MECS Modern Energy Cooking Services

The Potential for Enterprise Level eCooking in Nepal

Final Report

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Executive Summary

The current energy and socio-political context of Nepal suggests there are opportunities to increase electric cooking in enterprises (defined as including both commercial and institutional organisations). The energy consumption of the commercial sector in Nepal is only around 7% of national consumption (NEA, 2022), but the largest amount of energy used in the sector is in the form of thermal energy, used for cooking in the food and accommodation subsectors. Cooking energy in the commercial sector is dominated by fuelwood and LPG (WECS, 2022). Both fuels pose major issues. The use of fuelwood poses health hazards and contributes to pollution and environmental degradation. Reliance on commercial fuels like kerosene and LPG creates issues concerning affordability, energy security, and dependency on imports, as these fuels are entirely brought in from other countries.

However, Nepal possesses abundant hydropower potential for electricity generation, presenting an opportunity to promote electricity as a modern cooking fuel for enterprises. Transitioning to electric cooking (eCooking) can help Nepal achieve its Sustainable Development Goal (SDG) targets, improve the well-being of cooks with safer options, and strengthen the nation's energy security. Reducing dependence on LPG imports would also mitigate the risks of supply disruptions, price fluctuations/hikes, offering economic benefits. Thus, a shift to eCooking at the enterprise level holds substantial advantages from both a national and utility perspective.

Within this context, this study focusses on identifying the opportunities and challenges for enterprise level transitions to eCooking. The research assesses the extent of a possible shift to eCooking within enterprises and the assistance required for enabling transitions. For this study, a total of 162 enterprises across five enterprise categories (89 restaurants, 21 hotels, 19 canteens, 14 café/bakery shops, and 19 banquets) were surveyed inside the Kathmandu valley. 6 ethnographic studies, a market survey and one focus group discussion were also conducted.

Overall, the research findings indicate clear opportunities for electric cooking transitions in enterprises. A majority of the respondents from restaurants (70.8%), hotels (57.1%), canteens (57.9%), banquet (73.7%) and cafés/bakeries (78.6%) considered eCooking beneficial while most restaurants (52.8%), hotels (52.4%), and cafes (85.7%) stated their willingness to transition to eCooking although the percentage of canteens and banquets was less in comparison (26.3% and 31.6% respectively). In addition, most enterprises already used Cooking in some form, with the findings indicating larger transitions are feasible. Although LPG was the primary cooking fuel used (ranging from 74% of the cooking in cafes to 90% in banquet halls), electricity was the secondary cooking fuel in all enterprise categories, with the share of cooking on electricity greatest in cafés (26%). Ownership of at least one eCooking appliance varied between categories, ranging from 21% of canteens to 82% of all cafes/bakeries surveyed. Food processors, blenders, coffee-makers, microwave ovens and grinders were the most widely owned appliances, highlighting how electricity was often used for food preparation.

Larger eCooking transitions seem feasible as the most common cooking practices in the enterprises surveyed were found to be compatible with eCooking. In all enterprise categories apart from bakeries, steaming, shallow frying, boiling and deep frying were the most common cooking practices, suggesting modern efficient commercial scale eCooking appliances such as EPCs, electric steamers, induction stoves, electric deep fryers, water boilers, and rice cookers could be adopted. For bakeries, baking and coffee making were the main cooking practices, which could be catered for by electric ovens and coffee makers. Particular opportunities for eCooking transitions may lie with enterprises that batch cook ahead of service time, where the need for quicker cooking times which often suits LPG is less of a concern.

Larger transitions were also supported by most enterprises having appropriately sized meter connections for commercial eCooking: 33% had the largest 3 phase meters connections, while 70% had a 30 Amp connection or above. The need for additional transformers to cater for larger enterprise level eCooking loads was highlighted, with the access to land to install transformers a challenge, particularly for enterprises renting their premises.

Supply chain analysis identified existing domestic suppliers of larger eCooking appliances which could cater for the cooking practices commonly used by enterprises. All appliances were imported by suppliers, with the most common devices (e.g. coffee machines, ovens and deep fryers) held in store while others were imported to order. However, among enterprises there was a significant lack of knowledge and information on the availability of these appliances in the Nepali market, impeding transitions. While the reliability of devices was praised by suppliers, the lack of repair facilities for commercial scale eCooking appliances was also seen as a challenge as was the need for staff to receive training to operate new eCooking appliances effectively was seen as a challenge. Resistance to change from staff accustomed to traditional cooking methods could also pose difficulties during transitions.

The main concerns over eCooking adoption perceived by the surveyed enterprises were the reliability of the electricity supply, access to sufficiently large stoves and utensils, and increased cooking times. The survey data indicated concerns about the taste of food cooked with electricity and eCooking cost implications were less prominent although focus group discussions revealed stakeholder concerns about the upfront costs of eCooking. A preliminary financial analysis case study carried out as part of this research found an eCooking transition was financially beneficial due primarily to the lower fuel costs of electricity relative to LPG. Additional research using primary energy consumption data is recommended to provide more precise cost benefit analysis and help further the case for enterprise level eCooking.

Overall, the extent of the potential transition to eCooking enterprises in Nepal can make is likely to vary significantly due to various (often localised) factors including: the size of the enterprise, the reliability and affordability of the electricity supply, the availability and affordability of modern efficient eCooking appliances, and supportive government policies to promote enterprise level eCooking. The transition to enterprise level eCooking in Nepal requires a holistic approach and the following measures are recommended to accelerate uptake.

- Sensitising enterprises on the availability of enterprise level eCooking appliances in the Nepali market is crucial as many lacked knowledge of the technologies available.
- Conducting training programs for kitchen staff is also key to ensure they can effectively operate and maintain eCooking appliances. Focus group findings indicate community level networks are likely to be effective in raising awareness and influencing adoption of eCooking.
- In addition, increased investment and efforts to improve the reliability of the electricity supply are needed to facilitate smoother integration of enterprise level eCooking and encourage enterprises to consider and adopt eCooking solutions. Government support promoting eCooking in enterprises can help provide a return on these investments by increasing electricity consumption.
- Government/donor support for financing measures and strategies such as incentives, subsidies or grants may also be required to offset the initial investment costs associated with adopting electric cooking, particularly as enterprises have typically already invested in their existing cooking fuel system (usually LPG) and may be reluctant to invest again.

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1. Introduction

1.1 Background

The commercial sector in Nepal includes various businesses, offices, hotels, restaurants, and other establishments. Commercial establishments such as restaurants, lodges, hotels, sweet shops, canteens etc. also use LPG, fuelwood and electricity for cooking as well as space and water heating. The other commercial activities that use energy for cooking purposes include domestic and small-scale local food and agricultural processing, (i.e. milk processing, ghee and *khuwa* making, paddy and oil seeds roasting, beaten rice (c*hiura)* making, fish, meat and cardamom drying, etc). Besides, local bakeries, confectioneries, breweries, distilleries and sugar mills, at least during initial stage of operation have cooking function. It plays a significant role in the country's overall energy consumption. Like many developing nations, Nepal has been experiencing an increase in energy demand in recent years due to economic growth and urbanization.

The energy consumption in the year 2021 has reached 626 PJ, out of which, the commercial sector, although being the growing economic sector, consumed only about 7% of national consumption which is third in ranking behind residential (63.2 %) and industrial (18.3%) energy consumption. Although the commercial sector is expanding at a tremendous rate, the energy consumption rate is not as growing. The largest amount of energy used in the commercial sector is in form of thermal energy, used for cooking in the food and accommodation subsector. Thus, energy type-wise, the consumption of energy is dominated by fuelwood (52.48%) followed by LPG (24.79%) as shown in Figure 1 (WECS, 2022).

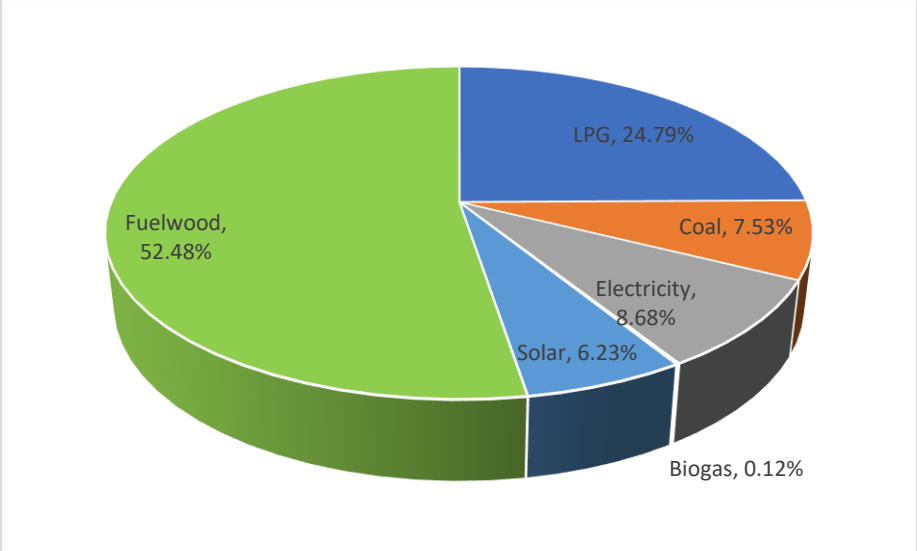

Figure 1 Energy Consumption of Nepal in the Commercial Sector in 2021 by fuel types

In Bagmati province, however, LPG dominates the source of energy consumption in the commercial sector. The commercial sector consumes 6.06 PJ (7.25 percent of total energy consumed) of energy in 2021, out of which 3.46 PJ (57.02 percent) comes from LPG and 2.18 PJ (35.97 %) from electricity (WECS, 2022) as shown in Figure 2. Major energy consumed in the commercial sector of the Bagmati province is for cooking purposes where LPG and electricity supplied 89.14 % and 0.14 % of the cooking energy respectively as shown in Figure 3.

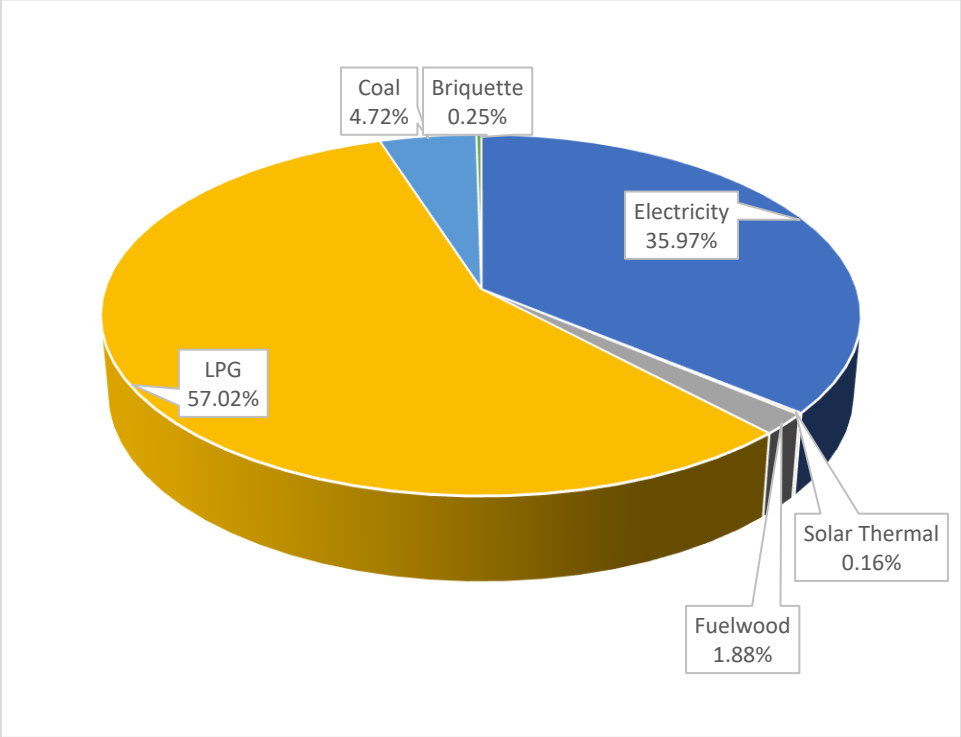

Figure 2 Energy consumption of Bagmati Province in the Commercial Sector in 2021 by fuel types

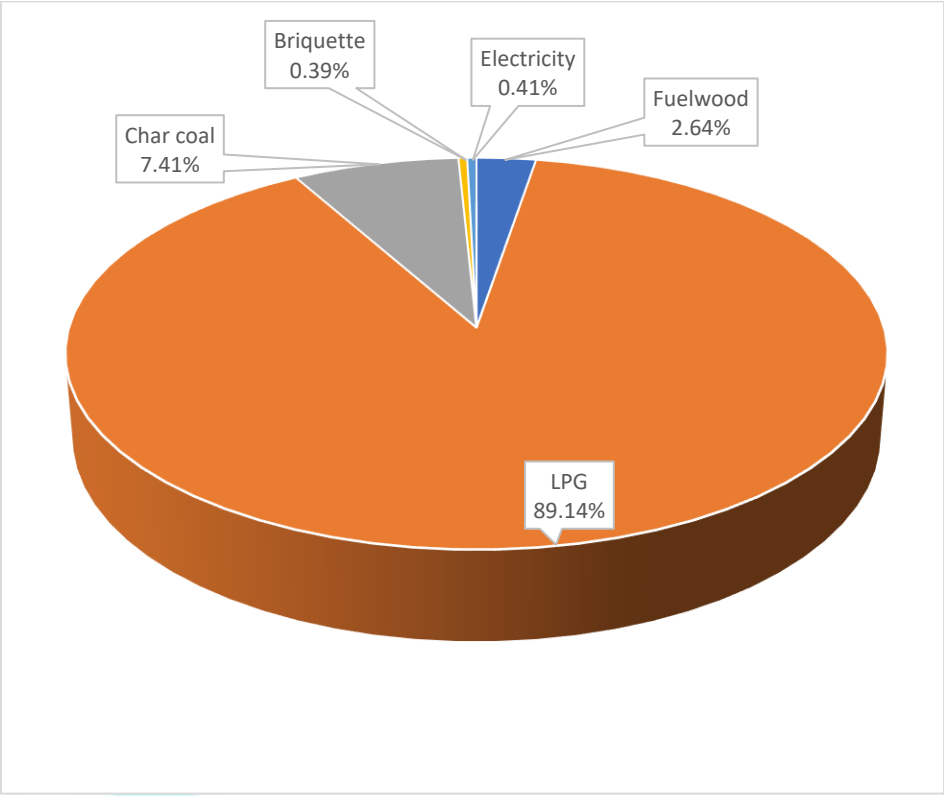

Figure 3 Energy consumption in cooking by fuel types in commercial sector of Bagmati Province in 2021

The electricity consumption in the commercial sector is very low and the total electricity consumption by this sector is only around 7% of the total electricity consumption (NEA, 2022). The country possesses abundant hydropower potential for electricity generation, presenting an opportunity to promote electricity as a modern cooking fuel for commercial enterprises. This is mainly due to the unsustainable

use of traditional cooking fuels, which poses health hazards and contributes to pollution and environmental degradation. On the other hand, reliance on commercial fuels like kerosene and LPG raises concerns about affordability, energy security, and dependency on imports, as these fuels are entirely brought in from other countries. By transitioning to electric cooking, Nepal can achieve sustainability, improve the well-being of cooks with a safer option, and strengthen the nation's energy security. Reducing dependence on LPG imports would also mitigate the risks of supply disruptions, price fluctuations, and price hikes, offering economic benefits. Thus, the shift to eCooking at the enterprise level holds substantial advantages from both a national and utility perspective.

The types of enterprises where cooking is done in Nepal, which may include restaurants, hotels, banquettes, canteens, and cafes (bakeries). Restaurants prepare and serve food and beverages to customers offering a variety of cuisines and dining options, ranging from casual to fine dining. Hotels in Nepal often have restaurants as part of their services. These restaurants cater to both hotel guests and external customers, offering various dining options based on the hotel's star rating and clientele. Banquet halls are event venues that often have their own kitchens or catering services. They host events such as weddings, conferences, and other gatherings, where cooking is done to provide meals for the attendees. Canteens are commonly found in institutions, schools, colleges, offices, and some public places. They serve as a cafeteria for employees, students, or visitors, providing meals and snacks. Cafes (bakeries) serve a variety of beverages, snacks, bakery items, and fast foods to their customers.

Electric cooking in domestic sector is gaining popularity nowadays with Nepal government focussing in electric cooking in domestic households. While Nepal has set an NDC target of making electric stove as primary mode of cooking in 25% of households by 2030 (GoN, 2020), the enterprise sector has been overlooked. With Nepal setting a target of having 15000 MW of installed capacity within a decade and utilizing 10000 MW of electricity inside country (MOEWRI, 2018), a study focussing on the opportunities and challenges of electric cooking in enterprises level is important and timely.

There may be further scope to increase eCooking given the ongoing drives to increase tourism. Nepal has enormous potential to be one of the most potential popular destination and hotels and restaurants are one of important prerequisite in tourism sector. There has been a significant increase in the number of hotels and restaurants in Nepal in past few years. As of mid-March 2021, there were 142 star-hotels, and by mid-March 2022, there are 162 hotels which rose to 173 in February 2023. The number of tourist level hotels, lodges and resorts excluding star level has increased from 1,171 till mid-March of 2021 to 1,183 till mid-March 2022 and 1228 in February 2023. According to Restaurants and Bar Association of Nepal (REBAN) there are around 3,000 standard restaurants, bars, fast food outlets and cafes operating across the country.

Rastriya Paryatan Rananitik Yojana 2016-2025 targets to attract 25 lakhs tourists in the country which has reached around 12 lakhs in 2019 before COVID period. Meeting its target number of tourists means Nepal will see a significant number of new hotels and restaurants opening in coming years where the electric cooking may be promoted.

1.2 Research aim and questions

The main aim of the study is to assess the potential for electric cooking in enterprises in Nepal. Towards this aim, the study addresses the following core research questions:

1. What are the opportunities and challenges for enterprise level transitions to eCooking?
2. What is required to assist transitions to electric cooking in different enterprise sectors?
3. What is the extent of the potential transition to electric cooking in different enterprise sectors?

A multidimensional study is essential to assess the potential, opportunities, and challenges associated with electric cooking in enterprises across Nepal. In answering the core research questions, the research addresses the following nine themes and sub questions.

Theme	Sub-questions
1. Cooking Practices and Customer Needs	• What is the compatibility of eCooking with enterprise level cooking practices and enterprise/customer needs? Do appliances fit the menus and customer tastes, does eCooking offer convenience/quick service, etc.? • Do commercial/institutional practices evolve with eCooking adoption?
2. Existing Beliefs	• Are enterprises using eCooking appliances for certain dishes in the menu? If yes, what are the experiences? • Are enterprise staff aware of the potential benefits of eCooking? • What existing beliefs, factual or otherwise, hold back the transition for enterprise level stakeholders?
3. Appliances	• What type(s) of eCooking technologies are appropriate for different enterprises and what are the particular requirements of devices for enterprise level eCooking (e.g., size of device, durability of device, warranties for commercial/institutional use)?
4. Supply Chain	• Can appliances in the market meet the requirements of different enterprises? • How reliable and sustainable is the supply chain for enterprise level eCooking? • Are after sales services, and repair and maintenance for the appliances locally available?
5. Energy	• How compatible is enterprise level eCooking with the electricity supply (e.g., availability, reliability, cost,) and the infrastructure of the enterprise premises (e.g., wiring, meter connections, etc.)? • What are the impacts of eCooking transitions on non-cooking energy needs of enterprises (e.g., preparing, storing, distributing etc.)? • Can eCooking compete in terms of these needs with other cooking fuels?
6. Cost	• Does switching to eCooking make economic sense for enterprises? • Could enterprises scale up through a transference to electrical cooking?
7. Networks	• What are the (sometimes invisible) social networks in patterns around food, appliance and fuel purchasing that might impact transitions to enterprise level cooking?
8. Gender and Inclusion	• What is the Gender, Inclusivity and Leave No One Behind (GILNOB) implications of enterprise level transitions to eCooking?
9. Wider Impact	• What are the potential wider impacts of enterprise level transitions to eCooking on nutrition and diet diversification, food safety, food waste, household cooking energy transitions, and local economic development?

1.3 Scope and Limitations of the study

- The geographic focus of the study was around Kathmandu valley.
- The study used survey tools and ethnographic approaches to understand opportunities and challenges for eCooking transitions. Quantitative analysis to determine the fuel consumption comparison in electric cooking and other forms of cooking by weighing fuels or taking energy readings was not in scope for this study but could be a valuable addition to a follow up building on this research.

