



**RURAL ENERGY ACCESS FOR COMMUNITIES AND HOUSEHOLDS
- MECS ECO PROJECT**

COOKING DIARIES STUDY IN MYANMAR

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The study was carried out and the report was developed by a team from Geres composed of Ma Nyo, Aung Ko Ko, Myat Lay Nwe, Minmin Han, Bernardo Sousa, Pierre Larnicol and Alexis Caujolle.

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1. EXECUTIVE SUMMARY

This report is the result of field research conducted by Geres in Myanmar on the electric cooking sector.

After a baseline study, this analysis consisted of studying the use of an electric cooking appliance, provided free of charge, by 50 selected households in 8 villages for 5 months.

The approach adopted allowed to follow the evolution of the situation over several months. Thus, it is not limited to simple surveys, "promises" or suggestions, but rather linked to real field observations over time, measurements and their analysis. This study therefore makes it possible, on the basis of experiments in real conditions, to establish scenarios for the adoption of electric cooking means by rural households connected to electricity grid in Myanmar.

Results

The study highlighted several tangible, quantitative and qualitative results:

- The adoption of electric cooking by households equipped with an appliance is rapid, global and long lasting. Participants used their equipment immediately upon obtaining it and **continued to cook with it even after several months. Although wood is still used to some extent, cooking with coal has been abandoned.** Despite some remaining issues, electric cooking is unanimously adopted and promoted by the participants.
- The main quantitative impacts of the use of electric cooking appliances are time savings for cooks (mainly women) that were measured over time, and reduced energy consumption for cooking (divided by 2 per cooking event). Gender impacts may be substantial. The impacts in terms of greenhouse gas emissions reduction, not measured in this study, are also probably significant.
- **Qualitatively, the fact that it is cleaner and easier and procures more comfort to the users are also impacts reported by the participants.** Gender-related impacts were also observed. Excluding investment costs (the appliances were given free of charge), **participants consider that electric cooking is cheaper than their previous cooking means.**

If the cooking time is faster, the time spent by the cooks monitoring the cooking is also shorter.

- **The rice cooker, the frying pan and the kettle are the most used products in rural areas.** The adoption of the rice cooker is particularly impressive (80% of the rice preparation) and is transforming the way households cook; rice being the staple of the local food.
- The switch to electric cooking has not changed households food habits. **They have kept the same menus.**

Challenges

Many challenges remain to be addressed before electric cooking becomes widespread in Myanmar:

- The country currently has an estimated 50% of the population (or approximately 26 million people) connected to the main electricity grid. The development of mini-grids remains relatively slow and the higher price of the electricity sold by mini-grids developers could represent another obstacle. As electric cooking is not an option for off-grid households, access to electricity remains the biggest challenge to scaling up the sector.
- For households connected to the electricity grid, **power cuts and other technical problems are still important.**
- Access to quality electric cooking equipment remains very low and complicated for households. Considering those connected to the grid, **the issue of access to equipment seems to be the biggest challenge.** This has several reasons from investment cost to last mile availability. These technologies may be adopted only if a sufficient number of stakeholders take up the subject and provide quality

services to the population (affordability, availability, product knowledge, product quality, guarantee, awareness, instalments, access to credit, last-mile logistics, etc.)

- **A significant proportion of the population considers that it is more dangerous to cook with electricity than with wood or coal.** Lack of knowledge about electricity, electric shocks and "fear of the unknown" make electric cooking less attractive.

In view of these results and challenges, Ah Lin Tan (an organisation created by Geres from the *REACH* project) seems to be well positioned to take an active part in the scaling up of the electric cooking sector in the Dry Zone and then in Myanmar. The participation of other value chain stakeholders will be necessary, but Ah Lin Tan has the knowledge of the issues and the keys factors of succes of the sector to ensure a consistent and efficient action. **This study has greatly contributed to strengthening the knowledge of the Geres team and therefore of Ah Lin Tan.** Aware of the richness of these lessons and the importance of this knowledge to contribute to the development of the sector, Geres wishes to share the results of this study with the greatest number of actors.



2. INTRODUCTION

Set up in 1976, Geres is an international development NGO which works to improve the living conditions of the poorest and tackle climate change and its impacts. As a grassroots actor, the energy transition is a major lever in all its actions. In order to drive societal change, Geres promotes the development and dissemination of innovative and local solutions, supports climate-energy policies and actions and encourages everyone to commit to Climate Solidarity by taking action and supporting vulnerable populations.

2.1. AIMS AND OBJECTIVES

2.1.1. GERES' PROJECT: REACH

The research action project aims at piloting a market-based last-mile distribution approach to accelerate the uptake of efficient cooking appliances in recently grid-connected villages in the rural Myanmar.

A community based and women-led network of entrepreneurs has been established in Thazi township and has currently sold more than 4,000 sustainable energy solutions such as improved cookstoves and certified solar products in non-grid-connected villages.

Around 85% of all Myanmar households still use biomass for their daily cooking needs, even in grid connected areas. Remote villages in Thazi township have benefited from a quick main grid expansion, providing an opportunity for these entrepreneurs to diversify their product mix and target new villages. Household appliances are commonly sold in rural towns but not in the villages. **These products do not comply with international quality and energy efficiency standards, most do not present any kind of energy efficiency labelling and households' awareness regarding energy efficiency is low.** Most products available are imported from neighbouring countries, and despite some having energy efficiency labelling, all are in foreign languages that neither the consumers nor the distributors understand.

The project will test the energy efficiency of the cooking appliances (electric pressure cookers, frying pans, rice cookers and kettles) available in the Myanmar market, select the most energy-efficient and safer ones, and pilot different marketing and distribution approaches to accelerate the access to efficient electric cooking appliances in rural communities.

Ah Lin Tan is a social business created by Geres, that will rely on these last-mile women entrepreneurs to disseminate sustainable energy solutions and other high-impact products to the communities. Ah Lin Tan will work as an intermediate between producers and manufacturers of sustainable energy solutions and other products to guarantee the access of high-quality, high-impact products to households and businesses in remote areas of Mandalay region and South Shan State.

2.1.2. THE COOKING DIARIES STUDY

To complete this process, a cooking diaries study will be carried out to provide an understanding on how people in Thazi Township cook and how compatible these practices are with innovative modern electric cooking appliances.

The Cooking Diaries approach developed for the MECS programme aimed to address a lack of data around how people cook, and how they might cook with electricity.

This cooking diaries experiment carried out by Geres is part of the REACH project and had the objective to generate the following types of data:

- Breakdown of meals cooked and water heated (or 'heating events');
- Individual dishes (or foods) cooked as part of a meal;
- Fuels used;
- Energy consumptions (by meal and by dish cooked);
- Etc.

2.2. CONTEXT AND BACKGROUND

2.2.1. MYANMAR

Myanmar has adopted the Sustainable Development Goals (SDGs or the 2030 Agenda) which, among others requires the country to make efforts to provide access to affordable, reliable, sustainable and modern energy for its citizens by 2030. It is also a signatory to the Paris Climate Agreement which aims at combating climate change and intensify the actions and investments needed for a sustainable low carbon future.

The country recently celebrated reaching the milestone of 50% nationwide electrification² reaching out to approximately 26 million people. Among off-grid households, 4 million have no access to electricity at all and utilize kerosene, oil and solid fuels as energy sources for lighting, cooking and other domestic uses³. According to 2017 World Bank Multi-Tier Framework report, more than half of Myanmar States/Regions are below the average grid extension rate. Five of them, namely Rakhine, Chin, Kachin, Ayeyarwaddy and Tanitharyi are below 20% grid coverage.

To increase access to reliable electricity, the Government in 2015 formulated an ambitious roadmap aiming at increasing electrification rate to reach 100% by 2030. This NEP, which is supported by significant funding

from the World Bank (USD 400 m) defines intermediate targets of reaching 47% access by 2020 and 76% access by 2025.

2.2.2. DRY ZONE

The central Dry Zone of Myanmar is home to 30% of the national population. Mostly rural, 80% of households in this region cook with traditional fireplaces, thus being exposed to health risk related to air pollution and putting greater pressure on the forest resources. Myanmar has one of the highest deforestation rates in the world, with an annual rate of 2%.

In the last years, the government of Myanmar has established the National Electrification Plan that aims at 100% electrification until 2030. The Dry Zone has been one of the first areas where the national-grid has been extended and mini-grids have been installed, giving for the first time the opportunity to these rural households to shift from biomass to electricity in their cooking. In a recent market assessment carried out by Geres (2019), **almost all households in recently connected areas have either purchased a rice cooker, frying pan and other cooking appliances or expressed their desire to do so.**

The Geres market research (2019) demonstrates there is a high demand for electric appliances from recently connected households. Rice cookers are the most prevalent electric cooking appliance purchased (73%) or planned to purchase (13%). Other electric cooking appliances have also been purchased (48%) or wished to be purchased (12%). These products are bought in nearby towns and customers need to pay up-front the full price. 70% of households use electricity for cooking, although 93% still use biomass fuels. The most common cooking method is the 3 stone (74%) and only 57% use rice cookers. Households still use biomass stoves because of the easiness to find biomass fuel, faster cooking, and the cost.

Households in this area still face some key challenges to change completely from biomass to electricity. The electricity price has more than doubled in 2019, which resulted in households reducing their electricity consumption and shifting back to cooking with biomass. **Most households consider electricity price has one of the main drivers of electric cooking.** Since most cooking appliances available in the Myanmar market, **imported from neighbouring countries, are of low energy efficiency, these have a high impact in household energy bills. However, Myanmar's government does not have a policy demanding appliances to respect minimum energy efficient standards and labelling.**

Other factors hindering the adoption of electric cooking include using traditional fireplaces for boiling water or other cooking needs such as cooking slow foods, low voltage at peak cooking hours from the main grid, and low quality of available cooking appliances which break regularly.

By purchasing high-quality energy efficient cooking appliances instead of high energy consuming ones, households should be able to spend less money on their cooking, which in turn allows them to cook with electric appliances instead of biomass stoves. This change should decrease their firewood consumption, save them time and decrease their strenuous work, primarily for women, the ones mostly responsible for firewood collection (Geres 2015 cookstoves market assessment in Myanmar).

3. METHODOLOGY

3.1. OVERALL METHODOLOGY

The research was carried out in Myanmar, in the dry zone region. This map shows where the surveys were conducted. The data collection was carried out with 50 households, in 8 different villages. The women entrepreneurs of the REACH project managed by Geres, who will join the Ah Lin Tan network (see above and 4.5.2 for more information), worked as enumerators for the data collection, as well as being participants in the study. On average, each enumerator was responsible for collecting the data from their own household and 5 to 6 other ones. The selected households live in the same village as the entrepreneur, to facilitate the data collection and to avoid potential travel constraints due to the COVID-19 pandemic.



Table 1 - List of targeted villages, entrepreneurs and households involved

Target village	Entrepreneur	Number of households involved
Ma Gyi Yoe	Hla Myint	7
Ohne Shit Kone	Thein Htwe	7
Mone Pin Sone	War Soe	7
Ma Ywal	Aye Myint	6
Tha Net Kan	Ma Khin Nan	7
Tha Min Zar Kone	Lae	5
Maung Ma Sel	Tin Nwe	7
Thone Pet Lei	Htay Lwin	5

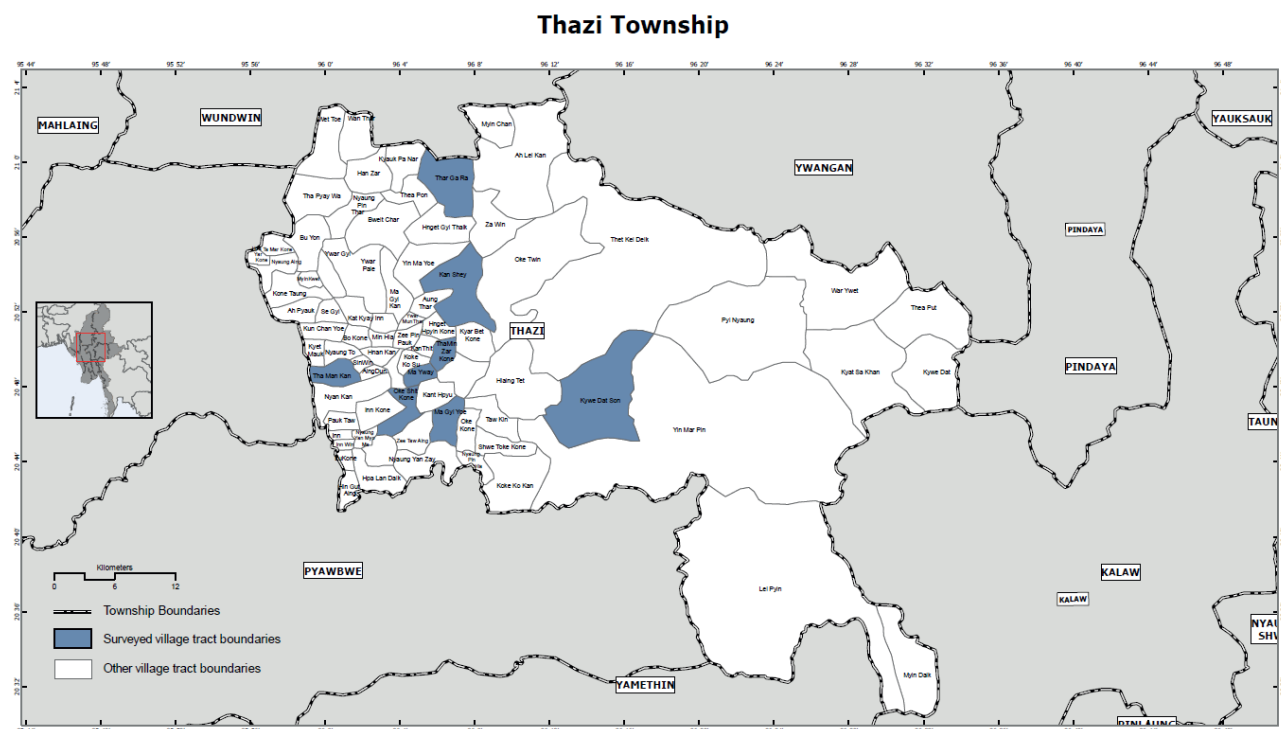


Figure 1 - Thazi Township and targeted areas

The data collection was carried out following this planning:

Table 2 - Details of the 4 phases of the study

#	Phase	Type	Start	End
1	Baseline	Intensive	06/01/2021	26/01/2021
2	Transition	Intensive	18/02/2021	18/03/2021
3	Monitoring	Light	23/03/2021	17/06/2021
4	Endline	Intensive	20/06/2021	18/07/2021
Exit survey		-	05/10/2021	14/10/2021

Details of each phase are indicated below.

