Highway. The total population of restaurants and hotels could not be determined due to the lack of official data at the rural municipality offices. However, based on our observations during the field visit, we estimate that more than 60% of micro enterprises of the targeted municipalities were covered in the survey.

3.1.2 DEMOGRAPHIC COMPOSITION OF SURVEY

The demographic composition of the survey respondents is shown in Figure 4. It demonstrates a remarkably balanced gender distribution, with female respondents comprising 51% and male respondents accounting for 49% of the sample population. This equilibrium in gender representation ensures that the survey findings comprehensively capture diverse perspectives and decision-making patterns across both genders in the context of e-cooking adoption.

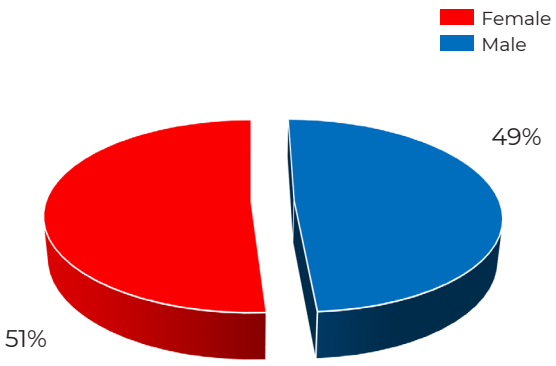


Figure 4: Gender distribution of baseline survey participants

3.1.3 MICRO ENTERPRISE TYPE

Among the surveyed firms, tea shops, general restaurants, and hotels each made up roughly one-third of the total, showing an even distribution across these types of food businesses. Additionally, one Nepali restaurant specializing in Daal Bhat and one Chowmein factory were included. Many of the hotels reported as offering accommodation were makeshift, without dedicated guest rooms, but could provide temporary lodging when needed.

Table 1: Type of MICRO ENTERPRISE surveyed

Type	Surveyed During			Percentage (%)
	Original Baseline	Post Evaluation	Total	
Tea Shop (sells tea + light snacks)	17	0	17	29.3
Restaurant (sells all different types of dishes)	16	3	19	32.8
Nepali Restaurant (sells mostly Daal Bhat)	1	0	1	1.7
Hotels (sells all dishes + has accomodation)	16	3	19	32.8
Other	1	1	2	3.4

3.1.4 OWNERSHIP STRUCTURE OF THE MICRO ENTERPRISES

A significant 44.8% of the micro enterprises operated in rental properties. Some of them also rented only the land and built cottages themselves. Interesting scenarios were observed among rented micro enterprises. For instance, some micro enterprises, while interested in transitioning to e-cooking, were unsure whether their landlord would allow them to upgrade the wiring infrastructure needed to operate e-cooking appliances. One enterprise reported that its landlord denied the access to the national grid's electricity, despite the house being already connected to it. Thus, different kinds of strategies might be needed during the intervention in hotels and restaurants operating in rental properties.

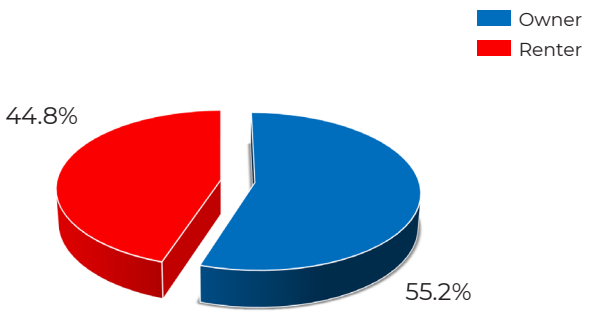


Figure 5: Distribution of ownership structure in micro enterprises

3.1.5 NUMBER OF STAFFS

A significant characteristic of the surveyed micro enterprises was their reliance on family labour. Approximately 74.3% (43 businesses) were identified as family businesses, meaning they did not employ individuals from outside the family (see Table 2). This was often linked to the micro enterprises' limited capacity to offer decent salaries to external staff. In contrast, the few micro enterprises that did employ external help (24.1%, or 13 businesses) were generally larger operations, such as hotels catering to a greater number of daily customers, who hired staff for roles like cooking and cleaning.

Table 2: Distribution of micro enterprises by number of staffs

Number of staff	Number of Enterprises	Percentage (%)
1 to 2	43	74.1
3 to 5	14	24.1
More than 5	1	1.7

3.1.6 ENTERPRISE TYPE – PEOPLE CATERED PER DAY

A majority of 74.1 % of micro enterprises served less than 30 people per day (see Table 3). Therefore, their cooking requirements were less frequent than the other 25.8% micro enterprises that served more than 30 people per day.

Table 3:Distribution of micro enterprises by number of people catered per day

People catered	Number of Enterprises	Percentage (%)
10 or less	18	31
11 to 30	25	43.1
31 to 50	10	17.2
More than 50	5	8.6

3.1.7 FOOD MENU

Table 4 presents the most commonly served dishes by the surveyed micro enterprises and the utensils used to prepare them. The dishes marked in light green are prepared more commonly than those marked in light blue. Chowmein was the most popular dish, prepared in almost all micro enterprises. Some hotels even offered nothing but Chowmein. The amount required for the entire day was boiled in the morning and stored in a refrigerator. It was then prepared and served per order throughout the day. Momo was also a favourite dish and was offered by most hotels. The keema and dumplings were prepared in the morning, stored in a refrigerator, and later served per order. Most of the other dishes can be easily prepared in electric pressure cookers and induction stoves with appropriate utensils made of iron or stainless steel.

Table 4: Dishes commonly served in survey areas along with utensils used

Dishes/Beverages	Utensils used	Dishes/ Beverages	Utensils used
Chowmein	Chowmein frying wok	Pakauda Jerry Donut Sel Roti Samosa Namkeen	Jalebi Kadhai
Momo	Momo steamer	Roti	Roti Pan
Mutton Chicken Chana Vegetables Noodles Boil Thukpa Boiled eggs	Kadhai	Daal Bhat	Pressure cooker
Tea	Milk Pan	Omelette Tomato Pickle	Frying Pan

3.1.8 COOKING FUELS

LPG was the most dominant cooking fuel, used by all 58 micro enterprises. Of these, 21 also used firewood. Out of 58 enterprises surveyed, 50 (98%) use LPG as their primary cooking fuel. Only one enterprise uses firewood as the primary cooking fuel (see Table 5).

Regarding e-cooking, while most hotels and restaurants used electric kettles for boiling water, they had no experience with other types of e-cooking appliances. Only one hotel was found to be using a microwave oven for heating bread and other snacks.

Table 5: Cooking Fuels used by the surveyed micro enterprises

Fuel	Number of Enterprises (N=58)	Percentage (%)
LPG	58	100
Firewood	21	36.2
Electricity	1	1.7
LPG only	36	6.2
Firewood only	0	0

3.1.8.1 Source of firewood

Most micro enterprises sourced firewood from their private land or nearby forests, primarily incurring expenses for labour and transportation, as illustrated by Table 6. Typically, they harvested firewood once or twice annually.

The total cost of firewood varied significantly depending on the source and daily consumption. For micro enterprises collecting from private land, expenses were limited to labour for cutting and transportation. Notably, some individuals collected firewood themselves from their private land, eliminating any direct monetary expenditure on the fuel itself. Firewood costs were typically calculated per tractor-load or per Bhari (a local unit of weight/volume based on what one person can carry on his/her back; The weight of one Bhari firewood can range from 30 to 50 kg). The price of a tractor-load also showed considerable variation, ranging from NPR 8,000 to 22,000, influenced by the tractor's size and distance between the loading and unloading of the firewood.

Labor costs for firewood harvesting were reported as NPR 1,000 per day for men and NPR 500 per day for women.

Table 6: Sources of firewood

Private Land	18
Community Forest	3
Saw Mills	2
Private land + community forest	2
Saw Mills + community forest	1
Private land + saw Mills	1

3.1.8.2 Liquefied Petroleum Gas (LPG) consumption

The annual LPG consumption among the surveyed micro enterprises varied significantly with a minimum of 3 cylinders per year, a maximum of 125 cylinders per year and an average of 32 cylinders per year (see Table 7).

Table 7: Consumption of LPG cylinders of surveyed micro enterprises per year

Number of enterprises surveyed	Number of LPG cylinders consumed per year
2	3
1	4
3	6
1	8
7	12
3	15
1	18
7	24
6	25
3	30
1	35
1	36
1	40
1	50
5	60
1	70
1	80
1	90
1	120
1	125

3.1.9 ELECTRICITY INFRASTRUCTURE

3.1.9.1 Electricity supply

One MHP plant can be found every few kilometres along the studied section of the Mid-Hill-Highway. They were constructed decades ago when the expansion of the national grid was not yet viable in the study areas. Consequently, MHP plants still serve as the primary source of electricity in all 58 micro enterprises (See Table 8). The expansion of the national grid has just begun in Nisikhola RM, and its connections are not yet available. In Badigad RM, although the national grid reached two years ago, not all households are connected to it. Some micro enterprises lack the land ownership documents required to connect the national grid's electricity. People hold that electricity from the MHP plants is more reliable and cheaper than the national grid. These factors shall be considered during the wiring upgradation and cost calculation phase. The micro enterprises having multiple sources of electricity (18 in total) use a changer to switch between the different sources' electricity, as illustrated in Figure 6.