2. Review of Existing Literature

Studies and pilot cases have been done on electric kitchen in different parts of the world. Academicians and professionals around the world are giving attention towards the adverse impacts of the enterprises such as restaurants on the environment. Commercial kitchens generate emissions, large quantities of food and plastic waste and the concept of green restaurants and hotels have received increased attention to reduce the environmental impacts. Going "green" means adopting environmentally responsible practice that is instituted by a restaurant and commercial kitchens to minimize its impact on the environment. Green practices are related to the kitchen as well as non-kitchen areas in the commercial establishment. Restaurants are responsible for a variety of "non-green" practices like the generation of food waste, usage of non-sustainable materials in packaging and service delivery, bad waste disposal strategies, and inefficient use of energy and water, among others. Use of energy efficient technology, reduction of use of plastic, recycle, reuse are all the practices of a green restaurant (Madanaguli & Amandeep, 2022).

Compared to other types of buildings of equal scale, hotels have a stronger negative environmental impact due to their substantial energy, water, and non-durable product use. In a similar vein, the banquettes and meeting and convention industries have a significant detrimental effect on the environment through their influence over numerous other areas, including energy consumption, transportation, food and beverage consumption, lodging, facilities, and goods and services needed to support a meeting or event (Myung, McClaren, & Li, 2012).

One of the main causes of unsustainability in commercial kitchens is emissions. Emissions are produced directly from the burning of fuels in the kitchen and vicarious emissions from ingredients like meat. (Madanaguli & Amandeep, 2022). The majority of energy is produced by fossil fuels, which emit greenhouse gases and exacerbate climate change. These emissions have an impact on ecological systems and are a major cause of global warming, which is dangerous for the ecosystem. Restaurants and other commercial kitchens need to embrace eco-friendly practices to improve their sustainability and reduce their environmental impact (Abdou, Hassan, & Salem, 2023).

For a country like Nepal where almost all the electricity is generated from renewable energy source dominated by hydropower, switching to the use of electricity from LPG/firewood cooking in commercial kitchens can contribute to large emission reduction. Furthermore, use of electric cooktops and appliances will improve the indoor air quality inside the kitchens as gas is likely to produce higher PM levels than electricity (Chang, Capuozzo, Okumus, & Cho, 2021).

Owing to numerous carbon problems of commercial kitchens, policy makers, environmentalist and enterprise owners in some countries are working to restrict to limit the use of fossil fuel. The United States provides one example. San Francisco and other jurisdictions are banning or restricting the use of natural gas and promoting switching to all-electric kitchens in new construction (Ehrlich, 2023). Google has developed an all-electric kitchen in Bay view campus (Giambastiani, 2022). Similarly, Microsoft has also built an all-electric restaurant in its One Esterra office building (Schlosser, 2022). The French Laundry in Napa Valley, Alinea in Chicago, LA restaurant Gwen have been using energy-efficient electric appliances such as induction cooktops. Michelin two-star Commis in Oakland, California and Michelin one-star restaurant Maude in Beverly Hills uses a combination of induction and gas. (Sheppard, 2023)

However, switching to electric cooking comes with its own set of opportunities and challenges. Switching to an electric kitchen depends on factors such as cost, infrastructure, ventilation, water

consumption and heating, food choices, chef preferences, and cultural differences (Ehrlich, 2023). Within an emerging literature, reports and articles have been published on the lessons learned from the commercial kitchens using electric appliances.

Sheppard in his article has indicated induction cooktops as better alternatives to gas stoves because of precise cooking method. Induction cooktops are easier to clean and keeps the kitchen cooler than a gas cooktop resulting in better environment inside kitchen. Induction stoves look cool, produce less noise and are incredibly fast. However, they break easily and are hard to repair. They tend to draw a great deal of power and blow fuses. According to the article some chefs, though, willing to adopt induction cooktop still believes gas is the more "practical" as induction are fragile in the fast-paced environment of a restaurant kitchen where pots and pans aren't handled delicately (Sheppard, 2023).

An article covering the all-electric kitchen of Google's Bay View campus has mentioned electric kitchens being significantly faster. Induction boils water twice as fast as traditional gas equipment and is far more efficient than gas stoves where the flames are wasted. The article also highlighted that eCooking was safer and simpler. However, all-electric kitchens tend to increase a building's electrical load, but technology and planning can help manage that need. (Giambastiani, 2022)

Brahma in 2022 indicated electric induction cooking offers clean, efficient, and fast cooking without the hole in the pocket due to the ever-rising gas prices. Gas stoves waste as much as 70 percent of their energy resulting in uncomfortable and potentially unsafe hot kitchens where the room temperatures often reach 135°F. The article reported a growing number of chefs prefer induction, due to the health benefits of not cooking with gas and the ability to reduce greenhouse gas emissions. Chefs stressed the precision and control afforded by induction cooking methods and dismissed as 'myths' the idea that delicious meals cannot be cooked without gas burners (Brahma, 2022).

UPS in its article in 2019 has compared electric oven with its counterparts. High-quality electric oven ensures that a minimal amount of heat energy escapes during the cooking of your food resulting in less cooking time when compared to other types of ovens. Electric ovens can be easily set up, are more user-friendly than their other counterparts and safer as the chances of any mishaps occurring are substantially reduced. Critically, for chefs, electric ovens cook food more evenly. However, operating them regularly can be a little costly if the electricity price is high and a robust wiring system is also crucial for the oven. (UPS, 2019)

McGuire in his article in 2021 wrote the perspective of numerous chefs of Australia's gas-led hospitality industry in switching to electric cooking.

The expense of installing induction appliances and the requirement to modify cooking methods to fit the new stovetop make many restaurants hesitant to make the transition. Chefs like gas stovetops because they can precisely manage the temperature and size of the flame, and the burners come in a wide range of shapes and sizes. Gas cooking, however, is not energy-efficient and emits airborne traces of formaldehyde, carbon monoxide, and other contaminants. Electric cooktops, also known as hotplates, are more energy-efficient than gas cooktops, but most industrial or professional kitchens cannot utilize them due to the time it takes to change the metal coils' temperature. Induction cooktops are easier to operate and use less energy than gas cooktops and they are a better option. However, installing an induction cooktop is costly and calls for special pots and pans. They are unsuitable for certain industrial kitchens due to their high-power requirements, especially in older buildings (McGuire, 2021)

Riell in 2023 indicated different factors influencing the restaurant owners to choose between gas or electric appliances. The choice is affected by the location of the restaurant as the price of gas or electricity varies with the geography. Furthermore, the restaurant menu and chef's preference highly affect the choice. (Riell, 2023)

A report produced by Greenest City or Healthy City Scholars Program (2019), a partnership between the City of Vancouver and the University of British Columbia provided an analysis of the transition cost, the operational and financial benefits of an induction kitchen, and policy recommendations to incentivize restaurant owners to transition. The study discovered that woks, deep fryers, ranges, and griddles are presently available with induction cooking equipment for commercial use. A standard oven and three to five cooking burners are typical features of an induction range. On the other hand, three or four high amperage single unit induction cookers are preferred by some establishments. Electric versions of all other restaurant cooking appliances, including broilers, steamers, and ovens, are available with increased energy efficiency.

In comparison to conventional gas ranges, which have an energy efficiency of 25% to 35%, induction ranges have an efficiency of 85% to 95%. This suggests that using three times as much energy to cook the same amount of food can be achieved with an induction range. Furthermore, induction cooking results in a roughly 23% reduction in the requirement for ventilation and air conditioning (HVAC), which lowers costs. Induction cookers have been shown to provide a number of established benefits, including reduced danger of fire, quicker cooking, enhanced kitchen ambience and air quality, easier cleaning, and energy savings that contribute to cost savings.

The report, however, indicated the initial investment as a challenge to adopt induction cooking. The report indicated that it would be difficult to raise the necessary funds to cover the cost of switching to an induction kitchen. A significant amount of money ($20,000 to $30,000) is required to install induction equipment and upgrade the kitchen's electrical system but is largely based on the restaurant's size, the kinds of equipment being bought, and the necessary electrical upgrades. The financial returns vary depending on the kind of restaurant, and in the absence of financial incentives, the estimated payback period is between 11 and 20 years (Atta, 2019).

Other perceived constraints and barriers to transitioning to induction cooking included Limited electricity amperage, future increases in electricity rates could lowering business profit, induction cooking might not support the preparation of Asian cuisines, chef's adaptation to induction cooking methods, limited availability of induction cooking appliances and maintenance services.

3. Methodology

A range of research methods were used to address the core research questions and overall aim of the study. The research started with literature review and then carried on to data collection. The data required for the study was collected from surveys of the enterprises. Randomly selected 162 enterprises (restaurants, hotels, canteens, banquettes and cafes) were surveyed in the study to obtain the qualitative information. The number of different enterprises surveyed is presented in Figure 4.

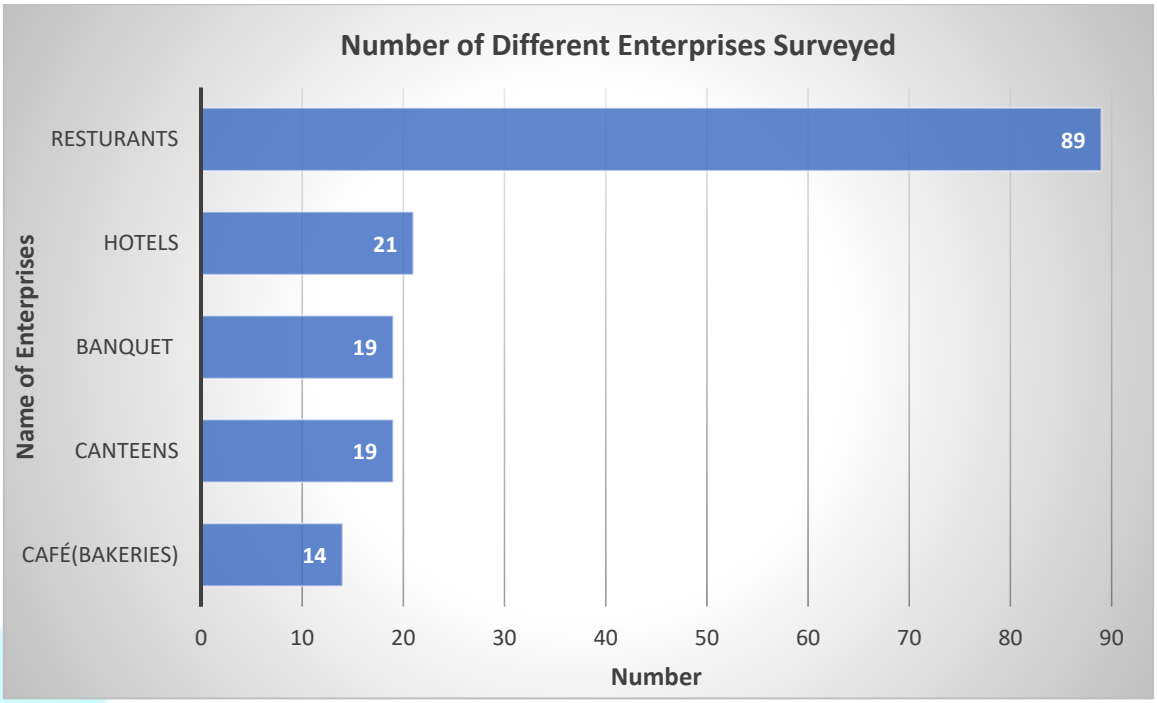

Figure 4 Number of enterprises surveyed by type

Furthermore, ethnographic study was conducted in 6 enterprises to obtain a more in-depth understanding of which parts of the cooking could reasonably be moved to eCooking appliances. The ethnographic study was conducted in 3 restaurants, 2 hotels and 1 canteen. Besides these market survey for commercial electric kitchen appliances and one FGD was conducted. Details of these methods are provided below.

3.1 Desk study, literature review and consultations

Several documents, reports, technical papers, and case studies concerning enterprise eCooking have been thoroughly reviewed by the study team. Group of stakeholders, including representatives from the Restaurant Association of Nepal (REBAN), Hotel Association of Nepal (HAN), experts from government agencies, utilities, private sector entities, and NGOs were engaged in consultations on issues pertaining to commercial level electric appliances. The list of experts and individuals consulted is provided in the annex.

3.2 Enterprise survey

Data related to restaurants, hotels, banquettes, bakery, and canteens were gathered through a combination of surveys and interviews. To ensure consistency, a standardized template consisting of questionnaires and checklists was prepared and utilized for conducting the surveys. The survey focused on obtaining basic information about the enterprises, their usage of eCooking appliances, electricity

supply infrastructure, menus, and the number of customers served, among other relevant details. The questionnaires also explored various aspects of electric cooking, including the adaptability of eCooking technology, its suitability for the specific establishments, potential wider impacts, willingness to switch to eCooking, and the willingness to pay for such technology. This comprehensive approach allowed for a thorough understanding of the opinions, preferences, and challenges related to eCooking adoption in a diverse range of foodservice enterprises. The survey covered 89 restaurants, 21 hotels, 19 canteens, 14 café/bakery shops, and 19 banquets located in the Kathmandu valley. The number of different sizes according to the serving capacity of the enterprises surveyed is presented in Figure 5 *Number of different sizes of enterprises surveyed*. For restaurants, canteens, hotels and café, a serving capacity of less than 20 is taken as small, serving capacity of 20 to 50 is taken as medium and for serving capacity more than 50 is taken as large. Banquettes whose serving capacity is more than 1000 is considered large.

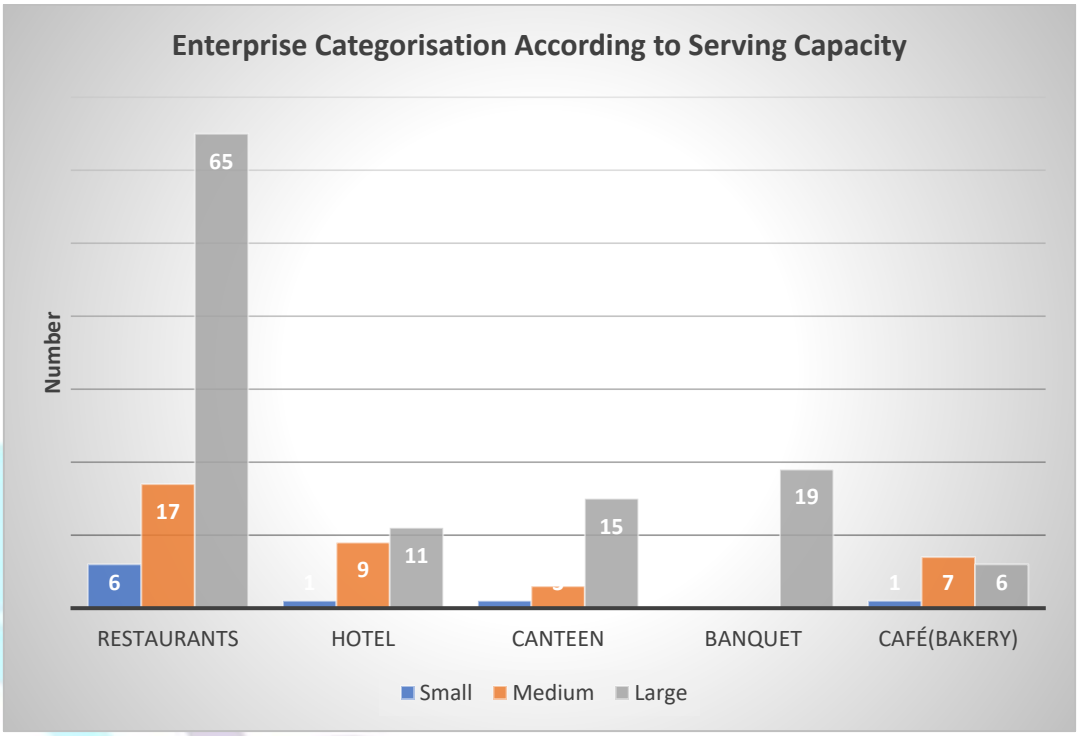

Figure 5 Number of different sizes of enterprises surveyed

3.3 Market survey for eCooking appliances

The market survey focused on exploring the range of eCooking appliances available in the market. The study team visited five suppliers (list provided in annex) of commercial cooking appliances and interviewed to get information on the commercial appliances on the market along with their features. To gather comprehensive information, the study team also utilized the vast resources of the internet, delving into online platforms and websites showcasing a wide range of eCooking appliances. The list of the websites visited for the market study is provided in annex. This approach helped to gain insights into the latest technological advancements, innovative cooking solutions, and energy-efficient devices catering to the needs of enterprises.

The other aspect of the market survey was the thorough analysis of associated costs related to eCooking adoption. This involved collecting data on the prices of different eCooking appliances, installation charges, and any additional costs associated with transitioning from conventional cooking methods. Different eCooking scenarios were considered based on common menu items. By varying the cooking

scenarios, such as the frequency of use, types of dishes prepared, and cooking time, the survey could present a range of upfront cost estimates. This approach allowed enterprises to assess the affordability and feasibility of eCooking adoption based on their specific cooking patterns.

3.4 Focused Group Discussion (FGDs)

One FGD was conducted with REBAN to discuss the various aspects of clean cooking technology adoption. 12 participants (list provided in annex) including owners of restaurants and REBAN members provided their feedback and opinions of electric cooking in enterprises level. The discussion focussed on two key questions.

- What are the barriers to scale up deployment of eCooking technologies?
- What are the barriers to sustained adoption of eCooking technologies at enterprise level?

Figure 6. FGD conducted with REBAN

3.5 Ethnography

Ethnography is an observational study conducted in six enterprises during this study. The study team visited six enterprises and spent two days in each kitchen to understand if eCooking could be compatible with the different types of enterprise.

The ethnographic study help understand the behaviours and practices inside the commercial kitchens in detail. It also provided an opportunity to have long detailed discussion on the topic with the chefs and cooking staffs. With long time spent with the staffs, they were more open to share their opinions and

experience in electric cooking. Ethnography allowed to gain a deep and holistic understanding of the possible transition to electric cooking in the enterprises. By spending an extended period of time with the group, it helped uncover many insights which could have been missed in other research methods. It helped to gain contextual understanding of the enterprises leading to the develop theories.

The list of enterprise where the ethnographic studies were done are listed below.

- Walnut Bistro (Restaurant)
- The Burger House and Crunchy Fried Chicken (Restaurant)
- Tokyo Ramen House (Restaurant)
- Trinity Hotel and Café (Hotel)
- Hotel Kutumba (Hotel)
- Bageshwori Chamena Griha (Canteen)

3.6 Data analysis

Data collected from various sources was organized and analysed to prepare the report. The data analysis was done with disaggregation of the enterprises by the type (restaurants, hotels, cafes/bakeries, canteens, banquettes). The results of the analysis were presented covering the themes presented in section 1.2. Furthermore, nine vignettes were prepared for nine different enterprises from the observations and study. The vignette contains the brief introduction of the enterprise, existing cooking practice and the extent of electric cooking possible in the individual enterprise.

4. Results

With the help of the methodologies adopted in the research, the team has conducted detailed study on the nine themes outlined in Section 1.2. cooking practices and customer needs, awareness level of the enterprises on potential benefits of eCooking, particular requirements of devices for enterprise level eCooking, supply chain of the appliances, compatibility with the electricity supply system, cost of switching to eCooking, gender, inclusivity and potential wider impacts of enterprise level transitions to eCooking.

4.1 Cooking practices and customer needs

The type of cuisine an enterprise offers will greatly influence the cooking methods, ingredients, menu items, and customer expectations. Most of the enterprises surveyed had similar menus except for the enterprise serving specialized cuisines such as Japanese, Korean, Turkish, etc. The common features and the common dishes served by different enterprise types are discussed below.

- Restaurants: Most restaurants serve common snacks items such as momo, chow mein, burger, sandwich, pizza, etc. Some Thakali restaurants serve Thakali set (Nepali thali) and are the most common dishes served by the restaurants. Some specialized restaurants such as Thakali, Newari Japanese, Korean, Chinese, Newari, Barbeque and sekuwa.
- Café/bakeries: Café / bakeries are similar to restaurants but are more casual, simple and offer pastries, cake and other baked items. Some café/bakeries also serve momo, chow mein, burger, sandwich, pizza, etc.
- Hotels: As people generally spent the night in hotels, they generally serve dinner (mostly Nepali Thali) and breakfast (English/American).
- Banquets: Banquets generally serve combination of Nepali and Indian dishes such as rice, daal curry in a buffet. The dishes are generally prepared in large quantities and kept in hot-case in small quantity.
- Canteens: The menu served by canteens depends on whether the types of offices they serve. For offices canteens they generally serve snacks but for college and school canteens which starts early they serve Nepali thali too. Hospital canteens operate generally long hours (18+ hour) serve Nepali thali, snacks, roti, etc.

The compatibility of eCooking with enterprise level cooking practices and customer needs were (partly) assessed by asking the 162 enterprises surveyed the cooking techniques adopted by the percentage of the enterprises (Figure 7-Figure *11*). The percentage in the y-axis refers to the percentage of the surveyed enterprise adopting the cooking technique. Overall, steaming, shallow frying, boiling and deep frying were the most common cooking techniques in all enterprises except for bakeries where baking and coffee making were the primary cooking techniques used. Steaming is used for momos, vegetables, yomari, etc. Shallow frying is used while preparing curry. Deep frying is used for French fries, meat, etc. LPG cooking ranges are used mostly for these purposes. Baking, however, is mostly done in an electric oven except for some restaurants where firewood pizza is made.

