

STUDY OF URBAN FUEL STACKING IN MATARAM CITY AND SUMBAWA REGENCY, INDONESIA



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1. INTRODUCTION

1.1. Background

In a rapidly changing world, where new fuels and technologies are being introduced frequently, cooking practices have also been simultaneously evolving. Clean cooking fuels become more and more affordable and readily available to more households around the world. The use of LPG, electricity, biogas, and biofuels are some of the cooking fuels that are considered clean as defined by the World Health Organization (WHO) Indoor air guidelines. These clean cooking fuels have important roles to play in the clean energy transition efforts of different countries as part of their contribution to combat climate change.

Despite the availability of clean cooking fuels, household fuel choices still differ in different places due to social, economic, and cultural dynamics. In Indonesia, the government has been pouring resources and efforts into encouraging households to transition to clean cooking fuels such as LPG, which has less emissions than biomass and is considered a 'clean fuel' in the context of air quality standards by the World Health Organisation (**Table 1**). The government has been providing subsidies to help compensate for the relatively higher prices of LPG especially to poorer households.

The 3-kg LPG Subsidy Program¹ of the government is found to be less effective in areas where a higher number of poorer households are located. In addition, the program had positive results in a number of provinces in Indonesia, but this disparity has been observed in the eastern part of the country (Bappenas, 2020). Approximately 14.9 million households still cook using biomass, for instance firewood (Kitt and Yates, 2020).

Hence, this study identifies the driving factors of such phenomena and explores the reasons for fuel stacking - the use of multiple types of fuels within the same household - in locations that are identified as low-income and peri-urban. So, this study focuses on the households in the study areas, which are Mataram City and Sumbawa Regency. Ultimately, this research aims to analyse how different urban contexts affect cooking fuel choices.

With the mainstreaming of climate change in every country's development plans, understanding the dynamics of clean-cooking fuels and how to sustainably transition to clean cooking will be crucial in formulating clean-energy strategies. This sector will play an important role in the clean energy transition strategy to meet sustainable development goals (particular Goal No. 7 - Affordable and Clean Energy) and to provide secure and flexible cooking fuels to households.

In Indonesia, this project was contracted to ICLEI - Local Governments for Sustainability Indonesia Office (ICLEI IO) to conduct surveys in two different urban contexts and analyse the factors driving cooking fuel choices in both areas. The ICLEI IO team is working closely with the UKAid funded Modern Energy Cooking Services (MECS) programme regarding technical design and implementation of the research activities.

¹The Indonesian Government has encouraged using 3-kgs LPG for household consumer and micro-enterprises. This is then regulated in article 3 paragraph (1) of the Presidential Regulation of the Republic of Indonesia Number 104 of 2007 concerning the Supply, Distribution, and Determination of the Price of 3-kgs LPG. The program was officially started in May 2007 aimed to convert kerosene to LPG for households (WSPA and Pertamina, 2012)

1.2. Study Literature

1.2.1. Dirty and Clean Cooking Fuels

Around 2.6 billion people in the world still cook using polluting open fires, or simple stoves fuelled by kerosene, biomass (e.g. wood, animal dung, crop waste), and coal (WHO, 2021). These ‘dirty fuels’ are a leading cause of pneumonia, stroke, ischaemic heart disease, and cancer which kills 3.8 million people every year (WHO, 2021).

Cooking fuels that are considered ‘clean fuels’ by the WHO include LPG, natural gas, ethanol, biogas, solar cooker, and electricity. These types of clean fuels produce emissions less than 7 mg/m³ with regards to carbon monoxide (CO) exposure level and less than 10 µg/m³ in terms of PM_{2.5} exposure level over a long duration, based on the WHO guidelines, delivering substantial reduction in household air pollution (HAP) exposures (WHO, 2014, as cited in Price et al., 2021). **Table 1** below is a WHO standard (annual average) on air quality guidelines values.

Table 1. Summary of Published WHO Air Quality Guideline Values

Pollutant (Unit for guideline)	Mean concentration over averaging time			Comment	Ref.
	1 hour	24 hours	1 year		
PM _{2.5} (µg/m ³)	-	25 ^a	10	24-hour guideline max. 3 days/ year	WHO 2006
PM ₁₀ (µg/m ³)	-	50 ^b	20	24-hour guideline max. 3 days/ year	WHO 2006
CO (mg/m ³)	35	7	1	-	WHO 2010

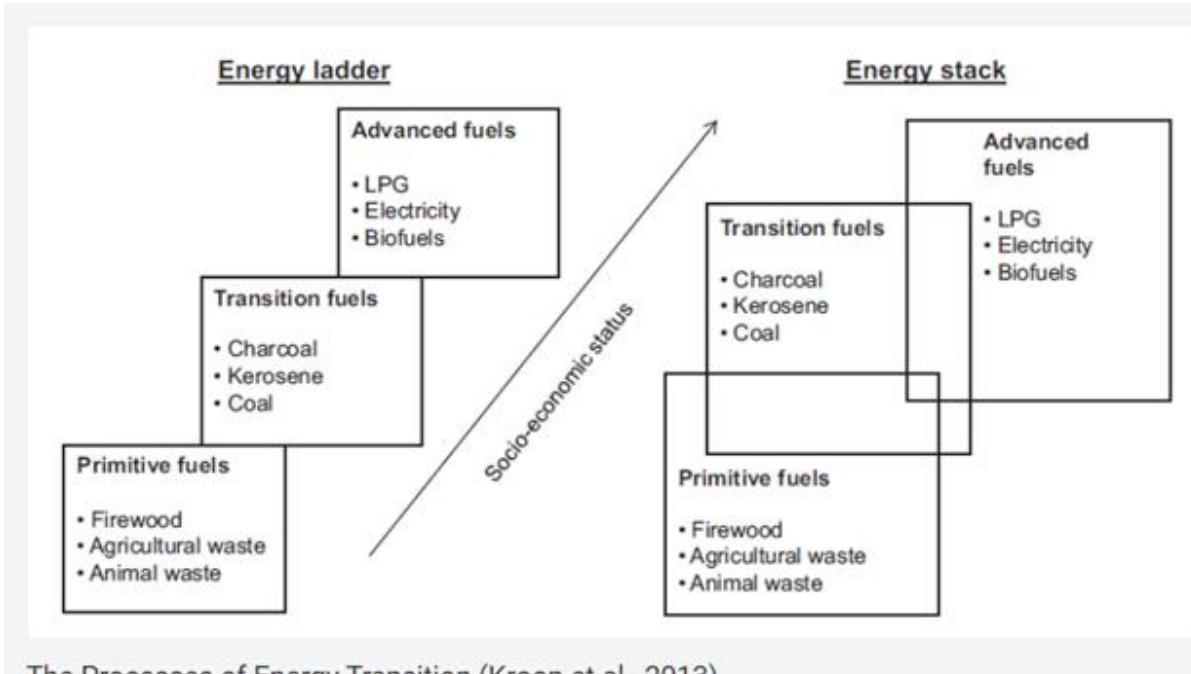
1.2.2. Concept of Energy Ladder

In developing countries like Indonesia, clean-energy transition is heavily affected by social, economic, and cultural factors. Each aspect has implications on cooking fuel decisions for each household in different urban contexts in the country. One important concept explaining this dynamic of clean-fuel transition is the “energy ladder” as shown in **Figure 1** which suggests that the use of “dirty” or polluting fuels increases as economic status decreases (Hosier and Dowd, 1987). While poverty remains a major challenge to fully transition to clean energy, other social and cultural elements still have significant influences on households’ fuel choices.

1.2.3. Fuel Stacking

As cities evolve and develop, urbanisation provides a greater opportunity for people to have higher income resulting in higher financial capacities to afford a clean fuel. In an article by the World Bank, it is rarely observed that households completely shift from one fuel to another with increased income, or as explained in the energy ladder (Zhang and Ochieng, 2020). Households rather practice fuel stacking, the use of multiple cooking fuel combinations within the same households (**Figure 1**), Zhang and Ochieng (2020) elaborated. Fuel stacking has been practised by poorer households in Indonesia as part of their daily living. The free and accessible firewood is such a common cooking fuel especially to those families living along a nearby forest.

With the benefits of fuel stacking, households get to enjoy the benefits of two or more cooking stoves for their everyday cooking. Household cooking becomes more efficient with one alternative stove available whenever the primary stove is in use or broken. This practice might vary from household to household depending on its economic and cultural status.



The Processes of Energy Transition (Kroon et al., 2013)

Figure 1. The Difference between Fuel Ladder and Fuel Stacking (Source: Kroon et al., 2013)

2. STUDY AREA

2.1. West Nusa Tenggara

In 2020, the Indonesian Statistic Agency (locally known as *Badan Pusat Statistik Indonesia* or BPS) reported that 0.8% of Indonesian households used electricity while 82.0% of households in 34 provinces used LPG (this includes biogas) as their primary fuel for cooking. However, 2.4% of households across the country still rely on firewood and 3.0% of households still use kerosene as their primary cooking fuels, respectively (BPS Indonesia, 2021).

In less-developed areas, particularly in eastern part of Indonesia, not all households have access to electricity. Based on the data submitted by the Ministry of Energy and Mineral Resources (MEMR) during a press conference held on May 28th 2021, it was noted that in the first quarter of 2021, the achievement of the electrification ratio² was 99.3% and the ratio of the number of electrified villages³ reached 99.6% for the entire country. There are still 542,124 Indonesian households that have not yet experienced electricity; the number of Indonesian villages that do not have electricity is 346.

The Government of Indonesia through the MEMR is targeting an electrification ratio of 100% in 2022. The work program is being carried out through:

² Electrification Ratio is the comparison between an electrified household and the total household.

³ Electrified Villages Ratio is the comparison between electrified villages and the total villages.

- Grid expansion by connecting villages or households close to the national grid (hereinafter PLN grid);
- Development of local new renewable energy (NRE)-based mini grids for community groups living in hard-to-reach areas;
- Construction of NRE power plants and electric energy charging stations;
- Provision of electrical power distribution equipment is intended for households who live in scattered communities;
- Implementation of the new installation electricity assistance program for poor households (low-income group).