Table 8: Sources of electricity in the surveyed micro enterprises

Source of Electricity	No. of Enterprises
MHP	58
National Grid + MHP	18 (31%)

Figure 6: Energy meters of two MHP plants with a converter in the middle

3.1.9.2 Connection capacity

The wiring infrastructure observed in the micro enterprises primarily utilized 1 sq. mm and 2.5 sq. mm wires. The initial, basic electrical connections provided by the MHP plants were predominantly used for lighting. Consequently, approximately 70% of micro enterprises had connections rated at 5 Amperes or less. In contrast,

the newly installed electricity meters from the national grid featured higher capacity MCBs of 15 A or 30 A (See Table 9). This disparity highlights that over 70% of micro enterprises require an upgrade to their internal wiring infrastructure to adequately support commercial-scale e-cooking appliances. For instance, commercial induction stoves with a power consumption of 3500 Watts necessitate a 30 A connection.

Table 9: Distribution of micro enterprises based on the rating of main MCB

Rating of main MCB	No of Micro Enterprises	Percentage (%)
5 A	41	70.7
15 A	14	24.1
30 A	3	5.2

3.1.10 AWARENESS AND ATTITUDES TOWARDS E-COOKING

A particularly significant finding from the user awareness assessment indicates that a substantial 80.4% of respondents have no prior knowledge of e-cooking solutions, while 5.9% possess some knowledge, and only 13.7% have experience with some form of e-cooking (see Figure 7). This stark awareness gap underscores the fundamental challenges facing the e-cooking initiative in the region.

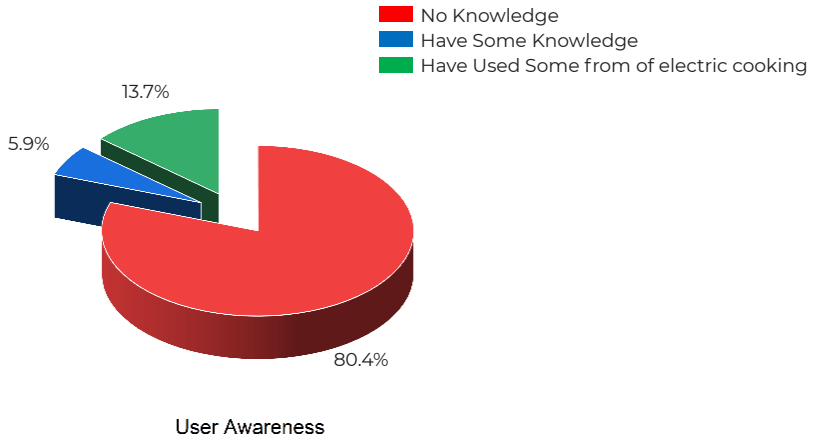


Figure 7: Participant's familiarity with e-cooking

3.1.11 WILLINGNESS TO PARTICIPATE

The willingness-to-participate metrics present a nuanced picture of market readiness, as illustrated by Figure 8. A significant majority (80.4%) express hesitation, indicating a cautious approach rather than outright rejection. The proportion of strong opposition stands at 11.8%, while those expressing strong positive intent comprise 7.8%.

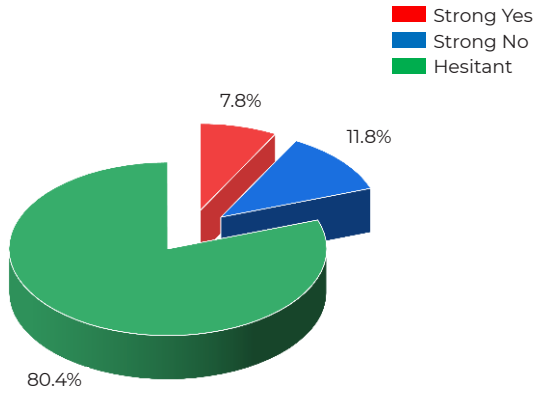


Figure 8: Willingness to participate in the project

This distribution suggests that while there isn't widespread resistance to e-cooking adoption, there exists substantial uncertainty that needs to be addressed through targeted interventions and awareness programs.

3.1.12 FACTORS CONTRIBUTING TO HESITATION AND OPPOSITION

A detailed examination of hesitation factors reveals a complex hierarchy of concerns influencing e-cooking adoption (see Figure 9). The predominant factor is the desire for practical demonstration, accounting for 39% of responses, indicating a strong preference for experiential validation before commitment.

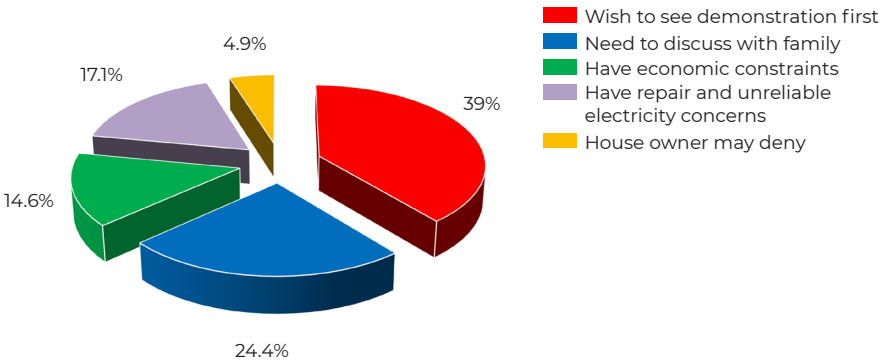


Figure 9: Factors of hesitation in percentage

This is followed by family consultation requirements at 24.4%, highlighting the collective nature of decision-making in the local context. Technical and infrastructure concerns, specifically regarding repairs and electricity reliability, represent 17.1% of responses, while economic constraints account for 14.6%. Property owner permission, though present, emerges as the least significant barrier at 4.9%, suggesting that landlord-tenant relationships may not substantially impede adoption.

When interpreted collectively, these statistical indicators suggest that while the foundation for e-cooking adoption exists, success will require a strategically phased approach. Key focus areas should include comprehensive demonstration programs, family-oriented awareness campaigns, and robust solutions for technical and economic concerns. The high percentage of hesitant respondents, coupled with low opposition, indicates significant potential for conversion through appropriate intervention strategies.

3.1.13 CONCERNS REGARDING APPLIANCE DURABILITY AND REPAIR

The majority of respondents expressed apprehension about potential repair issues arising shortly after adopting e-cooking solutions. Participants feared that, like other electrical and electronic appliances, e-cooking devices might break quickly, resulting in expensive repairs. A representative from Badigad Rural Municipality, who was also a survey participant, suggested developing robust plans and strategies to address repair and maintenance issues before introducing e-cooking appliances in order to build trust among users.

The following field observations might help to explain why people are so concerned about repair issues. The PEEDA team surveyed four micro enterprises in Putali Bazar, Nisikhola Rural Municipality, who had previously benefited from an e-cooking intervention programme. Unfortunately, none of them were using the e-cooking appliances they had received due to damage and other issues. Two electric pressure cookers (EPCs) had faulty valves on their lids. One induction stove was not working, and the owner was unaware of the reason why. The fourth participant had moved her kitchen from its previous location, where she had used her EPC. As the new kitchen lacked the necessary wiring infrastructure, she had been unable to use the device for more than six months at the time of the survey:

> *"When I asked some technicians at a nearby market to come and install wires and power sockets in my new kitchen, nobody was willing to travel for such a minor task."*

Such inconveniences are common with e-cooking appliances. To ensure the long-term usability of the distributed appliances and sustainability of the project itself, it is essential to train the local technicians in repairing induction stoves and electric pressure cookers. Additionally, reliable spare parts should be made available at the local level.

3.2 MARKET ASSESSMENT

3.2.1 INDUCTION STOVE AND INDUCTION-BASED APPLIANCES

The availability of induction stoves and compatible utensils in the local market was found to be limited, as illustrated by Table 10 and Table 11. Only a few shops sold induction cookers, and the sales volume over the past six months was very low. For example, SK Suppliers in Burtibang had some stock and variety, including utensils compatible with induction cooking. In contrast, other shops like Milan Mobile Center and Sanjay Electronics had sold only one or two units in the past year and lacked supporting cookware. This indicated a generally weak supply chain and low local demand for induction appliances at the time.

Table 10: Available induction stove brands in the local market

Sikko Brand - Sanjay Electronics	Induction brand	Sikko
	Model	SK 9001
	Power	2000 W
	Type (Touch/Control)	Touch
	Warranty Period	2 years
	Selling Price	NPR 3500
	Number of sales in the last 6 months	0
Baltra Brand –SK suppliers and Karki	Induction brand	Baltra
	Model	BIC114
	Power	2000 W
	Type (Touch/Control)	Touch
	Warranty Period	1 year
	Selling Price	NPR 4850
	Number of sales in the last 6 months	1

Only one supplier was found to offer induction-compatible utensils, such as pressure cookers and kadhai with aluminum bodies and stainless-steel bases. However, detailed records of their sales were not available, suggesting that these items were also rarely purchased. Most other cooking utensils used by micro enterprises were made of traditional iron, which is incompatible with flat-surface induction stoves, like the products illustrated in Figure 10.

Table 11: Available induction-compatible utensils in local market

S. N	Type of the utensil	Brand name	Capacity	Material used	Price (NPR)	No of sales in the last 6 months
1	Kadhai	Divine	3 L	Aluminium with steel base	(NPR)	No data
2	Pressure Cooker	Divine	3 L	Aluminium with steel base	1900	No data
3	Frying Pan			Iron		No data
4	Kadhai for samosa, do-nut, nam-keen, etc.			Iron	465	

Overall, the market assessment highlighted major gaps in the local supply and support system for commercial e-cooking solutions. While basic appliances and wiring materials were available (see Table 12), compatible cookware and trained repair services were lacking. These findings underscored the need to strengthen both the supply chain and the repair infrastructure to support future scale-up of e-cooking in rural commercial sectors.