To participate in the cooking diaries study, selected households had to respect some criteria, such as:

- Be a household with one main cook, not several cooks;
- The main cook agrees to participate in the study and to be interviewed;

- Households who mainly cook at home, at least 2 or 3 times a day, and only rarely eat outside;
- Cooks that are willing to learn, are organized and can write down the information needed.

3.2. APPLIANCES PROVISION AND INCENTIVES

At the beginning of the phase 2, an electric cooking appliance was given to each household. From the selected households, some already used some electric cooking appliances before the survey. The project provided an appliance that the household didn't have in their kitchen yet.

3.2.1. EQUIPMENT PROVIDED

Each household was given the following:

- 1 appliance / household, according to the household's profile and wishes. In total, 50 household appliances were distributed;
- 1 weighting scale to measure the woodfuel consumed;
- 1 plug-in meter to measure the quantity of electricity consumed.

At the end of the study, the households had to return the weighting scale and the plug-in meter.

The enumerators were given the equipment as the households, since they were also active participants in the cooking diaries study. In addition, they were also given a tablet to be able to fill out the surveys.

3.2.2. INCENTIVES

Several types of incentives for households were given:

- During training: 10,000 MMK/day, only for the main cook if they participate in all the training days;
- At the end of the study, if the participants had completed the full study, the electric cooking appliances was given free of charge;
- Each month of the study, household goods that do not affect the cooking menu were given to the households (e.g. soap, washing products, etc.)

In addition to the previous incentives, enumerators also received:

- 1000 MMK/survey/day if they collect and upload the information correctly

3.3. PHASES OF THE STUDY

3.3.1. PHASE 1: BASELINE (INTENSIVE)

The baseline establishes how households cooked before the project intervention. This is key to understand the cultural cooking processes and energy requirements before the project.

Key information to be learned during this phase: the menu, appliances and fuels used, energy measurements, fuel stacking, and cooking processes and times.

Participants have been asked not to change anything about how they regularly cook.

3.3.2. PHASE 2: TRANSITION (INTENSIVE)

The objective of this phase was to collect data on how people cooked after an electric appliance is introduced. Participants carried out the same activities as during the Phase 1, but could use the appliances given by Geres. Participants had the option to use the appliance but were not obliged to do it and could use other cooking methods if they wished.

The enumerators carried out the same activities as in Phase 1, with the same questionnaire.

3.3.3. PHASE 3: MONITOR (LIGHT)

This phase was less intensive and demanding than Phases 1 and 2. Participants needed to collect less information regarding their cooking processes. The questionnaire was less detailed than before, but this phase allowed to monitor the way people cook every day over a long period of time (around 3 months).

3.3.4. PHASE 4: ENDLINE (INTENSIVE)

Activities were the same as in Phase 2 for all participants. The questionnaire was also the same as the two first phases. It allowed to study the impact on a long-term basis and to check whether people have “definitely” changed the way they cook when a new electric cooking appliance is introduced.

3.4. METHODOLOGY EVALUATION

The overall methodology has been very well understood by the participants and the enumerators. The project implementation team was careful to implement enough training sessions to ensure the surveys would be properly carried out.

A right understanding of the processes cannot prevent human error over 6 months of surveys or the lack of rigour of some participants. The process remains quite complex as it includes the participation of several people and the transmission of information is a source of error. Data was checked by the implementation team before it was analysed. The very large amount of data collected does not allow to avoid all mistakes, some of which were still removed after analysis. The analysis phase is indeed a step that allows for some inconsistencies to be raised, but take then more time than planned.

However, enough data was collected correctly to know the main trends associated with the development of electric cooking. The fact that the long-term impact can be studied (4 months) is also particularly interesting in the context of such a research project.

From Geres' point of view, although it is flawed, the data collection could hardly be improved. It is crucial to explain from the beginning the importance of the accuracy of the data, why it is being collected and its usefulness, so that participants feel involved. But there is probably no better way to collect specifically cooking-related data in the field.

The analysis was also complicated by a decision, which is not due to the overall methodology but to its implementation. Indeed, the data was collected in different ways between phases 1 and 2 and then phase 4. While data were collected for a whole day during the first two phases, the surveys were then collected by cooking event. It means we got in the excel database:

- Phase 1 and 2: one horizontal row for all the cooking events of one specific day of one specific participant (dishes and water heating events – with the quantity of firewood or charcoal at the beginning and at the end of the day, but not the consumption for each cooking events);
- Phase 4: one horizontal row for each cooking event of each participant.

While we can understand the interest of such an approach (that is more accurate in phase 4), this methodology change complicates the analysis and does not allow for an effective comparison of the different phases. It would have been probably relevant to keep the same method for the three concerned phases. **This is all the more annoying as the interest of absolute figures (phase by phase) is somewhat limited whereas the comparison of scenarios and the study of the evolution of cooking methods over time is relevant.** Nevertheless, a lot of interesting information has been collected and analysed and this is the subject of this report.

In the case of this study conducted by Geres, the situation deteriorated rapidly in 2021 in Myanmar. The human resources situation at Geres was also particularly complicated as the project leader (and therefore the study manager) had to change twice in less than 6 months. This made the transmission of information difficult. The management of the operational team, carried out remotely (from Europe) from phase 2 of the study, was also complicated by the context.

Finally, given the information above, the very large amount of data collected and a process that relies heavily on the thoroughness of the participants, **readers who want to use this study will rather follow the broad trends, that are sufficiently accurate, rather than consider the absolute numbers.** Any information needed to understand the study or its results can be provided by the Geres team.

4. MAIN RESEARCH FINDINGS AND LESSONS LEARNED

4.1. MONITORING COMMUNITY COOKING PRACTICES

4.1.1. OVERVIEW OF DATA

As explained above, the experiment was split into multiple phases and the data collection was made differently for the phase 4. This overview of data aims to investigate the first two phases and compare the situations between the baseline and transition phase (when households receive an electric cooking appliance).

During these two phases, most of the records correspond to a whole day of cooking. This means that a significant part of the records corresponds to the preparation of breakfast, lunch and dinner. However, this is not the case for all records. In order to easily get results, we can assume as a rough estimate that one record corresponds approximately to one day.

For the phase 4, each record corresponds to one cooking event. The daily analysis was then easier to conduct. However, we note households do not cook for the 3 meals every day.

The details are shown in the table below.

Table 3 - Number of records per phase

Phase	Number of records [~number of days]	Number of records corresponding to breakfast + lunch + dinner	% of the total number of records
1	1 109	915	83%
2	1 448	1 392	96%
4	1 388	1 090	79%

When it was possible and relevant, the phases 1, 2 and 4 have been compared. Otherwise, the comparison is limited to phase 1 and 2.

People cooked most of the time many dishes per day. 4 dishes cooked per record is the most common situation. Water is usually heated only once a day. The introduction of an electric cooking appliance (phase 2) didn't really impact this cooking habit. The number of dishes cooked per day slightly decreased between the phases 2 and 4.

Table 4 - Cooking events per phase

	Phase 1		Phase 2		Phase 4	
	Number of dishes cooked per record	Number of times water was heated per record	Number of dishes cooked per record	Number of times water was heated per record	Number of dishes cooked per day	Number of times water was heated per day
N*	1 106	826	1 443	1 157	1 380	1 024
Average	3,9	1,1	4,2	1,3	3,6	1,0
Median	4,0	1,0	4,0	1,0	3,0	1,0
Std. Dev	1,6	0,9	1,7	1,0	1,9	0,9
NN**	4 356	1 261	6 132	1 900	5 261	1 520
Sum	5 617		8 032		6 761	

* Number of records (or day) a dish was cooked or water was heated.

** Total number of dishes cooked or times water was heated.

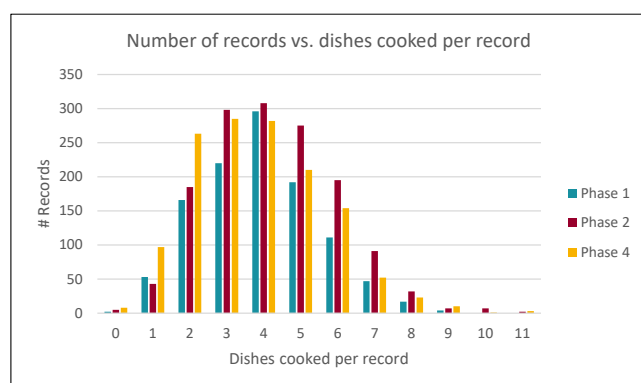


Figure 3.1 - Number of records vs. dishes cooked per record

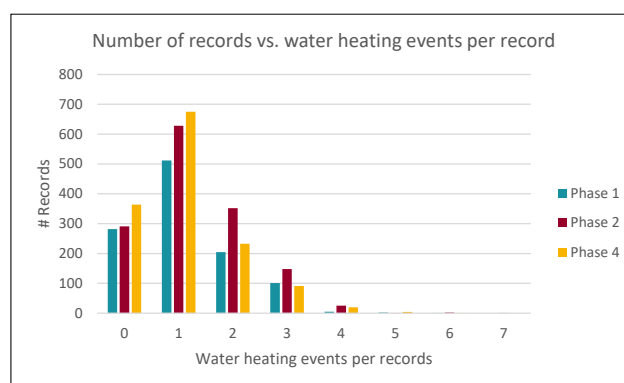


Figure 3.2 - Number of records vs. water heating events per record

The table below shows that more adults were usually cooked for than children. **It is particularly interesting to note that a dish is never cooked only for children.** The number of people cooked for per record was on average slightly higher in Phase 1 than in Phase 2. However, it increased again between the phases 2 and 4. Changes between phases are not that significant (and may also be due to rough estimates and the fact that data was not collected the same way in each phase).

Table 5 - Number of people cooked for per record

		Phase 1	Phase 2	Phase 4
Adults	N	1 109	1 445	1 387
	Average	3,9	3,6	4,0
	Median	4,0	3,0	4,0
	Std. Dev	1,8	1,7	2,6
Children	N	769	988	980
	Average	1,6	1,5	1,2
	Median	1,0	1,0	1,0
	Std. Dev	1,1	1,0	1,1
All	N	1 109	1 446	1 388
	Average	5,1	4,8	5,2
	Median	5,0	4,0	5,0
	Std. Dev	2,3	2,2	2,8

4.1.2. ENERGY USES AND CONSUMPTION

Only three sources of energy are used to cook by the people interviewed: charcoal, firewood and electricity. Interviewees were requested to weigh their charcoal and firewood before they start cooking and after they stopped in order to know their fuel consumption. Their electricity consumption was also measured by a meter used for each cooking event.



In order to compare the energy consumption per energy source, this conversion table was used (Source: World Bank).

Table 6 - Energy units conversion rate

Fuel	Calorific value	Unit
Charcoal	29,9	MJ/kg
Firewood	15,9	MJ/kg
Electricity	3,6	MJ/kWh

The charts below show the electricity consumption increased more than threefold between the phase 1 and phase 2 and keep growing up after that. If this was really low when people were asked not to change their habits, the electricity consumption of households substantially increased with the introduction of an electric cooking appliance in their kitchen. We note it replaced part of the firewood and charcoal consumption, which decreased. However, the use of firewood remains significant. Moreover, it became the second most used source of energy, overtaking charcoal (even in terms of energy consumed – in MJ). A few months after the introduction, households seem to keep cooking with electricity. During the phase 4, electricity accounted for 26% of the total cooking energy consumption.

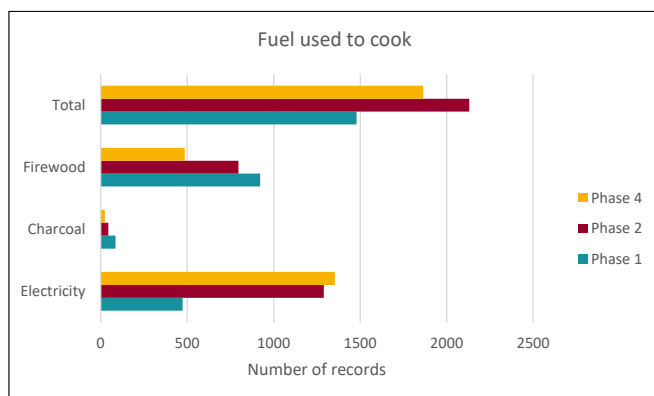


Figure 5.1 - Fuel used to cook

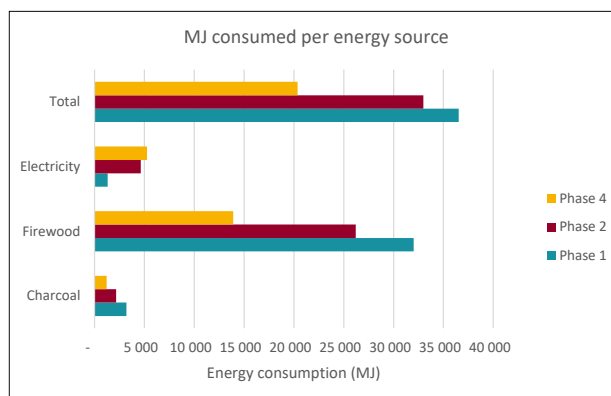


Figure 5.2 - Total energy consumed per energy source

The total energy consumption slightly decreased, whereas the number of times a dish was cooked or water was heated (cooking events) grew up between each phase. The energy consumption per cooking event has then more significantly decreased.

Table 7 - Energy consumption per event

	Phase 1	Phase 2	Phase 4
Energy consumption per event (MJ/event)	6,5	4,1	3,0

This is probably mostly due to the increased use of rice cookers and electric frying pans to cook dishes over the studied months. However, it may also be partly due to the increased use of kettles. These new appliances have almost totally stopped the use of 3 stone stoves. It has also considerably lowered the use of clean cookstoves (San Pya A1 – that can be used with charcoal or firewood). It would be interesting to understand why it replaced the San Pya A1 rather than the firewood stoves, that remained quite used. The use of other appliances (electric hotplates, electric pressure cookers) remains marginal.