To reduce the people's dependence on kerosene and encourage the use of a clean cooking fuel, the national government launched the Kerosene-LPG conversion Program in 2007. But this program has created minimal impact on the eastern part of Indonesia, and biomass cooking fuel is still commonly used in many areas (Bappenas, 2020). One of the reasons for this is that Eastern Indonesia has a high percentage of poor households and referring to the energy ladder, low-income households tend to rely more on biomass rather than clean modern energy. Dartanto et al (2017) suggested that compared to other provinces, uptake of LPG in the eastern provinces is relatively limited because people can't afford it.

West Nusa Tenggara (WNT) Province, located in eastern Indonesia (**Figure 2**), is one of the model cities under [ICLEI's 100% RE Project](#) to develop a roadmap towards 100% renewable energy and effectively implement local climate and energy action as part of efforts to tackling climate emergency - a security, socio-economic and environmental crisis - that requires the unprecedented transformation of energy systems and an immediate transition to renewable energy across all sectors. For this reason, the research focused on WNT Province.

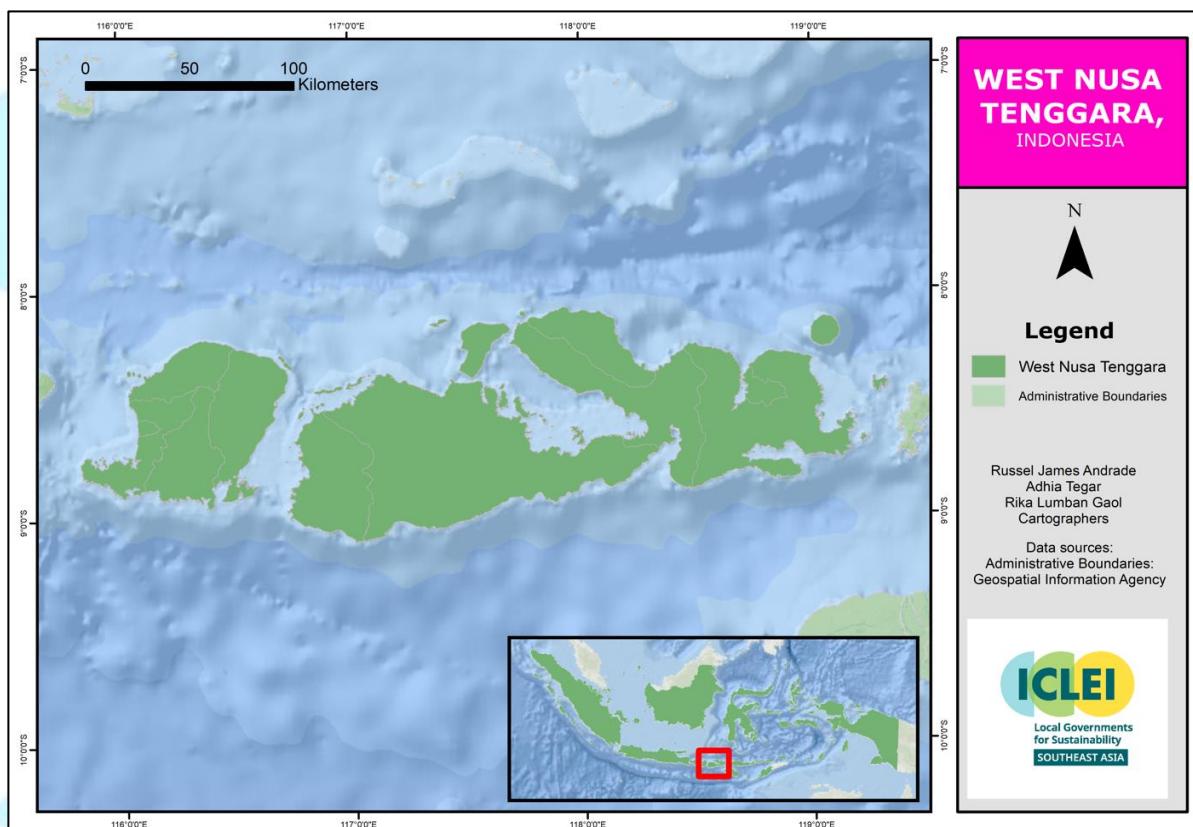


Figure 2. Map of West Nusa Tenggara

The main activities/industries of the province are agriculture, fisheries, products manufacture and livestock. In 2019, the Gross Domestic Regional Product (GDRP) was IDR 132,422.37 billion (0.83% of national GDP) (BPS West Nusa Tenggara Province, 2021). More importantly, the use of biomass fuel for cooking purposes is fairly high. Although LPG use in WNT Province has reached 61.6% in 2020, 9.2% of households are reportedly still using kerosene and 26.7% of households are still using firewood to cook. However, compared to areas in Java (Western Indonesia), this figure for biomass consumption is moderately high. For example, in East Java Province, 0.16%, 13.9%, and 82.6% of households are cooking with kerosene, firewood and LPG respectively in the same period (BPS East Java Province, 2021).

Although there has been an appeal about subsidising 3-kgs LPG only for the low-income groups, as many as 59.2% of households cook with 3-kg LPG. This makes 3-kg LPG the most used fuel for cooking by households in WNT Province. The subsidised 3-kg LPG is more widely used in urban areas (76.5%) than in rural areas (43.5%).

Additionally, 26.7% of households in WNT use firewood for cooking making it the second most-used cooking fuel in the province. This means that one in every four households in WNT still use firewood. In rural areas, firewood use is still high (42.8% of households), while in urban areas only 7.9% of households use firewood as cooking fuel. On the other hand, 9.2% of households use kerosene as their cooking fuel.

As many as 8.2% of households use kerosene in urban areas, while in rural areas, 10.1% of households use kerosene. Cooking with 12-kg LPG is the choice of 2.0% of households, while 1.6% of households use other fuels (e.g. electricity, biogas, LPG, charcoal). In addition, there are 1.3% households that do not cook at home. This might be because the households buy meals at the cafeteria close to their workplace or prefer to order food from food delivery services. The percentage of households that do not cook in urban areas is greater than in rural areas (**Figure 3**).

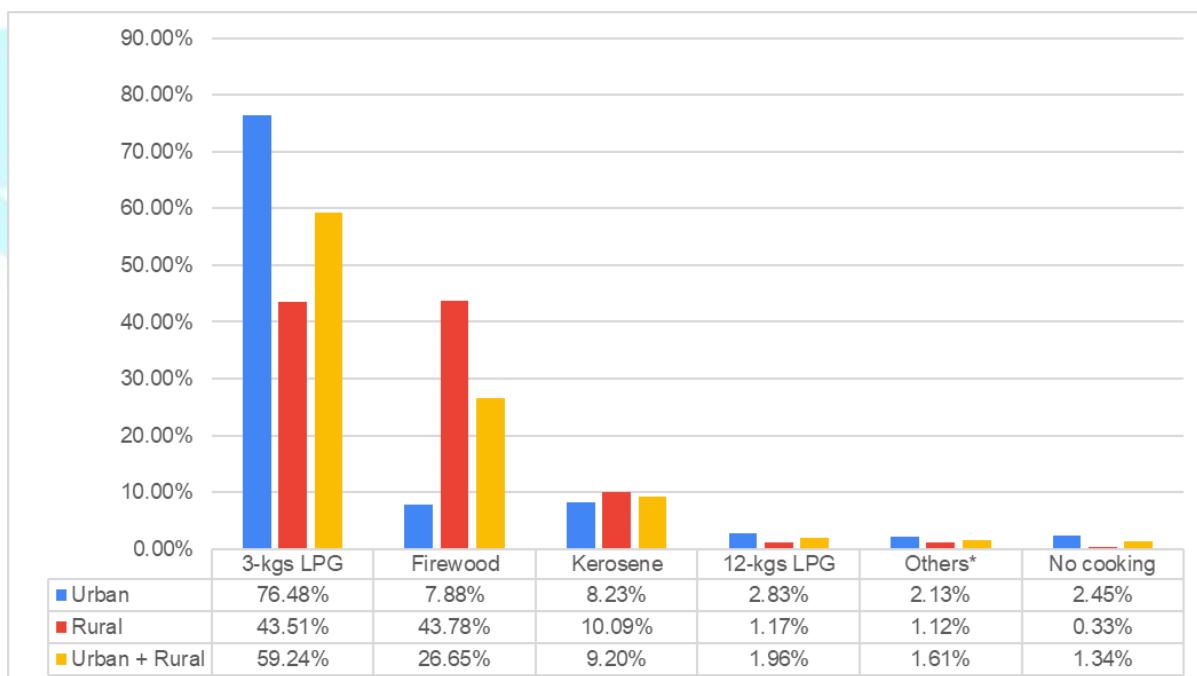


Figure 3. Percentage of Households in WNT Province by Primary Cooking Fuel Type

*Others: electricity, 5.5-kgs LPG, biogas, charcoal, and so on (Source: Susenas Data, March 2020, data processed).

In 2019, WNT Province ratified Regional Law No. 3/2019 about the Regional Energy Plan (RUED) to act as a regional energy policy guide for local energy planning. Through this policy, a community scale biogas development program to substitute kerosene and LPG was included in the RUED and will be implemented by 2050. This will be administered through active collaboration between relevant stakeholders including local governments and NGOs. As a matter of fact, the province reportedly has installed in total 6,129 units of biogas between 2015-2020, according to data provided by the Energy and Mineral Resources Agency of WNT. More importantly, this means the biogas units are around 0.41% of the total number of households in WNT as of 2020 due to the fact that there are 1,486,768 households registered in that year.

With regard to this project's requirement that the study should provide a nuanced understanding of fuel stacking practises in at least two towns or cities, Mataram City and Sumbawa Regency were chosen as study areas. Mataram City and Sumbawa Regency are part of WNT Province administrative areas and also participate as satellite cities of ICLEI's 100% RE Project. The rationale of the selected study areas is also because both areas are chosen as the program implementation for substituting kerosene and LPG with biogas energy for household cooking by 2050 according to information stated in the RUED.

