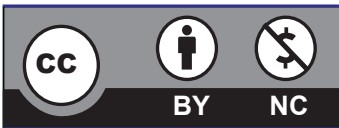


Research

The Cooking Solutions for Rural Livelihood: A Study of Sundarbazar Municipality

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ABSTRACT

Electric cooking systems have been promoted in Sundarbazar Municipality of Lamjung district as an alternative to liquefied petroleum gas (LPG) for cooking purposes. This study aims to assess the effectiveness of electric cooktops on rural livelihood. The study was conducted using a sample survey with a simple random sampling technique. The data was gathered through household surveys, focused group discussions, and field observations. The major source of data was a sample survey.

The study found that local people experienced induction cooktops as a time-saving, fast processing, and economically viable option for cooking purposes. The study also found that electric cooking solutions may be a good alternative to LPG in both urban and rural areas, as Nepal will produce excess electricity in the near future. The study suggests that innovation for electric cooking has the possibility of enhancing better livelihood in rural contexts. This study concludes that electric cooking solutions have positive impacts on rural livelihoods. The promotion of electric cooking among households can reduce the consumption of imported LPG. The study suggests that local governments should play an active and major role in advocating for electric cooking, providing training, and different forms of incentives such as distributing prizes. The study also suggests that capacity-building programs for users.

Keywords: clean energy, eCookstove, rural livelihood, sustainable development

Introduction

The use of renewable energy resources is essential for mitigating pollution and reducing climate change impacts (Twidell, & Weir, 2015). In Nepal, biomass is a primary source of energy for cooking purposes, but there is a noticeable shift towards commercial energy and renewable energy sources. The government aims to increase per-person energy consumption to 700 kWh by 2023 and 1,500 kWh by 2028, which requires a shift from the current energy consumption pattern and support for industries that rely on electricity, such as transportation and cooking (LGOA, 2017). The promotion of electric cooking solutions is becoming more popular in Nepal, and local governments have taken initiatives to promote small-scale clean energy projects. The study area, Sundarbazar Municipality of Lamjung district, has distributed 532 induction cooktops to rural families at no cost, and this paper deals with the social acceptance of electric cooking appliances by the rural community in the study area. The key research question is whether electric cooking is acceptable to rural households for their day-to-day cooking and how technological transformation contributes to sustainable development (WECS, 2022).

The Alternative Energy Promotion Center (AEPCC) is a national focal agency promoting renewable energy technologies in Nepal, and it has been promoting renewable energy systems through different programs and projects to popularize and promote the use of renewable energy technologies (AEPCC, 2022). The use of electric cooking solutions can help Nepal achieve the Sustainable Development Goals, improve public health, reduce poverty, and combat climate change. Biomass is a key source of energy all around the world, especially in developing countries (Suman, 2021). It includes firewood, agricultural residues, and animal waste, which has become primary energy sources for cooking purposes in Nepal (Suman, 2021). Nepal has more than 60 years of successful experience in the development of household biogas technologies (Lohani, Koirala, & Bhattarai, 2021). Despite the fact that Nepal has

been promoting biogas for many years with little noticeable technological advancement, there is still a need for indigenous technologies that can better handle multiple feedstocks and changing ambient temperatures (Lohani, Koirala, & Bhattarai, 2021; Lohani, Dhungana, Horn, & Khatiwada, 2021). A household bio-digester is one feasible way to create nutrient-rich digestate (bio-slurry) and a clean energy source (biogas) at the same time (Lohani, Koirala, & Bhattarai, 2021; Lohani, Dhungana, Horn, & Khatiwada, 2021). The current constitution of Nepal has introduced a three-tier structure of federal government (federal, province, and local) and all three levels have the constitutional power to enact laws, prepare budgets, and mobilize their resources (Shrestha, & Bhattarai, 2013). In this context, some local governments have already taken initiatives to promote small-scale clean energy projects by mobilizing the conditional grant they received from the central government (Suman, 2021). The ward number 3 of Sundarbazar Municipality, Lamjung, had distributed 532 induction cooktops to their rural families at no cost in the fiscal year 2077/78. The paper is going to discuss the potential opportunities and challenges associated with the promotion of electric cooking in the local area.