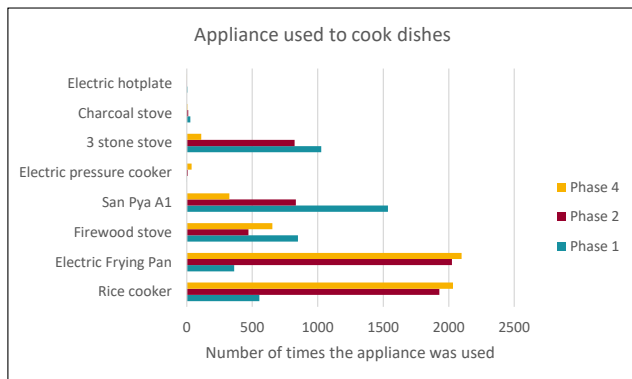


Figure 7.1 - Appliance used to cook dishes

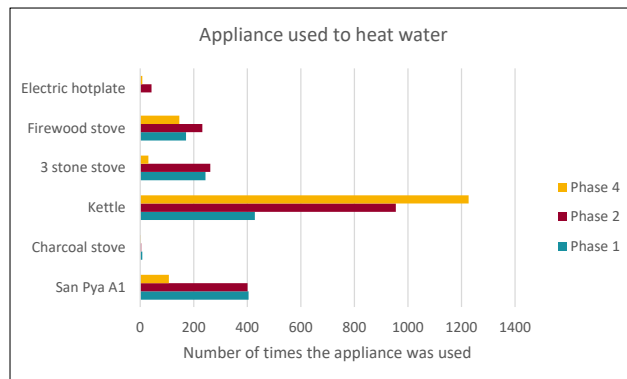


Figure 7.2 - Appliances used to heat water

The evolution over the whole study of the number of times a cooking appliance is used per day (sum of all the participants) is shown below. The red numbers represent the phases of the study. The first chart only relates to electric cooking appliances while the second considers all equipment. The data collection in phase 3 didn't include the details but only the number of times an equipment was used.

It shows the uses of electric appliances increased as soon as they were distributed in the villages. The transition is really quick, with almost no adjustment time. As seen above, the uses of these electric appliances kept growing between the phase 2 and 4.

The phase 3 didn't change anything to the cooking habits of the phase 2 and we can imagine the use of electric appliance gradually and slightly increased over the phase 2, 3 and then 4.

The number of times participants use a cooking appliance (electric or not) started to decrease in phase 4, but the main reason for this cannot be explained yet. It may be due to seasonality, to the increased use of electric appliances, to a lack of data collection (end of the study), or any other reason that could not be clarified. Interestingly, the use of electric appliances didn't drop off in phase 4. People may cook bigger quantities of food in electric appliances. This may also be due to the third wave of the Covid-19 pandemic, that may have had consequences on the diet of the population. People may have eaten more rice and less diversified foods. This would have to be evaluated more accurately.

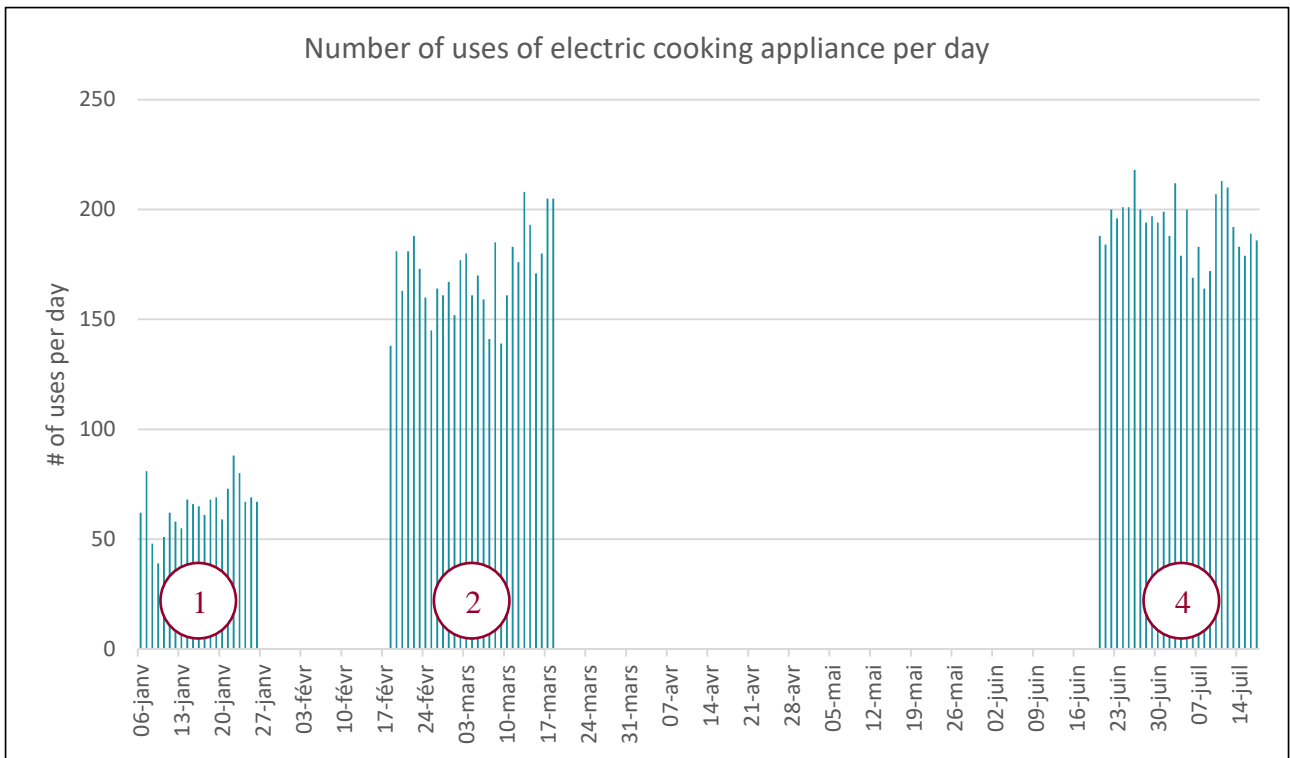


Figure 8 - Number of uses of an electric cooking appliance per day

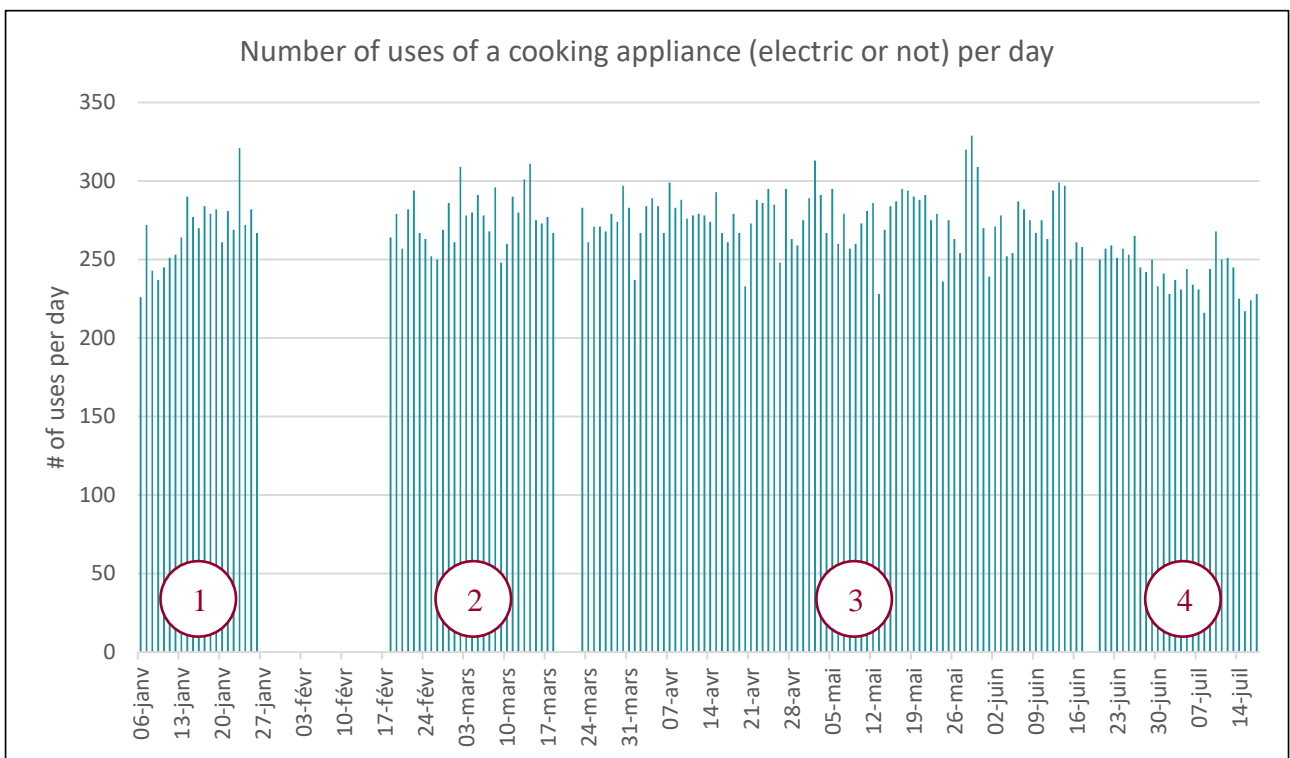


Figure 9 - Number of uses of a cooking appliance (electric or not) per day

As a result of the above information, the electricity consumption to cook dishes and heat water rose from 1 317 MJ (phase 1) to 5 257 MJ (phase 4).

It has to be noted that the use of lid decreased phase after phase. If the households used more and more the electric appliances, probably reducing the consumption of firewood and charcoal, more resources could still be saved.

The energy consumed per day has been calculated:

- As the energy of the records that include the preparation of breakfast, lunch and dinner for phases 1 and 2 (see table in 4.1.1).
- As the sum of the energy consumption of heating events on a given date for the phase 4.

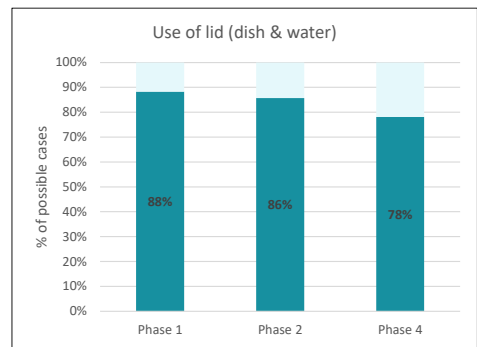


Figure 10 - Use of a lid

The distributions of event energy consumption in phase 1, 2 and 4 are presented below.

It shows that in phase 1, all three energy sources have the same statistical distribution, with many small consumers. The distribution decreases when looking at the largest energy users, with only a few of them using significant quantities of energy.

In phase 2, the distribution of the charcoal use becomes more disparate, as less households used this energy source. The use of electricity starts growing with households moving from a [1 ; 2] MJ/day rate to [2 ; 3] MJ/day. Once again, we observe electricity replaced part of the firewood consumption, with fewer people consuming more than 20 MJ/day from this source.

In phase 4, trends continue. Only a few people consume charcoal and electricity consumption keeps growing.

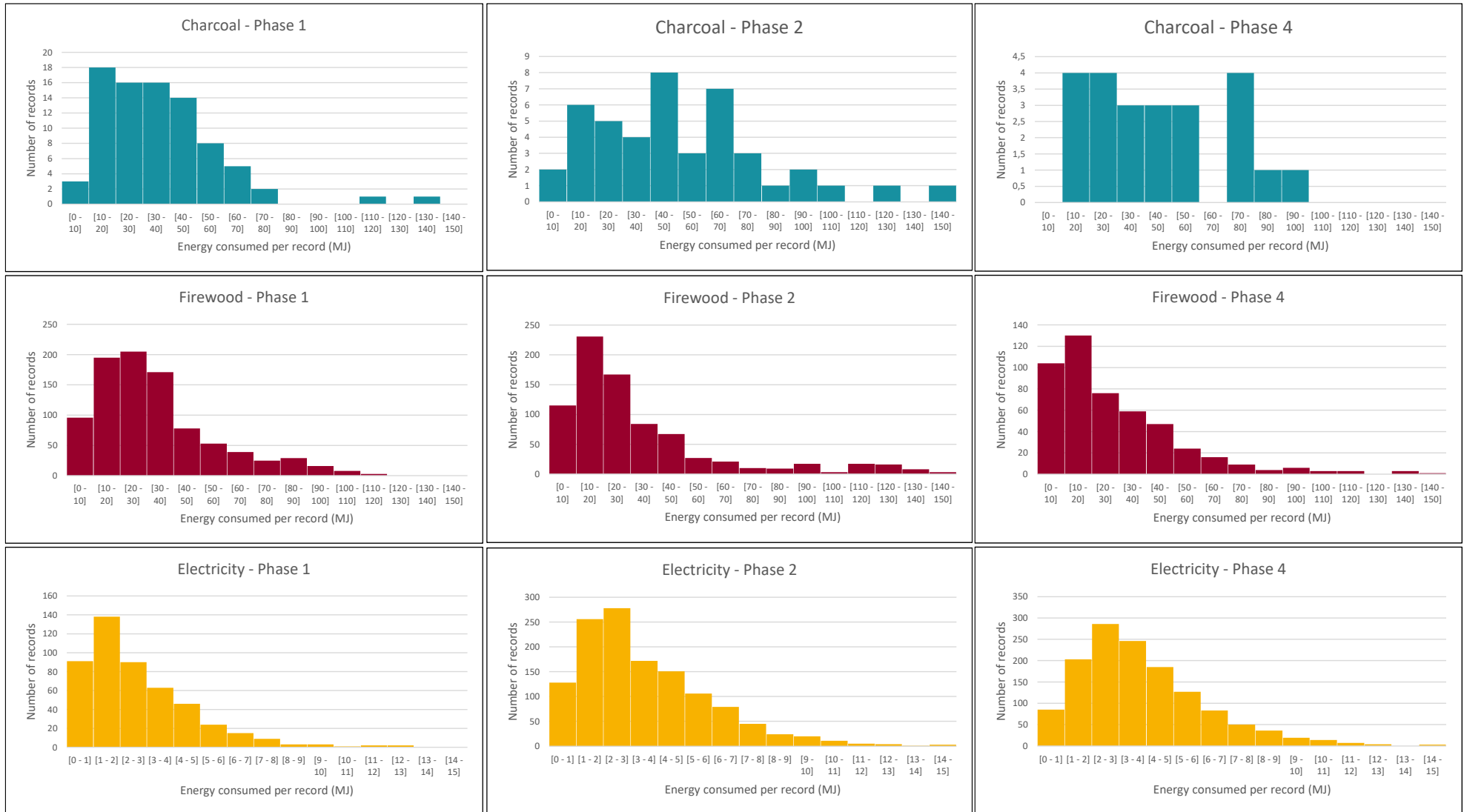


Figure 11 - Number of records per energy consumption rate per fuel type and per phase