2.2. Mataram City

Mataram City is the capital city of WNT Province (**Figure 4**). It is a peri-urban area with a GDRP of IDR 19,483.42 billion in 2019 accounting for 14.6% of the total GDRP of WNT Province. Further, Mataram City's GDRP is mostly influenced by three sectors: (1) Wholesale and Retail Trade - Repair of Motor Vehicles and Motorcycles (20.5%); (2) Financial and Insurance Activities (12.1%); (3) Manufacturing (9.2%), as reported in BPS of Mataram City (2021)

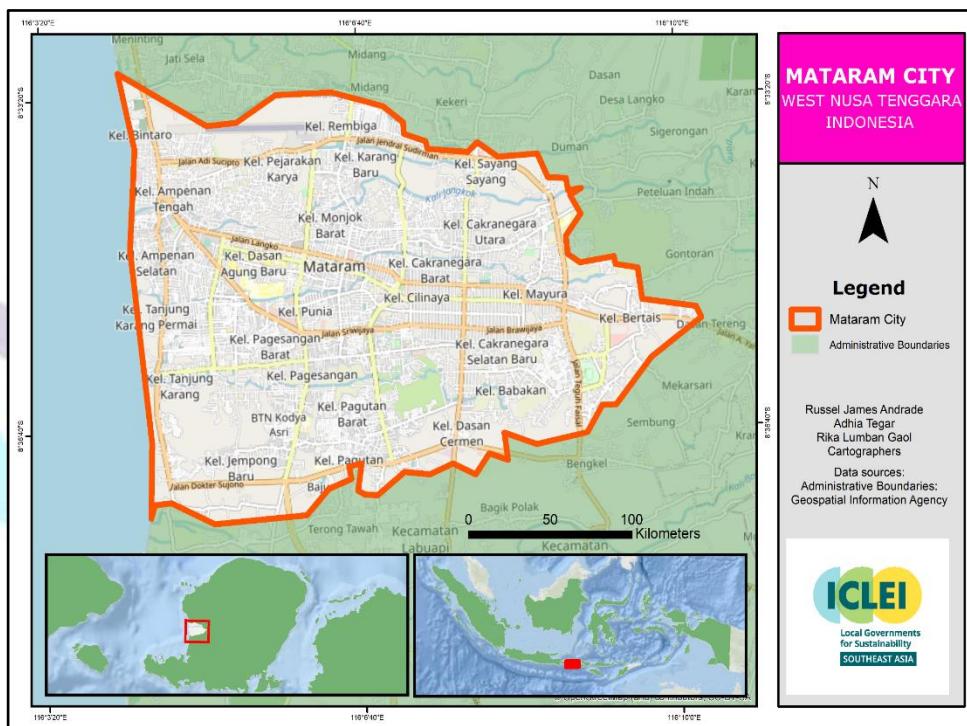


Figure 4. Map of Mataram City

Moreover, the city serves as home to 430,000 people and reportedly, 41,800 (8.5%) of them are considered poor (BPS of Mataram City, 2021). In terms of cooking fuels used in the city, households predominantly use LPG (87.0%). However, 1.2% and 4.4% of households were recorded to still use firewood and kerosene respectively, despite the government's program to shift to LPG.

In spite of high LPG usage in the city, there are still a number of households using dirty cooking fuels as their primary cooking fuel and little is known as to how households stack fuels. This interesting fact will be analysed to examine the driving factors affecting cooking fuel choices and fuel stacking among poorer households identified in the city.

2.3. Sumbawa Regency

Sumbawa Regency has a larger area compared to Mataram City and the population is also comparatively higher than the province capital with 510,000, including 63,000 poor people (12.3% of the total population), recorded in the Regency in 2020 as reported in BPS of Sumbawa Regency (2021). This may be a contributing factor to their primary cooking fuel preferences: only 47.0% use LPG, 26.6% use kerosene, 23.3% use firewood, 0.7% use electricity, and the remaining 2.4% use others.⁴

With respect to the GDRP, it was IDR 14.803,55 billion in 2019 (contributed 11.1% of the province's 2019 GDRP). Their GDRP is predominantly influenced by three sectors such as Forestry and Fishing industry, which contributes 38.4% of GDRP, followed by Motor/Wholesale and Retail Trade; Repair of Motor Vehicles and Motorcycles with 16.2%, and then Construction with 13.9%.

The relatively less-developed Regency of Sumbawa demonstrates a higher usage of dirty cooking fuels such as firewood and kerosene. It's peri-urban characteristics might be affecting the choices of households as well as its proximity to nearby forests which serve as their firewood sources. These will be inspected in this study to draw conclusions on the effects of different urban contexts on fuel choices.

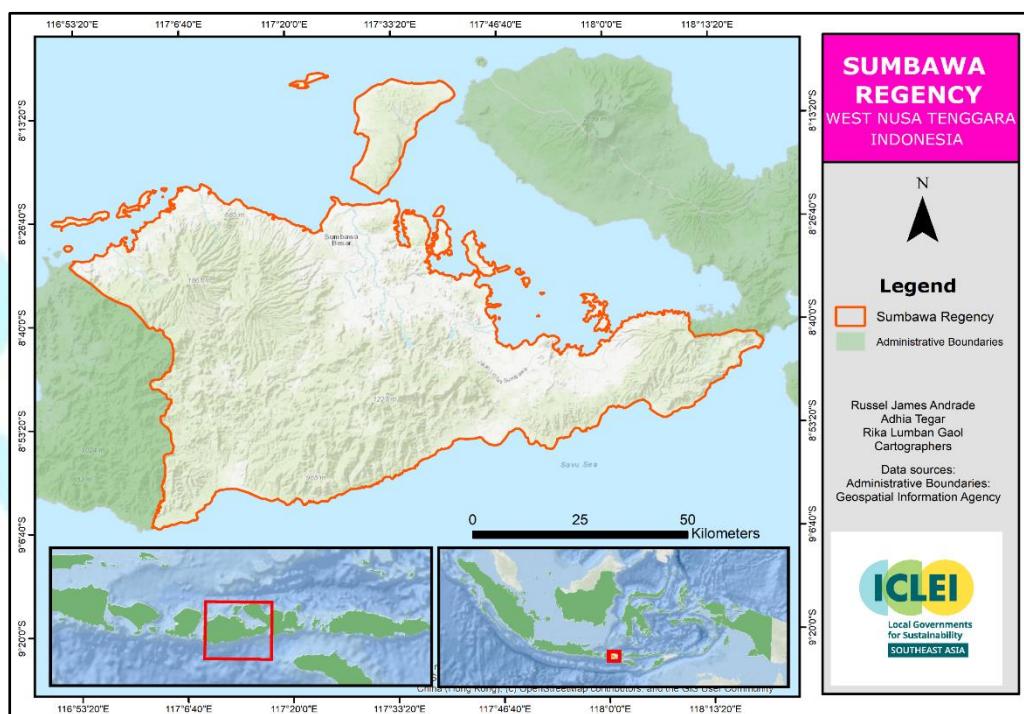


Figure 5. Map of Sumbawa Regency

⁴Others: including households who do not cook and biogas, according to statistic in West Nusa Tenggara Province in Figures by BPS (2021).

3. METHODOLOGY

3.1. Data Collection

3.1.1. Consultation with Local Governments

With regards to data collection phase, the researchers began this phase with two virtual Focus Group Discussions (FGD) with local government representatives from Mataram City and Sumbawa Regency via zoom meetings on the 15th of October and 11th of November 2021 to scope the local context on household cooking and ask assistance in identifying 20 household respondents (10 households in each study area) that match the criteria prior to visiting the study areas and data collection.

Then, on the 18th of November 2021, the Local Development Planning Agency of Mataram City (locally known as *Bappeda*) invited researchers and other local governments to *Bappeda*'s office. The purpose of the meeting was to give opportunity to the researchers to provide information for local governments, specifically the background of the study, its objectives and criteria of the respondents to help the local governments identify the households for data collection process. As the outcome, the *Montong Are* area of the Mandalika urban village was suggested by the local governments as the appropriate site for data collection that fulfils the criteria.

Definition

Rural villages (locally known as *Desa*): An administrative area that is Indonesia administrative level five (below sub-district/*Kecamatan*). It is led by a village head (*Kepala Desa*) that is elected by residents and has full rights for implementing their own regional autonomy (Evans and Millot, 2020).

Urban villages (locally known as *Kelurahan*): Same level as *Desa*, but the head of the *Kelurahan* is called Lurah, a civil servant that is directly appointed by Regent/Mayor. In contrast to *Desa*, *Kelurahan* is an instrument for autonomy implementation in regency/city areas (Evans and Millot, 2020).

As far as Sumbawa Regency is concerned, the local government organized a meeting on the 22nd of November 2021 and invited researchers in addition to the five heads

from three rural villages and two urban villages of Sumbawa Regency to communicate about the project and plans for data collection process in the field. In contrast to Mataram City, data collection for 10 households in Sumbawa Regency were not clustered in one area, but rather separated into five rural and urban villages, namely urban villages of Brang Bara and Brang Biji and rural villages of Kerato, Nijang and Karang Dima. During the interview process, researchers were accompanied by each head of urban and rural villages mentioned earlier.

3.1.2. Interview Process

With regards to data collection, two researchers were involved in this activity and applied a qualitative approach by using open-ended questions in a form of questionnaire (**Annex A**). Household interviews of 20 households were conducted across two sites; each researcher interviewed 10 households separately. The interviews were completed in three days in total and took approximately around 45-50 minutes for each household.

For the data collection in Mataram City, researchers were accompanied by a representative of the Community Social Workers (locally known as *Pekerja Sosial Masyarakat* or PSM) to help with the communication process should the respondents feel more comfortable speaking in their local language.

Interviews in this city were done in two days, with four households on the first day and six on the second day (**Table 2**) and for time efficiency, two researchers collected data separately with five households for each researcher.

Definition

Community Social Workers/*Pekerja Sosial Masyarakat* (PSM): Volunteers from the community that serve to assist the government and society in implementing regional social welfare, based on the Ministry of Social Affairs Regulation 01/2022 regarding Community Social Workers.

With respect to Sumbawa Regency, the interviews of 10 households were completed in one day in five different urban and rural villages (**Tables 3**). Firstly, researchers accompanied by two officers from *Bappeda* of Sumbawa Regency visited each head of villages and sub-district offices that previously had attended the FGD with the *Bappeda* of Sumbawa Regency and from there, they took the researchers to the households they had allocated for the interview. Additionally, throughout the interview, representatives from *Bappeda* of Sumbawa Regency accompanied the researchers in addition to the local governments of the selected urban and rural villages.