Problem Statement

Rural livelihoods in Nepal are at risk due to food insecurity, lack of proper resources, and limited access to modern cooking solutions. The use of traditional biomass fuels for cooking purposes is still predominant in rural areas, which contributes to indoor air pollution and health hazards. The Sundarbazar Municipality of Lamjung district has distributed electric cooktops to rural families at no cost, but it is unclear whether these electric cooking solutions are socially acceptable and have positive impacts on rural livelihoods. Therefore, there is a need for research to analyze the social impacts of electric cooktops and their acceptance at the household level in the Sundarbazar Municipality. The study aims to observe the changes that have occurred in the day-to-day life of rural people after the adoption of electric cooking systems, including their perceptions, experiences, and outcomes.

The study will contribute to the promotion of sustainable rural livelihoods, the reduction of indoor air pollution, and the achievement of the Sustainable Development Goals. The study will also provide insights into the potential opportunities and challenges associated with the promotion of electric cooking in rural areas of Nepal.

Research Objective

The main objective of the study is to analyze the social impacts of electric cooktops on day-to-day life and their acceptance at the household level in rural areas of Nepal, including their perceptions, experiences, and outcomes.

Literature Review

The scientific literature on eCooking technology in Nepal is limited, but there are studies that highlight the importance of transitioning from solid biomass to cleaner cooking technologies. According to the Alternative Energy Promotion Centre (AEPC, 2022), biomass energy is one of Nepal's most significant resources, but its utilization and management lack a proper and long-term approach. About 65% of households in the country use solid fuels as the primary source of energy for cooking (WECS, 2022), which creates serious concerns since it has adverse impacts on the environment, health, and socio-economic conditions. Household air pollution (HAP) accounts for about 18,000 premature deaths every year in Nepal (Clean Cooking Alliance, 2017).

The petroleum sector in Nepal is a monopoly, and Nepal Oil Corporation (NOC) is responsible for importing, sorting, and distributing all petroleum products in Nepal (Poudyal et al., 2019). LPG has to be imported, and residential sector solely consumes around 54% of all LPG imported into the country (AEPC, 2022). This over-dependence on LPG import has put Nepal in a terrifying situation, as it has not only contributed to widening the trade deficit but has also made Nepal very vulnerable to the risk of energy security (Bhandari & Pandit, 2018). Many argue that substituting LPG with electricity for cooking at the household level can reduce the country's huge trade deficit to a large extent (Chitrakar 2019; Nakarmi 2019).

The induction cooktops are also safer than other traditional stoves and LPG, with no open flame and little residual heat. According to a lab-based study conducted by the Centre for Energy Studies (CES), induction cooktops showed a 42% savings as compared with LPG (Shrestha, 2020). The Government of Nepal encouraged people to adopt induction cooktops by waiving custom duty on their imports (MoF, 2020) and also reduced the tariff for domestic consumers using more than 151 units in a month to motivate them to use electric cooking systems and other electric devices (NEA, 2021).

Methodology

The methodology used in this study involved both analytical and descriptive methods based on primary and secondary data. For the household study, a sample of 60 households was randomly selected from a total of 532 user households. The field data was obtained through focused group discussion and key informant interviews with induction cooktop users (primary cook persons) by the researcher at the local community of Sundarbazar Municipality, Ward No. 3. The survey was conducted in December 2022.

Study Area

The study area is Sundarbazar Municipality, located in the Lamjung district, under the Gandaki province in Nepal. Sundarbazar Municipality is surrounded by Rainas Municipality on the East, Madhya Nepal Municipality on the West, Besishahar Municipality on the North, and Tanahun district on the South. It can be reached within about 2.5 hours of walking distance from the middle Marsyangdi Hydropower Project, Siundibar, Lamjung. This hilly area is also important for its biodiversity and tourism. It covers an area of 72.03 sq. km. This municipality also includes the beautiful village of Duradanda, which has sites of historical, religious, and cultural significance, with a majority of people belonging to the Dura caste. The people in the study area were mainly found engaged in farming as their primary occupation.