4.1.3. TIME SAVING

Another possible interest of the electricity could be the time saving for people who cook. The graph below shows as a global trend that households take less time to cook per day phase after phase. **The trend line of the phase 1 shows a peak between 2h00 and 2h15 per day. It decreased in phase 2 to peak between 1h45 and 2h00. The phase 4 trend line draws a plateau between 1h00 and 1h45, but it shows a lot of people spent less than 1h15 per day cooking.**

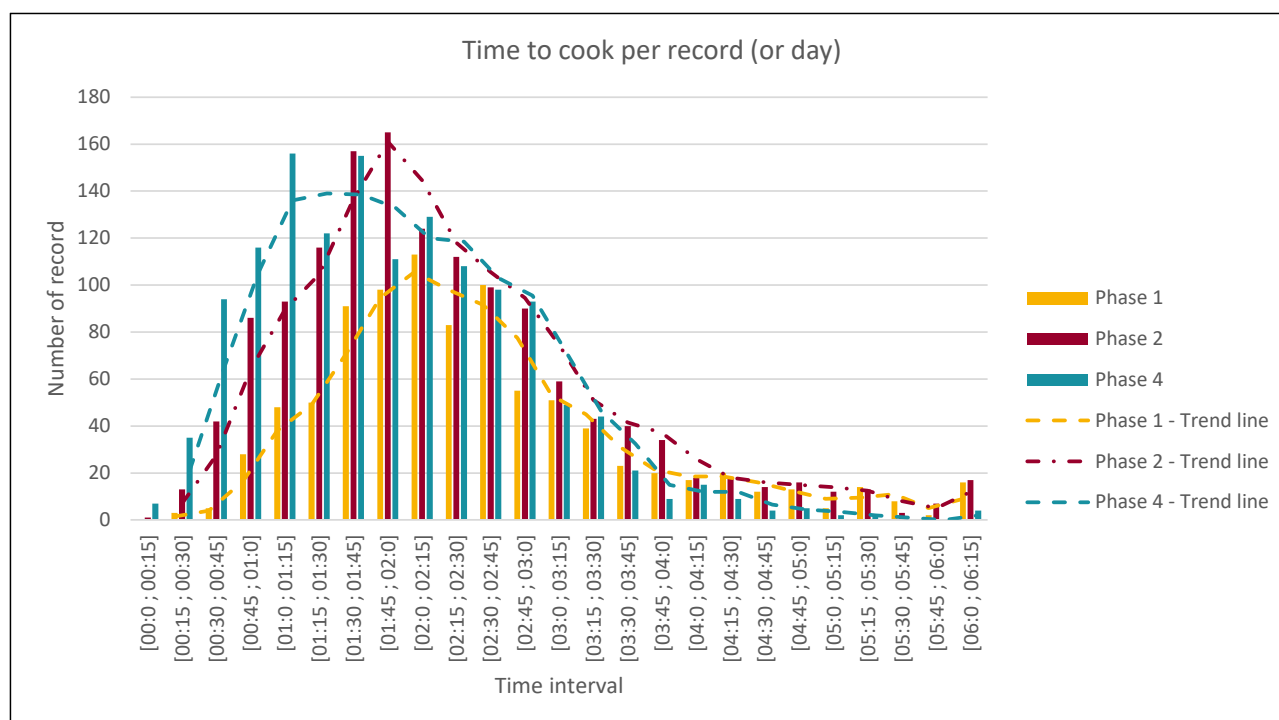


Figure 12 - Time to cook per record per phase

This chart also shows a downward trend from phase 1 to 4. **The average time to cook per day (or at least to prepare the breakfast, the lunch and the diner) decreased by more than 30 minutes.**

Table 8 - Time to cook per day

	Phase 1	Phase 2	Phase 4
N	914	1392	1388
Average	2:34	2 :18	1:53
Median	2:18	2 :02	1:45
Std. Dev	1:25	1:28	0:58

Rice is the most cooked dish. Around 45% of the dishes cooked are only rice. The time to cook rice slowly decreased between phase 1 and 4. On average, it took 5 minutes less in phase 4 than in phase 1 to cook rice (a 15% time saving).

Table 9 - Average time to cook rice

	Phase 1	Phase 2	Phase 4
Average time to cook rice (minutes)	36	33	31

4.1.4. ANALYSE OF THE PHASE 4 – PER COOKING EVENT

As the details per event was made available by the enumerators, it is possible to accurately analyse the energy consumption per source and the cooking habits of the households. The details provided by the surveys in phase 1 and 2 do not allow such an analysis.

The next chart shows the energy consumption is much higher when cooking with charcoal than firewood and then electricity. A dish requires around 20 MJ to be cooked with charcoal. It's about 2 times less with firewood and 20 times with electricity. The assessment is the same when **heating water, and may even be more significant. Kettles probably allow huge energy saving.** At the end of this phase 4, the average energy consumption of a cooking event is about 3 MJ.

Table 10 - Energy consumption per cooking event per fuel type

		Phase 4			
		Charcoal	Firewood	Electricity	Total
Dishes	Total energy consumption (MJ)	989	11 416	4 523	16 929
	N	47	1 043	4 169	5 259
	Average energy consumption (MJ)	21,0	10,9	1,1	3,2
Water heating	Total energy consumption (MJ)	215	2 496	738	3 449
	N	13	270	1 237	1 520
	Average energy consumption (MJ)	16,5	9,2	0,6	2,3
Total	Total energy consumption (MJ)	1 204	13 913	5 261	20 378
	N	60	1 313	5 406	6 779
	Average energy consumption (MJ)	20,1	10,6	1,0	3,0

● Analysis per meal

The analysis per meal is possible only when considering cooking events that only involve one meal: breakfast, lunch or supper. Water heating events may also be studied when not associated to a meal.

Households mainly cooked using electricity in phase 4 (already noted above). However, they proportionally use more electricity for breakfast and supper. The firewood is used for lunch preparation. Charcoal is almost only used in order to heat water.

Interestingly, the electricity and firewood consumptions do not depend on the meal it is used for. In other words, households consume the same quantity of energy when preparing a dish either for breakfast, lunch or supper. This may also be due to the fact that people cook pretty much the same dishes for every meal. Some dishes may be reserved for a special meal (such as fish paste for dinner) but this is rare and almost all dishes are cooked for either breakfast, lunch or dinner.

The charcoal consumption doesn't follow the same trend. However, the number of cooking events is too low to generalise this result.

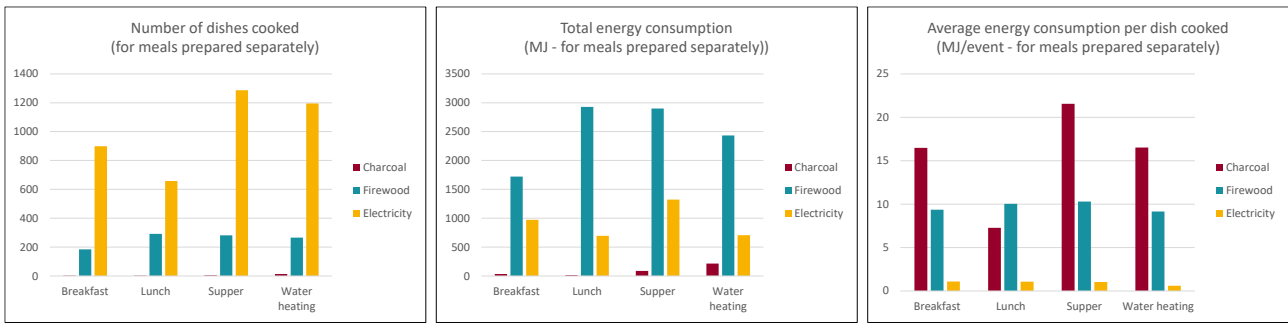


Figure 13 - Analysis of the energy consumption per dish cooked per fuel type and meals

● Analyse per capita

On average, dishes are cooked for 4,8 people. However, it is most of the time cooked for 6 people and rarely more than 7. A dish is never cooked for only 1 person.

Water may be heated for 1 to 7 people, without any probability rule. But it is on average heated for 3,7 people, which is lower than the dishes cooked. People mostly boil water for the preparation of green tea. Children do not drink tea but water, what could explain this difference.

Table 11 - Number of people a dish is cooked for or water is heated for

		Dishes cooked	Water heating event
People cooked for	N	5 296	1 474
	Average	4,8	3,7
	Median	5	3
	Std. Dev	1,6	1,9

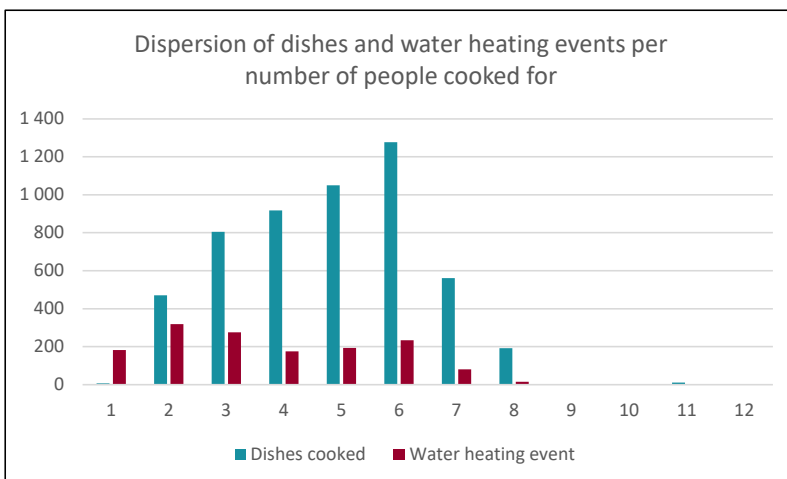


Figure 14 - Dispersion of dishes and water heating events per number of people cooked for

The energy consumption to cook a dish varies according to the number of people it is cooked for. Interestingly, the consumptions of firewood and electricity follow the same trend when the number of people cooked for increases. Variations observed when the number of people is over 10 may be due to the low number of cases studied.

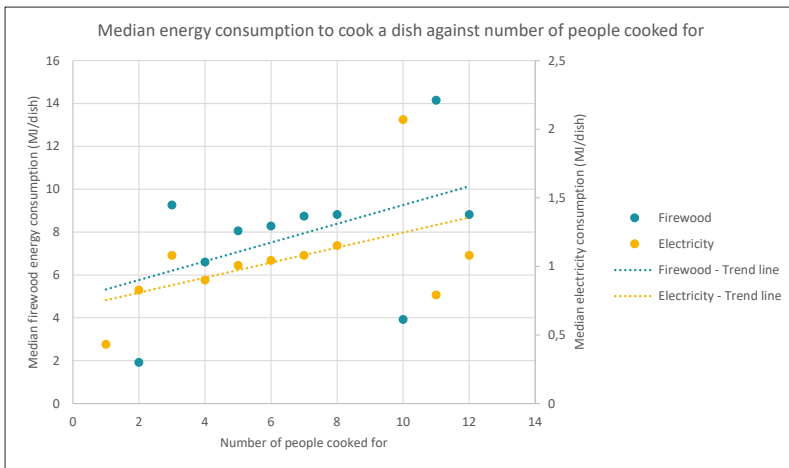


Figure 15 - Median energy consumption to cook a dish against the number of people cooked for

4.2. MONITORING ELECTRICITY SUPPLY AND USE

The participants were all equipped with an electric meter and were then able to provide information about the electricity consumption of each cooking event.

In phase 4, each household has been requested to register each cooking event. Each cooking event has then been registered with detailed information and then one horizontal row of the database corresponds to one cooking event of one participant.

This provides useful information about the daily electricity consumption of the participants.

4.2.1. AVERAGE HOUSEHOLD DAILY LOAD CURVE

In order to draw a load curve of an average household, the following methodology was used:

- Divide the consumption of each cooking event per the number of minutes associated with the event. It allows to know the average consumption per minute of each event;
- Sum all the consumptions of every participants for each minute of the day;
- Divide the result per the number of participants (51) and per the number of days (29) the phase 4 lasted.

This methodology was used for the dishes cooked, for the water heating event and for the global electricity consumption.

On average, we observe:

- A morning peak that starts around 4.00 am and comes slightly earlier for the dishes cooked than for water heating;
- The electricity then progressively decreases to become almost null around 12.00;
- An evening peak that starts around 4.30 pm, to reach a maximum at 5.30 pm and finishes around 19.30.

The maximum power requested about 200 W. However, this is only relevant if one considers the total population in order to know an average total maximum demand. Individually, it is not meaningful as it does not give the maximum consumption of a household – Then it is not useful or too risky to refer to it for a sizing exercise for example.

When sizing a mini-grid, this may be relevant to consider on average a 200 W maximum demand per household. However, when sizing an SHS, this would be too risky, as many people require more power and may experience peak loads of 500 W or more.

