

Bhutan Cooking Diaries 2023

*[Closing the Gap on Clean Cooking
in Bhutan]*

Department of Energy
Ministry of Energy & Natural Resources
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ABBREVIATIONS

AEAS	– Annual Environmental Accounts Statistic
BLSS	– Bhutan Living Standard Survey
CCT	– Controlled Cooking Test
KPT	– Kitchen Performance Test
LPG	– Liquefied Petroleum Gas
MECS	– Modern Energy Cooking Services
MT	– Metric Ton
NDC	– Nationally Determined Contribution
RGOB	– Royal Government of Bhutan
RMA	– Royal Monetary Authority
SDG	– Sustainable Development Goal
UNCDF	– United Nations’ Carbon Development Fund
UNESCAP	– United Nations’ Economic and Social Commission for Asia and the Pacific
WBT	– Water Boiling Test

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The DoE MoENR would also like to express our appreciation to UNESCAP and MECS for leading this study with focus to narrow the clean cooking gap in Bhutan and recommending accelerated efforts to the Government. This study is also important to mark the potential of clean cooking technology to address indoor air pollution that causes serious hazards to public health and lead to long-term pollution free, zero-carbon and climate resilient development.

Finally, we would like to thank Mr. Lam Dorji, Thimphu for monitoring the survey process, compiling the data, carrying out the analysis and for his consulting inputs and conscientious effort in putting together this report.

Disclaimer

The authors and advisors of this study report serve in their personal capacities. The views and opinions expressed in this report are those of the individual experts participating in the assessment study and do not represent those of their organizations.



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Executive Summary

Purpose of the Project

The main objective of this study is to gain a deeper understanding of how Bhutanese households cook, and to what extent their cooking practices are compatible with cooking with electricity. In particular to:

- Increase the use of electric cooking appliances amongst those with electricity connections not currently using them for cooking;
- Increase the proportion of electric cooking amongst those currently fuel/technology stacking;
- Contribute to the transition from Liquefied Petroleum Gas (LPG) based cooking to electricity for cooking.

This project is implemented by the United Nations Economic and Social Commission for Asia and the Pacific (UN ESCAP) in collaboration with Modern Energy Cooking Services (MECS) with plans to support the Government of Bhutan to promote accelerated adoption of electric cooking technologies in Bhutan.

The project plans to implement in three-phases beginning with inception phase (Phase-1) that collected valuable information and data through support of small-scale trials of about 37 electric cookstoves and compared with the base case. This will be followed by a second phase (Phase-2) that will pilot deployment of technologies to a larger cohort of households across Bhutan based on the business models selected in Phase-1 in order to evaluate their potential for scale up. In this phase, UNCDF will be supporting the pilot project along with UN ESCAP and MECS. Finally, the third phase will provide support to the Royal Government of Bhutan in securing international fundings through appropriate

funding proposals for national scale up of electric cooking.

This report contains a few priority recommendations to take forward to the next phase.

Study Methodology

The cooking diary study was conducted on 37 households, selected from all three zones/regions covering five Dzongkhags (districts) – Gasa (north region); Punakha, Wangdue, and Thimphu (central-west region); and Chhukha (south region). The selected households (HHs) include both urban, peri-urban and rural areas.

For the testing phase (Phase-1), quality data collection was essential. Therefore, the participants selected in this phase would be essential and were selected from the energy/power sector for the following reasons:

- i) People in the energy/power sector are aware of the importance of quality data collection.
- ii) These HHs will also have proper electricity wiring and safety aspects addressed and can even provide feedback on safety aspects of the electric cookstoves.
- iii) Having technical people doing the cooking tests, the data collection can be done online (via google sheets) for the ease of data collection and compilation.

The survey was carried out following the “Cooking Diaries version 3.0 Protocol 2019” [MECS, 2019] which works toward a global standard protocol. The study began with a registration survey designed to obtain the identified household’s consent, capturing basic information on who they cook for, the appliance they used and why.

The study was divided into two stages. In the first stage, each sample household was provided with plug-in energy meter and weighing scale to record the energy consumption during cooking. The households were asked to cook their dishes with business as usual for two weeks to establish baseline data. In the second stage, the participating households were provided with ecook stoves (energy efficient induction cooking stoves), with built-in data recorder supplied by ATEC, together with 2 numbers of induction friendly steel pots. The households were encouraged to switch to cook their dishes using ecook stove to the extent possible for four weeks. The study ended with conducting an exit survey to gather participants' views on their experiences of cooking with ecook stoves, easiness of cooking different dishes on ecook stove, and any alteration of food taste, etc..

Cooking Diary Survey Result

The cooking diary data was analyzed following the "analysis framework" published by MECS [MECS, 2021] and followings were the broad outcome of the survey results:

- (i) In the first stage, 1,374 heating events were recorded over a period of 2 weeks. Whereas in the second stage, collected about 1,995 heating events over a period of 4 weeks. Of the total heating events, more than 83 per cent planned to cook single dishes and less than 11 per cent cooked two dishes simultaneously while preparing a meal. Breakfast and dinner appeared to be most commonly cooked meals. Less than 13 per cent consumed zero energy meals either brought from a restaurant or friend/family members' place. The foods were catered to a family size of three on average. About two-third of the events were cooked by females.
- (ii) The two common cooking fuels were electricity and LPG. The electricity turned out to be the primary cooking fuel. The average per capita energy consumption decreased from 0.63 to 0.14 when transitioning from first stage to second stage, due to the higher efficiency of ecook stoves. The overall average daily energy consumption also reduced from 33.06 kWh/day to 14.79 kWh/day as well.
- (iii) The cooking data showed rice was cooked only using a "rice cooker" and a "water boiler" was used to heat and purify water for drinking. There was no record of using stoves to cook rice or heat water for purification for dinking in both stages of the study.
- (iv) The result showed the Bhutanese community generally start cooking meals from fresh and do not have habit of consuming partially cooked food. The reheating of pre-cooked food was common within the office going family. The cooking process for preparation of Bhutanese dish were more of boiling/steaming followed by wet fry. Introduction of ecook stove had not changed the cooking process.
- (v) The participants found easy to cook pancake, meat and vegetables; easy to control heat, clean and able to multi-task while cooking on the ecook stove.

Hence, cooking diary results showed the households' willingness to adopt new cooking technologies without barriers. Thus, the government's mandate to substitute LPG with electricity as primary cooking fuel can be easily achieved, if the Government can strategically bring appropriate cooking technology interventions into the market with policy support.

Recommendation

This cooking diary data provided some useful information to carry forward as feedback or lesson when formulating the nationwide roll-out implementation plan for ecook stove.

ii) **Re-assessment of internal house wiring load carrying capacity:** In the rural households based on the past development status, the utility company assumes only 2kW as overall load demand of each household when designing the rural electrification. Accordingly, the internal housing wires were sized. Now with the introduction of more and more new electrical appliances in the rural households, electrical load carrying capacity may need re-assessment and correction.

iii) **Advocacy strategy:** There is a need to develop communication strategies to create public awareness on the significant economic and social benefits of increased use of energy efficient cook stoves. Participants informed, for the older and uneducated users, some form of user training or advocacy may be essential for faster uptake of the stoves. The training supplemented by brochures showing ideal setting and indicating desired cooking setting for each dish may be desirable.

iii) **Utensil's Steel Grade:** The CCT results showed that selecting correct steel grade for the outer layer of the bottom base plate of the pot was key to achieve intended energy efficiency when cooking on ecook stove. Thus, in the nationwide ecook stove roll-out program, may include distribution of set of steel pot size (2lt, 3lt, 4lt, and frying pan) made from 430 grade stainless steel or find alternative innovative ways to make aluminum pots compatible with ecook stoves.

iiv) **Technical Backup Support:** Need to establish industrial partnership between principal suppliers and the local suppliers for improving market access and quality services. There is also a need for skill transformation programs and career advancement opportunities in ecook stoves.