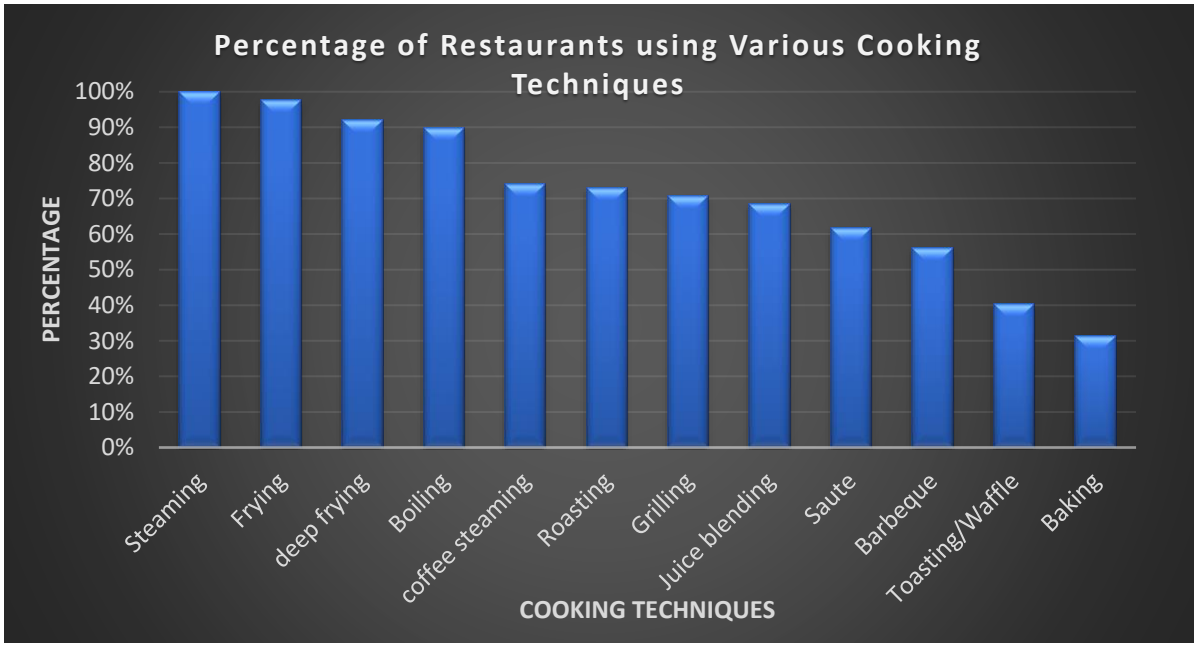

Figure 7: Percentage of restaurants using various cooking techniques

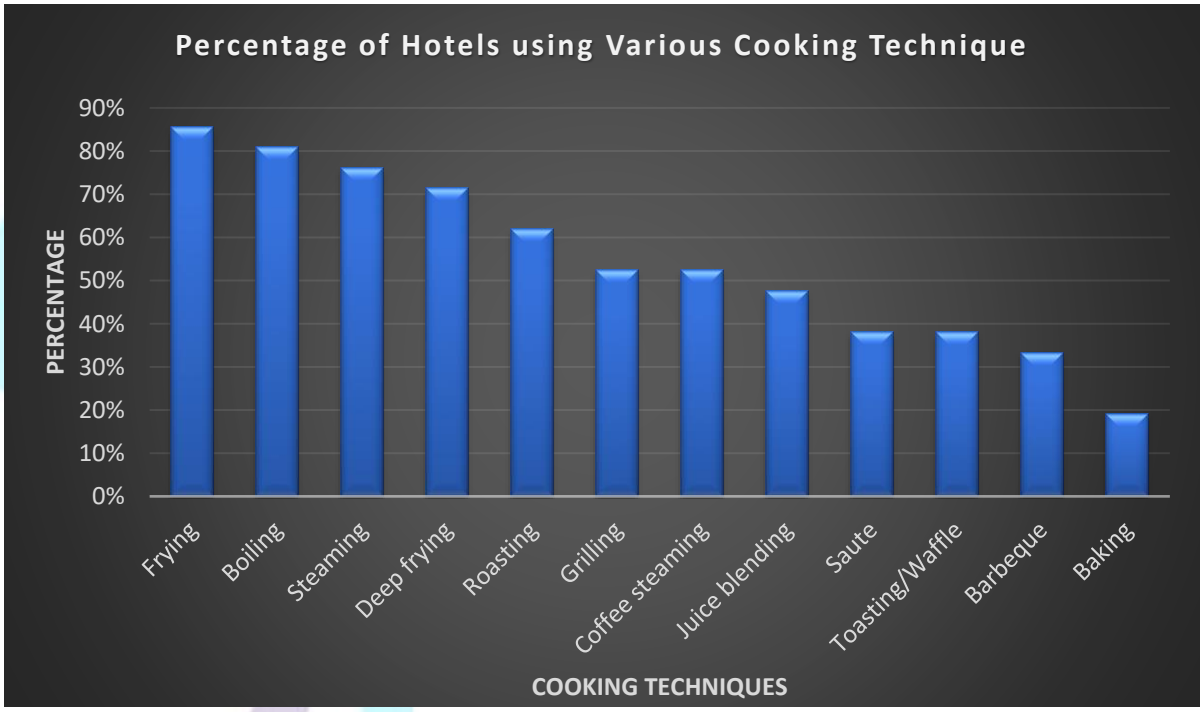

Figure 8: Percentage of hotels using various cooking techniques

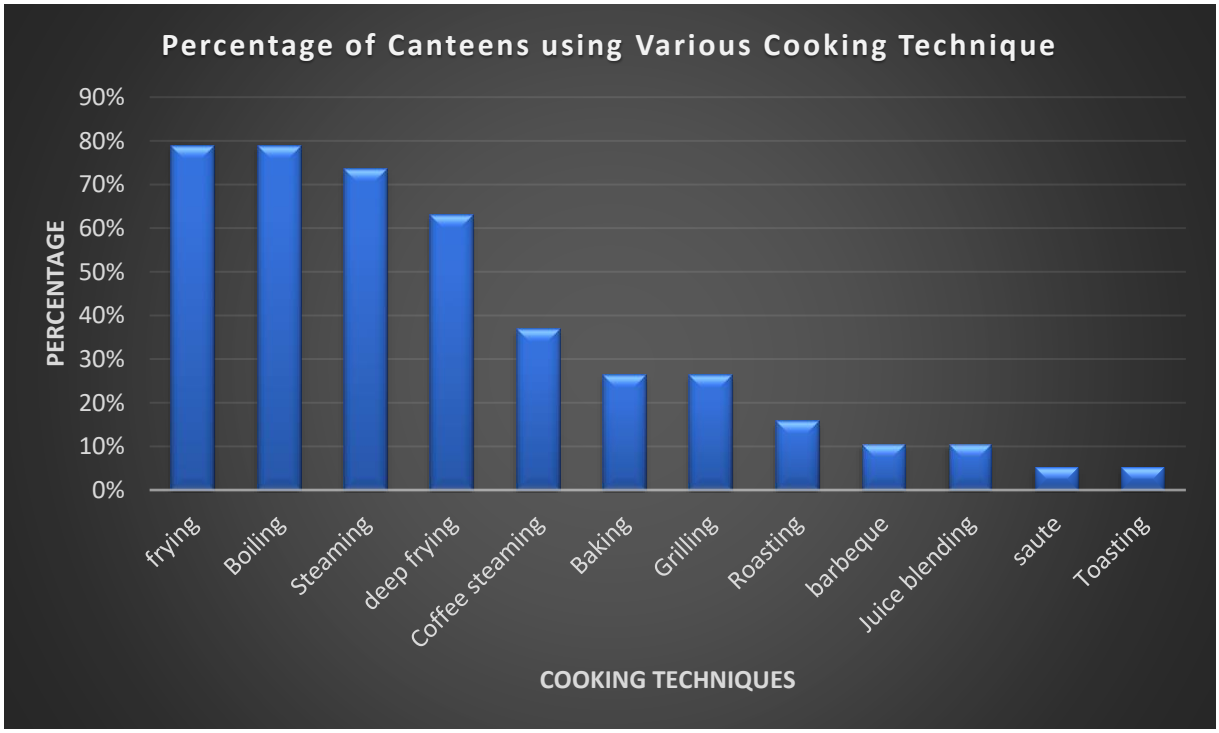

Figure 9: Percentage of canteens using various cooking techniques

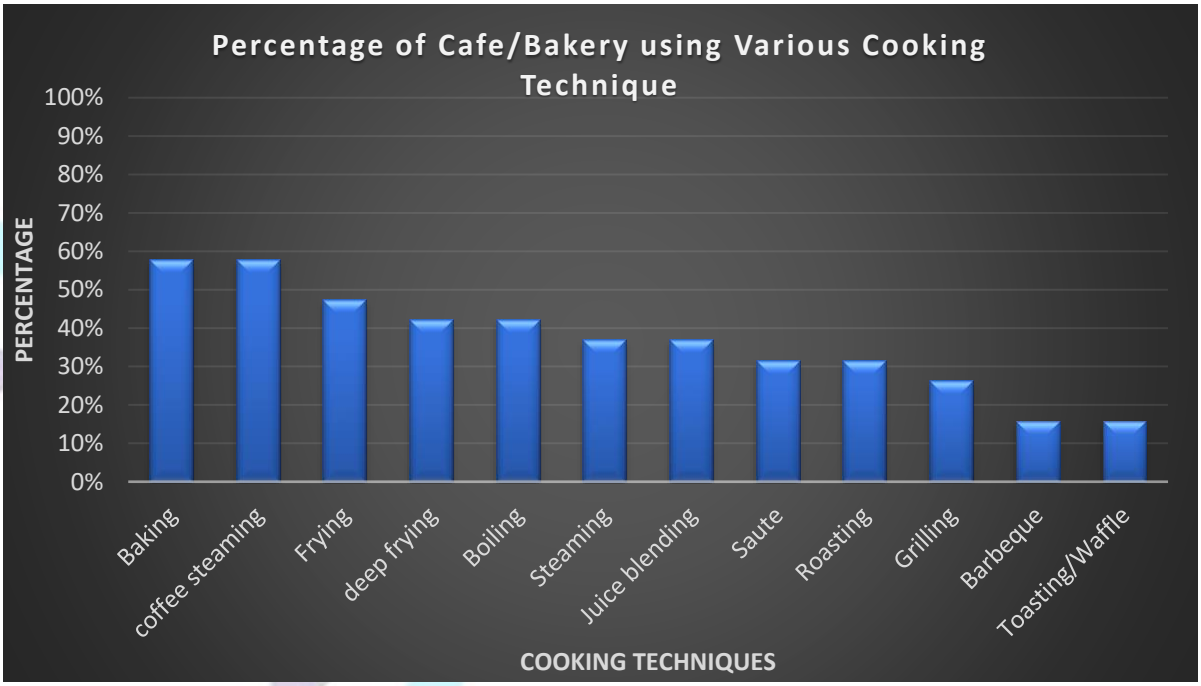

Figure 10: Percentage of café/bakery using various cooking techniques

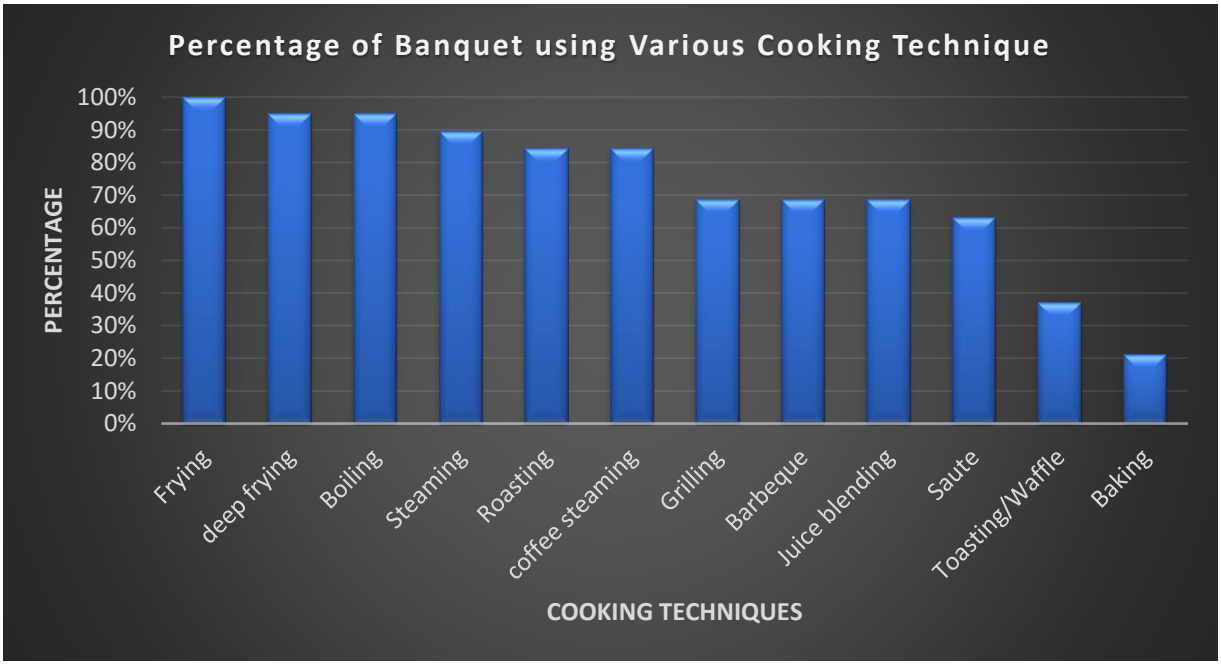

Figure 11: Percentage of banquet using various cooking techniques

eCooking was however used for baking, waffle making, and for food preparation techniques such as juice blending. Most of the cooking techniques though were found to be done using LPG burners. LPG cooking is compatible with almost all forms of cooking and is convenient and popular in enterprises of all types and sizes largely because it makes the quick service possible allowing enterprises to serve large number of customers at a time.

The interactions with chefs and market survey suggested there are electric appliances that are compatible with the cooking techniques where LPG is currently being used. A summary of cooking techniques, typical dishes prepared using these techniques, existing appliance(s) used for these techniques, and electrical appliances available which could be used instead is presented in *Table 1*. A description of various common eCooking appliances is provided in the Annex (A4).

Table 1. Summary of electrical appliances compatible to different cooking techniques

Cooking technique	Dishes cooked using this technique	Current Appliance Used	Compatible Electrical appliances
Frying (shallow)	Vegetables, Curry, meat	LPG range	Induction stoves, Hotplates
Deep Frying	Potato, Meat, Vegetables	LPG deep fryer, LPG range	Electrical Deep Fryer
Boiling	Momo, chow mein, vegetables, egg	LPG range	Water Boiler, Egg boiler
Steaming	Rice, Momo, vegetables	LPG range	Electric range, Rice cookers, Electric pressure cookers, Electric steamers
Sauteing	Vegetables, Noodles	LPG range	Electric range
Roasting	Meat, vegetables	LPG range, Rotisserie	Rotisserie
Baking	Pastries, Cake, Bread, Pizza	Electric Oven and Firewood Oven	Electric Oven
Coffee Making	Coffee	LPG range	Coffee maker

Grilling	Vegetables, Sandwich,	LPG range (griller)	Electric griddle
Barbeque	Meat, vegetables	Firewood, Coal	Oven
Juice Blending	Juice	Blender (Electric)	Blender
Toasting/Waffle Maker	Toast, Waffles,	LPG range, Waffle maker	Toaster, Waffle maker, Electric Range

Compatibility was also assessed by surveying the typical occupancies of the different enterprise categories. Occupancy rates have several implications for eCooking transitions as they will affect the selection of the type and size of eCooking appliances. Figure 12 shows the percentage of surveyed enterprises with different occupancy rate. Restaurants and cafes/bakeries generally had lower occupancies with 20-40 people the most common level. Hotels and canteens tended to have larger occupancy level at around 40-250 people, while banquet halls were larger still, with occupancy level between 250 and 1000+ people.

The investment barrier costs of eCooking transitions are reduced in enterprises with small occupancy rates which can be more easily matched to the use of eCooking appliances that are smaller, cheaper and require less redesign of the kitchen space. For instance, small restaurants, hotels, café and canteens (occupancy less than 20) generally make use of two burner LPG stoves (domestic type) or four burner LPG stoves and could potentially adopt smaller scale or even residential Induction stoves, Infra-red cooktops and EPCs. For medium (occupancy 20 to 40) and large enterprises (occupancy more than 40), the cooktops should be of large sizes. However, a higher occupancy rate may also indicate higher revenue of the enterprise and potentially greater capability to invest in eCooking appliances.

Banquets and some institutions often batch cook in large amounts ahead of service time, which likely increases compatibility with eCooking as the need for quick cooking times which typically sees enterprises choose to cook with LPG is less of a concern. Batch cooking with electricity is particularly likely to be compatible with dishes that require boiling, slow cooking, or deep frying where larger capacity appliances such as large EPCs, water boilers, and commercial deep fryers can be used. Dishes usually quick fried in appliances such as hotplates and induction stoves may be less viable in these settings due to the typically smaller sizes of the utensils.