Table 2. List of respondents in Mataram City and the date of collection

Code	Location	Date of collection
M-1	Mandalika, Mataram City	19 November 2021
M-2		
M-3		21 November 2021
M-4		
M-5		
M-6		19 November 2021
M-7		
M-8		21 November 2021
M-9		
M-10		

Table 3. List of respondents in Sumbawa Regency and the date of collection

Code	Location	Date of collection
S-1	Brang Bara	23 November 2021
S-2	Krato	
S-3	Nijang	
S-4	Karang Dima	
S-5	Brang Biji	
S-6	Brang Bara	
S-7	Krato	
S-8	Nijang	
S-9	Karang Dima	
S-10	Brang Biji	

3.2. Data Analysis

The results of household interviews were all perused by the researchers and then sorted into a range of different categories based on the section in the questionnaire in the form of tables using Microsoft Excel for deeper analysis. This was done so that researchers could identify the patterns, similar answers, or major findings based on the questions. The categories are meticulously described below:

- **Cooking Activities**

This particular category indicates households' demography such as the head of the household and person in charge of cooking the dishes for the family as well as paying for fuels. In addition to that, responses on respondents' cooking activities such as their daily cooking frequency, time consumed for cooking, and if there are any special dishes cooked with particular fuels stating also the reason for the fuel usage with its advantages and disadvantages are also shown here.

- **Preferences, Stoves Usage, Safety and Convenience**

This category provides responses on respondents' preferences for the fuels they are using such as information on whether respondents cook with them because of taste, cultural, or budgetary reasons. Additionally, details on the stoves' usage by respondents can be uncovered, for instance to know if the stoves are also used other than for cooking purposes. On top of that, this section tells of respondents' perceptions on safety in terms of cooking and which fuels are more convenient, along with difficulties operating the stove and solutions to solve those struggles.

- **COVID, Cooking Fuel Affordability & Accessibility**

This category notably contains information about accessibility and affordability of current fuels, such as the fuel costs, access to these fuels, the source of their fuels and frequency of getting them. Moreover, barriers and challenges in obtaining their cooking fuels are also identified in this section. The Impact of the COVID-19 pandemic on respondents' cooking activities and access to their fuels are divulged too in this section.

- **Health and Culture**

The answers in this category can inform respondents' awareness regarding the health issues associated with traditional cooking fuels and details on the cultural or religious beliefs that may influence their cooking fuels preferences.

- **Governments' Program & Electric Cooking Appliances**

In this category, researchers can identify respondents' views towards the Indonesian Government 3-kg LPG subsidy program, whether it has benefited them or been successful in general, and their hopes for the government to support the shift to modern energy. Moreover, it reveals respondents' knowledge on electric cooking appliances, their interest in getting one should there be support from the government or buying it with their own money.

4. RESULTS

4.1. Household Information Related to Cooking Activities

Table 4 below summarises the socio-demographic characteristics of respondents in the two study areas and illustrates some stark similarities, in particular on the main source of income (the respondents matched the sampling design of the study). Both sites were performing cooking fuel stacking practises by combining dirty-and-clean cooking fuels for the last 3-5 years and beyond.

Table 4. Socio-demographic Profiles of Respondents

Variables	Mataram City (n = 10)	Sumbawa Regency (n = 10)
Age (househusband and housewife; mean, sd ⁵)	57 (9.1)	55 (6.4)
The highest education (househusband and housewife)		
○ Never went school	79%	18%
○ Elementary school	21%	53%
○ Junior high school	-	6%
○ Senior high school	-	24%
Main source of income (househusband and housewife)		
○ Casual daily worker ⁶	43%	35%
○ Farm labourer	43%	18%
○ Fisherman	-	6%
○ Unemployment	14%	41%
Family size (mean, sd)	4.5 (2.1)	4.5 (1.2)
○ Male	42%	38%
○ Female	58%	62%

⁵sd is an abbreviation of standard deviation

⁶Onion and garlic peeler, motorcycle taxi driver, temporary maid, vegetables seller, food seller

Variables	Mataram City (n = 10)	Sumbawa Regency (n = 10)
Respondent is primary cook		
○ Yes	80%	90%
○ No ⁷	20%	10%
Cooking frequency		
○ Once in a day	30%	10%
○ Twice in a day	50%	80%
○ Thrice in a day	20%	10%

Dirty cooking fuel still the preference fuel for most households

In Mataram City, most respondents (70%) are still using firewood as their secondary cooking fuel with LPG as the primary one. This happened because there were 3 main challenges identified in using LPG as a primary cooking fuel, among others: not readily available, the distance is quite far for refilling, and the high price.

On the other hand, in the Sumbawa Regency, the majority of the respondents were reported to use firewood (80%) and kerosene (10%) as their primary fuel. Interestingly, the transition of dirty-to-clean cooking fuel in Sumbawa Regency through the Government of Indonesia programme of 3-kgs LPG is rated low because of reports of housefires and/or explosion events in media back in the day (WLPA and Pertamina, 2012) as well as stories from around their neighbourhoods, which have traumatised respondents, though they have never witnessed it in person. Therefore, a number of respondents in Sumbawa Regency feel reluctant to experience clean (modern) cooking practises. One respondent shared how their fear of LPG gas emerged:

I'm afraid to use LPG because of trauma. One time I came to visit my daughter and son-in-law and when they were about to install LPG after being refilled, there was a burst sound coming out of LPG. I was shocked and ran away afraid it would explode! Though it's okay in the end, but I'm still scared.

(Female, S-4)

Stacking combinations of dirty-and-clean cooking fuel portfolios

Table 5 showcases the main categories of stacking emerged during the study. The majority of the respondents in Mataram City chose LPG as their primary cooking fuel and combined firewood and electricity as second and third cooking fuels, respectively. The usage of LPG is more conveniently explained by the respondents as being cleaner, practical in terms of setting up the stove (just turn it on), faster and less hassle. Meanwhile, the phenomenon of cooking fuel stacking in Sumbawa Regency is quite varied. Most respondents prefer kerosene as the secondary fuel over LPG even though the price of LPG is cheaper than kerosene.

⁷Daughter and/or daughter in law

Table 5. Number of Respondents by Cooking Fuel Stacking Type

Location	Firewood & Kerosene	Firewood, Kerosene & Electricity ⁸	Firewood & LPG	Firewood, Kerosene & LPG	Firewood, LPG & Electricity	Firewood, Kerosene, LPG & Electricity	Total (n)
Mataram City	-	-	2	-	7	1	10
Sumbawa Regency	3	3	-	2	1	1	10

Furthermore, the majority of the respondents (55%) have used electric appliances alongside their cooking fuel, but restricted only to rice cookers. Those households predominantly use rice cookers to cook rice afresh or to reheat rice that has previously been cooked using primary and/or secondary cooking fuels so it can be consumed again later on (one respondent said their kids do not like eating cold rice). In addition to that, one respondent also revealed that they use a rice cooker more often during Ramadan to cook rice during dawn (before sunrise) and it was the reason the family bought the rice cooker in the first place.

"I decided to buy a rice cooker because Ramadan month was coming at that time. I thought it would be easier to cook rice during the suhoor (eating before sunrise) so we don't have to be troubled in the early morning cooking with firewood."

(Female, M2)

4.2. Factors Affecting Cooking-fuel related Decisions and Preferences

This section describes several reasons that were identified in relation to choices made to stack the primary cooking fuel with other fuels across the sites:

- Fuel availability, affordability and accessibility;
- Cultural reasons;
- Convenience and safety of cooking;
- Ideal preference of the future;
- Awareness of health issues induced by dirty fuels;
- Opinions on the Government of Indonesia's (GoI) programme of 3-kgs LPG;
- Cooking fuel aspirations.

Several factors were categorised under these reasons, including geographical factors, impact of COVID-19, gender composition, weather conditions, food taste, and friends or neighbours' influences.

Fuel Availability, Affordability, and Accessibility

Fuel availability and affordability is a dominant factor for low-income groups. For this group, the cost of the fuel also featured strongly as a reason for stacking and the type of fuel to stack with. The stacking was always with firewood because most respondents (85%) in two study areas reported that firewood is the most accessible cooking fuel in their areas. In addition, firewood including agricultural wastes (e.g. twigs, coconut fibre/husks, rice husk, sawdust, bamboo, dry stem and leaves, etc.) are free, and the geographical aspect also influences the accessibility of firewood. According to some respondents, firewood is easy to obtain around the neighbourhood; it is almost everywhere. In addition, they usually

⁸Only a rice cooker is regularly being used as the electricity for modern cooking appliances.

collect firewood not far from their home, such as on the river bank, forest on the hills, garden and others, such as from a wood furniture store:

"I obtain the wood from the chief of the village's house not far from here. Because he owns a wood furniture store and I often ask him for the excess/unused wood for me. If not, just go to forest on the hills not far from here"

(Female, S-4)

In contrast, during COVID-19 pandemic, LPG and kerosene have become scarce, which may be on account of agent travel restrictions. Some respondents maintained that scarcity and increase in fuel prices often occur, especially before the celebration of religious holidays.

Given the context of budgetary reasons, respondents who use LPG and/or kerosene as other cooking fuels were limiting their budget to afford these fuels. The decision was taken into account because the price of LPG and kerosene became expensive due to COVID-19 pandemic. Moreover, three respondents in both study areas said that their household income became uncertain and/or decreased because of the unavailability of jobs, as an impact of COVID-19 pandemic.