Figure 10: Iron utensils available in Burtibang

Table 12: Wiring materials available in the local market

Wiring component	Brand	Size / Capacity	Price (NPR)
Socket	Rathi	5 A 10 A 16 A	250
	Hero		220
	Swift		230
Wire	Usha	1 sq. mm 1.5 sq. mm 2.5 sq. mm	1700
	Annapurna		2600
	Prakash		4500
MCB	Lucky	6 A, 16 A, 32 A, 63 A	6 A – Rs. 200 16 A – Rs. 550 32 A – Rs. 700 63 A – Rs. 750
	Indoasian		6 A – Rs. 350 16 A – Rs. 450 32 A – Rs. 750 63 A – Rs. 1200
	Chint		

3.2.2 REPAIR AND MAINTENANCE SCENARIO

Local electric appliance repair shops were present in Kharbang (Badigad), Jugjakhola (Nisikhola), and Burtibang. These shops offered repair services for common household appliances such as rice cookers, mixers, televisions, and radios. However, none of the technicians had received specific training to repair induction stoves or EPCs. Furthermore, the quality spare parts necessary for repairing these newer appliances were not readily available in the local market. The nearest location with access to qualified service centers is Butwal, approximately 115 kilometres away.

Considering the anticipated need for local repair facilities, the project should prioritize efforts to establish a reliable repair and maintenance ecosystem at the local level.

3.3 COOKING DIARY DATA ANALYSIS

3.3.1 FUEL ANALYSIS

The pre-intervention cooking diaries documented 30 unique dishes across a total of 1,104 cooking events. Prior to the installation of e-cooking solutions, LPG was the dominant cooking fuel, accounting for 98.1% of all cooking activities (see left part of Figure 11). Nearly every dish was prepared using LPG. Firewood contributed only 1.4%, while the use of electricity for cooking was virtually non-existent—limited to occasional use of electric kettles by a few hotels for boiling water.

In contrast, the post-intervention cooking diaries recorded 40 unique dishes and a total of 789 cooking events. The introduction of e-cooking significantly changed the fuel stacking patterns and cooking practices among micro enterprises (see right part of Figure 11). Electricity became the primary cooking fuel, used in 61.6% of the events, while LPG's share dropped to 36.1%. Of the 40 recorded dishes, 22 were cooked more frequently using induction cookers than LPG stoves.

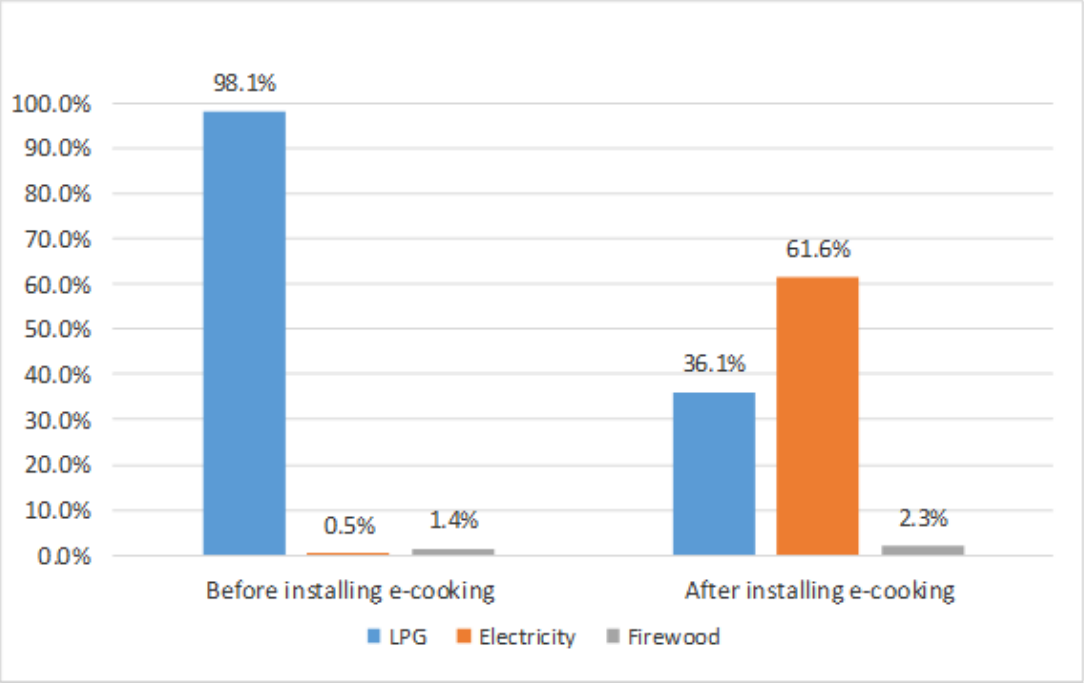


Figure 11: Fuel stacking used by the 20 participating micro enterprises before and after the installation of e-cooking

3.3.2 DISH LEVEL ANALYSIS

Rice, daal, vegetables and curries, Chowmein, momo, tea, and meat were among the most frequently cooked dishes both before and after the intervention. These seven dishes accounted for more than 70% of the enterprises's total cooking activities, as illustrated by Figure 12. Rice, daal, and vegetables are staple components of daily meals in Nepali households. Since the cooking diaries captured meals prepared both for customers and for the enterprise owners' families, the latter made up a significant portion of overall cooking needs. Additionally, Chowmein, momo, and tea were the most commonly served items to customers, as also indicated in the baseline survey.

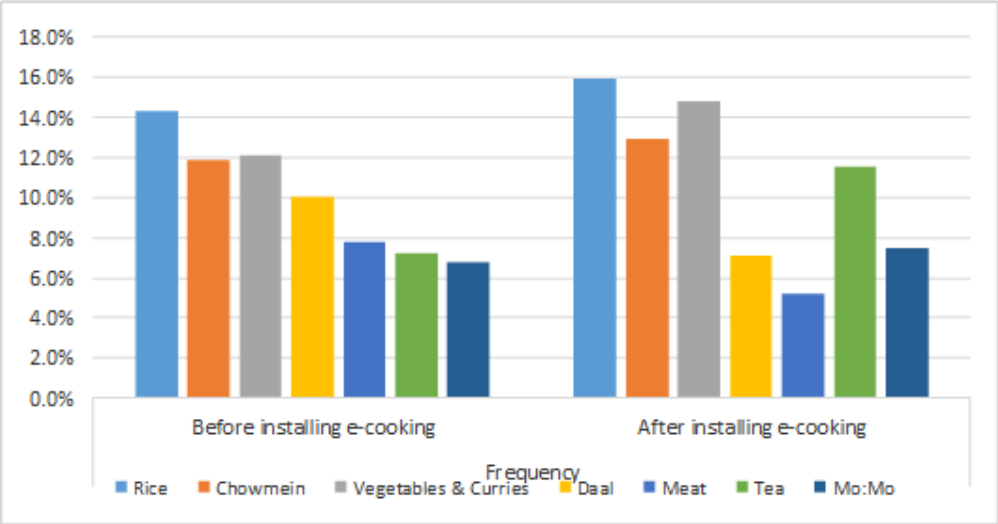
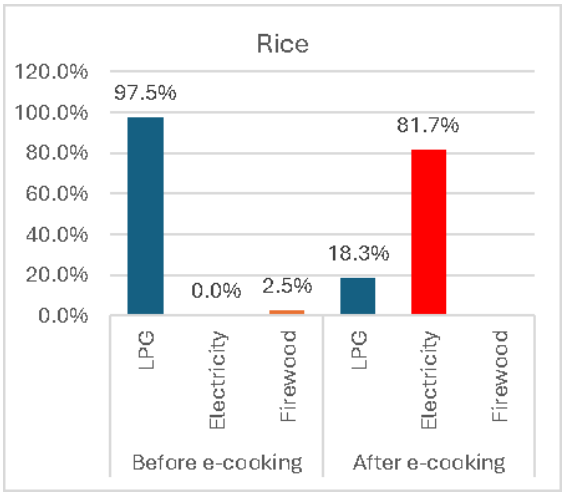
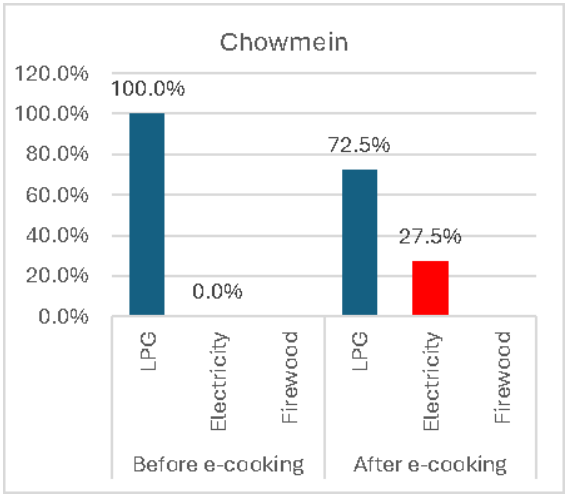
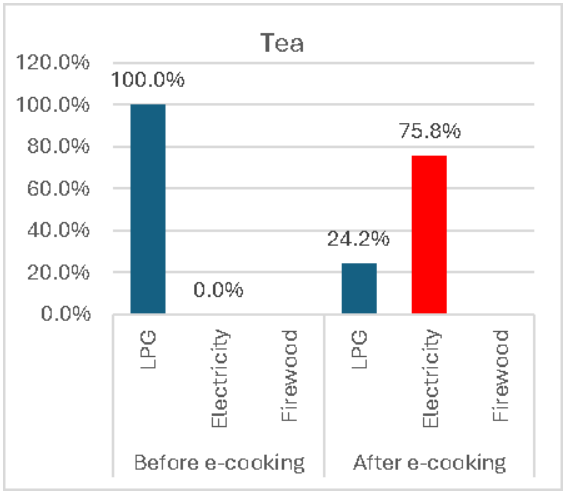