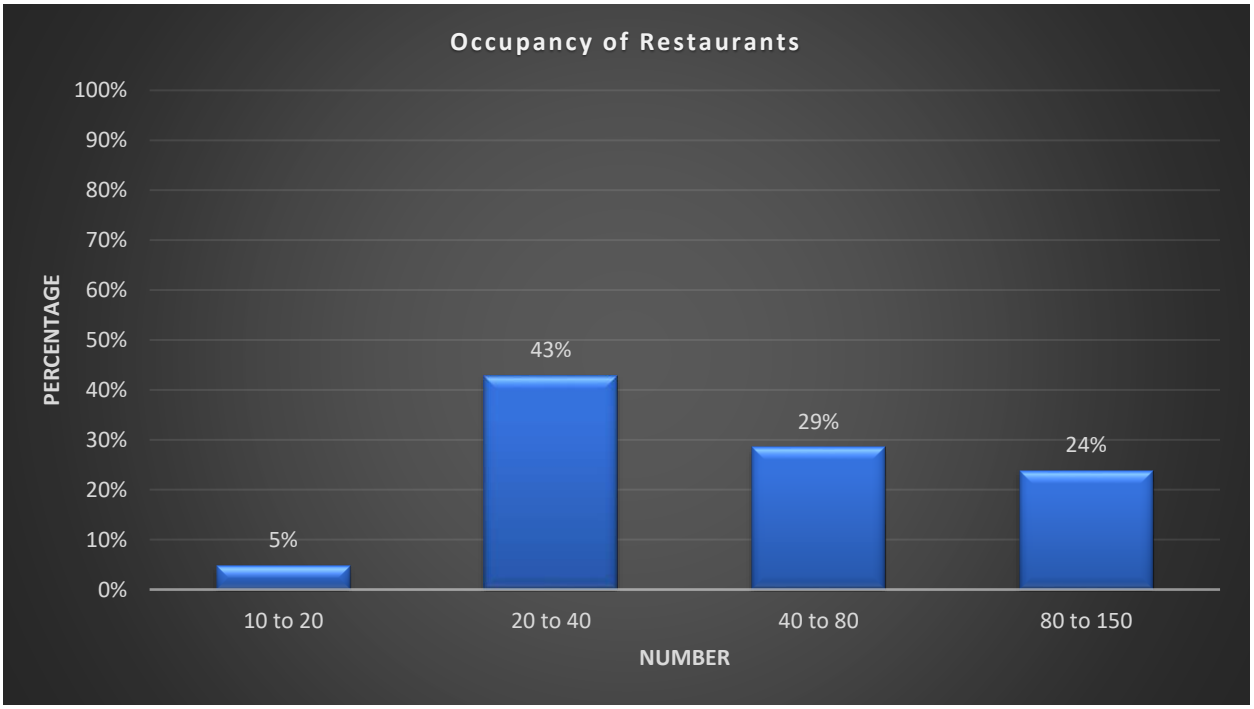

Figure 12: Different occupancy level in restaurants

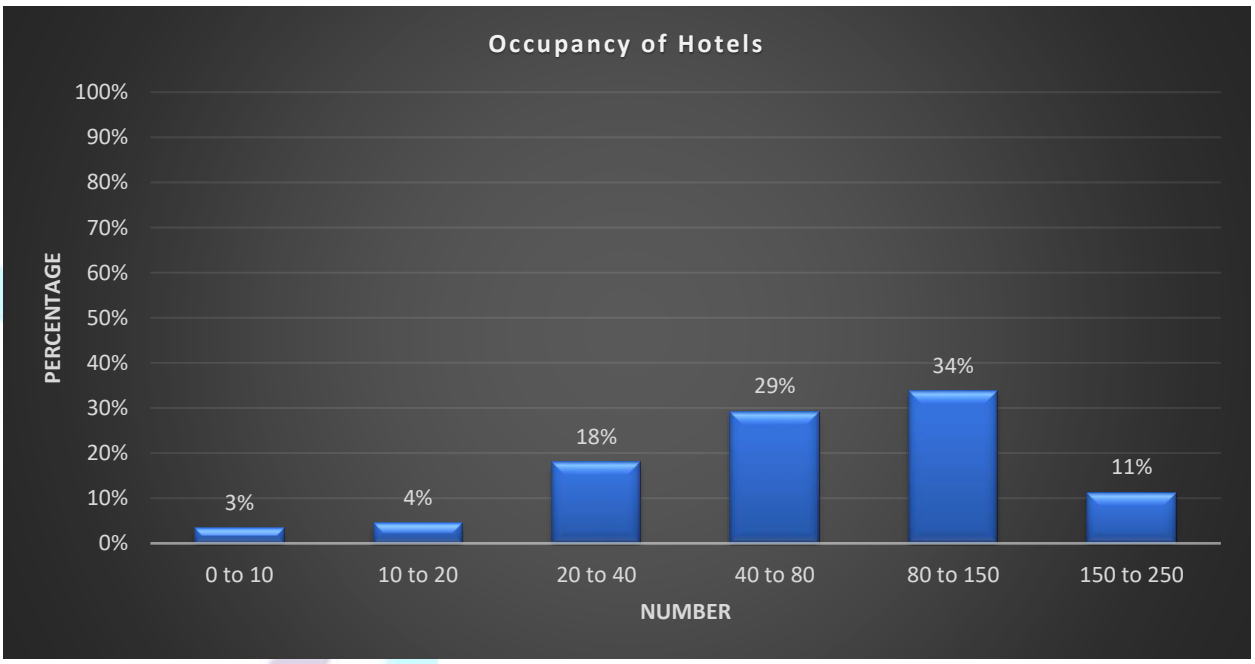

Figure 13: Different occupancy level in hotels

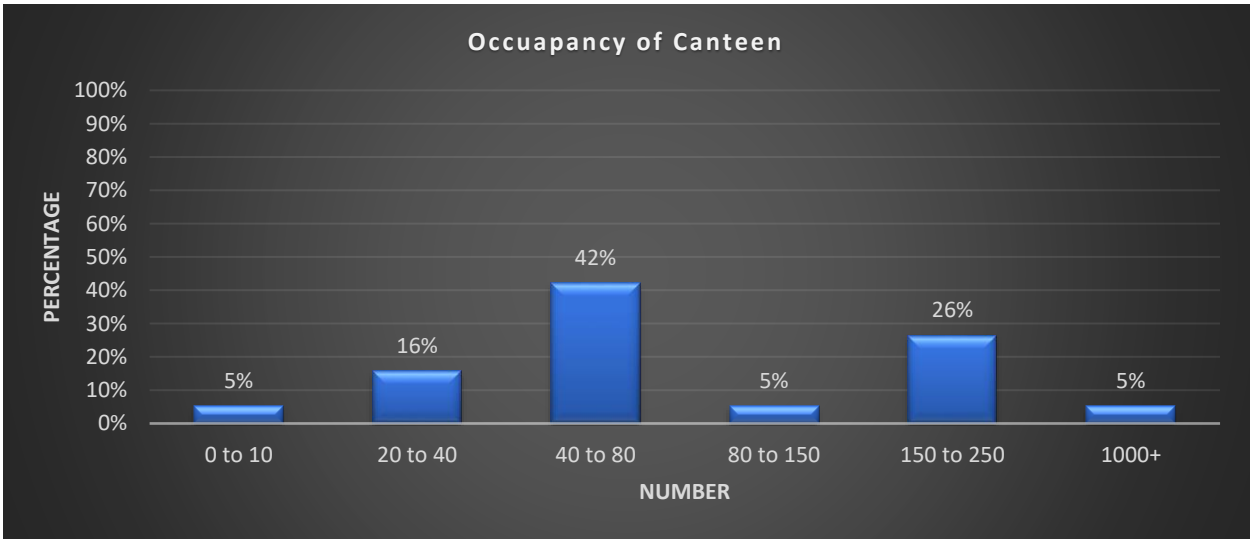

Figure 14: Different occupancy level in canteens

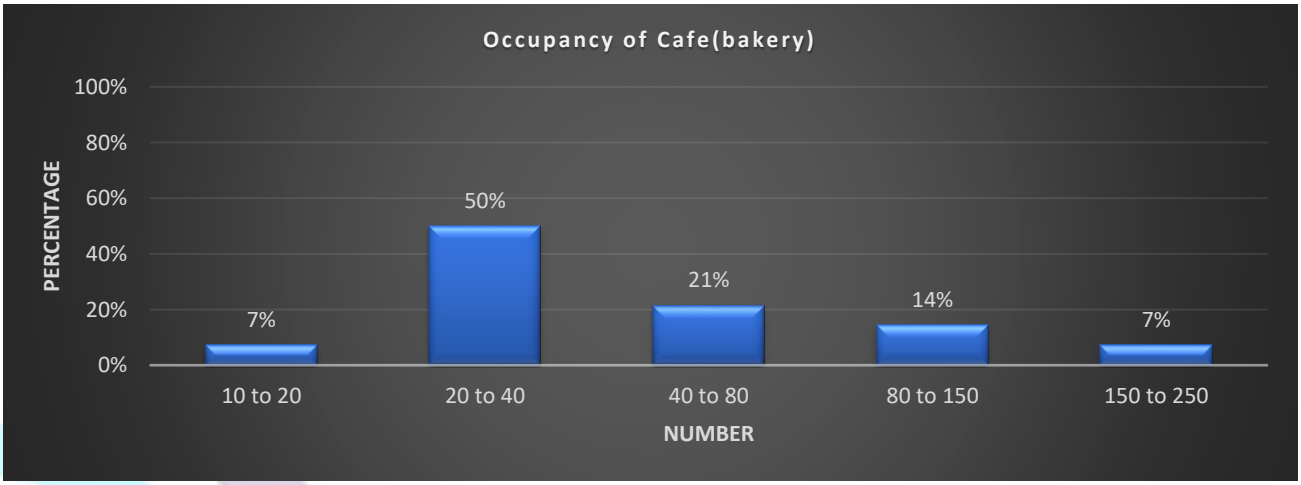

Figure 15: Different occupancy level in cafe/bakery

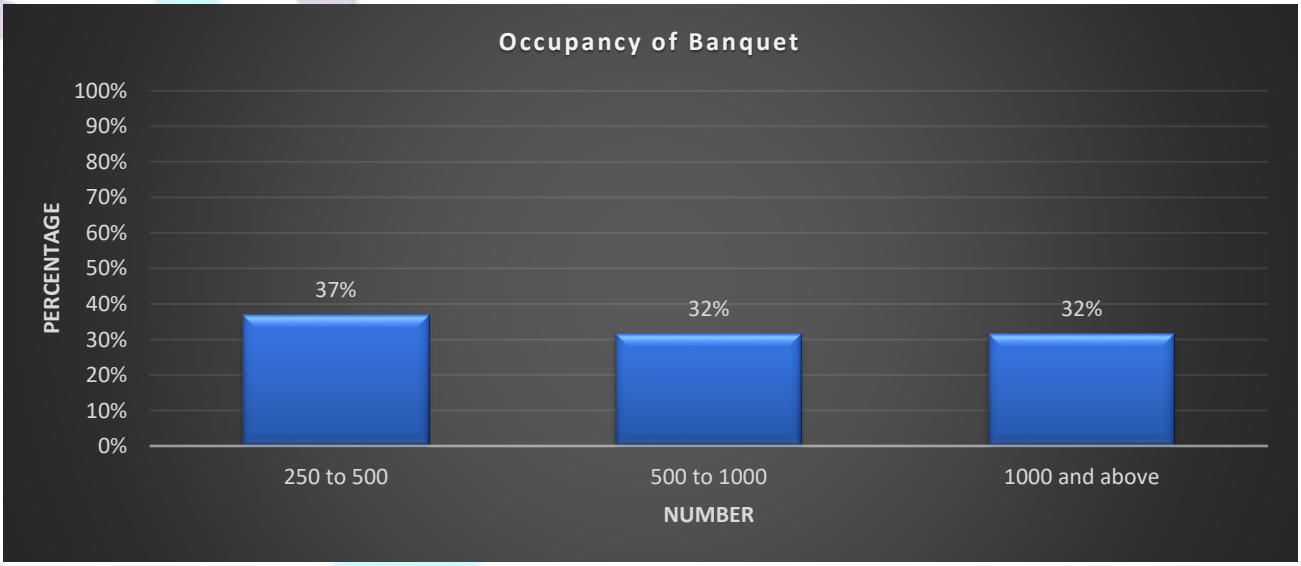

Figure 16: Different occupancy level in banquet

4.2 Existing beliefs

Figure 17 shows the percentage of the enterprises thinking eCooking to be beneficial. Overall, a majority in each category were positive. It has been observed the kitchen staffs who have experience of working in commercial kitchen during foreign employment have experienced in using electric appliances of different types and are generally indicates positive attitude towards electric cooking.

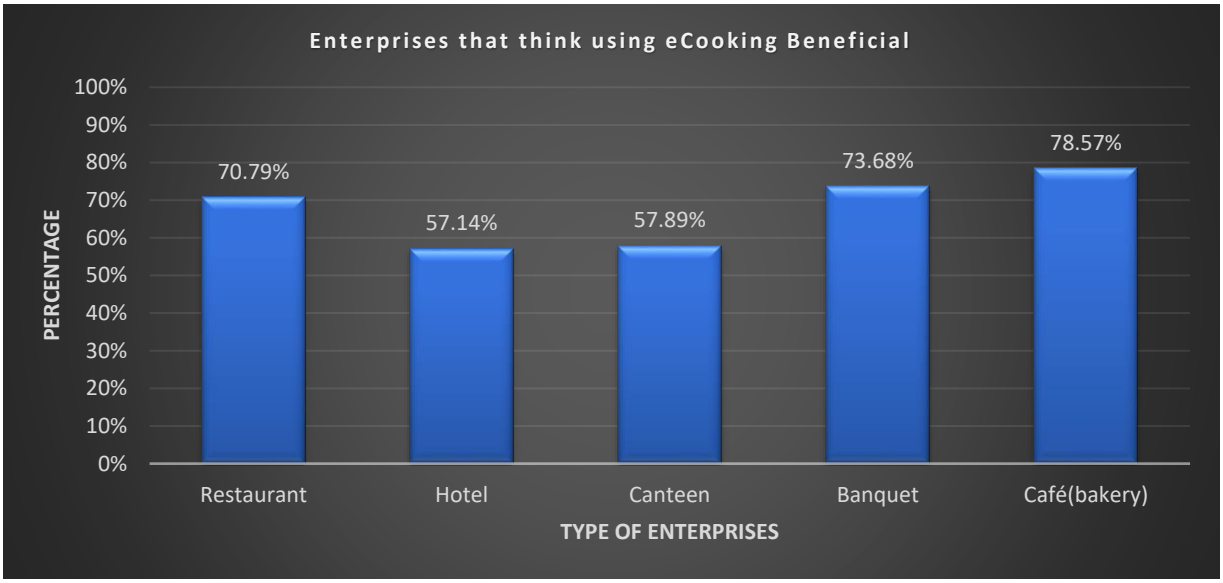

Figure 17: Percentage of enterprise thinking eCooking is beneficial

Figure 18 shows the percentage of different enterprises willing to transition to electric cooking. The highest percentage (85.71%) of café/bakery is willing to transition to eCooking. Baking is the most mostly used cooking technique in the bakeries and electric ovens and microwave ovens are very commonly used (Figure 29). The café/bakery without the electric appliances are willing to own the oven to a minimum. Besides the café/bakery, more than 50 percent of restaurants and hotels are willing to transition to electricity. Among the five different types of the enterprises, canteens and banquet halls were less willing to transition to electric cooking.

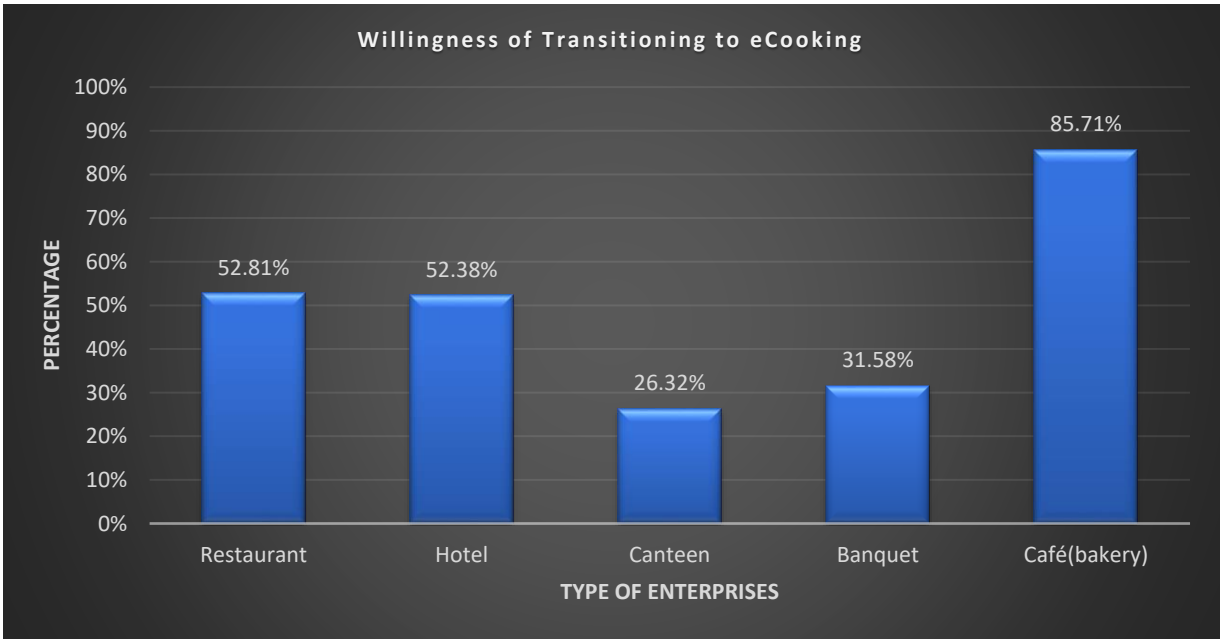

Figure 18: Percentage of the enterprise surveyed willing to transition to electric cooking

The survey explored existing beliefs that might hold back the transition to electric cooking for enterprises. Figure 19 to Figure 25 show the percentage of the enterprises holding certain beliefs regarding challenges for eCooking transitions. The most commonly held beliefs potentially holding back eCooking transitions were reliability of electricity supply, availability of large sized utensils for induction cooking and concerns regarding food taste and cooking time (Figures 19-22). Regarding the former, almost 50 percent or more enterprises of all types think frequent electricity outage holds back electric cooking (Figure 19). Concerns about cost factors were far less prominent (Figures 23-25).

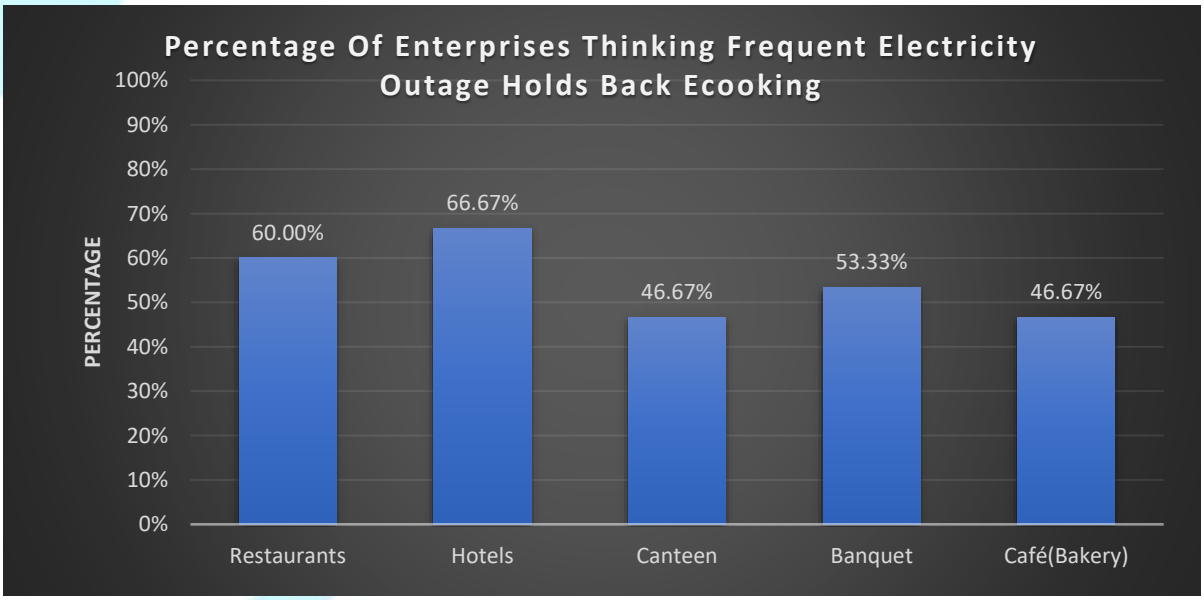

Figure 19: Percentage of enterprises thinking frequent electricity outage hold back electric cooking

The availability of cooktops of large sizes for induction cooking in the market is another belief hold by the enterprises that holds back adoption of induction cooking in the commercial kitchens. Figure 20 shows that 93.33 percent banquet and 80 percent canteens hold the belief where the cooking is done in large quantities at a time. 72.22 percent restaurants also believe the large sized induction cooktops and

utensils are not available in the market. Comparatively, the belief is held by small percentage in hotels (26.67 %) and café/bakery. The large disparity in beliefs between different enterprise types suggests there is a lack of awareness of the options currently available in the Nepali market.

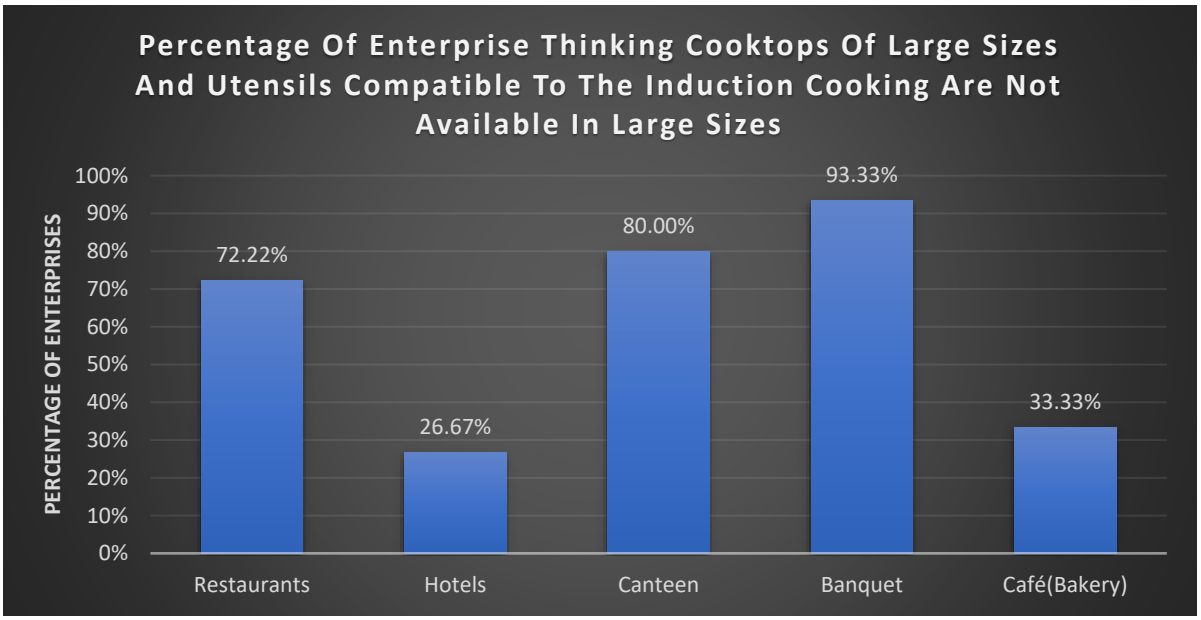

Figure 20: Percentage of Enterprise Thinking Cooktops of Large Sizes and Utensils Compatible to The Induction Cooking Are Not Available in Large Sizes

Concerns regarding the food taste and cooking time in electricity is more in enterprises other than restaurants. Nearly 50 percent of enterprises except for restaurants believed the food may taste different in electric cooking (Figure 21). Only 11.11 percent restaurants believe food taste different in electric cooking. Regarding the cooking time, more than 50 percent enterprises other than restaurants believe it takes more time to cook in electricity (Figure 22). The belief is highest in hotels (73.33 %) and lowest in restaurants (27.78 %).