1: Introduction and Background

1.1 Context of Project

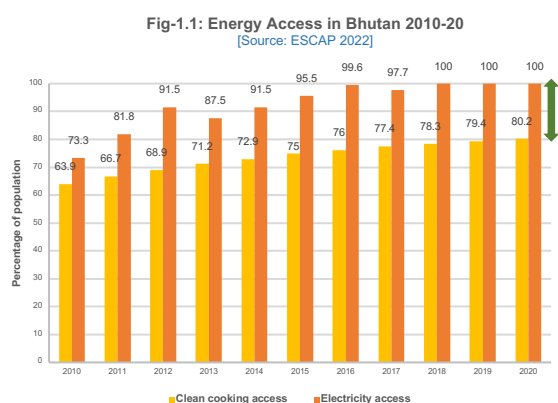
Clean cooking access has remained as one of the most elusive targets under SDG 7. UN ESCAP estimates that approximately 21 per cent of the Asia-Pacific region’s population will remain without access to clean cooking in 2030¹. While many countries have reached 100 per cent access to electricity from renewable sources, this has not been reflected in the clean cooking area (SDG target 7.1). Bhutan represents a good example of the gap between electricity and clean cooking access. Bhutan achieved universal access to electricity in 2018 but access to clean cooking has reached only 80.2 per cent as of 2020 (Fig-1.1). Therefore, there is a need for more comprehensive policies, strategies and targeted financing to achieve the SDG 7 target on universal access to clean cooking and realize its manifold benefits across health, air pollution, poverty, gender equality, climate change, and productive economic activity. UN ESCAP has partnered with the Royal Government of Bhutan to produce a Road Map [ESCAP, 2022] to achieve the SDG 7 targets and released in 2022. This highlights the clean cooking gap in Bhutan and recommends the Government’s accelerated efforts in this area.

1.2 Project Implementation Design

The clean cooking analysis report offers several recommendations. Amongst these are to increase consumer choice for clean and highly efficient cooking technologies to significantly expand use of electricity for cooking.

UN ESCAP, in collaboration with the Modern Energy Cooking Service (MECS) plan to support the Royal Government of Bhutan to promote accelerated adoption of electric cooking technologies in Bhutan through a phased approach to identify the optimal electric cooking technologies for Bhutan and demonstrating their use through a pilot deployment of MECS-funded technology trial for selected households. The project is planned to be implemented in three-phases, beginning with the inception phase that collected valuable information and data through support of small-scale trials of about 37 electric cookstoves and compared with the base case. This will be followed by a second phase that will pilot deployment of technologies to a larger cohort of households across Bhutan based on the business models selected in Phase-1 in order to evaluate their potential for the scale-up. Finally, a third phase will provide support to the Royal Government of Bhutan to develop a funding proposal for national scale-up of electric cooking.

The project will draw on the MECS theory of change for the promotion of electric cooking within individual country contexts.



¹ The statement is referred to in the Project Concept Note for Project “Closing the gap on Clean Cooking in Bhutan” dated March 2023.

1.3 Report Structure

This report covers first phase activities of the project undertaking development of a “*Cooking Diaries*” which provides a template to gather data on ability to cook dishes, taste, time, energy consumption, etc., from small-scale trials of 37 electric cookstoves and compare with the base case.

The report consists of five sections. Section 1 provides overall project background, the project implementation design and their expected outcomes. Section 2 describes briefly the aim of the study, the study methodology, study setup, data collection and recording forms, adopted in designing the “*Cooking Diaries Protocol*”. This section also provides rationale on selection of study area, household selection, and cooking appliances outlook gathered from the registry survey. Section 3 briefly explains the methodology of how accuracy of the field data was checked and highlights their limitations. Section 4 is the main part of this report and describes the cooking diary survey data analysis and presents comparative results of the study. It also captures the opinion of the participants collected at the end of the survey. The report finally concludes with conclusion statements and provides a way forward statement as recommendation.

2: Cooking Diary Development Process

2.1 Aims of the Study

The aim of this report was to gain a deeper understanding of how Bhutanese households cook, and to what extent their cooking practices and preferences were compatible with cooking with electricity. In particular to:

- Increase the use of electric cooking appliances amongst those with electricity connections not currently using them for cooking;
- Increase the proportion of electric cooking amongst those currently stacking;
- Contribute to the transition of other users from Liquefied Petroleum Gas (LPG) to electricity for cooking.

2.2 Study Method

To date, international improved cookstove tests focus on the Water Boiling Test (WBT), and the Kitchen Performance Test (KPT). None of these tests are designed to give key insights into how a cook cooks, and whether, when they transition to a different fuel or appliance, their cooking practices change.

The survey was carried out following the “Cooking Diaries version 3.0 Protocol 2019” [MECS, 2019] that captures some of the learnings gathered during implementation of the “Cooking Diaries” methodology which works toward a global standard protocol. This protocol document was authored by Dr. J Leary, Dr. S. Batchelor and Dr. N. Scott and with support from many other experts. This protocol seeks to match the recording of how people cook with quantitative measurements of energy consumptions following mixed methods. Following this mixed methods approach, cooking diaries study was designed to explore deeper into unique cooking practices of individual households in Bhutan.

The overall cooking diary data analysis was carried out following the analysis framework published by MECS in 2021 [MECS,2021].

2.2.1 Study Setup

The Department of Energy selected 37 households to participate in the study, based on the areas they live and their willingness to record high quality data for the duration of study.

The study began with a registration survey designed to obtain a household's consent, capture basic information on who they cook for, the appliance they used and why. To ensure recording quality data, each selected sample household was provided with a plug-in energy meter to measure electricity consumed and weighing scale to weigh the LPG cylinder and wood fuel, if used. The selected households were also briefed about the objectives and purpose of the study and explained how to complete the cooking diaries form and showed how to measure electricity energy using plug-in meter.

The study was divided into two stages. In both the stages, the participants were asked to keep recording in the electronic “Cooking Diary Form” what type of food they cooked, how they cooked it and for how long, no matter which fuel they used. To generate cooking data, the cooking person was asked to record what they cooked, cooking process, cooking time, weight of LPG cylinder/wood, or energy meter reading before and after cooking for each dish.

In the first stage, two weeks were spent in generating business-as-usual baseline data allowing the participants to cook their dishes as normal using whichever fuel they want; and in four weeks of second stage, the participants were distributed with energy efficient induction stoves (ecook stove) and encouraged to use supplied ecook stoves to cook their daily dishes to the extent possible.

The participating households were visited every two weeks to monitor and ensure the quality data was recorded.

The paper records kept with the participants' households were transcribed into digital form using an Excel Sheet and analyses were also performed in Excel itself.

The study ended taking exit survey to gather participant's views on their experiences of cooking with ecook stove, easiness of cooking different dishes on ecook stove, any alteration of food taste, etc.

2.2.2 Study Area & Household Selection

Bhutan is a small landlocked country, situated between China and India with a surface area of 38,394 sq.km. It has east-west dimension stretching around 300 km and 170 km at its maximum north-south dimension². Bhutan is one of the most rugged mountain terrains in the world. The country is divided into three distinct climate zones: alpine (north region), temperate (central), and subtropical (southern hills) zone.