Results and Discussion

Socio-demographic Characteristics of eCookstove Users

Out of the 60 HHs surveyed, approximately 35 percent of the respondents were female. For this study, the survey questionnaire was administered to the primary cook within each sampled household. In cases where a primary cook was absent, available family members were interviewed instead. It was observed that 65 percent of the survey respondents were male, serving as the primary source of survey information. This gender distribution imbalance could be attributed to cultural norms, whereby males tend to have more frequent interactions with outsiders, while females may not engage in such interactions as frequently.

Interestingly, the proportion of surveyed households headed by female members of the family was found to be 30 percent. This number aligns closely with the national average of female-headed households, which stands at 31.55 percent according to the National Population and Housing Census (NPHC) conducted in 2021 by the National Statistics Office (NSO).

In 90 percent of the surveyed HHs, female as a primary cook. Both male and female participate

in cooking in 6.67 percent of the HHs. Only 3.33 percent of respondents reported that additional members of the family have started cooking after introduction of the eCooking technology in their HH where most of them are male members. Among the surveyed HHs, 60 percent stated that the role of the male cook is primarily sporadic.

Majority (90 percent) of the respondents have completed their school level education, and only 10 percent have no formal education. On average, a family consists of 5 people, ranging from as few as 2 to as many as 7 individuals in the studied HHs.

Primary Cookstove in the Study Area

The primary cookstove usage in the surveyed HHs varied among different types. Of the total surveyed HHs, 20 percent relied on traditional cookstoves, which are the conventional and commonly used stoves. Improved cookstoves were used by 33.33 percent of the HHs, offering better efficiency and reduced smoke emissions compared to traditional ones. LPG was the primary cookstove choice for 41.67 percent of the HHs, indicating a transition to cleaner and more convenient fuel sources. A small percentage of HHs, 1.67 percent, used eCookstove, which are induction cooktops. Additionally, 3.33 percent of the surveyed HHs relied on biogas as their primary cookstove.

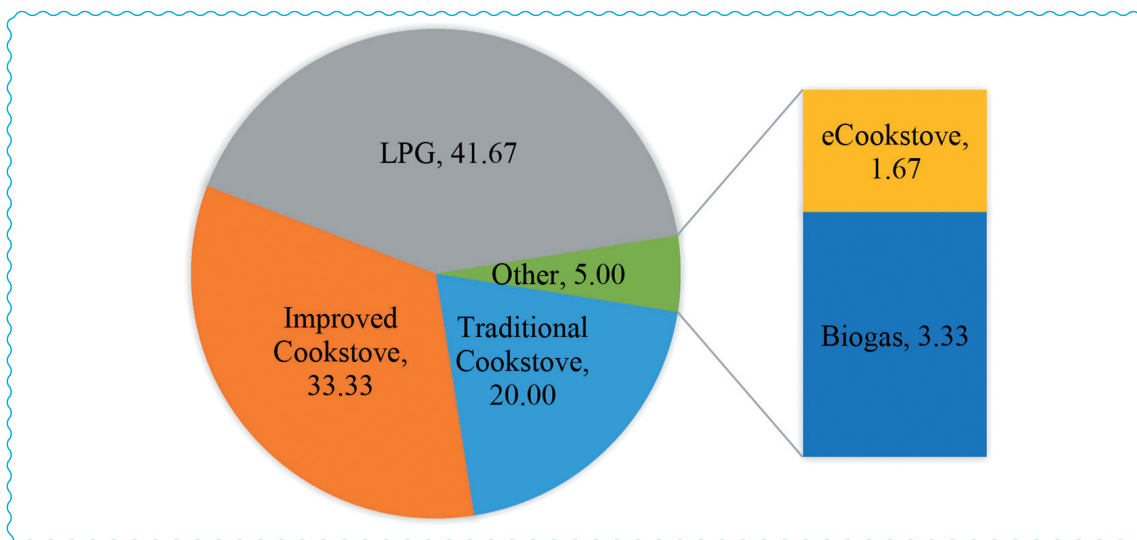


Figure 1: Primary Cookstove in the Study Area (Percentage)

Operational Status of eCookstove

Out of the 60 surveyed HHs, only 45 percent of eCookstove were found to be operational at the time of field visits. The study aimed to understand the reasons behind the non-operational status of the cooktops. Some users reported that their eCookstove was currently damaged or experiencing technical problems. Others mentioned a lack of knowledge on how to use it, concerns about high electricity consumption bills, the absence of a dedicated power socket, and the reluctance of elderly individuals responsible for cooking to switch to induction cooktops.