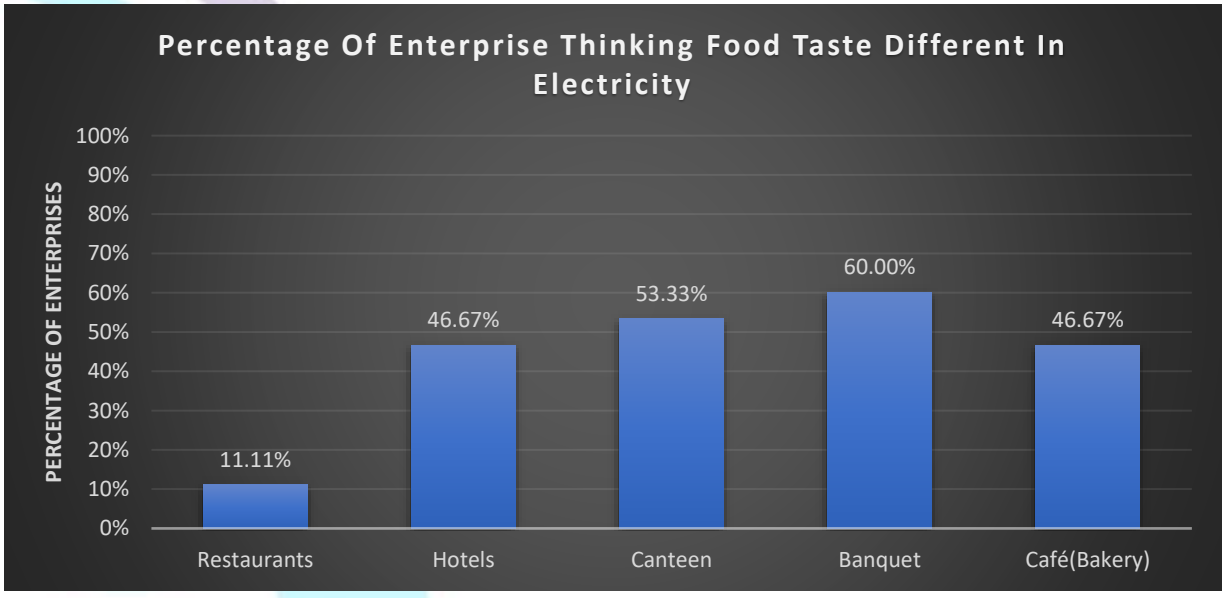

Figure 21: Percentage of Enterprise Thinking Food Taste Different in Electricity

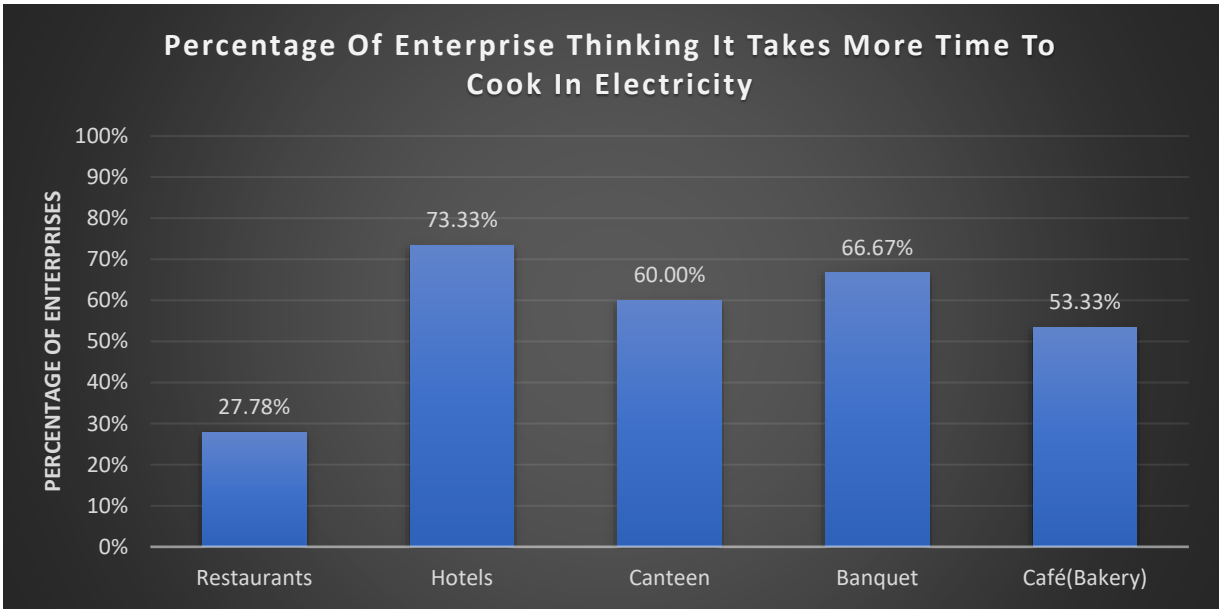

Figure 22: Percentage of Enterprise Thinking It Takes More Time to Cook in Electricity

The belief associated with the cost of transitioning to electric cooking is less of a barrier compared to other beliefs. Only 16.67% restaurants, 20.00% hotels and canteens, 26.67 % banquets and 40 % café/bakery believe it is expensive to buy electric appliances for cooking (Figure 23). Similarly, only 2.22 % restaurants, 13.33 % hotels and canteens, 33.33 % banquets and café/bakery believe reinvest in electric cooking might not be beneficial for the enterprises (Figure 25). Likewise, the café/bakery was the only enterprise type where there was a slight majority of respondents (53.33 percent) who believe electricity tariff is expensive. For other enterprise types, it was far less, ranging between 13 and 27 percent (Figure 24).

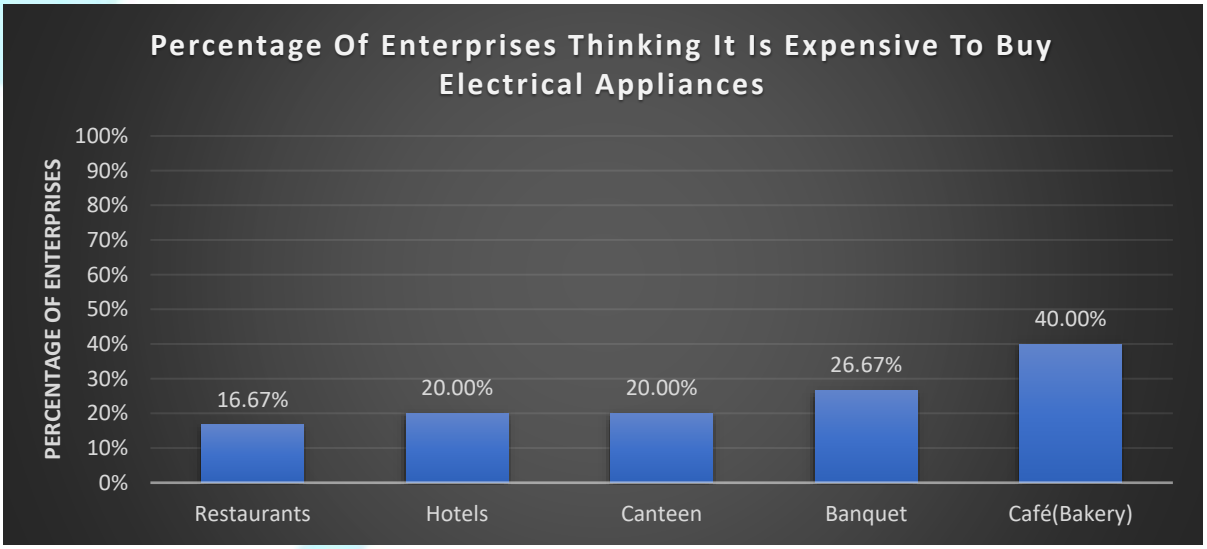

Figure 23: Percentage of Enterprises Thinking It Is Expensive to Buy Electrical Appliances

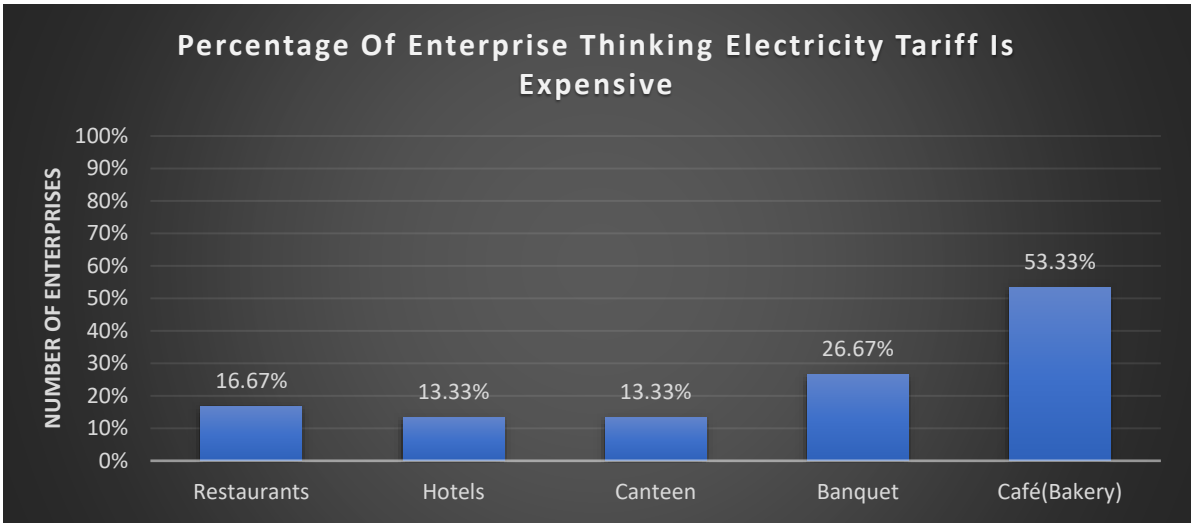

Figure 24: Percentage of enterprise thinking electricity tariff is expensive

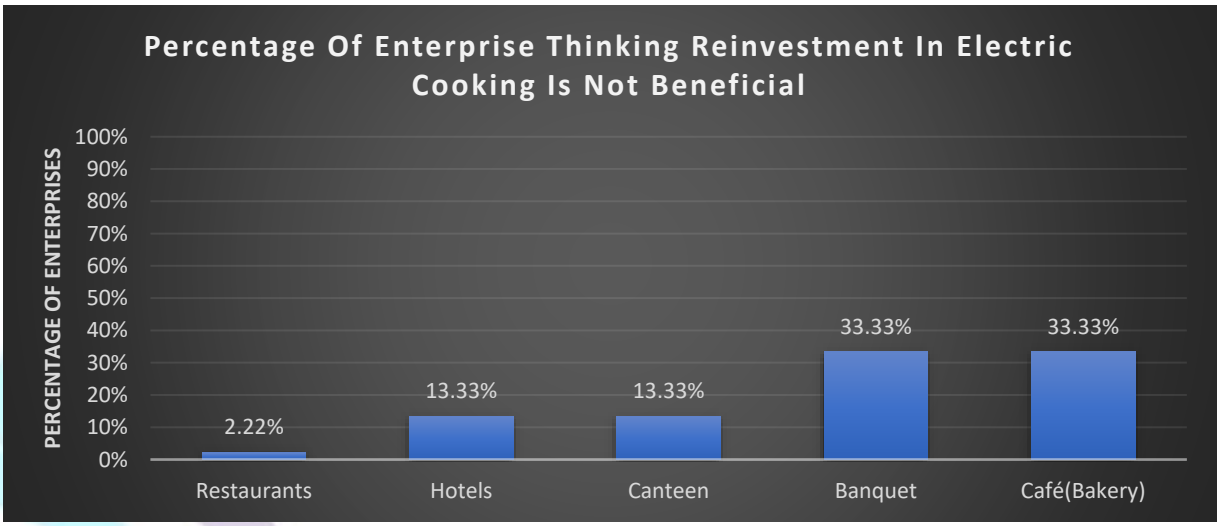

Figure 25: Percentage of Enterprise Thinking Reinvestment in Electric Cooking is not beneficial

One common belief observed in all of the ethnographic study relates to the kitchen space available for cooking. The chefs in all the kitchens were found saying "we have small kitchen" in one-on-one interaction. Even the big kitchens (floor-area wise such as that of Advanced College Canteen) looks very congested and difficult to work in. It has been observed the interior design and construction focussed on the aesthetics in the dining section whereas there seems to be lack the design perspective focussing on space management and comfort of working. The addition of new appliances in the kitchen means space management needs to be done.

4.3 Appliances

The appropriate eCooking technologies for different enterprises depend on their specific requirements and menu offerings. The enterprises are found to have electrical appliances for cooking purposes. 75.28% restaurants, 42.86% hotels, 21.05% canteens, 85.71 % café/bakery, and 73.68% banquets owned at least one appliance, with those for food preparation particularly common. Figure 26 and Figure 30 illustrate the percentage of the surveyed enterprises where various electrical appliances are owned. The eCooking technologies that are most widely found in different enterprises are: food processor, blender, coffee-maker, microwave oven and mixture/grinder. The survey suggested that the overall performance

of these appliances under use are good, but the reliability of electricity has been a problem. The chefs engaged during the study highlighted appliances should be of high quality, durable, highly energy efficient and should be easily repairable and cheaper.