For the cooking diary study, the selected sample households cover all three zones reaching five Dzongkhags (districts) – Gasa (north region), Punakha, Wangdue, Thimphu (central-west region), and Chhukha (south region) with following sample size.

Location	No. of Participants
Gasa	5
Lobesa, Punakha	4
Rurichhu, Wangdue	3
Thimthrom	12
Chhukha	4
Rinchentse, Chhukha	4
Pasakha, Chhukha	3
Phuensthsoling Throm	2
Total	37

The households selected include both from urban, peri-urban and rural areas.

The participants selected with good understanding of energy matters so that they are able to assess the safety and quality of internal electrical house wiring to use with ecook stove. The list of participants is in Appendix-1

2.2.3 Data Collection & Recording Form

For six weeks, the 37 households kept recording what, when and how they cooked, and energy consumption for every heating event throughout the day. Three survey forms as presented in Fig-2.2.3 were used to record data for the study.

Registration Survey Form	Cooking Diary Form	Exit Survey Form
Participants' general households' information & cooking habit data	Data on food cooked; coking process and time; used appliances; energy	Participants' feedback on study, and electric cooking

Fig-2.2.3: Forms used during cooking diary study

The detailed “cooking diary form” as in Appendix-2 was designed to capture information at meal-level in both stages. The google form was prepared to collect the data online. Two other surveys were conducted with a predefined set of questionnaires as in Appendix-3 (registry survey) and Appendix-4 (exit survey).

2.2.4 Cooking Appliances Outlook

The most common cooking appliances observed in the sample households during the registry survey were tabulated in Table-2.2.4 below.

RICE COOKER	ELECTRIC STOVE
WATER BOILER	INDUCTION STOVE
CURRY COOKER	LPG STOVE
	MICROWAVE

² Source: Statistical yearbook of Bhutan 2022

The above findings agree well with the findings of the 2022 Bhutan Living Standard Survey report, prepared by the National Statistical Bureau, Thimphu. Almost all the households in the country own a rice cooker (98 per cent). More than 85 per cent of households own a curry cooker (86.8 per cent), water boiler (85.6 per cent) and stove (87.2 per cent). 15 per cent of households own a microwave oven.

3: Cooking Diary Field Data Check

3.1 Common Errors

Some of the common errors crept into cooking diary datasheets were:

- a) **Missing & Duplicate Data:** Some of the participants had left the data fields incomplete. The participants were approached and common explanations or reasons provided for such incidents were mainly due to weak internet connectivity or disruptions when punching the data in online form. Such an event had also caused double entry of the heating event. The missing and duplicate records were identified and deleted after validating with the participants.
- b) **Time Format:** Despite repeated emphasis made to the participants to use 24 hours format, participants still used the 12 hours format mixed together with AM/PM confusing and making it difficult to identify. The times were made to enter using an automatic time stage.
- c) **Cook Name:** In many events, cook names were missing and on a few occasions, household identification numbers were missing as well. The initial master name list and their household identification number were referred and updated.
- d) **Dish Name:** The names of the dishes were not recorded clearly when left to the participants to enter as text format. The list of popular dish items cooked in Bhutan were prepared and a dropdown list was created in the form for the participants to select.
- e) **Selection of Electric Utensils:** Checks for correct selection of electric utensils to cook the selected dishes were performed. Some participants had chosen “Rice Cooker” to cook

curry and tea which were practically impossible. In such cases, the participants were consulted and information corrected.

Many of these errors were ironed out by conducting quality checks on the form within 4-6 days of commencing data collection, coaching participants, and improving the survey form.

3.2 Data Accuracy Check

This accuracy check was performed mainly to look for obvious mistakes made by participants when entering into “Google Form”. The checks were carried out for each household.

- a) **Electricity Meter Readings:** Two accuracy checks were performed on electric energy consumption levels. First, checked meter reading follows on from one dish to another. e.g by checking if dish-1 end reading was the same as dish-2 start reading. The second test was checked for repetitive energy consumption of the same dish and any consumption found unreasonably high was investigated e.g. when cooking rice for a few households had taken approximately 0.5kWh but other households had taken 0.2kWh.
- b) **Other Fuels:** Calculated the fuel used by subtracting weight at end of meal from weight at start of meal, then looked for unreasonably high or low values and investigated and when consumption values looked unreasonably high, were deleted. Few occasions observed where the initial and final weight of the LPG readings were same and for some even not recorded. These events were deleted.

3.3 Limitations

- a) Some households entered the data very casually, either they left half-way of entering data or not complied with the instructions while entering the data causing enormous challenges in data checks. In the screening process, it might have omitted or deleted useful information.
- b) Not all records had valid energy consumption data. At the other end of the scale, there were records where foods had been cooked but the beginning and end fuel readings were the same. Those were assumed to be errors and the consumption data were deleted.
- c) Participating households used an electric extension board to plug-in a rice cooker, curry cooker, water boiler, and electric stoves to carry out simultaneous cooking events to minimize time in the kitchen. For this experiment, only one plug-in energy meter was provided to each household. Thus, the energy consumption record for a single dish might also include partial energy consumption of other devices used.
- d) Most types of utensils/pots available in the individual households were not compatible to use with supplied ecook stoves. Some were compatible with generic induction stoves but the steel used in the pots was not of 430 grades, as needed for these ecook stoves. Thus, impacting energy efficiency. Supply of steel pots with ecook stoves might have enabled wide use of the induction stove as well.
- e) Participants expressed difficulties in accurately measuring the weight of the LPG consumed with the type of weighing scale provided. Some weighed LPG cylinders with regulators

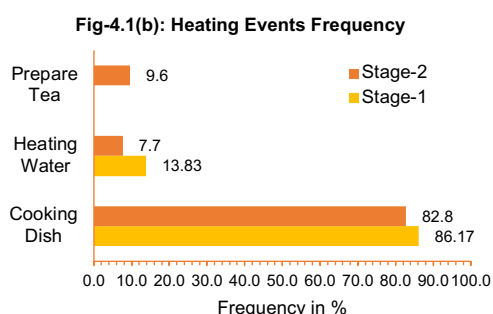
attached and some took weight keeping the weighing scale in the inclined position; seriously affecting the accuracy of the measurement.

4: Cooking Diary Field Data Analysis

The overall cooking diary data analysis was carried out following the analysis framework published by MECS in 2021 [MECS,2021].

4.1 Overview of Cooking Diary Data

- a) **Data Size:** In the 1st stage, 1,374 heating events were recorded over a period of 2 weeks. In the 2nd stage collected about 1,995 heating events over a period of 4 weeks.
- b) **Heating Events:** Of the total heating events, 86 per cent planned to cook dishes in 1st stage against 83 per cent in 2nd stage as illustrated in Fig-4.1(a). The decrease in percentage was caused by segregating “preparation of tea” as a separate heating event in 2nd stage. In 1st stage preparation of tea was considered as part of a cooking dish event as well as heating water event.



Of the total dish cooked events, less than 7.0 per cent carried out parallel cooking activities in 1st stage and increased to about 11 per cent in 2nd stage as shown in Fig-4.1(b). Mostly, curry and tea or curry and baby food were cooked simultaneously.