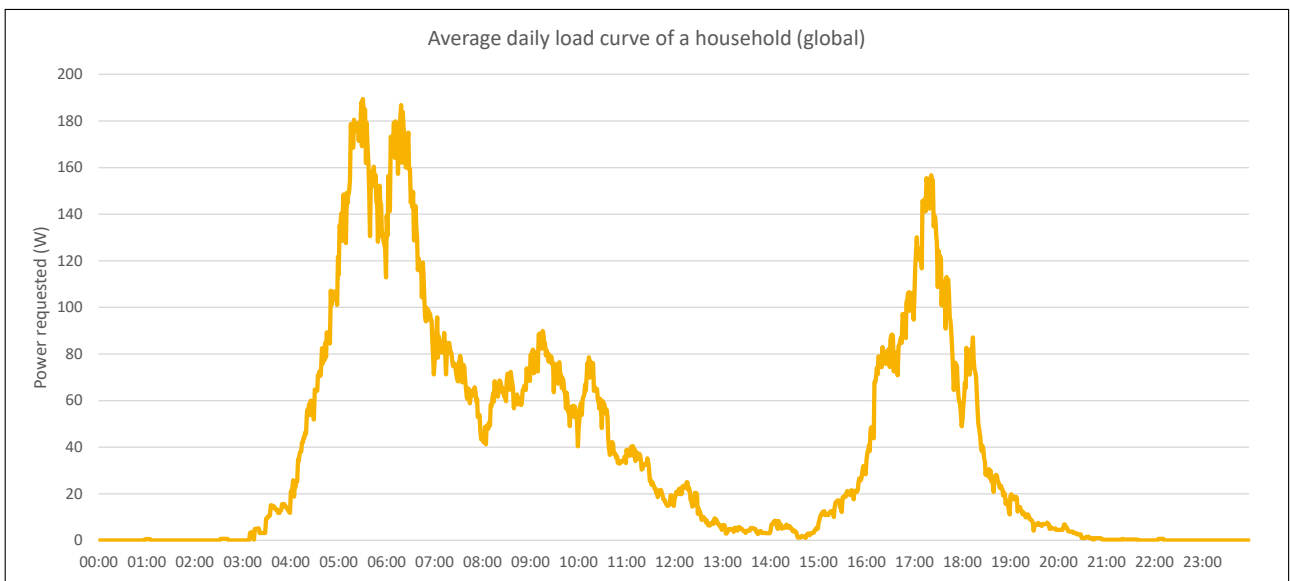
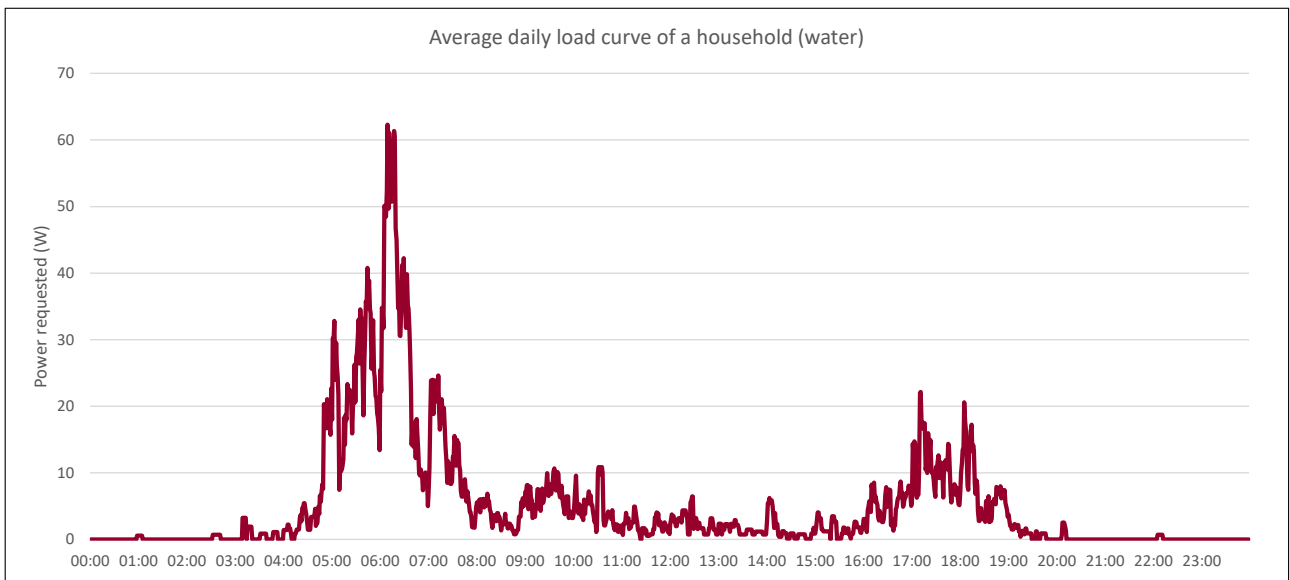
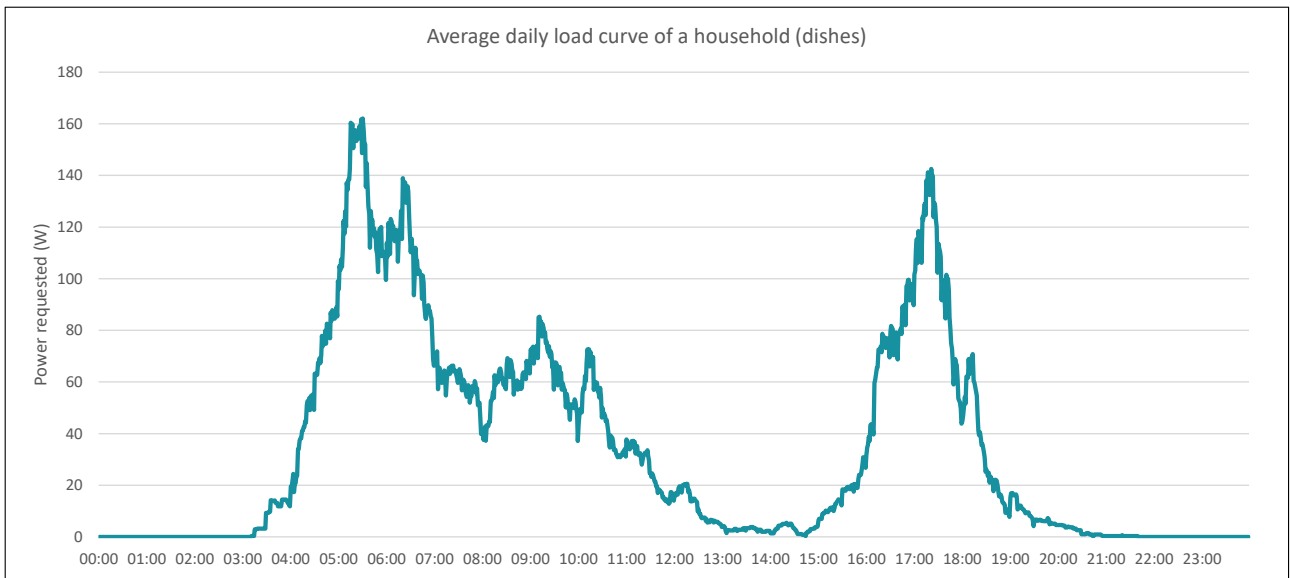


Figure 16 - Average daily load curve of a household in phase 4 (dishes, water, global)

The chart below is the same load curve but plotted for the 1st phase of the study. It is interesting to see that the increase in the use of electric cooking appliances has increased the consumption (peak at 200 W compared to 100 W in phase 1) but not the shape of the load curve. Consumption remains globally at the same times of the day. It may have widened the morning peak a little (starting from 4.30 am instead of 5.30 and finishing at 7.30 instead of 7.00), but the same trend and the same peaks can be seen. **Electric appliances have not transformed the cooking times.**

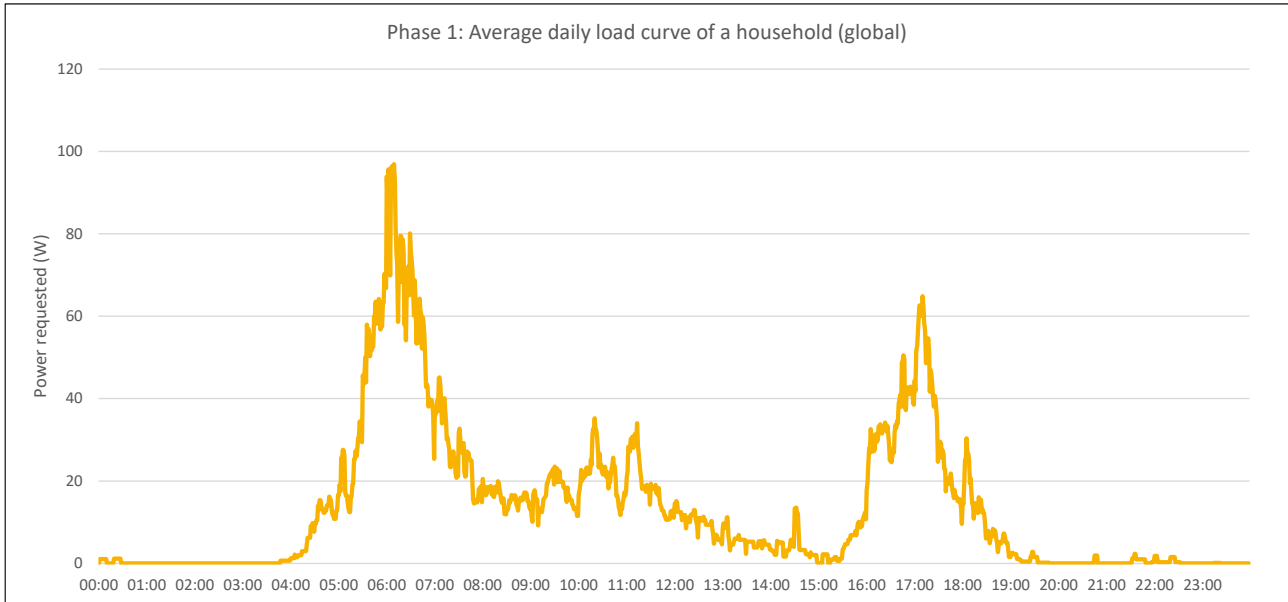


Figure 17 - Average daily load curve of a household in phase 1 (global)

The chart below shows the average daily load curve of all the participants. This is a sum of the consumptions of all participants. The curves are drawn as an average per day over 3 weeks (3 Mondays, 3 Tuesdays, etc.). It shows the load curve do not significantly depend on the day of the week. Load curves are roughly the same from Monday to Sunday, apart from some variations, that may also be due to data collection mistakes. We could observe a peak around 9.00 am on Sunday, but this only occurs 1 Sunday out of the 3 studied and is then difficult to generalise.

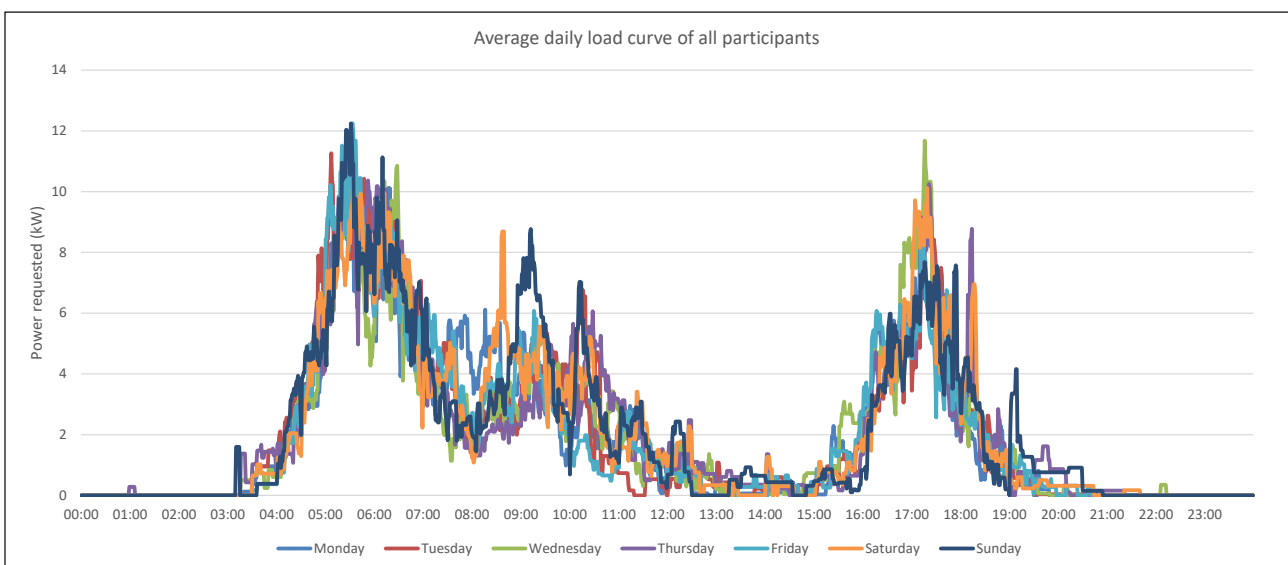


Figure 18 - Average daily load curve of all participants

4.2.2. LOAD CURVE OF HOUSEHOLD OVER ONE WEEK

An equivalent methodology was used to plot household load curves over a week.

The charts below show the daily load curve of some randomly selected households over a full week: from the 5th to the 11th of July 2021.

We observe:

- Households may have very different load curves and then very different habits or ways to cook food. Some households cook only in the morning (14, 42), others in the morning and at night (11, 74), but some may cook or heat water at any time of the day (22, 63).
- Load peaks are mostly around 1 kW. We may observe higher load peaks for some households, but they may also be due to data collection mistakes that could not be eliminated in post-processing.
- Usually, most of the households cook in the morning and in the evening – this is why we observe 2 load peaks in the average load curves charts above. However, it is difficult to generalize.



Figure 19 - Load curves of specific households over one week

4.3. MEALS COOKED

It was requested to each participant to register the meal cooked for each cooking event in the 4 phases. It was then possible to analyse the habits in terms of meals and their evolution.

The table below indicates the 20 most cooked dishes, the number of times it was prepared in each phase and the percentages of all the dishes cooked it represents.

It shows cooking with electricity did not cause participants to really change what they cooked overall. There is a high degree of consistence between Phase 1, 2 and 4. Cooking with electricity is apparently compatible with the local menus.

Rice is largely remained the most cooked dish (over 40% of the meals cooked in each phase). The percentages of each other dish have remained more or less the same over the 4 phases. Chicken curry, Roselle soup and fried vegetables are some of the most popular meals in this region. Cooking with electricity didn't increase or decrease their consumption.

Table 12 - Top 20 dishes cooked per phase

	Phase 1		Phase 2		Phase 3		Phase 4	
Rice	1 916	44%	2 642	43%	7 550	42%	2 470	47%
Dry fish curry	152	3%	209	3%	551	3%	147	3%
Bean soup	53	1%	136	2%	460	3%	108	2%
Chicken curry	230	5%	309	5%	705	4%	225	4%
Tomato curry with fish paste	152	3%	173	3%	336	2%	100	2%
Fried peas	106	2%	71	1%	175	1%	49	1%
Fried egg	118	3%	207	3%	700	4%	151	3%
Fried bamboo shoot	63	1%	67	1%	127	1%	66	1%
fried vegetables	182	4%	273	4%	1244	7%	242	5%
Beef curry	136	3%	170	3%	569	3%	184	3%
Pork curry	38	1%	32	1%	143	1%	20	0%
Cauliflower fried with egg	49	1%	42	1%	62	0%	15	0%
Roselle soup	273	6%	355	6%	1 268	7%	301	6%
Fish curry	163	4%	197	3%	752	4%	172	3%
Fried fish	43	1%	47	1%	175	1%	29	1%
Potato curry	61	1%	101	2%	499	3%	119	2%
Egg curry with tomato	67	2%	81	1%	406	2%	107	2%
Fish paste	34	1%	51	1%	270	1%	47	1%
Bitter grout	25	1%	28	0%	80	0%	41	1%
Egg plant with dry prawn	75	2%	80	1%	172	1%	47	1%
Gao bean (boiled)	29	1%	70	1%	108	1%	49	1%
Others	396	9%	759	12%	1711	9%	571	11%
TOTAL	4 361	100%	6 100	100%	18 063	100%	5 260	100%

Rice is definitely the most cooked dish. **It is interesting to observe how the preparation of this meal has been transformed when an electric cooking appliance (and particularly the rice cookers) was introduced.** In phase 4, Rice cookers are used in 82% of cases in order to cook rice, compared to 29% in phase 1 and 73% in phase 2. 3-stones stoves and San Pya A1 were almost abandoned for the preparation of rice.