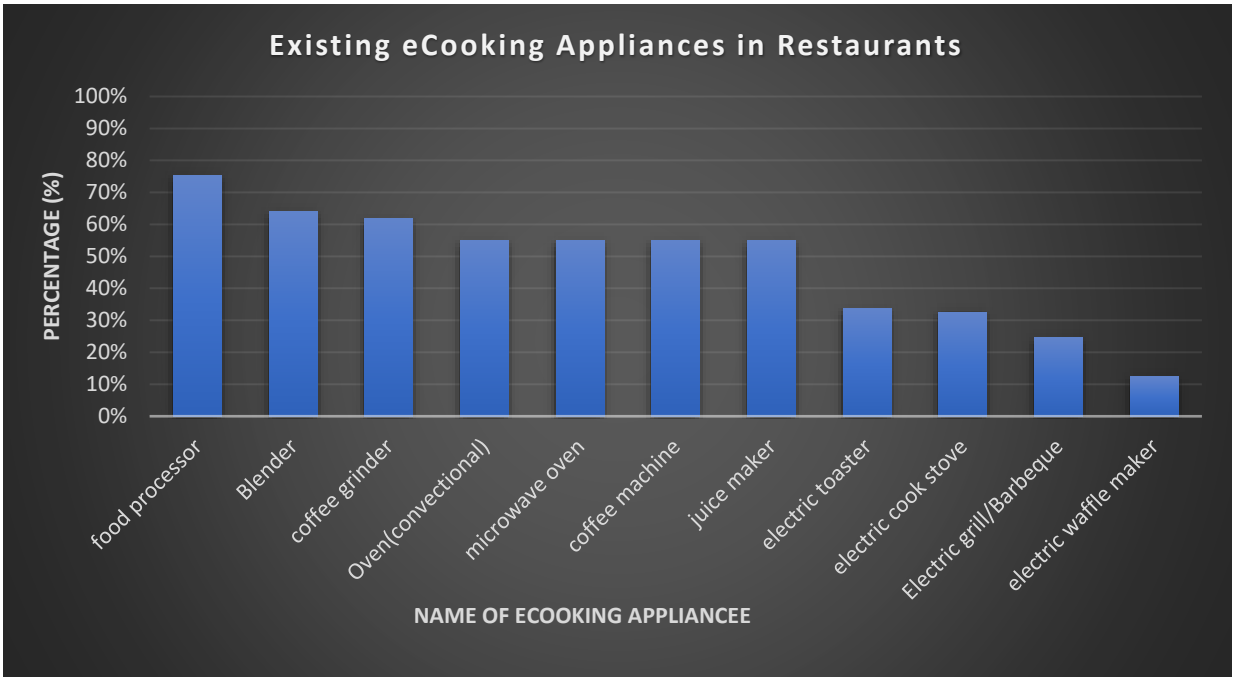

Figure 26: Existing eCooking Appliances in Restaurants

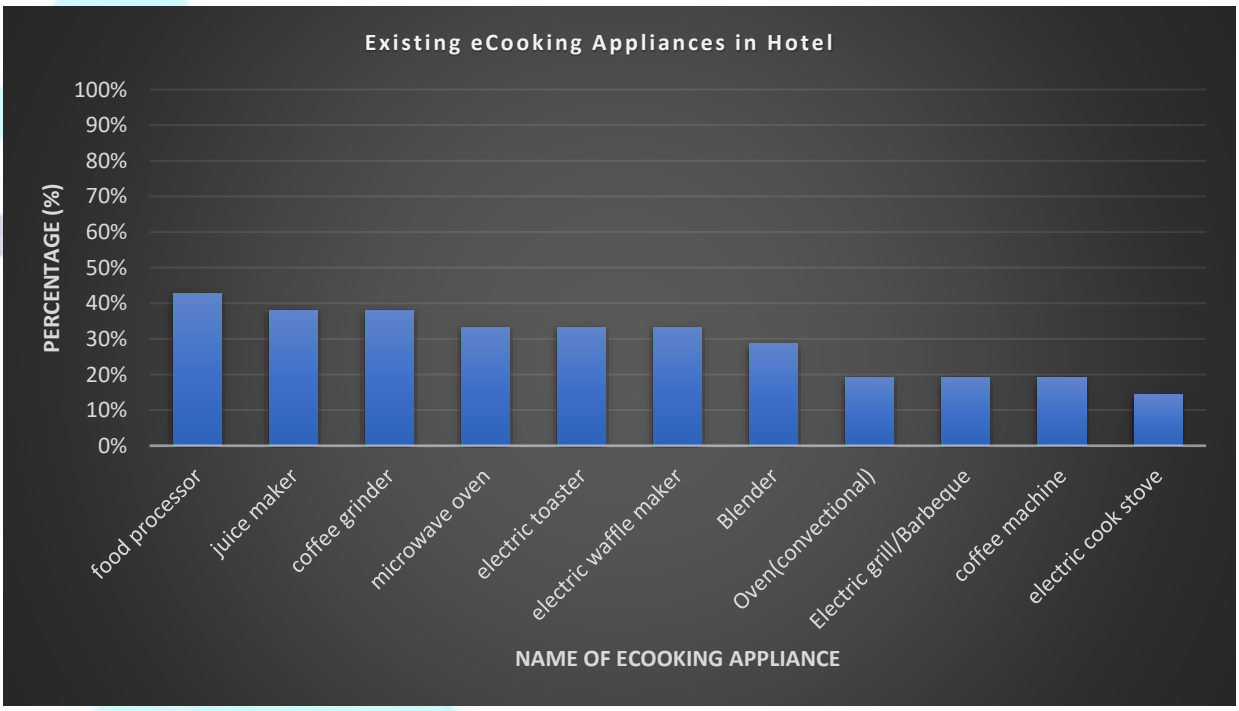

Figure 27: Existing eCooking Appliances in Hotel

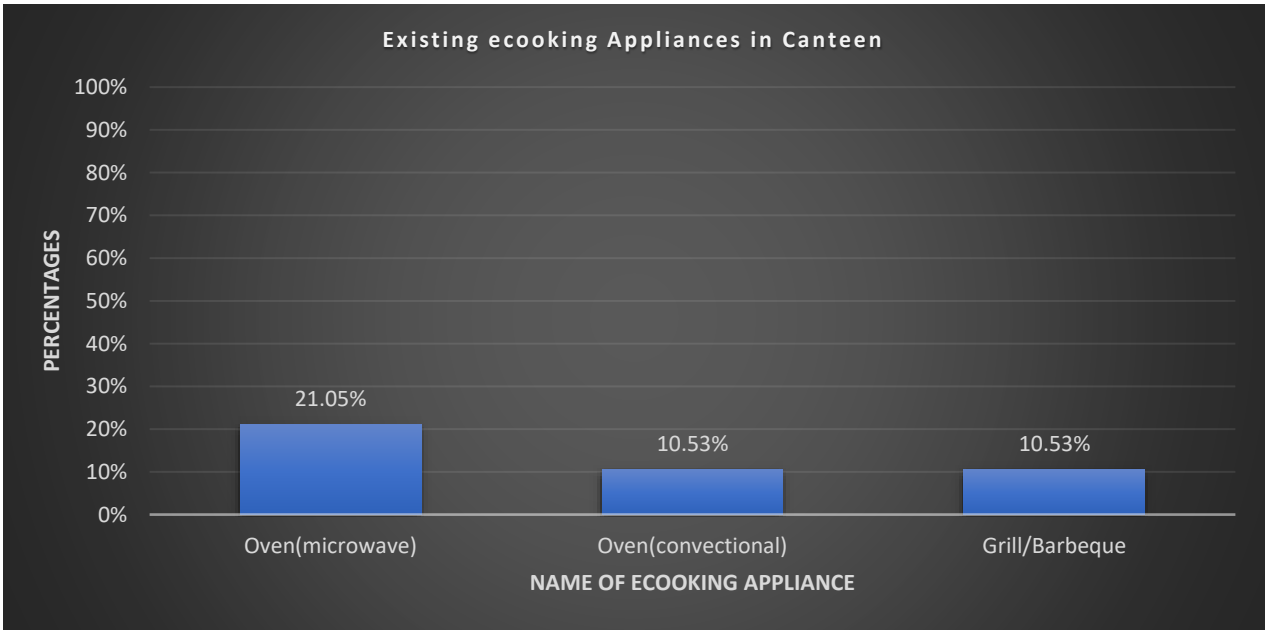

Figure 28: Existing eCooking Appliances in Canteen

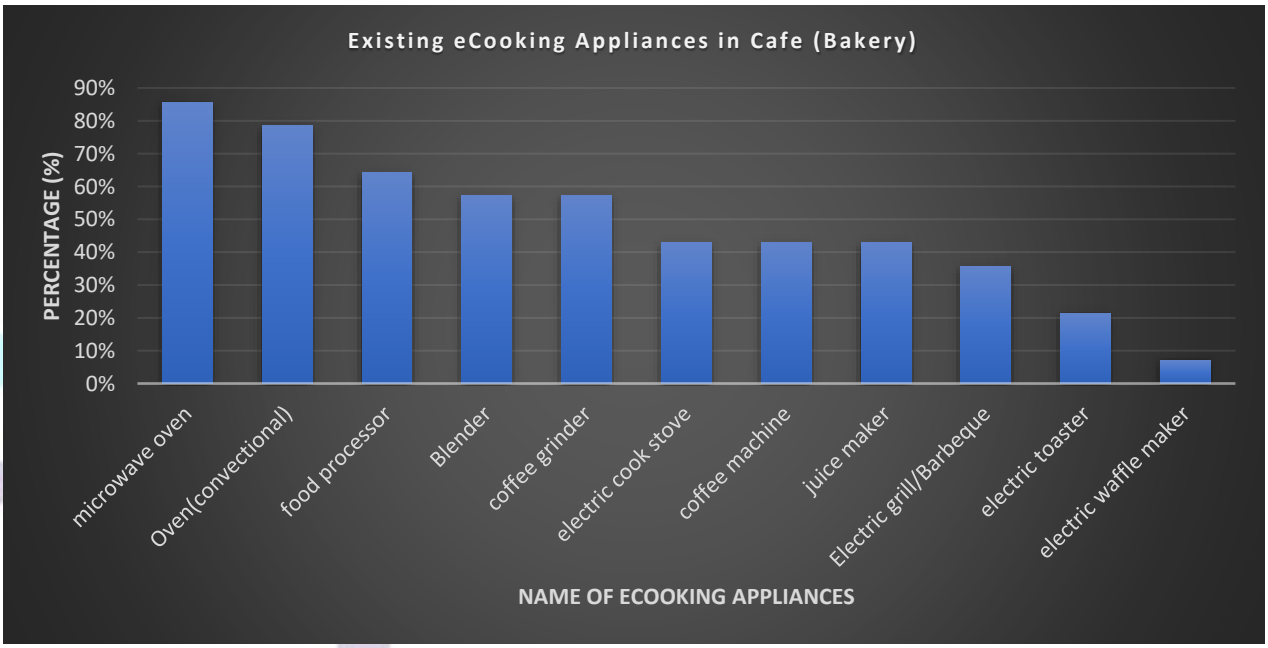

Figure 29: Existing eCooking Appliances in Cafe (Bakery)

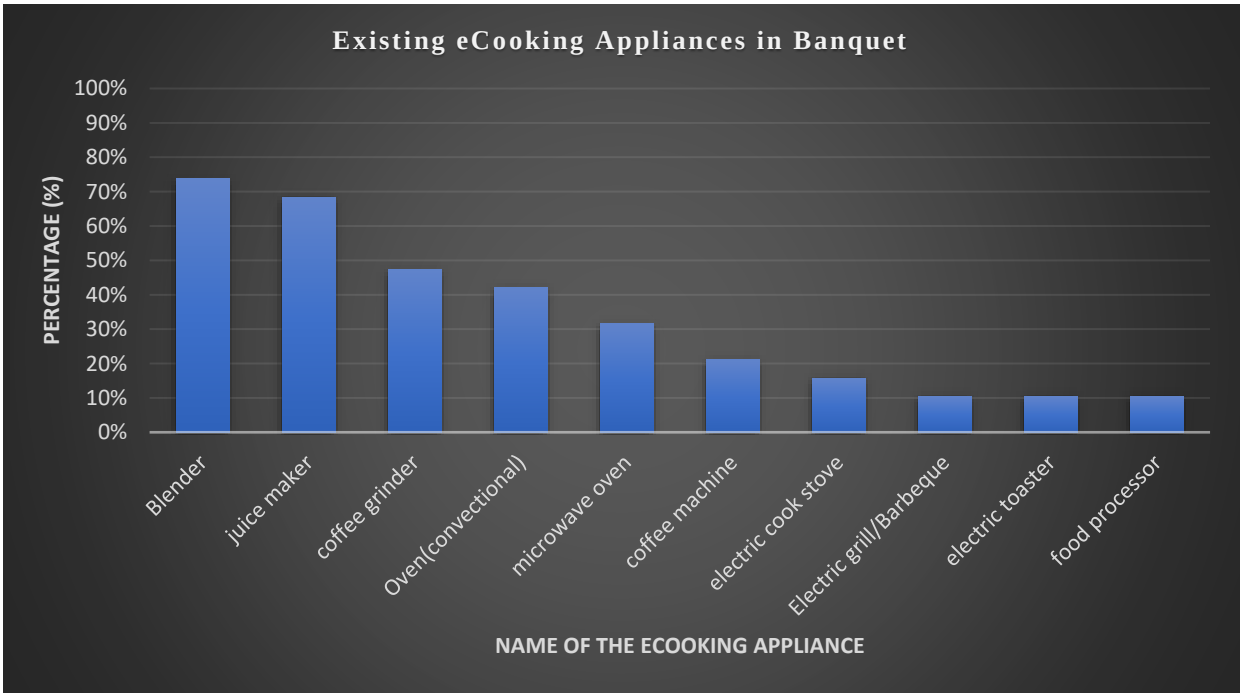

Figure 30: Existing eCooking Appliances in Banquet

The interactions with the chefs and observations suggest the following frequently owned electrical cooking appliances can be used in different enterprises.

Enterprise Type	Different electric cooking appliances that can be used
Restaurants	Induction cooktops, hotplates, Electric steamers, Electric Ranges, Coffee-maker, Electric Deep Fryer, Water Boiler, Ovens, Rotisserie, Electric Griddle
Hotels	Induction cooktops, hotplates, Water Boiler, Electric steamers, Electric Ranges, Coffee-maker, Electric Deep Fryer, Ovens, Electric Griddle, Toaster
Canteens	Induction cooktops, hotplates, Water Boiler, Electric steamers, Electric Ranges, Electric Deep Fryer, Coffee-maker
Café (Bakery)	Ovens, Coffee-maker, Induction cooktops, hotplates, Electric Ranges, Coffee-maker, Electric Deep Fryer
Banquet	Induction cooktops, hotplates, Electric Deep Fryer, Water Boiler, Electric steamers, Rotisserie, Coffee-maker, Electric Griddle

4.4 Supply chain

With the number of enterprises in Kathmandu valley, it is surprising to find only a small number of suppliers for commercial kitchen appliances. Only five suppliers/stores specialized in commercial kitchen appliances were found in the study. These suppliers stock kitchen appliances for all commercial kitchens and are not specific to a particular type of enterprise. Though the number of suppliers to the number of enterprises seems small, the suppliers interviewed reported that they are currently able to meet the demand of the enterprises which does not tend to change much. The demand from the enterprise is during its set up. Once any enterprise is set up, there is little demand from enterprises for the addition of new appliances which incur new costs from the appliance purchase and may incur additional costs from any required changes in the setup of the kitchen. The suppliers not only supply the enterprises of the Kathmandu valley but outside valley as well.

The suppliers engaged highlighted the demand for the commercial kitchen appliances is dominated by LPG ranges. In terms of electric appliances coffee machine and ovens are the top sellers. Besides the electric deep fryer is also gaining some popularity nowadays. All of these are imported from and supplied to the market. They are readily available as they are kept in the store. The electric cooking ranges and other electric appliances that are internationally available may not be readily available in the stores, but the suppliers can import once the enterprises order them.

Table 2: Available eCooking Appliances with their Warranty

Appliance Name	Brand/Model	Warranty Period (Month)
Electric Deep Fryer	Berjaya/BJY-EDF4A	6
	Intertek/F201	12
Induction Cooktop	Berjaya/BJY-IC	12
Baking Oven	Berjaya/ BJY-E25kw-3PRM	12
Combi Oven	Yale/	12
Convection Oven	Salva 17	0
Slice Toaster	ET-DS-4	12
Grill Machine	Malasya/NFW50-2	12
Proofer	Berjaya/1DPF-16	12
Coffee Machine	Cime	12

The suppliers reported the feedback on the electric appliance is good and there are very few cases of complaints. The appliances are generally reliable. Only few cases in issues with heaters of ovens have been reported so far. The warranty provided for the appliances differ with appliance type and brand. Mostly warranty period of 12 months is available for the appliances (as shown in *Table 2*). The warranty period is covered by the manufacturer.

The interaction with the suppliers as well as the enterprise owners suggest it is difficult to find technicians to repair the enterprise level eCooking appliances. There are local repair shops to repair domestic local repair shops but no dedicated to the enterprise level eCooking appliances. Ideally, technicians that repair domestic appliances are capable to repair commercial appliances too and are performing the repair works to some extent, but training and capacity building of the technicians is required to improve the competency.

4.5 Energy

The opportunity for transitions to eCooking was also assessed by analysing various parameters concerning the energy supply, energy use, and the building level electricity infrastructure within enterprises. Figure 31 displays the energy meter (electricity connection) capacities employed in different enterprises, with the most common being the three-phase energy meter, followed by the 30 Amp capacity. The use of high-capacity electrical appliance and multiple number of electrical appliances might require 3 phase supply though the final requirement might differ from the choice of individual enterprise. Having less than 30 ampere capacity might cause discomfort due to frequent tripping of MCBs while running multiple appliances simultaneously. Enterprises with 3 phase connection capacity can easily adopt electric cooking.

One major challenge especially for restaurants for adopting electric cooking is the electricity connection. Most of the restaurants are operated on rented buildings. Moreover, in places like Thamel, Durbar Marg, there is high density of restaurants in a small area. There are multiple restaurants even in a single building. With electric cooking the demand increases requiring own transformer which is a challenge due to availability of land. The NEA has provision of supplying up to 100 kVA load from its own transformer to the commercial consumers, but it is conditional to availability of the capacity in the existing transformer. The consultations with NEA suggested that the availability of land to install new transformers in such areas is always a challenge. In numerous cases NEA only approves load only if the commercial entity provided land to install the transformer. Providing land to NEA is easy for enterprises who run in their own land but for enterprises running on rented building it is difficult to provide the land. The issue related to location.

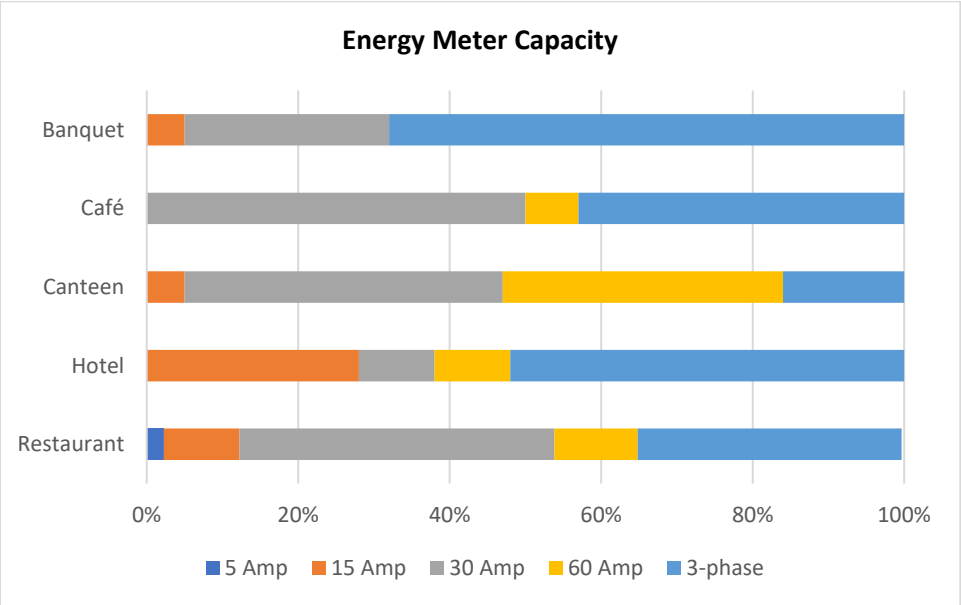

Figure 31: Electricity Connection capacity of different enterprises

The scope for eCooking transitions is also heavily dependent on the quality of the electricity supply. On average, the frequency of power outages varies from two times per week to six times per week, and the duration of these outages spans from 15 minutes to one hour. As per the interviews with the owners, this inconsistency in the power supply poses a challenge to adopting eCooking, as it would impact the promptness of serving food to customers, particularly during peak demand hours. MCB, fuse, and volt guard are the devices used by the enterprises for electrical safety.

Figure 32 is a graphical representation of the perceived affordability of electricity across different enterprise sectors. It reveals that only a small percentage of respondents consider electricity to be cheap, while a significant number express dissatisfaction with their electricity bills.

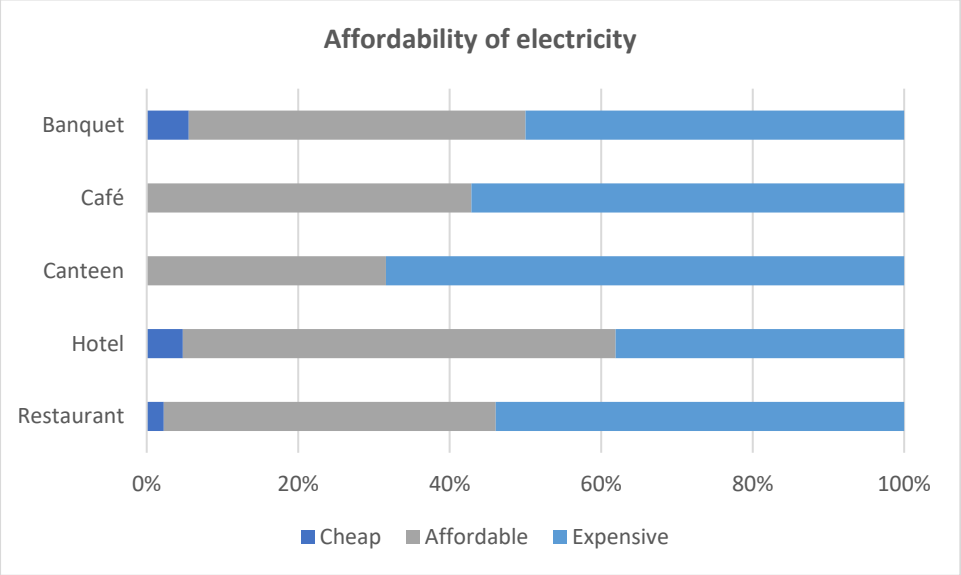

Figure 32: Percentage of enterprises responding to affordability of electricity

Figure 33 illustrates that 74% (in café) to 90% (in banquet) of the current fuel used is LPG, followed by electricity and firewood. Currently, electricity is mostly used by coffee maker, oven and water boiler/dispenser. Firewood is used for barbeque and pizza. Coal is used for barbeque. Café and bakeries show comparatively more usage of electricity as fuel as the use of oven for baking pastries, bread, muffin, cake, etc. and coffee-maker is more frequent in them. LPG is the main fuel to use cookstoves. The use of electric appliances such as oven, coffee maker is less in banquets resulting the use of electricity as fuel comparatively less.

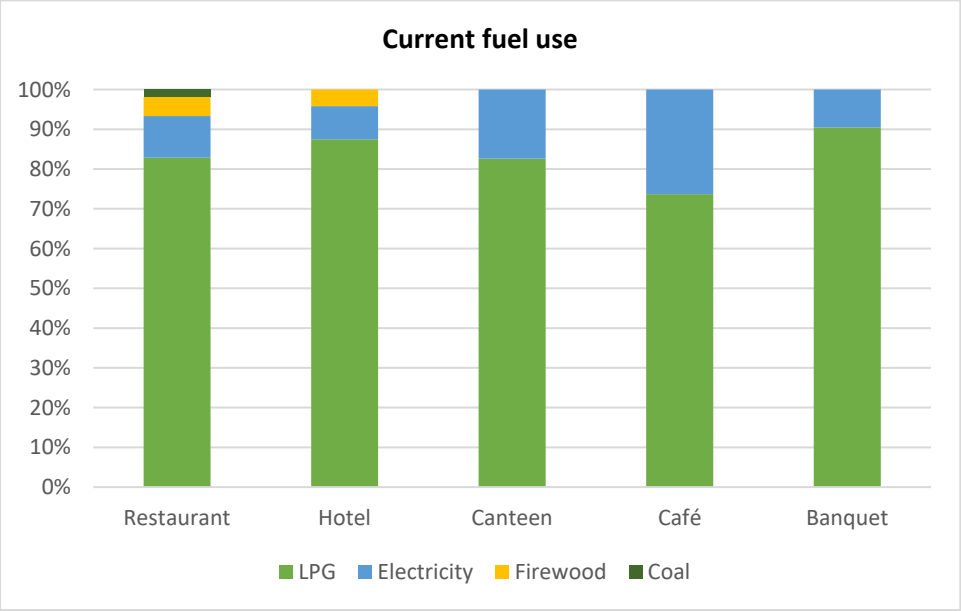

Figure 33: Current fuel use in percentage in different enterprises

4.6 Cost

The actual cost of switching to eCooking for enterprises depends on various factors, such as the choice of eCooking appliance(s) adopted and the existing operating costs they replace. Cooking fuel cost savings depend on the use of the appliance which in turn depends on the serving capacity and the occupancy of the enterprises. The fuel cost saving from eCooking transitions will likely be larger in enterprises where a greater number of dishes are prepared using LPG. Figure 34 shows the monthly

expenditure of the enterprises in LPG fuel, which varies drastically depending upon the size, number of customers served, menu, etc.

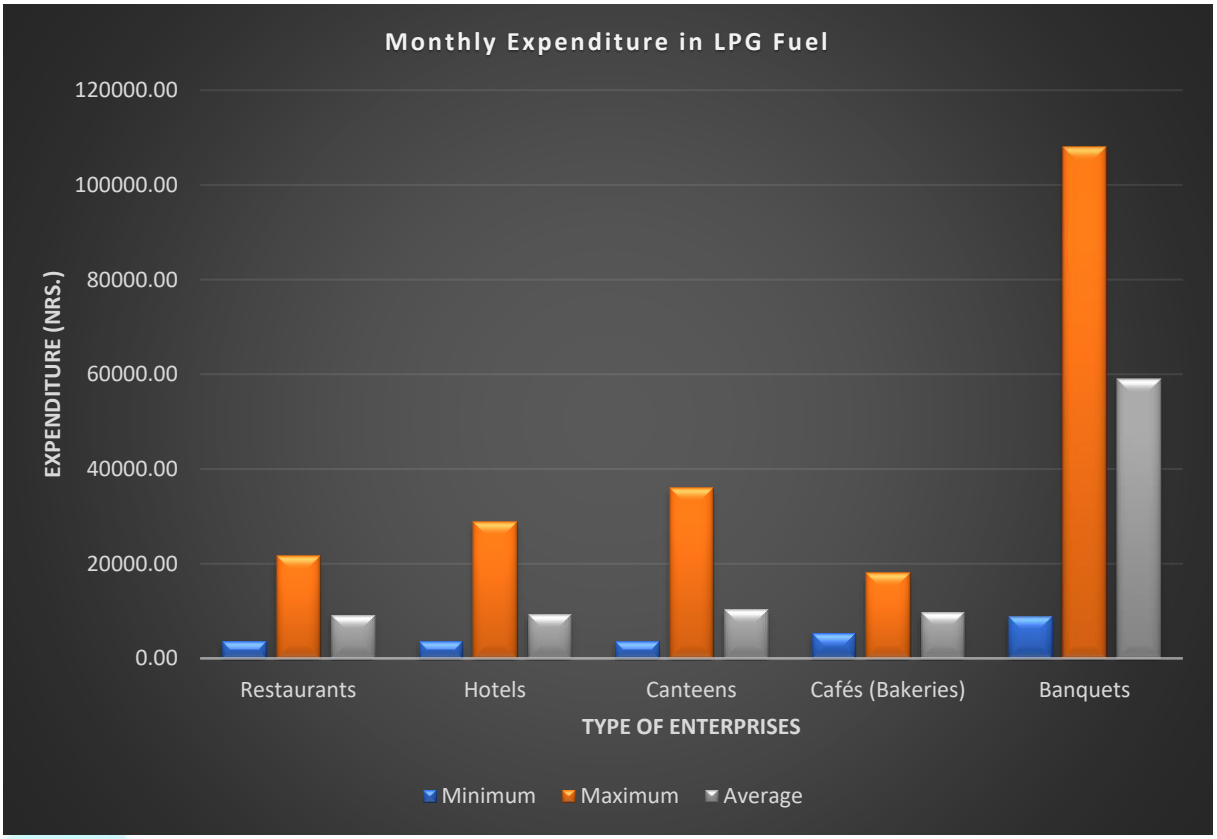

Figure 34: Monthly Expenditure of the Enterprises in LPG Fuel

Preliminary Financial Analysis

As stated earlier, the investment required and the return on the investment differs according to the enterprise, level of transition and the ultimate use of the appliances. To give a sense of the potential financial benefits of transitioning to eCooking, a preliminary financial analysis case study was done in one enterprise- Kaliz farm resort. Kaliz farm resort is small hotel with small group of people reserving the place for staycation and mostly eating Nepali Thali: a typical Nepali meal consisting of rice, daal (lentils), vegetables, and pickles. The following assumptions were made for the financial analysis.