In relation to the frequency of eCookstove usage, a follow-up question was queried to the users. Among the regular users, 55.56 percent reported using the eCookstove on a daily basis, while 37.04 percent utilized it a few times in a week, and 7.40 percent used it a few times in a month. The majority of regular users (80 percent) stated that they regularly use the induction cooktop to cook rice and tea. Additionally, 30 percent of users reported using their cooktop to prepare lentil soup (Dal). Biomass and LPG, on the other hand, are primarily utilized for cooking vegetables, Dheedo, Roti, and other food items, as the induction cooktop requires dedicated cookware for these specific dishes.

The operational status and frequency of eCookstove usage indicate a doubt among common users in the study area. Consequently, there is a need for increased awareness and live demonstration events to address this issue. These events are crucial for promoting the benefits and proper utilization of eCookstove. By organizing such activities, users can be educated about the functionality and advantages of eCookstove through practical demonstrations. Moreover, it could provide an opportunity for users to address any concerns or misconceptions they may have regarding the technology.

Decision Maker in Purchasing of eCooking Solutions

The cost of installation as per the information collected from Ward Office-3 of Sundarbazar

Municipality shows that the ward office spent an average of NPR. 2,500 per stove. The users were responsible to purchase the required utensils as per the need.

In Nepali society, traditionally male members hold greater influence in decision-making when it comes to purchasing household amenities. However, the survey data reveals a different trend regarding the purchase decision of cooking solutions including the kitchen utensils. Male members (55 percent) were responsible for the decisions, while female members accounted for 35 percent. In 10 percent of the cases, the decision was made jointly by both male and female members. Interestingly, when it comes to kitchen-related chores, female members emerge as the key decision-makers within the family. The key deciding factors for adopting modern cooking technology over fuelwood-based technology are health concerns, convenient cooking, and environmental concerns.

Benefits of eCooking Technology

The eCooking is a promising technology which significantly reduces HAP and also helps improve the health and economic well-being of rural family. It also contributes to climate change mitigation to some extent. The local community at Duradanda village still depend largely on biomass like firewood as a source of fuel for cooking purpose. If this situation continues, it is highly likely to stimulate unsustainable consumption of firewood, consequently forest degradation and scarcity of fuelwood has forced local people to use agricultural residues, a low-grade fuel. With the expansion of rural road networks, firewood scarcity and due to some social prestige values, the rural households are also buying LPG to meet their cooking requirements. As mentioned earlier, the imported LPG into Nepal in large quantities from India has also increased the trade deficit of the country. To reduce the dependency of both traditional biomass and LPG by switching to eCooking is the most essential for the social, environmental and economic prosperity at local as well as national level.

According to the information provided by Ward Chairperson Mr. Amrit Neupane (Ward No-3), the average cost of firewood per Bhari (equivalent to an average quantity of 30 kg) is NPR 400, while the cost of LPG per cylinder is NPR 1900. As revealed from the collected data, for single household the average monthly electricity bill was NPR 80 before whereas now it is approximately NPR 178. After the use of induction cooktop, those who have used LPG (1 cylinder consists of 14.2 kg gas), save an average of NPR 232~2 kg gas per month. However, the price of LPG was found varying depending upon the user's consumption and their distance from the local market center (transportation cost).