Table 13 - Appliance used to cook rice per phase

	Phase 1		Phase 2		Phase 4	
Rice cooker	551	29%	1 916	73%	2 017	82%
Electric Frying Pan	12	1%	9	0%	6	0%
Firewood stove	346	18%	123	5%	290	12%
San Pya A1	556	29%	231	9%	127	5%
Electric pressure cooker	0	0%	0	0%	9	0%
3 stones stove	441	23%	359	14%	19	1%
Charcoal stove	10	1%	4	0%	2	0%
Electric hotplate	0	0%	0	0%	0	0%
Total	1 916	100%	2 642	100%	2 470	100%

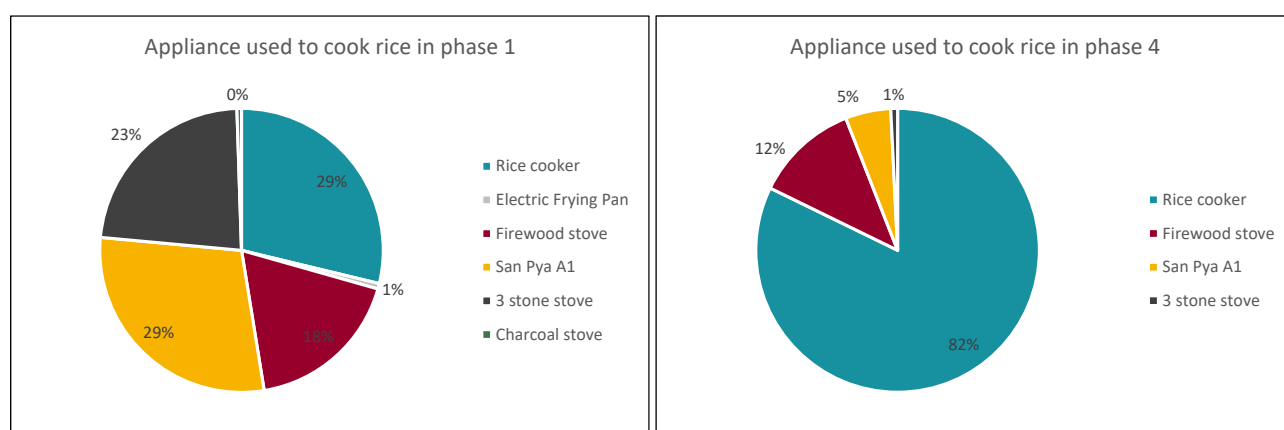


Figure 20 - Appliance used to cook rice in phase 1 and 4

The table below shows meals are mainly prepared separately (68%) in phase 4. However, a dish may be prepared for the breakfast and the lunch at the same time (15% of the cases). Dishes for the breakfast and the dinner are never cooked together if lunch is not included. One dish may be prepared for all the meals of the day (11%). In this case, this dish is rice in 54% of the cases.

It was not possible to analyse the evolution between the phase 1 and 4 as data was not recorded in the same way, but the fact that it is rice that is often being cooked for multiple meals suggests electric cooking may have led to a change (given the uptake of rice cookers).

Table 14 - Simultaneous preparation of meals in phase 4

	Number of meals	Cooking events	%
Breakfast	1	1 086	20%
Lunch	1	953	18%
Supper	1	1 574	30%
Breakfast + Lunch	2	794	15%
Breakfast + Supper	2	0	0%
Lunch + Supper	2	315	6%
Breakfast + Lunch + Supper	3	576	11%
TOTAL		5 298	100%

In this study, “precooking” means people cook to preserve food and eat it within a few days. For instance, they may buy chicken at the market but will have to cook it directly to preserve it as they do not have a

refrigerator. “Preparing meal in advance” means they cook for at least two meals of the day. Food is almost never reheated or precooked. The participants only cook fresh food. This is true for rice and for other dishes. This means people may eat cold food. Rice may be eaten cold as is it sometimes cooked for the whole day. Other dishes are mostly cooked just before it’s eaten otherwise they are also eaten cold. The introduction of electric appliances didn’t change anything to this baseline situation.

Table 15 - Fresh, reheated or precooked food per phase

		Fresh	Partially precooked	Reheated
Phase 1	Rice	1 874		41
	%	98%		2%
	Other	2 388	6	58
	%	97%	0%	2%
	Total	4 262	6	99
	%	98%	0%	2%
Phase 2	Rice	2 628		13
	%	100%		0%
	Other	3 360	10	90
	%	97%	0%	3%
	Total	5 988	10	103
	%	98%	0%	2%
Phase 4	Rice	2 461	1	8
	%	100%	0%	0%
	Other	2 742	10	39
	%	98%	0%	1%
	Total	5 203	11	47
	%	99%	0%	1%

Precooking is rarely used in the region and there are almost never any leftovers. However, participants are used to prepare meals in advance, particularly rice. Most of the time, people cook for the next meal. This baseline situation didn’t change with the introduction of electric appliances.

Table 16 - Precooking, cooking in advance and leftovers per phase

		Precooking	Prep. meal in advance	Leftovers	None
Phase 1	Rice	15	825	17	1 059
	%	1%	43%	1%	55%
	Other	15	838	38	1 564
	%	1%	34%	2%	64%
Phase 2	Total	30	1 663	55	2 623
	%	1%	38%	1%	60%
	Rice	3	1 183	7	1 449
	%	0%	45%	0%	55%
Phase 4	Other	26	1 638	23	1 771
	%	1%	47%	1%	51%
	Total	29	2 821	30	3 220
	%	0%	46%	0%	53%
Phase 4	Rice	2	986		1 480
	%	0%	40%		60%
	Other	14	982		1 794
	%	1%	35%		64%
Phase 4	Total	16	1 968		3 274
	%	0%	37%		62%

4.4. EXIT SURVEY – QUALITATIVE INFORMATION

An exit survey was carried out in October 2021 by the Geres team. The questionnaire was made available by MECS and it is presented in annex of this report.

This exit survey mostly provides qualitative feedback from participants on their perceptions and preferences of the electric cooking appliances they have been using. The fact that it was conducted almost one year after the introduction of an electric appliance allows for long-term feedback. 50 participants took part in this exit survey.

Here are some of the feedbacks and trends the team was able to get thanks to this exit survey:

- Mostly women use the electric cooking appliances. They are indeed always involved in the cooking process. However, men may also use the appliances (in 20% of the cases).
- Almost all participants report they save time when cooking with electricity. They also find it easier to cook, more convenient and say they cook more food as it is faster. Only 5 participants out of 51 consider the electricity appliance hasn't changed anything to the way they cook their meals.

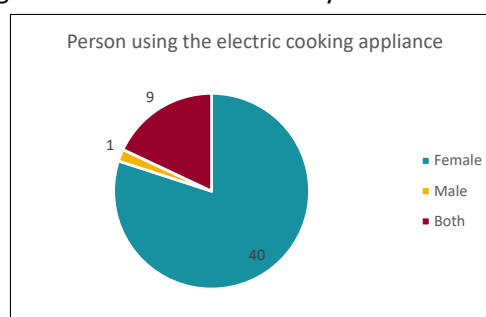


Figure 21 - Gender of the person using the electric cooking appliance at home

- **Most of the participant consider they have learnt to cook with electricity thanks to the demonstration done by the Geres teams and the entrepreneurs of the REACH project.** However, it seems learning is limited to the use of electric appliances (plug electric appliances, overall functioning, quantity of water, etc.). People do not consider they have learnt new dishes (or not significantly). Around 25% of the participants also say they didn't learn anything as they already knew how to cook with this kind of appliances.
- Covid-19 has apparently had a limited impact on the way people cook. Most of them report they were a little or not at all affected by the situation. The most common issue is related to the increase in the price of products, including basic needs.
- Responsibilities for cooking or preparing some meals may have changed a bit with the introduction of electric appliances. Interviewees' daughters sometimes contribute from now on. More family members may also cook when they need it, whereas this activity was previously only the mother's responsibility. However, 50% of the participants say it didn't change at all the person cooking.
- It is widely acknowledged by interviewees that cooking with electricity is easy. All the participants saw the initial demonstration and were then able to use their appliance. No issue was reported. People consider they can learn to cook with electricity by themselves. However, some of them appreciated the safety training. Safety recommendations by the seller would be sufficient.
- Participants are happy with their electric appliance. However, bigger appliances are required. Colour of the appliance may be a criterion, but choice differs from person to person. **Size remains the most quoted issue.**
- People were initially "scared" to cook with this kind of new appliances because of electric shocks. If no one mentions to be affected by a shock afterwards, it seems it is still the case and people are still afraid about that. However, participants are willing to cook with electricity. This seems comfortable, fast, easy and clean to them. **"Do & do not" recommendations were given at the beginning of the study. It seems useful as it makes people feel safer and provide helpful information, especially about electric shocks.** Awareness session about the way people can avoid shocks' situation could also be implemented.
- Participants mainly like to cook with electricity because it saves time. **The fact that it is cleaner and easier and procures more comfort to the users are also reasons why the participants have been happy to use their new appliances.** Interestingly, no one apparently mentioned health as a reason. This may also be due to the questionnaire form. People may consider "clean" as a way of cooking without smoke in the kitchen. People are also not necessarily aware of the health problems associated with cooking. Participants have spent the extra-time (they saved when cooking with electricity instead of other fuels) doing many various activities such as work, daily or household tasks, prayers, entertainment, etc. Some also enjoyed their free time.

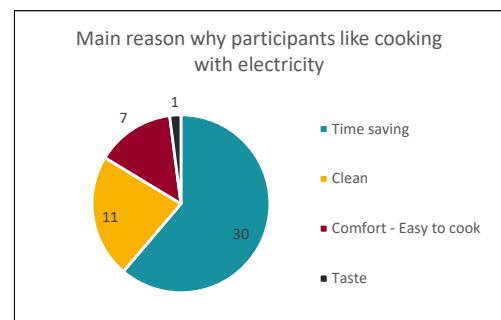


Figure 22 - Main reason why participants like cooking with electricity

- Participants do not use charcoal anymore (only 2 out of 50, for reason they can't explain), but all of them use firewood. The first reason is that some of the meals taste better when cooked with firewood. The second is that some of them need to be cooked for a long time to taste better (such as beef curry, boiled bean and soups). They don't like firewood smokes and the fact that the fire heats the kitchen. However, it may take time to change this cooking habit, that are taste related.

- Participants consider or know (when they have already paid their bill) that cooking with electricity is cheaper than with other fuels (like firewood or charcoal). 20% don't know yet if this is effectively cheaper or not. Anyway, all but one considers it affordable.

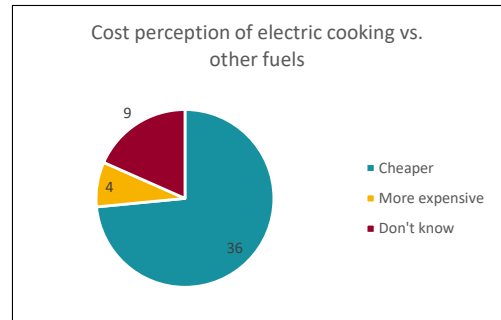


Figure 23 - Cost perception of electric cooking vs. other fuels

- Firewood smokes cause eyes irritation, cough and itchy throat. Participants are almost unanimous. They don't see any benefit to the smokes, except one who says it drives away the mosquitoes.

- Electric cooking is definitely seen as dangerous by the participants. Even 8 months after they received an electric cooking appliance and have apparently used it, most of them consider electricity is more dangerous than other cooking fuels. Electric shocks are seen as a major issue.** Even participants that consider it safer continue to say users should be careful with it, the way they use it and how to avoid electric shocks.

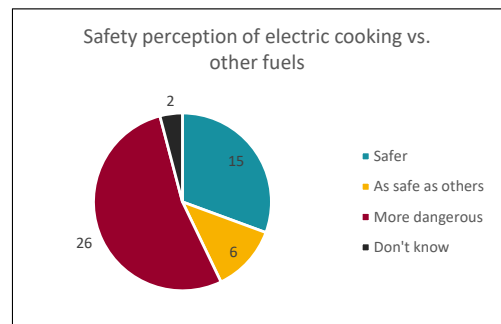


Figure 24 - Safety perception of electric cooking vs. other fuels

- Fried food (dishes with curry, meet especially chicken, vegetables, eggs, etc.) are mostly better when cooked with electricity. On the contrary, participants prefer to use firewood when preparing beef curry, boiled bean and soups. These all look like heavy dishes (ones that take a long time to cook). There might be a market for either a traditional pressure cooker used on an electric stove or an electric pressure cooker for these dishes.

- Although they are now all using electricity to cook, participants have all kept using firewood as well, **mainly because of power cuts** but also to prepare some particular dishes (as seen above). Power cuts seem to happen very frequently, with more than 50% of the participants experiencing them at least once a day. On average, these power cuts last between 20 and 40 minutes. **When a power cut occurs, 50% of the interviewees consider it affects the way they cook. Out of these 50%, 70% choose to change their cooking fuel (and then use firewood), whereas 30% wait for the power to return.**

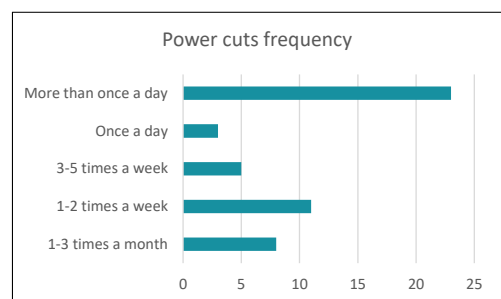


Figure 25 - Power cuts frequency

- On average, participant would be willing to spend around 23 000 MMK to buy the electric cooking appliance they use. This varies from 5 000 to 45 000 MMK. Here are some typical costs of appliances sold by the Ah Lin Tan network of entrepreneurs:

Table 17 - Typical costs of appliances sold by Ah Lin Tan

Appliance	Price (MMK)
Rice cooker	40,000 to 65,000
Kettle	15,000 to 20,000
Electric frying pan	33,000 to 45,000
Electric pressure cooker	70,000 to 80,000

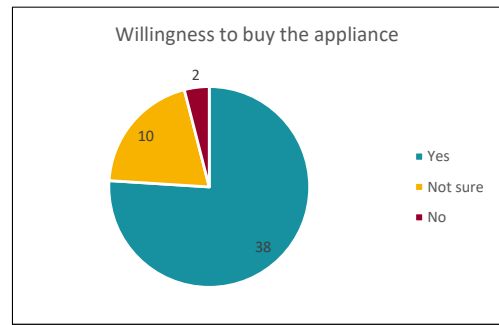


Figure 26 - Willingness to buy the appliance used

Knowing the appliances' cost, participants are mostly still willing to buy the product. This is probably due to the fact they are now used to cook with it and don't want to come back to their previous situation. **All participants would recommend others to start using this kind of appliances and almost all have already done so**, especially when people came to ask about the product.