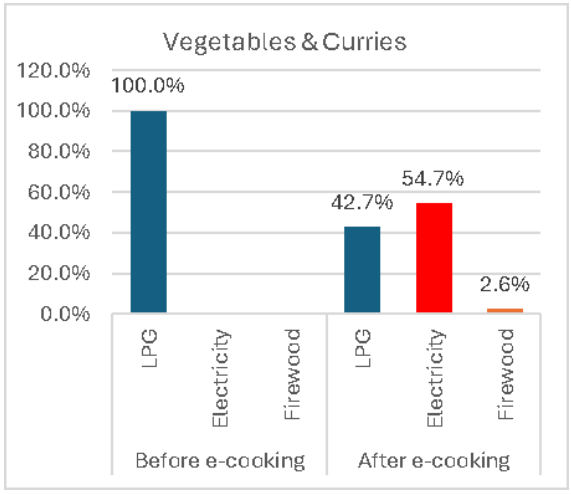
Figure 12: Frequencies of the dishes cooked in participant micro enterprises

The fuel stacking patterns used to cook the most common dishes before and after the e-cooking intervention are shown in Figure 13. Except for Chowmein, the induction cooker emerged as the preferred stove for preparing all other dishes. Rice and daal were almost always cooked using a pressure cooker. Momo and tea were prepared by steaming and boiling, respectively.









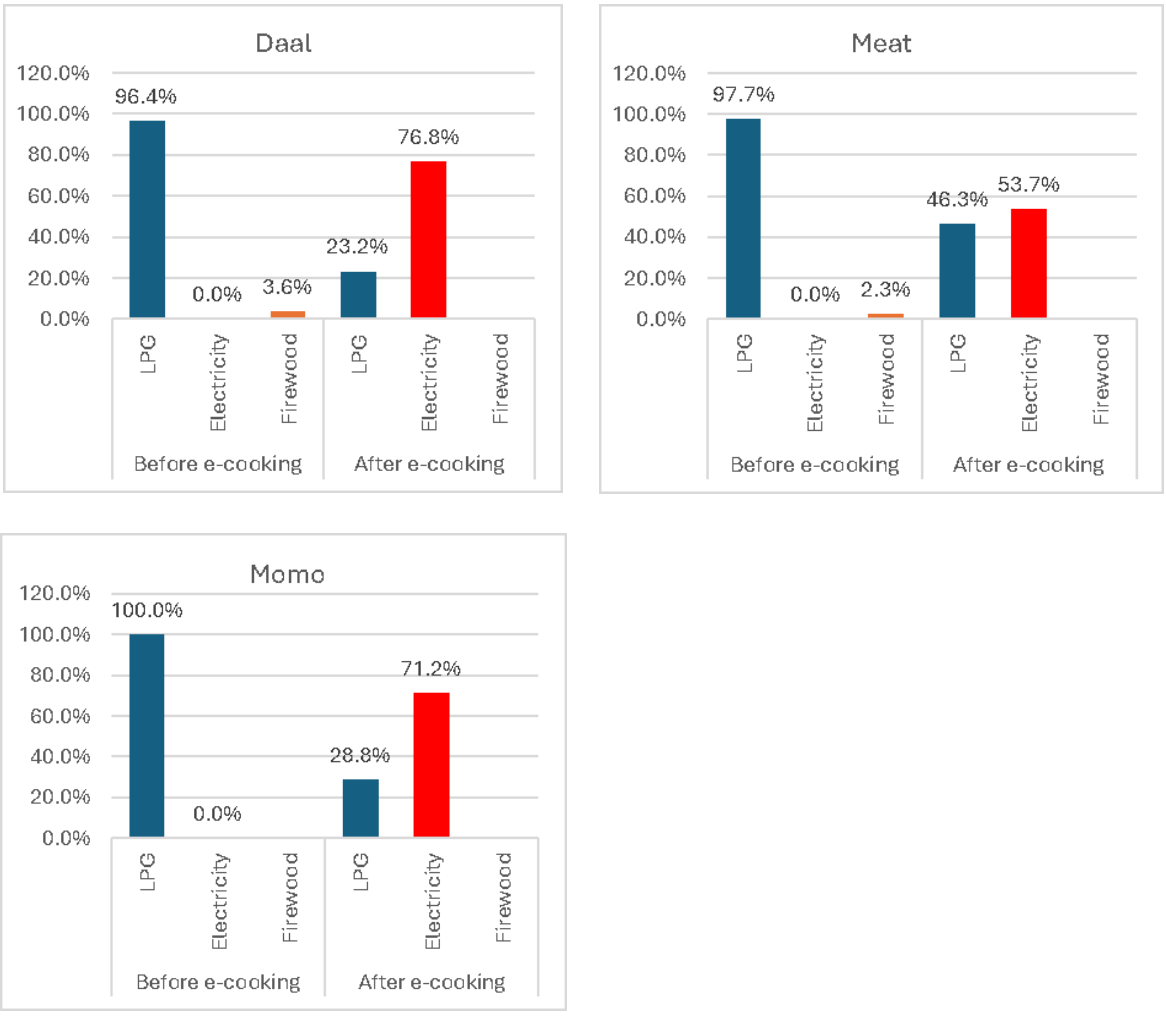


Figure 13: Fuel stacking used for the most common dishes before and after the e-cooking intervention (average of all 20 enterprises)

However, for dishes like Chowmein and meat, which are typically fried, enterprises continued to rely heavily on LPG. In fact, 72.5% of recorded Chowmein cooking events in the post-intervention period were carried out using LPG stoves. This preference was later confirmed during post-installation monitoring and post-evaluation surveys, where enterprises reported challenges in cooking Chowmein with the provided induction-compatible wok. Traditionally, Chowmein is cooked in an iron pan with a round base as illustrated in Figure 14a. The supplied induction-compatible wok, having a flat base, had differences in thickness and overall design compared to traditional pans as illustrated in Figure 14b. Vegetables would often get scorched at higher power settings. Although lowering the power level helped prevent burning, it was not ideal for achieving the desired texture or cooking the dish in a reasonable amount of time. Thus, all the participants were trained in how to use and change the mode of induction stoves depending on the type of food. However, it was observed that it was not preferable to cook Chowmein in an induction-compatible utensil, as the flat base did not concentrate oil at the centre, meaning that vegetables could not be fried properly.

a) b)

Figure 14: Utensils used to cook Chowmein. a) Round-based wok traditionally used with LPG stoves. b) Induction-compatible wok with flat base

3.3.3 COOKING METHODS

Pressure cooking, frying, and boiling were the most commonly used cooking methods in the micro enterprises, as illustrated in Figure 15. Together, these three methods accounted for over 90% of the entries in the cooking diaries, both before and after the installation of e-cooking solutions. During the pre-intervention phase, 99% of cooking activities were carried out using LPG stoves.

An interesting shift in the combination of cooking methods and fuels was observed during the post-intervention phase. Micro enterprises clearly preferred induction stoves for pressure cooking, boiling and steaming food (see Figure 16). Induction stoves were used significantly more frequently than LPG stoves for these methods. However, LPG continued to be used slightly more often for frying and roasting, indicating a continued reliance on gas for cooking methods that require sustained high heat.

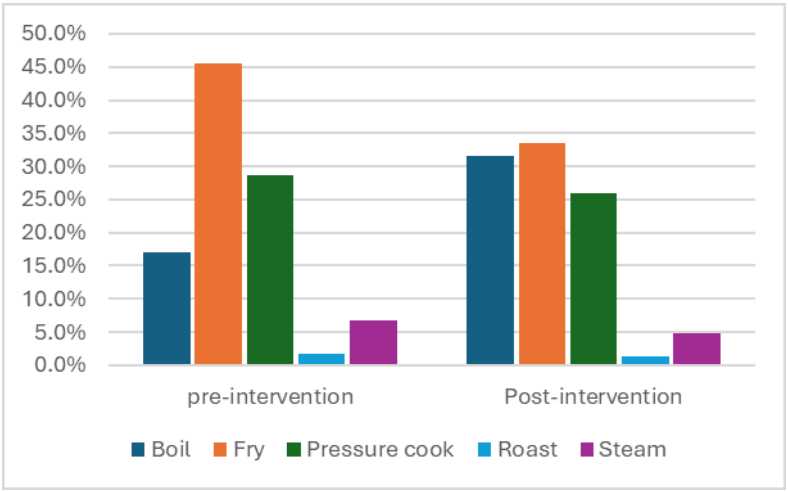


Figure 15: Cooking methods used before and after installing e-cooking solutions

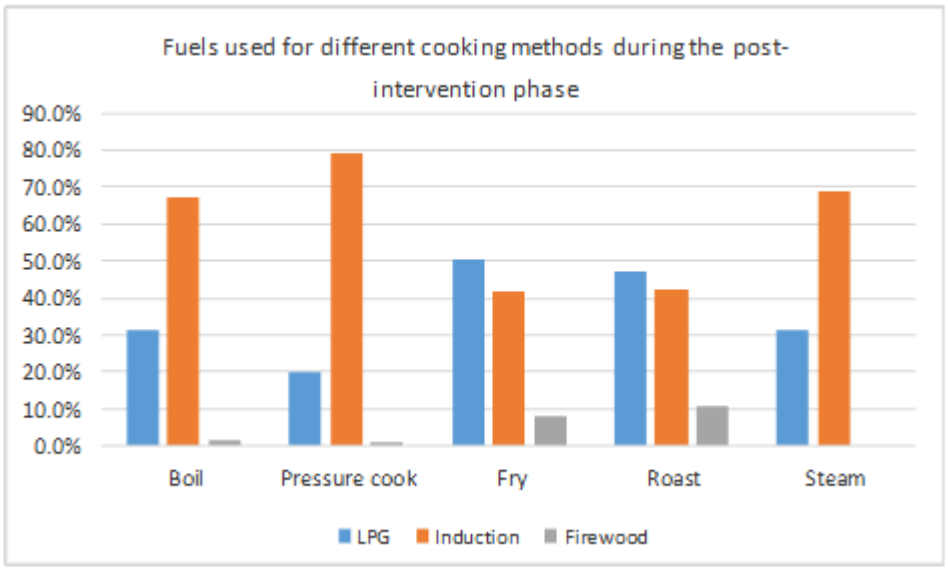


Figure 16: Fuels used for different cooking methods during the post-intervention phase

3.3.4 NUMBER OF PEOPLE SERVED PER DAY

During the pre-intervention phase, enterprises served an average of 41.5 customers per day, with a standard deviation of 22.9. In the post-intervention phase, the average was 37.9 customers per day, with a standard deviation of 13.7. These figures include dishes prepared for both customers and the family members of the enterprises.