Table 6.The Price Range of LPG, Kerosene and Electricity Prior-to-During COVID-19 Pandemic

Fuel Type	The Price Range in Both Survey Areas		Price Gap	Current Availability during COVID-19 Pandemic
	Prior COVID-19 Pandemic	During COVID-19 Pandemic		
Firewood	Free	Free	0	Always available
Electricity R-1/TR; Small Household <450VA / 900VA (ICLEI, 2020)	IDR/kWh (0-30 kWh): 169 / 275 IDR/kWh (30-60 kWh): 360 / 445 IDR/kWh (60+ kWh): 495 / 495		0	Always available
LPG o 3 kgs	IDR 15,000 – 17,000	IDR 20,000 – 22,000	IDR 5,000 – 7,000	Once in a week
Kerosene				
o 1 liter	IDR 5,000 – 6,000	IDR 15,000 – 16,000	IDR 10,000 – 11,000	
o 1.5 liters	IDR 10,000 – 20,000	IDR 22,000 – 27,000	IDR 12,000 – 17,000	

Table 6. The Price Range of LPG and Kerosene Prior-to-During COVID-19 Pandemic

The limitation of cooking fuel budget is also influenced by gender composition (**Figure 6**). In the households, more than half of the total respondents have a female as the head of the household, which is predominantly due to their husbands having passed away or divorced. That being said, in both study areas, females have more authority in paying for households' cooking fuels because either they earn their income or they are in charge of managing the households' expenditure; 75% females (housewives, head of the household and daughters) and 25% males (husband & sons) pay for cooking fuels. This is because females are responsible for managing household income (including expenditures) and determine the priorities of household needs.

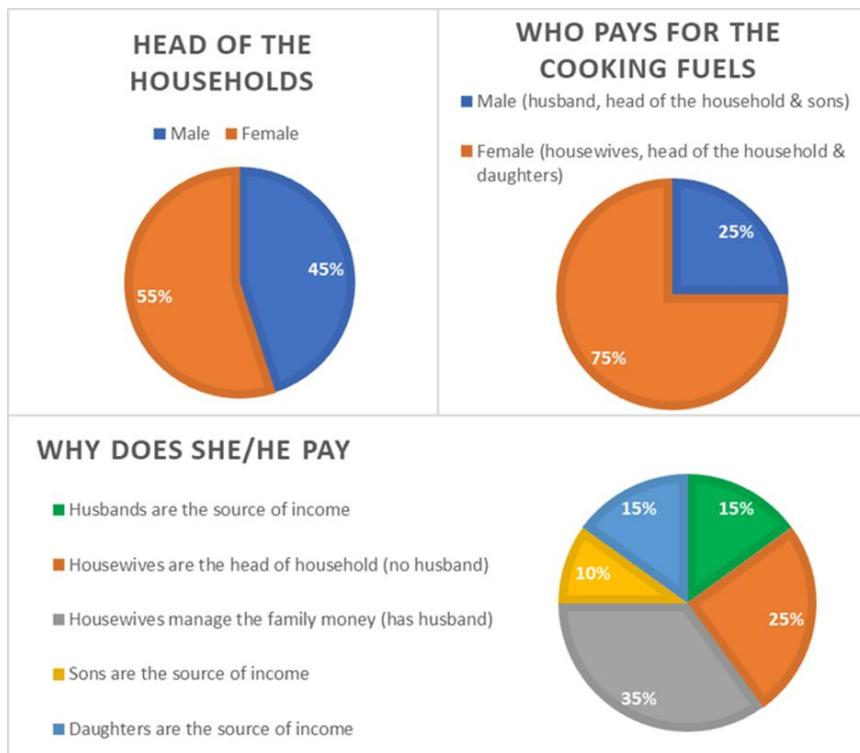


Figure 6. Gender Composition in the Households

In addition, **Figure 6** also indicates the reason why she/he pays. Significantly, out of 75% females who pay for the cooking fuels, 25% of them do it owing to the fact that they are the head of the household (no husband). Meanwhile only 15% of the total males pay for the fuel by themselves because they are the breadwinner of the family. The reason why the female-to-male ratio for the one who pays for the cooking fuels increased compared to ratio of head of the household is because there are seven respondents (35%) who have males as their head of the household as well as being the source of income yet the housewives are the ones who pay for the cooking fuels because they manage the family money, as said by one respondent:

"I pay it because I am in charge of managing household finances. Even though my husband is the main breadwinner."

(Female, M-7)

On top of that, five households are supported by their children for their source of income and leave cooking fuels payments to their sons/daughters. The data indicated 15% of households' cooking fuels are paid by their daughters and 10% are paid by their sons.

"My son pays for cooking fuel. Because he can help buy LPG gas from the salary he receives."

(Female, M-9)

Cultural Reason

Aside from economic reasons, food taste emerged as one of key considerations for most respondents to stick with firewood and agricultural waste. Evidently, 17 of the 20 respondents shared the same view that food cooked by using firewood was tastier. Moreover, the smell of food became more fragrant. Firewood and agricultural waste emit a fragrant aroma when burned, then the aroma is mixed with the aroma of the food being cooked and the combination of these aromas was favoured by several households, according to them. Interestingly, some respondents said that dishes cooked using firewood were not easily spoiled and lasted longer compared to using LPG, however the respondents could not elaborate when asked for more details.

There is also a tradition passed down from generation to generation and it has become a common practice especially in peri-urban areas that cooking for religious holidays, weddings, harvest season, thanksgiving or other celebrations is preferred using firewood. Apart from the fact that the portion of food being cooked is large and certain dishes take a long time to cook, it is customary to leave the food on the wood-fired stove because the residual heat in charcoal from the firewood keeps the food warm longer. This is also a factor in the experience of wood-fired stoves, which have been used for more than 20 years in almost every respondent's house (longer than the use of clean fuels).

As mentioned previously, religious beliefs are shown to have also played a part in fuel preferences for a certain household, particularly one household that admitted that she bought a rice cooker because to facilitate her in preparing rice for *Suhoor* during Ramadan, but apart from that month, she rarely uses it because the taste is not as good as using firewood, as she claimed.

A local traditional belief about a benefit resulting from cooking with firewood plays a role too in influencing cooking fuel choices; one respondent in Sumbawa Regency shared:

"There is a local tradition here that thinks that the burnt rice caused by cooking with firewood can make you strong and healthy."

(Female, S1)

As far as community influences on fuel choices are concerned, the data showed as many as a quarter of the respondents asserted that their cooking fuel choices have been influenced by either their neighbours, friends or even the head of environment in the village. For instance, in Mataram City, two households that were surveyed decided to use LPG because it was recommended by the village's head of environment that came to inform them about LPG and a government program about it. Additionally, another respondent maintained that she was initially afraid to use LPG but then she was convinced by the owner of the house where she worked as a maid.

"I became brave because when I worked as a maid in Cakranegara when I was young, I had to cook with LPG. The owner of the house taught me back in the day so since then I became brave enough to use it until now, because it's convenient"

(Female, M-4)

Meanwhile in Sumbawa Regency, one respondent claimed that she uses LPG as recommended by her neighbour who convinced her to use it and was more assured by the help from officers from the government.

"Yes, some friends said it's good using LPG because it's easy, but there are some who told me LPG can explode, dangerous. But I still tried it and learned with officers how to operate it to face my fear by asking questions. Since then, 2-3 days I'm able to operate it properly"

(Female, S-5)

Moreover, another respondent claims using a rice cooker was influenced by her friend when she saw her friend using it and was tempted to use it because she was told it was easy to operate. Though there was a little fear at the beginning, she then proceeded to use it and it has become a habit after continuous consultation with her friend.

Convenience and Safety of Cooking

Advantages <ul style="list-style-type: none"> •Free, always available •Food tastes better and smell good, lasts longer •Able to stack in the house Disadvantages <ul style="list-style-type: none"> •More difficult to use during rainy season •Dirty, smoke •Making cookware dirty, black crust •Flame must be guarded, hot & making sweaty 	Advantages <ul style="list-style-type: none"> •Quick, •Flame can be controlled •Cooking utensils are more durable Disadvantages <ul style="list-style-type: none"> •Sticky, very expensive, rare •Unstable price 	Advantages <ul style="list-style-type: none"> •Easy, efficient, quick, clean, no smoke, practical •Flame can be controlled Disadvantages <ul style="list-style-type: none"> •Expensive, does not improve food taste •Unstable price 	Advantages <ul style="list-style-type: none"> •Quick, easy, clean Disadvantages <ul style="list-style-type: none"> •Does not improve food taste, •Go spoil quickly
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Figure 7. Advantages and Disadvantages by Cooking Fuels Type

Deep diving the respondents' point of view about which fuel is more convenient for usage by validating their feeling, *happy or grateful even tired after finishing the cooking activity*, a quarter of respondents preferred firewood with surprising reasons, among others: (a) feel safe and no risk of exploding; (b) feel more comfortable and accustomed; and (c) cook faster. **Figure 7** summarises the respondents' opinion on advantages and disadvantages for certain fuels that are used for cooking.

Few respondents placed wood-fired stoves outside the house that is not attached to the main house, for instance in the backyard. The placement of a wood-fired stove that is not connected to the main house is usually equipped with a makeshift roof to reduce the inconvenience of having to cook in the rainy seasons. For the majority of kitchens located inside the house, the ventilation for air circulation can be considered quite good enough.

Following the influence of weather conditions on fuel preferences, nearly all respondents provided a similar answer that LPG and/or kerosene is preferred to firewood during rainy seasons but they are more likely to use firewood during dry seasons, with strong reasons for saving money from cooking fuel

costs. With high humidity in the rainy season, it made the firewood moist so it would be difficult to burn and caused a lot of smoke.

Ideal Preferences for the Future

Respondents' preferences on the type of cooking fuels that would ideally be used in the future are presented in **Figure 8**. During the interview process, researchers explained the benefits of a dirty-to-clean cooking fuels transition. The responses show that the phenomenon of dirty-and-clean cooking fuel stacking could persist among low-income groups living in peri-urban areas.