Before the use of eCookstove, the respondents used to spend an average of 24 hours per month (equivalent to 3 person days) collecting firewood, including travel time. This is valued at NPR 3000 worth of work, considering a person day as 8 hours and a wage rate of NPR 1, 000 per person day. Interestingly, after adopting the induction cooktop, they now spend an average of 12 hours per month (equivalent to 1.5 person days), valued at NPR 1500 worth of work, on firewood collection (including travel time). This indicates a significant savings of time required for firewood collection. The local people have also mentioned the faster cooking time of the induction compared to other mechanism as its primary advantage. The most cited disadvantage of the induction cooktop is its complete dependency in electricity making it useless during the power outage. It can be stated that the electric cooktop is quite handy during urgency and it reduces the time of collecting firewood and even having to buy LPG with extra costs.

Users' Perception, Acceptance and Satisfaction

Sixty percent of the users mentioned that the utility of the product was the most influencing factor for them to acquire it. The respondents stated that the induction cooktop is highly convenient in urgent situations, reducing the time required for collecting firewood and the need to purchase LPG with additional costs. Furthermore, its portability, space-saving design, and various cooking mode

and power options collectively contribute to its usefulness, making the utility factor highly pronounced among users.

The traditional biomass fuels still play a crucial role in rural parts of Nepal where promotional activities of eCooking itself is a challenge. In the study area, firewood is cheaper and almost available free of cost. However, the community of Duradanda itself is much aware of the health impact of indoor air pollution from traditional stoves and thus offered to reduce firewood consumption. Some rural families having remittance-based economy also assume that they are better off and motivate them to shift to cleaner and more convenient cooking technologies such as LPG and electric cooktops. Shifting from traditional cooking fuel to cleaner energy leads to rural livelihood improvement, improved health and environmental protection at the same time. The rural society is also undergoing modernization and local people are preferring for more clean and smart technologies in their daily lives. The use of locally produced hydropower electricity to run cooking technologies are also gaining popularity which would significantly contribute to reduce Nepal's trade deficit.

During the field visits, it was reported that it is difficult to obtain firewood for physically weak people like elderly persons. The smoke emitted from firewood burning has also mostly affected the health of women, children and elderly persons. Study site is located within the catchment area of Middle Marsyangdi Hydropower project (70MW); however, the peak load management is still challenging as the reliability of electricity supply during the cooking hours seems irregular. The induction cooktops installed households do not have proper wiring and have a low level of connection with 5A Miniature Circuit Breaker (MCB) capacity, which limits the use of multiple electric appliances at the same time. The after-sales service provider at local area is the most challenging issue of induction cooktop promotion in the study area. The municipality and concerned stakeholders need to ensure electrical safety provisions and reliability of regular electricity supply at household level. If

electricity supply can be made uninterrupted, tariff be made affordable, and people be provided with efficient cooktops with subsidy, electricity has high possibility to substitute LPG and other forms of household cooking fuels.

Only 20 percent of users believe that food cooked on induction cooktops or eCookstove has a better taste compared to other cooking methods. The users were asked to indicate their satisfaction levels on a 5-point Likert scale (ranging from highly satisfied-5 to highly dissatisfied-1) based

on various aspects such as safety, easy operation, design and size, clean kitchen, time saved, and efficiency. Regarding safety, the majority of users (75 percent) expressed satisfaction. When it comes to easy operation, a significant majority (66.67 percent) reported being highly satisfied. In terms of design and size, the majority of users (60 percent) expressed satisfaction. In regard to a clean kitchen, a large majority (91.67 percent) indicated being highly satisfied. The aspect of time saved received high satisfaction, with the majority of users (86.67 percent) being highly satisfied.

Table 1: Satisfaction Level on Various Aspects of Induction Cooktop (eCookstove)

	Safety	Easy to Operate	Design and Size	Clean kitchen	Time Saved	More Efficient
Highly satisfied	16.67	66.67	33.33	91.67	86.67	25.00
Satisfied	75.00	31.67	60.00	5.00	16.67	66.67
Neither satisfied or dissatisfied (neutral)	8.33	1.67	6.67	3.33	5.00	8.33
	100.00	100.00	100.00	100.00	108.33	100.00

These findings suggest that the users have generally shown positive satisfaction levels across various aspects of induction cooktops or eCookstove, particularly in terms of easy operation, clean kitchen, time saved, and perceived efficiency.