- In this eCooking transition case study, the enterprise is assumed to adopt the electric pressure cooker (EPC) to cook the rice and daal components of Nepali Thali.
- The maximum occupancy of the hotel is 40 and for serving various number of customers, it is assumed that it is realistic for the hotel to adopt 1*17L EPC and 1*5L EPC.
- It is assumed that the EPC will be used to cook rice and daal. Though the EPCs can cook other dishes too, it is fair to assume that chefs are more likely to cook rice and daal which are already mostly prepared with pressure cooking on other fuels.
- Cooking daal is generally a two-step process. First, the lentil is pressure cooked in water and in second step “tadka” (where spices are heated in oil or ghee) is added to the lentils. Hot water is also often added to reheat and bulk out the daal. Here it has been assumed that the EPC will replace the main pressure-cooking phase while the tadka and hot water will continue to be prepared using LPG. To prepare both daal and rice, EPC will be used to cook daal first which

will then be transferred to another vessel to add tadka. The same EPC now will be used to cook rice.

- Three different cases of occupancy have been considered to carry out the financial analysis i.e. average daily occupancy of the hotel be 20, 30 or 40. For different occupancy, the combination of usage of the two cookers to cook rice and daal is shown in *Table 1* & *Table 3*. It has been assumed that a 5L cooker can cook rice for 6 or 7 people while a 17L can cook for 18 to 20 people as the portion per people vary. While serving Nepali Thali, rice and daal can be refilled multiple times so it is fair to cook rice in more quantity. To cook daal using 17L EPC once is enough. During the pressure-cooking phase daal is prepared in a thick paste like texture and can then be reheated and bulked out by adding tadka water as per the requirement (a common cooking practice in Nepal).

Table 3: Number of times the EPCs will be used

	number of times EPC will be used					
	to cook rice		to cook daal		Equivalent no of uses of 5L EPC	
Combination of usage	17L EPC	5L EPC	17L EPC	5L EPC	Rice	Daal
20 number of people	1	1	1		4	3
30 number of people	1	2	1		5	3
40 number of people	2	1	1		7	3

- The investment cost of the hotel for the transition is taken as NRs. 30,000. The cost of 17 L EPC is taken as NRs. 20000 (Alibaba.com, 2023) and the cost of 5 L EPC is taken as NRs. 10000 (NEF; MECS, 2023).
- Since actual measurement of fuel consumption while preparing the dishes in the enterprises were not done in this study, the cost saving was taken from the controlled cooking test (CCT) conducted by PEEDA/MECS in 2020 to simulate a family of 5 people. The cost saving of while cooking rice and daal (lentil) for 5 people in 5L EPC was found to be NRs. 1.29 and NRs. 3.96 respectively in comparison to cooking in LPG stove which was revised as per the fuel cost in 2023. The study was conducted in 2020 and the cost of LPG per cylinder was taken as NRs. 1440 which has increased to NRs. 1895 in 2023 (NOC, 2023) whereas the average electricity cost per unit was taken as NRs. 10. The revised cost saving while cooking rice and daal was found to be NRs. 2.35 and NRs. 5.88 respectively. The research on cost saving due to use of large commercial sized EPCs is a new and rather unexplored topic thus it is difficult to predict the actual fuel cost saving due to use of 17L EPC. A working paper on large sized EPC published by MECS compared the total energy consumption in heating 50 litres of water using 65 L, 40 L, 33 L, 8 L and 6 L EPCs and found out that in terms of the energy consumption one large size EPC is equivalent to multiple number of small EPCs. Using the same logic, it is assumed that a 17L EPC is approximately equivalent to three 5L EPCs (see Table 3).
- Cost savings per day for rice and daal cooking were then calculated using the dish cost savings for daal and rice cooked in an EPC (NRs. 2.35 and NRs. 5.88 respectively) multiplied by the number of times the EPCs would need to be used for different occupancy levels which is shown by the column for equivalent no of uses of 5L EPC in Table 3. Yearly cost savings were then calculated by multiplying the daily cost saving under each occupancy level by 350, the number of days the resort is assumed to be opened. Yearly cost savings ranged between NR. 9464 and NR. 11932 (Table 4).

- *Table 4: Daily and Yearly Cost Savings*

Occupancy	**20**	**30**	**40**
Cost saving per day (NR)	27.04	29.39	34.09
Total cost saving per year (NR)	9464	10286.5	11931.5
Payback Period in years	3.17	2.92	2.51
IRR (%)	6	9	16

With the assumptions mentioned above the payback period of transition to EPC was calculated with varying daily occupancy rate (number of people served) of the hotel. As seen in Figure 35*: Payback period for eCooking transition: a case study in Kaliz Farm Resort* the payback period is 2.51 years when the daily occupancy rate is 40. Assuming 5 years as the life of the EPC, the IRR of the investment in EPC was found to be 6, 9 and 16 percent when the daily occupancy rate is 20, 30 and 40 respectively. Overall, the findings indicate that an eCooking transition can be financially beneficial for the Kaliz Farm Resort. A detailed calculation of the financial analysis is provided in annex A5.

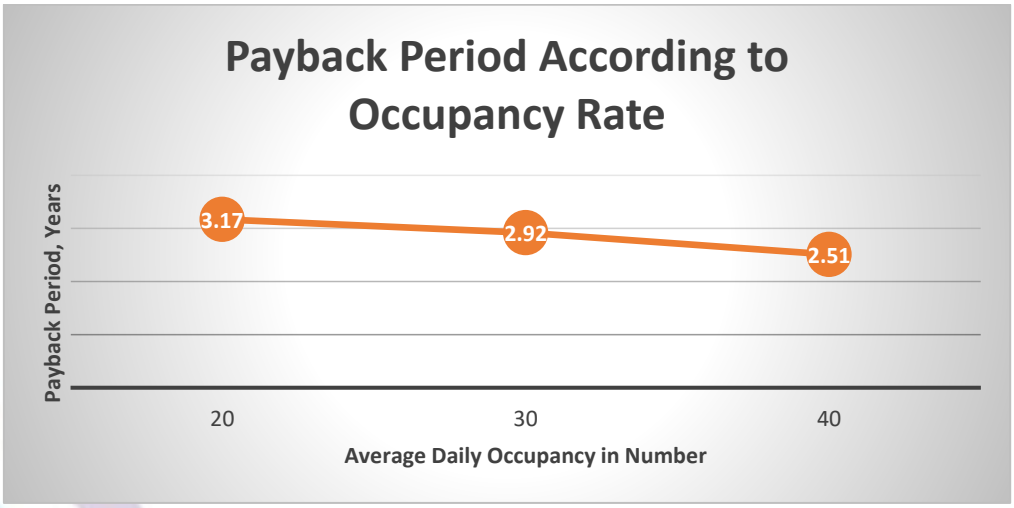

Figure 35: Payback period for eCooking transition: a case study in Kaliz Farm Resort

The financial analysis provided in this case study is a preliminary work and is done to get an idea of what to expect in the future from the financial perspective. For more precise cost analysis, further analysis is required involving primary data collection of energy consumption of commercial appliances. The exact payback period will also require analysis of other factors such as any costs incurred from upgradation of electricity connection and internal wiring, changes in the electricity tariff and the use of the appliances. In addition, lifetime cost analysis comparing cooking on electric appliances with cooking on other fuels is required to better understand the costs associated with factors such as repair and replacement of materials.

4.7 Networks

Transition to enterprise-level cooking in Nepal is influenced by various social networks and patterns around food, beliefs, appliances, electricity distribution system, and cooking fuel purchasing. Insights gathered from FGDs conducted with the REWAN team highlight several key points to take into account:

- Traditional cooking practices have deep cultural and social significance in Nepal. The familiarity and comfort with these practices might act as a barrier to adopting modern or commercial cooking methods.

- Social networks within communities can influence the adoption of enterprise-level cooking since Nepal has been seen as a highly influential society.
- Awareness of the benefits of enterprise-level cooking, such as cost savings, efficiency, and reduced environmental impact, can spread through social networks.
- Enterprise-level cooking often requires significant upfront investment in equipment and infrastructure. Access to financing or resources can facilitate or hinder this transition.
- Access to different cooking fuels, such as electricity, LPG, or biomass, can influence the choices made by the enterprises. The availability of specific fuels might be influenced by social networks and economic factors.

4.8 Gender and inclusion

The transition to enterprise-level eCooking in Nepal has several gender and inclusivity implications, which are important to consider ensuring that transitions do not aggravate existing inequalities. The active involvement of women in decision-making processes within these enterprises plays a pivotal role in influencing energy transition choices. To explore this further, the research team has collected data on the representation and roles of women staff in the enterprises under study.

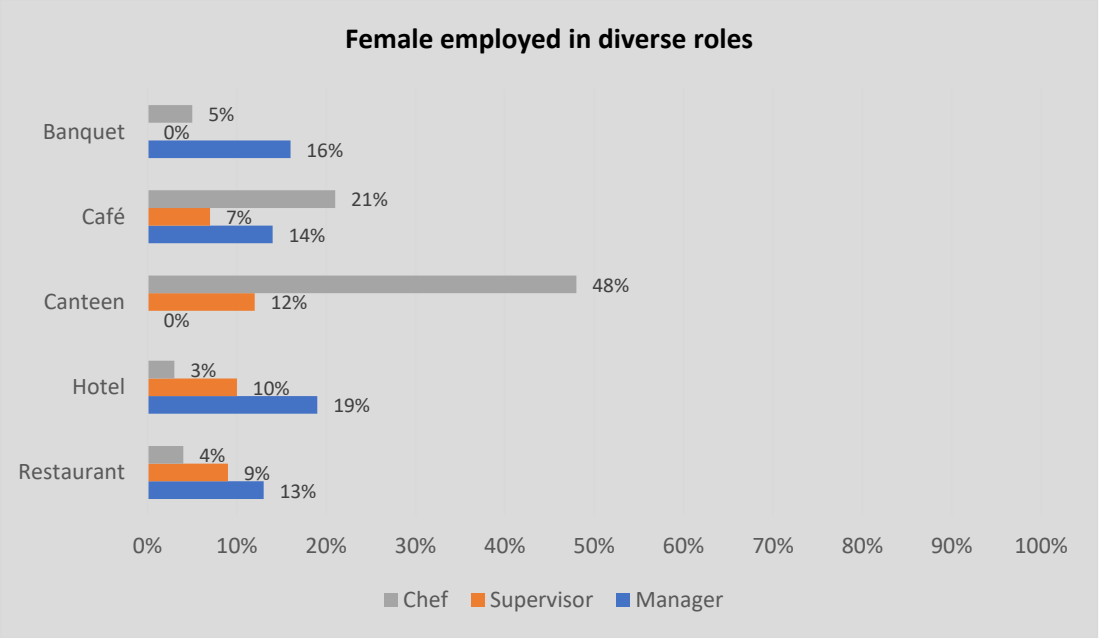

Figure 36: Percentage of female employed in different roles in the enterprises

Figure 36 illustrates the limited representation of women in key positions such as manager, supervisor, and chef within the surveyed enterprises. The lowest representation of women is observed in banquets and hotels. Instead, women are predominantly employed as kitchen helpers and waiters, indicating a preference for traditional roles over non-traditional ones.

4.9 Wider impact

The FGDs and KIIs done with various key stakeholders including the users, suppliers, and energy experts through their understanding reveal that the enterprise-level transitions to eCooking in Nepal can have several potential wider impacts across various domains:

- Two chefs with experience of using electric appliances suggested the adoption of eCooking technologies leads to more efficient and controlled cooking with the rapid technological advancements.

- They also highlighted eCooking technologies come with advanced safety features and better temperature control, contributing to improved food safety, especially in commercial settings with large food preparation.
- The internal working condition inside the kitchens will get improved due to improvement in air quality due to reduced LPG burning. The ambient temperature inside the kitchen will get reduced due to reduction in heat waste due to LPG burning resulting in pleasant working environment for the chefs.
- Several suppliers reported enterprise-level eCooking fosters local economic development by creating new business opportunities for equipment manufacturers, suppliers, and service providers. Improved food safety and reduced waste contribute to increased profitability and support the local economy.
- Experts and enterprise owners believe shifting to eCooking reduces reliance on imported LPG fuels increasing energy security as well as improving national economy, lowering greenhouse gas emissions positively impacting the environment and climate change.
- Experts believe the adoption of eCooking technologies influences cooking practices, leading to behavioural shifts towards cleaner and more efficient cooking methods with broader societal and environmental benefits.

Vignettes

The ethnographic approach helps to understand the opportunities and challenges of the electric cooking adoption and the specific barriers of the individual enterprises. The approach helped in bonding with the chefs and managers which resulted in detailed discussion on the electric cooking and their perspectives on this.

1. Trinity hotel and café

Trinity hotel, located in Lalitpur district, was established in 2018 with 20 rooms and a restaurant with garden dining. The restaurant can serve 50 customers at a time.

Figure 37: WoNEE Study Team in consultation with management team of Trinity Hotel and Cafe

Figure 38: Various dishes being cooked at Trinity Hotel using LPG burners and different sized utensils

The kitchen is equipped with an LPG cooking range consisting of six burners and one griddle. The six-burner stove is supplied by three gas cylinders whereas the grill is connected to two gas cylinders. Besides the cooking range, there is one small size microwave oven and one sandwich maker. In the café counter there is a coffee maker.

All the food in the hotel is prepared by the use of the burner and griddle i.e. there is no use of electric appliance for cooking. The sandwich maker is no longer used as the kitchen staff find griller easy to use and the oven is used only for reheating the cooked food which is very rare occasion in the hotel.

Commercial micro-wave oven, electric deep fryer, electric toaster and electric grill are some of the appliances that the hotel can make use of. The owner and kitchen staff are interested in using oven, electric deep fryer and electric toaster which will make the work of the chefs easy. The chef in the kitchen has experience of working in all electric kitchen in Qatar and appreciated the idea of increasing electric cooking appliances in the kitchen. The chef mentioned the difference in the way of cooking in all electric kitchen where the cooking range consists of hotplates instead of LPG burners. Besides the availability of technology, technicians, electricity infrastructure and reliable electricity supply, he also raised concern regarding the taste of some typical Nepali dishes which require high flame cooking. Some dishes like chow mien, fried rice, even mix-vegetables, etc. are prepared by stir-frying in high flame which might not be possible to cook with the same taste and flavour in electric hotplate.

Tossing and frying is done to remove the moisture as quickly as possible in number of dishes in Nepal which is not possible in hotplates. Even momo requires high flame, high heat which may not be possible in hotplates. Though some domestic electric appliance is available in the market to steam momo, commercial device for steaming momo may not be available. The chef finally suggested a hybrid cooking range of hotplate and LPG burner stove may be a solution to all type of cooking.

Few challenges lie ahead in the hotel to uptake use of electric appliances. The kitchen space is one of the barriers at the moment, but it can be solved by an interior design. A well-designed interior layout can make effective utilization of the space, optimize the flow of work in kitchen and increase employee comfort and productivity. Besides kitchen space, additional cost for the new appliances, upgradation of electrical wiring, provision of back-up supply is some of the issues the owner should deal with.

2. Walnut Bistro

Figure 39: WoNEE study team in consultation with management team of Walnut Bistro

Wallnut Bistro, located in Kathmandu, is restaurant established in 2018 with serving capacity of 250 customers at a time. The kitchen is equipped with an LPG cooking range consisting of six burners. The six-burner stove is supplied by three gas cylinders. Besides the cooking range, there kitchen includes Electric water boiler, Oven, Electric Deep Fryer, Coffee Maker. Besides the burner oven is the most used appliance in the kitchen which is used for baking, roasting and grilling.

LPG burners are still used to cook many dishes in the restaurant. The chef understands well the advantages of electric cooking such as safety, automated control and believes there are specific electric appliances developed in the world to cook specific devices such as momo maker, which is one of the appliances the restaurant wants to adopt. However, there was information gap about the availability in the local market and how it affects the taste and texture, timing of cooking. Furthermore, importing the appliance from other countries have a challenge of testing facility (how to ensure quality of the appliance) as well as after sales service. Besides momo maker, hotplates are also an option to replace few burners in the kitchen but there is a concern in the cooking time of electric appliance.

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Figure 40: Cooks using LPG burners with different sized vessels in Walnut Bistro

Figure 41: Use of electric oven in Walnut Bistro

3. Bageshwori Chamena Griha (Canteen)

Bageshwori chamena griha is a canteen operating in the premises of Advanced College of Engineering and Management. The canteen serves more than 400 to 500 people (students, teachers and college staffs) per day except for the college holidays. The normal college time is 7 am morning to 2 pm mid-day and hence the canteen also serves in this time period. However, almost 70 percent of the total servings of the day is done in 2 hours' time i.e. 8:30 am to 10:30 am. This a high rush period in the canteen.

Figure 42: LPG burners and food cooked in large amounts in large sized vessels in Bageshori Canteen. Providing kitchen staff with eCooking training could help unlock the opportunities identified for reheating, boiling and steaming food items using electric appliances.

Since a large number of customers are served in a short period of time, a lot of food is pre-cooked in large amount and only serving is done when the customers arrive. Daal Bhat Taakari (Nepali thali) is the most common dish in the canteen which are prepared in large quantity in large vessel. Besides these snacks item such as momo, chow mein, chana (fried gram which was soaked overnight), aalu (boiled

potato fried in oil with different spices), boiled eggs, omelette, tea, coffee, etc. are the most common food in the canteen.

The kitchen consists of cooking range of 11 LPG burners and no electric cooking appliance. The kitchen staffs with no experience of working with electric cooking thinks that the dishes and the amount in which they are cooked may not be suitable for electric cooking. Furthermore, the reliability of electricity supply is also a major concern to initiate electric cooking. The college has a backup supply of electricity through two Diesel generators of 125 kVA and 63 kVA capacity, but these generators are used to provide backup supply to the college activities only. Without backup supply the use of electric appliances in the kitchen might be problematic especially if the electricity is cut off during rush hour.

Electric boiler, steamer and microwave oven are some of the devices that the canteen can adopt. Using oven can actually improve the quality of food served as the precooked food can be reheated during serving. Electric boiler and steamer can be used to cook momo, steam vegetables, etc. But the kitchen staff should be trained to include these processes into their daily cooking routine.

4. Hotel Kutumba

Hotel Kutumba is a new boutique hotel located in Lalitpur districts which offer 22 rooms within house fine dining restaurant. The restaurant offers signature Nepali, Oriental and Continental dishes.

Figure 43: Use of vessels of different type and size with a 6-stove LPG burner in Hotel Kutumba. The kitchen has the infrastructure to support an all-electric kitchen.

The kitchen cooking appliance include a cooking range of 6 LPG burners and a griddle. Other cooking appliance include coffee maker and a toaster. The chef is highly interested in all electric cooking i.e. replacing the LPG cooking range with electric hotplate range and interested in knowing the products in the market. The prime factor driving him towards the electric cooking range is that the electric range is easy to clean and will make the kitchen look good. The kitchen has infrastructure to support all electric kitchen and the hotel also has backup electricity supply of diesel generator of 150 kVA. The hotel is actually planning to expand and building a new kitchen where the chef would like to have all electric kitchen but lack of knowledge and information on the appliance available in the market is a challenge.

5. The Burger House and Crunchy Fried Chicken

The Burger House and Crunchy Fried Chicken is a prominent fast food chain restaurant which specializes on Fried Chicken and Burgers, along with other drinks and foods. The Burger House and

Crunchy Fried Chicken is one of the most popular fast food chain restaurants in Nepal with 88 outlets all over the country.

Figure 44: Use of 4 stove LPG burner in the Burger House. The restaurant also frequently uses an electric deep fryer.