3.4 SMART METERS

The average daily electricity consumption of induction stoves in the micro enterprises is summarized in Table 13. On average, an enterprise used 1.61 kWh of electricity per day for cooking, with a standard deviation of 1.13 kWh. High-use hotels recorded consumption as high as 4.5 kWh per day.

Table 13: Average daily electrical energy consumption from induction stove in micro enterprises

S.N.	Meter No.	Daily Average Energy (kWH)	S.D.	Range
1	232	1.78	0.73	3.49
2	280	0.34	0.61	3.90
3	282	0.73	0.36	1.50
4	420	4.50	1.58	6.44
5	410	1.05	0.67	3.71
6	319	1.20	0.71	2.66
7	298	0.80	0.58	2.30
8	406	3.00	1.26	5.33
9	398	1.17	0.48	1.43
10	441	3.13	0.82	2.77
11	381	1.13	0.53	2.48
12	447	0.64	0.42	1.45
13	237	2.90	2.77	3.33
14	304	0.52	0.59	2.00
15	278	1.74	0.59	1.92
16	381	1.18	0.55	2.38

Figure 17 compares the daily electricity consumption of a high-use and a low-use hotel over a two-month period. The wide fluctuations in daily energy use were primarily due to the variations in the number of customers served each day.

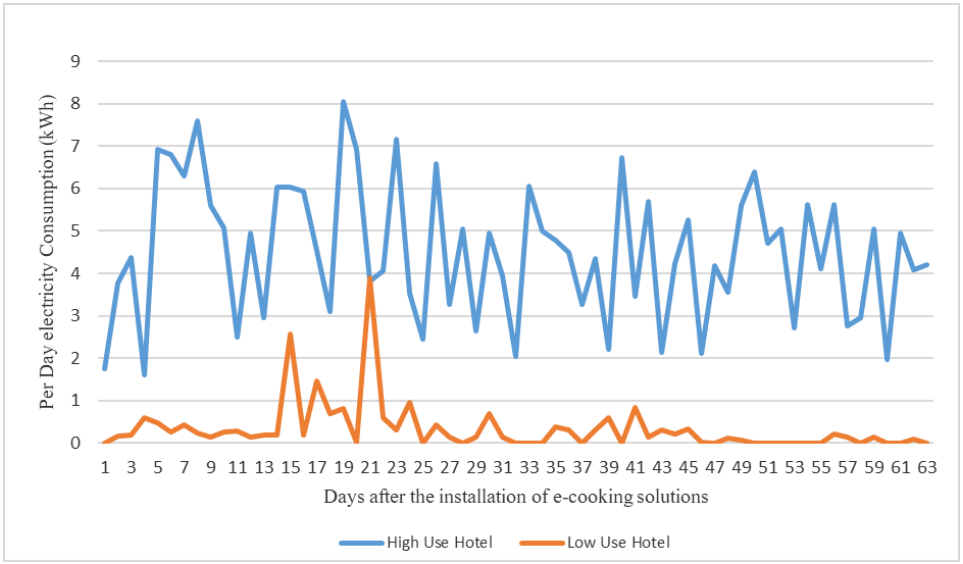


Figure 17: Progress of per day electrical energy consumption between highest and lowest induction used hotels over period of two months

A calculation of the theoretical savings in LPG and overall fuel expenditure for both the high-use and low-use hotels is presented in Table 14. Since the local micro-hydropower plants applied varying electricity tariff rates ranging from Rs. 5 to Rs. 10 per unit, the savings are shown as a range rather than a fixed value.

The following assumptions were used to estimate the equivalent LPG savings:

- 1 kg of LPG contains energy equivalent to 13.6 kWh of electrical energy
- LPG stoves operate at an efficiency of 50%
- One LPG cylinder contains 14.2 kg of gas and costs Rs. 2,000

Based on these assumptions, the low-use hotel saved approximately 2.42 kg of LPG per month, resulting in a net monthly saving of Rs. 176 to Rs. 341. Similarly, the high-use hotel saved up to 20.42 kg of LPG per month, leading to a net saving of Rs. 1,487 to Rs. 2,181.

Table 14: Estimated saving in LPG expenses per month made by the highest and lowest induction used hotels

	Low-Use Hotel	High-Use Hotel
Average Monthly Electricity Consumption (kWh)	16.48	138.83
Monthly Electricity Bill (Rs. 5/kWh)	82.40	694.15
Monthly Electricity Bill (Rs. 10/kWh)	164.80	1388.30
Amount of LPG replaced per month (kg)	2.42	20.42
Monthly savings in LPG expenditure	341.34	2875.52
Net savings in fuel per month (Rs. 5/kWh)	258.94	2181.37
Net savings in fuel per month (Rs. 10/kWh)	176.54	1487.22

3.5 ENDLINE SURVEY DATA ANALYSIS

All 20 micro enterprises involved in the testing phase participated in the survey. Thirteen had also participated in the baseline survey conducted in December 2024, while the remaining seven joined the project after learning about it through demonstration campaigns or through a local enumerator.

3.5.1 FREQUENCY OF INDUCTION COOKER USAGE FOR DIFFERENT DISHES

The cooking diary study had already revealed the types of stoves used for preparing different dishes. In the post-evaluation survey, micro enterprises were asked to provide qualitative responses to the question: *"How frequently do you use the induction cooker to prepare some of the most common dishes?"*. Since not all micro enterprises had the necessary utensils to cook every dish, only those possessing the required utensils, as listed in Table 15, have been included in the analysis.

Table 15: Induction cooker usage frequency for common dishes

Dishes	Required utensil	No. of enterprises possessing the required utensil	How frequently do micro enterprises use induction cooker to cook different dishes?			
			Always	Often	Rarely	Never
Chowmein	Chowmein Wok	11		4	3	4
Momo	momo Steamer	5	2	2	1	
Tea	Milk Pan	17	13	4		
Rice	Pressure Cooker	15	4	9	2	
Daal	Pressure Cooker	15	2	11	2	
Vegetables	Kadhai	13		10	2	

As already revealed by the analysis of the cooking diary data, the participant micro enterprises used induction stoves for dishes that are typically boiled or pressure-cooked, such as tea, rice, and daal. Induction cooktops were also commonly used for preparing vegetables and meat, which often involve a combination of frying and boiling. However, in the case of Chowmein, a greater proportion of micro enterprises either rarely used or never used induction cookers—even when they had induction-compatible Chowmein woks. As mentioned earlier, this was due to the issue of vegetables getting scorched at higher power settings.

Most micro enterprises preferred using induction cookers for steaming items like momo, although some expressed concerns about the small size of the momo steamer provided. The following testimonial from a hotel owner in Badigad describes the difficulty in a clear way:

> *"This induction cooker is perfect for steaming veg momos sold here when the number of guests is small. I can easily steam 4 plates of momo with this steamer. But when customers come in larger groups, I have to use the LPG stove because the aluminium steamer is much larger and can cook almost 8 plates in one batch."*

The micro enterprises were provided with 28-inch momo steamers, the largest available in Kathmandu at the time. This highlights the need for future project upscaling efforts to focus on introducing larger momo steamers to the market.

3.5.2 FACTORS AFFECTING THE ADOPTION OF E-COOKING IN MICRO ENTERPRISES

Enterprise owners identified unreliable electricity supply and the inappropriate type and size of cookware as the main barriers to cooking with electricity. Most complaints regarding cookware were related to the Chowmein woks and the limited capacity of the momo steamers.

As shown by Table 16 the most frequently cited issue was the unreliability of the electricity service. Many MHP plants in the region are routinely shut down for one to two hours in the morning to allow the generators to cool down. This directly affected micro enterprises that needed to do bulk cooking in the morning, such as deep-frying samosas or boiling Chowmein. During the rainy season, unscheduled power cuts created additional challenges, as a restaurant owner in Badigad describes:

> *"I find it very convenient to cook with induction stoves and use them all the time. But the electricity here is not reliable. Today, it has been six hours since the power went out. I certainly can't wait that long for it to come back, so I have to rely on LPG stoves again."*

Table 16: Factors that affect micro enterprises to cook with electricity

Factors	How often do these factors hinder micro enterprises from using e-cooking?			
	Always	Often	Rarely	Never
Unavailability of Electricity	0	4	13	3
Inappropriate Size of Cookware	1	7	5	7
Unavailability of Proper Space in the Kitchen	1	0	0	19
Lack of Operational Knowledge	0	0	1	19

In contrast to the perceptions recorded during the baseline survey, limited kitchen space and lack of operational knowledge were not found to be significant barriers to adopting e-cooking. A flat table or even a small area on the floor was generally sufficient to accommodate the induction cookers. Additionally, learning to operate the induction stoves—using just a few buttons and basic functions—proved to be straightforward for most hotel and restaurant owners.