Fig-4.1(b): Simultaneous Two Dishes Cooking Trend

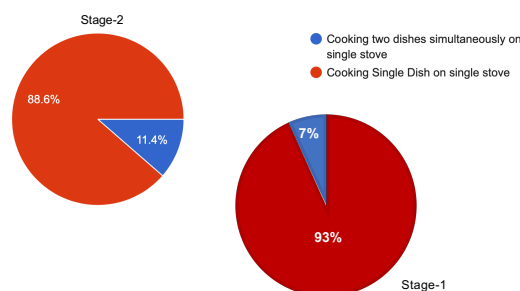


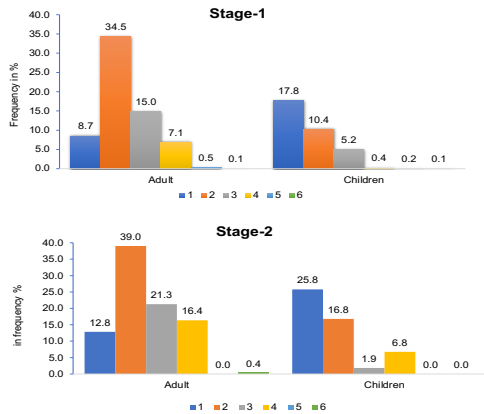
Table-4.1 shows the frequency by types of heating events. Breakfast and dinner appeared to be the most commonly cooked meals in both the study stages.

Heating Events	Frequency in %	
	Stage-1 (n=1374)	Stage-2 (n=1,995)
Breakfast	35.85	29.9
Lunch	22.67	27.4
Dinner	35.93	39.8
Snacks	3.46	2.5
Baby Food	1.05	0.5

Small number of cases (less than 13 per cent) consumed zero energy meals in both phases. The meals were either brought from a restaurant or obtained from friends/family members’ place.

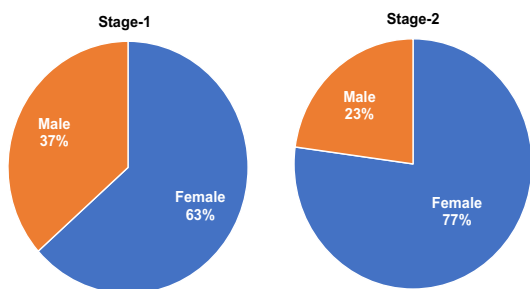
- c) **Household Composition:** Fig-4.1(c) shows by frequency the number of people catered for adults and children in both the study stages. The frequency data showed the food was mostly cooked to cater to the family size of 3 (2 adults and 1 child) members in both the study stages. The household composition had not changed significantly over the survey period.

Fig-4.1(c): Dish Serving Family Size



d) **Cook's gender participation:** In the 1st stage of study, 63 per cent participants to cook meals were female. This ratio increased to 77 per cent in the 2nd stage. The male participation in the 2nd stage decreased to 23 per cent against 37 per cent in the 1st stage as illustrated in Fig-4.1(d).

Fig-4.1(d): Cook's Gender Ratio



4.2 Energy Consumption

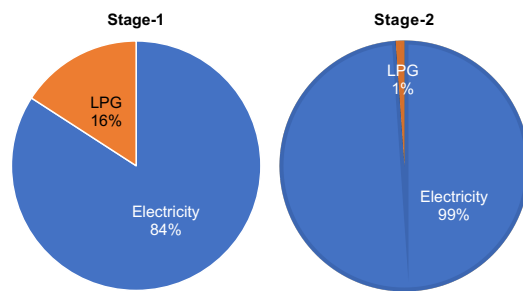
The energy consumption for each fuel was plotted.

4.2.1 Type of Fuel Used

The type of fuels used to cook during the entire experiment is presented in Fig-4.2.1. Two common fuels used for cooking appeared electricity and Liquefied Petroleum Gas (LPG) and electricity turned-out to be a major cooking fuel used. In the 2nd stage, the share of use of electricity as cooking fuel increased by 15 per cent compared to the 1st

stage study period as was intended in the design of the experiment.

Fig-4.2.1: Cooking Fuel Choice

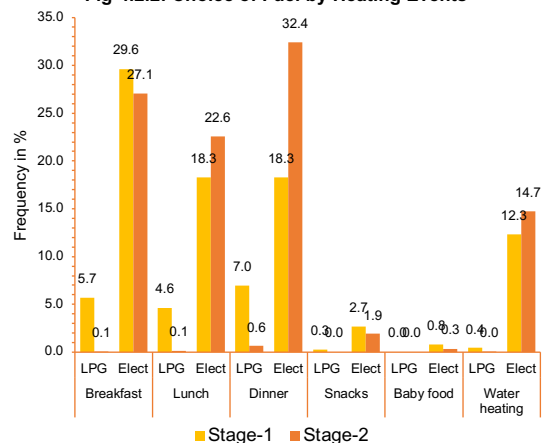


In many cases, the participants indicated that LPG fuel was used as stacking fuel to allow parallel cooking of dishes and to reduce cooking time, particularly in preparing breakfast when kids need to attend school.

4.2.2 Choice of Fuel by Heating Events

Fig-4.2.2 compares the choice of fuels used for cooking different events in the 1st stage and 2nd stage study. This chart presents the number of occasions (or cases) in which fuels were used. It does not reflect the amount of energy used. It shows electricity was the most preferred choice of source of energy for cooking meals. The frequency of use of electricity increased for preparing lunch and dinner and for boiling water in the 2nd stage of the study as compared to the 1st stage. Accordingly, the frequency of use of LPG significantly reduced in the 2nd stage of the study.

Fig-4.2.2: Choice of Fuel by Heating Events

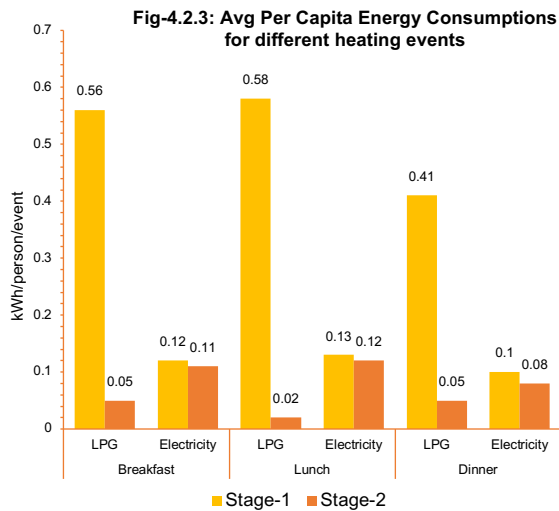


4.2.3 Per Capita Energy Consumption by Heating Events

Energy consumption is directly proportional to the number of the people being cooked for. Per capita energy consumption was calculated simply by dividing the energy consumption for the heating event by the number of people that the meal was cooked for. The adults and children have been given an equal weighting when calculating per capita consumptions.

Since the frequency of preparation of snacks and baby food, being less than 3 per cent of the total sample size in both the stages of the study, the per capita energy consumption was not compared.

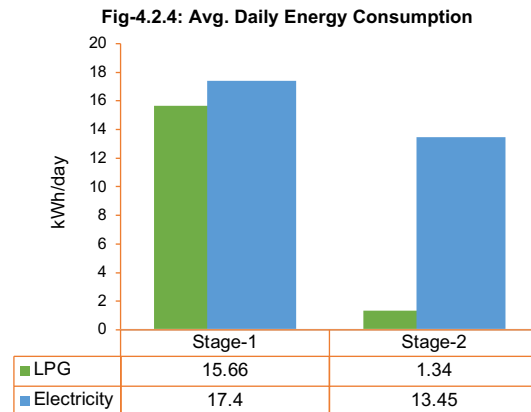
Data shows (Fig-4.2.3) that for all fuels, preparing food for breakfast and lunch were the most energy intensive heating events during the 1st stage of study.