Based on field observations and data obtained from the study, it has been observed that almost all users are satisfied with the performance, utility, and benefits provided by the eCookstove compared to other cooking mechanisms. The effectiveness of eCooking can be considered a positive and socially accepted aspect, as most users also perceive it as cost-effective. However, one common concern expressed by users is the limitation of a singular cooking hub on the induction cooktop, which may necessitate the use of multiple other cook stoves during times of hurry. It is believed that if induction products with multiple cooking hubs are made available, users would completely transition to eCooking from other mechanisms.

Sustainability and Scalability

The government policy "One household one eCookstove i.e., EK Ghar Ek Bijuli Chulo" had a

stimulating effect on the eCooking market in Nepal. Additionally, the availability of sufficient electricity generation in the country provides an opportunity for future growth in this sector. The enablers to the wider uptake of electric cooking systems include factors such as supportive policies, regulations, and incentives that promote the use of clean energy sources. The government subsidies for electric cooking systems can reduce the financial burden on households, while regulations that mandate the use of clean energy sources can create a market demand for these technologies. In addition, the availability of skilled human resources, technical expertise, repair and maintenance services, and local capacity building can support the installation and operations of those systems. On the other hand, barriers to the wider uptake of electric cooking systems include factors such as lack of awareness, limited access to financing, inadequate infrastructure, hesitation to change from business as usual, and cultural preferences for traditional energy sources.

Critically, the electric cooktops and its accessories generally remain costly for poor households

unless large subsidies are provided, especially with regards to stove and cookware prices. This type electric cooktop promotion program was implemented in the trickle-down approach by ignoring the involvement and participation of the target community at the inception phase. The program is focused on their short-term physical targets and outputs rather than long-term sustainability, particularly overlooking after sales services. However, the introduction of electric cooktops in rural areas brought several positive changes like time saved for cooking, minimized the frequencies of firewood collection and its consumption, reduced indoor air pollution and also contribution to reduce the dependency on imported LPG. This type modern clean cooking technology is a relatively new concept and upfront the cost is relatively high in the beginning. It is right time to remove the subsidies for petroleum products including LPG. Such subsidies can be moved to clean energy systems which will help largely reduce the dependency on importation of petroleum products.

The transition from firewood to eCookstove contributes significantly to sustainable development. It reduces the reliance on traditional fuel sources, mitigates deforestation, and helps preserve valuable ecosystems. By minimizing indoor air pollution, eCookstove improve health outcomes, particularly for women and children who are most exposed to smoke emissions. The use of eCookstove also promotes energy efficiency and reduces carbon emissions, contributing to climate change mitigation. Furthermore, the shift to eCooking reduces the time and effort spent on firewood collection, allowing for enhanced productivity and socioeconomic development. Overall, the adoption of eCookstove fosters a sustainable and healthier future for communities while addressing environmental, health, and economic aspects of sustainable development.

Conclusion

The empirical evidence suggests that clean energy systems have the potential to contribute to sustainable rural livelihoods. However, the success of these systems depends on a range of

factors, including local context and community involvement and ownership, effective policies and financing mechanisms, and appropriate technical design and maintenance support systems. The literature highlights the importance of transitioning from solid biomass to cleaner cooking technologies, such as induction cooktops, to reduce the use of imported LPG and promote positive changes in local communities. The electric cooking technology could help in inducing positive changes in the local communities, directly benefiting local people due to its fast and safe processing, pollution-free kitchen environment, reduced drudgery associated with biomass collection, and improved kitchen hygiene.

The literature also emphasizes the importance of sustainable energy policies and relevant policy recommendations for end-users to promote renewable energy sources. Renewable energy has an important role to play in meeting the future energy needs in both rural and urban areas. The development and implementation of sustainable energy policies and initiatives can help to address the energy imbalance within the country's socioeconomic and political landscapes and promote sustainable development.

Overall, the literature highlights the need for a comprehensive and integrated approach to promote sustainable energy systems and address the challenges associated with energy access and livelihood enhancement. The promotion of clean energy systems, such as induction cooktops, can contribute to sustainable rural livelihoods and help to reduce the negative impacts of traditional cooking technologies on the environment, health, and socio-economic conditions.

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