3.5.3 PERCEIVED BENEFITS OF E-COOKING

Micro enterprises were also asked to share their opinions on the perceived benefits of e-cooking. Figure 18 provides an overview of the answers to that question. All participants unanimously agreed that e-cooking is cleaner and more environmentally friendly than traditional cooking fuels.

Additionally, 85% of micro enterprises considered e-cooking to be safer compared to other cooking options. The remaining 15% acknowledged the need for caution when operating any electrical appliance, noting that safety ultimately depends on proper use.

Nearly all micro enterprises found induction stoves easier to operate as they simply needed to turn on the power and press a few buttons. In contrast, LPG stoves required frequent cylinder replacements, while firewood cooking involved collecting fuel and dealing with the difficulty of burning it, especially during the wet season.

The running cost of cooking with induction cookers was also perceived as lower than that of alternative fuels. By the time of the post-evaluation survey, most hotels and restaurants had already noticed a reduction in LPG use and appreciated the cost savings made possible through e-cooking.

Furthermore, 65% of micro enterprises reported that induction cookers were faster than their LPG stoves. However, 35% did not fully agree. These micro enterprises typically used LPG stoves with large burners designed for cooking in bigger pots to serve more customers. Some also faced persistent low voltage issues, with power levels occasionally dropping below 170 volts, which affected the performance of their induction cookers.

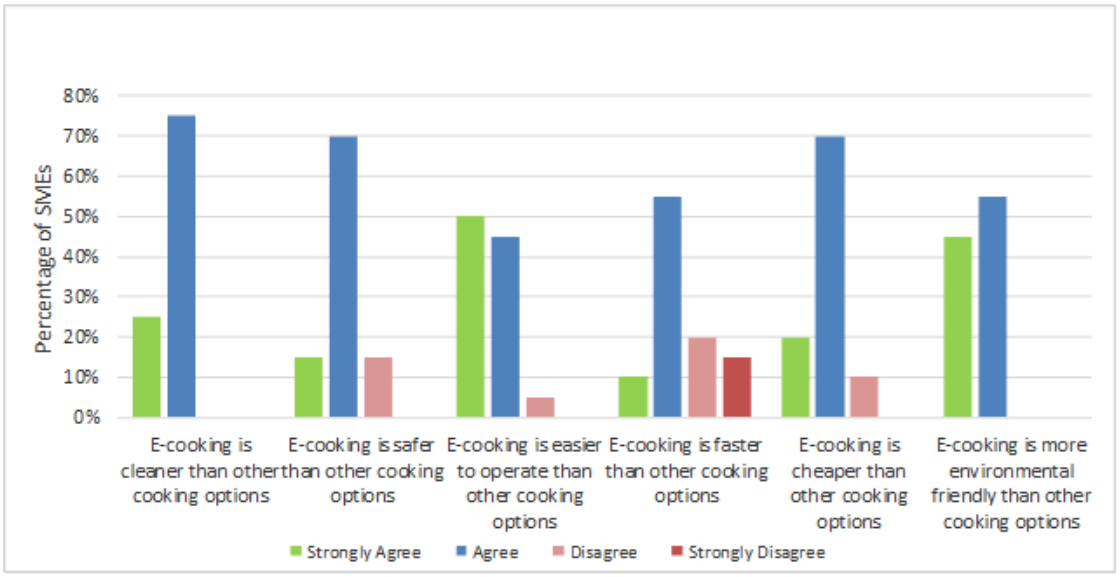


Figure 18: Micro enterprises' perception on the benefits of commercial e-cooking compared to traditional alternatives

3.5.4 SAFETY

During the testing phase, none of the participants reported any incidents of electric shock, fire hazards, short circuits, or any other safety-related issues with the e-cooking devices. This helped dispel the participants' preconceived fears about the dangers of using electricity for cooking.

3.5.5 MOTIVATIONAL FACTORS TO USE E-COOKING

Several factors motivated micro enterprises to adopt and test e-cooking in their businesses, with subsidies and demonstration campaigns playing the most significant roles. Many micro enterprises were initially unable to afford the upfront costs of e-cooking solutions. However, the incentive package made these technologies more accessible, as illustrates the following testimonial of a tea shop owner in Nisikhola:

> *"When I was abroad, I used to cook in induction stove. It was very easy and flexible. Now that I am getting the stove for a cheaper price, I had to have it."*

The demonstration campaigns highlighted key benefits of e-cooking—such as a cleaner, smokeless kitchen environment, lower running costs compared to LPG, and user-friendly operation—which further encouraged participation. micro enterprises involved in the second phase were also motivated by the positive experiences shared by first-phase participants, having seen or heard about the advantages firsthand.

Additionally, the portability of the induction stove, i.e. its ability to be easily moved from one place to another, was seen as a practical and convenient feature.

3.5.6 NEED OF MULTIPLE STOVES

Hotels and restaurants typically have more frequent and intensive cooking needs than the residential sector. Micro enterprises engaged in bulk cooking—especially in the mornings—often need to prepare multiple dishes simultaneously. For electric cookstoves to meet a larger share of these cooking needs, businesses would require more than one unit.

In the post-evaluation survey, 12 (60%) out of 20 participants expressed the need for an additional electric stove. One hotel owner in Badigad described this issue in the following way:

> *"I use this induction stove every morning for more than three hours. Sometimes, the over-temperature protection system gets triggered and shuts the stove off due to continuous use. When I'm in a hurry, I end up cooking rice and vegetables for my kids on the LPG stove. I wish I had another induction cooker so I could cook all the dishes with electricity and save more on LPG expenses."*

To assess the genuine satisfaction of micro enterprises with e-cooking, participants were asked if they would be willing to give away their induction stoves and utensils for the same price they paid. None agreed to this. When asked at what price they would be willing to give them away, 17 participants said they would not trade their stove and utensils for any price. The remaining three stated they would consider giving them away only if they could purchase a stove with two burners and the necessary utensils for the same price. This indicates a high level of satisfaction and added value compared to the cookstoves previously used.

3.6 FINANCIAL ANALYSIS

Figure 19 shows that, without subsidy, the cost of the cooking solution (including one induction stove and a set of induction-compatible cookware selected by the owners) ranged between NPR 7,600 and NPR 15,840. This could pose a considerable financial burden for micro enterprises operating on tight margins. However, with the subsidized incentive model provided by this project, participant contributions were reduced significantly, in some cases to less than NPR 2,000, making the technology far more affordable. This variation in appliance costs highlights the importance of customization within enterprises, as different micro enterprises have diverse cooking requirements depending on the type of dishes they prepare and the scale of their operations. In most cases, e-cooking replaced a significant share of LPG use, with some businesses using induction stoves for over 80% of their dishes, while others adopted a partial use pattern alongside LPG.

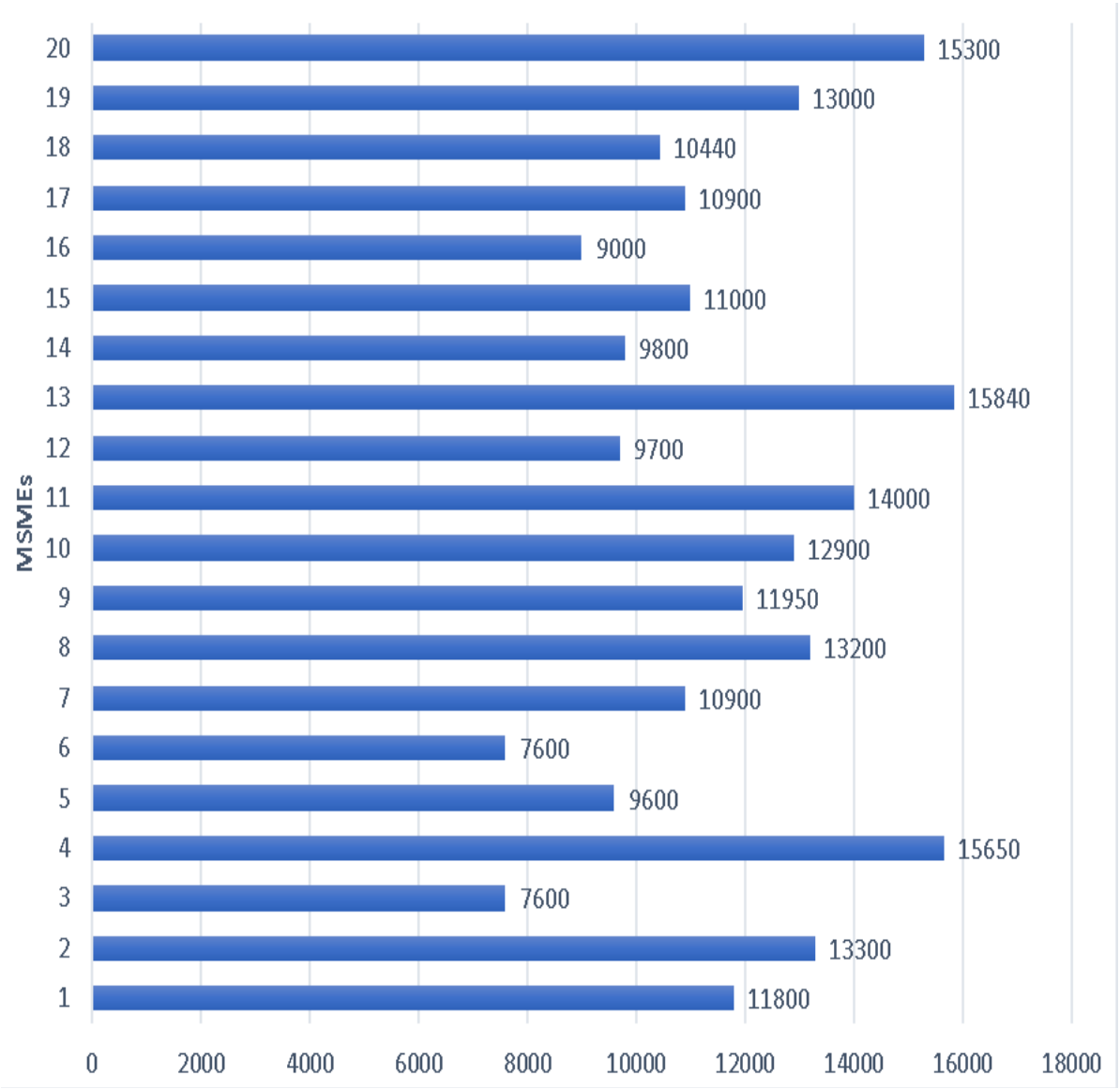


Figure 19: Cost of e-Cooking solution installed in the participating micro-enterprises