In the 2nd stage of study period, average per capita energy consumption of LPG drastically decreased compared to the average consumption in the 1st stage of study as illustrated in Fig-4.2.3. This had contributed to decrease in overall average per capita energy consumption from 0.63 to 0.14 kWh/person/event, due to increase in use of electricity over LPG and contribution from the efficiency of ecook stoves.

4.2.4 Energy Consumption Per Day

Daily energy consumption was derived by summing up the fuels used across all events in a day, then converted to energy (kWh). The Fig-4.2.4 gives average daily fuel used and energy consumptions. In both the stages of study, electricity was consumed most, indicating electricity as the most widely used source of energy for cooking.

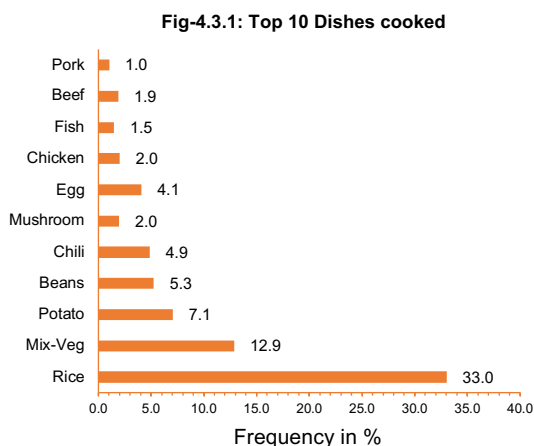


The data shows that the use of ecook stoves had reduced the overall daily energy consumption. The most significant change was the drastic reduction of LPG energy consumption from 15.66 kWh/day to 1.34 kWh/day and the overall total energy consumption also reduced from 33.06 kWh/day to 14.79 kWh/day when transiting to the 2nd stage of the study.

4.3 Dishes Cooked

4.3.1 Food Types Cooked

Fig-4.3.1 illustrates the top 10 dishes commonly cooked and frequency of the dishes cooked by the participants. Rice was the frequently cooked dish with 33 per cent share followed by mixed vegetables (12.9 per cent), and Potato (7.1 per cent). This indicates rice was the main staple food served in breakfast, lunch and dinner.



In the 1st stage of the study period, the participants were asked to enter the name of the dishes cooked, in text format rather than providing multiple options. The participants entered various local names for a single dish. Thus, impact on cooking practices, and energy consumption per dish could not be compared with the 2nd stage data.

However, the cooking process used to cook dishes indicates that use of ecook stoves will not change the frequency or allow substituting with another dish.

4.3.2 Cooking Habit

To capture the cooking habits, the participants were asked to record whether they cooked the dish from fresh, or used partially cooked food to prepare meals, or reheated the precooked food for the meal. Further, the participants were also asked to record if the dish was prepared in advance or any leftover after the meals. In both the stages of the study, the data report (Table-4.3.2) shows less than 11 per cent of the total dish cooking event represents reheating of food and 87 per cent dishes were cooked from fresh. The data also indicate after they finish taking their meals, 33 to 40 per cent of the cooked food was kept as leftovers. Most of the reheating meals were consumed during lunch time. Rice and curry were mostly reheated. There was an indication of slight decrease in trend

in the 2nd stage study period as seen in Table-4.3.2, but it was not significant.

Table-4.3.2: Cooking Habit Event

Event	Frequency in %	
	Stage-1 (n=1375)	Stage-2 (n=1995)
Dish Cooked from		
● Fresh	87.1	87.2
● Partially cooked food	1.7	1.7
● Reheated pre-cooked food	11.2	11.1
Any leftover after meal		
● Non	53.79	60.3
● Leftover	40.0	33.0
● Cooked meal in advance	6.1	6.7

The meal consisted of multiple foods and it was not possible to determine which food was reheated.

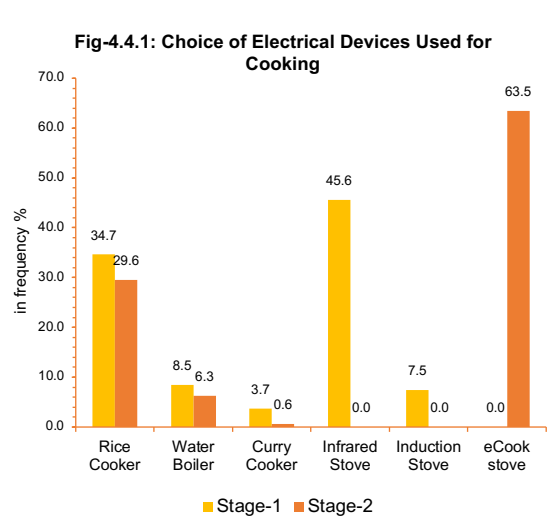
4.4 Cooking Devices

Participants were asked to record the following information on how they cooked:

- Cooking appliance used i.e. what type of stove
- Type of cooking pot/utensil
- How they used the lid.
- Cooking process used e.g. fry, boil, etc.

4.4.1 Appliances Used for Cooking

There were multiple electrical devices used in the kitchen. Participants were asked to record the information on electric appliances used to cook individual foods. Fig-4.4.1 shows the infrared stove as a popular choice (46 per cent) for cooking their daily dishes and only 7 per cent used induction stove to cook dishes in the 1st stage of study period. However, in the 2nd stage of study period, the infrared stove was completely replaced by ATEC's ecook stove. Thus, the induction stove use increased drastically from 7 per cent to 63 per cent (including ecook stove). This increase was mainly facilitated by supply of induction friendly steel pots with ecook stove.



Throughout the experiment period, the rice was being cooked using the rice cooker and almost the entire water was heated using a water boiler.

A few cases were recorded using microwave appliances to heat the food in the 1st stage of study period.

4.4.2 Utensils Used for Cooking

In the survey form, the need to record details of types of pots they used where not specified. However, participants were asked to record the characteristics of the utensils they used from the dropdown list. Table-4.4.2 shows the frequency of usage of different size utensils in the 1st stage and the 2nd stage of study. It is clear from the table that the participants prefer medium and big surface pots to cook their food.

Table-4.4.2: Utensils used to cook food

Utensils	Stage-1	Stage-2
Frying pan	3.3%	2.4%
Surface big	20.5%	11.2%
Surface medium	67.4%	80.8%
Surface small	8.8%	5.7%

For this survey, the pot size was defined as:

- Surface big – bottom pot flat surface diameter greater than 20 cm;
- Surface medium – bottom pot flat surface diameter between 10 – 20 cm; and
- Surface small – bottom pot flat surface diameter less than 10 cm.

The size of two induction friendly steel pots distributed with ecook stoves in the 2nd stage, falls in the category of “Surface medium”. For this reason, the frequency of use of medium size utensils increased by 13 per cent in the 2nd stage of study period as most of the utensils they owned previously were not induction friendly.

4.4.3 Use of Pot Lid

The participants were asked to record if they closed the pot lid while cooking and Table-4.4.3 shows the comparison on frequency of closing the pot lid while cooking. From the table, it is clear that the participants had not significantly changed their cooking habit when transitioning from the 1st stage to the 2nd stage.