The cooking range is of LPG type and has 6 burners. The restaurant uses electric deep fryer which is used frequently. The chef finds it easy to use, time saving, easy to clean and with better control. The wiring of the kitchen is three phase and supports the use of additional electric appliance, but the manager sees the frequent electricity cut-off as a challenge to adopt electric cooking. An additional barrier for the chain restaurant industry is the need for consistent taste at each location. Use of new appliances may change the taste of food and switching to electric cooking may require testing.

6. Tokyo Ramen House (Japanese Restaurant)

Tokyo Ramen House, located in Lalitpur, was established in 2023. The restaurant was opened for the fulfilment of ramen, sushi and other Japanese food demands among the people. Kathmandu valley, a popular tourist destination, is seeing the growth in number of Japanese, Korean, Chinese and Indian restaurants in localities around Thamel, Jhamiskhel and Bouddha. These are the places where tourists visiting Nepal mostly stay.

Figure 45: Different cooking appliances in Tokyo Ramen House: LPG burners (Top Left), Electric Oven (Top Right), Electric Deep Fryer (Bottom Left) and Electric Rice Cooker (Bottom right)

With the owner having worked in Japan for more than 17 years, an ethnography was conducted in Tokyo Ramen House to observe if the use of electricity is more in comparison to other restaurants. The kitchen consists of cooking range of 6 LPG burner and 1 griddle similar to other restaurants. But the restaurant is using rice cooker, induction cooktop (domestic) to cook rice and other light food such as omelette which has not been seen in other restaurants. Besides, the restaurants own commercial size microwave oven and electric deep fryer. The owner like to add more electric appliance in the restaurant but sees reliability of the electricity a major problem to adopt more electric appliance. The chef is concerned regarding the cooking time of the electric appliance and is doubtful of working with more electric appliance. The kitchen space is another challenge to add more electric appliance.

7. Krishna noodle factory

Small noodle factories are a common cottage industry in Nepal. They produce a noodle which are used by restaurants, hotels and domestic households to prepare Chow mein, Thukpa, Spring rolls, etc. To make the noodle first a dough is prepared by mixing the flour, salt and right amount of water. Then kneading of the dough is done which helps develop gluten, which gives noodles their texture and structure. The dough is allowed to rest and then rolled out and shaped in a machine to get strips of the noodle. The noodle is then cooked/steamed for quick usage or dried for longer storage. The noodles are then packed in desired amount in a packet and sent to the market.

Figure 46: Noodles being weighed for packaging

Figure 47: Rolling out of the dough using electric roller

Krishna noodle factory is one of the noodle factories located in Dhangadhi district providing jobs to 4 female workers. There are three electric machines for making the dough, rolling out the strips and drying the noodles and one LPG stove to steam the noodles. All the function except for the cooking is electric and the owner likes to change that. The reliability of the electricity is not a problem to the factory as it is a small factory and other functions that do not require electricity can be done during cut off. But the owner is finding it difficult to get the electric appliance in the market. The domestic induction/infra-red cooktop cannot fit the required size and other than that the owner does not have information on the technology.

Figure 48: Noodles being steamed using LPG stove

8. Kaliz farm Resort

Kaliz Farm Resort located in Tikabhairab, Lalitpur is a resort specializing in Kaliz meat. The resort has farm to raise Kaliz pheasant (wild cock). Nepali Thali with Kaliz meat is the main attraction of the resort. Other than that people visit the place for barbeque and drinks.

Figure 49: A four burner LPG stove in Kaliz Farm. The lower occupancy levels indicate the restaurant could make use of domestic induction cooktops

Figure 50: Cook using LPG stove for frying in Kaliz Farm

The kitchen includes a 4-burner cooking range of LPG and can incorporate a number of electric cooking appliance such as toaster, griddle, rice cooker or electric pressure cooker. The occupancy of the resort is small with small group of people reserving the place for staycation and mostly having Nepali Khana. With small number of people visiting the restaurant can even make use of domestic induction cooktop to serve the costumers. The owner also believes that such appliances could be used in the kitchen but as

the owner has already invested in LPG cooking range which is enough to cater the customers and is hesitant to add more appliance.

9. Thapagaon Banquette

Thapagaon Banquette is located in Baneshwor, Kathmandu and is in operation for around 10 years. It is an entertainment and event hosting venue that hosts and provide food facility in events such as wedding, engagement, rice feeding and corporate events. The banquette can accommodate up to 800-people at a time in an event. All the cooking in the banquette is done on LPG burners. There is a total of 11 burners in the kitchen and about 50 LPG gas cylinders are consumed every month.

The manager has not thought of transitioning to electric cooking and thinks electric cooking is not suitable for cooking the food in large volume. The electric cooking requires large cooking time and even the technology is not available in required size.

5. Conclusion

5.1 Opportunities and challenges

There appear to be clear opportunities to promote electric cooking in restaurants and hotels. The findings indicate many of the cooking practices of restaurants, hotels and café (bakery) are compatible with various electrical appliances while the study highlights that 52.8%, 52.4% and 85.7% of restaurants, hotels and café respectively are willing to adopt electric cooking. There is possibility therefore to decrease the LPG usage and increase the electricity consumption in commercial sector increasing the revenue of Nepal Electricity Authority which can be support to the quality and reliability improvement program. The willingness of banquets and canteens to adopt electric cooking is, however, less in comparison to other enterprises.

The following provides a summary of the study findings indicating further opportunities for enterprises to transition to eCooking.

- Increased awareness: The study indicates that 70.8%, 57.1%, 57.9%, 73.7% and 78.6% of respondents from restaurants, hotels, canteens, banquet and café/bakeries respectively are familiar with associated benefits of eCooking technologies. Examples include increased environmental consciousness and focus on health, which appear to have contributed to an increased demand for cleaner and more sustainable cooking solutions. The study further shows that more than 50% of the owners of the restaurants, hotels and bakeries surveyed are beginning to consider and have expressed their willingness to transition to eCooking.
- Availability of appliances and evolving supply chain: Among the enterprises studied, eCooking appliances such as coffee maker, juicer, blender, ovens are prevalent across all enterprise types (detailed in section 4.3). Moreover, technological advancements in the market have resulted in more efficient and user-friendly eCooking appliances, simplifying the transition process.
- Reducing dependence on fossil fuels: Currently, all the surveyed businesses heavily rely on LPG, ranging from 74% in cafes to 90% in banquets. Given the uncertainty surrounding LPG import and its high cost, transitioning to eCooking can significantly decrease reliance on this non-renewable resource. This shift will help decrease dependency on imported fuels and result in reduced greenhouse gas emissions, contributing to a positive impact on the environment and climate change.

Adopting eCooking in enterprises in Nepal can bring numerous benefits, but the research findings indicate several challenges impeding adoption.

- Initial investment: The stakeholders' discussions during the FGDs highlighted concerns about the significant upfront costs associated with the shift to eCooking. These expenses include investing in new cooking appliances that are compatible with eCooking technology, procuring the required eCooking appliances, and improving house wiring. For smaller enterprises, such as cafes and small restaurants with limited budgets, these costs may serve as a deterrent to adopting eCooking.
- Infrastructure and electricity supply: The need for NEA distribution system strengthening is a major concern for enterprises considering eCooking, particularly in larger enterprises with higher load requirements. Increased investment and efforts are required to improve the electricity distribution infrastructure and electricity supply to support more widespread adoption of eCooking. Additionally, for some enterprises, upgrading existing infrastructure to support eCooking may be complex and time-consuming, requiring careful planning and investment.

- Reliability of electricity supply is likely to be more of a concern for enterprises which do not own back-up diesel generators. Most restaurants typically do not own DGs whereas their use is much more extensive in hotels. Diesel is costly and has environmental issues; therefore, improving supply reliability can decrease the use of DGs can have significant financial and environmental benefits. The promotion of electric cooking can also increase the energy consumption and income of NEA which can help provide returns on the investments in distribution infrastructure. Challenges remain on the availability of land for installing transformers to supply large demand to the costumers.
- Staff training and adaptation: Enterprise staff may require training to operate new cooking appliances effectively. Resistance to change from staff accustomed to traditional cooking methods could pose challenges during the transition.

5.2 Assistance for transitioning

Assisting the transition to electric cooking in various enterprise sectors in Nepal requires a holistic approach, combining supportive measures and strategies. Stakeholders emphasized the importance of government-provided financial incentives, subsidies, or grants to help businesses offset the initial investment costs associated with adopting electric cooking, particularly for small and medium-sized enterprises with limited budgets.

Moreover, conducting training programs for chefs, cooks, and kitchen staff is vital to ensure they can effectively operate and maintain electric cooking appliances. This training will enable them to adapt to the new technologies and maximize the benefits they offer. To promote the adoption of electric cooking, organizing technology demonstrations and awareness campaigns is crucial. Such initiatives can educate enterprises about the advantages of electric cooking and address any misconceptions or concerns they might have.

A reliable and stable electricity supply is essential for the successful integration of electric cooking in enterprises. Hence, efforts to improve and maintain the energy infrastructure are of utmost importance. Additionally, supportive policies and regulations that incentivize electric cooking play a significant role in encouraging its adoption. This can include tax incentives and reduced import tariffs on electric cooking appliances, making them more accessible and affordable for businesses.

5.3 Extent of possible transition

The extent of the potential transition to eCooking enterprises in Nepal can make is likely to vary significantly due to various (often localised) factors including: the size of the enterprise, reliability and affordability of electricity supply, affordability of electric cooking appliances, and supportive government policies to promote enterprise level eCooking. Critically, the extent of the possible transition is also dependent on the technologies which can be adopted by the enterprises to match their menus and cooking practices as indicated in Table 1.

The study findings also highlight how the respondents from different enterprises have expressed varying degrees of interest in transitioning to electric cooking, with interest levels ranging from 26.32 % in canteens, 52.81 % in restaurants, 52.38 % in hotels, 31.58% in banquet, to 85.71 % in café/bakery. Larger enterprises may have more financial capability to invest in eCooking appliances and upgrade their distribution infrastructure, while smaller enterprises face more challenges due to typically more limited budgets and access to financing.

The commitment of the government in promoting eCooking and implementing supportive policies and incentives can play a significant role in determining the extent of the potential transition and helping to accelerate the adoption of eCooking technologies across various enterprise sectors. Furthermore, the availability of advanced and cost-effective eCooking appliances in the market is another factor. As technology improves and becomes more affordable, enterprises seem more likely to consider and adopt eCooking solutions.

6. Recommendations

The research findings from this study indicate clear opportunities for electric cooking transitions in enterprises in Nepal. To unlock these opportunities and increase electric cooking uptake in enterprises, the following interventions are recommended:

- Training on electric cooking: Training should be provided to the kitchen staffs to ensure proper use of electric appliances which delivers tasty food. To accelerate this process, vocational training centres and schools for chefs and hotel management should include electric cooking in the curriculum and develop eCookbooks.
- Strengthening the supply chain: Suppliers should be provided information on electric cooking appliances available both domestically and abroad. In addition, standards and testing to standards need to be implemented to ensure good quality appliances, while a significant number of technicians should be trained in repair and maintenance of such appliances to improve access to currently lacking after sales services. To support this, academic/training centres should include training of commercial appliance repair.
- Awareness and promotion: Interventions promoting the benefits of electric cooking and the availability of enterprise level eCooking appliance enterprises need to be increased (e.g. via programs and events).
- Kitchen design and construction sector: Awareness raising of the interior design requirements for enterprise level eCooking should be conducted with architects, engineers and interior designers responsible for building design. Without such sensitisation, a lack of consideration for factors such as kitchen space management, comfort of working environment, access to plug points and other electricity infrastructure is likely, impeding future eCooking transitions. Electric cooking may require several appliances and therefore space management in the kitchen is an important consideration.
- Research and development: Pilot programs should be conducted to showcase advantages of electric cooking in enterprises.
- Reliable and quality electricity supply: The power quality and reliability are major barriers to increased uptake of electric cooking. While significant investment is required to improve the distribution infrastructure and in turn improve reliability and quality, promoting electric cooking in enterprises can help provide return on those investments.

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Annex

A1. List of experts and individual Consulted during the study

- Tek Bahadur Dangi, Hotel Association, CEO
- Ram Gurung REBAN, Office Secretary
- Araniko Rajbhandari REBAN, President
- Jayanand Jha, DCS Chief, NEA
- Prakash Budha, Engineer, Lagankhel DCS, NEA
- Sher Singh Bhat, Retired DMD, NEA
- Chef and Owner of various enterprises

A1. List of the suppliers surveyed for Market Survey

- Kitchen Mart Nepal Pvt Ltd, Sitapaila, Kathmandu
- B2B Hospitality, Lazimpat, Kathmandu
- Himchuli Steel Trade Pvt Ltd, Kuleshwor, Kathmandu
- Friend's Kitchen, Anamnagar, Kathmandu
- The Yale Group, Jhamsikhel, Lalitpur

A3. List of websites for market survey

- https://www.berjayasteel.com/
- https://www.alibaba.com
- https://www.indiamart.com
- https://www.daraz.com.np
- https://www.blackanddecker.com
- https://www.philips.co.in/c-m-ho/food-preparation/food-processor/latest

A3. Participants of FGD

Arniko Rajbhandary	Manager, ND's Ice Cream & Fast Food, President, REBAN
Shayharsa Bista	Owner, Nepali Club
Sharad Dahal	Owner, Rooftop Café
Ekraj Adhikari	Owner, K-Too Restaurant land
Biplav Bhatta	Mitho Thakali Restaurant & Bar
Gana Raj Shrestha	Owner, Avocado Café
Puran B. Chaudary	Owner, MoMotarou Restaurant
Rabin Chaudary	Manager, MoMotarou Restaurant
Ram Gurung	REBAN
Anup Lal Kakshapati	REBAN
Bikash Bhattarai	REBAN Pokhara
Prabhat Yogi	WHPL/Consultant

A4. Details of Common eCooking Appliances

The market survey suggests a wide variety of eCooking technologies are available in Nepali market which are discussed below.

1. **Electrical Deep Fryer**

Source: Berjaya

An electrical deep fryer is a kitchen appliance designed to fry food by immerging it completely in hot oil or fat at a controlled and consistent temperature. The purpose of this appliance is deep frying the food. The working temperature of deep fryer is about 175 to 190 ℃. The power capacity of the appliances ranges from 2.4 kW to 11 kW indicating need of three phase supply in the kitchen as well. The initial cost varies from Rs. 30,000 to Rs. 150,000. The deep fryer is famous for frying foods like:

- French fries
- Chicken wings
- Fish fillets
- Doughnuts
- Other battered or breaded

2. **Electric Baking Oven**

Source: Berjaya

An electric baking oven is specially designed for the cooking technique of baking. Baking involves cooking food by surrounding it with dry, hot air inside an enclosed space, such an oven. Commercial baking ovens are generally supplied by three phases. The electric baking oven is applicable for cooking food like:

- Breads and pastries
- Cookies
- Pizzas
- Baked Vegetables
- Casseroles and Roasts

3. Electrical Griddle:

Source: Berjaya

An electrical griddle is used primarily for the cooking technique of griddling or flat-top cooking. Griddling is a method of cooking food on a flat, smooth, and heated surface called a griddle. The electrical griddle, also known as an electric flat-top grill, provides a large, even cooking surface that is heated by electric heating elements embedded in or below the griddle plate. The power rating of the commercial griddle varies from 3 kW to 8 kW and the price ranges from Rs. 80,000 to 5,00,000.

Following are some common dishes and foods cooked using an electrical griddle:

- Pancakes
- Eggs
- Bacon and sausages
- Burgers

- Grilled cheese sandwiches
- Vegetables
- Thin cut of meat
- Seafood
- Flatbreads and Naan

4. Induction cooktop

Source: Berjaya

An induction cooktop is used for various cooking techniques that involve direct heating of cookware using electromagnetic induction. Unlike traditional gas or electric cooktops that generate heat through a burner or heating element, induction cooktops use electromagnetic fields to heat the cookware directly. Commercial induction cooktops are generally larger in size and are of higher power capacity ranging from 2 kW to 6 kW.

Following are some cooking techniques where induction cooktop is commonly used:

- Boiling and Simmering
- Sauteing and Stir-Frying
- Pan-Frying and shallow frying
- Deep Frying
- Braising and Stewing
- Steaming
- Melting and tempering
- Sous vide
- Simmering and reductions

5. Electrical Proofer

Source: Berjaya

An electric proofer is a specialized electrical appliance used in commercial kitchens, bakeries, and foodservice establishments. The main purpose of electric proofer is to provide a controlled and

consistent environment for yeast-based dough to rise ferment before baking. The rated capacity is around 2 kW.

The electrical Proffer is used in baking process like:

- Mixing and Kneading
- Portioning and Shaping
- Proofing
- Rising
- Baking

6. **Electric Smoker:**

Source: Berjaya

An electrical smoker is used for the cooking technique known as “smoking.” Smoking is a slow and low-temperature cooking process that infuses food with smoky flavours and results in tender, flavourful dishes. Electric smokers are designed to provide a controlled and consistent environment for smoking various type of foods as:

- Meats
- Fish
- Poultry
- Vegetables

It could cost around Rs. 2,00,000 to 6,00,000.

7. Electric Salamander

Source: Berjaya

An electrical salamander is used primarily for the cooking technique of "broiling" or grilling". It is a versatile kitchen appliance commonly found in commercial kitchens, including restaurants and hotels. The electrical salamander is typically mounted on the wall or ceiling above the cooking station or range.

The electrical salamander is commonly used for following cooking techniques:

- Broiling steaks and chops
- Melting cheese
- Browing and glazing
- Toasting
- Finishing baked goods
- Reheating

A5. Financial Analysis of eCooking Transition

Investment cost of EPC (6L): Nrs. 10,000
Electricity cost per unit: NRs. 10
LPG cost per cylinder: NRs. 1895

Number of people= 5	LPG	EPC	Revised LPG	Revised cost saving
Cost of cooking rice, NRs.	3.36	2.07	4.42	2.35 (X)
Cost of cooking Daal, NRs.	6.09	2.13	8.01	5.88
			Total Saving, NRs.	8.23 (Y)

Daily Occupancy	20	30	40

	number of times EPC will be used					
	to cook rice		**to cook daal**		Equivalent 5 L EPC	
Combination of usage	**17 L EPC**	**5 L EPC**	**17 L EPC**	**5 L EPC**	**Rice**	**Daal**
20 number of people	1	1	1		4	3
30 number of people	1	2	1		5	3
40 number of people	2	1	1		7	3

Occupancy	**20**	**30**	**40**
Cost saving per day	27.04	29.39	34.09
Day per year	350		
Total cost saving per year	9464	10286.5	11931.5
Payback Period in years	3.17	2.92	2.51

IRR Calculation for daily occupancy = 20

Year	**In Cash Flow, I**	**Discount Factor (10%)**	**Discounted In Cash Flow, Id**	**Annual Out Cash Flow, O**	**Discount Factor (10%)**	**Discounted Out Cash Flow, Od**	**Difference (I-O)**	**Discounted difference (Id-Od)**
0		1		30000	1	30000	-30000	-30000
1	9464.00	0.90	8517.6	0	0.9	0	9464	8517.6
2	9464.00	0.81	7665.84	0	0.81	0	9464.00	7665.84
3	9464.00	0.73	6899.256	0	0.73	0	9464	6899.256
4	9464.00	0.66	6209.33	0	0.66	0	9464	6209.33

5	9464.00	0.59	5588.397	0	0.59	0	9464	5588.397
							IRR	6%

IRR Calculation for daily occupancy = 30

Year	In Cash Flow, I	Discount Factor (10%)	Discounted In Cash Flow, Id	Annual Out Cash Flow, O	Discount Factor (10%)	Discounted Out Cash Flow, Od	Difference (I-O)	Discounted difference (Id-Od)
0		1		30000	1	30000	-30000	-30000
1	10286.50	0.90	9257.85	0	0.9	0	10286.5	9257.85
2	10286.50	0.81	8332.065	0	0.81	0	10286.50	8332.065
3	10286.50	0.73	7498.859	0	0.73	0	10286.5	7498.859
4	10286.50	0.66	6748.973	0	0.66	0	10286.5	6748.973
5	10286.50	0.59	6074.075	0	0.59	0	10286.5	6074.075
							IRR	9%

IRR Calculation for daily occupancy = 40

Year	In Cash Flow, I	Discount Factor (10%)	Discounted In Cash Flow, Id	Annual Out Cash Flow, O	Discount Factor (10%)	Discounted Out Cash Flow, Od	Difference (I-O)	Discounted difference (Id-Od)
0		1		30000	1	30000	-30000	-30000
1	11937.50	0.90	10743.75	0	0.9	0	11937.5	10743.75
2	11937.50	0.81	9669.375	0	0.81	0	11937.50	9669.375
3	11937.50	0.73	8702.438	0	0.73	0	11937.5	8702.438
4	11937.50	0.66	7832.194	0	0.66	0	11937.5	7832.194
5	11937.50	0.59	7048.974	0	0.59	0	11937.5	7048.974
							IRR	16%