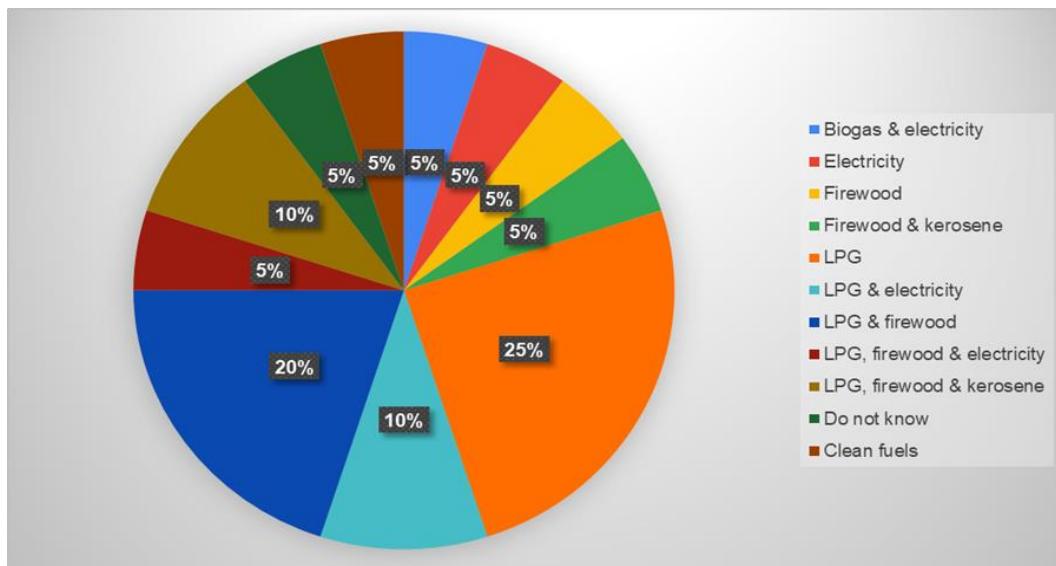


Figure 8. The Respondents' Preferences on the Type of Cooking Fuels that would be ideally used in the Future

Furthermore, it demonstrates the respondents' interest in trying electric appliances, particularly electric stoves, for cooking purposes in the future, as 25% of interviewed households include electricity in their preference for the type of cooking fuel that would ideally be used in the coming days. On top of that, 70% of respondents included LPG as one of the ideal fuels to be used in the future. In fact, 30% of those respondents who have not cooked with LPG before (due to fear) have a desire to try it someday:

"I hope I'm brave enough to use LPG in the future. Because after all, in terms of cost, cooking using LPG is cheaper than using kerosene. This is the result of my calculation after I asked my friends."

(Female, S-6)

Meanwhile, 70% of the respondents have shown an interest in using electric stoves in the future should there be any government programs. On top of that, 66% of respondents who have never used any electrical appliances in their house affirmed that they would like to use it if there is a government program.

"If there is support from the government, I'd be interested, but if the electricity is also subsidized, if not, it will be expensive too."

(Female, S-2)

Nevertheless, few respondents do not intend to use electric stoves, with or without government support. Reasons given for this include having no knowledge of the appliances, high electricity consumption, reducing the taste of the food, and “no feeling of cooking”.

“If there is a program like that, I think I’m not interested in using it. Because it does not use fire, it does not feel like cooking”

(Female, M-2)

On the other hand, in the case where there is no support from governments, 85% of respondents admitted they have no desire to get electrical stoves in the future using their own money. Their reasons ranged from concerns around the expense of appliances, additional cost for electricity, as well as not being an important need for the family.

“Even though I have money, I prefer to save the money in case it is needed for urgent needs such as medical treatment.”

(Female, M-9)

Awareness on health issues induced by dirty fuels

With respect to knowledge on health concerns of using dirty fuels, half of the respondents are aware about the health issues, they do understand that inhaling smoke, including ashes, and the strong chemical smell of kerosene could have a bad impact upon respiratory infections. Some respondents reported that mild cough and sore eyes were symptoms experienced in a short period of time, in the past three months or a year.

On the other hand, some respondents do not know about, and have never experienced, any significant health issues because they stated that they are already used to it. Regardless of health awareness, the respondents were still using dirty cooking fuels because of their limited financial capacities and, moreover, tragedies of the 3-kg LPG programme made them afraid to switch.

In terms of health factors and its relation to the Gol programme of 3-kgs LPG, one of its goals is to minimise the health risks from kerosene usage. The combustion of kerosene also contributes to burns and respiratory poisoning, especially among children, because of improper kerosene storage. It was reported that the distribution of 3-kgs LPG along with hose and one-burner stove from Gol was happening in both study areas from the mid-2017 onwards. Regardless, some recipients in Sumbawa Regency were reluctant to switch from kerosene-to LPG and conveyed that it is more convenient for them to keep using kerosene, besides being afraid of the LPG.

Capturing respondents' views about the definition of safety in the context of cooking, the researchers directed the respondents that their opinion should not be limited only to accidents-related issues. When prompted further in this way, respondents mentioned a number of additional safety related issues:

- Low risk and easy to operate;
- There is no possibility of gas leaking and no explosion;
- The fuel used does not damage the cooking utensils, such as pots, cauldrons and so on;
- No need to pay attention to the food being cooked in order to avoid fire spreading or in the other words cooking activity could be left for a while;
- Keeping flammable objects or items away from around stoves, for example objects made of plastic, cell phones and so on;

- Able to extinguish the flame immediately if there's fire;
- Those fuels making the kitchen dirty are less safe;
- The flame on the stove was in a safe and controlled condition.

Opinions on the Government of Indonesia's 3-kgs LPG programme

Significantly, according to majority of respondents in Mataram City and Sumbawa Regency, when asked about their opinion on the GoI programme of 3-kgs LPG, they thought it was a good program and allowed them to experience clean (modern) cooking practices. In our study, one respondent (M-9) in Mataram City stated that they had experienced a mild explosion when using LPG. Nevertheless, it did not hinder them from continuing to use LPG. Based on the interviews, some respondents who do not use LPG also thought it is a good program for the citizens and some others do not know because they do not use it.

"At first, I used a gas stove for cooking with 2 burners and it exploded. As a result, I bought a new one, because it was completely unusable. I feel helped (by the 3-kgs LPG programme), even though there have been explosions before but I still use LPG gas, because it does not produce smoke and is cleaner."

(Female, M9)

Cooking fuel Aspirations

Noting that fuel availability and affordability are particularly prominent, ideal approaches proposed by the respondents for pursuing clean cooking practises should focus on accessibility and convenience. The respondents thought that the kinds of support needed to shift dirty-to-clean cooking fuels are as follows:

- Access to LPG and/or other clean cooking fuels are easier;
- The price should stable (affordable) and always available;
- Have same opportunity for everyone to try clean cooking fuel (energy justice);
- Provide subsidy for low-income group and make sure the clean cooking fuel (electricity) is able to use for low-power customers;
- Provide job opportunities so everyone has an income to afford the clean cooking fuel;
- Teach on how to use and operate the equipment;
- Make sure the quality of products (fuel and equipment) has been well tested.

In summary, different urban contexts have significant influence on the cooking fuel choices of households. In a busy city like Mataram, time is very important. Because most citizens go to work, they have less time for cooking. LPG becomes the best fuel choice for cooking for these households as evidenced in this study. LPG is the primary cooking fuel used in the majority of the households surveyed in Mataram City. The more stable financial capacity provided by city jobs enables the households, in particular low-income groups, to afford LPG as their primary cooking fuel. While in Sumbawa Regency, cooking preparations can be a bit longer because of the tedious process of firewood preparation and fire ignition. In addition, the higher accessibility of firewood proves to be more advantageous to these rural and urban village households.

Speaking of 'dirty cooking fuels' like firewood and kerosene, the use of kerosene fuel in Sumbawa Regency is more common compared to Mataram City. This happens because the implementation of the GoI of 3-kgs programme was carried out first in Mataram City then followed by Sumbawa Regency and

other satellite cities within WNT Province administrative areas. Moreover, the GoI has set a target that the kerosene to LPG conversion should be completed in 2022 for all cities and regencies in Indonesia. One important factor that is similar to both contexts is taste. Household respondents in both study areas said that food tastes better when cooked on firewood. Burning wood creates smoke, which transfers the flavour, depending on the type of wood used as different types of wood give different flavours (Husbands and Cranford 2019).

5. DISCUSSION

This qualitative study assessed the reasons for fuel stacking based on users' experience, given the widely reported pervasiveness of this practice, which can greatly hamper the ability to fully transition to clean cooking in specific urban contexts, namely peri-urban areas. The overall objective of this study is to investigate whether or not the hypothesis is correct

"Fuel stacking practices in urban areas are complex and tied to specific urban, economic and cultural dynamics. As well as issues of fuel availability, affordability and reliability, fuel stacking practices are also influenced by other aspects of urban life related to work, mobility, community, need, culture and aspiration."

From here, the study findings support those of several factors. **Fuel availability and affordability** are dominant and left the group with "no choice" but to stack. Note that among the study households, the nature of 'stacking' was to use different fuels for preparing different dishes. For instance, they would cook rice with either a firewood/rice cooker and then the side dishes such as fried chicken, fish or soup are cooked with LPG gas/kerosene.

Cooking is one of the essential activities in a household. In low-income groups, where households' income is very limited, other **basic needs** (e.g. meals, groceries, education) would be prioritized over buying clean cooking fuels like LPG. According to the study results, the households decided to spend less on clean cooking fuel because of the abundance of firewood and agriculture wastes that can be freely collected.

From the socio-demographic profiles of the respondents, it is shown that the type of **work**, for example casual daily workers with flexible working hours including the unemployed, have more free time to be able to look for firewood and store it as a reserve. Kerosene or LPG gas is used if the respondents have enough money to buy it or the kiosk is willing to provide it on instalments. Other types of workers, such as fishermen or farm laborers, get easy access firewood and agricultural waste at the location where they work.

Culture also plays an important role and becomes one of the influencing factors or aspects. Food is tastier and has a more fragrant aroma when cooked using firewood. This preference has been embedded and become a strong local belief. While it is possible to find cooking techniques that retain the same taste and aroma using clean cooking fuels (e.g. gas, biogas, electricity, biofuels and so on), it will take time to convince people. This is because the stigma and perceptions that have been embedded are very strong.

Furthermore, it has become a hereditary habit in Indonesian households regarding **gender norms**, with females often being responsible for cooking activities, determining the type of fuel used and limiting

the budget to buy cooking fuel as well. The habit was proven to be found in this study. According to the study results, females are not only housewives but also some are head of the household. Females tend to be responsible for managing household finances including allocating the budget for priority needs.