Out of the 20 participating micro enterprises, three applicants (4, 12 and 13) were taken for a closer fuel analysis. The primary reasons for selecting these sites were: (i) the monsoon season limited field activity to these locations, (ii) these kitchens remained consistently operational during the study period, and (iii) their cooking diaries were detailed and well-maintained, ensuring higher accuracy and precision of data collection. LPG consumption was measured at 30-day intervals, which allowed for an exact assessment of fuel LPG after induction cooktop installation.

The use of LPG prior to installing e-cooking solutions was standardized by adjusting the data to reflect the same number of customers across all SMEs. For simplicity in analysis, an assumption was made that each customer consumes an equal amount of electricity for their meals after the transition to e-cooking.

Table 17: Analysis of fuel costs and savings of micro enterprises that adopted an e-cooking solution

Nr.	Baseline LPG used before the intervention (NPR)	LPG used after the intervention (NPR)	Avg. Electricity Cost (NPR)	Total fuel Cost Now (NPR)	Total Saving in fuel costs (NPR)
4	4,000	1,100	1,350	2,450	1,550
12	2,000	310	870	1,180	820
13	1,500	971	156	1,127	373

All three kitchens showed a significant reduction in LPG consumption after adopting induction cooking. Micro entrepreneur 4 achieved the largest cut (from 4,000 NPR to 1,100 NPR), while micro entrepreneur 12's use dropped by nearly 85%. Micro entrepreneur 13's savings were relatively modest compared to the others, partly due to lower LPG use before installation and lower induction usage rates. Micro entrepreneur 4 had the highest electricity cost due to higher induction usage, but also reported the greatest net savings (NPR 1,550) by cutting LPG use drastically. Micro entrepreneur 12 also demonstrated considerable savings (NPR 820), while micro entrepreneur 13 achieved only NPR 373, showing that induction adoption was less financially impactful in this case.

Micro Enterprise Nr.	Payback Period (Months)	Induction Usage (%)
4	10.09	86%
12	11.83	65%
13	42.47	36%

The analysis shows a clear relationship between induction usage rates and payback speed. Micro entrepreneur 4, with the high us of the e-cooking solution, is projected to be able to recover the full price of its e-cooking solution in about 10 months. The case of micro entrepreneur 12 also exhibit a rather short payback period of around 12 months. The relatively low usage of the e-cooking solution by entrepreneur 13 leads to a much longer payback period of over 3 years (42 months), reducing the financial attractiveness of induction cooking for this enterprise.

4. DISCUSSION OF KEY INSIGHTS

The implementation of e-cooking solutions in micro enterprises across Badigad and Nisikhola provided valuable insights into both the opportunities and challenges of promoting e-cooking in rural and semi-urban commercial settings. In the following subsections, the key findings are discussed along the themes kitchen infrastructure, cooking practices, awareness and perceptions, supply system, customization need, and policy and macro-economic implications.

4.1 KITCHEN INFRASTRUCTURE

One of the key findings was the lack of readiness in electrical infrastructure. Although national grid has reached to the study area, many micro enterprises were still not connected to national grid, and most did not have the wiring capacity to support high-power appliances. This highlights a structural barrier to the immediate adoption of e-cooking. This observation reinforces the importance of including the assessment of electrical readiness of potential users as well as support for electrical upgrade when needed as integral parts of any program or policy that aims to promote e-cooking solutions in Nepal's rural and peri-uban contexts.

In contrast to the apprehension of most of the baseline survey participants, the lack of Kitchen space was not seen as a major barrier to e-cooking transition. The induction cookers only required a flat surface and covered minimal space. Consequently, the post-evaluation survey revealed that more than 90% of the participants never had space-related issues with their e-cooking solutions. This suggests that the compact size and flexibility of induction stoves do not pose a significant challenge for scaling adoption.

Figure 20: Installation of a 2,000 watt induction stove at a hotel in the Baglung district

4.2 COOKING PRACTICES

User feedback indicated that e-cooking was quickly adopted for certain foods such as tea, rice, and momo. The results indicate that the tested induction stoves are suitable for dealing with pressure cooking, boiling, and steaming practices. For these types of cooking practices, the induction stove was preferred by most of the users. This reflects the importance of aligning appliance choice, utensil design, and training with local cooking repertoires.

However, that is not the case for frying and roasting. A particularly interesting challenge arose with the cooking of Chowmein, which is a very popular dish which requires rapid, high-heat frying and frequent pan movement. Curved-base induction cooktops, designed for round-bottom utensils and suitable for cooking Chowmein are available but rarely found in Nepal. The only one available was a high-power 3500 W model, which was expensive and found only in Kathmandu. Smaller, lower-power curved-base models were not available. To address the challenge of frying and roasting, especially for popular dishes like Chowmein, there is a need to introduce smaller, affordable curved-base induction cooktops in Nepal.

The cooking diaries revealed a mix of partial and full substitution of traditional cooking fuels. Some users continued parallel use of LPG or firewood, particularly for high-volume cooking or specific dishes. This suggests that while e-cooking can displace a significant share of traditional fuel use, complete substitution may require further innovation in appliance capabilities and utensils.

4.3 AWARENESS AND PERCEPTIONS

Before the intervention, awareness of e-cooking in commercial contexts was low. Demonstrations during installation and follow-up visits were highly effective in generating interest and building trust in the technology. Participants appreciated the cleaner working environment, faster cooking speeds, and reduced smoke exposure, which improved comfort for both cooks and customers.

However, without prior examples of sustained e-cooking use in their peer group, some participants remained cautious about long-term adoption. This became evident across the two batches of installations: while the first batch involved early adopters who were willing to experiment despite uncertainties, the second batch clearly illustrated how peer experiences influenced decision-making. Seeing peers in the first batch successfully integrate induction cooking into daily operations gave later participants the confidence to invest and adopt the technology. This reinforces the critical role of demonstration kitchens and peer-to-peer learning networks in accelerating acceptance and building lasting confidence in e-cooking solutions.

4.4 SUPPLY SYSTEM

The market assessment revealed critical supply chain gaps in the local markets, particularly regarding the availability of induction-compatible cookware, quality electrical components, and after-sales services. While basic induction stoves were found in some local markets, compatible utensils (those designed for commercial-scale cooking) were limited. One specific gap observed was the lack of larger-sized

momo steamers suited for high-volume cooking in micro enterprises kitchens. This highlights the need for future project upscaling efforts to focus on introducing such commercial-grade cooking vessels to the market, in addition to standard utensil sets. Further, it was also difficult to find good quality Chowmein woks in suitable sizes for the micro enterprises and compatible with induction stoves in the local markets.

Similarly, the lack of a proper local infrastructure for repair services poses an additional challenge to ensuring not only sustainable adoption but also to scaling up the diffusion of e-cooking solutions. This aspect goes far beyond the limited scope of a single action research project like the present one. However, the observations in the analysed region already indicate the need for providing suitable in training to the local technicians in repairing induction stoves and electric pressure cookers as well as building a reliable stock of spare parts at local level in order to support any further efforts to upscale the diffusion of e-cooking solutions in rural and peri-urban contexts like the one in the studied region.

4.5 CUSTOMIZATION NEED IN MICRO ENTERPRISES

Hotels and small eateries have highly diverse menus and cooking styles, which directly influence their appliance requirements. For instance, micro enterprises cooking high-volume dishes such as Chowmein or momo require larger burners or high-capacity steamers, while others may only need compact induction units for tea, snacks, or small meal preparation. As a result, the appliance costs in this project varied widely, ranging from NPR 7,600 to NPR 15,840. Very few of the participant micro entrepreneurs already owned cookware compatible with induction stoves.

In addition to appliances, all participating hotels received a wiring upgrade, for which a uniform subsidy of NPR 2,000 was applied. However, in practice, the actual wiring costs for many micro enterprises were higher due to longer cable runs, higher power requirements, or the need for additional safety features such as circuit breakers. This highlights the importance of site-specific assessments and customized solutions when implementing e-cooking in the commercial sector.