- 60% of the participants say they have faced issues with their electric cooking appliance. As some of them didn't know how to cook with electricity at the beginning, it is difficult to judge whether this is due to the material or the way it was used. Some of the participants (less than 20%) regret the poor quality of the products, without being able to give a main reason. However, **wiring seems to be the most frequent problem encountered**. It will be important to understand why.

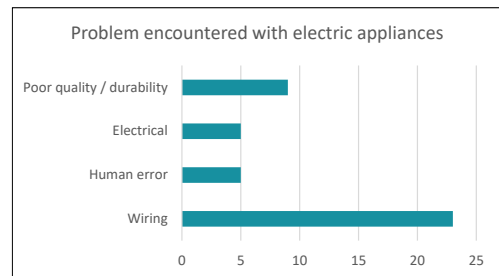


Figure 27 - Problem encountered with electric cooking appliances

- Participants mostly like the rice when it's cooked "between soft and hard" (registered as "other" in the chart below). No matter what is the ideal quality of cooked rice, rice cooker is always the best appliance to cook this dish. It seems then a bit surprising that almost one in two participants agreed with the belief that cooking rice with firewood tastes better than with electricity. People may value convenience of the rice cooker over taste. This may also be due to a confusion cause by the questionnaire form.

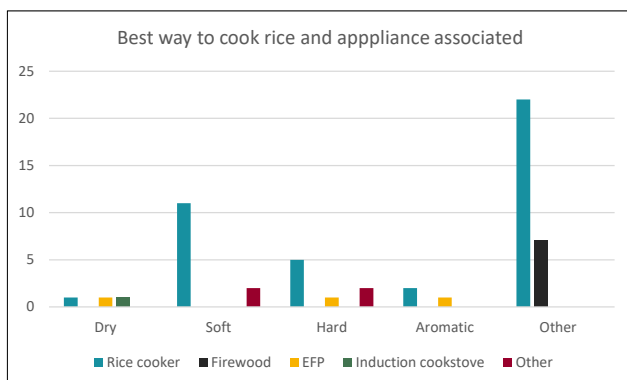
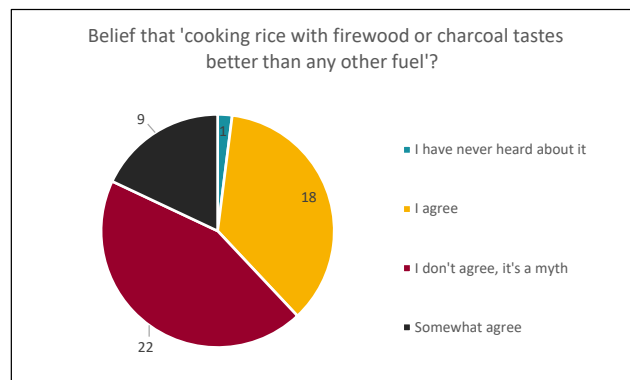


Figure 28 - Best appliance to cook rice



4.5. SCALING UP ELECTRIC COOKING

4.5.1. DRIVING THE TRANSITION TO ELECTRIC COOKING

The study shows people in this region are really willing to cook with electricity and there is a huge potential for this sector. It has to be noted that this willingness to use electricity to cook doesn't depend on the village where this study was carried out. Even if we can observe differences between the villages, the trends are the same and the increase in electricity use is common to all studied villages. **The results can then be considered “regionally”.**

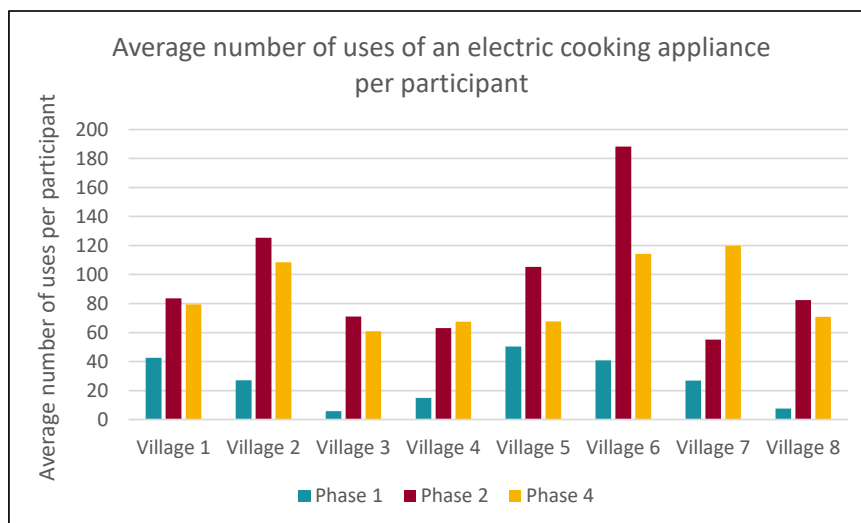


Figure 29 - Average number of uses of an electric cooking appliance per participant

People find it faster, easier, cleaner, more comfortable, and for most of them cheaper than other fuels (mostly firewood).

If some of the participant were already used to cook with electric appliances before the study, the distribution of this kind of products has led to a significant and quick increase in its use. It is clear that people still lack equipment and means to buy it. As soon as they have an appliance, they use it and easily replace their old cooking method. If they keep cooking with firewood for some of the dishes, they quickly adopt rice cookers, electric frying pans and kettles for the preparation of many others menus.

The power cuts, the dangers of electric cooking (electric shocks) or the taste of some wood-fired foods are other arguments that could slow down the transition, but a big step can be taken by removing the barrier of access to an electric appliance:

- Frequent power cuts are a major issue for the transition, but they seem to be quite short (usually less than 30 minutes or one hour per day) and mostly depend on the national electricity company that we usually cannot impact on.

It has to be noted that the study was carried out in village where people have access to the national grid and pay a subsidised price of the electricity. This electric cooking transition may not be the same in a village where electricity is distributed by a mini-grid, with a much higher electricity price. However, the national grid is being developed quite quickly in Myanmar (at least before the coup).

- Even after 6 months of use, people are still relatively afraid of cooking with electricity because of electric shocks. However, only a few of them has already been affected by such an accident. This issue may quite quickly be solved with awareness and explanation of the corrects methods of use.
- The taste of food cooked with firewood is an opinion of the local population against which it is “complicated to argue”. It may change over time if people consider the advantages of electricity over

wood to be too significant, but it is likely to be a long-term situation. Moreover, the figures above show that it only represents a few dishes and a limited number of uses.

At the end of the study, the most important barrier **really seems to be the access to high quality, affordable and adapted equipment**. The transition to electric cooking is likely to occur if suppliers and sellers provide to the last mile affordable, reliable and safe appliances, which can convince the population to switch.

4.5.2. GERES' ACTIVITIES TO SCALE UP ELECTRIC COOKING

● Challenges

One of the main constraints to the global transition still remains the lack of access to the electric grid, which limits the type of energy solutions households have access to. In non-grid connected villages, 94% of households have access to electricity through self-assembled solar home systems, which always provide them with lighting and phone charging, and for half of those with entertainment options (TV or radio). These households do not use the SHS for any type of productive activity or cooking. The latter is exclusively done using firewood, 80% of the times using the traditional 3-stone cooking method. A market study carried out by Geres shows most of these households would like to see their energy access improved: 82% of households would like to change their cooking technology mainly for reasons of safety, no smoke, fuel and time savings.

In grid-connected villages, access to modern energy solutions is more widespread, with 96% of households connected to the grid. This results in a major difference from non-grid connected villages: almost 80% of households cook (at least partly) using electricity, namely by using rice cookers, electric frying pans and kettles. However, firewood is still widely used, at even bigger rates than electricity, which means that most household stack these two fuels. This has been confirmed by this report. A lot of households mention that they would like to purchase more appliances, namely fridges and fans. In grid-connected villages, income generation activities using electricity remain rare.

● REACH – Ah Lin Tan

The *REACH* (Rural Energy Access for Communities and Households) project managed by Geres is working to increase access to clean energy solutions (improved cookstoves, adapted electric cooking appliances) for communities in remote rural areas of the Dry Zone. A pilot network of 15 women entrepreneurs is operational and is disseminating products in 30 villages, already reaching several thousand households. The first phase of the project has confirmed the relevance and feasibility of creating a social enterprise. This one would be based on women able to implement last mile distribution and demonstrate the quality of the products locally sold. The proof of concept and a complete business plan based on 100 female distributors reaching 200 villages should enable the *Ah Lin Tan - Myanmar Radiance* social enterprise to be created in 2022 to ensure a formal existence to the network and to facilitate the access to financial resources. This would enable its development in the Dry zone and the southern Shan state.

Following an initial project phase focused on off-grid villages, **Geres realised that the energy efficiency of equipment in villages connected to the national grid**, and in particular electric cooking appliances, represented a considerable challenge. This is also seen as a great opportunity to increase the impacts of the project and the future company on people's lives.

Geres is then directly involved in the transition to electric cooking in Myanmar. Its experience and this study show this will require, among other things:

- Resistant products to be made locally available in the market;
- Products to be affordable and adapted to the population's means;
- Instalments and credit offer to be well thought, as initial investment seem to be a significant barrier to the access to an electric appliance;

- Demonstration of products' quality and instructions for use to ensure safety to be provided by a local reseller (an entrepreneur under the *Ah Lin Tan* network).
- An efficient after-sales service, with product's guarantee, to be implemented;
- a wide range of products to be developed and locally proposed (multi cooking pot, soup pot, mixer, etc.)

In order to make this transition a success and to participate in its realisation, Geres is setting up a strict product selection process.

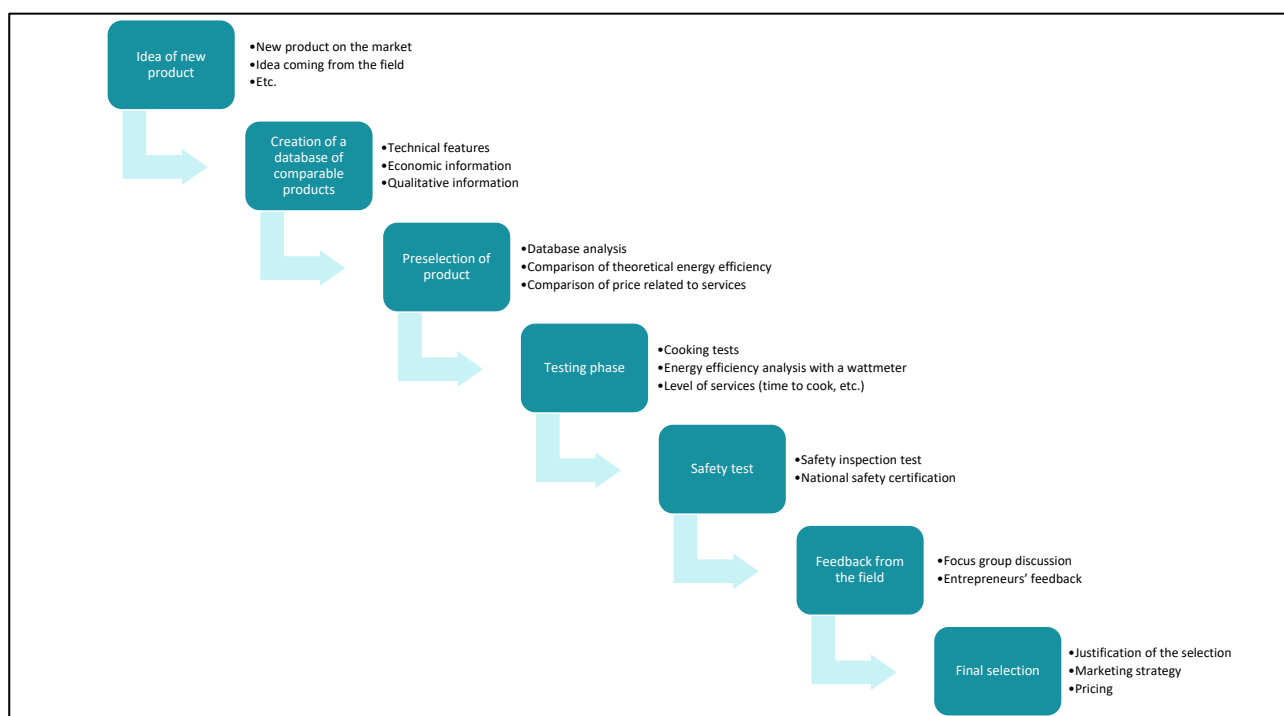


Figure 30 - Product selection process implemented by Geres

In Myanmar, too few actors are yet ready to put all these conditions in place to enable and accelerate the transition. Then, Geres aims to participate in the creation of a local actor of the transition, that would meet all these criteria.

Ah Lin Tan will be a social business that will rely on last-mile women entrepreneurs to disseminate sustainable energy solutions and other high-impact products to the communities. **Ah Lin Tan will work as an intermediate between producers or providers of sustainable energy solutions and other last mile customers to guarantee an access to high-quality, high-impact products to households and businesses in remote areas of Mandalay region and South Shan State. This kind of stakeholders is really missing in the field.**

The current situation in Myanmar complicates Ah Lin Tan's evolution. The Covid-19 crisis and the political situation slow down the Geres in its projects and the country in its transition, without however challenge the objectives. As an NGO, Geres also depends on access to funding. Their possible lack, due to the local situation, could hinder Geres' involvement in the transition.

● Positioning

According to the market research, households in rural villages in Myanmar do not have access to modern, reliable, affordable and sustainable products. Most households usually cook with traditional methods that

have negative impacts on their health and environment. Most households only have access to low quality lighting solutions, and only a minority has access to a larger range of energy services. When they do access other energy services, the equipment used is also of low quality.

Ah Lin Tan chooses to differentiate itself from other distributors and retailers of household products by focusing on high-quality, high-impact, low-energy consumption products. The goal is to focus the business in a triple bottom line approach and not to add another stakeholder providing the same services as the existing ones. The products sold will have a social impact with the communities, allowing them to access energy services not previously available to them, benefiting them both economically and health-wise. The products will also contribute to improving the environment by reducing waste and fuel consumption.