Deep diving on gender norms, females' experience of **convenience** in using stoves and cooking appliances is one of the reasons for making choices because they are in charge of preparing food for the family. Convenience is also not limited to the operational side (technical) but also includes the willingness side (psychological). As evidenced, it was found that almost all respondents in Sumbawa Regency were reluctant to use LPG gas, despite assistance from the GoI, due to the explosions and/or house fires. This finding indicates that females are concerned with safety matters and as a result this influences their decision making on cooking fuel choices.

This fact will pose a challenge for dirty-to-clean cooking fuel transitions, in particular firewood/kerosene to LPG. It may also be a barrier to transitioning to cooking with electricity, where some households are still afraid of short circuits or electrocution. An interesting reservation to cooking with electricity is that cooking without fire does not feel like cooking.

Additionally, this qualitative study has also demonstrated that **community influence** such as from peers and community leaders is one of the factors contributing to fuel preferences for some households. One respondent decided to use a rice cooker as the result of seeing her friend using it and was encouraged to get one. Further, some households decided to use LPG after the village's head of the environment recommended it, though initially they had a bad perception or feeling afraid towards the clean cooking fuels (LPG and electricity), but those things were eventually overcome after gathering insights from their friends, networks, and neighbours. Subsequently, they became fully convinced of the fuels and decided to stack it with their previous fuels (e.g., firewood and kerosene) due to reasons such as aroma, habits, taste and economics, for instance.

On top of that, one respondent notably illustrates how her decision to use firewood was influenced by support from her community/neighbourhood. In this case her chief of the village provides excess wood from his wood furniture store where she can freely take it. Thus, her transition to cleaner energy may likely be hindered because this fuel is freely available most of the time.

The study results also demonstrate that risks of **health** by sustaining the long-term firewood and kerosene usage are neglected because of financial capability along with convenience reasons. Even though half of the respondents are aware of the negative impact on health, they do not take detailed health calculations (e.g. cost of morbidity and mortality; worsened by COVID-19 pandemic) into consideration when assessing the economic potential of shifting to clean cooking fuels.

Respondents' **aspirations** on ideal approaches for pursuing clean cooking practices reveal that a complete transition to clean fuels could happen among low-income groups if fuels were readily available, and affordability could be addressed by considering factors around secure employment. These requirements are essential to effective household energy interventions.

6. CONCLUSION AND RECOMMENDATION

For Sumbawa Regency

This area has a high percentage of low-income households, so encouraging more poorer families to transition to a clean cooking fuel will require substantial financial and technical support. Households still using and relying on free, but unsustainable firewood should be properly informed about the adverse effects of using firewood as a cooking fuel on their health and the environment. It is however important to understand the cultural dynamics of each household to formulate appropriate strategies that can be sustained by both the local government and the households such as providing safety precautions for those who fear safety.

For Mataram City

Just like any progressive city in Indonesia, the city has more people using LPG as their primary cooking fuel. The ease of using LPG cookstoves and cooking food faster provides more time for many households to do other tasks. The hustle and bustle of city living requires fast and easy-to-use cooking practices. But this modern way of living in the city does not make people, in particular low-income groups, veer away completely from using dirty cooking fuels, especially when there is an occasion to celebrate. This may be occasional, but this might have a significant negative impact on their health and the environment.

The local governments must develop innovative solutions that will encourage their citizens to transition to a clean cooking fuel. In addition, clear information regarding its benefits, side effects if any, mitigation and safety measures must be properly conveyed to the households to gain their trust on using clean cooking fuels in the future. Thus, the Community Social Workers play a vital role here as a bridge between households in a particular neighbourhood and the local governments to implement the strategies.

Considering the social, economic, and cultural dynamics of each study area, the following are the proposed recommendations drawn from this study for both the Governments of Mataram City and Sumbawa Regency:

Table 7. Proposed Recommendations to Mataram City and Sumbawa Regency

No.	Proposed Recommendations	Key Actors	Time Frame
1.	Coordinate with the Health Agency to provide information on health calculations (cost of morbidity and mortality) on dirty cooking fuels usage and, together with the head of urban village and rural village as well as community social workers, to socialize the information by using simple (local) language that is easily understood.	Housing Settlement Agency, Health Agency, Head of Urban Village, Head of Rural Village, Community Social Workers	Short-term
2.	[for Sumbawa Regency in particular] <ul style="list-style-type: none"> ○ Provide and socialize information on the benefits of shifting from kerosene to LPG from the economic potential point of view, together with the Head of 	Local Development Planning Agency, Head of Urban Village,	Short-term

No.	Proposed Recommendations	Key Actors	Time Frame
	<p>Urban and Rural Villages as well as community social workers, by using simple (local) language that is easily understood.</p> <ul style="list-style-type: none"> ○ Continue to motivate and give aspirations to households (especially females, the ones who are responsible for preparing food for the family) to shift from kerosene to LPG. 	Head of Rural Village, Community Social Workers	
3.	<p>Develop and submit a proposal entitled “Reducing firewood usage by replacing traditional open fires with modern and clean cooking fuels like LPG and electricity for energy efficiency specifically for low-income groups” to the Global Environment Facility Small-Grant Programme under (the GEF-SGP) to SGP Indonesia Secretariat.</p> <p>Case study in Nusa Penida (SGP Indonesia Secretariat, 2021) can be used as reference.</p>	Local Development Planning Agency, Environment Agency, Housing Settlement Agency, Local NGOs, Head of Urban Village, Head of Rural Village	Short to mid-term
5.	<p>Collaborate with the (local) universities and/or research institutions to explore the potential of cooking using solar energy, portable anaerobic digester (biogas), and/or other renewable energy sources with no-cost at all for daily usage. Only allocating costs for procurement and maintenance.</p> <p>A case study in Bogor City, Indonesia (ICLEI SEAS, 2021) and India (World Economic Forum, 2021) can be used as references.</p>	Local Development Planning Agency, Environment Agency, Housing Settlement Agency, Universities and/or research institution	Short to mid-term
6.	<p>Have and strengthen partnerships with private sector through corporate social responsibility (CSR) programmes for financial support and capacity building as well for sustainable clean cooking appliances.</p>	Local Development Planning Agency, Regional Secretariat	Short to mid-term
7.	<p>Develop and submit a proposal on accessing village funds for sustainable clean cooking appliances, together with the Head of Urban and Rural Villages.</p>	Local Development Planning Agency, Environment Agency, Housing Settlement Agency, Head of Urban Village, Head of Rural Village	Short to mid-term

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ANNEX A. HOUSEHOLD SURVEY QUESTIONNAIRE



Household Survey Design for MECS Programme

Version : 3.0
 Date : 16 November 2021

Priority respondent (descending order):

1. Household member making the fuel choices
2. Head of household

A. Surveyor Information

Surveyor name 1	:	
Surveyor name 2	:	
Household/Sample No.	:	

B. Survey Location

Province	:	
City/Regency	:	
Sub-district	:	
Area/village	:	
Address	:	

C. Household Information Related to Cooking Activities

1. Please complete this table

Indicator	House Husband	Housewife
Name ¹		

¹ Subject to the disclosure of the respondent.

Contact Number ¹		
Age		
Occupation		
Highest educational attainment		
Who is the head of the household (please tick ✓)		
For extended family living in one-house, please indicate the name of the household member making the cooking fuels selection.		
Total number of family member/s living in the house	0-18 years old -Male: -Female: 19-55 years old -Male: -Female: 55 years old and above -Male: -Female: Total:	
Average household monthly income	IDR	
Who cooks in your house?		

Household Questionnaire for Urban Fuel Switching prepared by ICLEI Indonesia

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If someone else cooks in your house, what is your relationship with him/her? Why do they do the cooking? Which fuels do they use for cooking, and why?

2. Do you limit your budget for monthly cooking fuel cost and why? If yes, could you tell us what is your monthly budget for cooking fuels?

3. How many times do you cook in a day in your household? Could you elaborate your answer?

4. For how many people do you cook in your household daily (breakfast/lunch/dinner/so on)? How long (minutes) does it take to cook for the household?

5. How do you feel after cooking for them? Why?



6. Do you prefer any cooking practices (traditional or modern²)? Please explain your answer.

7. What kind of stoves do you use for cooking purposes?

- Woodfire stove
- Kerosene stove
- LPG stove
- Biogas stove. Please select one (strikethrough the rests), is it from: cow dung/domestic wastewater/organic waste/others:
- Pipeline natural gas stove
- Electricity stove
- Biofuel Stove
- Others³, please specify:

8. Based on your answer above, why do you prefer cooking using the stoves of your choice?
Do you use the stoves for other purposes than cooking food?

² Modern cooking practices by fuel type: electricity, natural gas, LPG, ethanol, biogas

³ For example, a woodfire stove is not 100% woodfire usage as a fuel but the possibility to have combination fuels between rice husk, sawdust/dry-agriculture by products, etc.

Please use the table below as guidance to explore the response on Question Number 8.

Indicator	Woodfire stove	Kerosene stove	LPG stove	Biogas stove	Pipeline natural gas stove	Electricity stove	Biofuel stove	Others, please specify:
Used for (cooking/water boiling/etc.)								
Taste reasons (please explain)								
Budgetary reasons								
Cultural reasons(please explain)								
If for cooking, please mention the item cooked, for how many people (household size) and how it is cooked? ⁴								
How long (minutes or hours) do you need to set up your cookstove?								
How long (years) has the cookstove been used since it was first used or purchased?								

⁴ The question can be explored for cooking techniques, e.g. frying, deep frying, boiling etc.

Indicator	Woodfire stove	Kerosene stove	LPG stove	Biogas stove	Pipeline natural gas stove	Electricity stove	Biofuel stove	Others, please specify:
Do you often face difficulty when operating current cooking stoves? Please specify.								
How do you solve technical problems? If it is not solved, what are your actions or decisions?								
During the use of cookstoves, have there been any accidents in the last 3 months and 1 year? If not, could you please share with us regarding the safety of your cookstoves usage during the past 3 months and/or a year?								
In your opinion, what do you think about safety in terms of cooking?								
Could you tell me what you consider clean cooking to be? Could you share								

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Indicator	Woodfire stove	Kerosene stove	LPG stove	Biogas stove	Pipeline natural gas stove	Electricity stove	Biofuel stove	Others, please specify:
your experiences or thoughts on cleanliness of the different fuels?								
Which fuels are more convenient for you, and why?								