4.6 FINANCIAL VIABILITY

From a financial standpoint, the shift to e-cooking technologies has direct implications for return on investment, payback period, and long-term cost savings. Prior to the intervention, most micro enterprises were heavily dependent on LPG cylinders, incurring recurring costs that fluctuated with market price volatility. For instance, a medium-sized eatery using three to four cylinders per month would typically spend between NPR 6,000–10,000 monthly on fuel alone. In contrast, with induction cooktops and other e-cooking appliances, the primary expenditure shifts from fuel purchase to electricity consumption, which is comparatively cheaper. Preliminary observations suggest that electricity usage even after accounting for increased loads often results in a reduction of 20–40% in monthly operating costs compared to LPG expenditure.

This cost differential is crucial in determining the payback period of investment. Even when micro enterprises bear the full appliance cost without subsidies, the reduced operating expenses translate into a relatively short payback horizon — often between 6 months to 1.5 years depending on usage intensity and local tariff

rates. Moreover, beyond the payback period, any additional savings accumulate as direct returns, thereby strengthening cash flow for micro enterprises. This means that increased profit margins can be reinvested in business expansion, improved service quality, or employee wages, contributing indirectly to local economic resilience.

Additionally, when analysing cost per customer, a pattern of efficiency emerges. Before adoption, the high recurring costs of LPG meant that fuel expenditures were distributed across fewer servings, effectively inflating per-customer energy costs. Post-intervention, the lower marginal cost of electricity per unit of food produced reduces the per-plate fuel expense, allowing micro enterprises either to maintain competitive pricing or to increase profit margins without burdening customers. This economic flexibility provides micro enterprises with a stronger competitive advantage, particularly in price-sensitive markets such as small hotels and eateries.

Critically, these financial savings also shield micro enterprises from the risks associated with LPG price volatility and supply disruptions, which are common in Nepal's import-dependent energy landscape. By looking into electricity as a primary cooking source, businesses achieve more predictable budgeting and financial planning. The cumulative impact over several years is not just reduced operating expenditure, but also increased business stability, making e-cooking a strategic investment rather than merely a technological substitution.

4.7 POLICY AND MACRO-ECONOMIC IMPLICATIONS

The findings of this study regarding electricity consumption and LPG savings at enterprise level offer valuable insights into Nepal's wider energy transition. Although the sample size is limited, a consistent trend emerges with LPG consumption decreasing while electricity consumption increases across all participants, with variations depending on cooking needs and usage rates. However, these results cannot be extrapolated directly to the national level due to a lack of robust data on the number of enterprises in Nepal's cooking sector and their state of electrification. Nevertheless, the findings point to important policy and macro-economic implications.

Firstly, a large-scale shift towards e-cooking in commercial settings could substantially reduce Nepal's dependence on imported LPG, thereby alleviating pressure on the trade deficit. Since Nepal currently imports almost all its LPG, even modest reductions in enterprise-level demand could have significant macroeconomic benefits when scaled nationally.

Secondly, increasing the uptake of e-cooking would strengthen the financial viability of MHP plants by raising local electricity demand. This is particularly important in rural areas, where underutilisation of MHPs limits income generation and incentives for long-term operation and maintenance. Higher demand from enterprises could ensure more sustainable business models for MHP plants and foster rural economic development.

Finally, these findings closely align with Nepal's policy commitments under NDC 3.0, which aims to expand the use of electric cookstoves to reach 2.1 million households and 15,000 institutions and firms by 2035. Evidence from this study

suggests that targeted support for the commercial sector, through measures such as demonstration campaigns, financing mechanisms sensitive to the different financial capacities of entrepreneurs, infrastructure upgrades and reliable after-sales service, can play a critical role in achieving these targets.

4.8 LIMITATIONS OF THE STUDY

The project was implemented in rural regions of Nepal, where micro enterprises typically served a moderate number of customers per day, usually not exceeding 50. Therefore, the findings may not fully represent the nature and needs of larger eateries in bigger urban centers and cities.

During the testing phase, only one type of cooker, a 1900-watt induction stove, was provided to all micro enterprises. Depending on the nature of the business, other e-cooking devices might be more suitable. For example, a Nepali restaurant that primarily serves daal and rice may find electric pressure cookers more effective for their needs.

Each enterprise received only one induction cooker. Given the commercial cooking demands, achieving a full transition to e-cooking with just one cookstove can be challenging.

The cooking diary study had some limitations in accuracy, as most diaries were filled out in the evenings. Since many hotels were run by sole owners responsible for all daily tasks, they could only complete the diaries at night based on memory. Consequently, records of the number of people served and timing of cooking are approximate.

Similarly, cooking energy calculations based on smart meter data are estimates, as some hourly data were missing due to poor network connectivity, which was the main cause of data gaps.

5. CONCLUSIONS AND RECOMMENDATIONS

The study set out to assess the practical suitability, operational efficiency, and user acceptance of e-cooking solutions for commercial applications in rural Nepal. The results demonstrate that induction-based e-cooking is technically feasible, financially profitable, and well-accepted among micro enterprises. Users reported faster cooking times, cleaner working environments, and noticeable reductions in LPG use, with many achieving meaningful monthly savings.

While adoption levels varied according to cooking practices, electricity infrastructure, and menu types, the intervention confirmed that e-cooking can operate effectively in commercial contexts and contribute toward Nepal's clean energy transition goals. However, it also becomes clear that, while the tested e-cooking solutions can meet many cooking needs of commercial users, they do not cover all the different cooking practices. Using multiple electric cookers could further reduce LPG consumption and enable a complete transition to e-cooking. Moreover, in some cases it seems to be meaningful to promote the combination of different e-cooking technologies in one single kitchen, for instance combining electric pressure cookers, electric water heater and induction stoves. However, this would require upgrading the electrical infrastructure, including installing a 32 A MCB on the main energy meter and using at least 4 mm^2 wiring.

Furthermore, the data indicate that the intervention's approach applied by the study may have been crucial in ensuring the positive results regarding the adoption and use of the tested e-cooking solutions. Key components of this approach include: a) evaluating and, when required, upgrading the wiring infrastructure of the users as constitutive part of the whole intervention; b) running awareness campaigns that included hands-on testing of the technology, reflection on learning outcomes, and information sharing; c) providing a limited subsidy to spark the interest of early adopters.

Policy recommendations

To support the wider adoption of e-cooking in Nepal, national clean cooking strategies must explicitly integrate not only households but also commercial applications. This aligns directly with Nepal's NDC 3.0 target of expanding the use of electric cookstoves to 2.1 million households and an additional 15,000 institutions and firms by 2035. SMEs, hotels, hostels, and restaurants are central to this transition, as they consume significant amounts of cooking fuel and influence broader consumer behavior.

A critical step in enabling this transition is the establishment of comprehensive quality and safety standards. While Nepal already has standards and benchmarks for induction stoves, parallel standards for compatible utensils and cookware are also necessary. Without such guidelines, efficiency and safety may be compromised, limiting the performance and user confidence in e-cooking solutions. Standards for wiring and electrical components should also be strengthened to ensure the safe integration of high-capacity e-cooking appliances in commercial settings.

In addition to regulatory frameworks, targeted financing mechanisms are needed to make e-cooking solutions more accessible to enterprises. High upfront appliance costs remain a barrier, despite long-term financial savings through reduced LPG usage. Accessible credit schemes, subsidies for high-volume users, or innovative leasing models could reduce the financial burden, shorten payback periods, and encourage faster adoption.

By combining strong policy frameworks, robust standards for both appliances and cookware, and accessible financing mechanisms, Nepal can achieve its NDC 3.0 goals while ensuring that the shift to e-cooking is safe, inclusive, and economically viable for enterprises of all scales.

Technical and implementation recommendations

Commercial enterprises have diverse cooking practices and higher-volume needs than households, making cookware customization essential. It is important to identify, test, and promote cookware suitable for high-demand dishes such as Chowmein and large-capacity momo steamers to improve the technical and practical viability of e-cooking in commercial applications.

The promotion of e-cooking appliances should always be combined with a) the evaluation and provision of the cookware that meet at least the most regular cooking practices of user; b) the mandatory assessment of the electrical infrastructure and the necessary upgrades, including certified wiring and circuit protection, to ensure safe and efficient operation; and c) the provision of accessible and affordable after sales service. Training local technicians in appliance installation and repair is equally crucial to secure reliable, ongoing technical support within the community.

Market development recommendations

Strengthening local supply chains for certified electrical components, spare parts, and commercial-grade cookware is essential to ensure the consistent availability of quality products for e-cooking. Building partnerships between appliance suppliers, cookware manufacturers, and local vendors can further improve product accessibility and distribution efficiency. At the same time, supporting the development of local repair and maintenance services will help minimize downtime, reduce dependency on distant service providers, and enhance user confidence in adopting e-cooking solutions.

Awareness raising recommendations

This intervention showed that it can be challenging to engage micro enterprises in testing commercial e-cooking solutions, especially when they are required to contribute significantly to the upfront costs. While demonstration campaigns can effectively communicate the benefits, live examples that showcase the financial and social advantages are the most persuasive. It is easier to encourage a hotel to install electric stoves if they see a neighbouring business successfully using them, experiencing fuel and time savings, and fulfilling all cooking needs. To encourage wide-scale adoption, it is therefore advisable to pilot the project with a small group of hotels and restaurants, before scaling-up after a few months.

Recommendations for future research

Future research should expand the scope of e-cooking interventions to larger businesses and institutions in order to assess the performance of e-cooking solutions under higher-volume and more diverse cooking demands. Beyond induction stoves, alternative technologies and combinations of appliances should be tested to identify the most suitable options for different cooking practices. Additionally, sustainable financing mechanisms need to be explored, such as microloans, partnerships with vendors, or collaboration with micro-finance institutions, to enable enterprises to adopt e-cooking without relying on subsidies, which are not realistic and sustainable for a transformation across the whole sector.

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