Table-4.4.3: Use of pot lid while cooking

	Stage-1	Stage-2
No	17.8%	12.5%
Sometimes	26.0%	30.1%
Yes	56.2%	57.4%

4.4.4 Cooking Process Adopted

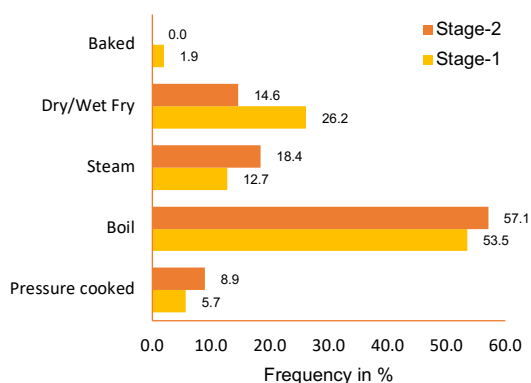
The data showed most of the dishes were cooked adopting following cooking processes as illustrated in Fig-4.4.4.

- Pressure cooking
- Boiling
- Steaming
- Dry/deep fry, and
- Baking

Pressure cooking was commonly used when preparing meat and dal dishes which require long cooking hours. The vegetable dishes were cooked first boiling till it was cooked and following wet frying. The steaming cooking process was used to cook rice using a rice cooker.

Fig-4.4.4 shows a comparison on change of cooking process followed which had not significantly changed when transitioning from the 1st stage to the 2nd stage of the study.

Fig-4.4.4: Cooking Process Adopted



4.5 Cooking Time

4.5.1 Cooking Time of Day

It was observed that breakfast preparation started as early as 6 am and continued till 8 am. Most of the lunches were cooked between 11:30 am and 12:30 pm, depending on the type of dishes cooked, to serve between 1 pm and 2 pm when the office breaks for lunch. The dinner cooking time significantly varies across households. Some households prefer to take early dinner while few others take late dinner around 9:30 pm. Thus, dinner preparation has a long cooking period starting from 5 pm till 9 pm. There was not much shift in the cooking time pattern between the two stages.

4.5.2 Time Taken to Prepare Meal

The comparative analysis on time taken to prepare meals using different fuels was not carried out mainly due to findings of inconsistency in the data caused by the following events.

- Same dish was cooked on multiple devices, i.e. curry cooker, LPG, induction, infrared stoves; using different cooking processes, like steaming, boiling, pressure cooking, and dry frying; and catering to different family member sizes.
- The time recorded showed inconsistency e.g. cooking time of bean took between 10 min and 55 min on infrared stove; between 2 min and 58 min on LPG stove, etc.

- Inconsistency was observed when correlating energy consumption values with time.

4.6 Water Heating

As illustrated in Fig-4.1(a) above, in the 1st stage of study, about 14 per cent of events recorded water heating against 7.7 per cent in the 2nd stage. The overall decrease in frequency was caused by segregating the preparation of tea from water heating in the 2nd stage study period.

The purpose of heating water was to prepare tea and for purifying drinking water. In the 2nd stage of study period, about 9.6 per cent of the total water heating event was for preparation of tea. Tea was mostly prepared during breakfast and snacks periods. It took about 10 min to prepare tea with average energy consumption of 0.07 kWh.

A water boiler was used to heat and purify water for drinking. On an average it took 30 min to boil the water with average energy consumption of 0.23 kWh.

4.7 Exit Survey Response

At the end of the experiment, set of questions were shared with the participants through email and also conducted focus group discussions to collect opinion on the survey exercise, in general, and particular feedback on experiences of using new cook stoves. The participants' feedbacks/opinions are summarized below:

- ⇒ The participants strongly agree that it was easy to control heat, easy to clean, and able to multitask while cooking on ecook stove. They experienced ecook stove has less chance to burn the food as burner heat can be regulated.
- ⇒ The participants strongly agree that because of steel pots shared with the ecook stove, it significantly increased the usage of ecook stoves during the experiment period. Because, most of

- the pots available in their kitchen were not compatible to use with ecook stoves. This would have impacted on the frequency of ecook stove usage.
- ⇒ There was a mixed reaction amongst the participants when asked on the adequacy of the supplied pot sizes. About 70 per cent agreed that the pot sizes were adequate but all participants responded that only two pots were not adequate to meet the cooking demand.
 - ⇒ When asked how easy it was to cook pancake/chapati, meat and vegetables; almost all the participants strongly agreed different meals can be easily cooked with the ecook stove. In terms of taste, very few expressed the smoky taste was missing.
 - ⇒ Comparative questions were asked on the best and worst things about cooking with electricity and LPG. All participants agreed that the best thing about electricity was its clean energy source, more safety as heat can be easily regulated, smokeless, and easy to clean the stoves when cooking. In this experiment, participants realized that cooking with electricity was cheaper than cooking on LPG. The downsides of electric stoves were too noisy when cooking; and electricity grid supply disrupts frequently during cooking periods and sometimes this forces people to skip the meal particularly in the rural areas. The LPG was good as it does not produce noise during cooking and electric supply interruption has no influence on cooking. Some participants expressed that food cooked on LPG was tastier than cooked on electricity. However, they mentioned that difficulties were faced in the distribution supply chain and handling of LPG cylinders, especially in the rural areas.
 - ⇒ As set of questions was designed to get feedback on ATEC's ecook stove from user friendly prospective. Participants informed that it was a bit tricky as a first-time user but was able to learn to cook on ATEC stove easily over a week. They also shared it would be much easier for the educated and young generation to learn to use the ecook stove by themselves. However, for the older and uneducated users, some form of user training or advocacy may be essential. The training supplemented by brochures showing ideal setting and indicating desired cooking setting for each dish may be helpful for faster uptake of the stoves.
 - ⇒ One thing about the change in design of ecook stove, participants recommend to reduce the noise of stove when in use, and make "picture model" selection for easy use like the one available with "Electric Pressure Cooker". However, about 35 per cent participants agree the current numbering selector were convenient.
 - ⇒ In the experiment period, of the 40 stoves supplied, one single burner stove was found defective before being put to test. Another one single and one double burner stove failed during the experiment period. Some participants pointed the concerns on the durability and the technical backup services availability. It may be important for ATEC to initiate discussions with the local suppliers on how to provide after sales services to scale up in the domestic market.

5: Conclusion & Recommendation

5.1 Conclusion

- a) In Bhutanese society, still more females participate actively in cooking meals for the family. About two-third of the cooking events were cooked by females in this study.
- b) The baseline data (1st stage) showed LPG (16 per cent) and electricity (84 per cent) were the two dominating cooking fuels adopted by the participants. Of the two fuels used, electricity remained a primary source of energy for cooking. This result correlates with the outcome of the Bhutan Living Standard Survey 2022 report.
- c) The cooking data showed rice was cooked only using “rice cooker” and water boiler was used to heat and purify water for drinking. There was no record of using stoves to cook rice or heat water for purification in the entire experiment period. In the 1st stage of study period, infrared stove was most popular used amongst electric stoves but the pattern changed when ecook stove was introduced in the 2nd stage along with the set of steel pots. The whole fleet of infrared stove got replaced with induction stoves resulting in reduction of per capita energy consumption as well.
- d) The introduction of an energy efficient cooking stove (ecook stove) resulted in a rapid increase of electricity use in cooking from 84 per cent to 99 per cent reducing an average per capita energy consumption of LPG from 0.52 kWh/person to 0.04 kWh/person. The daily average consumption of LPG also decreased from 15.66 kWh/day to 1.34 kWh/day as well.
- e) The result showed that the Bhutanese community generally start cooking

meals from fresh and do not have habit of consuming partially cooked food. The reheating of pre-cooked food was common within the office going family. The cooking process for preparation of Bhutanese dish being more of boiling/steaming and wet fry, introduction of ecook stove had not changed the cooking process. The participants found easy to cook pancake, meat and vegetables; easy to control heat, clean and able to multitask while cooking on the ecook stove.