9. Do you cook any special dishes? What are they? Why are you cooking them? What cooking fuel do you use to cook these special dishes?

10. Which of these fuels is your tier cooking fuel (from the most frequently used (primary-to-secondary-to-tertiary and so on)? Please indicate the number (1/2/3/n) in the box.

- Woodfire
- Briquette/Charcoal
- Kerosene
- LPG
- Biogas
- Biofuel
- Pipeline natural gas
- Electricity
- Others, please specify:

For the primary, secondary and tertiary fuels, could you please share with us how often you use it daily? Are they often used at the same time?



Primary fuel: times in a day; for: breakfast/lunch/snack/dinner preparation*
 Secondary fuel: times in a day; for: breakfast/lunch/snack/dinner preparation
 Tertiary fuel: times in a day; for: breakfast/lunch/snack/dinner preparation

*Note: Please select the appropriate options (strikethrough the rests)

11. Based on your answer above, please explain why you are using the current cooking fuels?

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12. What are the benefits you receive? Any disadvantages/barriers you encounter?

If you cook with different fuels, answer the following questions: Please use the following table to explore the answers above.

Indicator	Woodfire	Kerosene	LPG	Biogas	Pipeline natural	Electricity	Biofuel	Others, please specify:
Advantages								
Disadvantages including challenges/ barriers								

13. What kind of cook wares do you use on the stove for cooking?

- Non-stick fry pan
- Silver pot
- iron pot



- Aluminium pan
- Others, please specify:

14. Does your choice of cookware affect your choice on selecting your cooking stove and fuel? If yes, please elaborate your answer.

15. What are the modern cooking appliances regularly being used in your household? How long (minutes or hours) do you use in daily/weekly? (Please proceed to number 19 if you don't have modern cooking appliances.)

Choices below are for guidance only:

- Pressure cooker
- Electric pressure cooker
- Microwave oven
- Electric oven
- Electric kettle
- Electric frying pan/air fryer
- Induction stove
- Electric bread maker
- Electric sandwich maker
- Electric coffee maker
- Rice cooker
- Others⁵, please specify:

For example:

Rice cooker: 3 times in a day @45 minutes; for: breakfast/lunch/snack/dinner preparation*

Note: Please select the appropriate options (strikethrough the rests)

⁵ For "others" might explore for another modern cooking appliances by using LPG/bio-ethanol



16. Could you explain when and why you are using the modern cooking appliances above?

17. Do you combine cooking appliances (clean and dirty fuels) for cooking certain meals?

18. What are the problems you usually encounter when using the appliance? How do these problems affect your choice of using them? Choices below are for guidance only.

- Problem to operate properly
- Not understanding how long the food will be ready
- Power cuts
- Lack of manual controls
- Pot size
- Others, please specify:



19. If you have modern cooking appliances (Question No.15), who in your family decides to buy the modern appliances and what/who influences them? Please explain your answer.

20. Have you noticed any changes in your cooking practice because of COVID-19? If yes, please tell us how so?

21. Has COVID-19 changed your access or use of your current fuels? Why?

22. Has COVID-19 changed access or use of certain fuels? Why?

D. Cooking Fuel Accessibility and Affordability

23. Before using this particular fuel you're currently using, what was the fuel you were using in the past 5 years? Have you changed your fuel preferences? Please explain the reason.



24. Who pays for your cooking fuels? Why is he/she paying for the fuels?

25. How many times in a month do you usually buy your primary cooking fuel and how much do you spend in a month paying for the primary cooking fuel? Why do you spend such an amount of money on your primary cooking fuel?

Frequency: times
Monthly cost: IDR
Quantity: (in kg/liter/kW/Nm³)

26. How many times in a month do you usually buy your secondary cooking fuel and How much do you spend in a month paying for the secondary cooking fuel? Why do you spend such an amount of money on your secondary cooking fuels?

Frequency: times
Monthly cost: IDR
Quantity: (in kg/liter/kW/Nm³)

27. What is the most accessible cooking fuel in your area? Do you use it for cooking? Why or why not?

28. What other cooking fuels are available in your area? Do you use them for cooking? Why or why not?



29. Where do you procure cooking fuels and why? Additionally, has your fuel choice ever been influenced by neighbors/networks/friends' recommendation?

30. Is your primary cooking fuel always available at the store closest to where you live? If not, what alternative cooking fuel do you usually use? Please explain why.

31. What are the challenges you usually encounter in getting your primary cooking fuel? How do these challenges affect your cooking fuel choices and how do you deal with it?

Options for guidance only.

Not readily available

High price; please inform in IDR

Far distance; please inform in km

Transportation problem; please inform the frequency

Good quality fuel is not readily available; please inform the fuel

Others, please specify:

Please use the box below to further explore the selected reasons.

32. Is your secondary cooking fuel always available at the store closest to where you live? How do these challenges affect your cooking fuel choices and how do you deal with it?



33. Do you prefer a particular fuel during the summer and rainy seasons? Please state the reason why.

E. Impacts of cook stoves on health and culture

34. Is your kitchen outdoor or indoor?

35. If your kitchen is indoor, does it have a good ventilation system?

36. Are you aware of any health issues from using traditional cooking fuel/practice (firewood, kerosene, crops)? If yes, and still using the traditional cooking fuel, why do you still use them? Do you also have any experiences on health issues for modern cooking fuel/practice? Please tell us.

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37. Have you ever been sick by inhaling smoke from the traditional cooking fuel that you use for cooking in the past three months or a year?

38. In three months or a year, how many times did you seek treatment? How much did you spend on the treatment? Have you changed your cooking fuels after getting sick? Please explain your answer.

39. Prior to changing your fuel due to health reasons, what is your previous fuel? Do you sometimes still use this fuel as tertiary (complementary) ? Please explain why.

40. Are there any cultural/religious beliefs that influence your cooking preferences? If yes, when do you usually use them? Why do you use these cultural beliefs?

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41. What do you think about the government program of 3-kg LPG subsidy (energy justice)? Do you feel you have benefited from this program? Do you think this program is successful in helping its beneficiary communities (low income group)?

42. If you are not using an electric cooking appliance, are you interested in buying an electric stove for cooking in the foreseeable future if there is support from the government? (such as discount, subsidy, etc)?

43. Would you consider purchasing an electric cooking appliance or less-risk cooking equipment at your own personal expense?

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44. If you are not interested in purchasing an electric cooking appliance or less-risk cooking equipment at your own personal expense, state the reason why Is it expensive/consumes high electricity/taste of food cooked by it is not good/not interesting/etc.).

45. What kind of support do you think is needed to shift from traditional to modern/cleaner cooking fuel? Please explain your answer.

46. In your opinion, what are the ideal approach to make clean energy security⁶ for cooking more accessible? Please explain your answer.

47. In the future, what cooking fuel(s) would you ideally like to use? Why? Please explain your answer.

⁶ Energy security is availability, affordability, accessibility, acceptability and sustainability (4A+1S)

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48. Could you please inform us of your average household monthly expenditures?

Type of Expenditures	Estimated Average Monthly Expenditures ⁷	
	Number (IDR/month)	Percentage
Meals (Food & drink items)		
Groceries (Household items)		
Education		
Transportation		
Electricity		
Medical (insurance)		
Communication (phone & internet packages)		
Fuel for cooking purposes		
Others, please specify:		
Others, please specify:		
Total		

⁷ The information can be informed in number and/or percentage; depending on the willingness of the respondent to provide the answers.

2 ANNEX B. PHOTOGRAPHS

I. Consultation Meeting with Local Governments



Meeting with Local Government Organizations (LGOs) in Mataram City on 18th November 2021



Meeting with Local Government Organizations (LGOs) in Sumbawa Regency on 22nd November 2021

II. Mataram City

M-1



M-2



M-3



M-4



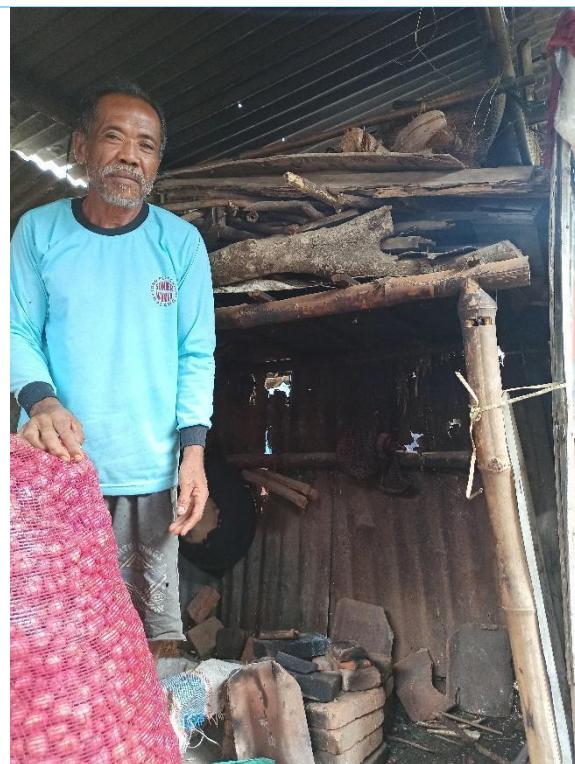
M-5



M-6



M-7



M-8



M-9



M-10

III. Sumbawa Regency



S-1





S-2



S-3



S-4

Loughborough
University



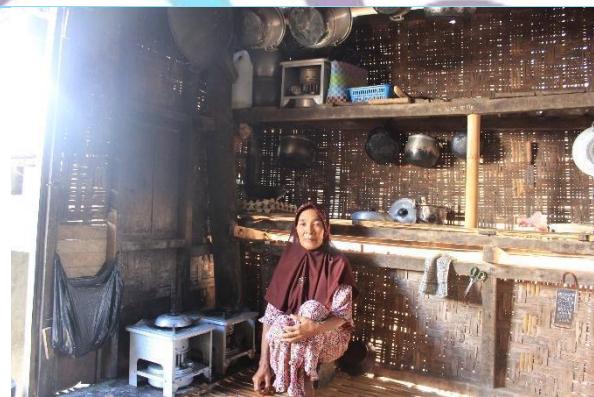
S-5



S-6



S-7



S-8



S-9



S-10