5. GENDER

5.1. GENDER-RELATED RESULTS

There was no really structured gender aspect included in the questionnaire and the survey to be filled in everyday in the 4 phases of the study. Participants were able to choose their new appliance between a rice cooker, a frying pan, a kettle, etc. If they couldn't choose the type of product (quality, design, etc.), the study is based on their choice of cooking. A part from that, the only gender-related question asked was the gender of the person cooking.

It is somewhat surprising to see that in the exit survey, 20% of the participants answered that men also used electric cooking appliances, whereas in phase 4, only 3 cooking events out of 6781 were recorded as being performed by men. This quantitative result shows that only women are involved in cooking activities in the region. Qualitatively and 3 months later, the responses are more nuanced, although the vast majority of activities is still carried out by women.

Although the accuracy of the figures given in the survey may be questioned, or if sometimes two people cook together but the questionnaire only allows for one figure to be given, the trend is very clear and cannot be discussed. The results of phase 4 are also observed during phases 1 and 2. No gender-related change could apparently be seen with the transition to electric cooking in the region.

However, participants also said in the exit survey that their daughters increasingly took part to the cooking tasks. If the gender imbalance remains the same (as people that cook are still mostly women), the attraction of the new generations for electric cooking can be seen positively.

While the transition to electric cooking in the studied villages has not had a short-term significant impact on the sharing of cooking-related tasks with men, the quantitative and qualitative results show that it freed up time and made the work of the cooks easier and less dangerous, from a health perspective (see above).

Although women also admit they spent some of the time saved on other household or daily tasks, these tasks also had to be done before. Thus, the transition to electric cooking could have important impacts on women's living conditions.

Apart from the "classic" impacts linked to the improvement of cooking solutions and from the possible unplanned impacts mentioned just above, further studies should be carried out and actions put in place to ensure that the electric cooking transition is accompanied by a better sharing of tasks and a behaviour change.

5.2. GENDER PERSPECTIVE IN GERES' PROJECTS IN MYANMAR

In relation with the further studies needed, Geres and F3E have carried out a study in 2021 entitled *Intervention strategies to remove barriers to women's entrepreneurship*. This includes recommendations and an action plan that aims at facilitating women's entrepreneurship and improving women's living conditions, and therefore particularly sensitive to gender aspects. The main proposals of the action plan are listed in annex. Geres is considering this in the development of Ah Lin Tan.

Through its "Inclusion & Energy" program, Geres pays special attention to including gender aspects when designing, implementing and monitoring its projects. This is also true in Myanmar for the setting-up and the development of Ah Lin Tan.

Past experiences and studies were considered in the design of the project. It is for instance known that the transition from biomass stoves to electric ones will decrease the firewood consumption, save time and

decrease the strenuous work, primarily for women, the ones mostly responsible for firewood collection (*Geres 2015 cookstoves market assessment in Myanmar*).

The creation of a network of women entrepreneurs will also have positive social impacts, by providing women with good economic opportunities. Local women entrepreneurs will be trained and supported by the Ah Lin Tan company. The training will include business management, marketing and sales skills, product information, roles and responsibilities, etc. All these actions contribute to the women empowerment and to their emancipation.

Improving the conditions of access to credit for women is also an objective of the project, in order to facilitate their economic independence. Different informal credit systems will be tested and the consumers' willingness to pay will be verified. Free testing period will also be explored to allow consumers to try the product and pay later if satisfied. Even though microfinance institutions do not provide consumption loans, partnerships will be explored to create attractive financial products to allow for scale-up.

This will bring significant beneficial impacts on Myanmar's cooking energy market by, among others:

- Increase revenues for women entrepreneurs, thus promoting global prosperity and enhancing women's role in the communities and economy. In Thazi, still 50% of women are excluded from the labour market. This research will allow to test new business opportunities for women entrepreneurs, allowing them to increase their revenues and benefit their families.
- Improving health outcomes for women and children by reducing exposure to household air pollution related to biomass cooking methods, namely traditional fireplaces, and poor ventilation.
- Increase the time available for women, who are also more responsible for cooking in the household, and therefore potentially their free time, to devote to activities of their choice.

6. NEXT STEPS

6.1. USE OF RESULTS AND KNOWLEDGE SHARING

First of all, the results of this research project and this report will be used in the Geres' projects in Myanmar and in particular in the Ah Lin Tan project.

The significant results and impacts of electric cooking reported in this report show that:

- **The market for electric cooking appliances can quickly develop in areas connected to the grid, if the equipment proposed meets the need correctly.**
- **These impacts are strong marketing arguments, which should be used to improve the diffusion of this cooking solution.**

The results will therefore be useful first to the Geres team, developer of the Ah Lin Tan project, and then to Ah Lin Tan itself.

The quantitative and qualitative results of this study will also be widely shared with interested stakeholders. If agreed, this study financed by MECS will be made public on the Geres website. NGOs like Geres, which are subsidized, have an important role to play in R&D in the energy access sector and more specifically in electric cooking. One way to increase impact is to share the results of such research projects.

Knowledge will be shared with other international organizations working on such topics, including United 4 Efficiency (UNEP) and CLASP (NGO), two organizations looking to develop standards and compliance mechanisms for energy efficiency in electric appliances. The knowledge acquired during this pilot project will help them design their interventions better, namely around the government's role.

Finally, the final report will be shared with both the Dry Zone Greening Department, the project partner, as well as with the Energy Efficiency and Conservation Division of Directorate of Industrial Collaboration of the Ministry of Industry, the unit responsible for setting public policy regarding the quality standards and compliance mechanisms in household appliances. Geres initiated a dialogue and a dedicated working group on national cookstove standard during its Switch Asia SCALE project (2014-2018) and intends to use this experience for the benefit of cooking appliances.

Finally, most distributors of electric cooking appliances in Myanmar currently have little understanding of energy efficiency. The marketing strategy, energy-efficient testing results and product selection will be shared with the suppliers of electric cooking appliances. The objective is to start to build the understanding of cooking appliances distributors around energy-efficiency topics, which is currently lacking among them.

6.2. OPERATIONAL NEXT STEPS

The situation in Myanmar is currently particularly complicated and significant challenges will need to be faced to scale-up the electric cooking. However, activities can still be carried out in the field. By the way, the AFD, which funds the *Ecodev* multi-country economic program led by Geres and therefore the Ah Lin Tan project, has confirmed the allocation of funding despite the current political situation.

Geres will continue to look for funding opportunities, first for the development of its current projects but also to carry on research on electric cooking in Myanmar. But Geres will also start raising funds for the Ah Lin Tan organization, whose capital needs are relatively low but whose cash flow needs are more significant.

Geres' team will also take the following next steps that aim to scale up the results of its projects:

- Increase the number of communities targeted and of last-mile distributors / entrepreneurs to scale-up the distribution network;

- Officially set-up the Ah Lin Tan organization, which will act as the missing link in the value chain and thus ensure the distribution of clean energy solutions in remote villages through a market-based approach;
- Implement further tests for new appliances and eventually importing appliances respecting international standards if needed, as well as undergo more thorough testing in quality and safety;
- Develop a robust financial mechanism, in partnership with MFI, to guarantee access to credit to potential customers and/or entrepreneurs;
- Collaborate with the government of Myanmar, suppliers and other relevant stakeholders to develop national standards, labels and compliance policies for electric cooking appliances;
- Collaborate with universities, research institutes and companies to carry out further studies and pilot interventions.

For scaling-up, most of the activities would target Myanmar, but the electric cooking appliances could be scaled-up to other countries in South and Southeast Asia where access to energy efficient appliances is lacking and last-mile distributor networks could be leveraged.



7. CONCLUSIONS AND RECOMMENDATIONS

● Conclusions

The overall methodology used for this field research project funded by MECS is particularly relevant and interesting. The knowledge learnt have been capitalized by Geres and could be replicated in other projects. This and the materials used could also be shared by Geres with interested stakeholders. The process is somewhat laborious and sometimes time-consuming, but field research projects take time. Project managers need to know this is “the price to pay”, especially to report long-term results.

The methodological choices made for this study were generally the right ones (sample size, methodology, participants, materials used, incentives, etc.) except for the change in data collection method between phases 2 and 4, which should be avoided.

Initial explanations are particularly important to ensure that participants understand the instructions. The data is collected over more than 6 months and requires a lot of work from each stakeholder. It is then important that the instructions are clear to everyone from the beginning. Once understood, they are relatively easy to implement by the participants. This initial time investment is therefore worthwhile.

Technically, the results are extremely interesting and allow Geres and the readers of the report to confirm or learn from many findings. The switch to electric cooking is almost instantaneous once a household gets such an appliance. One of the main findings of this study is that people do want to cook with electricity in the region.

Moreover, this changes people's habits in terms of food only slightly. Electric appliances almost completely replace some other biomass solutions. **In the region, electric cooking could for instance put an end to the use of charcoal.** When electric cooking appliances are available (phase 4), rice is cooked using a rice cooker in 80% of cases. This kind of results is impressive compared to the baseline and confirm the interest of the population in the electric cooking. This sector may then have a very promising future in Myanmar, if:

- The technology allows it: i.e. the electricity grid develops nationally and rapidly;
- The supply side allows it: a sufficient number of stakeholders take up the subject and provide quality services to the population (product quality, guarantee, awareness, instalments, access to credit, last-mile logistics, etc.).

The environmental and social impacts of the electric cooking, indirectly calculated or qualitatively assessable in this study, are very promising. The switch to electric cooking allows a drastic decrease in energy consumption for cooking and a significant reduction in the use of wood and charcoal resources. The time saved and the convenience of electric cooking also improve the living conditions of women. While it is not clear yet whether men really participate in the cooking tasks or not, and whether electric cooking could rebalance responsibilities or not, it is certain that the impacts on women's lives will be particularly substantial.

● Recommendations

This analysis relates the results of a study conducted by Geres in the specific context of cooking diaries. Many other studies have been carried out by Geres in the past few years (especially market studies, but also about the barriers to women's entrepreneurship, among others) and may be made available by Geres on request. These studies already contain recommendations that it is then not relevant to repeat here. However, these few findings may be considered by organisations that want to take part in the scaling-up of the electric cooking:

- To provide resistant products, adapted to the living conditions in rural, humid, hot, sometimes dusty areas, etc. and sometimes faulty electricity grid subject to voltage variations. This requires a low level of advanced technology (little computerisation) and a highly simplified user experience.
- **The high use of the products when provided (free of charge) shows that non-use is linked to an access problem.** This may be due to the last mile unavailability, to an economic barrier related to investment or a lack of awareness and/or customer service delivered by resellers with little knowledge of the electric cooking sector. Electric cooking has a promising future only if the players in the sector know how to develop it properly and meet customers' expectations. The scaling-up of electric cooking will require improved customer service in terms of logistics (last mile availability), economics (affordability, instalments), technology (low technology level, simple user experience, tested quality, warranty) and sales (awareness, explanations, promotion, after-sales service).
- The rice cooker, the frying pan and the kettle are the most used products in rural areas and should therefore be at the heart of the strategy of the stakeholders involved. Rice accounts for one in two cooking events and it is cooked in a rice cooker in 80% of cases. **The rice cooker is the priority.**
- Women are and remain the ones in charge of cooking tasks in this region. They must be the main target for stakeholders, that must take their expectations into account.
- The marketing strategy should be based on the time saving, comfort, absence of smoke (health) and cleanliness of electric cooking. These are the main reasons and differences with the biomass fuels why people want to switch to electric cooking.
- People are looking for bigger appliances than what it usually found in the local market. Providers should be able to meet this expectation.
- Electric cooking and its dangers are still poorly understood by users, for whom these solutions are still relatively new. Explanations and recommendations for use should be provided when purchasing such an appliance. An explanatory sheet, a phone number or a local customer service may be set up in order to raise awareness.

8. APPENDIX

● Action plan of the study carried out by Geres about the barriers to women's entrepreneurship

Main objective		
Remove barriers to women's entrepreneurship		
Specific Objectives	Operational Objectives	Actions
OS 1 GERES 'intervention methods boost the confidence of women entrepreneurs	OO 1.1 Women entrepreneurs become confident and have visionary plans for their business's long-term survival	<p>Action 1.1.1 Provide essential training programs on Leadership Management, Time Management, Communication and other necessary trainings required.</p> <p>Action 1.1.2 Develop a workplan in coordination with the women entrepreneurs</p> <p>Action 1.1.3 Provide opportunities for exchanging entrepreneurship experience amongst entrepreneurs from different areas during monthly meetings.</p>
OS 2 Facilitate in designing post-COVID, post-coup marketing plan	OO 2.1 Entrepreneurs could maintain some sales during economic down-turn.	<p>Action 2.1.1 Train and work closely with entrepreneurs to help them recruit sub-retailers who are loyal and hardworking.</p> <p>Action 2.1.2 Produce catalogues with product specifications and pictures which can be carried easily and distributed by women entrepreneurs and their sub-retailers.</p> <p>Action 2.1.3 Enhance leadership skills of women entrepreneurs so that they can further strengthen their sub-retailers.</p> <p>Action 2.1.4 Map out villages and draw market expansion plans for each entrepreneur.</p> <p>Action 2.1.5 Where possible, execute various marketing strategies such as cooking demonstrations, flyer distribution, printing vinyls and producing t-shirts.</p> <p>Action 2.1.6 Analyse and keep track of how sales figures vary with the implementation of different marketing strategies.</p>

		Action 2.1.7 Recruit one more staff to focus on supporting women entrepreneurs to boost sales figures
OS3 Facilitate and Assist vulnerable women entrepreneurs to gain access to credit and expand their business	OO3.1 Vulnerable women entrepreneurs have access to credit and could expand their businesses.	Action 3.1.1 Assist and work with entrepreneurs to connect them microfinance organizations if there is potential for expansion.
OS4 Establish a “name” for the entrepreneurs	OO4.1 Entrepreneurs could retain customers and build reputation OO4.2 Entrepreneurs can respond to the needs of the customers and expand product variety	Action 4.1.1 Provision of training on repair of electrical products to women entrepreneurs Action 4.1.2 Provision of necessary tools required for repairing electrical products Action 4.2.1 Training entrepreneurs to understand and respond to the needs of the clients Action 4.2.2 GERES working closely with entrepreneurs to build relationships with suppliers of different electrical products.
OS 5 GERES 'intervention methods to target the right women entrepreneurs	OO 5.1 GERES could identify right women entrepreneurs for the program	Action 5.1.1 Partner and work closely with local organizations to identify appropriate entrepreneurs Action 5.1.2 Make “test sales” intervention a critical part of the recruitment process. Action 5.1.3 Use a mixed method of recruitment (village gathering, recommendations, gathering in a workshop) depending on the nature of the village and the income generating activities in the village



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