- f) The participants, particularly in the rural and peri-urban areas, face challenges in getting the LPG fuel on time and with handling LPG cylinders. By learning and experiencing new comfort cooking with ecook stove, the participants not only commit to continue using ecook stove but expressed willingness to advocate and encourage other households to switch to electricity as cheap and convenient cooking fuel when used with energy efficient electric cook stoves.

Hence, the cooking diary survey and exit survey results showed households' willingness to adopt new cooking technology without any barrier. Further, all urban households and about 99.5 per cent of rural households in Bhutan have access to grid connected electricity. Thus, the Government's mandate to substitute LPG with electricity as primary cooking fuel can be easily achieved, if the Government can strategically bring appropriate cooking technology interventions into the market with policy support.

5.2 Recommendation

This cooking diary data provided some useful information to carry forward as feedback or lesson when formulating the nationwide ecook stove roll-out implementation plan.

- i) **Re-assessment of internal house wiring load carrying capacity:** In urban households, the estimate of electrical load demand and internal electrical wiring were designed and installed as per the national standards and quality monitoring by municipal and utility companies. However, in rural households it was based on the past development status. The utility company assumes only 2kW as overall load demand of each household when designing the rural electrification. Accordingly, the internal housing wires were sized. Now with the introduction of more and more new electrical appliances in rural households, electrical load carrying capacity may need re-assessment and correction.
- ii) **Advocacy Strategy:** There is a need to develop communication strategy to create public awareness on the significant economic and social benefits of increased use of energy efficient ecook stove. Participants informed that it was much easier for the educated and young generation to learn to use the ATEC's ecook stove by themselves. However, for the older and uneducated users, some form of user training or advocacy may be essential for faster uptake of the stoves. The training supplemented by brochures showing ideal setting and indicating desired cooking setting for each dish may be desirable.
- iii) **Utensil's Steel Grade:** The participants outspoke the utensils available in their kitchen were of aluminum materials and were not compatible with ecook stove. Further, CCT results showed that selecting correct steel grade for the outer layer of the bottom base plate of the pot was key to achieving intended energy efficiency when cooking on ecook stove. Thus, in the nationwide ecook stove roll-out program, may include distribution of set of pot size (2lt, 3lt, 4lt, and frying pan) made from 430 grade stainless steel or find alternative innovative ways to make aluminum pots compatible with ecook stoves. Until the solutions are not provided as part of the package, the frequency and efficient use of ecook stoves may be significantly impacted.
- iv) **Technical Backup Support:** In the supply lot, one ecook stove was found defective before the test. Whereas, during the experiment period, two more ecook stoves got damaged. The participants are concerned on its durability. A mechanism needs to be established with the "Principal Stove Suppliers" to engage the "Local Suppliers" and build technical capacity in maintenance of the ecook stoves and to provide effective after-sale-services to the customers to extend the life of the stove and to scale up in the domestic market.

6. Reference List

- 1) [BLSS, 2022] - "*Bhutan Living Standards Survey 2022*", National Statistics Bureau, Thimphu Bhutan.
 - 2) [AEAS, 2022] - "*Annual Environmental Accounts Statistics 2022*", National Statistics Bureau, Thimphu Bhutan.
 - 3) [MECS, 2019] - Dr. J Leary, Dr. S Batchelor and Dr. N Scott, 2019. "*Cooking Diaries 3.0 Protocols*", Modern Energy Cooking Services, UK.
 - 4) [MECS, 2021] - Nigel Scott, September 2021, "*Analysis Framework – MECS Cooking Diaries*", Modern Energy Cooking Services, UK
 - 5) [ESCAP, 2022] – SDG 7 Road Map for Bhutan, UN ESCAP, available at <https://www.unescap.org/kp/2022/energy-transition-pathways-2030-escap-agenda-sdg-7-roadmap-bhutan>.
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7. List of Appendices

Appendix-1: List of Households / Participants

GROUP	SI	Name	Designation	HH ID #	Email ID	Place
Group-1	1	Jigme Sherub	Head	G01	jigmesherub@bpc.bt.	Gasa
	2	Tashi Dendup	Section Officer	G02	tdendup47@gmail.com	
	3	Indra Lal Maidali	Technician I	G03	indralal370@gmail.com.	
	4	Pema Letho	Asst. Line Staff	G04	rigkhams@yahoo.com.	
	5	Kinzang Jamtsho	Asst. Technician	G05	kinzangjamtsho194@gmail.com	
Group-2	1	Sonam Tshewang	Section Officer	L01	tshewangsonam63@gmail.com	Lobesa
	2	Boning	Lineman-III	L02	boning35979@gmail.com	
	3	Mindu	Lineman-III	L03	mindutshering37@gmail.com	
	4	Namgay Dem	OS	L04	namgaydem@bpc.bt	Basochhu
	5	Tandin Wangchuk	Junior Engineer (E)	B01	t.wangchuk164@drukgreen.bt	
Group-3	6	Lok Bdr. Thapa	Foreman (E)	B02	lokbr1661@gmail.com	Thimphu
	7	Jurmi Wangchuk	Technician (E)	B03	j.wangchuk152@drukgreen.bt	
	1	Karma P Dorji	Director, DoE	T01	kpdorji@moenr.gov.bt	
	2	Ugyen Rinzin	Engineer	T02	ugyenrinzin@moenr.gov.bt	
	3	Dechen Dema	Executive Engineer	T03	dechend@moenr.gov.bt	
	4	Damchu Dema	Executive Engineer	T04	ddema@moenr.gov.bt	
	5	Dawa Zam	Executive Engineer	T05	dzam@moenr.gov.bt	
	6	Chencho Bidha	Operator	T06	chenchobidha@moenr.gov.bt	
	7	Ugyen Chopel	Executive Engineer	T07	uchopel@moenr.gov.bt	
	8	Sonam Gyeltshen	Executive Engineer	T08	sgyeltshen@moenr.gov.bt	
	9	Ugyen	Chief Engineer	T09	ugyen@moenr.gov.bt	
	10	Kuenga Choden Dorji	Dy. Executive Engineer	T10	kcdorji@moenr.gov.bt	
11	Sonam Tshering	Officiating Chief	T11	sonamtshering@moenr.gov.bt		
12	Pema Thinley	Engineer	T12	pemathinley1@moenr.gov.bt		
Group-4	1	Choney Wangmo	Foreman (E)	C01	c.wanhmo1658@gmail.com	Chukha
	2	C. K Bhattarai	Foreman (E)	C02	chandra360bhattarai@gmail.com	
	3	Tashi Yangzom	Technician (E)	C03	yangzumtshay@gmail.com	
	4	Leki Wangdi	Technician (E)	C04	l.wangdi@gmail.com	
	5	Kelzang Tobgyel	Foreman (E)	T01	k.tobgyal357@drukgreen.bt	Rinchentse
	6	Keder Nath Ghalley	Technician (E)	T02	kedarnath19892015@gmail.com	
	7	Pema Wangchuk	Technician (E)	T03		
	8	Damchen	Technician (E)	T04	d.damchen@gmail.com	
Group-5	1	Namgay Dorji	Technician	P01	namgaydorji20@bpc.bt	Phuntsholing
	2	Jitman Rai	JE	P02	jitmanrai@bpc.bt	Pasakha
	3	Tshe Wangchuk	Multitasking	P03	tshewangchuk62@gmail.com	
	4	Rinchen Tshering	Multitasking	P04	rtshering97@gmail.com	
	5	Purna Bahadur Ghalley	VEEET	P05	purnabahadurghalley3@gmail.com	

Appendix-2: Cooking Diary Handout Form

DIARY FORM: Please fill in one form every time you cook or heat water.											
Household Identification: _____								Date: _____			
Before Cooking						After Cooking					
Time: _____	LPG: _____ kg	Kerosene: _____ lts	Time: _____	LPG: _____ kg	Kerosene: _____ lts						
Electricity: _____	Charcoal: _____ kg	Firewood: _____ kg		Charcoal: _____ kg	Firewood: _____ kg						
	Biogas: _____ kg	Dung cake: _____ kg		Biogas: _____ kg	Dung cake: _____ kg						
How long to light charcoal/firewood? _____ min						Did you save any charcoal/firewood for later?		Yes	No		
Who cooked?		Name: _____			Gender:	Male:	Female:	Other:			
What did you cook/heat water for?		Breakfast: _____	Lunch: _____	Supper: _____	Snack: _____	Baby food: _____	Water heating: _____	Other: _____			
How many people did you cater for?		Adult: _____		Children: _____							
Did you serve any food that did not require cooking?		Yes: _____	No: _____			If Yes, specify: _____					
Dish 1	WHICH DISH DID YOU PREPARE?		DEVICES?		UTENSILS?	PROCESS?		LID?	FRESH?	LEFTOVER?	DURATION?
	Rice	Chicken	Rice Cooker	Electric stove	Surface big	Boil	Steam	Yes	Fresh	Non	Time spent cooking:
	Fish	Meat	Microwave	Kerosene stove	Surface med	Grill	Dry fry	No		leftover	_____ : _____
	Eggs	Pancake/chapati	Gas stove	Firewood stove	Surface small	Bake	Wet fry	sometimes	Partially		
	Chips	Pasta/noodle		Induction stove	Frying pan	Deep fry	Pressure cooked		Precooked reheated		If electric,
	Sausage	Potato									Meter reading before:
	Porridge	Mix vegetable									
	Dal	Chili									
	Momo	mushroom									Meter reading after:
	Other: _____	Other: _____			Other: _____	Other: _____					
Water 1	WHY WAS THE WATER HEATED?		DEVICES?		UTENSILS?	LID?	HEAT FORM?		SAVING FOR LATER?		DURATION?
	Drinking	Purifying	Rice Cooker		Surface big	Yes	Fresh		None		Time spent cooking:
			Microwave	Electric Stove	Surface med	No	Still worm		Some		_____ : _____
	Bathing		Gas stove	Kerosene stove	Surface small	sometimes			All		If electric,
			Induction heater	Firewood stove							Meter reading before:
			Electric kettle								
			Geyser								Meter reading after:
	Other: _____	Other: _____			Other: _____						

Source: MECS-Cooking Diaries 3.0 Protocols (Aug2019)

Appendix-3: Registration Survey Form

1. Consent

Do you consent to be part of this study? (Yes/No) _____
 Do you consent to any photos taken during this study being used in research publications? (Yes/No) _____
 Name: _____
 Signature: _____
 Contact No.: _____
 Date: _____

2. Details of participant

Age: _____	Gender: _____	Male _____	Female _____	Other _____
What is the highest level of school you have attended?				
Completed secondary: _____	High then secondary: _____	Incomplete secondary: _____		
Completed primary: _____	Incomplete primary: _____	None: _____		

3. Information on your household (HH)

- i) Location: _____
- ii) Type of area:
 - a) Urban
 - b) Peri-urban
 - c) Rural
- iii) How many people live in the HH? _____
- iv) Who cooks in your HH?

Name	Relationship to head of HH	What proportion of the cooking do they do? (50%, ¼, all)	When do they cook? (eg. lunchtime only, all meals, special occasions)

- v) How many rooms in the dwelling (bedrooms plus kitchen, bathroom, living room etc.)? _____
- vi) Type of dwelling (options to be edited to suit country context):
 - a) Traditional house
 - b) Cottage house
 - c) Concrete Building
- vii) Please record all types of cooking appliances owned (even if not used). Please take a photo of all appliances.

Type of cooking device	Brand name or local name	How many	When is it used? (Regular/ Occasion/ Never)	What do you usually use it for? (eg. Quick things in the morning, when the gas runs out, when there is a blackout, for long cooking dish)	How many hotplates/burners does it have? What is their diameter (cm)?	Power rating (w), (electric only)
					No: _____ Dia _____ cm	
					No: _____ Dia _____ cm	
					No: _____ Dia _____ cm	
					No: _____ Dia _____ cm	
					No: _____ Dia _____ cm	
					No: _____ Dia _____ cm	
					No: _____ Dia _____ cm	
					No: _____ Dia _____ cm	
					No: _____ Dia _____ cm	

viii) Fuel Measurements

- a) How often do you usually buy charcoal/wood/kerosene/LPG? _____
- b) What quantity do you usually purchase (kg)? _____
- c) How much does this cost (Nu.)? _____
- ix) All households electrical connection:
 - a) Is your meter individual or shared? _____
 - b) How much do you normally spend on average per month (Nu) for electricity? _____
 - c) How much do you think cooking with electricity would cost you per week? _____

Appendix-4: Exit Survey Form

Name: _____ Date: _____ Location: _____

1. How did the eCooker suit the way you cook in your home?

(Score: 1=strongly disagree; 2=disagree; 3=no opinion; 4=agree; 5=strongly agree)

	ATEC STOVE					INFRARED					Comments
	1	2	3	4	5	1	2	3	4	5	
It was easy to control heat											
I was able to multitask while eCooker was cooking.											
The eCooker could cook fast enough											
The eCooker was hot enough											
The eCooker often burnt the food											
All my pots fit on the eCooker's burner											
The pot it came with was big enough											
All my pots can be used on the eCooker											
The eCooker made the pots dirty											
The eCooker itself was easy to clean											
The eCooker looked good in my kitchen											
There is enough space for the eCooker in my kitchen											
Operating the eCooker was easy											
The eCooker was safe to use.											
I prefer to use an electric kettle for water boiling											

2. How easy is it to cook each food on the eCooker?

(Score: 1=strongly disagree; 2=disagree; 3=no opinion; 4=agree; 5=strongly agree)

	ATEC stove					INFRARED					Comments
	1	2	3	4	5	1	2	3	4	5	
Pancake/Chapati											
Meat											
Vegetable											

- How many burners (rings) or separate appliances do you need for cooking?
- What were the best things about cooking with electricity? And what were the worst things about cooking with electricity?
- What do you like most about cooking with LPG? AND what are the best things about not cooking with LPG?
- Do you think cooking with electricity is cheaper or more expensive than cooking with the fuels you normally use?
- Were there times when the electricity was off and you wanted to cook or heat water? If so, what did you do?
- Do you feel that cooking with the electric cooker is safer or more dangerous than cooking with your normal stove, and why? (e.g. risk of fires, burns)
- How easy is it to learn to cook on ATEC Stove compared to other electric stoves?

12. Would people need training on how to use ATEC stove, or would they be able to learn by themselves? If so, what should the training focus on?
13. If you could change one thing about the design of each ATEC stove, what would you change?
14. We are done with our survey and are leaving the ATEC stove with you. Will you continue using it or will you switch back to your old stove? If so, what will you continue to use them for?

END OF SURVEY – Please thank the HH for participating in the survey.